Sequencer64 (seq64) Developer Reference Manual

0.90.3

Generated by Doxygen 1.8.13

Contents

1 Sequencer64 **1**

1.1 Introduction 1

2 MIDI File Parsing in Sequencer64 **3**

2.1 Introduction 3

2.2 SMF 1 Parsing 3

2.2.1 MIDI File Header, MThd 3

2.2.2 MIDI Track, MTrk 4

2.2.2.1 Channel Events 4

2.2.2.2 Meta Events 5

2.2.3 Meta Events Summary 6

2.2.3.1 Sequence Number (0x00) 6

2.2.3.2 Track/Sequence Name (0x03) 7

2.2.3.3 End of Track (0x2F) 7

2.2.3.4 Set Tempo Event (0x51) 7

2.2.3.5 Time Signature Event (0x58) 8

2.2.3.6 SysEx Event (0xF0) 9

2.2.3.7 Sequencer Specific (0x7F) 10

2.2.3.8 Non-Specific End of Sequence 10

2.3 SMF 0 Parsing 10

2.4 Running Status 11

3 JACK, Live, and Song Modes in Sequencer64 **13**

3.1 Introduction . . . 13

3.2 JACK Functions . . . 13

3.2.1 jack_client_open() . . . 14

3.2.2 jack_on_shutdown() . . . 14

3.2.3 jack_set_sync_callback() . . . 14

3.2.4 jack_set_process_callback() . . . 15

3.2.5 jack_set_session_callback() . . . 15

3.2.6 jack_activate() . . . 15

3.2.7 jack_release_timebase() . . . 15

3.2.8 jack_client_close() . . . 15

3.2.9 jack_transport_start() . . . 15

3.2.10 jack_transport_stop() . . . 15

3.2.11 jack_transport_locate() . . . 15

3.2.12 jack_transport_reposition() . . . 16

3.2.13 jack_transport_query() . . . 16

3.3 Modes Operation . . . 16

3.3.1 No JACK, Live Mode . . . 16

3.3.2 No JACK, Song Mode . . . 16

3.3.3 JACK Transport . . . 17

3.4 Breakage . . . 17

3.5 JACK References . . . 18

4 User Testing of Sequencer64 with Yoshimi **19**

4.1 Introduction . . . 19

4.2 Smoke Test . . . 19

4.3 Tests in the Patterns Window . . . 20

4.3.1 Button Clicks on a Pattern . . . 21

4.3.2 Patterns Window Key Shortcuts . . . 21

4.3.3 The Sequencer64 User File . . . 21

4.4 Tests Using Valgrind . . . 21

4.4.1 Valgrind Suppressions . . . 22

4.4.2 Full Valgrind Leak-Checking . . . 22

4.4.2.1 Leak-Checking Basic Operation . . . 23

4.5 Specific Fault Debugging . . . 23

4.6 Snipping of a MIDI file. . . . 23

5 Speed Issue of Sequencer64 **25**

5.1 Introduction . . . 25

5.2 Initial Change of Containers . . . 25

5.3 Back to the Original Container . . . 26

5.4 What is Next, the Vector? . . . 26

6 Licenses **27**

6.1 License Terms for the This Project. . . . 27

6.2 XPC Application License . . . 27

6.3 XPC Library License . . . 28

6.4 XPC Documentation License . . . 28

6.5 XPC Affero License . . . 29

6.6 XPC License Summary . . . 29

7 Todo List **31**

8 Deprecated List **35**

9 Namespace Index **37**

9.1 Namespace List . . . 37

10 Hierarchical Index **39**

10.1 Class Hierarchy . . . 39

11 Data Structure Index **43**

11.1 Data Structures . . . 43

12 Namespace Documentation **49**

12.1 Gtk Namespace Reference . . . 49

12.2 seq64 Namespace Reference . . . 49

12.2.1 Detailed Description . . . 64

12.2.2 Typedef Documentation . . . 64

12.2.2.1 midibyte . . . 64

12.2.2.2 bussbyte . . . 65

12.2.2.3 midishort . . . 65

12.2.2.4 midilong . . . 65

12.2.2.5 midipulse . . . 65

12.2.2.6 midibpm . . . 65

12.2.2.7 rterror_callback . . . 65

12.2.2.8 rtmidi_callback_t . . . 66

12.2.3 Enumeration Type Documentation . . . 66

12.2.3.1 wave_type_t . . . 66

12.2.3.2 seq_modifier_t . . . 66

12.2.3.3 seq_event_type_t . . . 67

12.2.3.4 seq_scroll_direction_t . . . 67

12.2.3.5 clock_e . . . 68

12.2.3.6 interaction_method_t . . . 68

12.2.3.7 c_music_scales . . . 69

12.2.3.8 draw_type_t . . . 69

12.2.3.9 mouse_action_e . . . 69

12.2.3.10 edit_action_t . . . 70

12.2.3.11 rtmidi_api . . . 70

12.2.4 Function Documentation . . . 70

12.2.4.1 swap() . . . 71

12.2.4.2 wave_type_name() . . . 71

12.2.4.3 extract_timing_numbers() . . . 71

12.2.4.4 pulses_to_string() . . . 72

12.2.4.5 pulses_to_measurestring() . . . 72
12.2.4.6 pulses_to_midi_measures() . . . 73
12.2.4.7 pulses_to_timestring() [1/2] . . . 73
12.2.4.8 pulses_to_timestring() [2/2] . . . 74
12.2.4.9 measurestring_to_pulses() . . . 74
12.2.4.10 midi_measures_to_pulses() . . . 75
12.2.4.11 timestring_to_pulses() [1/2] . . . 75
12.2.4.12 string_to_pulses() . . . 75
12.2.4.13 string_to_midibyte() . . . 76
12.2.4.14 shorten_file_spec() . . . 76
12.2.4.15 string_not_void() . . . 76
12.2.4.16 string_is_void() . . . 77
12.2.4.17 strings_match() . . . 77
12.2.4.18 log2_time_sig_value() . . . 78
12.2.4.19 tempo_us_to_bytes() . . . 78
12.2.4.20 zoom_power_of_2() . . . 78
12.2.4.21 bpm_from_tempo_us() . . . 79
12.2.4.22 tempo_us_from_bpm() . . . 79
12.2.4.23 pulse_length_us() . . . 80
12.2.4.24 delta_time_us_to_ticks() . . . 80
12.2.4.25 ticks_to_delta_time_us() . . . 81
12.2.4.26 clock_tick_duration_bogus() . . . 81
12.2.4.27 clock_ticks_from_ppqn() . . . 82
12.2.4.28 double_ticks_from_ppqn() . . . 82
12.2.4.29 pulses_per_measure() . . . 83
12.2.4.30 measures_to_ticks() . . . 83
12.2.4.31 wave_func() . . . 84
12.2.4.32 extract_port_names() . . . 84
12.2.4.33 extract_bus_name() . . . 85
12.2.4.34 extract_port_name() . . . 85

12.2.4.35 help_check() . . . 85
12.2.4.36 parse_options_files() . . . 86
12.2.4.37 parse_mute_groups() . . . 87
12.2.4.38 process_o_options() . . . 87
12.2.4.39 parse_command_line_options() . . . 87
12.2.4.40 write_options_files() . . . 88
12.2.4.41 build_details() . . . 88
12.2.4.42 message_concatenate() . . . 88
12.2.4.43 info_message() . . . 89
12.2.4.44 error_message() . . . 89
12.2.4.45 is_note_off_velocity() . . . 89
12.2.4.46 to_string() . . . 90
12.2.4.47 file_access() . . . 90
12.2.4.48 file_exists() . . . 90
12.2.4.49 file_readable() . . . 91
12.2.4.50 file_writable() . . . 91
12.2.4.51 file_accessible() . . . 91
12.2.4.52 file_executable() . . . 92
12.2.4.53 file_is_directory() . . . 92
12.2.4.54 make_directory() . . . 92
12.2.4.55 ppqn_is_valid() . . . 93
12.2.4.56 jack_sync_callback() . . . 93
12.2.4.57 jack_shutdown_callback() . . . 94
12.2.4.58 jack_timebase_callback() . . . 94
12.2.4.59 jack_transport_callback() . . . 95
12.2.4.60 create_jack_client() . . . 95
12.2.4.61 show_jack_statuses() . . . 96
12.2.4.62 get_current_jack_position() . . . 97
12.2.4.63 jack_session_callback() . . . 97
12.2.4.64 invalid_key() . . . 98

12.2.4.65 keyval_name() . . . 98
12.2.4.66 keyval_normalize() . . . 98
12.2.4.67 create_lash_driver() . . . 98
12.2.4.68 lash_driver() . . . 99
12.2.4.69 delete_lash_driver() . . . 99
12.2.4.70 millisleep() . . . 99
12.2.4.71 is_null_midipulse() . . . 99
12.2.4.72 output_thread_func() . . . 99
12.2.4.73 input_thread_func() . . . 100
12.2.4.74 rc() . . . 100
12.2.4.75 usr() . . . 100
12.2.4.76 choose_ppqn() . . . 101
12.2.4.77 timestring_to_pulses() [2/2] . . . 101
12.2.4.78 get_compound_option() . . . 101
12.2.4.79 jack_dummy_callback() . . . 103
12.2.4.80 seq_app_name() . . . 103
12.2.4.81 seq_client_name() . . . 103
12.2.4.82 seq_version() . . . 104
12.2.4.83 make_section_name() . . . 104
12.2.4.84 font_render() . . . 104
12.2.4.85 adjustment_dummy() . . . 105
12.2.4.86 is_ctrl_key() [1/3] . . . 105
12.2.4.87 is_shift_key() [1/3] . . . 105
12.2.4.88 is_no_modifier() . . . 105
12.2.4.89 is_ctrl_key() [2/3] . . . 105
12.2.4.90 is_shift_key() [2/3] . . . 106
12.2.4.91 is_ctrl_key() [3/3] . . . 106
12.2.4.92 is_shift_key() [3/3] . . . 106
12.2.4.93 is_ctrl_shift_key() . . . 106
12.2.4.94 is_super_key() . . . 107

12.2.4.95 test_widget_click() . . . 107
12.2.4.96 update_mainwid_sequences() . . . 107
12.2.4.97 update_perfedit_sequences() . . . 107
12.2.4.98 FF_RW_timeout() . . . 107
12.2.4.99 clamp() [1/2] . . . 108
12.2.4.100 clamp() [2/2] . . . 108
12.2.4.101 silence_jack_errors() . . . 108
12.2.4.102 silence_jack_info() . . . 108
12.2.4.103 midi_api_name() . . . 108
12.2.4.104 midi_probe() . . . 109
12.2.4.105 midi_input_test() . . . 109
12.2.4.106 min() . . . 109
12.2.4.107 jack_process_rtmidi_input() . . . 110
12.2.4.108 jack_process_rtmidi_output() . . . 110
12.2.4.109 jack_process_io() . . . 111
12.2.4.110 jack_message_bit_bucket() . . . 111
12.2.4.111 midi_input_callback() . . . 111
12.2.5 Variable Documentation . . . 111
12.2.5.1 c_controller_names . . . 112
12.2.5.2 EVENT_STATUS_BIT . . . 112
12.2.5.3 EVENT_ANY . . . 112
12.2.5.4 EVENT_NOTE_OFF . . . 112
12.2.5.5 EVENT_NOTE_ON . . . 112
12.2.5.6 EVENT_AFTERTOUCH . . . 112
12.2.5.7 EVENT_CONTROL_CHANGE . . . 112
12.2.5.8 EVENT_PROGRAM_CHANGE . . . 113
12.2.5.9 EVENT_CHANNEL_PRESSURE . . . 113
12.2.5.10 EVENT_PITCH_WHEEL . . . 113
12.2.5.11 EVENT_MIDI_SYSEX . . . 113
12.2.5.12 EVENT_MIDI_QUARTER_FRAME . . . 113

12.2.5.13 EVENT_MIDI_SONG_POS . . . 113
12.2.5.14 EVENT_MIDI_SONG_SELECT . . . 114
12.2.5.15 EVENT_MIDI_SONG_F4 . . . 114
12.2.5.16 EVENT_MIDI_SONG_F5 . . . 114
12.2.5.17 EVENT_MIDI_TUNE_SELECT . . . 114
12.2.5.18 EVENT_MIDI_SYSEX_END . . . 114
12.2.5.19 EVENT_MIDI_SYSEX_CONTINUE . . . 114
12.2.5.20 EVENT_MIDI_CLOCK . . . 114
12.2.5.21 EVENT_MIDI_SONG_F9 . . . 114
12.2.5.22 EVENT_MIDI_START . . . 115
12.2.5.23 EVENT_MIDI_CONTINUE . . . 115
12.2.5.24 EVENT_MIDI_STOP . . . 115
12.2.5.25 EVENT_MIDI_SONG_FD . . . 115
12.2.5.26 EVENT_MIDI_ACTIVE_SENS . . . 115
12.2.5.27 EVENT_MIDI_RESET . . . 115
12.2.5.28 EVENT_MIDI_META . . . 115
12.2.5.29 EVENT_NULL_CHANNEL . . . 116
12.2.5.30 EVENT_GET_CHAN_MASK . . . 116
12.2.5.31 EVENT_CLEAR_CHAN_MASK . . . 116
12.2.5.32 EVENTS_ALL . . . 116
12.2.5.33 EVENTS_UNSELECTED . . . 116
12.2.5.34 c_midibus_output_size . . . 116
12.2.5.35 c_midibus_input_size . . . 116
12.2.5.36 c_midibus_sysex_chunk . . . 117
12.2.5.37 c_midibus . . . 117
12.2.5.38 c_midich . . . 118
12.2.5.39 c_midiclocks . . . 118
12.2.5.40 c_triggers . . . 118
12.2.5.41 c_notes . . . 118
12.2.5.42 c_timesig . . . 118

12.2.5.43 c_bpmtag . . . 118
12.2.5.44 c_triggers_new . . . 118
12.2.5.45 c_mutegroups . . . 118
12.2.5.46 c_midictrl . . . 119
12.2.5.47 c_musickey . . . 119
12.2.5.48 c_musicscale . . . 119
12.2.5.49 c_backsequence . . . 119
12.2.5.50 c_transpose . . . 119
12.2.5.51 c_perf_bp_mes . . . 119
12.2.5.52 c_perf_bw . . . 119
12.2.5.53 c_midi_track_ctrl . . . 120
12.2.5.54 c_midi_control_bpm_up . . . 120
12.2.5.55 c_midi_control_bpm_dn . . . 120
12.2.5.56 c_midi_control_ss_up . . . 120
12.2.5.57 c_midi_control_ss_dn . . . 120
12.2.5.58 c_midi_control_mod_replace . . . 120
12.2.5.59 c_midi_control_mod_snapshot . . . 121
12.2.5.60 c_midi_control_mod_queue . . . 121
12.2.5.61 c_midi_control_mod_gmute . . . 121
12.2.5.62 c_midi_control_mod_glearn . . . 121
12.2.5.63 c_midi_control_play_ss . . . 121
12.2.5.64 c_midi_controls . . . 121
12.2.5.65 c_midi_control_playback . . . 121
12.2.5.66 c_midi_control_record . . . 121
12.2.5.67 c_midi_control_solo . . . 122
12.2.5.68 c_midi_control_thru . . . 122
12.2.5.69 c_midi_control_bpm_page_up . . . 122
12.2.5.70 c_midi_control_bpm_page_dn . . . 122
12.2.5.71 c_midi_control_16 . . . 122
12.2.5.72 c_midi_control_17 . . . 122

12.2.5.73 c_midi_control_18 . . . 122
12.2.5.74 c_midi_control_19 . . . 122
12.2.5.75 c_midi_controls_extended . . . 123
12.2.5.76 g_midi_control_limit . . . 123
12.2.5.77 c_scales_policy . . . 123
12.2.5.78 c_scales_transpose_up . . . 123
12.2.5.79 c_scales_transpose_dn . . . 124
12.2.5.80 c_scales_text . . . 125
12.2.5.81 c_key_text . . . 125
12.2.5.82 c_interval_text . . . 125
12.2.5.83 c_chord_text . . . 125
12.2.5.84 c_chord_number . . . 125
12.2.5.85 c_chord_table_text . . . 125
12.2.5.86 c_chord_size . . . 125
12.2.5.87 c_chord_table . . . 126
12.2.5.88 c_max_instruments . . . 126
12.2.5.89 c_max_busses . . . 126
12.2.5.90 versiontext . . . 126
12.2.5.91 long_options . . . 126
12.2.5.92 s_arg_list . . . 126
12.2.5.93 s_help_1a . . . 127
12.2.5.94 s_help_1b . . . 127
12.2.5.95 s_help_2 . . . 127
12.2.5.96 s_help_3 . . . 127
12.2.5.97 s_help_4 . . . 127
12.2.5.98 s_build_alsamidi_support . . . 127
12.2.5.99 s_build_portmidi_support . . . 127
12.2.5.100 s_build_rtmidi_support . . . 127
12.2.5.101 s_build_highlight_empty . . . 128
12.2.5.102 s_build_lash_support . . . 128

12.2.5.103s_build_jack_support . . . 128
12.2.5.104s_build_jack_session . . . 128
12.2.5.105s_event_editor . . . 128
12.2.5.106s_build_pause_support . . . 128
12.2.5.107s_build_use_event_map . . . 128
12.2.5.108s_build_chord_generator . . . 128
12.2.5.109s_build_edit_highlight . . . 129
12.2.5.110s_build_timesig_tempo . . . 129
12.2.5.111s_build_midi_vector . . . 129
12.2.5.112s_build_solid_grid . . . 129
12.2.5.113s_build_follow_progress . . . 129
12.2.5.114s_statistics_support . . . 129
12.2.5.115s_strip_empty_mutes . . . 129
12.2.5.116s_seq32_jack_support . . . 129
12.2.5.117s_seq32_transport . . . 130
12.2.5.118s_seq32_transpose . . . 130
12.2.5.119s_seq32_menu_buttons . . . 130
12.2.5.120s_seq32_lfo_support . . . 130
12.2.5.121s_debug_mode . . . 130
12.2.5.122s_status_pairs . . . 130
12.2.5.123s_character_mapping . . . 130
12.2.5.124s_global_lash_driver . . . 131
12.2.5.125c_status_replace . . . 131
12.2.5.126c_status_snapshot . . . 131
12.2.5.127c_status_queue . . . 132
12.2.5.128g_rc_settings . . . 132
12.2.5.129g_user_settings . . . 132
12.2.5.130s_handlesize [1/2] . . . 132
12.2.5.131s_jitter_amount . . . 132
12.2.5.132gs_mainwid_pointer . . . 132
12.2.5.133c_mainwid_x . . . 132
12.2.5.134c_mainwid_y . . . 133
12.2.5.135gs_perfedit_pointer_0 . . . 133
12.2.5.136gs_perfedit_pointer_1 . . . 133
12.2.5.137s_handlesize [2/2] . . . 133

13 Data Structure Documentation 135

13.1 seq64::AbstractPerfInput Class Reference . . . 135

13.1.1 Constructor & Destructor Documentation . . . 136

13.1.1.1 AbstractPerfInput() . . . 136

13.1.1.2 ~AbstractPerfInput() . . . 136

13.1.2 Member Function Documentation . . . 137

13.1.2.1 on_button_press_event() . . . 137

13.1.2.2 on_button_release_event() . . . 137

13.1.2.3 on_motion_notify_event() . . . 137

13.1.2.4 activate_adding() . . . 137

13.1.2.5 handle_motion_key() . . . 137

13.1.2.6 is_adding() . . . 138

13.1.2.7 set_adding() . . . 138

13.1.2.8 is_adding_pressed() . . . 138

13.1.2.9 set_adding_pressed() . . . 138

13.1.3 Friends And Related Function Documentation . . . 138

13.1.3.1 perfroll . . . 138

13.1.4 Field Documentation . . . 138

13.1.4.1 m_adding . . . 138

13.1.4.2 m_adding_pressed . . . 139

13.2 seq64::automutex Class Reference . . . 139

13.2.1 Detailed Description . . . 139

13.2.2 Constructor & Destructor Documentation . . . 139

13.2.2.1 automutex() [1/3] . . . 139

13.2.2.2 automutex() [2/3] . . . 139

13.2.2.3 automutex() [3/3] . . . 139

13.2.2.4 ~automutex() . . . 140

13.2.3 Member Function Documentation . . . 140

13.2.3.1 operator=() . . . 140

13.2.4 Field Documentation . . . 140

13.2.4.1 m_safety_mutex . . . 140
13.3 seq64::busarray Class Reference . . . 140
13.3.1 Constructor & Destructor Documentation . . . 142
13.3.1.1 busarray() . . . 142
13.3.1.2 ~busarray() . . . 142
13.3.2 Member Function Documentation . . . 142
13.3.2.1 add() [1/2] . . . 142
13.3.2.2 add() [2/2] . . . 143
13.3.2.3 initialize() . . . 143
13.3.2.4 count() . . . 143
13.3.2.5 bus() . . . 144
13.3.2.6 start() . . . 144
13.3.2.7 stop() . . . 144
13.3.2.8 continue_from() . . . 144
13.3.2.9 init_clock() . . . 144
13.3.2.10 clock() . . . 144
13.3.2.11 sysex() . . . 145
13.3.2.12 play() . . . 145
13.3.2.13 set_clock() . . . 145
13.3.2.14 set_all_clocks() . . . 146
13.3.2.15 get_clock() . . . 146
13.3.2.16 get_midi_bus_name() . . . 146
13.3.2.17 print() . . . 147
13.3.2.18 port_exit() . . . 147
13.3.2.19 set_input() . . . 147
13.3.2.20 set_all_inputs() . . . 148
13.3.2.21 get_input() . . . 148
13.3.2.22 is_system_port() . . . 148
13.3.2.23 poll_for_midi() . . . 149
13.3.2.24 get_midi_event() . . . 149

13.3.2.25 replacement_port() . . . 149
13.3.3 Field Documentation . . . 150
13.3.3.1 m_container . . . 150
13.4 seq64::businfo Class Reference . . . 150
13.4.1 Detailed Description . . . 151
13.4.2 Constructor & Destructor Documentation . . . 151
13.4.2.1 businfo() [1/3] . . . 151
13.4.2.2 businfo() [2/3] . . . 151
13.4.2.3 businfo() [3/3] . . . 152
13.4.2.4 ∼businfo() . . . 152
13.4.3 Member Function Documentation . . . 152
13.4.3.1 remove() . . . 152
13.4.3.2 bus() [1/3] . . . 152
13.4.3.3 bus() [2/3] . . . 152
13.4.3.4 active() . . . 153
13.4.3.5 initialize() . . . 153
13.4.3.6 initialized() . . . 153
13.4.3.7 init_clock() [1/3] . . . 153
13.4.3.8 init_input() [1/2] . . . 154
13.4.3.9 bus() [3/3] . . . 154
13.4.3.10 activate() . . . 154
13.4.3.11 deactivate() . . . 154
13.4.3.12 init_clock() [2/3] . . . 154
13.4.3.13 init_input() [2/2] . . . 154
13.4.3.14 start() . . . 154
13.4.3.15 stop() . . . 155
13.4.3.16 continue_from() . . . 155
13.4.3.17 init_clock() [3/3] . . . 155
13.4.3.18 clock() . . . 155
13.4.3.19 sysex() . . . 155

13.4.3.20 print() . . . 155
13.4.4 Friends And Related Function Documentation . . . 155
13.4.4.1 busarray . . . 155
13.4.5 Field Documentation . . . 156
13.4.5.1 m_bus . . . 156
13.4.5.2 m_active . . . 156
13.4.5.3 m_initialized . . . 156
13.4.5.4 m_init_clock . . . 156
13.4.5.5 m_init_input . . . 156
13.5 seq64::click Class Reference . . . 156
13.5.1 Detailed Description . . . 157
13.5.2 Constructor & Destructor Documentation . . . 158
13.5.2.1 click() [1/3] . . . 158
13.5.2.2 click() [2/3] . . . 158
13.5.2.3 click() [3/3] . . . 158
13.5.3 Member Function Documentation . . . 158
13.5.3.1 operator=() . . . 159
13.5.3.2 is_press() . . . 159
13.5.3.3 is_left() . . . 159
13.5.3.4 is_middle() . . . 159
13.5.3.5 is_right() . . . 159
13.5.3.6 x() . . . 159
13.5.3.7 y() . . . 160
13.5.3.8 button() . . . 160
13.5.3.9 modifier() . . . 160
13.5.3.10 mod_control() . . . 160
13.5.3.11 mod_control_shift() . . . 160
13.5.3.12 mod_super() . . . 160
13.5.4 Field Documentation . . . 160
13.5.4.1 m_is_press . . . 160

13.5.4.2 m_x . . . 161
13.5.4.3 m_y . . . 161
13.5.4.4 m_button . . . 161
13.5.4.5 m_modifier . . . 161
13.6 seq64::condition_var Class Reference . . . 161
13.6.1 Detailed Description . . . 162
13.6.2 Constructor & Destructor Documentation . . . 162
13.6.2.1 condition_var() . . . 162
13.6.3 Member Function Documentation . . . 162
13.6.3.1 wait() . . . 162
13.6.3.2 signal() . . . 163
13.6.4 Field Documentation . . . 163
13.6.4.1 sm_cond . . . 163
13.6.4.2 m_cond . . . 163
13.7 seq64::configfile Class Reference . . . 163
13.7.1 Constructor & Destructor Documentation . . . 164
13.7.1.1 configfile() . . . 164
13.7.1.2 ∼configfile() . . . 165
13.7.2 Member Function Documentation . . . 165
13.7.2.1 next_data_line() . . . 165
13.7.2.2 line_after() . . . 165
13.7.2.3 parse() . . . 166
13.7.2.4 write() . . . 166
13.7.2.5 get_error_message() . . . 166
13.7.2.6 set_error_message() . . . 166
13.7.3 Field Documentation . . . 166
13.7.3.1 m_error_message . . . 166
13.7.3.2 m_name . . . 167
13.7.3.3 m_d . . . 167
13.7.3.4 m_line . . . 167

13.8 seq64::editable_event Class Reference . . . 167
13.8.1 Detailed Description . . . 171
13.8.2 Member Enumeration Documentation . . . 171
13.8.2.1 category_t . . . 171
13.8.2.2 timestamp_format_t . . . 172
13.8.3 Constructor & Destructor Documentation . . . 172
13.8.3.1 editable_event() [1/4] . . . 172
13.8.3.2 editable_event() [2/4] . . . 173
13.8.3.3 editable_event() [3/4] . . . 173
13.8.3.4 editable_event() [4/4] . . . 173
13.8.3.5 ~editable_event() . . . 173
13.8.4 Member Function Documentation . . . 174
13.8.4.1 value_to_name() . . . 174
13.8.4.2 name_to_value() . . . 174
13.8.4.3 operator=() . . . 174
13.8.4.4 parent() . . . 175
13.8.4.5 category() [1/3] . . . 175
13.8.4.6 category() [2/3] . . . 175
13.8.4.7 category_string() . . . 175
13.8.4.8 category() [3/3] . . . 175
13.8.4.9 timestamp_string() . . . 175
13.8.4.10 timestamp() [1/3] . . . 176
13.8.4.11 timestamp() [2/3] . . . 176
13.8.4.12 timestamp() [3/3] . . . 176
13.8.4.13 time_as_pulses() . . . 176
13.8.4.14 time_as_measures() . . . 176
13.8.4.15 time_as_minutes() . . . 177
13.8.4.16 set_status_from_string() . . . 177
13.8.4.17 format_timestamp() . . . 177
13.8.4.18 stock_event_string() . . . 177

13.8.4.19 status_string() . . . 178
13.8.4.20 meta_string() . . . 178
13.8.4.21 seqspec_string() . . . 178
13.8.4.22 channel_string() . . . 178
13.8.4.23 data_string() . . . 178
13.8.4.24 analyze() . . . 178
13.8.5 Field Documentation . . . 179
13.8.5.1 sm_category_names . . . 179
13.8.5.2 sm_channel_event_names . . . 179
13.8.5.3 sm_system_event_names . . . 179
13.8.5.4 sm_meta_event_names . . . 179
13.8.5.5 sm_prop_event_names . . . 179
13.8.5.6 sm_category_arrays . . . 180
13.8.5.7 m_parent . . . 180
13.8.5.8 m_category . . . 180
13.8.5.9 m_name_category . . . 180
13.8.5.10 m_format_timestamp . . . 180
13.8.5.11 m_name_timestamp . . . 180
13.8.5.12 m_name_status . . . 180
13.8.5.13 m_name_meta . . . 181
13.8.5.14 m_name_seqspec . . . 181
13.8.5.15 m_name_channel . . . 181
13.8.5.16 m_name_data . . . 181
13.9 seq64::editable_events Class Reference . . . 181
13.9.1 Member Typedef Documentation . . . 183
13.9.1.1 Key . . . 183
13.9.1.2 EventsPair . . . 183
13.9.1.3 Events . . . 183
13.9.1.4 iterator . . . 183
13.9.1.5 const_iterator . . . 184

13.9.2 Constructor & Destructor Documentation . . . 184
13.9.2.1 editable_events() [1/3] . . . 184
13.9.2.2 editable_events() [2/3] . . . 184
13.9.2.3 editable_events() [3/3] . . . 184
13.9.2.4 ~editable_events() . . . 184
13.9.3 Member Function Documentation . . . 185
13.9.3.1 operator=() . . . 185
13.9.3.2 timing() . . . 185
13.9.3.3 string_to_pulses() . . . 185
13.9.3.4 load_events() . . . 185
13.9.3.5 save_events() . . . 186
13.9.3.6 events() . . . 186
13.9.3.7 begin() [1/2] . . . 186
13.9.3.8 begin() [2/2] . . . 186
13.9.3.9 end() [1/2] . . . 186
13.9.3.10 end() [2/2] . . . 186
13.9.3.11 dref() [1/2] . . . 186
13.9.3.12 dref() [2/2] . . . 187
13.9.3.13 count() . . . 187
13.9.3.14 add() [1/2] . . . 187
13.9.3.15 add() [2/2] . . . 187
13.9.3.16 replace() . . . 188
13.9.3.17 remove() . . . 188
13.9.3.18 clear() . . . 188
13.9.3.19 current_event() [1/2] . . . 188
13.9.3.20 current_event() [2/2] . . . 188
13.9.4 Friends And Related Function Documentation . . . 189
13.9.4.1 eventslots . . . 189
13.9.5 Field Documentation . . . 189
13.9.5.1 m_events . . . 189

13.9.5.2 m_current_event . . . 189
13.9.5.3 m_sequence . . . 189
13.9.5.4 m_midi_parameters . . . 189
13.10 seq64::event Class Reference . . . 190
13.10.1 Detailed Description . . . 194
13.10.2 Member Typedef Documentation . . . 194
13.10.2.1 SysexContainer . . . 194
13.10.3 Constructor & Destructor Documentation . . . 194
13.10.3.1 event() [1/2] . . . 194
13.10.3.2 event() [2/2] . . . 195
13.10.3.3 ∼event() . . . 195
13.10.4 Member Function Documentation . . . 195
13.10.4.1 operator=() . . . 195
13.10.4.2 operator<() . . . 196
13.10.4.3 set_timestamp() . . . 196
13.10.4.4 get_timestamp() . . . 197
13.10.4.5 get_channel() . . . 197
13.10.4.6 check_channel() . . . 197
13.10.4.7 is_channel_msg() . . . 197
13.10.4.8 is_one_byte_msg() . . . 198
13.10.4.9 is_two_byte_msg() . . . 198
13.10.4.10 is_note_msg() . . . 199
13.10.4.11 is_strict_note_msg() . . . 199
13.10.4.12 is_desired_cc_or_not_cc() . . . 199
13.10.4.13 mod_timestamp() . . . 200
13.10.4.14 set_status() [1/2] . . . 200
13.10.4.15 set_status() [2/2] . . . 201
13.10.4.16 set_status_keep_channel() . . . 201
13.10.4.17 set_channel() . . . 201
13.10.4.18 get_status() . . . 202

13.10.4.19 non_cc_match() . . . 202
13.10.4.20 cc_match() . . . 202
13.10.4.21 set_data() [1/2] . . . 202
13.10.4.22 set_data() [2/2] . . . 203
13.10.4.23 get_data() . . . 203
13.10.4.24 increment_data1() . . . 203
13.10.4.25 decrement_data1() . . . 203
13.10.4.26 increment_data2() . . . 203
13.10.4.27 decrement_data2() . . . 204
13.10.4.28 append_sysex() [1/2] . . . 204
13.10.4.29 append_sysex() [2/2] . . . 204
13.10.4.30 restart_sysex() . . . 204
13.10.4.31 get_sysex() [1/2] . . . 204
13.10.4.32 get_sysex() [2/2] . . . 205
13.10.4.33 set_sysex_size() . . . 205
13.10.4.34 get_sysex_size() . . . 205
13.10.4.35 link() . . . 205
13.10.4.36 get_linked() . . . 205
13.10.4.37 is_linked() . . . 205
13.10.4.38 clear_link() . . . 205
13.10.4.39 paint() . . . 206
13.10.4.40 unpaint() . . . 206
13.10.4.41 is_painted() . . . 206
13.10.4.42 mark() . . . 206
13.10.4.43 unmark() . . . 206
13.10.4.44 is_marked() . . . 206
13.10.4.45 select() . . . 206
13.10.4.46 unselect() . . . 206
13.10.4.47 is_selected() . . . 207
13.10.4.48 make_clock() . . . 207

13.10.4.49 data() . . . 207
13.10.4.50 get_note() . . . 207
13.10.4.51 set_note() . . . 207
13.10.4.52 transpose_note() . . . 207
13.10.4.53 get_note_velocity() . . . 208
13.10.4.54 set_note_velocity() . . . 208
13.10.4.55 is_note_on() . . . 208
13.10.4.56 is_note_off() . . . 208
13.10.4.57 is_note() . . . 209
13.10.4.58 is_note_off_recorded() . . . 209
13.10.4.59 print() . . . 209
13.10.4.60 get_rank() . . . 209
13.10.5 Field Documentation . . . 210
13.10.5.1 m_timestamp . . . 210
13.10.5.2 m_status . . . 210
13.10.5.3 m_channel . . . 210
13.10.5.4 m_data . . . 210
13.10.5.5 m_sysex . . . 210
13.10.5.6 m_sysex_size . . . 210
13.10.5.7 m_linked . . . 210
13.10.5.8 m_has_link . . . 211
13.10.5.9 m_selected . . . 211
13.10.5.10 m_marked . . . 211
13.10.5.11 m_painted . . . 211
13.11 seq64::event_list::event_key Class Reference . . . 211
13.11.1 Detailed Description . . . 211
13.11.2 Constructor & Destructor Documentation . . . 212
13.11.2.1 event_key() [1/2] . . . 212
13.11.2.2 event_key() [2/2] . . . 212
13.11.3 Member Function Documentation . . . 212

13.11.3.1 operator<() . . . 212
13.11.4 Field Documentation . . . 213
13.11.4.1 m_timestamp . . . 213
13.11.4.2 m_rank . . . 213
13.12seq64::event_list Class Reference . . . 213
13.12.1 Detailed Description . . . 215
13.12.2 Member Typedef Documentation . . . 215
13.12.2.1 Events . . . 215
13.12.2.2 EventsPair . . . 216
13.12.2.3 iterator . . . 216
13.12.2.4 const_iterator . . . 216
13.12.3 Constructor & Destructor Documentation . . . 216
13.12.3.1 event_list() [1/2] . . . 216
13.12.3.2 event_list() [2/2] . . . 216
13.12.3.3 ~event_list() . . . 216
13.12.4 Member Function Documentation . . . 216
13.12.4.1 operator=() . . . 217
13.12.4.2 begin() [1/2] . . . 217
13.12.4.3 begin() [2/2] . . . 217
13.12.4.4 end() [1/2] . . . 217
13.12.4.5 end() [2/2] . . . 217
13.12.4.6 count() . . . 217
13.12.4.7 empty() . . . 217
13.12.4.8 add() . . . 217
13.12.4.9 append() . . . 218
13.12.4.10push_back() . . . 218
13.12.4.11is_modified() . . . 219
13.12.4.12unmodify() . . . 219
13.12.4.13remove() . . . 219
13.12.4.14clear() . . . 219

13.12.4.15 merge() . . . 219
13.12.4.16 sort() . . . 220
13.12.4.17 dref() [1/2] . . . 220
13.12.4.18 dref() [2/2] . . . 220
13.12.4.19 link_new() . . . 221
13.12.4.20 clear_links() . . . 221
13.12.4.21 verify_and_link() . . . 221
13.12.4.22 mark_selected() . . . 221
13.12.4.23 mark_out_of_range() . . . 221
13.12.4.24 mark_all() . . . 222
13.12.4.25 unmark_all() . . . 222
13.12.4.26 remove_marked() . . . 222
13.12.4.27 unpaint_all() . . . 222
13.12.4.28 count_selected_notes() . . . 222
13.12.4.29 any_selected_notes() . . . 223
13.12.4.30 count_selected_events() . . . 223
13.12.4.31 select_all() . . . 223
13.12.4.32 unselect_all() . . . 223
13.12.4.33 print() . . . 223
13.12.4.34 events() . . . 224
13.12.5 Friends And Related Function Documentation . . . 224
13.12.5.1 editable_events . . . 224
13.12.5.2 midifile . . . 224
13.12.5.3 midi_container . . . 224
13.12.5.4 midi_splitter . . . 224
13.12.5.5 sequence . . . 224
13.12.6 Field Documentation . . . 224
13.12.6.1 m_events . . . 224
13.12.6.2 m_is_modified . . . 225
13.13 seq64::eventedit Class Reference . . . 225

13.13.1 Constructor & Destructor Documentation . . . 229
13.13.1.1 eventedit() . . . 229
13.13.1.2 ~eventedit() . . . 230
13.13.2 Member Function Documentation . . . 231
13.13.2.1 enqueue_draw() . . . 231
13.13.2.2 set_seq_title() . . . 231
13.13.2.3 set_seq_time_sig() . . . 231
13.13.2.4 set_seq_ppqn() . . . 231
13.13.2.5 set_seq_count() . . . 231
13.13.2.6 set_event_category() . . . 232
13.13.2.7 set_event_timestamp() . . . 232
13.13.2.8 set_event_name() . . . 232
13.13.2.9 set_event_data_0() . . . 232
13.13.2.10 set_event_data_1() . . . 233
13.13.2.11 perf_modify() . . . 233
13.13.2.12 set_dirty() . . . 233
13.13.2.13 v_adjustment() [1/2] . . . 233
13.13.2.14 v_adjustment() [2/2] . . . 233
13.13.2.15 change_focus() . . . 234
13.13.2.16 close_out() . . . 234
13.13.2.17 handle_close() . . . 234
13.13.2.18 handle_delete() . . . 234
13.13.2.19 handle_insert() . . . 235
13.13.2.20 handle_modify() . . . 235
13.13.2.21 handle_save() . . . 235
13.13.2.22 handle_cancel() . . . 235
13.13.2.23 on_realize() . . . 235
13.13.2.24 on_set_focus() . . . 235
13.13.2.25 on_focus_in_event() . . . 236
13.13.2.26 on_focus_out_event() . . . 236

13.13.2.27 on_key_press_event() . . . 236
13.13.2.28 on_delete_event() . . . 236
13.13.3 Friends And Related Function Documentation . . . 237
13.13.3.1 eventslots . . . 237
13.13.4 Field Documentation . . . 237
13.13.4.1 m_table . . . 237
13.13.4.2 m_vadjust . . . 237
13.13.4.3 m_vscroll . . . 237
13.13.4.4 m_eventslots . . . 237
13.13.4.5 m_htopbox . . . 238
13.13.4.6 m_showbox . . . 238
13.13.4.7 m_editbox . . . 238
13.13.4.8 m_optsbox . . . 238
13.13.4.9 m_bottbox . . . 238
13.13.4.10 m_rightbox . . . 238
13.13.4.11 m_button_del . . . 238
13.13.4.12 m_button_ins . . . 238
13.13.4.13 m_button_modify . . . 239
13.13.4.14 m_button_save . . . 239
13.13.4.15 m_button_cancel . . . 239
13.13.4.16 m_label_seq_name . . . 239
13.13.4.17 m_label_time_sig . . . 239
13.13.4.18 m_label_ppqn . . . 239
13.13.4.19 m_label_channel . . . 239
13.13.4.20 m_label_ev_count . . . 239
13.13.4.21 m_label_spacer . . . 240
13.13.4.22 m_label_modified . . . 240
13.13.4.23 m_label_category . . . 240
13.13.4.24 m_entry_ev_timestamp . . . 240
13.13.4.25 m_entry_ev_name . . . 240

13.13.4.26 m_entry_ev_data_0 . . . 240
13.13.4.27 m_entry_ev_data_1 . . . 240
13.13.4.28 m_label_time_fmt . . . 240
13.13.4.29 m_label_right . . . 241
13.13.4.30 m_seq . . . 241
13.13.4.31 m_have_focus . . . 241
13.14 seq64::eventslots Class Reference . . . 241
13.14.1 Constructor & Destructor Documentation . . . 245
13.14.1.1 eventslots() . . . 246
13.14.1.2 ~eventslots() . . . 246
13.14.2 Member Function Documentation . . . 246
13.14.2.1 event_count() . . . 246
13.14.2.2 line_count() . . . 246
13.14.2.3 line_maximum() . . . 246
13.14.2.4 line_increment() . . . 246
13.14.2.5 top_index() . . . 246
13.14.2.6 current_index() . . . 247
13.14.2.7 pager_index() . . . 247
13.14.2.8 load_events() . . . 247
13.14.2.9 set_current_event() . . . 247
13.14.2.10 insert_event() [1/2] . . . 247
13.14.2.11 insert_event() [2/2] . . . 248
13.14.2.12 delete_current_event() . . . 249
13.14.2.13 modify_current_event() . . . 250
13.14.2.14 save_events() . . . 250
13.14.2.15 select_event() . . . 250
13.14.2.16 set_text() . . . 251
13.14.2.17 enqueue_draw() . . . 251
13.14.2.18 convert_y() . . . 251
13.14.2.19 draw_event() . . . 252

13.14.2.20 draw_events() . . . 252
13.14.2.21 change_vert() . . . 253
13.14.2.22 page_movement() . . . 253
13.14.2.23 page_topper() . . . 253
13.14.2.24 decrement_top() . . . 254
13.14.2.25 increment_top() . . . 254
13.14.2.26 decrement_current() . . . 254
13.14.2.27 increment_current() . . . 254
13.14.2.28 decrement_bottom() . . . 255
13.14.2.29 increment_bottom() . . . 255
13.14.2.30 on_realize() . . . 255
13.14.2.31 on_expose_event() . . . 255
13.14.2.32 on_button_press_event() . . . 255
13.14.2.33 on_button_release_event() . . . 255
13.14.2.34 on_focus_in_event() . . . 256
13.14.2.35 on_focus_out_event() . . . 256
13.14.2.36 on_scroll_event() . . . 256
13.14.2.37 on_size_allocate() . . . 256
13.14.2.38 on_move_up() . . . 256
13.14.2.39 on_move_down() . . . 256
13.14.2.40 on_frame_up() . . . 256
13.14.2.41 on_frame_down() . . . 257
13.14.2.42 on_frame_home() . . . 257
13.14.2.43 on_frame_end() . . . 257
13.14.3 Friends And Related Function Documentation . . . 257
13.14.3.1 eventedit . . . 257
13.14.4 Field Documentation . . . 257
13.14.4.1 m_parent . . . 257
13.14.4.2 m_seq . . . 257
13.14.4.3 m_event_container . . . 257

13.14.4.4 m_slots_chars . . . 258
13.14.4.5 m_char_w . . . 258
13.14.4.6 m_setbox_w . . . 258
13.14.4.7 m_slots_x . . . 258
13.14.4.8 m_slots_y . . . 258
13.14.4.9 m_event_count . . . 258
13.14.4.10 m_line_count . . . 258
13.14.4.11 m_line_maximum . . . 259
13.14.4.12 m_line_overlap . . . 259
13.14.4.13 m_top_index . . . 259
13.14.4.14 m_current_index . . . 259
13.14.4.15 m_top_iterator . . . 259
13.14.4.16 m_bottom_iterator . . . 259
13.14.4.17 m_current_iterator . . . 259
13.14.4.18 m_pager_index . . . 260
13.15 seq64::font Class Reference . . . 260
13.15.1 Member Enumeration Documentation . . . 261
13.15.1.1 Color . . . 261
13.15.2 Constructor & Destructor Documentation . . . 261
13.15.2.1 font() . . . 262
13.15.3 Member Function Documentation . . . 262
13.15.3.1 init() . . . 262
13.15.3.2 render_string_on_drawable() . . . 262
13.15.3.3 char_width() . . . 263
13.15.3.4 char_height() . . . 263
13.15.3.5 padded_height() . . . 263
13.15.4 Field Documentation . . . 263
13.15.4.1 m_use_new_font . . . 263
13.15.4.2 m_cell_w . . . 263
13.15.4.3 m_cell_h . . . 263

13.15.4.4 m_font_w . . . 263
13.15.4.5 m_font_h . . . 264
13.15.4.6 m_offset . . . 264
13.15.4.7 m_padded_h . . . 264
13.15.4.8 m_pixmap . . . 264
13.15.4.9 m_black_pixmap . . . 264
13.15.4.10 m_white_pixmap . . . 264
13.15.4.11 m_b_on_y_pixmap . . . 264
13.15.4.12 m_y_on_b_pixmap . . . 265
13.15.4.13 m_b_on_c_pixmap . . . 265
13.15.4.14 m_c_on_b_pixmap . . . 265
13.15.4.15 m_clip_mask . . . 265
13.16 seq64::FruityPerfInput Class Reference . . . 265
13.16.1 Constructor & Destructor Documentation . . . 267
13.16.1.1 FruityPerfInput() . . . 267
13.16.2 Member Function Documentation . . . 267
13.16.2.1 on_button_press_event() . . . 267
13.16.2.2 on_button_release_event() . . . 268
13.16.2.3 on_motion_notify_event() . . . 268
13.16.2.4 update_mouse_pointer() . . . 269
13.16.2.5 on_left_button_pressed() . . . 269
13.16.2.6 on_right_button_pressed() . . . 269
13.16.2.7 activate_adding() . . . 270
13.16.2.8 handle_motion_key() . . . 270
13.16.3 Friends And Related Function Documentation . . . 270
13.16.3.1 perfroll . . . 270
13.16.4 Field Documentation . . . 270
13.16.4.1 m_current_x . . . 270
13.16.4.2 m_current_y . . . 271
13.17 seq64::FruitySeqEventInput Struct Reference . . . 271

13.17.1 Constructor & Destructor Documentation . . . 271
13.17.1.1 FruitySeqEventInput() . . . 271
13.17.2 Member Function Documentation . . . 271
13.17.2.1 update_mouse_pointer() . . . 271
13.17.2.2 on_button_press_event() . . . 272
13.17.2.3 on_button_release_event() . . . 273
13.17.2.4 on_motion_notify_event() . . . 273
13.17.3 Field Documentation . . . 273
13.17.3.1 m_justselected_one . . . 273
13.17.3.2 m_is_drag_pasting_start . . . 273
13.17.3.3 m_is_drag_pasting . . . 274
13.18 seq64::FruitySeqRollInput Class Reference . . . 274
13.18.1 Constructor & Destructor Documentation . . . 274
13.18.1.1 FruitySeqRollInput() . . . 274
13.18.2 Member Function Documentation . . . 274
13.18.2.1 update_mouse_pointer() . . . 274
13.18.2.2 on_button_press_event() . . . 275
13.18.2.3 on_button_release_event() . . . 275
13.18.2.4 on_motion_notify_event() . . . 275
13.18.3 Field Documentation . . . 276
13.18.3.1 m_erase_painting . . . 276
13.18.3.2 m_drag_paste_start_pos . . . 276
13.19 seq64::gui_assistant Class Reference . . . 276
13.19.1 Detailed Description . . . 278
13.19.2 Constructor & Destructor Documentation . . . 278
13.19.2.1 gui_assistant() . . . 278
13.19.2.2 ~gui_assistant() . . . 278
13.19.3 Member Function Documentation . . . 278
13.19.3.1 quit() . . . 278
13.19.3.2 jack_idle_connect() . . . 278

13.19.3.3 lash_timeout_connect() . . . 279
13.19.3.4 keys() [1/2] . . . 279
13.19.3.5 keys() [2/2] . . . 279
13.19.4 Field Documentation . . . 279
13.19.4.1 m_keys_perform . . . 279
13.20 seq64::gui_assistant_gtk2 Class Reference . . . 279
13.20.1 Constructor & Destructor Documentation . . . 280
13.20.1.1 gui_assistant_gtk2() . . . 281
13.20.1.2 ~gui_assistant_gtk2() . . . 281
13.20.2 Member Function Documentation . . . 281
13.20.2.1 quit() . . . 281
13.20.2.2 lash_timeout_connect() . . . 281
13.20.2.3 jack_idle_connect() . . . 281
13.20.3 Field Documentation . . . 281
13.20.3.1 sm_internal_keys . . . 282
13.21 seq64::gui_drawingarea_gtk2 Class Reference . . . 282
13.21.1 Detailed Description . . . 285
13.21.2 Constructor & Destructor Documentation . . . 285
13.21.2.1 gui_drawingarea_gtk2() [1/3] . . . 285
13.21.2.2 gui_drawingarea_gtk2() [2/3] . . . 285
13.21.2.3 gui_drawingarea_gtk2() [3/3] . . . 286
13.21.2.4 ~gui_drawingarea_gtk2() . . . 286
13.21.3 Member Function Documentation . . . 286
13.21.3.1 operator=() . . . 286
13.21.3.2 window_x() . . . 286
13.21.3.3 window_y() . . . 286
13.21.3.4 current_x() . . . 286
13.21.3.5 current_y() . . . 287
13.21.3.6 drop_x() . . . 287
13.21.3.7 drop_y() . . . 287

13.21.3.8 force_draw() . . . 287
13.21.3.9 perf() . . . 287
13.21.3.10 clear_window() . . . 287
13.21.3.11 set_line() . . . 287
13.21.3.12 draw_line() [1/6] . . . 288
13.21.3.13 draw_line() [2/6] . . . 288
13.21.3.14 draw_line_on_pixmap() [1/2] . . . 288
13.21.3.15 draw_line_on_pixmap() [2/2] . . . 289
13.21.3.16 draw_line() [3/6] . . . 289
13.21.3.17 draw_line() [4/6] . . . 290
13.21.3.18 draw_line() [5/6] . . . 290
13.21.3.19 draw_line() [6/6] . . . 290
13.21.3.20 render_string() . . . 291
13.21.3.21 render_string_on_pixmap() . . . 291
13.21.3.22 draw_rectangle() [1/6] . . . 292
13.21.3.23 draw_rectangle() [2/6] . . . 292
13.21.3.24 draw_rectangle() [3/6] . . . 292
13.21.3.25 draw_rectangle() [4/6] . . . 293
13.21.3.26 draw_rectangle() [5/6] . . . 293
13.21.3.27 draw_rectangle() [6/6] . . . 294
13.21.3.28 draw_rectangle_on_pixmap() [1/2] . . . 294
13.21.3.29 draw_rectangle_on_pixmap() [2/2] . . . 295
13.21.3.30 draw_normal_rectangle_on_pixmap() . . . 295
13.21.3.31 draw_drawable() . . . 296
13.21.3.32 scroll_hadjust() . . . 296
13.21.3.33 scroll_vadjust() . . . 296
13.21.3.34 scroll_hset() . . . 297
13.21.3.35 scroll_vset() . . . 297
13.21.3.36 set_current_drop_x() . . . 297
13.21.3.37 set_current_drop_y() . . . 297

13.21.3.38 gtk_drawarea_init() . . . 298
13.21.3.39 on_realize() . . . 298
13.21.4 Field Documentation . . . 298
13.21.4.1 m_gc . . . 298
13.21.4.2 m_window . . . 298
13.21.4.3 m_vadjust . . . 298
13.21.4.4 m_hadjust . . . 298
13.21.4.5 m_pixmap . . . 298
13.21.4.6 m_background . . . 299
13.21.4.7 m_foreground . . . 299
13.21.4.8 m_mainperf . . . 299
13.21.4.9 m_window_x . . . 299
13.21.4.10 m_window_y . . . 299
13.21.4.11 m_current_x . . . 299
13.21.4.12 m_current_y . . . 299
13.21.4.13 m_drop_x . . . 300
13.21.4.14 m_drop_y . . . 300
13.22 seq64::gui_palette_gtk2 Class Reference . . . 300
13.22.1 Detailed Description . . . 303
13.22.2 Member Typedef Documentation . . . 303
13.22.2.1 Color . . . 303
13.22.3 Constructor & Destructor Documentation . . . 304
13.22.3.1 gui_palette_gtk2() . . . 304
13.22.3.2 ~gui_palette_gtk2() . . . 304
13.22.4 Member Function Documentation . . . 304
13.22.4.1 load_inverse_palette() . . . 304
13.22.4.2 is_inverse() . . . 305
13.22.4.3 line_color() . . . 305
13.22.4.4 progress_color() . . . 305
13.22.4.5 black() . . . 305

13.22.4.6 dark_red() . . . 305
13.22.4.7 dark_green() . . . 305
13.22.4.8 dark_orange() . . . 305
13.22.4.9 dark_blue() . . . 306
13.22.4.10 dark_magenta() . . . 306
13.22.4.11 dark_cyan() . . . 306
13.22.4.12 white() . . . 306
13.22.4.13 grey() . . . 306
13.22.4.14 dark_grey() . . . 306
13.22.4.15 light_grey() . . . 306
13.22.4.16 red() . . . 306
13.22.4.17 orange() . . . 307
13.22.4.18 yellow() . . . 307
13.22.4.19 green() . . . 307
13.22.4.20 blue() . . . 307
13.22.4.21 black_paint() . . . 307
13.22.4.22 white_paint() . . . 307
13.22.4.23 black_key() . . . 307
13.22.4.24 white_key() . . . 307
13.22.4.25 bg_color() [1/2] . . . 308
13.22.4.26 bg_color() [2/2] . . . 308
13.22.4.27 fg_color() [1/2] . . . 308
13.22.4.28 fg_color() [2/2] . . . 308
13.22.5 Field Documentation . . . 308
13.22.5.1 m_is_inverse . . . 308
13.22.5.2 m_black . . . 308
13.22.5.3 m_dk_red . . . 308
13.22.5.4 m_dk_green . . . 309
13.22.5.5 m_dk_orange . . . 309
13.22.5.6 m_dk_blue . . . 309

13.22.5.7 m_dk_magenta . . . 309
13.22.5.8 m_dk_cyan . . . 309
13.22.5.9 m_red . . . 309
13.22.5.10 m_white . . . 309
13.22.5.11 m_orange . . . 309
13.22.5.12 m_yellow . . . 310
13.22.5.13 m_green . . . 310
13.22.5.14 m_blue . . . 310
13.22.5.15 m_grey . . . 310
13.22.5.16 m_dk_grey . . . 310
13.22.5.17 m_lt_grey . . . 310
13.22.5.18 m_blk_paint . . . 310
13.22.5.19 m_wht_paint . . . 310
13.22.5.20 m_blk_key . . . 311
13.22.5.21 m_wht_key . . . 311
13.22.5.22 m_line_color . . . 311
13.22.5.23 m_progress_color . . . 311
13.22.5.24 m_bg_color . . . 311
13.22.5.25 m_fg_color . . . 311
13.23 seq64::gui_window_gtk2 Class Reference . . . 312
13.23.1 Constructor & Destructor Documentation . . . 313
13.23.1.1 gui_window_gtk2() . . . 313
13.23.1.2 ~gui_window_gtk2() . . . 314
13.23.2 Member Function Documentation . . . 314
13.23.2.1 perf() . . . 314
13.23.2.2 quit() . . . 314
13.23.2.3 redraw_period_ms() . . . 314
13.23.2.4 is_realized() . . . 314
13.23.2.5 scroll_hadjust() . . . 314
13.23.2.6 scroll_vadjust() . . . 315

13.23.2.7 scroll_hset() . . . 315
13.23.2.8 scroll_vset() . . . 315
13.23.2.9 on_realize() . . . 315
13.23.3 Field Documentation . . . 316
13.23.3.1 m_mainperf . . . 316
13.23.3.2 m_window_x . . . 316
13.23.3.3 m_window_y . . . 316
13.23.3.4 m_redraw_period_ms . . . 316
13.23.3.5 m_is_realized . . . 316
13.24 seq64::jack_assistant Class Reference . . . 316
13.24.1 Constructor & Destructor Documentation . . . 320
13.24.1.1 jack_assistant() . . . 320
13.24.1.2 ~jack_assistant() . . . 320
13.24.2 Member Function Documentation . . . 321
13.24.2.1 parent() [1/2] . . . 321
13.24.2.2 parent() [2/2] . . . 321
13.24.2.3 is_running() . . . 321
13.24.2.4 is_master() . . . 321
13.24.2.5 get_ppqn() . . . 321
13.24.2.6 get_beat_width() . . . 321
13.24.2.7 set_beat_width() . . . 321
13.24.2.8 get_beats_per_measure() . . . 322
13.24.2.9 set_beats_per_measure() . . . 322
13.24.2.10 get_beats_per_minute() . . . 322
13.24.2.11 set_beats_per_minute() . . . 322
13.24.2.12 transport_state() . . . 322
13.24.2.13 transport_not_starting() . . . 323
13.24.2.14 init() . . . 323
13.24.2.15 deinit() . . . 324
13.24.2.16 session_event() . . . 324

13.24.2.17 activate() . . . 324
13.24.2.18 start() . . . 324
13.24.2.19 stop() . . . 325
13.24.2.20 position() . . . 325
13.24.2.21 output() . . . 326
13.24.2.22 set_ppqn() . . . 326
13.24.2.23 get_jack_tick() . . . 327
13.24.2.24 get_jack_pos() . . . 327
13.24.2.25 toggle_jack_mode() . . . 327
13.24.2.26 set_jack_mode() . . . 327
13.24.2.27 get_jack_mode() . . . 327
13.24.2.28 get_jack_stop_tick() . . . 327
13.24.2.29 set_jack_stop_tick() . . . 328
13.24.2.30 jack_frame_rate() . . . 328
13.24.2.31 get_follow_transport() . . . 328
13.24.2.32 set_follow_transport() . . . 328
13.24.2.33 toggle_follow_transport() . . . 328
13.24.2.34 toggle_song_start_mode() . . . 328
13.24.2.35 song_start_mode() . . . 328
13.24.2.36 set_start_from_perfedit() . . . 329
13.24.2.37 client() . . . 329
13.24.2.38 client_name() . . . 329
13.24.2.39 client_uuid() . . . 329
13.24.2.40 set_jack_running() . . . 329
13.24.2.41 tick_multiplier() . . . 329
13.24.2.42 client_open() . . . 330
13.24.2.43 get_jack_client_info() . . . 330
13.24.2.44 show_position() . . . 330
13.24.2.45 sync() . . . 331
13.24.2.46 set_position() . . . 332

13.24.2.47 info_message() . . . 332
13.24.2.48 error_message() . . . 332
13.24.3 Friends And Related Function Documentation . . . 334
13.24.3.1 jack_transport_callback . . . 334
13.24.3.2 jack_shutdown_callback . . . 334
13.24.3.3 jack_sync_callback . . . 334
13.24.3.4 jack_timebase_callback . . . 335
13.24.3.5 get_current_jack_position . . . 336
13.24.3.6 jack_session_callback . . . 336
13.24.4 Field Documentation . . . 337
13.24.4.1 sm_status_pairs . . . 337
13.24.4.2 m_jack_parent . . . 337
13.24.4.3 m_jack_client . . . 337
13.24.4.4 m_jack_client_name . . . 337
13.24.4.5 m_jack_client_uuid . . . 337
13.24.4.6 m_jack_frame_current . . . 337
13.24.4.7 m_jack_frame_last . . . 338
13.24.4.8 m_jack_pos . . . 338
13.24.4.9 m_jack_transport_state . . . 338
13.24.4.10 m_jack_transport_state_last . . . 338
13.24.4.11 m_jack_tick . . . 338
13.24.4.12 m_jsession_ev . . . 338
13.24.4.13 m_jack_running . . . 338
13.24.4.14 m_jack_master . . . 339
13.24.4.15 m_jack_frame_rate . . . 339
13.24.4.16 m_toggle_jack . . . 339
13.24.4.17 m_jack_stop_tick . . . 339
13.24.4.18 m_follow_transport . . . 339
13.24.4.19 m_ppqn . . . 339
13.24.4.20 m_beats_per_measure . . . 339

13.24.4.21 m_beat_width . . . 340
13.24.4.22 m_beats_per_minute . . . 340
13.25 seq64::jack_scratchpad Class Reference . . . 340
13.25.1 Detailed Description . . . 340
13.25.2 Field Documentation . . . 341
13.25.2.1 js_current_tick . . . 341
13.25.2.2 js_total_tick . . . 341
13.25.2.3 js_clock_tick . . . 341
13.25.2.4 js_jack_stopped . . . 341
13.25.2.5 js_dumping . . . 341
13.25.2.6 js_init_clock . . . 341
13.25.2.7 js_looping . . . 341
13.25.2.8 js_playback_mode . . . 342
13.25.2.9 js_ticks_converted . . . 342
13.25.2.10 js_ticks_delta . . . 342
13.25.2.11 js_ticks_converted_last . . . 342
13.25.2.12 js_delta_tick_frac . . . 342
13.26 seq64::jack_status_pair_t Struct Reference . . . 342
13.26.1 Field Documentation . . . 342
13.26.1.1 jf_bit . . . 343
13.26.1.2 jf_meaning . . . 343
13.27 seq64::keybindentry Class Reference . . . 343
13.27.1 Member Enumeration Documentation . . . 344
13.27.1.1 type . . . 344
13.27.2 Constructor & Destructor Documentation . . . 344
13.27.2.1 keybindentry() . . . 344
13.27.3 Member Function Documentation . . . 345
13.27.3.1 set() . . . 345
13.27.3.2 on_key_press_event() . . . 345
13.27.4 Friends And Related Function Documentation . . . 345

13.27.4.1 options . . . 345
13.27.5 Field Documentation . . . 345
13.27.5.1 m_key . . . 345
13.27.5.2 m_type . . . 346
13.27.5.3 m_perf . . . 346
13.27.5.4 m_slot . . . 346
13.28 seq64::keys_perform Class Reference . . . 346
13.28.1 Detailed Description . . . 353
13.28.2 Member Typedef Documentation . . . 353
13.28.2.1 SlotMap . . . 353
13.28.2.2 RevSlotMap . . . 353
13.28.3 Constructor & Destructor Documentation . . . 353
13.28.3.1 keys_perform() . . . 354
13.28.3.2 ~keys_perform() . . . 354
13.28.4 Member Function Documentation . . . 354
13.28.4.1 set_keys() . . . 354
13.28.4.2 get_keys() . . . 354
13.28.4.3 bpm_up() [1/2] . . . 354
13.28.4.4 bpm_up() [2/2] . . . 355
13.28.4.5 bpm_dn() [1/2] . . . 355
13.28.4.6 bpm_dn() [2/2] . . . 355
13.28.4.7 replace() [1/2] . . . 355
13.28.4.8 replace() [2/2] . . . 355
13.28.4.9 queue() [1/2] . . . 356
13.28.4.10 queue() [2/2] . . . 356
13.28.4.11 keep_queue() [1/2] . . . 356
13.28.4.12 keep_queue() [2/2] . . . 356
13.28.4.13 snapshot_1() [1/2] . . . 356
13.28.4.14 snapshot_1() [2/2] . . . 356
13.28.4.15 snapshot_2() [1/2] . . . 357

13.28.4.16 snapshot_2() [2/2] . . . 357
13.28.4.17 screenset_up() [1/2] . . . 357
13.28.4.18 screenset_up() [2/2] . . . 357
13.28.4.19 screenset_dn() [1/2] . . . 357
13.28.4.20 screenset_dn() [2/2] . . . 358
13.28.4.21 set_playing_screenset() [1/2] . . . 358
13.28.4.22 set_playing_screenset() [2/2] . . . 358
13.28.4.23 group_on() [1/2] . . . 358
13.28.4.24 group_on() [2/2] . . . 358
13.28.4.25 group_off() [1/2] . . . 359
13.28.4.26 group_off() [2/2] . . . 359
13.28.4.27 group_learn() [1/2] . . . 359
13.28.4.28 group_learn() [2/2] . . . 359
13.28.4.29 start() [1/2] . . . 359
13.28.4.30 start() [2/2] . . . 359
13.28.4.31 pause() [1/2] . . . 360
13.28.4.32 pause() [2/2] . . . 360
13.28.4.33 pattern_edit() [1/2] . . . 360
13.28.4.34 pattern_edit() [2/2] . . . 360
13.28.4.35 event_edit() [1/2] . . . 360
13.28.4.36 event_edit() [2/2] . . . 361
13.28.4.37 stop() [1/2] . . . 361
13.28.4.38 stop() [2/2] . . . 361
13.28.4.39 song_mode() [1/2] . . . 361
13.28.4.40 song_mode() [2/2] . . . 361
13.28.4.41 menu_mode() [1/2] . . . 361
13.28.4.42 menu_mode() [2/2] . . . 362
13.28.4.43 follow_transport() [1/2] . . . 362
13.28.4.44 follow_transport() [2/2] . . . 362
13.28.4.45 fast_forward() [1/2] . . . 362

13.28.4.46 fast_forward() [2/2] . . . 362
13.28.4.47 rewind() [1/2] . . . 362
13.28.4.48 rewind() [2/2] . . . 362
13.28.4.49 pointer_position() [1/2] . . . 363
13.28.4.50 pointer_position() [2/2] . . . 363
13.28.4.51 toggle_mutes() [1/2] . . . 363
13.28.4.52 toggle_mutes() [2/2] . . . 363
13.28.4.53 toggle_jack() [1/2] . . . 363
13.28.4.54 toggle_jack() [2/2] . . . 363
13.28.4.55 tap_bpm() [1/2] . . . 363
13.28.4.56 tap_bpm() [2/2] . . . 364
13.28.4.57 show_ui_sequence_key() [1/2] . . . 364
13.28.4.58 show_ui_sequence_key() [2/2] . . . 364
13.28.4.59 show_ui_sequence_number() [1/2] . . . 364
13.28.4.60 show_ui_sequence_number() [2/2] . . . 364
13.28.4.61 get_key_events() . . . 364
13.28.4.62 get_key_groups() . . . 365
13.28.4.63 get_key_events_rev() . . . 365
13.28.4.64 get_key_groups_rev() . . . 365
13.28.4.65 lookup_keyevent_key() . . . 365
13.28.4.66 lookup_keyevent_seq() . . . 365
13.28.4.67 lookup_keygroup_key() . . . 365
13.28.4.68 lookup_keygroup_group() . . . 366
13.28.4.69 key_name() . . . 366
13.28.4.70 set_all_key_events() . . . 366
13.28.4.71 set_all_key_groups() . . . 367
13.28.4.72 set_key_event() . . . 367
13.28.4.73 set_key_group() . . . 367
13.28.4.74 at_bpm_up() . . . 367
13.28.4.75 at_bpm_dn() . . . 368

13.28.4.76 at_replace() . . . 368
13.28.4.77 at_queue() . . . 368
13.28.4.78 at_keep_queue() . . . 368
13.28.4.79 at_snapshot_1() . . . 368
13.28.4.80 at_snapshot_2() . . . 368
13.28.4.81 at_screenset_up() . . . 368
13.28.4.82 at_screenset_dn() . . . 368
13.28.4.83 at_set_playing_screenset() . . . 369
13.28.4.84 at_group_on() . . . 369
13.28.4.85 at_group_off() . . . 369
13.28.4.86 at_group_learn() . . . 369
13.28.4.87 at_start() . . . 369
13.28.4.88 at_pause() . . . 369
13.28.4.89 at_song_mode() . . . 369
13.28.4.90 at_toggle_jack() . . . 369
13.28.4.91 at_menu_mode() . . . 370
13.28.4.92 at_follow_transport() . . . 370
13.28.4.93 at_fast_forward() . . . 370
13.28.4.94 at_rewind() . . . 370
13.28.4.95 at_pointer_position() . . . 370
13.28.4.96 at_toggle_mutes() . . . 370
13.28.4.97 at_tap_bpm() . . . 370
13.28.4.98 at_pattern_edit() . . . 370
13.28.4.99 at_event_edit() . . . 371
13.28.4.100 at_stop() . . . 371
13.28.4.101 at_show_ui_sequence_key() . . . 371
13.28.4.102 at_show_ui_sequence_number() . . . 371
13.28.5 Friends And Related Function Documentation . . . 371
13.28.5.1 options . . . 371
13.28.5.2 perform . . . 371

13.28.5.3 optionsfile . . . 371
13.28.6 Field Documentation . . . 372
13.28.6.1 m_key_show_ui_sequence_key . . . 372
13.28.6.2 m_key_show_ui_sequence_number . . . 372
13.28.6.3 m_key_events . . . 372
13.28.6.4 m_key_groups . . . 372
13.28.6.5 m_key_events_rev . . . 372
13.28.6.6 m_key_groups_rev . . . 372
13.28.6.7 m_key_bpm_up . . . 372
13.28.6.8 m_key_bpm_dn . . . 373
13.28.6.9 m_key_replace . . . 373
13.28.6.10 m_key_queue . . . 373
13.28.6.11 m_key_keep_queue . . . 373
13.28.6.12 m_key_snapshot_1 . . . 373
13.28.6.13 m_key_snapshot_2 . . . 373
13.28.6.14 m_key_screenset_up . . . 373
13.28.6.15 m_key_screenset_dn . . . 373
13.28.6.16 m_key_set_playing_screenset . . . 374
13.28.6.17 m_key_group_on . . . 374
13.28.6.18 m_key_group_off . . . 374
13.28.6.19 m_key_group_learn . . . 374
13.28.6.20 m_key_start . . . 374
13.28.6.21 m_key_pause . . . 374
13.28.6.22 m_key_song_mode . . . 374
13.28.6.23 m_key_toggle_jack . . . 374
13.28.6.24 m_key_menu_mode . . . 375
13.28.6.25 m_key_follow_transport . . . 375
13.28.6.26 m_key_rewind . . . 375
13.28.6.27 m_key_fast_forward . . . 375
13.28.6.28 m_key_pointer_position . . . 375

13.28.6.29m_key_toggle_mutes . . . 375
13.28.6.30m_key_tap_bpm . . . 375
13.28.6.31m_key_pattern_edit . . . 375
13.28.6.32m_key_event_edit . . . 376
13.28.6.33m_key_stop . . . 376
13.29seq64::keys_perform_gtk2 Class Reference . . . 376
13.29.1 Detailed Description . . . 378
13.29.2 Constructor & Destructor Documentation . . . 378
13.29.2.1 keys_perform_gtk2() . . . 378
13.29.2.2 ~keys_perform_gtk2() . . . 378
13.29.3 Member Function Documentation . . . 378
13.29.3.1 key_name() . . . 378
13.29.3.2 set_all_key_events() . . . 379
13.29.3.3 set_all_key_groups() . . . 379
13.30seq64::keys_perform_transfer Struct Reference . . . 379
13.30.1 Field Documentation . . . 380
13.30.1.1 kpt_bpm_up . . . 380
13.30.1.2 kpt_bpm_dn . . . 380
13.30.1.3 kpt_screenset_up . . . 380
13.30.1.4 kpt_screenset_dn . . . 380
13.30.1.5 kpt_set_playing_screenset . . . 380
13.30.1.6 kpt_group_on . . . 380
13.30.1.7 kpt_group_off . . . 380
13.30.1.8 kpt_group_learn . . . 381
13.30.1.9 kpt_replace . . . 381
13.30.1.10kpt_queue . . . 381
13.30.1.11kpt_keep_queue . . . 381
13.30.1.12kpt_snapshot_1 . . . 381
13.30.1.13kpt_snapshot_2 . . . 381
13.30.1.14kpt_start . . . 381

13.30.1.15 kpt_stop . . . 381
13.30.1.16 kpt_show_ui_sequence_key . . . 382
13.30.1.17 kpt_show_ui_sequence_number . . . 382
13.30.1.18 kpt_pattern_edit . . . 382
13.30.1.19 kpt_event_edit . . . 382
13.30.1.20 kpt_tap_bpm . . . 382
13.30.1.21 kpt_pause . . . 382
13.30.1.22 kpt_song_mode . . . 382
13.30.1.23 kpt_toggle_jack . . . 382
13.30.1.24 kpt_menu_mode . . . 383
13.30.1.25 kpt_follow_transport . . . 383
13.30.1.26 kpt_fast_forward . . . 383
13.30.1.27 kpt_rewind . . . 383
13.30.1.28 kpt_pointer_position . . . 383
13.30.1.29 kpt_toggle_mutes . . . 383
13.31 seq64::keystroke Class Reference . . . 383
13.31.1 Detailed Description . . . 384
13.31.2 Constructor & Destructor Documentation . . . 384
13.31.2.1 keystroke() [1/3] . . . 385
13.31.2.2 keystroke() [2/3] . . . 385
13.31.2.3 keystroke() [3/3] . . . 385
13.31.3 Member Function Documentation . . . 385
13.31.3.1 operator=() . . . 385
13.31.3.2 is_press() . . . 386
13.31.3.3 is_letter() . . . 386
13.31.3.4 is() . . . 386
13.31.3.5 is_delete() . . . 386
13.31.3.6 key() . . . 387
13.31.3.7 shift_lock() . . . 387
13.31.3.8 modifier() . . . 387

13.31.3.9 mod_control() . . . 387
13.31.3.10 mod_control_shift() . . . 387
13.31.3.11 mod_super() . . . 387
13.31.4 Field Documentation . . . 388
13.31.4.1 m_is_press . . . 388
13.31.4.2 m_key . . . 388
13.31.4.3 m_modifier . . . 388
13.32 seq64::lash Class Reference . . . 388
13.32.1 Detailed Description . . . 389
13.32.2 Constructor & Destructor Documentation . . . 389
13.32.2.1 lash() . . . 389
13.32.3 Member Function Documentation . . . 389
13.32.3.1 set_alsa_client_id() . . . 389
13.32.3.2 start() . . . 390
13.32.3.3 process_events() . . . 390
13.32.3.4 init() . . . 390
13.32.3.5 handle_event() . . . 390
13.32.3.6 handle_config() . . . 390
13.32.4 Field Documentation . . . 391
13.32.4.1 m_perform . . . 391
13.32.4.2 m_client . . . 391
13.32.4.3 m_lash_args . . . 391
13.32.4.4 m_is_lash_supported . . . 391
13.33 seq64::lfownd Class Reference . . . 392
13.33.1 Detailed Description . . . 393
13.33.2 Constructor & Destructor Documentation . . . 394
13.33.2.1 lfownd() . . . 394
13.33.2.2 ~lfownd() . . . 394
13.33.3 Member Function Documentation . . . 394
13.33.3.1 toggle_visible() . . . 394

13.33.3.2 scale_lfo_change() . . . 394
13.33.3.3 on_focus_out_event() . . . 394
13.33.4 Field Documentation . . . 395
13.33.4.1 m_seq . . . 395
13.33.4.2 m_seqdata . . . 395
13.33.4.3 m_hbox . . . 395
13.33.4.4 m_scale_value . . . 395
13.33.4.5 m_scale_range . . . 395
13.33.4.6 m_scale_speed . . . 395
13.33.4.7 m_scale_phase . . . 395
13.33.4.8 m_scale_wave . . . 396
13.33.4.9 m_wave_name . . . 396
13.33.4.10 m_value . . . 396
13.33.4.11 m_range . . . 396
13.33.4.12 m_speed . . . 396
13.33.4.13 m_phase . . . 396
13.33.4.14 m_wave . . . 396
13.34 seq64::maintime Class Reference . . . 397
13.34.1 Detailed Description . . . 399
13.34.2 Constructor & Destructor Documentation . . . 399
13.34.2.1 maintime() [1/2] . . . 399
13.34.2.2 maintime() [2/2] . . . 399
13.34.2.3 ~maintime() . . . 399
13.34.3 Member Function Documentation . . . 399
13.34.3.1 operator=() . . . 399
13.34.3.2 idle_progress() . . . 399
13.34.3.3 on_realize() . . . 400
13.34.3.4 on_expose_event() . . . 400
13.34.4 Friends And Related Function Documentation . . . 400
13.34.4.1 mainwnd . . . 400

13.34.5 Field Documentation . . . 400
13.34.5.1 m_beat_width . . . 400
13.34.5.2 m_bar_width . . . 401
13.34.5.3 m_pill_width . . . 401
13.34.5.4 m_box_width . . . 401
13.34.5.5 m_box_height . . . 401
13.34.5.6 m_flash_width . . . 401
13.34.5.7 m_flash_height . . . 401
13.34.5.8 m_flash_x . . . 401
13.34.5.9 m_box_less_pill . . . 402
13.34.5.10 m_tick . . . 402
13.34.5.11 m_ppqn . . . 402
13.35 seq64::mainwid Class Reference . . . 402
13.35.1 Detailed Description . . . 406
13.35.2 Constructor & Destructor Documentation . . . 406
13.35.2.1 mainwid() . . . 406
13.35.2.2 ~mainwid() . . . 406
13.35.3 Member Function Documentation . . . 407
13.35.3.1 set_screenset() . . . 407
13.35.3.2 reset() . . . 407
13.35.3.3 update_sequences_on_window() . . . 407
13.35.3.4 draw_pixmap_on_window() . . . 407
13.35.3.5 fill_background_window() . . . 408
13.35.3.6 redraw() . . . 408
13.35.3.7 seq_set_and_edit() . . . 408
13.35.3.8 seq_set_and_eventedit() . . . 408
13.35.3.9 draw_marker_on_sequence() . . . 408
13.35.3.10 update_markers() . . . 409
13.35.3.11 valid_sequence() . . . 409
13.35.3.12 draw_sequence_on_pixmap() . . . 409

13.35.3.13 draw_sequences_on_pixmap() . . . 410
13.35.3.14 draw_sequence_pixmap_on_window() . . . 410
13.35.3.15 seq_from_xy() . . . 410
13.35.3.16 timeout() . . . 411
13.35.3.17 calculate_base_sizes() . . . 411
13.35.3.18 select_fg_bg_colors() . . . 411
13.35.3.19 on_realize() . . . 411
13.35.3.20 on_expose_event() . . . 411
13.35.3.21 on_button_press_event() . . . 412
13.35.3.22 on_button_release_event() . . . 412
13.35.3.23 on_motion_notify_event() . . . 413
13.35.3.24 on_focus_in_event() . . . 413
13.35.3.25 on_focus_out_event() . . . 413
13.35.4 Friends And Related Function Documentation . . . 414
13.35.4.1 mainwnd . . . 414
13.35.4.2 update_mainwid_sequences . . . 414
13.35.5 Field Documentation . . . 414
13.35.5.1 m_armed_progress_color . . . 414
13.35.5.2 m_moving_seq . . . 414
13.35.5.3 m_button_down . . . 414
13.35.5.4 m_moving . . . 414
13.35.5.5 m_old_seq . . . 415
13.35.5.6 m_screenset . . . 415
13.35.5.7 m_last_tick_x . . . 415
13.35.5.8 m_last_playing . . . 415
13.35.5.9 m_mainwnd_rows . . . 415
13.35.5.10 m_mainwnd_cols . . . 415
13.35.5.11 m_seqarea_x . . . 415
13.35.5.12 m_seqarea_y . . . 415
13.35.5.13 m_seqarea_seq_x . . . 416

13.35.5.14m_seqarea_seq_y . . . 416
13.35.5.15m_mainwid_x . . . 416
13.35.5.16m_mainwid_y . . . 416
13.35.5.17m_mainwid_border . . . 416
13.35.5.18m_mainwid_spacing . . . 416
13.35.5.19m_text_size_x . . . 416
13.35.5.20m_text_size_y . . . 416
13.35.5.21m_max_sets . . . 417
13.35.5.22m_screenset_slots . . . 417
13.35.5.23m_screenset_offset . . . 417
13.35.5.24m_progress_height . . . 417
13.36seq64::mainwnd Class Reference . . . 417
13.36.1 Constructor & Destructor Documentation . . . 422
13.36.1.1 mainwnd() . . . 423
13.36.1.2 ∼mainwnd() . . . 423
13.36.2 Member Function Documentation . . . 423
13.36.2.1 open_file() . . . 423
13.36.2.2 rc_error_dialog() . . . 424
13.36.2.3 ppqn() [1/2] . . . 424
13.36.2.4 ppqn() [2/2] . . . 424
13.36.2.5 handle_signal() . . . 424
13.36.2.6 adj_callback_ss() . . . 424
13.36.2.7 adj_callback_bpm() . . . 424
13.36.2.8 edit_callback_notepad() . . . 425
13.36.2.9 timer_callback() . . . 425
13.36.2.10set_play_image() . . . 425
13.36.2.11set_songlive_image() . . . 425
13.36.2.12start_playing() . . . 426
13.36.2.13pause_playing() . . . 426
13.36.2.14stop_playing() . . . 426

13.36.2.15 toggle_playing() . . . 426
13.36.2.16 learn_toggle() . . . 426
13.36.2.17 open_performance_edit() . . . 426
13.36.2.18 open_performance_edit_2() . . . 427
13.36.2.19 enregister_perfedits() . . . 427
13.36.2.20 sequence_key() . . . 427
13.36.2.21 apply_song_transpose() . . . 427
13.36.2.22 clear_mute_groups() . . . 427
13.36.2.23 reload_mute_groups() . . . 427
13.36.2.24 update_window_title() . . . 427
13.36.2.25 toLower() . . . 428
13.36.2.26 file_new() . . . 428
13.36.2.27 file_open() . . . 428
13.36.2.28 file_save() . . . 428
13.36.2.29 set_song_mute() . . . 428
13.36.2.30 file_import_dialog() . . . 428
13.36.2.31 options_dialog() . . . 429
13.36.2.32 jack_dialog() . . . 429
13.36.2.33 about_dialog() . . . 429
13.36.2.34 build_info_dialog() . . . 429
13.36.2.35 query_save_changes() . . . 429
13.36.2.36 new_open_error_dialog() . . . 429
13.36.2.37 file_save_as() . . . 430
13.36.2.38 file_exit() . . . 430
13.36.2.39 new_file() . . . 430
13.36.2.40 save_file() . . . 431
13.36.2.41 choose_file() . . . 431
13.36.2.42 ds_save() . . . 431
13.36.2.43 install_signal_handlers() . . . 431
13.36.2.44 signal_action() . . . 431

13.36.2.45 edit_field_has_focus() . . . 431
13.36.2.46 populate_menu_file() . . . 432
13.36.2.47 populate_menu_edit() . . . 432
13.36.2.48 populate_menu_help() . . . 432
13.36.2.49 populate_menu_view() . . . 432
13.36.2.50 on_delete_event() . . . 432
13.36.2.51 on_key_press_event() . . . 432
13.36.2.52 on_key_release_event() . . . 433
13.36.2.53 on_realize() . . . 433
13.36.2.54 on_grouplearnchange() . . . 433
13.36.3 Field Documentation . . . 433
13.36.3.1 m_sigpipe . . . 433
13.36.3.2 m_tooltips . . . 433
13.36.3.3 m_menubar . . . 434
13.36.3.4 m_menu_file . . . 434
13.36.3.5 m_menu_edit . . . 434
13.36.3.6 m_menu_view . . . 434
13.36.3.7 m_menu_help . . . 434
13.36.3.8 m_ppqn . . . 434
13.36.3.9 m_main_wid . . . 434
13.36.3.10 m_main_time . . . 435
13.36.3.11 m_perf_edit . . . 435
13.36.3.12 m_perf_edit_2 . . . 435
13.36.3.13 m_options . . . 435
13.36.3.14 m_main_cursor . . . 435
13.36.3.15 m_image_play . . . 435
13.36.3.16 m_button_learn . . . 435
13.36.3.17 m_button_stop . . . 436
13.36.3.18 m_button_play . . . 436
13.36.3.19 m_button_perfedit . . . 436

13.36.3.20m_button_jack . . . 436
13.36.3.21m_adjust_bpm . . . 436
13.36.3.22m_spinbutton_bpm . . . 436
13.36.3.23m_adjust_ss . . . 436
13.36.3.24m_spinbutton_ss . . . 436
13.36.3.25m_adjust_load_offset . . . 437
13.36.3.26m_spinbutton_load_offset . . . 437
13.36.3.27m_entry_notes . . . 437
13.36.3.28m_is_running . . . 437
13.36.3.29m_timeout_connect . . . 437
13.36.3.30m_menu_mode . . . 437
13.36.3.31m_call_seq_edit . . . 437
13.36.3.32m_call_seq_eventedit . . . 438
13.37seq64::mastermidibase Class Reference . . . 438
13.37.1 Constructor & Destructor Documentation . . . 442
13.37.1.1 mastermidibase() . . . 443
13.37.1.2 ∼mastermidibase() . . . 444
13.37.2 Member Function Documentation . . . 444
13.37.2.1 init() . . . 444
13.37.2.2 get_num_out_buses() . . . 444
13.37.2.3 get_num_in_buses() . . . 444
13.37.2.4 filter_by_channel() [1/2] . . . 445
13.37.2.5 filter_by_channel() [2/2] . . . 445
13.37.2.6 get_beats_per_minute() . . . 445
13.37.2.7 get_bpm() . . . 445
13.37.2.8 get_ppqn() . . . 445
13.37.2.9 is_dumping() . . . 445
13.37.2.10get_sequence() . . . 445
13.37.2.11start() . . . 446
13.37.2.12stop() . . . 446

13.37.2.13 port_start() . . . 446
13.37.2.14 port_exit() . . . 446
13.37.2.15 play() . . . 447
13.37.2.16 continue_from() . . . 447
13.37.2.17 init_clock() . . . 447
13.37.2.18 emit_clock() . . . 448
13.37.2.19 sysex() . . . 448
13.37.2.20 print() . . . 448
13.37.2.21 flush() . . . 449
13.37.2.22 set_sequence_input() . . . 449
13.37.2.23 dump_midi_input() . . . 449
13.37.2.24 initialize_buses() . . . 449
13.37.2.25 get_midi_out_bus_name() . . . 450
13.37.2.26 get_midi_in_bus_name() . . . 450
13.37.2.27 poll_for_midi() . . . 450
13.37.2.28 is_more_input() . . . 451
13.37.2.29 get_midi_event() . . . 451
13.37.2.30 set_clock() . . . 451
13.37.2.31 set_input() . . . 452
13.37.2.32 get_input() . . . 452
13.37.2.33 is_input_system_port() . . . 452
13.37.2.34 get_clock() . . . 453
13.37.2.35 set_ppqn() . . . 453
13.37.2.36 set_beats_per_minute() . . . 453
13.37.2.37 port_settings() . . . 454
13.37.2.38 clock() . . . 454
13.37.2.39 input() . . . 454
13.37.2.40 activate() . . . 454
13.37.2.41 api_init() . . . 454
13.37.2.42 api_start() . . . 455

13.37.2.43 api_continue_from() . . . 455
13.37.2.44 api_init_clock() . . . 455
13.37.2.45 api_stop() . . . 455
13.37.2.46 api_set_ppqn() . . . 455
13.37.2.47 api_set_beats_per_minute() . . . 455
13.37.2.48 api_flush() . . . 456
13.37.2.49 api_clock() . . . 456
13.37.2.50 api_port_start() . . . 456
13.37.2.51 api_is_more_input() . . . 456
13.37.2.52 api_get_midi_event() . . . 456
13.37.2.53 api_poll_for_midi() . . . 456
13.37.2.54 save_clock() . . . 456
13.37.2.55 save_input() . . . 457
13.37.3 Friends And Related Function Documentation . . . 457
13.37.3.1 perform . . . 457
13.37.3.2 midi_alsa_info . . . 457
13.37.4 Field Documentation . . . 458
13.37.4.1 m_max_busses . . . 458
13.37.4.2 m_bus_announce . . . 458
13.37.4.3 m_inbus_array . . . 458
13.37.4.4 m_outbus_array . . . 458
13.37.4.5 m_master_clocks . . . 458
13.37.4.6 m_master_inputs . . . 458
13.37.4.7 m_queue . . . 458
13.37.4.8 m_ppqn . . . 459
13.37.4.9 m_beats_per_minute . . . 459
13.37.4.10 m_dumping_input . . . 459
13.37.4.11 m_vector_sequence . . . 459
13.37.4.12 m_filter_by_channel . . . 459
13.37.4.13 m_seq . . . 459

13.37.4.14m_mutex . . . 459
13.38seq64::mastermidibus Class Reference . . . 460
13.38.1 Detailed Description . . . 462
13.38.2 Constructor & Destructor Documentation . . . 462
13.38.2.1 mastermidibus() [1/2] . . . 462
13.38.2.2 ∼mastermidibus() [1/2] . . . 462
13.38.2.3 mastermidibus() [2/2] . . . 462
13.38.2.4 ∼mastermidibus() [2/2] . . . 462
13.38.3 Member Function Documentation . . . 463
13.38.3.1 api_is_more_input() [1/2] . . . 463
13.38.3.2 api_get_midi_event() [1/2] . . . 463
13.38.3.3 api_poll_for_midi() [1/2] . . . 463
13.38.3.4 api_init() [1/2] . . . 464
13.38.3.5 api_set_ppqn() [1/2] . . . 465
13.38.3.6 api_set_beats_per_minute() [1/2] . . . 465
13.38.3.7 api_flush() [1/2] . . . 465
13.38.3.8 api_start() . . . 465
13.38.3.9 api_stop() . . . 466
13.38.3.10api_continue_from() . . . 466
13.38.3.11api_port_start() [1/2] . . . 466
13.38.3.12activate() . . . 466
13.38.3.13api_is_more_input() [2/2] . . . 466
13.38.3.14api_get_midi_event() [2/2] . . . 466
13.38.3.15api_poll_for_midi() [2/2] . . . 467
13.38.3.16api_init() [2/2] . . . 467
13.38.3.17api_set_ppqn() [2/2] . . . 467
13.38.3.18api_set_beats_per_minute() [2/2] . . . 467
13.38.3.19api_flush() [2/2] . . . 467
13.38.3.20api_port_start() [2/2] . . . 467
13.38.3.21port_list() . . . 467

13.38.4 Friends And Related Function Documentation . . . 468
13.38.4.1 midi_alsa_info . . . 468
13.38.4.2 midi_jack_info . . . 468
13.38.5 Field Documentation . . . 468
13.38.5.1 m_alsa_seq . . . 468
13.38.5.2 m_num_poll_descriptors . . . 468
13.38.5.3 m_poll_descriptors . . . 468
13.38.5.4 m_midi_master . . . 469
13.38.5.5 m_use_jack_polling . . . 469
13.39seq64::midi_alsa Class Reference . . . 469
13.39.1 Constructor & Destructor Documentation . . . 472
13.39.1.1 midi_alsa() . . . 472
13.39.1.2 ∼midi_alsa() . . . 472
13.39.2 Member Function Documentation . . . 472
13.39.2.1 get_client() . . . 473
13.39.2.2 get_port() . . . 473
13.39.2.3 api_init_out() . . . 473
13.39.2.4 api_init_in() . . . 473
13.39.2.5 api_init_out_sub() . . . 474
13.39.2.6 api_init_in_sub() . . . 474
13.39.2.7 api_deinit_in() . . . 474
13.39.2.8 api_get_midi_event() . . . 474
13.39.2.9 api_poll_for_midi() . . . 475
13.39.2.10 api_play() . . . 475
13.39.2.11 api_sysex() . . . 475
13.39.2.12 api_flush() . . . 476
13.39.2.13 api_continue_from() . . . 476
13.39.2.14 api_start() . . . 476
13.39.2.15 api_stop() . . . 476
13.39.2.16 api_clock() . . . 476

13.39.2.17 api_set_ppqn() . . . 477
13.39.2.18 api_set_beats_per_minute() . . . 477
13.39.2.19 set_virtual_name() . . . 477
13.39.3 Field Documentation . . . 478
13.39.3.1 m_seq . . . 478
13.39.3.2 m_dest_addr_client . . . 478
13.39.3.3 m_dest_addr_port . . . 478
13.39.3.4 m_local_addr_client . . . 478
13.39.3.5 m_local_addr_port . . . 478
13.39.3.6 m_input_port_name . . . 478
13.40 seq64::midi_alsa_info Class Reference . . . 479
13.40.1 Constructor & Destructor Documentation . . . 480
13.40.1.1 midi_alsa_info() . . . 480
13.40.1.2 ~midi_alsa_info() . . . 481
13.40.2 Member Function Documentation . . . 481
13.40.2.1 seq() . . . 481
13.40.2.2 api_get_midi_event() . . . 481
13.40.2.3 api_poll_for_midi() . . . 482
13.40.2.4 api_set_ppqn() . . . 482
13.40.2.5 api_set_beats_per_minute() . . . 482
13.40.2.6 api_port_start() . . . 482
13.40.2.7 api_flush() . . . 483
13.40.2.8 get_all_port_info() . . . 483
13.40.3 Field Documentation . . . 484
13.40.3.1 sm_input_caps . . . 484
13.40.3.2 sm_output_caps . . . 484
13.40.3.3 m_alsa_seq . . . 484
13.40.3.4 m_num_poll_descriptors . . . 484
13.40.3.5 m_poll_descriptors . . . 484
13.41 seq64::midi_api Class Reference . . . 485

13.41.1 Detailed Description . . . 487
13.41.2 Constructor & Destructor Documentation . . . 487
13.41.2.1 midi_api() . . . 487
13.41.2.2 ~midi_api() . . . 487
13.41.3 Member Function Documentation . . . 488
13.41.3.1 is_input_port() . . . 488
13.41.3.2 is_virtual_port() . . . 488
13.41.3.3 is_system_port() . . . 488
13.41.3.4 api_connect() . . . 488
13.41.3.5 api_init_out() . . . 488
13.41.3.6 api_init_out_sub() . . . 488
13.41.3.7 api_init_in() . . . 489
13.41.3.8 api_init_in_sub() . . . 489
13.41.3.9 api_deinit_in() . . . 489
13.41.3.10 api_get_midi_event() . . . 489
13.41.3.11 api_poll_for_midi() . . . 489
13.41.3.12 api_play() . . . 490
13.41.3.13 api_sysex() . . . 490
13.41.3.14 api_continue_from() . . . 490
13.41.3.15 api_start() . . . 490
13.41.3.16 api_stop() . . . 490
13.41.3.17 api_flush() . . . 491
13.41.3.18 api_clock() . . . 491
13.41.3.19 api_set_ppqn() . . . 491
13.41.3.20 api_set_beats_per_minute() . . . 491
13.41.3.21 api_get_bus_name() . . . 491
13.41.3.22 api_get_port_name() . . . 491
13.41.3.23 is_port_open() . . . 492
13.41.3.24 master_info() [1/2] . . . 492
13.41.3.25 master_info() [2/2] . . . 492

13.41.3.26 parent_bus() [1/2] . . . 492
13.41.3.27 parent_bus() [2/2] . . . 492
13.41.3.28 master_midi_mode() . . . 492
13.41.3.29 error() . . . 492
13.41.3.30 user_callback() . . . 493
13.41.3.31 cancel_callback() . . . 493
13.41.3.32 set_port_open() . . . 493
13.41.3.33 input_data() . . . 493
13.41.4 Field Documentation . . . 493
13.41.4.1 m_master_info . . . 493
13.41.4.2 m_parent_bus . . . 494
13.41.4.3 m_input_data . . . 494
13.41.4.4 m_connected . . . 494
13.41.4.5 m_error_string . . . 494
13.41.4.6 m_error_callback . . . 494
13.41.4.7 m_first_error_occurred . . . 494
13.41.4.8 m_error_callback_user_data . . . 494
13.42 seq64::midi_container Class Reference . . . 495
13.42.1 Detailed Description . . . 497
13.42.2 Constructor & Destructor Documentation . . . 497
13.42.2.1 midi_container() . . . 497
13.42.2.2 ~midi_container() . . . 497
13.42.3 Member Function Documentation . . . 497
13.42.3.1 fill() . . . 497
13.42.3.2 size() . . . 498
13.42.3.3 done() . . . 498
13.42.3.4 put() . . . 499
13.42.3.5 get() . . . 499
13.42.3.6 clear() . . . 499
13.42.3.7 position_reset() . . . 499

13.42.3.8 position() . . . 499
13.42.3.9 position_increment() . . . 499
13.42.3.10 add_variable() . . . 499
13.42.3.11 add_long() . . . 500
13.42.3.12 add_short() . . . 500
13.42.3.13 add_event() . . . 500
13.42.3.14 fill_seq_number() . . . 500
13.42.3.15 fill_seq_name() . . . 501
13.42.3.16 fill_meta_track_end() . . . 501
13.42.3.17 fill_proprietary() . . . 501
13.42.3.18 fill_time_sig_and_tempo() . . . 502
13.42.3.19 song_fill_seq_event() . . . 503
13.42.3.20 song_fill_seq_trigger() . . . 503
13.42.4 Friends And Related Function Documentation . . . 503
13.42.4.1 midifile . . . 503
13.42.5 Field Documentation . . . 504
13.42.5.1 m_sequence . . . 504
13.42.5.2 m_position_for_get . . . 504
13.43 seq64::midi_control Class Reference . . . 504
13.43.1 Detailed Description . . . 505
13.43.2 Member Enumeration Documentation . . . 505
13.43.2.1 action . . . 505
13.43.3 Constructor & Destructor Documentation . . . 506
13.43.3.1 midi_control() . . . 506
13.43.4 Member Function Documentation . . . 506
13.43.4.1 active() . . . 506
13.43.4.2 inverse_active() . . . 506
13.43.4.3 status() . . . 506
13.43.4.4 data() . . . 507
13.43.4.5 min_value() . . . 507

13.43.4.6 max_value() . . . 507
13.43.4.7 set() [1/2] . . . 507
13.43.4.8 set() [2/2] . . . 507
13.43.4.9 match() . . . 508
13.43.4.10 in_range() . . . 508
13.43.5 Field Documentation . . . 508
13.43.5.1 m_active . . . 508
13.43.5.2 m_inverse_active . . . 508
13.43.5.3 m_status . . . 508
13.43.5.4 m_data . . . 508
13.43.5.5 m_min_value . . . 509
13.43.5.6 m_max_value . . . 509
13.44 seq64::midi_in_alsa Class Reference . . . 509
13.44.1 Constructor & Destructor Documentation . . . 511
13.44.1.1 midi_in_alsa() . . . 511
13.45 seq64::midi_in_jack Class Reference . . . 511
13.45.1 Constructor & Destructor Documentation . . . 513
13.45.1.1 midi_in_jack() . . . 513
13.45.1.2 ~midi_in_jack() . . . 513
13.45.2 Member Function Documentation . . . 513
13.45.2.1 api_poll_for_midi() . . . 514
13.45.2.2 api_get_midi_event() . . . 514
13.45.2.3 open_client() . . . 514
13.45.3 Field Documentation . . . 514
13.45.3.1 m_client_name . . . 515
13.46 seq64::midi_info Class Reference . . . 515
13.46.1 Constructor & Destructor Documentation . . . 518
13.46.1.1 midi_info() . . . 518
13.46.1.2 ~midi_info() . . . 518
13.46.2 Member Function Documentation . . . 518

13.46.2.1 midi_mode() [1/2] . . . 518
13.46.2.2 midi_mode() [2/2] . . . 518
13.46.2.3 midi_handle() [1/2] . . . 518
13.46.2.4 input_ports() . . . 518
13.46.2.5 output_ports() . . . 519
13.46.2.6 full_port_count() . . . 519
13.46.2.7 clear() . . . 519
13.46.2.8 app_name() . . . 519
13.46.2.9 ppqn() . . . 519
13.46.2.10 bpm() . . . 519
13.46.2.11 api_set_ppqn() . . . 519
13.46.2.12 api_set_beats_per_minute() . . . 520
13.46.2.13 api_port_start() . . . 520
13.46.2.14 api_get_midi_event() . . . 520
13.46.2.15 api_poll_for_midi() . . . 520
13.46.2.16 api_flush() . . . 520
13.46.2.17 api_connect() . . . 520
13.46.2.18 get_port_count() . . . 521
13.46.2.19 get_bus_id() . . . 521
13.46.2.20 get_bus_name() . . . 521
13.46.2.21 get_port_id() . . . 521
13.46.2.22 get_port_name() . . . 521
13.46.2.23 get_input() . . . 521
13.46.2.24 get_virtual() . . . 521
13.46.2.25 get_system() . . . 522
13.46.2.26 queue_number() . . . 522
13.46.2.27 connect_name() . . . 522
13.46.2.28 port_list() . . . 522
13.46.2.29 global_queue() [1/2] . . . 522
13.46.2.30 error() . . . 522

13.46.2.31 get_all_port_info() . . . 523
13.46.2.32 add_bus() . . . 523
13.46.2.33 global_queue() [2/2] . . . 523
13.46.2.34 midi_handle() [2/2] . . . 523
13.46.2.35 bus_container() . . . 523
13.46.2.36 nc_midi_port_info() . . . 524
13.46.2.37 ref_midi_port_info() . . . 524
13.46.3 Friends And Related Function Documentation . . . 524
13.46.3.1 rtmidi_info . . . 524
13.46.4 Field Documentation . . . 524
13.46.4.1 m_midi_mode_input . . . 524
13.46.4.2 m_input . . . 524
13.46.4.3 m_output . . . 524
13.46.4.4 m_bus_container . . . 525
13.46.4.5 m_global_queue . . . 525
13.46.4.6 m_midi_handle . . . 525
13.46.4.7 m_app_name . . . 525
13.46.4.8 m_ppqn . . . 525
13.46.4.9 m_bpm . . . 525
13.46.4.10 m_error_string . . . 525
13.47 seq64::midi_jack Class Reference . . . 526
13.47.1 Constructor & Destructor Documentation . . . 528
13.47.1.1 midi_jack() . . . 529
13.47.1.2 ~midi_jack() . . . 529
13.47.2 Member Function Documentation . . . 529
13.47.2.1 multi_client() . . . 529
13.47.2.2 client_handle() [1/2] . . . 529
13.47.2.3 jack_data() . . . 529
13.47.2.4 remote_port_name() [1/2] . . . 530
13.47.2.5 remote_port_name() [2/2] . . . 530

13.47.2.6 port_handle() [1/2] . . . 530
13.47.2.7 client_handle() [2/2] . . . 530
13.47.2.8 port_handle() [2/2] . . . 530
13.47.2.9 open_client_impl() . . . 530
13.47.2.10 close_client() . . . 531
13.47.2.11 close_port() . . . 531
13.47.2.12 create_ringbuffer() . . . 531
13.47.2.13 connect_port() . . . 532
13.47.2.14 register_port() . . . 532
13.47.2.15 open_client() . . . 533
13.47.2.16 api_connect() . . . 533
13.47.2.17 api_init_out() . . . 533
13.47.2.18 api_init_in() . . . 534
13.47.2.19 api_init_out_sub() . . . 534
13.47.2.20 api_init_in_sub() . . . 534
13.47.2.21 api_deinit_in() . . . 535
13.47.2.22 api_get_midi_event() . . . 535
13.47.2.23 api_poll_for_midi() . . . 535
13.47.2.24 api_play() . . . 535
13.47.2.25 api_sysex() . . . 536
13.47.2.26 api_flush() . . . 536
13.47.2.27 api_continue_from() . . . 536
13.47.2.28 api_start() . . . 536
13.47.2.29 api_stop() . . . 537
13.47.2.30 api_clock() . . . 537
13.47.2.31 api_set_ppqn() . . . 537
13.47.2.32 api_set_beats_per_minute() . . . 537
13.47.2.33 api_get_port_name() . . . 537
13.47.2.34 send_byte() . . . 538
13.47.2.35 set_virtual_name() . . . 538

13.47.3 Friends And Related Function Documentation . . . 538
13.47.3.1 midi_jack_info . . . 538
13.47.4 Field Documentation . . . 539
13.47.4.1 m_multi_client . . . 539
13.47.4.2 m_remote_port_name . . . 539
13.47.4.3 m_jack_info . . . 539
13.47.4.4 m_jack_data . . . 539
13.48seq64::midi_jack_data Struct Reference . . . 539
13.48.1 Detailed Description . . . 540
13.48.2 Constructor & Destructor Documentation . . . 540
13.48.2.1 midi_jack_data() . . . 540
13.48.2.2 ∼midi_jack_data() . . . 540
13.48.3 Member Function Documentation . . . 540
13.48.3.1 valid_buffer() . . . 540
13.48.4 Field Documentation . . . 541
13.48.4.1 m_jack_client . . . 541
13.48.4.2 m_jack_port . . . 541
13.48.4.3 m_jack_buffsize . . . 541
13.48.4.4 m_jack_buffmessage . . . 541
13.48.4.5 m_jack_lasttime . . . 541
13.48.4.6 m_jack_rtmidiin . . . 541
13.49seq64::midi_jack_info Class Reference . . . 542
13.49.1 Constructor & Destructor Documentation . . . 544
13.49.1.1 midi_jack_info() . . . 544
13.49.1.2 ∼midi_jack_info() . . . 544
13.49.2 Member Function Documentation . . . 544
13.49.2.1 multi_client() . . . 544
13.49.2.2 client_handle() [1/2] . . . 545
13.49.2.3 api_get_midi_event() . . . 545
13.49.2.4 api_connect() . . . 545

13.49.2.5 api_poll_for_midi() . . . 545
13.49.2.6 api_set_ppqn() . . . 545
13.49.2.7 api_set_beats_per_minute() . . . 546
13.49.2.8 api_port_start() . . . 546
13.49.2.9 api_flush() . . . 547
13.49.2.10 get_all_port_info() . . . 547
13.49.2.11 client_handle() [2/2] . . . 548
13.49.2.12 connect() . . . 548
13.49.2.13 disconnect() . . . 548
13.49.2.14 extract_names() . . . 548
13.49.2.15 add() . . . 548
13.49.3 Friends And Related Function Documentation . . . 548
13.49.3.1 midi_jack . . . 548
13.49.3.2 jack_process_io . . . 549
13.49.4 Field Documentation . . . 549
13.49.4.1 m_multi_client . . . 549
13.49.4.2 m_jack_ports . . . 549
13.49.4.3 m_jack_client . . . 549
13.50 seq64::midi_list Class Reference . . . 549
13.50.1 Member Typedef Documentation . . . 551
13.50.1.1 CharList . . . 551
13.50.2 Constructor & Destructor Documentation . . . 551
13.50.2.1 midi_list() . . . 551
13.50.2.2 ~midi_list() . . . 552
13.50.3 Member Function Documentation . . . 552
13.50.3.1 size() . . . 552
13.50.3.2 done() . . . 552
13.50.3.3 put() . . . 552
13.50.3.4 get() . . . 552
13.50.3.5 clear() . . . 553

13.50.4 Field Documentation . . . 553
13.50.4.1 m_char_list . . . 553
13.51 seq64::midi_measures Class Reference . . . 553
13.51.1 Detailed Description . . . 554
13.51.2 Constructor & Destructor Documentation . . . 554
13.51.2.1 midi_measures() [1/2] . . . 554
13.51.2.2 midi_measures() [2/2] . . . 554
13.51.3 Member Function Documentation . . . 554
13.51.3.1 measures() [1/2] . . . 554
13.51.3.2 measures() [2/2] . . . 554
13.51.3.3 beats() [1/2] . . . 555
13.51.3.4 beats() [2/2] . . . 555
13.51.3.5 divisions() [1/2] . . . 555
13.51.3.6 divisions() [2/2] . . . 555
13.51.4 Field Documentation . . . 555
13.51.4.1 m_measures . . . 555
13.51.4.2 m_beats . . . 556
13.51.4.3 m_divisions . . . 556
13.52 seq64::midi_message Class Reference . . . 556
13.52.1 Detailed Description . . . 557
13.52.2 Member Typedef Documentation . . . 557
13.52.2.1 container . . . 557
13.52.3 Constructor & Destructor Documentation . . . 557
13.52.3.1 midi_message() . . . 557
13.52.4 Member Function Documentation . . . 557
13.52.4.1 operator[]() . . . 557
13.52.4.2 at() [1/2] . . . 557
13.52.4.3 at() [2/2] . . . 558
13.52.4.4 array() . . . 558
13.52.4.5 count() . . . 558

13.52.4.6 empty() . . . 558
13.52.4.7 push() . . . 558
13.52.4.8 timestamp() [1/2] . . . 558
13.52.4.9 timestamp() [2/2] . . . 558
13.52.5 Field Documentation . . . 558
13.52.5.1 m_bytes . . . 559
13.52.5.2 m_timestamp . . . 559
13.53 seq64::midi_out_alsa Class Reference . . . 559
13.53.1 Constructor & Destructor Documentation . . . 561
13.53.1.1 midi_out_alsa() . . . 561
13.54 seq64::midi_out_jack Class Reference . . . 561
13.54.1 Constructor & Destructor Documentation . . . 563
13.54.1.1 midi_out_jack() . . . 563
13.54.1.2 ~midi_out_jack() . . . 563
13.54.2 Member Function Documentation . . . 563
13.54.2.1 send_message() . . . 563
13.54.2.2 open_client() . . . 564
13.55 seq64::midi_port_info Class Reference . . . 564
13.55.1 Constructor & Destructor Documentation . . . 565
13.55.1.1 midi_port_info() . . . 565
13.55.2 Member Function Documentation . . . 565
13.55.2.1 add() [1/2] . . . 565
13.55.2.2 add() [2/2] . . . 566
13.55.2.3 clear() . . . 566
13.55.2.4 get_port_count() . . . 566
13.55.2.5 get_bus_id() . . . 566
13.55.2.6 get_bus_name() . . . 566
13.55.2.7 get_port_id() . . . 566
13.55.2.8 get_port_name() . . . 566
13.55.2.9 get_input() . . . 567

13.55.2.10 get_virtual() . . . 567
13.55.2.11 get_system() . . . 567
13.55.2.12 get_queue_number() . . . 567
13.55.2.13 connect_name() . . . 567
13.55.3 Field Documentation . . . 567
13.55.3.1 m_port_count . . . 567
13.55.3.2 m_port_container . . . 568
13.56 seq64::midi_queue Class Reference . . . 568
13.56.1 Detailed Description . . . 568
13.56.2 Constructor & Destructor Documentation . . . 569
13.56.2.1 midi_queue() . . . 569
13.56.2.2 ~midi_queue() . . . 569
13.56.3 Member Function Documentation . . . 569
13.56.3.1 empty() . . . 569
13.56.3.2 count() . . . 569
13.56.3.3 full() . . . 569
13.56.3.4 add() . . . 569
13.56.3.5 pop() . . . 570
13.56.3.6 pop_front() . . . 570
13.56.3.7 allocate() . . . 570
13.56.3.8 deallocate() . . . 570
13.56.3.9 front() . . . 570
13.56.4 Field Documentation . . . 571
13.56.4.1 m_front . . . 571
13.56.4.2 m_back . . . 571
13.56.4.3 m_size . . . 571
13.56.4.4 m_ring_size . . . 571
13.56.4.5 m_ring . . . 571
13.57 seq64::midi_splitter Class Reference . . . 571
13.57.1 Detailed Description . . . 572

13.57.2 Constructor & Destructor Documentation . . . 573
13.57.2.1 midi_splitter() . . . 573
13.57.2.2 ~midi_splitter() . . . 574
13.57.3 Member Function Documentation . . . 574
13.57.3.1 log_main_sequence() . . . 574
13.57.3.2 initialize() . . . 574
13.57.3.3 increment() . . . 574
13.57.3.4 split() . . . 575
13.57.3.5 ppqn() . . . 575
13.57.3.6 count() . . . 575
13.57.3.7 split_channel() . . . 576
13.57.4 Field Documentation . . . 576
13.57.4.1 m_ppqn . . . 576
13.57.4.2 m_use_default_ppqn . . . 576
13.57.4.3 m_smf0_channels_count . . . 577
13.57.4.4 m_smf0_channels . . . 577
13.57.4.5 m_smf0_main_sequence . . . 577
13.57.4.6 m_smf0_seq_number . . . 577
13.58 seq64::midi_timing Class Reference . . . 577
13.58.1 Detailed Description . . . 578
13.58.2 Constructor & Destructor Documentation . . . 578
13.58.2.1 midi_timing() [1/2] . . . 578
13.58.2.2 midi_timing() [2/2] . . . 578
13.58.3 Member Function Documentation . . . 578
13.58.3.1 beats_per_minute() [1/2] . . . 579
13.58.3.2 beats_per_minute() [2/2] . . . 579
13.58.3.3 beats_per_measure() [1/2] . . . 579
13.58.3.4 beats_per_measure() [2/2] . . . 579
13.58.3.5 beat_width() [1/2] . . . 579
13.58.3.6 beat_width() [2/2] . . . 579

13.58.3.7 ppqn() [1/2] . . . 580
13.58.3.8 ppqn() [2/2] . . . 580
13.58.4 Field Documentation . . . 580
13.58.4.1 m_beats_per_minute . . . 580
13.58.4.2 m_beats_per_measure . . . 580
13.58.4.3 m_beat_width . . . 580
13.58.4.4 m_ppqn . . . 581
13.59 seq64::midi_vector Class Reference . . . 581
13.59.1 Member Typedef Documentation . . . 583
13.59.1.1 CharVector . . . 583
13.59.2 Constructor & Destructor Documentation . . . 583
13.59.2.1 midi_vector() . . . 583
13.59.2.2 ~midi_vector() . . . 584
13.59.3 Member Function Documentation . . . 584
13.59.3.1 size() . . . 584
13.59.3.2 done() . . . 584
13.59.3.3 put() . . . 584
13.59.3.4 get() . . . 585
13.59.3.5 clear() . . . 585
13.59.4 Field Documentation . . . 585
13.59.4.1 m_char_vector . . . 585
13.60 seq64::midibase Class Reference . . . 585
13.60.1 Constructor & Destructor Documentation . . . 590
13.60.1.1 midibase() . . . 591
13.60.1.2 ~midibase() . . . 592
13.60.2 Member Function Documentation . . . 592
13.60.2.1 show_bus_values() . . . 592
13.60.2.2 display_name() [1/2] . . . 592
13.60.2.3 bus_name() [1/2] . . . 592
13.60.2.4 port_name() [1/2] . . . 592

13.60.2.5 connect_name() . . . 592
13.60.2.6 get_bus_index() . . . 592
13.60.2.7 get_bus_id() . . . 593
13.60.2.8 get_port_id() . . . 593
13.60.2.9 ppqn() . . . 593
13.60.2.10 bpm() . . . 593
13.60.2.11 match() . . . 593
13.60.2.12 is_virtual_port() [1/2] . . . 593
13.60.2.13 is_virtual_port() [2/2] . . . 593
13.60.2.14 is_input_port() [1/2] . . . 594
13.60.2.15 is_output_port() . . . 594
13.60.2.16 is_input_port() [2/2] . . . 594
13.60.2.17 is_system_port() . . . 594
13.60.2.18 set_system_port_flag() . . . 594
13.60.2.19 set_clock() . . . 594
13.60.2.20 get_clock() . . . 594
13.60.2.21 set_clock_status() . . . 595
13.60.2.22 get_input() . . . 595
13.60.2.23 set_input_status() . . . 595
13.60.2.24 queue_number() . . . 595
13.60.2.25 set_bus_id() . . . 595
13.60.2.26 set_name() . . . 595
13.60.2.27 set_alt_name() . . . 596
13.60.2.28 set_multi_name() . . . 596
13.60.2.29 set_clock_mod() . . . 597
13.60.2.30 get_clock_mod() . . . 597
13.60.2.31 poll_for_midi() . . . 597
13.60.2.32 get_midi_event() . . . 597
13.60.2.33 init_out() . . . 598
13.60.2.34 init_in() . . . 598

13.60.2.35 deinit_in() . . . 598
13.60.2.36 init_out_sub() . . . 598
13.60.2.37 init_in_sub() . . . 599
13.60.2.38 play() . . . 599
13.60.2.39 sysex() . . . 599
13.60.2.40 flush() . . . 599
13.60.2.41 start() . . . 599
13.60.2.42 stop() . . . 600
13.60.2.43 clock() . . . 600
13.60.2.44 continue_from() . . . 600
13.60.2.45 init_clock() . . . 600
13.60.2.46 print() . . . 601
13.60.2.47 set_input() . . . 601
13.60.2.48 display_name() [2/2] . . . 601
13.60.2.49 bus_name() [2/2] . . . 601
13.60.2.50 port_name() [2/2] . . . 601
13.60.2.51 set_port_id() . . . 601
13.60.2.52 api_poll_for_midi() . . . 602
13.60.2.53 api_get_midi_event() . . . 602
13.60.2.54 api_init_in_sub() . . . 602
13.60.2.55 api_init_out_sub() . . . 602
13.60.2.56 api_deinit_in() . . . 602
13.60.2.57 api_play() . . . 603
13.60.2.58 api_sysex() . . . 603
13.60.2.59 api_flush() . . . 603
13.60.2.60 api_init_in() . . . 603
13.60.2.61 api_init_out() . . . 603
13.60.2.62 api_continue_from() . . . 604
13.60.2.63 api_start() . . . 604
13.60.2.64 api_stop() . . . 604

13.60.2.65 api_clock() . . . 604
13.60.3 Friends And Related Function Documentation . . . 604
13.60.3.1 mastermidibus . . . 604
13.60.4 Field Documentation . . . 604
13.60.4.1 m_clock_mod . . . 605
13.60.4.2 m_bus_index . . . 605
13.60.4.3 m_bus_id . . . 605
13.60.4.4 m_port_id . . . 605
13.60.4.5 m_clock_type . . . 605
13.60.4.6 m_inputing . . . 605
13.60.4.7 m_ppqn . . . 605
13.60.4.8 m_bpm . . . 605
13.60.4.9 m_queue . . . 606
13.60.4.10 m_display_name . . . 606
13.60.4.11 m_bus_name . . . 606
13.60.4.12 m_port_name . . . 606
13.60.4.13 m_lasttick . . . 606
13.60.4.14 m_is_virtual_port . . . 606
13.60.4.15 m_is_input_port . . . 606
13.60.4.16 m_is_system_port . . . 607
13.60.4.17 m_mutex . . . 607
13.61 seq64::midibus Class Reference . . . 607
13.61.1 Detailed Description . . . 610
13.61.2 Constructor & Destructor Documentation . . . 610
13.61.2.1 midibus() [1/3] . . . 610
13.61.2.2 midibus() [2/3] . . . 611
13.61.2.3 ~midibus() [1/2] . . . 611
13.61.2.4 midibus() [3/3] . . . 611
13.61.2.5 ~midibus() [2/2] . . . 611
13.61.3 Member Function Documentation . . . 612

13.61.3.1 get_client() . . . 612
13.61.3.2 get_port() . . . 612
13.61.3.3 api_init_out() [1/2] . . . 612
13.61.3.4 api_init_in() [1/2] . . . 612
13.61.3.5 api_init_out_sub() [1/2] . . . 613
13.61.3.6 api_init_in_sub() [1/2] . . . 613
13.61.3.7 api_deinit_in() [1/2] . . . 613
13.61.3.8 api_play() [1/2] . . . 613
13.61.3.9 api_sysex() . . . 614
13.61.3.10 api_flush() . . . 614
13.61.3.11 api_continue_from() [1/2] . . . 614
13.61.3.12 api_start() [1/2] . . . 614
13.61.3.13 api_stop() [1/2] . . . 615
13.61.3.14 api_clock() [1/2] . . . 615
13.61.3.15 set_virtual_name() . . . 615
13.61.3.16 api_connect() . . . 615
13.61.3.17 api_init_in() [2/2] . . . 616
13.61.3.18 api_init_in_sub() [2/2] . . . 616
13.61.3.19 api_init_out() [2/2] . . . 616
13.61.3.20 api_init_out_sub() [2/2] . . . 616
13.61.3.21 api_deinit_in() [2/2] . . . 616
13.61.3.22 api_get_midi_event() . . . 616
13.61.3.23 api_poll_for_midi() . . . 617
13.61.3.24 api_continue_from() [2/2] . . . 617
13.61.3.25 api_start() [2/2] . . . 617
13.61.3.26 api_stop() [2/2] . . . 617
13.61.3.27 api_clock() [2/2] . . . 618
13.61.3.28 api_play() [2/2] . . . 618
13.61.4 Friends And Related Function Documentation . . . 618
13.61.4.1 mastermidibus . . . 618

13.61.5 Field Documentation . . . 618
13.61.5.1 m_seq . . . 618
13.61.5.2 m_dest_addr_client . . . 618
13.61.5.3 m_dest_addr_port . . . 619
13.61.5.4 m_local_addr_client . . . 619
13.61.5.5 m_local_addr_port . . . 619
13.61.5.6 m_input_port_name . . . 619
13.61.5.7 m_rt_midi . . . 619
13.61.5.8 m_master_info . . . 619
13.62 seq64::midifile Class Reference . . . 619
13.62.1 Detailed Description . . . 622
13.62.2 Constructor & Destructor Documentation . . . 622
13.62.2.1 midifile() . . . 622
13.62.2.2 ~midifile() . . . 623
13.62.3 Member Function Documentation . . . 623
13.62.3.1 parse() . . . 623
13.62.3.2 write() . . . 624
13.62.3.3 write_song() . . . 625
13.62.3.4 error_message() . . . 625
13.62.3.5 error_is_fatal() . . . 625
13.62.3.6 ppqn() . . . 625
13.62.3.7 parse_smf_0() . . . 625
13.62.3.8 parse_smf_1() . . . 626
13.62.3.9 parse_prop_header() . . . 626
13.62.3.10 parse_proprietary_track() . . . 627
13.62.3.11 pow2() . . . 628
13.62.3.12 checklen() . . . 628
13.62.3.13 add_trigger() . . . 629
13.62.3.14 read_long() . . . 629
13.62.3.15 read_short() . . . 629

13.62.3.16 read_byte() . . . 630
13.62.3.17 read_varinum() . . . 630
13.62.3.18 write_long() . . . 630
13.62.3.19 write_short() . . . 630
13.62.3.20 read_byte_array() . . . 631
13.62.3.21 write_byte() . . . 631
13.62.3.22 write_varinum() . . . 631
13.62.3.23 write_track_name() . . . 632
13.62.3.24 read_track_name() . . . 632
13.62.3.25 write_seq_number() . . . 632
13.62.3.26 read_seq_number() . . . 633
13.62.3.27 write_track_end() . . . 633
13.62.3.28 write_header() . . . 633
13.62.3.29 write_prop_header() . . . 634
13.62.3.30 write_proprietary_track() . . . 634
13.62.3.31 varinum_size() . . . 635
13.62.3.32 prop_item_size() . . . 635
13.62.3.33 track_name_size() . . . 636
13.62.3.34 errdump() [1/2] . . . 636
13.62.3.35 errdump() [2/2] . . . 636
13.62.3.36 write_track() . . . 637
13.62.3.37 seq_number_size() . . . 637
13.62.3.38 track_end_size() . . . 637
13.62.3.39 is_sysex_special_id() . . . 637
13.62.4 Field Documentation . . . 638
13.62.4.1 m_mutex . . . 638
13.62.4.2 m_file_size . . . 638
13.62.4.3 m_error_message . . . 638
13.62.4.4 m_error_is_fatal . . . 638
13.62.4.5 m_disable_reported . . . 638

13.62.4.6 m_pos . . . 638
13.62.4.7 m_name . . . 638
13.62.4.8 m_data . . . 639
13.62.4.9 m_char_list . . . 639
13.62.4.10 m_new_format . . . 639
13.62.4.11 m_global_bgsequence . . . 639
13.62.4.12 m_ppqn . . . 639
13.62.4.13 m_use_default_ppqn . . . 639
13.62.4.14 m_smf0_splitter . . . 639
13.63 seq64::mutex Class Reference . . . 640
13.63.1 Constructor & Destructor Documentation . . . 641
13.63.1.1 mutex() . . . 641
13.63.2 Member Function Documentation . . . 641
13.63.2.1 lock() . . . 641
13.63.2.2 unlock() . . . 641
13.63.3 Field Documentation . . . 641
13.63.3.1 sm_recursive_mutex . . . 641
13.63.3.2 m_mutex_lock . . . 641
13.64 seq64::editable_event::name_value_t Struct Reference . . . 641
13.64.1 Field Documentation . . . 642
13.64.1.1 event_value . . . 642
13.64.1.2 event_name . . . 642
13.65 seq64::options Class Reference . . . 642
13.65.1 Member Enumeration Documentation . . . 643
13.65.1.1 button . . . 644
13.65.2 Constructor & Destructor Documentation . . . 644
13.65.2.1 options() . . . 644
13.65.3 Member Function Documentation . . . 644
13.65.3.1 perf() . . . 644
13.65.3.2 clock_callback_off() . . . 645

13.65.3.3 clock_callback_on() . . . 645
13.65.3.4 clock_callback_mod() . . . 645
13.65.3.5 clock_mod_callback() . . . 645
13.65.3.6 input_callback() . . . 645
13.65.3.7 filter_callback() . . . 645
13.65.3.8 transport_callback() . . . 646
13.65.3.9 mouse_seq24_callback() . . . 646
13.65.3.10 mouse_fruity_callback() . . . 646
13.65.3.11 mouse_mod4_callback() . . . 646
13.65.3.12 mouse_snap_split_callback() . . . 646
13.65.3.13 mouse_click_edit_callback() . . . 646
13.65.3.14 lash_support_callback() . . . 646
13.65.3.15 add_midi_clock_page() . . . 647
13.65.3.16 add_midi_input_page() . . . 647
13.65.3.17 add_keyboard_page() . . . 647
13.65.3.18 add_extended_keys_page() . . . 647
13.65.3.19 add_mouse_page() . . . 647
13.65.3.20 add_jack_sync_page() . . . 647
13.65.4 Field Documentation . . . 647
13.65.4.1 m_tooltips . . . 647
13.65.4.2 m_mainperf . . . 648
13.65.4.3 m_button_ok . . . 648
13.65.4.4 m_button_jack_transport . . . 648
13.65.4.5 m_button_jack_master . . . 648
13.65.4.6 m_button_jack_master_cond . . . 648
13.65.4.7 m_button_jack_connect . . . 648
13.65.4.8 m_button_jack_disconnect . . . 648
13.65.4.9 m_notebook . . . 648
13.66 seq64::optionsfile Class Reference . . . 649
13.66.1 Detailed Description . . . 650

13.66.2 Constructor & Destructor Documentation . . . 650
13.66.2.1 optionsfile() . . . 650
13.66.2.2 ~optionsfile() . . . 650
13.66.3 Member Function Documentation . . . 650
13.66.3.1 parse() . . . 650
13.66.3.2 parse_mute_group_section() . . . 652
13.66.3.3 write() . . . 652
13.66.3.4 error_message() . . . 653
13.67 seq64::perfedit Class Reference . . . 653
13.67.1 Detailed Description . . . 658
13.67.2 Constructor & Destructor Documentation . . . 658
13.67.2.1 perfedit() . . . 658
13.67.2.2 ~perfedit() . . . 659
13.67.3 Member Function Documentation . . . 659
13.67.3.1 init_before_show() . . . 659
13.67.3.2 enqueue_draw() . . . 659
13.67.3.3 zoom_check() . . . 659
13.67.3.4 enregister_peer() . . . 660
13.67.3.5 set_zoom() . . . 660
13.67.3.6 get_toggle_jack() . . . 660
13.67.3.7 toggle_jack() . . . 660
13.67.3.8 rewind() . . . 661
13.67.3.9 fast_forward() . . . 661
13.67.3.10 set_follow_transport() . . . 661
13.67.3.11 toggle_follow_transport() . . . 661
13.67.3.12 set_jack_mode() . . . 661
13.67.3.13 set_transpose() . . . 661
13.67.3.14 transpose_button_callback() . . . 662
13.67.3.15 set_beats_per_bar() . . . 662
13.67.3.16 set_beat_width() . . . 662

13.67.3.17 set_snap() . . . 663
13.67.3.18 set_guides() . . . 663
13.67.3.19 grow() . . . 663
13.67.3.20 set_looped() . . . 663
13.67.3.21 expand() . . . 663
13.67.3.22 collapse() . . . 663
13.67.3.23 copy() . . . 664
13.67.3.24 undo() . . . 664
13.67.3.25 redo() . . . 664
13.67.3.26 popup_menu() . . . 664
13.67.3.27 draw_sequences() . . . 664
13.67.3.28 timeout() . . . 664
13.67.3.29 set_image() . . . 664
13.67.3.30 start_playing() . . . 665
13.67.3.31 pause_playing() . . . 665
13.67.3.32 stop_playing() . . . 665
13.67.3.33 toggle_playing() . . . 665
13.67.3.34 on_realize() . . . 665
13.67.3.35 on_key_press_event() . . . 665
13.67.3.36 on_key_release_event() . . . 666
13.67.3.37 on_delete_event() . . . 666
13.67.4 Friends And Related Function Documentation . . . 666
13.67.4.1 update_perfedit_sequences . . . 666
13.67.5 Field Documentation . . . 666
13.67.5.1 m_peer_perfedit . . . 666
13.67.5.2 m_table . . . 667
13.67.5.3 m_vadjust . . . 667
13.67.5.4 m_hadjust . . . 667
13.67.5.5 m_vscroll . . . 667
13.67.5.6 m_hscroll . . . 667

13.67.5.7 m_perfnames . . . 667
13.67.5.8 m_perfroll . . . 667
13.67.5.9 m_perftime . . . 667
13.67.5.10 m_menu_snap . . . 668
13.67.5.11 m_menu_xpose . . . 668
13.67.5.12 m_button_xpose . . . 668
13.67.5.13 m_entry_xpose . . . 668
13.67.5.14 m_image_play . . . 668
13.67.5.15 m_button_snap . . . 668
13.67.5.16 m_entry_snap . . . 668
13.67.5.17 m_button_stop . . . 668
13.67.5.18 m_button_play . . . 669
13.67.5.19 m_button_loop . . . 669
13.67.5.20 m_button_expand . . . 669
13.67.5.21 m_button_collapse . . . 669
13.67.5.22 m_button_copy . . . 669
13.67.5.23 m_button_grow . . . 669
13.67.5.24 m_button_undo . . . 669
13.67.5.25 m_button_redo . . . 669
13.67.5.26 m_button_jack . . . 670
13.67.5.27 m_button_follow . . . 670
13.67.5.28 m_button_bpm . . . 670
13.67.5.29 m_entry_bpm . . . 670
13.67.5.30 m_button_bw . . . 670
13.67.5.31 m_entry_bw . . . 670
13.67.5.32 m_hbox . . . 670
13.67.5.33 m_hlbox . . . 670
13.67.5.34 m_tooltips . . . 671
13.67.5.35 m_menu_bpm . . . 671
13.67.5.36 m_menu_bw . . . 671

13.67.5.37 m_snap . . . 671
13.67.5.38 m_bpm . . . 671
13.67.5.39 m_bw . . . 671
13.67.5.40 m_ppqn . . . 671
13.67.5.41 m_is_running . . . 671
13.67.5.42 m_standard_bpm . . . 672
13.68 seq64::perfnames Class Reference . . . 672
13.68.1 Detailed Description . . . 674
13.68.2 Constructor & Destructor Documentation . . . 674
13.68.2.1 perfnames() . . . 674
13.68.2.2 ~perfnames() . . . 675
13.68.3 Member Function Documentation . . . 675
13.68.3.1 redraw_dirty_sequences() . . . 675
13.68.3.2 enqueue_draw() . . . 675
13.68.3.3 convert_y() . . . 675
13.68.3.4 draw_sequences() . . . 675
13.68.3.5 draw_sequence() . . . 676
13.68.3.6 change_vert() . . . 676
13.68.3.7 redraw() . . . 676
13.68.3.8 on_realize() . . . 676
13.68.3.9 on_expose_event() . . . 677
13.68.3.10 on_button_press_event() . . . 677
13.68.3.11 on_button_release_event() . . . 677
13.68.3.12 on_size_allocate() . . . 678
13.68.3.13 on_scroll_event() . . . 678
13.68.4 Friends And Related Function Documentation . . . 678
13.68.4.1 perfedit . . . 678
13.68.5 Field Documentation . . . 678
13.68.5.1 m_parent . . . 679
13.68.5.2 m_names_chars . . . 679

13.68.5.3 m_char_w . . . 679
13.68.5.4 m_setbox_w . . . 679
13.68.5.5 m_namebox_w . . . 679
13.68.5.6 m_names_x . . . 679
13.68.5.7 m_names_y . . . 679
13.68.5.8 m_xy_offset . . . 680
13.68.5.9 m_seqs_in_set . . . 680
13.68.5.10 m_sequence_max . . . 680
13.68.5.11 m_sequence_offset . . . 680
13.68.5.12 m_sequence_active . . . 680
13.69 seq64::perform Class Reference . . . 680
13.69.1 Detailed Description . . . 694
13.69.2 Member Enumeration Documentation . . . 694
13.69.2.1 mute_op_t . . . 694
13.69.2.2 ff_rw_button_t . . . 694
13.69.3 Constructor & Destructor Documentation . . . 694
13.69.3.1 perform() . . . 694
13.69.3.2 ~perform() . . . 695
13.69.4 Member Function Documentation . . . 695
13.69.4.1 is_modified() [1/2] . . . 695
13.69.4.2 modify() . . . 695
13.69.4.3 ppqn() . . . 695
13.69.4.4 sequence_count() . . . 696
13.69.4.5 sequence_max() . . . 696
13.69.4.6 is_control_status() . . . 696
13.69.4.7 set_edit_sequence() . . . 696
13.69.4.8 unset_edit_sequence() . . . 696
13.69.4.9 is_edit_sequence() . . . 697
13.69.4.10 get_beats_per_bar() . . . 697
13.69.4.11 set_beats_per_bar() . . . 697

13.69.4.12 get_beat_width() . . . 697
13.69.4.13 set_beat_width() . . . 697
13.69.4.14 clocks_per_metronome() [1/2] . . . 698
13.69.4.15 clocks_per_metronome() [2/2] . . . 698
13.69.4.16 set_32nds_per_quarter() . . . 698
13.69.4.17 get_32nds_per_quarter() . . . 698
13.69.4.18 us_per_quarter_note() [1/2] . . . 698
13.69.4.19 us_per_quarter_note() [2/2] . . . 698
13.69.4.20 gui() [1/2] . . . 698
13.69.4.21 gui() [2/2] . . . 699
13.69.4.22 keys() [1/2] . . . 699
13.69.4.23 keys() [2/2] . . . 699
13.69.4.24 master_bus() . . . 699
13.69.4.25 filter_by_channel() . . . 699
13.69.4.26 is_running() . . . 699
13.69.4.27 is_pattern_playing() [1/2] . . . 699
13.69.4.28 toggle_song_start_mode() . . . 700
13.69.4.29 song_start_mode() [1/2] . . . 700
13.69.4.30 song_start_mode() [2/2] . . . 700
13.69.4.31 is_jack_running() . . . 700
13.69.4.32 is_jack_master() . . . 700
13.69.4.33 enregister() . . . 700
13.69.4.34 toggle_jack_mode() . . . 700
13.69.4.35 set_jack_mode() . . . 701
13.69.4.36 get_toggle_jack() . . . 701
13.69.4.37 set_jack_stop_tick() . . . 701
13.69.4.38 combine_bytes() . . . 701
13.69.4.39 FF_rewind() . . . 702
13.69.4.40 FF_RW_timeout() . . . 702
13.69.4.41 start_from_perfedit() [1/2] . . . 702

13.69.4.42 start_from_perfedit() [2/2] . . . 702
13.69.4.43 set_follow_transport() . . . 702
13.69.4.44 get_follow_transport() . . . 703
13.69.4.45 toggle_follow_transport() . . . 703
13.69.4.46 set_reposition() . . . 703
13.69.4.47 ff_rw_type() [1/2] . . . 703
13.69.4.48 ff_rw_type() [2/2] . . . 703
13.69.4.49 rewind() . . . 703
13.69.4.50 fast_forward() . . . 703
13.69.4.51 reposition() . . . 704
13.69.4.52 clear_all() . . . 704
13.69.4.53 launch() . . . 704
13.69.4.54 new_sequence() . . . 705
13.69.4.55 add_sequence() . . . 705
13.69.4.56 delete_sequence() . . . 706
13.69.4.57 is_sequence_in_edit() . . . 706
13.69.4.58 clear_sequence_triggers() . . . 706
13.69.4.59 print_triggers() . . . 707
13.69.4.60 print_busses() . . . 707
13.69.4.61 finish() . . . 707
13.69.4.62 get_tick() . . . 707
13.69.4.63 set_tick() . . . 707
13.69.4.64 get_jack_tick() . . . 707
13.69.4.65 set_jack_tick() . . . 707
13.69.4.66 set_left_tick() . . . 708
13.69.4.67 get_left_tick() . . . 708
13.69.4.68 set_start_tick() . . . 708
13.69.4.69 get_start_tick() . . . 708
13.69.4.70 set_right_tick() . . . 709
13.69.4.71 get_right_tick() . . . 709

13.69.4.72 left_right_size() . . . 709
13.69.4.73 is_active() . . . 709
13.69.4.74 apply_song_transpose() . . . 710
13.69.4.75 set_transpose() . . . 710
13.69.4.76 get_transpose() . . . 710
13.69.4.77 get_beats_per_minute() . . . 710
13.69.4.78 clear_mute_groups() . . . 710
13.69.4.79 reload_mute_groups() . . . 710
13.69.4.80 set_sequence_control_status() . . . 711
13.69.4.81 unset_sequence_control_status() . . . 711
13.69.4.82 sequence_playing_toggle() . . . 711
13.69.4.83 sequence_playing_change() . . . 712
13.69.4.84 sequence_playing_on() . . . 712
13.69.4.85 sequence_playing_off() . . . 712
13.69.4.86 mute_all_tracks() . . . 712
13.69.4.87 toggle_all_tracks() . . . 713
13.69.4.88 armed_saved() . . . 713
13.69.4.89 toggle_playing_tracks() . . . 713
13.69.4.90 mute_screenset() . . . 713
13.69.4.91 output_func() . . . 713
13.69.4.92 input_func() . . . 714
13.69.4.93 set_group_mute_state() . . . 714
13.69.4.94 get_group_mute_state() . . . 715
13.69.4.95 set_offset() . . . 715
13.69.4.96 get_offset() . . . 715
13.69.4.97 save_playing_state() . . . 715
13.69.4.98 restore_playing_state() . . . 716
13.69.4.99 key_name() . . . 716
13.69.4.100 get_key_events() . . . 716
13.69.4.101 get_key_groups() . . . 716

13.69.4.102 get_key_events_rev() . . . 716
13.69.4.103 get_key_groups_rev() . . . 716
13.69.4.104 show_ui_sequence_key() [1/2] . . . 716
13.69.4.105 show_ui_sequence_key() [2/2] . . . 716
13.69.4.106 show_ui_sequence_number() [1/2] . . . 717
13.69.4.107 show_ui_sequence_number() [2/2] . . . 717
13.69.4.108 lookup_keyevent_key() . . . 717
13.69.4.109 lookup_keyevent_seq() . . . 717
13.69.4.110 lookup_keygroup_key() . . . 719
13.69.4.111 lookup_keygroup_group() . . . 719
13.69.4.112 start_playing() . . . 719
13.69.4.113 pause_playing() . . . 720
13.69.4.114 stop_playing() . . . 721
13.69.4.115 start_key() . . . 721
13.69.4.116 pause_key() . . . 721
13.69.4.117 stop_key() . . . 721
13.69.4.118 learn_toggle() . . . 722
13.69.4.119 decrement_beats_per_minute() . . . 722
13.69.4.120 increment_beats_per_minute() . . . 722
13.69.4.121 page_decrement_beats_per_minute() . . . 722
13.69.4.122 page_increment_beats_per_minute() . . . 722
13.69.4.123 decrement_screenset() . . . 723
13.69.4.124 increment_screenset() . . . 723
13.69.4.125 highlight() . . . 723
13.69.4.126 is_smf_0() . . . 723
13.69.4.127 get_sequence() [1/2] . . . 723
13.69.4.128 get_sequence() [2/2] . . . 724
13.69.4.129 sequence_key() . . . 724
13.69.4.130 sequence_label() . . . 724
13.69.4.131 set_input_bus() . . . 725

13.69.4.132 set_clock_bus() . . . 725
13.69.4.133 mainwnd_key_event() . . . 726
13.69.4.134 perfroll_key_event() . . . 726
13.69.4.135 playback_key_event() . . . 726
13.69.4.136 move_triggers() . . . 727
13.69.4.137 copy_triggers() . . . 727
13.69.4.138 push_trigger_undo() . . . 727
13.69.4.139 pop_trigger_undo() . . . 728
13.69.4.140 pop_trigger_redo() . . . 728
13.69.4.141 is_dirty_main() . . . 728
13.69.4.142 is_dirty_edit() . . . 728
13.69.4.143 is_dirty_perf() . . . 729
13.69.4.144 is_dirty_names() . . . 729
13.69.4.145 is_exportable() . . . 729
13.69.4.146 set_screenset() . . . 730
13.69.4.147 get_screenset() . . . 730
13.69.4.148 set_playing_screenset() . . . 730
13.69.4.149 toggle_other_seqs() . . . 730
13.69.4.150 toggle_other_names() . . . 731
13.69.4.151 have_undo() . . . 731
13.69.4.152 set_have_undo() . . . 731
13.69.4.153 have_redo() . . . 731
13.69.4.154 set_have_redo() . . . 732
13.69.4.155 split_trigger() . . . 732
13.69.4.156 get_max_trigger() . . . 732
13.69.4.157 collapse() . . . 732
13.69.4.158 copy() . . . 732
13.69.4.159 expand() . . . 732
13.69.4.160 midi_control_toggle() . . . 733
13.69.4.161 midi_control_on() . . . 733

13.69.4.162 midi_control_off() . . . 733
13.69.4.163 midi_control_event() . . . 734
13.69.4.164 handle_midi_control() . . . 734
13.69.4.165 handle_midi_control_ex() . . . 735
13.69.4.166 set_screen_set_notepad() . . . 735
13.69.4.167 current_screen_set_notepad() . . . 735
13.69.4.168 set_screen_set_notepad() [1/2] . . . 736
13.69.4.169 set_screen_set_notepad() [2/2] . . . 736
13.69.4.170 set_playing_screenset() . . . 736
13.69.4.171 any_group_unmutes() . . . 736
13.69.4.172 print_group_unmutes() . . . 737
13.69.4.173 mute_group_tracks() . . . 737
13.69.4.174 select_and_mute_group() . . . 737
13.69.4.175 set_song_mute() . . . 737
13.69.4.176 set_mode_group_mute() . . . 738
13.69.4.177 unset_mode_group_mute() . . . 738
13.69.4.178 select_group_mute() . . . 738
13.69.4.179 set_mode_group_learn() . . . 738
13.69.4.180 unset_mode_group_learn() . . . 738
13.69.4.181 is_group_learning() . . . 739
13.69.4.182 set_and_copy_mute_group() . . . 739
13.69.4.183 activate() . . . 739
13.69.4.184 start() . . . 739
13.69.4.185 stop() . . . 739
13.69.4.186 start_jack() . . . 740
13.69.4.187 stop_jack() . . . 740
13.69.4.188 position_jack() . . . 740
13.69.4.189 off_sequences() . . . 741
13.69.4.190 all_notes_off() . . . 741
13.69.4.191 set_active() . . . 741

13.69.4.192 set_was_active() . . . 741
13.69.4.193 reset_sequences() . . . 741
13.69.4.194 play() . . . 742
13.69.4.195 set_orig_ticks() . . . 742
13.69.4.196 set_beats_per_minute() . . . 742
13.69.4.197 set_looping() . . . 743
13.69.4.198 max_active_set() . . . 743
13.69.4.199 launch_input_thread() . . . 743
13.69.4.200 launch_output_thread() . . . 743
13.69.4.201 init_jack_transport() . . . 744
13.69.4.202 deinit_jack_transport() . . . 744
13.69.4.203 seq_in_playing_screen() . . . 744
13.69.4.204 is_modified() [2/2] . . . 744
13.69.4.205 valid_midi_control_seq() . . . 745
13.69.4.206 is_screenset_valid() . . . 745
13.69.4.207 set_running() . . . 745
13.69.4.208 is_pattern_playing() [2/2] . . . 746
13.69.4.209 set_playback_mode() . . . 746
13.69.4.210 mute_group_offset() . . . 746
13.69.4.211 is_seq_valid() . . . 746
13.69.4.212 is_mseq_valid() . . . 747
13.69.4.213 install_sequence() . . . 747
13.69.4.214 timer_start() . . . 748
13.69.4.215 timer_stop() . . . 748
13.69.4.216 clamp_track() . . . 748
13.69.4.217 set_key_event() . . . 749
13.69.4.218 set_key_group() . . . 749
13.69.4.219 create_master_bus() . . . 749
13.69.4.220 add_clock() . . . 750
13.69.4.221 set_clock() . . . 750

13.69.4.22 add_input() . . . 750
13.69.4.23 set_input() . . . 750
13.69.4.24 get_input() . . . 751
13.69.4.25 is_input_system_port() . . . 751
13.69.5 Friends And Related Function Documentation . . . 751
13.69.5.1 jack_assistant . . . 751
13.69.5.2 keybindentry . . . 751
13.69.5.3 mainwnd . . . 751
13.69.5.4 midifile . . . 751
13.69.5.5 optionsfile . . . 752
13.69.5.6 options . . . 752
13.69.5.7 perfedit . . . 752
13.69.5.8 perfroll . . . 752
13.69.5.9 input_thread_func . . . 752
13.69.5.10 output_thread_func . . . 752
13.69.5.11 jack_sync_callback . . . 753
13.69.5.12 jack_transport_callback . . . 753
13.69.5.13 jack_shutdown . . . 754
13.69.5.14 jack_timebase_callback . . . 754
13.69.5.15 get_current_jack_position . . . 755
13.69.6 Field Documentation . . . 755
13.69.6.1 sm_mc_dummy . . . 755
13.69.6.2 m_song_start_mode . . . 755
13.69.6.3 m_start_from_perfedit . . . 756
13.69.6.4 m_reposition . . . 756
13.69.6.5 m_excell_FF_RW . . . 756
13.69.6.6 m_FF_RW_button_type . . . 756
13.69.6.7 m_mute_group . . . 756
13.69.6.8 m_armed_saved . . . 756
13.69.6.9 m_armed_statuses . . . 756

13.69.6.10m_tracks_mute_state . . . 757
13.69.6.11m_mode_group . . . 757
13.69.6.12m_mode_group_learn . . . 757
13.69.6.13m_mute_group_selected . . . 757
13.69.6.14m_playing_screen . . . 757
13.69.6.15m_playscreen_offset . . . 757
13.69.6.16m_seqs . . . 757
13.69.6.17m_seqs_active . . . 758
13.69.6.18m_was_active_main . . . 758
13.69.6.19m_was_active_edit . . . 758
13.69.6.20m_was_active_perf . . . 758
13.69.6.21m_was_active_names . . . 758
13.69.6.22m_sequence_state . . . 758
13.69.6.23m_transpose . . . 758
13.69.6.24m_out_thread . . . 759
13.69.6.25m_in_thread . . . 759
13.69.6.26m_out_thread_launched . . . 759
13.69.6.27m_in_thread_launched . . . 759
13.69.6.28m_running . . . 759
13.69.6.29m_is_pattern_playing . . . 759
13.69.6.30m_inputing . . . 759
13.69.6.31m_outputing . . . 760
13.69.6.32m_looping . . . 760
13.69.6.33m_playback_mode . . . 760
13.69.6.34m_ppqn . . . 760
13.69.6.35m_bpm . . . 760
13.69.6.36m_beats_per_bar . . . 760
13.69.6.37m_beat_width . . . 760
13.69.6.38m_clocks_per_metronome . . . 761
13.69.6.39m_32nds_per_quarter . . . 761

13.69.6.40m_us_per_quarter_note . . . 761
13.69.6.41m_master_bus . . . 761
13.69.6.42m_master_clocks . . . 761
13.69.6.43m_master_inputs . . . 761
13.69.6.44m_one_measure . . . 761
13.69.6.45m_left_tick . . . 762
13.69.6.46m_right_tick . . . 762
13.69.6.47m_starting_tick . . . 762
13.69.6.48m_tick . . . 762
13.69.6.49m_jack_tick . . . 762
13.69.6.50m_usemidiclock . . . 762
13.69.6.51m_midiclockrunning . . . 762
13.69.6.52m_midiclocktick . . . 763
13.69.6.53m_midiclockpos . . . 763
13.69.6.54m_dont_reset_ticks . . . 763
13.69.6.55m_screen_set_notepad . . . 763
13.69.6.56m_midi_cc_toggle . . . 763
13.69.6.57m_midi_cc_on . . . 763
13.69.6.58m_midi_cc_off . . . 763
13.69.6.59m_offset . . . 763
13.69.6.60m_control_status . . . 764
13.69.6.61m_screenset . . . 764
13.69.6.62m_seqs_in_set . . . 764
13.69.6.63m_max_sets . . . 764
13.69.6.64m_sequence_count . . . 764
13.69.6.65m_sequence_max . . . 764
13.69.6.66m_sequence_high . . . 764
13.69.6.67m_edit_sequence . . . 765
13.69.6.68m_is_modified . . . 765
13.69.6.69m_condition_var . . . 765

13.69.6.70 m_jack_asst . . . 765
13.69.6.71 m_have_undo . . . 765
13.69.6.72 m_undo_vect . . . 765
13.69.6.73 m_have_redo . . . 765
13.69.6.74 m_redo_vect . . . 766
13.69.6.75 m_notify . . . 766
13.69.6.76 m_gui_support . . . 766
13.70 seq64::performcallback Struct Reference . . . 766
13.70.1 Detailed Description . . . 767
13.70.2 Member Function Documentation . . . 768
13.70.2.1 on_grouplearnchange() . . . 768
13.71 seq64::perfroll Class Reference . . . 768
13.71.1 Constructor & Destructor Documentation . . . 773
13.71.1.1 perfroll() . . . 773
13.71.1.2 ~perfroll() . . . 773
13.71.2 Member Function Documentation . . . 773
13.71.2.1 set_guides() . . . 773
13.71.2.2 update_sizes() . . . 774
13.71.2.3 init_before_show() . . . 774
13.71.2.4 fill_background_pixmap() . . . 774
13.71.2.5 increment_size() . . . 775
13.71.2.6 draw_all() . . . 775
13.71.2.7 follow_progress() . . . 775
13.71.2.8 redraw_progress() . . . 775
13.71.2.9 draw_progress() . . . 775
13.71.2.10 redraw_dirty_sequences() . . . 775
13.71.2.11 set_ppqn() . . . 776
13.71.2.12 convert_xy() . . . 776
13.71.2.13 convert_x() . . . 776
13.71.2.14 snap_x() . . . 777

13.71.2.15 draw_sequence_on() . . . 777
13.71.2.16 draw_background_on() . . . 777
13.71.2.17 draw_drawable_row() . . . 777
13.71.2.18 change_horz() . . . 777
13.71.2.19 change_vert() . . . 778
13.71.2.20 split_trigger() . . . 778
13.71.2.21 enqueue_draw() . . . 778
13.71.2.22 set_zoom() . . . 778
13.71.2.23 convert_drop_xy() . . . 778
13.71.2.24 horizontal_adjust() . . . 778
13.71.2.25 vertical_adjust() . . . 779
13.71.2.26 horizontal_set() . . . 779
13.71.2.27 vertical_set() . . . 779
13.71.2.28 on_realize() . . . 780
13.71.2.29 on_expose_event() . . . 780
13.71.2.30 on_button_press_event() . . . 780
13.71.2.31 on_button_release_event() . . . 781
13.71.2.32 on_motion_notify_event() . . . 781
13.71.2.33 on_scroll_event() . . . 781
13.71.2.34 on_focus_in_event() . . . 781
13.71.2.35 on_focus_out_event() . . . 781
13.71.2.36 on_size_allocate() . . . 782
13.71.2.37 on_key_press_event() . . . 782
13.71.2.38 on_size_request() . . . 782
13.71.3 Friends And Related Function Documentation . . . 782
13.71.3.1 FruityPerfInput . . . 782
13.71.3.2 Seq24PerfInput . . . 783
13.71.3.3 perfedit . . . 783
13.71.4 Field Documentation . . . 783
13.71.4.1 m_parent . . . 783

13.71.4.2 m_h_page_increment . . . 783
13.71.4.3 m_v_page_increment . . . 783
13.71.4.4 m_snap . . . 783
13.71.4.5 m_ppqn . . . 783
13.71.4.6 m_page_factor . . . 784
13.71.4.7 m_divs_per_beat . . . 784
13.71.4.8 m_ticks_per_bar . . . 784
13.71.4.9 m_perf_scale_x . . . 784
13.71.4.10 m_zoom . . . 784
13.71.4.11 m_names_y . . . 784
13.71.4.12 m_background_x . . . 784
13.71.4.13 m_size_box_w . . . 785
13.71.4.14 m_measure_length . . . 785
13.71.4.15 m_beat_length . . . 785
13.71.4.16 m_old_progress_ticks . . . 785
13.71.4.17 m_have_button_press . . . 785
13.71.4.18 m_transport_follow . . . 785
13.71.4.19 m_trans_button_press . . . 785
13.71.4.20 m_4bar_offset . . . 786
13.71.4.21 m_sequence_offset . . . 786
13.71.4.22 m_roll_length_ticks . . . 786
13.71.4.23 m_drop_tick . . . 786
13.71.4.24 m_drop_tick_trigger_offset . . . 786
13.71.4.25 m_drop_sequence . . . 786
13.71.4.26 m_sequence_max . . . 786
13.71.4.27 m_sequence_active . . . 787
13.71.4.28 m_fruity_interaction . . . 787
13.71.4.29 m_seq24_interaction . . . 787
13.71.4.30 m_interaction . . . 787
13.71.4.31 m_moving . . . 787

13.71.4.32 m_growing . . . 787
13.71.4.33 m_grow_direction . . . 787
13.72 seq64::perftime Class Reference . . . 788
13.72.1 Constructor & Destructor Documentation . . . 790
13.72.1.1 perftime() . . . 790
13.72.1.2 ~perftime() . . . 791
13.72.2 Member Function Documentation . . . 791
13.72.2.1 reset() . . . 791
13.72.2.2 set_scale() . . . 791
13.72.2.3 set_guides() . . . 791
13.72.2.4 increment_size() . . . 792
13.72.2.5 enqueue_draw() . . . 792
13.72.2.6 set_zoom() . . . 792
13.72.2.7 draw_background() . . . 792
13.72.2.8 draw_progress_on_window() . . . 792
13.72.2.9 change_horz() . . . 792
13.72.2.10 set_ppqn() . . . 793
13.72.2.11 tick_to_pixel() . . . 793
13.72.2.12 pixel_to_tick() . . . 793
13.72.2.13 tick_offset() . . . 794
13.72.2.14 update_sizes() . . . 794
13.72.2.15 idle_progress() . . . 794
13.72.2.16 update_pixmap() . . . 794
13.72.2.17 draw_pixmap_on_window() . . . 794
13.72.2.18 on_realize() . . . 794
13.72.2.19 on_expose_event() . . . 794
13.72.2.20 on_button_press_event() . . . 795
13.72.2.21 on_size_allocate() . . . 795
13.72.2.22 on_button_release_event() . . . 795
13.72.2.23 key_press_event() . . . 796

13.72.3 Friends And Related Function Documentation . . . 796
13.72.3.1 perfedit . . . 796
13.72.4 Field Documentation . . . 796
13.72.4.1 m_parent . . . 796
13.72.4.2 m_4bar_offset . . . 796
13.72.4.3 m_tick_offset . . . 796
13.72.4.4 m_ppqn . . . 797
13.72.4.5 m_snap . . . 797
13.72.4.6 m_measure_length . . . 797
13.72.4.7 m_left_marker_tick . . . 797
13.72.4.8 m_right_marker_tick . . . 797
13.72.4.9 m_perf_scale_x . . . 797
13.72.4.10 m_timearea_y . . . 797
13.73 seq64::midi_port_info::port_info_t Struct Reference . . . 797
13.73.1 Detailed Description . . . 798
13.73.2 Field Documentation . . . 798
13.73.2.1 m_client_number . . . 798
13.73.2.2 m_client_name . . . 798
13.73.2.3 m_port_number . . . 798
13.73.2.4 m_port_name . . . 799
13.73.2.5 m_queue_number . . . 799
13.73.2.6 m_is_input . . . 799
13.73.2.7 m_is_virtual . . . 799
13.73.2.8 m_is_system . . . 799
13.74 seq64::rc_settings Class Reference . . . 799
13.74.1 Detailed Description . . . 804
13.74.2 Constructor & Destructor Documentation . . . 804
13.74.2.1 rc_settings() [1/2] . . . 804
13.74.2.2 rc_settings() [2/2] . . . 804
13.74.3 Member Function Documentation . . . 805

13.74.3.1 operator=() . . . 805
13.74.3.2 config_filespec() . . . 805
13.74.3.3 user_filespec() . . . 805
13.74.3.4 set_defaults() . . . 806
13.74.3.5 auto_option_save() [1/2] . . . 806
13.74.3.6 legacy_format() [1/2] . . . 806
13.74.3.7 lash_support() [1/2] . . . 806
13.74.3.8 allow_mod4_mode() [1/2] . . . 806
13.74.3.9 allow_snap_split() [1/2] . . . 806
13.74.3.10 allow_click_edit() [1/2] . . . 806
13.74.3.11 show_midi() [1/2] . . . 806
13.74.3.12 priority() [1/2] . . . 807
13.74.3.13 stats() [1/2] . . . 807
13.74.3.14 pass_sysex() [1/2] . . . 807
13.74.3.15 with_jack_transport() [1/2] . . . 807
13.74.3.16 with_jack_master() [1/2] . . . 807
13.74.3.17 with_jack_master_cond() [1/2] . . . 807
13.74.3.18 with_jack_midi() [1/2] . . . 807
13.74.3.19 with_jack() . . . 807
13.74.3.20 filter_by_channel() [1/2] . . . 808
13.74.3.21 manual_alsa_ports() [1/2] . . . 808
13.74.3.22 reveal_alsa_ports() [1/2] . . . 808
13.74.3.23 print_keys() [1/2] . . . 808
13.74.3.24 device_ignore() [1/2] . . . 808
13.74.3.25 device_ignore_num() [1/2] . . . 808
13.74.3.26 nteraction_method() [1/2] . . . 808
13.74.3.27 filename() [1/2] . . . 808
13.74.3.28 filename() [2/2] . . . 808
13.74.3.29 jack_session_uuid() [1/2] . . . 809
13.74.3.30 ast_used_dir() [1/2] . . . 809

13.74.3.31 last_used_dir() [2/2] . . . 809
13.74.3.32 config_directory() [1/2] . . . 809
13.74.3.33 home_config_directory() . . . 809
13.74.3.34 config_filename() [1/2] . . . 810
13.74.3.35 user_filename() [1/2] . . . 810
13.74.3.36 config_filename_alt() [1/2] . . . 810
13.74.3.37 user_filename_alt() [1/2] . . . 810
13.74.3.38 application_name() . . . 810
13.74.3.39 app_client_name() . . . 810
13.74.3.40 auto_option_save() [2/2] . . . 810
13.74.3.41 legacy_format() [2/2] . . . 811
13.74.3.42 ash_support() [2/2] . . . 811
13.74.3.43 allow_mod4_mode() [2/2] . . . 811
13.74.3.44 allow_snap_split() [2/2] . . . 811
13.74.3.45 allow_click_edit() [2/2] . . . 811
13.74.3.46 show_midi() [2/2] . . . 811
13.74.3.47 priority() [2/2] . . . 811
13.74.3.48 stats() [2/2] . . . 812
13.74.3.49 pass_sysex() [2/2] . . . 812
13.74.3.50 with_jack_transport() [2/2] . . . 812
13.74.3.51 with_jack_master() [2/2] . . . 812
13.74.3.52 with_jack_master_cond() [2/2] . . . 812
13.74.3.53 with_jack_midi() [2/2] . . . 812
13.74.3.54 filter_by_channel() [2/2] . . . 812
13.74.3.55 manual_alsa_ports() [2/2] . . . 813
13.74.3.56 reveal_alsa_ports() [2/2] . . . 813
13.74.3.57 print_keys() [2/2] . . . 813
13.74.3.58 device_ignore() [2/2] . . . 813
13.74.3.59 device_ignore_num() [2/2] . . . 813
13.74.3.60 nteraction_method() [2/2] . . . 813

13.74.3.61 jack_session_uuid() [2/2] . . . 814
13.74.3.62 config_directory() [2/2] . . . 814
13.74.3.63 set_config_files() . . . 814
13.74.3.64 config_filename() [2/2] . . . 814
13.74.3.65 user_filename() [2/2] . . . 815
13.74.3.66 config_filename_alt() [2/2] . . . 815
13.74.3.67 user_filename_alt() [2/2] . . . 815
13.74.4 Friends And Related Function Documentation . . . 815
13.74.4.1 optionsfile . . . 815
13.74.4.2 options . . . 816
13.74.4.3 mainwnd . . . 816
13.74.4.4 rtmidi_info . . . 816
13.74.4.5 parse_command_line_options . . . 816
13.74.4.6 help_check . . . 816
13.74.5 Field Documentation . . . 817
13.74.5.1 m_auto_option_save . . . 817
13.74.5.2 m_legacy_format . . . 817
13.74.5.3 m_lash_support . . . 817
13.74.5.4 m_allow_mod4_mode . . . 817
13.74.5.5 m_allow_snap_split . . . 817
13.74.5.6 m_allow_click_edit . . . 818
13.74.5.7 m_show_midi . . . 818
13.74.5.8 m_priority . . . 818
13.74.5.9 m_stats . . . 818
13.74.5.10 m_pass_sysex . . . 818
13.74.5.11 m_with_jack_transport . . . 818
13.74.5.12 m_with_jack_master . . . 818
13.74.5.13 m_with_jack_master_cond . . . 818
13.74.5.14 m_with_jack_midi . . . 819
13.74.5.15 m_filter_by_channel . . . 819

13.74.5.16m_manual_alsa_ports . . . 819
13.74.5.17m_reveal_alsa_ports . . . 819
13.74.5.18m_print_keys . . . 819
13.74.5.19m_device_ignore . . . 819
13.74.5.20m_device_ignore_num . . . 819
13.74.5.21m_interaction_method . . . 819
13.74.5.22m_filename . . . 820
13.74.5.23m_jack_session_uuid . . . 820
13.74.5.24m_last_used_dir . . . 820
13.74.5.25m_config_directory . . . 820
13.74.5.26m_config_filename . . . 820
13.74.5.27m_user_filename . . . 820
13.74.5.28m_config_filename_alt . . . 820
13.74.5.29m_user_filename_alt . . . 820
13.74.5.30m_application_name . . . 821
13.74.5.31m_app_client_name . . . 821
13.75seq64::rect Class Reference . . . 821
13.75.1 Field Documentation . . . 821
13.75.1.1 x . . . 821
13.75.1.2 y . . . 821
13.75.1.3 height . . . 822
13.75.1.4 width . . . 822
13.76seq64::gui_drawingarea_gtk2::rect Struct Reference . . . 822
13.76.1 Field Documentation . . . 822
13.76.1.1 x . . . 822
13.76.1.2 y . . . 822
13.76.1.3 height . . . 822
13.76.1.4 width . . . 823
13.77seq64::rterror Class Reference . . . 823
13.77.1 Detailed Description . . . 824

13.77.2 Member Enumeration Documentation . . . 824
13.77.2.1 Type . . . 824
13.77.3 Constructor & Destructor Documentation . . . 824
13.77.3.1 rterror() . . . 824
13.77.3.2 ∼rterror() . . . 824
13.77.4 Member Function Documentation . . . 825
13.77.4.1 print_message() . . . 825
13.77.4.2 getType() . . . 825
13.77.4.3 get_message() . . . 825
13.77.4.4 what() . . . 825
13.77.5 Field Documentation . . . 825
13.77.5.1 m_message . . . 825
13.77.5.2 m_type . . . 825
13.78 seq64::rtmidi Class Reference . . . 826
13.78.1 Detailed Description . . . 828
13.78.2 Constructor & Destructor Documentation . . . 828
13.78.2.1 rtmidi() . . . 828
13.78.2.2 ∼rtmidi() . . . 828
13.78.3 Member Function Documentation . . . 828
13.78.3.1 api_connect() . . . 828
13.78.3.2 api_play() . . . 829
13.78.3.3 api_continue_from() . . . 829
13.78.3.4 api_start() . . . 829
13.78.3.5 api_stop() . . . 829
13.78.3.6 api_clock() . . . 829
13.78.3.7 api_set_ppqn() . . . 829
13.78.3.8 api_set_beats_per_minute() . . . 830
13.78.3.9 api_init_out() . . . 830
13.78.3.10 api_init_out_sub() . . . 830
13.78.3.11 api_init_in() . . . 830

13.78.3.12 api_init_in_sub() . . . 830
13.78.3.13 api_deinit_in() . . . 830
13.78.3.14 api_get_midi_event() . . . 831
13.78.3.15 api_poll_for_midi() . . . 831
13.78.3.16 api_sysex() . . . 831
13.78.3.17 api_flush() . . . 831
13.78.3.18 as_port_open() . . . 831
13.78.3.19 get_bus_id() . . . 831
13.78.3.20 get_bus_name() . . . 832
13.78.3.21 get_port_id() . . . 832
13.78.3.22 get_port_name() . . . 832
13.78.3.23 get_port_count() . . . 832
13.78.3.24 full_port_count() . . . 832
13.78.3.25 get_api() [1/2] . . . 833
13.78.3.26 get_api() [2/2] . . . 833
13.78.3.27 set_api() . . . 833
13.78.3.28 delete_api() . . . 833
13.78.4 Friends And Related Function Documentation . . . 833
13.78.4.1 midibus . . . 833
13.78.5 Field Documentation . . . 833
13.78.5.1 m_midi_info . . . 833
13.78.5.2 m_midi_api . . . 834
13.79 seq64::rtmidi_in Class Reference . . . 834
13.79.1 Detailed Description . . . 836
13.79.2 Constructor & Destructor Documentation . . . 836
13.79.2.1 rtmidi_in() . . . 836
13.79.2.2 ~rtmidi_in() . . . 837
13.79.3 Member Function Documentation . . . 837
13.79.3.1 user_callback() . . . 837
13.79.3.2 cancel_callback() . . . 837

13.79.3.3 openmidi_api() . . . 837
13.80 seq64::rtmidi_in_data Class Reference . . . 838
13.80.1 Detailed Description . . . 839
13.80.2 Constructor & Destructor Documentation . . . 839
13.80.2.1 rtmidi_in_data() . . . 839
13.80.3 Member Function Documentation . . . 839
13.80.3.1 queue() [1/2] . . . 839
13.80.3.2 queue() [2/2] . . . 839
13.80.3.3 message() [1/2] . . . 839
13.80.3.4 message() [2/2] . . . 839
13.80.3.5 ignore_flags() [1/2] . . . 839
13.80.3.6 test_ignore_flags() . . . 840
13.80.3.7 ignore_flags() [2/2] . . . 840
13.80.3.8 do_input() [1/2] . . . 840
13.80.3.9 do_input() [2/2] . . . 840
13.80.3.10 first_message() [1/2] . . . 840
13.80.3.11 first_message() [2/2] . . . 840
13.80.3.12 continue_sysex() [1/2] . . . 840
13.80.3.13 continue_sysex() [2/2] . . . 841
13.80.3.14 using_callback() [1/2] . . . 841
13.80.3.15 using_callback() [2/2] . . . 841
13.80.3.16 api_data() [1/3] . . . 841
13.80.3.17 api_data() [2/3] . . . 841
13.80.3.18 api_data() [3/3] . . . 841
13.80.3.19 user_data() [1/3] . . . 841
13.80.3.20 user_data() [2/3] . . . 842
13.80.3.21 user_data() [3/3] . . . 842
13.80.3.22 user_callback() [1/2] . . . 842
13.80.3.23 user_callback() [2/2] . . . 842
13.80.4 Field Documentation . . . 842

13.80.4.1 m_queue . . . 842
13.80.4.2 m_message . . . 842
13.80.4.3 m_ignore_flags . . . 842
13.80.4.4 m_do_input . . . 843
13.80.4.5 m_first_message . . . 843
13.80.4.6 m_api_data . . . 843
13.80.4.7 m_using_callback . . . 843
13.80.4.8 m_user_callback . . . 843
13.80.4.9 m_user_data . . . 843
13.80.4.10 m_continue_sysex . . . 843
13.81 seq64::rtmidi_info Class Reference . . . 843
13.81.1 Detailed Description . . . 845
13.81.2 Constructor & Destructor Documentation . . . 846
13.81.2.1 rtmidi_info() . . . 846
13.81.2.2 ~rtmidi_info() . . . 846
13.81.3 Member Function Documentation . . . 846
13.81.3.1 get_version() . . . 846
13.81.3.2 get_compiled_api() . . . 846
13.81.3.3 midi_mode() [1/2] . . . 846
13.81.3.4 midi_mode() [2/2] . . . 847
13.81.3.5 clear() . . . 847
13.81.3.6 add_input() . . . 847
13.81.3.7 add_output() . . . 847
13.81.3.8 add_bus() . . . 847
13.81.3.9 get_bus_id() . . . 847
13.81.3.10 get_bus_name() . . . 848
13.81.3.11 get_port_count() . . . 848
13.81.3.12 full_port_count() . . . 848
13.81.3.13 get_port_id() . . . 848
13.81.3.14 get_port_name() . . . 848

13.81.3.15 get_input() . . . 849
13.81.3.16 get_virtual() . . . 849
13.81.3.17 get_system() . . . 849
13.81.3.18 get_all_port_info() . . . 849
13.81.3.19 queue_number() . . . 849
13.81.3.20 app_name() . . . 849
13.81.3.21 global_queue() . . . 849
13.81.3.22 ppqn() . . . 850
13.81.3.23 api_set_ppqn() . . . 850
13.81.3.24 bpm() . . . 850
13.81.3.25 api_set_beats_per_minute() . . . 850
13.81.3.26 api_port_start() . . . 850
13.81.3.27 api_get_midi_event() . . . 850
13.81.3.28 api_flush() . . . 850
13.81.3.29 api_poll_for_midi() . . . 851
13.81.3.30 port_list() . . . 851
13.81.3.31 selected_api() [1/2] . . . 851
13.81.3.32 get_api_info() [1/2] . . . 851
13.81.3.33 get_api_info() [2/2] . . . 851
13.81.3.34 api_connect() . . . 851
13.81.3.35 selected_api() [2/2] . . . 851
13.81.3.36 set_api_info() . . . 852
13.81.3.37 delete_api() . . . 852
13.81.3.38 openmidi_api() . . . 852
13.81.4 Friends And Related Function Documentation . . . 852
13.81.4.1 mastermidibus . . . 852
13.81.4.2 midibus . . . 853
13.81.4.3 rtmidi_in . . . 853
13.81.4.4 rtmidi_out . . . 853
13.81.5 Field Documentation . . . 853

13.81.5.1 m_info_api . . . 853
13.81.5.2 sm_selected_api . . . 853
13.82seq64::rtmidi_out Class Reference . . . 854
13.82.1 Detailed Description . . . 855
13.82.2 Constructor & Destructor Documentation . . . 855
13.82.2.1 rtmidi_out() . . . 855
13.82.2.2 ∼rtmidi_out() . . . 855
13.82.3 Member Function Documentation . . . 856
13.82.3.1 openmidi_api() . . . 856
13.83seq64::Seq24PerfInput Class Reference . . . 856
13.83.1 Constructor & Destructor Documentation . . . 857
13.83.1.1 Seq24PerfInput() . . . 857
13.83.2 Member Function Documentation . . . 857
13.83.2.1 on_button_press_event() . . . 858
13.83.2.2 on_button_release_event() . . . 858
13.83.2.3 on_motion_notify_event() . . . 858
13.83.2.4 activate_adding() . . . 859
13.83.2.5 handle_motion_key() . . . 859
13.83.3 Friends And Related Function Documentation . . . 859
13.83.3.1 perfroll . . . 859
13.83.4 Field Documentation . . . 860
13.83.4.1 m_effective_tick . . . 860
13.84seq64::Seq24SeqEventInput Struct Reference . . . 860
13.84.1 Constructor & Destructor Documentation . . . 860
13.84.1.1 Seq24SeqEventInput() . . . 860
13.84.2 Member Function Documentation . . . 860
13.84.2.1 set_adding() . . . 860
13.84.2.2 on_button_press_event() . . . 861
13.84.2.3 on_button_release_event() . . . 861
13.84.2.4 on_motion_notify_event() . . . 861

13.84.3 Field Documentation . . . 862
13.84.3.1 m_adding . . . 862
13.85 seq64::seqdata Class Reference . . . 862
13.85.1 Constructor & Destructor Documentation . . . 865
13.85.1.1 seqdata() . . . 865
13.85.1.2 ~seqdata() . . . 866
13.85.2 Member Function Documentation . . . 866
13.85.2.1 reset() . . . 866
13.85.2.2 redraw() . . . 866
13.85.2.3 set_zoom() . . . 866
13.85.2.4 set_data_type() . . . 867
13.85.2.5 idle_redraw() . . . 867
13.85.2.6 update_sizes() . . . 867
13.85.2.7 update_pixmap() . . . 867
13.85.2.8 draw_line_on_window() . . . 867
13.85.2.9 xy_to_rect() . . . 868
13.85.2.10 draw_events_on() . . . 869
13.85.2.11 change_horz() . . . 869
13.85.2.12 convert_x() . . . 870
13.85.2.13 render_number() . . . 870
13.85.2.14 draw_events_on_pixmap() . . . 870
13.85.2.15 draw_pixmap_on_window() . . . 870
13.85.2.16 on_realize() . . . 870
13.85.2.17 on_expose_event() . . . 870
13.85.2.18 on_button_press_event() . . . 871
13.85.2.19 on_button_release_event() . . . 871
13.85.2.20 on_motion_notify_event() . . . 872
13.85.2.21 on_leave_notify_event() . . . 872
13.85.2.22 on_scroll_event() . . . 872
13.85.2.23 on_size_allocate() . . . 873

13.85.3 Friends And Related Function Documentation . . . 873
13.85.3.1 lfownd . . . 873
13.85.3.2 seqevent . . . 873
13.85.3.3 seqroll . . . 873
13.85.4 Field Documentation . . . 873
13.85.4.1 m_seq . . . 873
13.85.4.2 m_zoom . . . 873
13.85.4.3 m_scroll_offset_ticks . . . 874
13.85.4.4 m_scroll_offset_x . . . 874
13.85.4.5 m_number_w . . . 874
13.85.4.6 m_number_h . . . 874
13.85.4.7 m_number_offset_y . . . 874
13.85.4.8 m_status . . . 874
13.85.4.9 m_cc . . . 874
13.85.4.10 m_numbers . . . 874
13.85.4.11 m_old . . . 875
13.85.4.12 m_drag_handle . . . 875
13.85.4.13 m_dragging . . . 875
13.86 seq64::seqedit Class Reference . . . 875
13.86.1 Detailed Description . . . 882
13.86.2 Constructor & Destructor Documentation . . . 883
13.86.2.1 seqedit() . . . 883
13.86.2.2 ~seqedit() . . . 883
13.86.3 Member Function Documentation . . . 883
13.86.3.1 set_zoom() . . . 883
13.86.3.2 set_snap() . . . 884
13.86.3.3 set_note_length() . . . 884
13.86.3.4 set_beats_per_bar() . . . 884
13.86.3.5 set_beat_width() . . . 885
13.86.3.6 set_transpose_image() . . . 885

13.86.3.7 set_rec_vol() . . . 885
13.86.3.8 horizontal_adjust() . . . 886
13.86.3.9 vertical_adjust() . . . 886
13.86.3.10 horizontal_set() . . . 886
13.86.3.11 vertical_set() . . . 886
13.86.3.12 set_measures() . . . 887
13.86.3.13 apply_length() . . . 887
13.86.3.14 get_measures() . . . 887
13.86.3.15 set_midi_channel() . . . 887
13.86.3.16 set_midi_bus() . . . 888
13.86.3.17 set_scale() . . . 888
13.86.3.18 set_chord() . . . 888
13.86.3.19 set_key() . . . 888
13.86.3.20 set_background_sequence() . . . 889
13.86.3.21 transpose_change_callback() . . . 889
13.86.3.22 name_change_callback() . . . 889
13.86.3.23 play_change_callback() . . . 889
13.86.3.24 record_change_callback() . . . 889
13.86.3.25 q_rec_change_callback() . . . 889
13.86.3.26 thru_change_callback() . . . 890
13.86.3.27 undo_callback() . . . 890
13.86.3.28 redo_callback() . . . 890
13.86.3.29 set_data_type() . . . 890
13.86.3.30 update_all_windows() . . . 890
13.86.3.31 fill_top_bar() . . . 891
13.86.3.32 create_menus() . . . 891
13.86.3.33 popup_menu() . . . 891
13.86.3.34 popup_event_menu() . . . 891
13.86.3.35 popup_midibus_menu() . . . 892
13.86.3.36 popup_sequence_menu() . . . 892

13.86.3.37 popup_tool_menu() . . . 892
13.86.3.38 popup_midich_menu() . . . 892
13.86.3.39 create_menu_image() . . . 892
13.86.3.40 timeout() . . . 892
13.86.3.41 do_action() . . . 893
13.86.3.42 mouse_action() . . . 893
13.86.3.43 start_playing() . . . 893
13.86.3.44 stop_playing() . . . 893
13.86.3.45 change_focus() . . . 893
13.86.3.46 handle_close() . . . 893
13.86.3.47 on_realize() . . . 894
13.86.3.48 on_set_focus() . . . 894
13.86.3.49 on_focus_in_event() . . . 894
13.86.3.50 on_focus_out_event() . . . 894
13.86.3.51 on_delete_event() . . . 894
13.86.3.52 on_scroll_event() . . . 895
13.86.3.53 on_key_press_event() . . . 895
13.86.4 Field Documentation . . . 896
13.86.4.1 seqmenu . . . 896
13.86.4.2 m_initial_snap . . . 896
13.86.4.3 m_initial_note_length . . . 896
13.86.4.4 m_initial_chord . . . 896
13.86.4.5 m_initial_zoom . . . 897
13.86.4.6 m_zoom . . . 897
13.86.4.7 m_snap . . . 897
13.86.4.8 m_note_length . . . 897
13.86.4.9 m_scale . . . 897
13.86.4.10 m_chord . . . 897
13.86.4.11 m_key . . . 897
13.86.4.12 m_bgsequence . . . 897

13.86.4.13 m_measures . . . 898
13.86.4.14 m_ppqn . . . 898
13.86.4.15 m_pp_whole . . . 898
13.86.4.16 m_pp_eighth . . . 898
13.86.4.17 m_pp_sixteenth . . . 898
13.86.4.18 m_seq . . . 898
13.86.4.19 m_menubar . . . 898
13.86.4.20 m_menu_tools . . . 899
13.86.4.21 m_menu_zoom . . . 899
13.86.4.22 m_menu_snap . . . 899
13.86.4.23 m_menu_note_length . . . 899
13.86.4.24 m_menu_length . . . 899
13.86.4.25 m_toggle_transpose . . . 899
13.86.4.26 m_image_transpose . . . 899
13.86.4.27 m_menu_midich . . . 899
13.86.4.28 m_menu_midibus . . . 900
13.86.4.29 m_menu_data . . . 900
13.86.4.30 m_menu_key . . . 900
13.86.4.31 m_menu_scale . . . 900
13.86.4.32 m_menu_chords . . . 900
13.86.4.33 m_menu_sequences . . . 900
13.86.4.34 m_menu_bpm . . . 900
13.86.4.35 m_menu_bw . . . 900
13.86.4.36 m_menu_rec_vol . . . 901
13.86.4.37 m_vadjust . . . 901
13.86.4.38 m_hadjust . . . 901
13.86.4.39 m_vscroll_new . . . 901
13.86.4.40 m_hscroll_new . . . 901
13.86.4.41 m_seqkeys_wid . . . 901
13.86.4.42 m_seqtime_wid . . . 901

13.86.4.43m_seqdata_wid . . . 901
13.86.4.44m_seqevent_wid . . . 902
13.86.4.45m_seqroll_wid . . . 902
13.86.4.46m_button_lfo . . . 902
13.86.4.47m_lfo_wnd . . . 902
13.86.4.48m_table . . . 902
13.86.4.49m_vbox . . . 902
13.86.4.50m_hbox . . . 902
13.86.4.51m_hbox2 . . . 902
13.86.4.52m_button_undo . . . 903
13.86.4.53m_button_redo . . . 903
13.86.4.54m_button_quantize . . . 903
13.86.4.55m_button_tools . . . 903
13.86.4.56m_button_sequence . . . 903
13.86.4.57m_entry_sequence . . . 903
13.86.4.58m_button_bus . . . 903
13.86.4.59m_entry_bus . . . 903
13.86.4.60m_button_channel . . . 904
13.86.4.61m_entry_channel . . . 904
13.86.4.62m_button_snap . . . 904
13.86.4.63m_entry_snap . . . 904
13.86.4.64m_button_note_length . . . 904
13.86.4.65m_entry_note_length . . . 904
13.86.4.66m_button_zoom . . . 904
13.86.4.67m_entry_zoom . . . 904
13.86.4.68m_button_length . . . 905
13.86.4.69m_entry_length . . . 905
13.86.4.70m_button_key . . . 905
13.86.4.71m_entry_key . . . 905
13.86.4.72m_button_scale . . . 905

13.86.4.73 m_entry_scale . . . 905
13.86.4.74 m_button_chord . . . 905
13.86.4.75 m_entry_chord . . . 905
13.86.4.76 m_tooltips . . . 906
13.86.4.77 m_button_data . . . 906
13.86.4.78 m_entry_data . . . 906
13.86.4.79 m_button_bpm . . . 906
13.86.4.80 m_entry_bpm . . . 906
13.86.4.81 m_button_bw . . . 906
13.86.4.82 m_entry_bw . . . 906
13.86.4.83 m_button_rec_vol . . . 906
13.86.4.84 m_toggle_play . . . 907
13.86.4.85 m_toggle_record . . . 907
13.86.4.86 m_toggle_q_rec . . . 907
13.86.4.87 m_toggle_thru . . . 907
13.86.4.88 m_entry_name . . . 907
13.86.4.89 m_editing_status . . . 907
13.86.4.90 m_editing_cc . . . 907
13.86.4.91 m_have_focus . . . 907
13.87 seq64::seqevent Class Reference . . . 908
13.87.1 Constructor & Destructor Documentation . . . 911
13.87.1.1 seqevent() . . . 911
13.87.1.2 ~seqevent() . . . 912
13.87.2 Member Function Documentation . . . 912
13.87.2.1 reset() . . . 912
13.87.2.2 redraw() . . . 912
13.87.2.3 set_zoom() . . . 912
13.87.2.4 set_snap() . . . 912
13.87.2.5 set_data_type() . . . 912
13.87.2.6 update_sizes() . . . 913

13.87.2.7 draw_background() . . . 913
13.87.2.8 draw_events_on_pixmap() . . . 913
13.87.2.9 draw_pixmap_on_window() . . . 913
13.87.2.10 draw_selection_on_window() . . . 913
13.87.2.11 update_pixmap() . . . 914
13.87.2.12 force_draw() . . . 914
13.87.2.13 idle_redraw() . . . 914
13.87.2.14 x_to_w() . . . 914
13.87.2.15 drop_event() . . . 914
13.87.2.16 draw_events_on() . . . 915
13.87.2.17 start_paste() . . . 915
13.87.2.18 change_horz() . . . 915
13.87.2.19 convert_x() . . . 915
13.87.2.20 convert_t() . . . 916
13.87.2.21 snap_y() . . . 916
13.87.2.22 snap_x() . . . 916
13.87.2.23 on_realize() . . . 917
13.87.2.24 on_expose_event() . . . 917
13.87.2.25 on_button_press_event() . . . 917
13.87.2.26 on_button_release_event() . . . 917
13.87.2.27 on_motion_notify_event() . . . 918
13.87.2.28 on_focus_in_event() . . . 918
13.87.2.29 on_focus_out_event() . . . 918
13.87.2.30 on_key_press_event() . . . 919
13.87.2.31 on_size_allocate() . . . 919
13.87.3 Friends And Related Function Documentation . . . 919
13.87.3.1 FruitySeqEventInput . . . 919
13.87.3.2 Seq24SeqEventInput . . . 919
13.87.4 Field Documentation . . . 920
13.87.4.1 m_fruity_interaction . . . 920

13.87.4.2 m_seq24_interaction . . . 920
13.87.4.3 m_seq . . . 920
13.87.4.4 m_zoom . . . 920
13.87.4.5 m_snap . . . 920
13.87.4.6 m_ppqn . . . 920
13.87.4.7 m_old . . . 920
13.87.4.8 m_selected . . . 921
13.87.4.9 m_scroll_offset_ticks . . . 921
13.87.4.10 m_scroll_offset_x . . . 921
13.87.4.11 m_seqdata_wid . . . 921
13.87.4.12 m_selecting . . . 921
13.87.4.13 m_moving_init . . . 921
13.87.4.14 m_moving . . . 921
13.87.4.15 m_growing . . . 921
13.87.4.16 m_painting . . . 922
13.87.4.17 m_paste . . . 922
13.87.4.18 m_move_snap_offset_x . . . 922
13.87.4.19 m_status . . . 922
13.87.4.20 m_cc . . . 922
13.88 seq64::seqkeys Class Reference . . . 922
13.88.1 Detailed Description . . . 925
13.88.2 Constructor & Destructor Documentation . . . 925
13.88.2.1 seqkeys() . . . 925
13.88.2.2 ~seqkeys() . . . 926
13.88.3 Member Function Documentation . . . 926
13.88.3.1 set_scale() . . . 926
13.88.3.2 set_key() . . . 926
13.88.3.3 set_hint_key() . . . 926
13.88.3.4 set_hint_state() . . . 927
13.88.3.5 force_draw() . . . 927

13.88.3.6 set_listen_button_press() . . . 927
13.88.3.7 set_listen_button_release() . . . 927
13.88.3.8 set_listen_motion_notify() . . . 928
13.88.3.9 draw_area() . . . 928
13.88.3.10 update_pixmap() . . . 928
13.88.3.11 convert_y() . . . 928
13.88.3.12 draw_key() . . . 928
13.88.3.13 change_vert() . . . 929
13.88.3.14 update_sizes() . . . 929
13.88.3.15 reset() . . . 929
13.88.3.16 is_black_key() . . . 929
13.88.3.17 on_realize() . . . 930
13.88.3.18 on_expose_event() . . . 930
13.88.3.19 on_button_press_event() . . . 930
13.88.3.20 on_button_release_event() . . . 930
13.88.3.21 on_motion_notify_event() . . . 931
13.88.3.22 on_enter_notify_event() . . . 931
13.88.3.23 on_leave_notify_event() . . . 931
13.88.3.24 on_scroll_event() . . . 931
13.88.3.25 on_size_allocate() . . . 932
13.88.4 Friends And Related Function Documentation . . . 932
13.88.4.1 seqroll . . . 932
13.88.4.2 FruitySeqRollInput . . . 932
13.88.5 Field Documentation . . . 932
13.88.5.1 m_seq . . . 932
13.88.5.2 m_scroll_offset_key . . . 933
13.88.5.3 m_scroll_offset_y . . . 933
13.88.5.4 m_hint_state . . . 933
13.88.5.5 m_hint_key . . . 933
13.88.5.6 m_keying . . . 933

13.88.5.7 m_keying_note . . . 933
13.88.5.8 m_scale . . . 933
13.88.5.9 m_key . . . 933
13.88.5.10 m_show_octave_letters . . . 934
13.89 seq64::seqmenu Class Reference . . . 934
13.89.1 Detailed Description . . . 938
13.89.2 Member Typedef Documentation . . . 938
13.89.2.1 SeqeditMap . . . 938
13.89.2.2 SeqeditPair . . . 938
13.89.2.3 iterator . . . 938
13.89.2.4 const_iterator . . . 938
13.89.3 Constructor & Destructor Documentation . . . 938
13.89.3.1 seqmenu() . . . 938
13.89.3.2 ~seqmenu() . . . 939
13.89.4 Member Function Documentation . . . 939
13.89.4.1 current_seq() [1/2] . . . 939
13.89.4.2 is_modified() [1/2] . . . 939
13.89.4.3 current_seq() [2/2] . . . 939
13.89.4.4 set_edit_sequence() . . . 939
13.89.4.5 unset_edit_sequence() . . . 940
13.89.4.6 is_edit_sequence() . . . 940
13.89.4.7 is_modified() [2/2] . . . 940
13.89.4.8 get_current_sequence() . . . 940
13.89.4.9 get_sequence() . . . 940
13.89.4.10 is_current_seq_active() . . . 940
13.89.4.11 is_current_seq_in_edit() . . . 940
13.89.4.12 new_current_sequence() . . . 941
13.89.4.13 new_sequence() . . . 941
13.89.4.14 delete_current_sequence() . . . 941
13.89.4.15 toggle_current_sequence() . . . 941

13.89.4.16 popup_menu() . . . 941
13.89.4.17 seq_edit() . . . 941
13.89.4.18 seq_event_edit() . . . 942
13.89.4.19 create_seqedit() . . . 942
13.89.4.20 remove_seqedit() . . . 942
13.89.4.21 seq_set_and_edit() . . . 942
13.89.4.22 seq_set_and_eventedit() . . . 943
13.89.4.23 redraw() . . . 943
13.89.4.24 seq_new() . . . 943
13.89.4.25 seq_copy() . . . 943
13.89.4.26 seq_cut() . . . 944
13.89.4.27 seq_paste() . . . 944
13.89.4.28 seq_clear_perf() . . . 944
13.89.4.29 set_bus_and_midi_channel() . . . 944
13.89.4.30 set_transposable() . . . 944
13.89.4.31 mute_all_tracks() . . . 945
13.89.4.32 unmute_all_tracks() . . . 945
13.89.4.33 toggle_all_tracks() . . . 945
13.89.4.34 on_realize() . . . 945
13.89.5 Friends And Related Function Documentation . . . 945
13.89.5.1 mainwnd . . . 945
13.89.5.2 seqedit . . . 945
13.89.6 Field Documentation . . . 946
13.89.6.1 sm_seqedit_list . . . 946
13.89.6.2 m_menu . . . 946
13.89.6.3 m_mainperf . . . 946
13.89.6.4 m_clipboard . . . 946
13.89.6.5 m_seqedit . . . 946
13.89.6.6 m_eventedit . . . 946
13.89.6.7 m_current_seq . . . 947

13.89.6.8 m_modified . . . 947
13.90 seq64::seqroll Class Reference . . . 947
13.90.1 Constructor & Destructor Documentation . . . 953
13.90.1.1 seqroll() . . . 953
13.90.1.2 ~seqroll() . . . 954
13.90.2 Member Function Documentation . . . 954
13.90.2.1 set_snap() . . . 954
13.90.2.2 set_zoom() . . . 954
13.90.2.3 set_note_length() . . . 955
13.90.2.4 note_off_length() . . . 955
13.90.2.5 add_note() . . . 955
13.90.2.6 add_chord() . . . 955
13.90.2.7 set_key() . . . 956
13.90.2.8 set_scale() . . . 956
13.90.2.9 set_chord() . . . 956
13.90.2.10 set_data_type() . . . 956
13.90.2.11 set_background_sequence() . . . 957
13.90.2.12 update_pixmap() . . . 957
13.90.2.13 update_sizes() . . . 957
13.90.2.14 update_background() . . . 957
13.90.2.15 draw_background_on_pixmap() . . . 957
13.90.2.16 draw_events_on_pixmap() . . . 958
13.90.2.17 draw_selection_on_window() . . . 958
13.90.2.18 draw_progress_on_window() . . . 958
13.90.2.19 reset() . . . 958
13.90.2.20 update_and_draw() . . . 958
13.90.2.21 redraw() . . . 959
13.90.2.22 redraw_events() . . . 959
13.90.2.23 start_paste() . . . 959
13.90.2.24 complete_paste() [1/2] . . . 959

13.90.2.25 complete_paste() [2/2] . . . 959
13.90.2.26 follow_progress() . . . 959
13.90.2.27 force_draw() . . . 959
13.90.2.28 horizontal_adjust() . . . 959
13.90.2.29 vertical_adjust() . . . 960
13.90.2.30 snap_y() . . . 960
13.90.2.31 snap_x() . . . 960
13.90.2.32 convert_xy() . . . 961
13.90.2.33 convert_tn() . . . 961
13.90.2.34 xy_to_rect() . . . 961
13.90.2.35 convert_tn_box_to_rect() . . . 962
13.90.2.36 convert_sel_box_to_rect() . . . 962
13.90.2.37 get_selected_box() . . . 963
13.90.2.38 draw_events_on() . . . 963
13.90.2.39 idle_redraw() . . . 963
13.90.2.40 idle_progress() . . . 964
13.90.2.41 change_horz() . . . 964
13.90.2.42 change_vert() . . . 964
13.90.2.43 move_selection_box() . . . 964
13.90.2.44 move_selected_notes() . . . 964
13.90.2.45 grow_selected_notes() . . . 965
13.90.2.46 set_adding() . . . 965
13.90.2.47 update_mouse_pointer() . . . 965
13.90.2.48 button_press_initial() . . . 966
13.90.2.49 align_selection() . . . 966
13.90.2.50 button_press() . . . 966
13.90.2.51 button_release() . . . 966
13.90.2.52 motion_notify() . . . 967
13.90.2.53 clear_selected() . . . 967
13.90.2.54 clear_old() . . . 967

13.90.2.55 clear_flags() . . . 967
13.90.2.56 scroll_offset_x() . . . 968
13.90.2.57 scroll_offset_y() . . . 969
13.90.2.58 set_current_offset_x_y() . . . 969
13.90.2.59 adding() . . . 970
13.90.2.60 selecting() . . . 970
13.90.2.61 growing() . . . 970
13.90.2.62 normal_action() . . . 970
13.90.2.63 select_action() . . . 970
13.90.2.64 drop_action() . . . 970
13.90.2.65 moving() . . . 971
13.90.2.66 on_realize() . . . 971
13.90.2.67 on_expose_event() . . . 971
13.90.2.68 on_button_press_event() . . . 971
13.90.2.69 on_button_release_event() . . . 971
13.90.2.70 on_motion_notify_event() . . . 972
13.90.2.71 on_focus_in_event() . . . 972
13.90.2.72 on_focus_out_event() . . . 973
13.90.2.73 on_key_press_event() . . . 973
13.90.2.74 on_scroll_event() . . . 973
13.90.2.75 on_size_allocate() . . . 974
13.90.2.76 on_leave_notify_event() . . . 974
13.90.2.77 on_enter_notify_event() . . . 974
13.90.3 Friends And Related Function Documentation . . . 975
13.90.3.1 FruitySeqRollInput . . . 975
13.90.4 Field Documentation . . . 975
13.90.4.1 m_horizontal_adjust . . . 975
13.90.4.2 m_vertical_adjust . . . 975
13.90.4.3 m_old . . . 975
13.90.4.4 m_selected . . . 975

13.90.4.5 m_seq . . . 976
13.90.4.6 m_seqkeys_wid . . . 976
13.90.4.7 m_fruity_interaction . . . 976
13.90.4.8 m_pos . . . 976
13.90.4.9 m_zoom . . . 976
13.90.4.10 m_snap . . . 976
13.90.4.11 m_ppqn . . . 976
13.90.4.12 m_note_length . . . 976
13.90.4.13 m_scale . . . 977
13.90.4.14 m_chord . . . 977
13.90.4.15 m_key . . . 977
13.90.4.16 m_adding . . . 977
13.90.4.17 m_selecting . . . 977
13.90.4.18 m_moving . . . 977
13.90.4.19 m_moving_init . . . 977
13.90.4.20 m_growing . . . 977
13.90.4.21 m_painting . . . 978
13.90.4.22 m_paste . . . 978
13.90.4.23 m_is_drag_pasting . . . 978
13.90.4.24 m_is_drag_pasting_start . . . 978
13.90.4.25 m_justselected_one . . . 978
13.90.4.26 m_move_delta_x . . . 978
13.90.4.27 m_move_delta_y . . . 978
13.90.4.28 m_move_snap_offset_x . . . 978
13.90.4.29 m_progress_x . . . 979
13.90.4.30 m_scroll_offset_ticks . . . 979
13.90.4.31 m_scroll_offset_key . . . 979
13.90.4.32 m_scroll_offset_x . . . 979
13.90.4.33 m_scroll_offset_y . . . 979
13.90.4.34 m_transport_follow . . . 979

13.90.4.35 m_trans_button_press . . . 979
13.90.4.36 m_background_sequence . . . 979
13.90.4.37 m_drawing_background_seq . . . 980
13.90.4.38 m_status . . . 980
13.90.4.39 m_cc . . . 980
13.91 seq64::seqtime Class Reference . . . 980
13.91.1 Constructor & Destructor Documentation . . . 982
13.91.1.1 seqtime() . . . 983
13.91.1.2 ~seqtime() . . . 983
13.91.2 Member Function Documentation . . . 983
13.91.2.1 reset() . . . 983
13.91.2.2 redraw() . . . 983
13.91.2.3 set_zoom() . . . 983
13.91.2.4 draw_pixmap_on_window() . . . 983
13.91.2.5 draw_progress_on_window() . . . 984
13.91.2.6 update_pixmap() . . . 984
13.91.2.7 change_horz() . . . 984
13.91.2.8 update_sizes() . . . 985
13.91.2.9 idle_progress() . . . 985
13.91.2.10 on_realize() . . . 985
13.91.2.11 on_expose_event() . . . 985
13.91.2.12 on_size_allocate() . . . 985
13.91.2.13 on_button_press_event() . . . 985
13.91.2.14 on_button_release_event() . . . 985
13.91.3 Field Documentation . . . 986
13.91.3.1 m_seq . . . 986
13.91.3.2 m_scroll_offset_ticks . . . 986
13.91.3.3 m_scroll_offset_x . . . 986
13.91.3.4 m_zoom . . . 986
13.91.3.5 m_ppqn . . . 986

13.92 seq64::sequence Class Reference . . . 986
13.92.1 Detailed Description . . . 997
13.92.2 Member Typedef Documentation . . . 997
13.92.2.1 EventStack . . . 997
13.92.3 Member Enumeration Documentation . . . 997
13.92.3.1 select_action_e . . . 997
13.92.4 Constructor & Destructor Documentation . . . 998
13.92.4.1 sequence() . . . 998
13.92.4.2 ~sequence() . . . 998
13.92.5 Member Function Documentation . . . 998
13.92.5.1 operator=() . . . 998
13.92.5.2 partial_assign() . . . 998
13.92.5.3 events() [1/2] . . . 999
13.92.5.4 events() [2/2] . . . 999
13.92.5.5 any_selected_notes() . . . 999
13.92.5.6 triggerlist() [1/2] . . . 999
13.92.5.7 triggerlist() [2/2] . . . 999
13.92.5.8 get_trigger_count() . . . 999
13.92.5.9 set_trigger_paste_tick() . . . 999
13.92.5.10 get_trigger_paste_tick() . . . 1000
13.92.5.11 number() [1/2] . . . 1000
13.92.5.12 number() [2/2] . . . 1000
13.92.5.13 modify() . . . 1000
13.92.5.14 event_count() . . . 1000
13.92.5.15 set_hold_undo() . . . 1000
13.92.5.16 get_hold_undo() . . . 1001
13.92.5.17 set_have_undo() . . . 1001
13.92.5.18 have_undo() . . . 1001
13.92.5.19 set_have_redo() . . . 1001
13.92.5.20 have_redo() . . . 1001

13.92.5.21 push_undo() . . . 1001
13.92.5.22 pop_undo() . . . 1002
13.92.5.23 pop_redo() . . . 1002
13.92.5.24 push_trigger_undo() . . . 1002
13.92.5.25 pop_trigger_undo() . . . 1002
13.92.5.26 pop_trigger_redo() . . . 1002
13.92.5.27 set_name() [1/2] . . . 1002
13.92.5.28 set_name() [2/2] . . . 1003
13.92.5.29 set_measures() . . . 1003
13.92.5.30 get_measures() . . . 1003
13.92.5.31 get_ppqn() . . . 1003
13.92.5.32 set_beats_per_bar() . . . 1003
13.92.5.33 get_beats_per_bar() . . . 1003
13.92.5.34 set_beat_width() . . . 1004
13.92.5.35 get_beat_width() . . . 1004
13.92.5.36 measures_to_ticks() . . . 1004
13.92.5.37 clocks_per_metronome() [1/2] . . . 1004
13.92.5.38 clocks_per_metronome() [2/2] . . . 1004
13.92.5.39 set_32nds_per_quarter() . . . 1004
13.92.5.40 get_32nds_per_quarter() . . . 1005
13.92.5.41 us_per_quarter_note() [1/2] . . . 1005
13.92.5.42 us_per_quarter_note() [2/2] . . . 1005
13.92.5.43 set_rec_vol() . . . 1005
13.92.5.44 set_song_mute() . . . 1005
13.92.5.45 toggle_song_mute() . . . 1005
13.92.5.46 get_song_mute() . . . 1006
13.92.5.47 apply_song_transpose() . . . 1006
13.92.5.48 set_transposable() . . . 1006
13.92.5.49 get_transposable() . . . 1006
13.92.5.50 get_name() . . . 1006

13.92.5.51 name() . . . 1006
13.92.5.52 set_editing() . . . 1006
13.92.5.53 get_editing() . . . 1007
13.92.5.54 set_raise() . . . 1007
13.92.5.55 get_raise() . . . 1007
13.92.5.56 set_length() . . . 1007
13.92.5.57 get_length() . . . 1008
13.92.5.58 get_last_tick() . . . 1008
13.92.5.59 set_last_tick() . . . 1008
13.92.5.60 mod_last_tick() . . . 1008
13.92.5.61 set_playing() . . . 1008
13.92.5.62 get_playing() . . . 1009
13.92.5.63 toggle_playing() . . . 1009
13.92.5.64 toggle_queued() . . . 1009
13.92.5.65 off_queued() . . . 1009
13.92.5.66 on_queued() . . . 1009
13.92.5.67 get_queued() . . . 1009
13.92.5.68 get_queued_tick() . . . 1010
13.92.5.69 check_queued_tick() . . . 1010
13.92.5.70 set_recording() . . . 1010
13.92.5.71 get_recording() . . . 1010
13.92.5.72 set_snap_tick() . . . 1010
13.92.5.73 set_quantized_rec() . . . 1010
13.92.5.74 get_quantized_rec() . . . 1010
13.92.5.75 set_thru() . . . 1011
13.92.5.76 get_thru() . . . 1011
13.92.5.77 is_dirty_main() . . . 1011
13.92.5.78 is_dirty_edit() . . . 1011
13.92.5.79 is_dirty_perf() . . . 1011
13.92.5.80 is_dirty_names() . . . 1012

13.92.5.81 set_dirty_mp() . . . 1012
13.92.5.82 set_dirty() . . . 1012
13.92.5.83 get_midi_channel() . . . 1012
13.92.5.84 is_smf_0() . . . 1012
13.92.5.85 set_midi_channel() . . . 1012
13.92.5.86 print() . . . 1013
13.92.5.87 print_triggers() . . . 1013
13.92.5.88 play() . . . 1013
13.92.5.89 play_queue() . . . 1014
13.92.5.90 add_note() . . . 1014
13.92.5.91 add_event() [1/2] . . . 1015
13.92.5.92 add_chord() . . . 1016
13.92.5.93 add_event() [2/2] . . . 1016
13.92.5.94 append_event() . . . 1017
13.92.5.95 sort_events() . . . 1017
13.92.5.96 add_trigger() . . . 1017
13.92.5.97 split_trigger() . . . 1017
13.92.5.98 grow_trigger() . . . 1018
13.92.5.99 del_trigger() . . . 1018
13.92.5.100 get_trigger_state() . . . 1018
13.92.5.101 select_trigger() . . . 1019
13.92.5.102 get_triggers() . . . 1019
13.92.5.103 unselect_triggers() . . . 1019
13.92.5.104 intersect_triggers() . . . 1020
13.92.5.105 intersect_notes() . . . 1020
13.92.5.106 intersect_events() . . . 1021
13.92.5.107 del_selected_trigger() . . . 1021
13.92.5.108 cut_selected_trigger() . . . 1021
13.92.5.109 copy_selected_trigger() . . . 1021
13.92.5.110 paste_trigger() . . . 1021

13.92.5.111 move_selected_triggers_to() . . . 1022
13.92.5.112 selected_trigger_start() . . . 1022
13.92.5.113 selected_trigger_end() . . . 1023
13.92.5.114 get_max_trigger() . . . 1023
13.92.5.115 move_triggers() . . . 1023
13.92.5.116 copy_triggers() . . . 1023
13.92.5.117 clear_triggers() . . . 1024
13.92.5.118 get_trigger_offset() . . . 1024
13.92.5.119 set_midi_bus() . . . 1024
13.92.5.120 get_midi_bus() . . . 1024
13.92.5.121 set_master_midi_bus() . . . 1024
13.92.5.122 select_note_events() . . . 1025
13.92.5.123 select_events() [1/3] . . . 1025
13.92.5.124 select_events() [2/3] . . . 1026
13.92.5.125 select_events() [3/3] . . . 1027
13.92.5.126 select_event_handle() . . . 1027
13.92.5.127 select_linked() . . . 1027
13.92.5.128 select_even_or_odd_notes() . . . 1028
13.92.5.129 select_all_notes() . . . 1028
13.92.5.130 get_num_selected_notes() . . . 1028
13.92.5.131 get_num_selected_events() . . . 1029
13.92.5.132 select_all() . . . 1029
13.92.5.133 copy_selected() . . . 1029
13.92.5.134 cut_selected() . . . 1029
13.92.5.135 paste_selected() . . . 1030
13.92.5.136 get_selected_box() . . . 1031
13.92.5.137 get_clipboard_box() . . . 1031
13.92.5.138 adjust_timestamp() . . . 1031
13.92.5.139 trim_timestamp() . . . 1032
13.92.5.140 clip_timestamp() . . . 1032

13.92.5.141 move_selected_notes() . . . 1033
13.92.5.142 stream_event() . . . 1034
13.92.5.143 change_event_data_range() . . . 1034
13.92.5.144 change_event_data_lfo() . . . 1035
13.92.5.145 increment_selected() . . . 1036
13.92.5.146 decrement_selected() . . . 1036
13.92.5.147 grow_selected() . . . 1037
13.92.5.148 stretch_selected() . . . 1037
13.92.5.149 remove_marked() . . . 1038
13.92.5.150 mark_selected() . . . 1038
13.92.5.151 remove_selected() . . . 1038
13.92.5.152 unpaint_all() . . . 1038
13.92.5.153 unselect() . . . 1038
13.92.5.154 verify_and_link() . . . 1039
13.92.5.155 link_new() . . . 1039
13.92.5.156 zero_markers() . . . 1039
13.92.5.157 play_note_on() . . . 1039
13.92.5.158 play_note_off() . . . 1039
13.92.5.159 off_playing_notes() . . . 1040
13.92.5.160 stop() . . . 1040
13.92.5.161 pause() . . . 1040
13.92.5.162 reset_draw_marker() . . . 1040
13.92.5.163 reset_draw_trigger_marker() . . . 1040
13.92.5.164 get_next_note_event() . . . 1041
13.92.5.165 get_minmax_note_events() . . . 1042
13.92.5.166 get_next_event() [1/2] . . . 1042
13.92.5.167 get_next_event() [2/2] . . . 1043
13.92.5.168 get_next_trigger() . . . 1043
13.92.5.169 quantize_events() . . . 1043
13.92.5.170 push_quantize() . . . 1044

13.92.5.171 transpose_notes() . . . 1044
13.92.5.172 shift_notes() . . . 1045
13.92.5.173 multiply_pattern() . . . 1045
13.92.5.174 musical_key() [1/2] . . . 1045
13.92.5.175 musical_key() [2/2] . . . 1045
13.92.5.176 musical_scale() [1/2] . . . 1045
13.92.5.177 musical_scale() [2/2] . . . 1045
13.92.5.178 background_sequence() [1/2] . . . 1046
13.92.5.179 background_sequence() [2/2] . . . 1046
13.92.5.180 show_events() . . . 1046
13.92.5.181 copy_events() . . . 1046
13.92.5.182 note_off_margin() . . . 1046
13.92.5.183 event_in_range() . . . 1047
13.92.5.184 set_parent() . . . 1047
13.92.5.185 put_event_on_bus() . . . 1047
13.92.5.186 set_trigger_offset() . . . 1048
13.92.5.187 adjust_trigger_offsets_to_length() . . . 1048
13.92.5.188 adjust_offset() . . . 1048
13.92.5.189 remove() [1/2] . . . 1048
13.92.5.190 remove() [2/2] . . . 1049
13.92.5.191 remove_all() . . . 1049
13.92.5.192 channel_match() . . . 1049
13.92.6 Friends And Related Function Documentation . . . 1049
13.92.6.1 perform . . . 1050
13.92.6.2 triggers . . . 1050
13.92.7 Field Documentation . . . 1050
13.92.7.1 m_events_clipboard . . . 1050
13.92.7.2 m_parent . . . 1050
13.92.7.3 m_events . . . 1050
13.92.7.4 m_triggers . . . 1050

13.92.7.5 m_events_undo_hold . . . 1050
13.92.7.6 m_have_undo . . . 1051
13.92.7.7 m_have_redo . . . 1051
13.92.7.8 m_events_undo . . . 1051
13.92.7.9 m_events_redo . . . 1051
13.92.7.10 m_iterator_draw . . . 1051
13.92.7.11 m_channel_match . . . 1051
13.92.7.12 m_midi_channel . . . 1051
13.92.7.13 m_bus . . . 1052
13.92.7.14 m_song_mute . . . 1052
13.92.7.15 m_transposable . . . 1052
13.92.7.16 m_notes_on . . . 1052
13.92.7.17 m_masterbus . . . 1052
13.92.7.18 m_playing_notes . . . 1052
13.92.7.19 m_was_playing . . . 1052
13.92.7.20 m_playing . . . 1052
13.92.7.21 m_recording . . . 1053
13.92.7.22 m_quantized_rec . . . 1053
13.92.7.23 m_thru . . . 1053
13.92.7.24 m_queued . . . 1053
13.92.7.25 m_dirty_main . . . 1053
13.92.7.26 m_dirty_edit . . . 1053
13.92.7.27 m_dirty_perf . . . 1053
13.92.7.28 m_dirty_names . . . 1053
13.92.7.29 m_editing . . . 1054
13.92.7.30 m_raise . . . 1054
13.92.7.31 m_name . . . 1054
13.92.7.32 m_last_tick . . . 1054
13.92.7.33 m_queued_tick . . . 1054
13.92.7.34 m_trigger_offset . . . 1054

13.92.7.35 m_maxbeats . . . 1054
13.92.7.36 m_ppqn . . . 1054
13.92.7.37 m_seq_number . . . 1055
13.92.7.38 m_length . . . 1055
13.92.7.39 m_snap_tick . . . 1055
13.92.7.40 m_time_beats_per_measure . . . 1055
13.92.7.41 m_time_beat_width . . . 1055
13.92.7.42 m_clocks_per_metronome . . . 1055
13.92.7.43 m_32nds_per_quarter . . . 1055
13.92.7.44 m_us_per_quarter_note . . . 1056
13.92.7.45 m_rec_vol . . . 1056
13.92.7.46 m_note_on_velocity . . . 1056
13.92.7.47 m_note_off_velocity . . . 1056
13.92.7.48 m_musical_key . . . 1056
13.92.7.49 m_musical_scale . . . 1056
13.92.7.50 m_background_sequence . . . 1056
13.92.7.51 m_mutex . . . 1057
13.92.7.52 m_note_off_margin . . . 1057
13.93 seq64::trigger Class Reference . . . 1057
13.93.1 Detailed Description . . . 1058
13.93.2 Constructor & Destructor Documentation . . . 1058
13.93.2.1 trigger() . . . 1058
13.93.3 Member Function Documentation . . . 1058
13.93.3.1 operator<() . . . 1058
13.93.3.2 length() . . . 1058
13.93.3.3 tick_start() [1/2] . . . 1059
13.93.3.4 tick_start() [2/2] . . . 1059
13.93.3.5 increment_tick_start() . . . 1059
13.93.3.6 decrement_tick_start() . . . 1059
13.93.3.7 tick_end() [1/2] . . . 1059

13.93.3.8 tick_end() [2/2] . . . 1059
13.93.3.9 increment_tick_end() . . . 1060
13.93.3.10 decrement_tick_end() . . . 1060
13.93.3.11 offset() [1/2] . . . 1060
13.93.3.12 offset() [2/2] . . . 1060
13.93.3.13 increment_offset() . . . 1060
13.93.3.14 decrement_offset() . . . 1060
13.93.3.15 selected() [1/2] . . . 1060
13.93.3.16 selected() [2/2] . . . 1061
13.93.4 Field Documentation . . . 1061
13.93.4.1 m_tick_start . . . 1061
13.93.4.2 m_tick_end . . . 1061
13.93.4.3 m_offset . . . 1061
13.93.4.4 m_selected . . . 1061
13.94 seq64::triggers Class Reference . . . 1061
13.94.1 Member Typedef Documentation . . . 1064
13.94.1.1 List . . . 1064
13.94.1.2 Stack . . . 1064
13.94.2 Member Enumeration Documentation . . . 1064
13.94.2.1 grow_edit_t . . . 1064
13.94.3 Constructor & Destructor Documentation . . . 1065
13.94.3.1 triggers() . . . 1065
13.94.3.2 ~triggers() . . . 1065
13.94.4 Member Function Documentation . . . 1065
13.94.4.1 operator=() . . . 1065
13.94.4.2 set_ppqn() . . . 1066
13.94.4.3 set_length() . . . 1066
13.94.4.4 triggerlist() [1/2] . . . 1066
13.94.4.5 triggerlist() [2/2] . . . 1066
13.94.4.6 push_undo() . . . 1066

13.94.4.7 pop_undo() . . . 1066
13.94.4.8 pop_redo() . . . 1066
13.94.4.9 print() . . . 1066
13.94.4.10 play() . . . 1067
13.94.4.11 add() . . . 1067
13.94.4.12 adjust_offsets_to_length() . . . 1068
13.94.4.13 split() [1/2] . . . 1068
13.94.4.14 grow() . . . 1068
13.94.4.15 remove() . . . 1069
13.94.4.16 get_state() . . . 1069
13.94.4.17 select() . . . 1069
13.94.4.18 unselect() . . . 1070
13.94.4.19 intersect() . . . 1070
13.94.4.20 remove_selected() . . . 1070
13.94.4.21 copy_selected() . . . 1070
13.94.4.22 paste() . . . 1071
13.94.4.23 move_selected() . . . 1071
13.94.4.24 get_selected_start() . . . 1071
13.94.4.25 get_selected_end() . . . 1072
13.94.4.26 get_maximum() . . . 1072
13.94.4.27 move() . . . 1072
13.94.4.28 copy() . . . 1072
13.94.4.29 clear() . . . 1074
13.94.4.30 next() . . . 1074
13.94.4.31 next_trigger() . . . 1074
13.94.4.32 reset_draw_trigger_marker() . . . 1074
13.94.4.33 set_trigger_paste_tick() . . . 1075
13.94.4.34 get_trigger_paste_tick() . . . 1075
13.94.4.35 adjust_offset() . . . 1075
13.94.4.36 split() [2/2] . . . 1075

13.94.5 Friends And Related Function Documentation . . . 1075
13.94.5.1 midi_container . . . 1076
13.94.5.2 midifile . . . 1076
13.94.5.3 sequence . . . 1076
13.94.5.4 Seq24PerfInput . . . 1076
13.94.5.5 FruityPerfInput . . . 1076
13.94.6 Field Documentation . . . 1076
13.94.6.1 m_parent . . . 1076
13.94.6.2 m_triggers . . . 1076
13.94.6.3 m_clipboard . . . 1077
13.94.6.4 m_undo_stack . . . 1077
13.94.6.5 m_redo_stack . . . 1077
13.94.6.6 m_iterator_play_trigger . . . 1077
13.94.6.7 m_iterator_draw_trigger . . . 1077
13.94.6.8 m_trigger_copied . . . 1077
13.94.6.9 m_paste_tick . . . 1077
13.94.6.10 m_ppqn . . . 1077
13.94.6.11 m_length . . . 1078
13.95 seq64::user_instrument Class Reference . . . 1078
13.95.1 Detailed Description . . . 1079
13.95.2 Constructor & Destructor Documentation . . . 1079
13.95.2.1 user_instrument() [1/2] . . . 1079
13.95.2.2 user_instrument() [2/2] . . . 1079
13.95.3 Member Function Documentation . . . 1079
13.95.3.1 operator=() . . . 1080
13.95.3.2 is_valid() . . . 1080
13.95.3.3 set_defaults() . . . 1080
13.95.3.4 name() . . . 1080
13.95.3.5 controller_count() . . . 1080
13.95.3.6 controller_max() . . . 1080

13.95.3.7 controller_name() . . . 1080
13.95.3.8 controller_active() . . . 1081
13.95.3.9 set_controller() . . . 1081
13.95.3.10 set_name() . . . 1081
13.95.3.11 copy_definitions() . . . 1082
13.95.4 Field Documentation . . . 1082
13.95.4.1 m_is_valid . . . 1082
13.95.4.2 m_controller_count . . . 1082
13.95.4.3 m_instrument_def . . . 1082
13.96 seq64::user_instrument_t Struct Reference . . . 1082
13.96.1 Field Documentation . . . 1083
13.96.1.1 instrument . . . 1083
13.96.1.2 controllers . . . 1083
13.96.1.3 controllers_active . . . 1083
13.97 seq64::user_midi_bus Class Reference . . . 1083
13.97.1 Detailed Description . . . 1084
13.97.2 Constructor & Destructor Documentation . . . 1084
13.97.2.1 user_midi_bus() [1/2] . . . 1084
13.97.2.2 user_midi_bus() [2/2] . . . 1085
13.97.3 Member Function Documentation . . . 1085
13.97.3.1 operator=() . . . 1085
13.97.3.2 is_valid() . . . 1085
13.97.3.3 set_defaults() . . . 1085
13.97.3.4 name() . . . 1086
13.97.3.5 channel_count() . . . 1086
13.97.3.6 channel_max() . . . 1086
13.97.3.7 instrument() . . . 1086
13.97.3.8 set_instrument() . . . 1086
13.97.3.9 set_name() . . . 1087
13.97.3.10 copy_definitions() . . . 1087

13.97.4 Field Documentation . . . 1087
13.97.4.1 m_is_valid . . . 1087
13.97.4.2 m_channel_count . . . 1087
13.97.4.3 m_midi_bus_def . . . 1087
13.98 seq64::user_midi_bus_t Struct Reference . . . 1088
13.98.1 Field Documentation . . . 1088
13.98.1.1 alias . . . 1088
13.98.1.2 instrument . . . 1088
13.99 seq64::user_settings Class Reference . . . 1088
13.99.1 Detailed Description . . . 1096
13.99.2 Member Typedef Documentation . . . 1096
13.99.2.1 Busses . . . 1097
13.99.2.2 BussIterator . . . 1097
13.99.2.3 BussConstIterator . . . 1097
13.99.2.4 Instruments . . . 1097
13.99.2.5 InstrumentIterator . . . 1097
13.99.2.6 InstrumentConstIterator . . . 1097
13.99.3 Member Enumeration Documentation . . . 1097
13.99.3.1 mainwid_grid_style_t . . . 1097
13.99.4 Constructor & Destructor Documentation . . . 1098
13.99.4.1 user_settings() [1/2] . . . 1098
13.99.4.2 user_settings() [2/2] . . . 1098
13.99.5 Member Function Documentation . . . 1098
13.99.5.1 operator=() . . . 1098
13.99.5.2 set_defaults() . . . 1098
13.99.5.3 normalize() . . . 1098
13.99.5.4 add_bus() . . . 1099
13.99.5.5 add_instrument() . . . 1099
13.99.5.6 bus() . . . 1099
13.99.5.7 instrument() . . . 1099

13.99.5.8 bus_count() . . . 1099
13.99.5.9 set_bus_instrument() . . . 1099
13.99.5.10 bus_instrument() . . . 1099
13.99.5.11 bus_name() . . . 1100
13.99.5.12 instrument_count() . . . 1100
13.99.5.13 set_instrument_controllers() . . . 1100
13.99.5.14 instrument_name() [1/2] . . . 1100
13.99.5.15 instrument_name() [2/2] . . . 1100
13.99.5.16 instrument_controller_active() . . . 1100
13.99.5.17 controller_active() . . . 1101
13.99.5.18 instrument_controller_name() . . . 1101
13.99.5.19 controller_name() . . . 1101
13.99.5.20 grid_style() [1/2] . . . 1101
13.99.5.21 grid_is_normal() . . . 1101
13.99.5.22 grid_is_white() . . . 1101
13.99.5.23 grid_is_black() . . . 1101
13.99.5.24 grid_brackets() [1/2] . . . 1102
13.99.5.25 mainwnd_rows() [1/2] . . . 1102
13.99.5.26 mainwnd_cols() [1/2] . . . 1102
13.99.5.27 seqs_in_set() . . . 1102
13.99.5.28 gmute_tracks() . . . 1102
13.99.5.29 max_sets() [1/2] . . . 1102
13.99.5.30 max_sequence() . . . 1102
13.99.5.31 text_x() [1/2] . . . 1102
13.99.5.32 text_y() [1/2] . . . 1103
13.99.5.33 seqchars_x() [1/2] . . . 1103
13.99.5.34 seqchars_y() [1/2] . . . 1103
13.99.5.35 seqarea_x() [1/2] . . . 1103
13.99.5.36 seqarea_y() [1/2] . . . 1103
13.99.5.37 seqarea_seq_x() [1/2] . . . 1103

13.99.5.38 seqarea_seq_y() [1/2] . . . 1103
13.99.5.39 mainwid_border() [1/2] . . . 1103
13.99.5.40 mainwid_spacing() [1/2] . . . 1104
13.99.5.41 mainwid_x() . . . 1104
13.99.5.42 mainwid_y() . . . 1104
13.99.5.43 control_height() [1/2] . . . 1104
13.99.5.44 zoom() [1/2] . . . 1104
13.99.5.45 zoom() [2/2] . . . 1104
13.99.5.46 global_seq_feature() [1/2] . . . 1104
13.99.5.47 global_seq_feature() [2/2] . . . 1105
13.99.5.48 seqedit_scale() [1/2] . . . 1105
13.99.5.49 seqedit_scale() [2/2] . . . 1105
13.99.5.50 seqedit_key() [1/2] . . . 1105
13.99.5.51 seqedit_key() [2/2] . . . 1105
13.99.5.52 seqedit_bgsequence() [1/2] . . . 1105
13.99.5.53 seqedit_bgsequence() [2/2] . . . 1105
13.99.5.54 use_new_font() [1/2] . . . 1106
13.99.5.55 allow_two_perfedits() [1/2] . . . 1106
13.99.5.56 perf_h_page_increment() [1/2] . . . 1106
13.99.5.57 perf_v_page_increment() [1/2] . . . 1106
13.99.5.58 progress_bar_colored() [1/2] . . . 1106
13.99.5.59 progress_bar_thick() [1/2] . . . 1106
13.99.5.60 nverse_colors() [1/2] . . . 1106
13.99.5.61 window_redraw_rate() [1/2] . . . 1106
13.99.5.62 use_more_icons() [1/2] . . . 1107
13.99.5.63 save_user_config() [1/2] . . . 1107
13.99.5.64 save_user_config() [2/2] . . . 1107
13.99.5.65 grid_brackets() [2/2] . . . 1107
13.99.5.66 grid_style() [2/2] . . . 1107
13.99.5.67 mainwnd_rows() [2/2] . . . 1107

13.99.5.68 mainwnd_cols() [2/2] . . . 1107
13.99.5.69 max_sets() [2/2] . . . 1108
13.99.5.70 text_x() [2/2] . . . 1108
13.99.5.71 text_y() [2/2] . . . 1108
13.99.5.72 seqchars_x() [2/2] . . . 1108
13.99.5.73 seqchars_y() [2/2] . . . 1108
13.99.5.74 seqarea_x() [2/2] . . . 1108
13.99.5.75 seqarea_y() [2/2] . . . 1108
13.99.5.76 seqarea_seq_x() [2/2] . . . 1109
13.99.5.77 seqarea_seq_y() [2/2] . . . 1109
13.99.5.78 mainwid_border() [2/2] . . . 1109
13.99.5.79 mainwid_spacing() [2/2] . . . 1109
13.99.5.80 control_height() [2/2] . . . 1109
13.99.5.81 dump_summary() . . . 1109
13.99.5.82 midi_ppqn() [1/2] . . . 1109
13.99.5.83 midi_beats_per_bar() [1/2] . . . 1110
13.99.5.84 midi_beats_per_minute() [1/2] . . . 1110
13.99.5.85 midi_beat_width() [1/2] . . . 1110
13.99.5.86 midi_buss_override() [1/2] . . . 1110
13.99.5.87 velocity_override() [1/2] . . . 1110
13.99.5.88 bpm_precision() [1/2] . . . 1110
13.99.5.89 bpm_step_increment() [1/2] . . . 1110
13.99.5.90 bpm_page_increment() [1/2] . . . 1110
13.99.5.91 min_zoom() . . . 1111
13.99.5.92 max_zoom() . . . 1111
13.99.5.93 baseline_ppqn() . . . 1111
13.99.5.94 option_daemonize() [1/2] . . . 1111
13.99.5.95 option_logfile() [1/2] . . . 1111
13.99.5.96 use_new_font() [2/2] . . . 1111
13.99.5.97 allow_two_perfedits() [2/2] . . . 1111

13.99.5.98 perf_h_page_increment() [2/2] . . . 1112
13.99.5.99 perf_v_page_increment() [2/2] . . . 1112
13.99.5.100 progress_bar_colored() [2/2] . . . 1112
13.99.5.101 progress_bar_thick() [2/2] . . . 1112
13.99.5.102 reverse_colors() [2/2] . . . 1112
13.99.5.103 window_redraw_rate() [2/2] . . . 1112
13.99.5.104 use_more_icons() [2/2] . . . 1112
13.99.5.105 option_daemonize() [2/2] . . . 1113
13.99.5.106 option_logfile() [2/2] . . . 1113
13.99.5.107 midi_ppqn() [2/2] . . . 1113
13.99.5.108 midi_buss_override() [2/2] . . . 1113
13.99.5.109 velocity_override() [2/2] . . . 1113
13.99.5.110 bpm_precision() [2/2] . . . 1113
13.99.5.111 bpm_step_increment() [2/2] . . . 1113
13.99.5.112 bpm_page_increment() [2/2] . . . 1114
13.99.5.113 midi_beats_per_bar() [2/2] . . . 1114
13.99.5.114 midi_beats_per_minute() [2/2] . . . 1114
13.99.5.115 midi_beat_width() [2/2] . . . 1114
13.99.5.116 private_bus() . . . 1114
13.99.5.117 private_instrument() . . . 1114
13.99.6 Friends And Related Function Documentation . . . 1114
13.99.6.1 userfile . . . 1115
13.99.7 Field Documentation . . . 1115
13.99.7.1 m_midi_buses . . . 1115
13.99.7.2 m_instruments . . . 1115
13.99.7.3 m_grid_style . . . 1115
13.99.7.4 m_grid_brackets . . . 1115
13.99.7.5 m_mainwnd_rows . . . 1116
13.99.7.6 m_mainwnd_cols . . . 1116
13.99.7.7 m_max_sets . . . 1116

13.99.7.8 m_mainwid_border . . . 1116
13.99.7.9 m_mainwid_spacing . . . 1116
13.99.7.10 m_control_height . . . 1116
13.99.7.11 m_current_zoom . . . 1116
13.99.7.12 m_global_seq_feature_save . . . 1117
13.99.7.13 m_seqedit_scale . . . 1117
13.99.7.14 m_seqedit_key . . . 1117
13.99.7.15 m_seqedit_bgsequence . . . 1117
13.99.7.16 m_use_new_font . . . 1117
13.99.7.17 m_allow_two_perfedits . . . 1118
13.99.7.18 m_h_perf_page_increment . . . 1118
13.99.7.19 m_v_perf_page_increment . . . 1118
13.99.7.20 m_progress_bar_colored . . . 1118
13.99.7.21 m_progress_bar_thick . . . 1118
13.99.7.22 m_inverse_colors . . . 1118
13.99.7.23 m_window_redraw_rate_ms . . . 1118
13.99.7.24 m_use_more_icons . . . 1119
13.99.7.25 m_text_x . . . 1119
13.99.7.26 m_text_y . . . 1119
13.99.7.27 m_seqchars_x . . . 1119
13.99.7.28 m_seqchars_y . . . 1119
13.99.7.29 m_midi_ppqn . . . 1120
13.99.7.30 m_midi_beats_per_measure . . . 1120
13.99.7.31 m_midi_beats_per_minute . . . 1120
13.99.7.32 m_midi_beat_width . . . 1120
13.99.7.33 m_midi_buss_override . . . 1120
13.99.7.34 m_velocity_override . . . 1121
13.99.7.35 m_bpm_precision . . . 1121
13.99.7.36 m_bpm_step_increment . . . 1121
13.99.7.37 m_bpm_page_increment . . . 1121

13.99.7.38 m_total_seqs . . . 1121
13.99.7.39 m_seqs_in_set . . . 1122
13.99.7.40 m_gmute_tracks . . . 1122
13.99.7.41 m_max_sequence . . . 1122
13.99.7.42 m_seqarea_x . . . 1122
13.99.7.43 m_seqarea_y . . . 1122
13.99.7.44 m_seqarea_seq_x . . . 1122
13.99.7.45 m_seqarea_seq_y . . . 1123
13.99.7.46 m_mainwid_x . . . 1123
13.99.7.47 m_mainwid_y . . . 1123
13.99.7.48 m_save_user_config . . . 1123
13.99.7.49 mc_min_zoom . . . 1123
13.99.7.50 mc_max_zoom . . . 1123
13.99.7.51 mc_baseline_ppqn . . . 1124
13.99.7.52 m_user_option_daemonize . . . 1124
13.99.7.53 m_user_option_logfile . . . 1124
13.100 seq64::userfile Class Reference . . . 1124
13.100.1 Constructor & Destructor Documentation . . . 1126
13.100.1.1 userfile() . . . 1126
13.100.1.2 ~userfile() . . . 1126
13.100.2 Member Function Documentation . . . 1126
13.100.2.1 parse() . . . 1126
13.100.2.2 write() . . . 1127
13.100.2.3 dump_setting_summary() . . . 1127

Index **1129**

Chapter 1

Sequencer64

Author(s) Chris Ahlstrom 2016-10-23

1.1 Introduction

Sequencer64 is a major cleanup, refactoring, and documentation of the Seq24 live-play MIDI sequencer.

The current document, generated by Doxygen, describes the functions, classes, modules, and other entities used in this project.

Also read the ROADMAP, README, and contrib/bugs_to_investigate files to understand the genesis of this project and the things that still need to be done with Sequencer64.

Also, we have pretty deeply documented *Seq24* and *Sequencer64* with PDF files that can be generated by git-cloning the following projects, installing a number of tools related to PDF and LaTeX, and running "make":

- https://github.com/ahlstromcj/seq24-doc.git
- https://github.com/ahlstromcj/sequencer64-doc.git

These project also have prebuilt PDFs should one not want to bother building them.

In the present document, we've left out a some side-code to cut down on the size of the document. Still, the resulting PDF is over 1000 pages long.

Some useful references:

- http://acad.carleton.edu/courses/musc108-00-f14/pages/04/04StandardMIDIFiles.html
- http://www.midimusicadventures.com/qs/midi-zips/soundtracks/kq6gm.zip

Chapter 2

MIDI File Parsing in Sequencer64

Author(s) Chris Ahlstrom 2016-02-13

2.1 Introduction

This section describes the parsing of a MIDI file (and a few other topics). We wanted to add the reading of SMF 0 files to *Sequencer64*. We started with the main format that is supported, SMF 1. Once we understood that we, we figured out how to split a SMF 0 tracks correctly.

We split the midifile::parse() function into two sections. The first section analyzes the header of the MIDI. Then, based on whether the file is SMF 1 (the normal case) or SMF 0, either the parse_smf_1() function of or the parse_smf_0() function is called. The parse_smf_0() function creates one sequence object per channel present in the SMF 0 file, plus the original track. The last pattern slot (sequence 16) will contain the original track data, and the rest will contain common data and then channel data for each channel. After the parsing is done, all the tracks (including the original track) will be added to the performance. The user then has the option of deleting the original track, which will be the last track.

2.2 SMF 1 Parsing

This section describes the parsing of the header chunk, MThd, and the track chunk, MTrk.

The midifile::parse() function starts by opening the MIDI file, getting its file-size, pre-allocating the data vector to that size, reading all of the characters into that vector, and then closing the file.

2.2.1 MIDI File Header, MThd

The data of the header is read:

```
Header ID:     "MThd"         read_long()       4 bytes
MThd length:     6            read_long()       4 bytes
Format:        0, 1, 2        read_short()      2 bytes
No. of track:  1 or more      read_short()      2 bytes
PPQN:           192           read_short()      2 bytes
```

The header ID and it's length are always the same values. The formats that Sequencer64 supports are 0 or 1. SMF 0 has only one track, while SMF 1 can support an arbitary number of tracks. The last value in the header is the PPQN value, which specifies the "pulses per quarter note", which is the basic time-resolution of events in the MIDI file. Common values are 96 or 192, but higher values are also common. Sequencer64 and its precursor, Seq24, default to 192.

2.2.2 MIDI Track, MTrk

Sequencer64 next reads the tracks specified in the file. Each track is assumed to cover a different MIDI channel, but always the same MIDI buss. (The MIDI buss is not a data item in standard MIDI files, but it is a special data item in Seq24/Sequencer64 MIDI files.) Each track is tagged by a standard chunk marker, "MTrk". Other markers are possible, and are to be ignored, if nothing else. Here are the values read at the beginning of a track:

```
Track ID:      "MTrk"         read_long()       4 bytes
Track length:  varies         read_long()       4 bytes
```

The track length is the number of bytes that need to be read in order to get all of the data in the track.

Next, a new sequence object is created, with the PPQN value passed to its constructor. The sequence then is hooked to the master MIDI buss object. The "RunningTime" accumulator is set to 0 for that track.

Next, the parse() function loops through the rest of the track, reading data and logging it to the sequence. Let's go through the loop, which is the meat of the processing.

TODO: An empty event is created before track processing, and re-used for every track and event. This seems dangerous. We moved the event constructor two levels of nesting deeper, and it seems to work fine.

Delta time. The amount time that passes from one event to the next is the *delta time*. For some events, the time doesn't matter, and is set to 0. This values is a *variable length value*, also known as a "VLV" or a "varinum". It provides a way of encoding arbitrarily large values, a byte at a time. For now, just note that a varinum is 1 or more bytes, and MIDI provides a way to tell when the varinum is complete.

```
Delta time:    varies         read_varinum()    1 or more bytes
```

2.2.2.1 Channel Events

Status. The byte after the delta time is examined by masking it against 0x80 to check the high bit. If not set, it is a "running status", it is replaced with the "last status", which is 0 at first.

```
Status byte:   varies         read_byte()       1 byte
```

If the high bit is set, it is a status, and is passed to the setter `event::set_status()`.

The "RunningTime" accumulator is incremented by the delta-time. The current time is adjusted as per the PPQN ratio, if needed, and passed to the setter `event::set_timestamp()`.

Now what does the status mean? First, the channel part of the status is masked out using the 0xF0 mask.

If it is a 2-data-byte event (note on, note off, aftertouch, control-change, or pitch-wheel), then the two data bytes are read:

```
Data byte 0:   varies         read_byte()       1 byte
Data byte 1:   varies         read_byte()       1 byte
```

If the status is a note-on event, with data[1] = 0, then it is converted to a note-off event, a fix for the output quirks of some MIDI devices, and the status of the event is amended to EVENT_NOTE_OFF.

If it is a 1-data-btye event (program change or channel pressure), then only data byte 0 is read.

Then the one or two data bytes are added to the event by overloads of `event::set_data()`, the event is added to the current sequence by `sequence::add_event()`, and the MIDI channel of the sequence is set by `sequence::set_midi_channel()`.

Note that this is the point where parsing could detect a change in channel, and select a new sequence to support that channel, and add the events to that sequence, if the file were SMF 0.

Also note that the channel of the sequence is set every a new channel event/status is read. This should be done once, and then simply warned about if a non-matching channel occurs.

Lastly, note that it might be better to do the sequence function calls at the end of processing the event.

2.2.2.2 Meta Events

If the event status masks off to 0xF0 (0xF0 to 0xFF), then it is a meta event. If the status is 0xFF, it is called a "Sequencer-specific", or "SeqSpec" event. For this kind of event, then a type byte and the length of the event are read.

```
Meta type:     varies         read_byte()       1 byte
Meta length:   varies         read_varinum()    1 or more bytes
```

If the type of the SeqSpec (0xFF) meta event is 0x7F, parsing checks to see if it is one of the Seq24 "proprietary" events. These events are tagged with various values that mask off to 0x24240000. The parser reads the tag:

```
Prop tag:     0x242400nn      read_long()       4 bytes
```

These tags provide a way to save and recover Seq24/Sequencer64 properties from the MIDI file: MIDI buss, MIDI channel, time signature, sequence triggers, and (new), the key, scale, and background sequence to use with the track/sequence. Any leftover data for the tagged event is let go. Unknown tags ate skipped.

If the type of the SeqSpec (0xFF) meta event is 0x2F, then it is the End-of-Track marker. The current time is set using `sequence::set_length()` and then `sequence::zero_markers()` is called, and parsing is done for that track.

If the type of the SeqSpec (0xFF) meta event is 0x03, then it is the sequence name. The "length" number of bytes are read, and loaded by `sequence::set_name()`.

If the type of the SeqSpec (0xFF) meta event is 0x00, then it is the sequence number, which is read:

```
Seq number:    varies         read_short()      2 bytes
```

Note that the sequence number might be modified latter to account for the current screenset in force for a file import operation.

Anything other SeqSpec type is simply skipped by reading the "length" number of bytes.

To summarize the process, here are the relevant event and sequence setter calls typically made while parsing a MIDI track:

1. `perform::add_sequence()`
   (a) `sequence::sequence()`
   (b) `sequence::set_master_midi_bus())`
   (c) `sequence::add_event()`
      i. `event::event()`
      ii. `event::set_status()`
      iii. `event::set_timestamp()`
      iv. `event::set_data()`
   (d) `sequence::set_midi_channel()`
   (e) `sequence::set_length()`
   (f) `sequence::zero_markers()`
   (g) `sequence::set_name()`
   (h) `sequence::set_midi_bus()`
2. `xxxxx::yyyy()`

2.2.3 Meta Events Summary

Here, we summarize the MIDI meta events for your edification.

1. `FF 00 02 ssss`: Sequence Number.
2. `FF 01 len text`: Text Event.
3. `FF 02 len text`: Copyright Notice.
4. `FF 03 len text`: Sequence/Track Name.
5. `FF 04 len text`: Instrument Name.
6. `FF 05 len text`: Lyric.
7. `FF 06 len text`: Marker.
8. `FF 07 len text`: Cue Point.
9. `FF 08 len text`: Patch/program Name.
10. `FF 09 len text`: Device Name.
11. `FF 0A through 0F len text`: Other kinds of text events.
12. `FF 20 01 cc`: MIDI channel (obsolete, used by Cakewalk)
13. `FF 21 01 pp`: MIDI port (obsolete, used by Cakewalk)
14. `FF 2F 00`: End of Track.
15. `FF 51 03 tttttt`: Set Tempo, us/qn.
16. `FF 54 05 hr mn se fr ff`: SMPTE Offset.
17. `FF 58 04 nn dd cc bb`: Time Signature.
18. `FF 59 02 sf mi`: Key Signature.
19. `FF 7F len data`: Sequencer-Specific.

The next sections describe the events that *Sequencer* tries to handle. These are

- Sequence Number (0x00)
- Track Name (0x03)
- End-of-Track (0x2F)
- Set Tempo (0x51) (Sequencer64 only)
- Time Signature (0x58) (Sequencer64 only)
- Sequencer-Specific (0x7F)
- System Exclusive (0xF0) Sort of handled, functionality incomplete..

2.2.3.1 Sequence Number (0x00)

```
FF 00 02 ss ss
```

This optional event must occur at the beginning of a track, before any non-zero delta-times, and before any transmittable MIDI events. It specifies the number of a sequence.

2.2.3.2 Track/Sequence Name (0x03)

```
FF 03 len text
```

If in a format 0 track, or the first track in a format 1 file, the name of the sequence. Otherwise, the name of the track.

2.2.3.3 End of Track (0x2F)

```
FF 2F 00
```

This event is not optional. It is included so that an exact ending point may be specified for the track, so that it has an exact length, which is necessary for tracks which are looped or concatenated.

2.2.3.4 Set Tempo Event (0x51)

The MIDI Set Tempo meta event sets the tempo of a MIDI sequence in terms of the microseconds per quarter note. This is a meta message, so this event is never sent over MIDI ports to a MIDI device.

After the delta time, this event consists of six bytes of data:

```
FF 51 03 tt tt tt
```

Example:

```
FF 51 03 07 A1 20
```

1. 0xFF is the status byte that indicates this is a Meta event.
2. 0x51 the meta event type that signifies this is a Set Tempo event.
3. 0x03 is the length of the event, always 3 bytes.
4. The remaining three bytes carry the number of microseconds per quarter note. For example, the three bytes above form the hexadecimal value 0x07A120 (500000 decimal), which means that there are 500,000 microseconds per quarter note.

Since there are 60,000,000 microseconds per minute, the event above translates to: set the tempo to 60,000,000 / 500,000 = 120 quarter notes per minute (120 beats per minute). This is a 24-bit binary value, so each byte covers the full range of 0x00 to 0xFF.

This event normally appears in the first track. If not, the default tempo is 120 beats per minute. This event is important if the MIDI time division is specified in "pulses per quarter note", which does not itself define the length of the quarter note. The length of the quarter note is then determined by the Set Tempo meta event.

Representing tempos as time per beat instead of beat per time allows absolutely exact DWORD-term synchronization with a time-based sync protocol such as SMPTE time code or MIDI time code. This amount of accuracy provided by this tempo resolution allows a four-minute piece at 120 beats per minute to be accurate within 500 usec at the end of the piece.

We have now added the Tempo meta event (and the Time Signature meta event) to the track, which allows other sequencers to obtain these values from a Sequencer64 MIDI file. Here are the original headers for a normal MIDI file and its legacy (Seq24) conversion, as shown by the midicvt application:

```
hymne.asc

MThd 1 4 96
MTrk
0 Meta SeqName "Vangelis: Hymne"
0 TimeSig 4/4 24 8
0 Tempo 750000
0 Meta TrkEnd
TrkEnd
```

```
hymne-ppqn-384.asc

MThd 1 4 384
MTrk
0 SeqNr 0
0 Meta SeqName "Vangelis: Hymne"
0 SeqSpec 24 24 00 08       (no triggers)
0 SeqSpec 24 24 00 01 00    (MIDI buss 0)
0 SeqSpec 24 24 00 06 04 04 (beats, width)
0 SeqSpec 24 24 00 02 00    (MIDI ch. 0)
96 Meta TrkEnd
TrkEnd
```

Here is the header data that result from the new conversion, which is used if the "legacy" option is not in force:

```
MThd 1 4 192
MTrk
0 SeqNr 0
0 Meta SeqName "Vangelis: Hymne"
0 TimeSig 4/4 24 8
0 Tempo 750000
0 SeqSpec 24 24 00 08
0 SeqSpec 24 24 00 01 00
0 SeqSpec 24 24 00 06 04 04
0 SeqSpec 24 24 00 02 00
48 Meta TrkEnd
TrkEnd
```

2.2.3.5 Time Signature Event (0x58)

After the delta time, this event consists of seven bytes of data:

```
FF 58 04 nn dd cc bb
```

The time signature is expressed as four numbers. `nn` and `dd` represent the numerator and denominator of the time signature as it would be notated. The numerator counts the number of beats in a measure (beats per measure or beats per bar). The denominator is a negative power of two: 2 represents a quarter-note, 3 represents an eighth-note, etc. The denominator specifies the unit of the beat (e.g. 4 or 8). In Seq24/Sequencer64, this value is also called the "beat width".

The `cc` parameter expresses the number of MIDI clocks (or "ticks", or "pulses") in a metronome click. The standard MIDI clock ticks 24 times per quarter note, so a value of 6 would mean the metronome clicks every 1/8th note. A `cc` value of 6 would mean that the metronome clicks once every 1/8th of a note (quaver). This MIDI clock is different from the clock (PPQN) that determines the start time and duration of the notes.

The `bb` parameter expresses the number of notated 32nd-notes in a MIDI quarter note (24 MIDI Clocks). The usual value for this parameter is 8, though some sequencers allow the user to specify that what MIDI thinks of as a quarter note, should be notated as something else. For example, a value of 16 means that the music plays two quarter notes for each quarter note metered out by the MIDI clock, so that the music plays at double speed.

Examples:

```
FF 58 04 04 02 18 08
```

1. 0xFF is the status byte that indicates this is a Meta event.
2. 0x58 the meta event type that signifies this is a Time Signature event.

3. 0x04 is the length of the event, always 4 bytes.

4. 0x04 is the numerator of the time signature, and ranges from 0x00 to 0xFF.

5. 0x02 is the log base 2 of the denominator, and is the power to which 2 must be raised to get the denominator. Here, the denominator is 2 to 0x02, or 4, so the time signature is 4/4.

6. 0x18 is the metronome pulse in terms of the number of MIDI clock ticks per click. Assuming 24 MIDI clocks per quarter note, the value here (0x18 = 24) indidicates that the metronome will tick every 24/24 quarter note. If the value of the sixth byte were 0x30 = 48, the metronome clicks every two quarter notes, i.e. every half-note.

7. 0x08 defines the number of 32nd notes per beat. This byte is usually 8 as there is usually one quarter note per beat, and one quarter note contains eight 32nd notes.

A time signature of 6/8, with a metronome click every 3rd 1/8 note, would be encoded:

```
FF 58 04 06 03 24 08
```

Remember, a 1/4 note is 24 MIDI Clocks, therefore a bar of 6/8 is 72 MIDI Clocks. Hence 3 1/8 notes is 36 (=0x24) MIDI Clocks.

There should generally be a Time Signature Meta event at the beginning of a track (at time = 0), otherwise a default 4/4 time signature will be assumed. Thereafter they can be used to effect an immediate time signature change at any point within a track.

For a format 1 MIDI file, Time Signature Meta events should only occur within the first MTrk chunk.

If a time signature event is not present in a MIDI sequence, 4/4 signature is assumed.

In *Sequencer64*, the c_timesig SeqSpec event is given priority. The conventional time signature is used only if the c_timesig SeqSpec is not present in the file. NEEDS TO BE TESTED.

2.2.3.6 SysEx Event (0xF0)

If the meta event status value is 0xF0, it is called a "System-exclusive", or "SysEx" event.

```
F0 len data F7
```

Sequencer64 has some code in place to store these messages, but the data is currently not actually stored or used. Although there is some infrastructure to support storing the SysEx event within a sequence, the SysEx information is simply skipped. *Sequencer64* warns if the terminating 0xF7 SysEx terminator is not found at the expected length. Also, some malformed SysEx events have been encountered, and those are detected and skipped as well.

2.2.3.7 Sequencer Specific (0x7F)

This data, also known as SeqSpec data, provides a way to encode information that a specific sequencer application needs, while marking it so that other sequences can safely ignore the information.

```
FF 7F len data
```

In *Seq24* and *Sequencer64*, the data portion starts with four bytes that indicate the kind of data for a particular SeqSpec event:

```
c_midibus        ^  0x24240001  Track buss number
c_midich         ^  0x24240002  Track channel number
c_midiclocks     *  0x24240003  Track clocking
c_triggers       ^  0x24240004  See c_triggers_new
c_notes          *  0x24240005  Song data, notes
c_timesig        ^  0x24240006  Track time signature
c_bpmtag         *  0x24240007  Song beats/minute
c_triggers_new   ^  0x24240008  Track trigger data
c_mutegroups     *  0x24240009  Song mute group data
c_midictrl       *  0x24240010  Song MIDI control
c_musickey       +  0x24240011  Track key (Sequencer64 only)
c_musicscale     +  0x24240012  Track scale (Sequencer64 only)
c_backsequence   +  0x24240013  Track background sequence (Sequencer64 only)

* = global only; ^ = track only; + = both
```

In *Seq24*, these events are placed at the end of the song, but are not marked as SeqSpec data. Most MIDI applications handle this situation fine, but some (e.g. midicvt) do not. Therefore, *Sequencer64* makes sure to wrap each data item in the 0xFF 0x7F wrapper.

Also, the last three items above (key, scale, and background sequence) can also be stored (by *Sequencer64*) with a particular sequence/track, as well as at the end of the song. Not sure if this bit of extra flexibility is useful, but it is there.

2.2.3.8 Non-Specific End of Sequence

Any other statuses are deemed unsupportable in *Sequencer64*, and abort parsing with an error.

If the –bus option is in force, `sequence::set_midi_bus()` is called to override the buss number (if any) stored with the sequence.

Finally, `perform::add_sequence()` adds the sequence to the encoded tune.

2.3 SMF 0 Parsing

After parsing SMF 1 track data, we end up with a number of sequences, each on a different MIDI channel. With SMF 0, data for all channels is present in a single track. Sequencer64 will read SMF 0 data, but we really need to be able to have one MIDI channel per track. So we need to take the data from the sequence and use it to make more sequences.

- `sequence::add_event()`.
- `sequence::set_midi_channel()`.
- `sequence::set_length()`.
- `sequence::set_midi_bus()`.
- `perform::add_sequence()`.

This code basically works. For now, please look at the source code for more details. Also, the reading of SMF 0 MIDI files is described in the *sequencer64-doc* project on GitHub.

2.4 Running Status

When we apply the `midicvt` application to a file saved by *Sequencer64*, we can end up with a successful ASCII conversion that ends with an error message:

```
$ midicvt hymne-seq64.midi -o hymne-seq64.asc
? Error at MIDI file offset 12155 [0x2f7b]
Error: Garbage at end 'readtrack(): unexpected running status'
```

Is this a problem in `midicvt` or *Sequencer4*? Let's learn about running status.

Running status is a way to speed up the sending of MIDI bytes to a synthesizer or sequencer by taking advantage of redundancy where possible. For example, if we're sending a consecutive group of Note On and Note Off messages to a particular channel, we can save some time by not sending the channel status byte after the first time. Here's an example with Note On on channel 1:

```
0x90 3C 7F
0x90 40 7F
0x90 43 F3
```

Since no change in status occurs after the first of these three events, we can drop the subsequent status bytes:

```
0x90 3C 7F
40 7F
43 F3
```

The 0x90 byte is saved in a "running status buffer" (RSB), and is filled in by the receiving device.

Here is the sequence of events for operating with running status.

1. Clear the RSB buffer (RSB = 0) to start.
2. If a **Voice Category Status** (VCS) byte is received, then set RSB = VCS. VCS bytes range from 0x80 to 0xEF. This is binary 1000000 to 11100000.
3. If a data byte is received (data bytes range from 0x00 to 0x7F, binary 0000000 to 0111111; that is, bit 7 is always 0 in a data byte):
   (a) If RSB != 0, first insert the RSB into the incoming data stream, then insert the data byte.
   (b) If RSB == 0, then just insert the data byte into the incoming data stream.
4. Clear the RSB buffer (RSB = 0) when a System Common Message (SCM) status byte is received. SCM bytes range from 0xF0 to 0xF7.
5. The message after an SCM **must** begin with a status byte. That is a byte with bit 7 set.
6. Do no special action when a Realtime Category Message (RCM) byte is received. RCM bytes range from 0xF8 to 0xFF.

Note that some events, such as Tempo, assume that its bytes are all data bytes.

Chapter 3

JACK, Live, and Song Modes in Sequencer64

Author(s) Chris Ahlstrom 2017-04-01

3.1 Introduction

This section describes the interactions between JACK settings and the Live/Song Mode settings, with an eye to describing the proper behavior of Sequencer64 with JACK settings, how the Live/Song modes are supposed to work, and what bugs or issues remain in Sequencer64's JACK handling.

Note: There is currently no description of the 0.90.x line's native JACK MIDI support, except what is found in the developer's reference manual and in the updated sequencer64-doc project at GitHub.

I'm not sure why Doxygen is applying the "code" font so often here. Weird, annoying.

3.2 JACK Functions

Please study the following URL and note these important points:

```
http://jackaudio.org/files/docs/html/transport-design.html
```

- The timebase master continuously updates position information, beats, timecode, etc. There is at most one master active at a time. If no client is registered as timebase master, frame numbers will be the only position information available.
- The timebase master registers a callback that updates position information while transport is rolling. Its output affects the following process cycle. This function is called immediately after the process callback in the same thread whenever the transport is rolling, or when any client has set a new position in the previous cycle.
- Clients that don't declare a sync callback are assumed ready immediately, anytime the transport wants to start. If a client doesn't require slow-sync processing, it can set its sync callback to NULL.
- The transport state is always valid; initially it is JackTransportStopped.
- When someone calls `jack_transport_start()`, the engine resets the poll bits and changes to a new state, JackTransportStarting.
- When all slow-sync clients are ready, the state changes to JackTransportRolling.

Does Sequencer64 need a latency callback?

```
http://jackaudio.org/files/docs/html/group__ClientCallbacks.html
```

(We need to see why most of the following is in a monospaced font. Is there a new Doxygen feature?)

Here are summaries of the JACK functions used in the jack_assistant module:

3.2.1 jack_client_open()

```
Open a client session with a JACK server. More complex and
powerful than <tt>jack_client_new()</tt>.
Clients choose which of several
servers to connect, and how to start the server automatically, if
not already running. There is also an option for JACK to generate
a unique client name.


  const char *   client_name,
  jack_options_t    options,
  jack_status_t *   status,
     ...
```

client_name of at most jack_client_name_size() characters. The name scope is local to each server. Unless forbidden by the JackUseExactName option, the server will modify this name to create a unique variant, if needed.

options formed by OR-ing together JackOptions bits. Only the JackOpenOptions bits are allowed.

status (if non-NULL) an address for JACK to return information from the open operation. This status word is formed by OR-ing together the relevant JackStatus bits.

Optional parameters: depending on corresponding [options bits] additional parameters may follow status (in this order).

[JackServerName] (char $*$) server_name selects from among several possible concurrent server instances. Server names are unique to each user. If unspecified, use "default" unless $JACK_DEFAULT_SERVER is defined in the process environment.

Returns:

Opaque client handle if successful. If this is NULL, the open operation failed, and $*$status includes JackFailure, and the caller is not a JACK client.

3.2.2 jack_on_shutdown()

```
Registers a function to call when the JACK server shuts down the
client thread. It must be an asynchonrous POSIX signal
handler: only async-safe functions, executed from another thread.
A typical function might set a flag or write to a pipe so that the
rest of the application knows that the JACK client thread has shut
down.  Clients do not need to call this function. It only helps
clients understand what is going on. It should be called before
<tt>jack_client_activate()</tt>.
```

3.2.3 jack_set_sync_callback()

```
Register/unregister as a slow-sync client; it can't respond
immediately to transport position changes.  The callback is run at
the first opportunity after registration: if the client is active,
this is the next process cycle, otherwise it is the first cycle
after <tt>jack_activate()</tt>.  After that, it runs as per
JackSyncCallback rules.  Clients that don't set this callback are
assumed ready immediately any time the transport wants to start.
```

3.2.4 jack_set_process_callback()

```
Tells the JACK server to call the callback whenever there is work.
The function must be suitable for real-time execution, it cannot
call functions that might block for a long time: malloc(), free(),
printf(), pthread_mutex_lock(), sleep(), wait(), poll(), select(),
pthread_join(), pthread_cond_wait(), etc.  In the current class,
this function is a do-nothing function.
```

3.2.5 jack_set_session_callback()

```
Tells the JACK server to call the callback when a session event is
delivered.  Setting more than one session callback per process is
probably a design error.  For a multiclient application, it's more
sensible to create a JACK client with only one session callback.
```

3.2.6 jack_activate()

```
Tells the JACK server that the application is ready to start
processing.
```

3.2.7 jack_release_timebase()

TODO

3.2.8 jack_client_close()

TODO

3.2.9 jack_transport_start()

```
Starts the JACK transport rolling.  Any client can make this
request at any time. It takes effect no sooner than the next
process cycle, perhaps later if there are slow-sync clients. This
function is realtime-safe.  No return code.
```

3.2.10 jack_transport_stop()

```
Starts the JACK transport rolling.  Any client can make this
request at any time.  This function is realtime-safe.  No return
code.
```

3.2.11 jack_transport_locate()

```
Repositions the transport to a new frame number.  May be called at
any time by any client. The new position takes effect in two
process cycles. If there are slow-sync clients and the transport is
already rolling, it will enter the JackTransportStarting state and
begin invoking their sync_callbacks until ready. This function is
realtime-safe.
```

3.2.12 jack_transport_reposition()

```
Request a new transport position.  May be called at any time by any
client. The new position takes effect in two process cycles. If
there are slow-sync clients and the transport is already rolling,
it will enter the JackTransportStarting state and begin invoking
their sync_callbacks until ready. This function is realtime-safe.
This call, made in the position() function, is currently disabled.
```

3.2.13 jack_transport_query()

Query the current transport state and position. This function is realtime-safe, and can be called from any thread. If called from the process thread, pos corresponds to the first frame of the current cycle and the state returned is valid for the entire cycle.

The first parameter is the client, which is a pointer to the JACK client structure.

The second parameter is a pointer to structure for returning current transport position; pos->valid will show which fields contain valid data. If pos is NULL, do not return position information.

This function returns the current transport state.

3.3 Modes Operation

3.3.1 No JACK, Live Mode

In ~/.config/sequencer64/sequencer64.rc, set:

- jack_transport = 0
- jack_master = 0
- jack_master_cond = 0
- song_start_mode = 0

By changing the start mode to 0 (false), Sequencer64 is put into Live Mode. With this setting, control of the muting and unmuting of patterns resides in the main window (the patterns window). One can start the playback in the performance (song) window, but it will not affect which patterns play, at all.

Note that this option is part of the *File / Options / JACK/LASH* configuration page.

3.3.2 No JACK, Song Mode

In ~/.config/sequencer64/sequencer64.rc, set:

- jack_transport = 0
- jack_master = 0
- jack_master_cond = 0
- song_start_mode = 1

By changing the start mode to 1 (true), Sequencer64 is put into Song Mode.

With this setting, control of the muting and unmuting of patterns resides in the song window (the performance window). The patterns shown in the pattern slots of the main window turn on and off whenever the progress bar is in the pattern as drawn in the perforance window.

Note that this option is part of the *File / Options / JACK/LASH* configuration page.

3.3.3 JACK Transport

In ~/.config/sequencer64/sequencer64.rc, set:

- jack_transport = 1
- jack_master = 0
- jack_master_cond = 0
- song_start_mode = 0 or 1 (see previous section)

The current behavior is that qjackctl and sequencer64 playback/progress seem to be independent of each other.

The workaround seems to be to set seq24/sequencer64 as JACK Master, or if another *application* (e.g. Qtractor) is JACK Master.

OLD BEHAVIOR:

```
Start qjackctl, verify that it sets up correctly, then click it's
"play" button to start the transport rolling.  Run sequencer64, load a
file.  Then note that starting playback (whether in the main window or
in the performance window) is ineffective, but resets the time counter
in qjackctl.  Why?  With JACK sync enabled by the macro:

         [JACK transport slave]
         jack sync(): zero frame rate [single report]!?
         [JackTransportRolling]
         [JackTransportStarting]  (every time space bar pressed)
         [Start playback]
         . . .
```

END OF OLD BEHAVIOR.

3.4 Breakage

Old message about seq24 being broken:

http://lists.linuxaudio.org/pipermail/linux-audio-user/2010-November/073848.html

```
   i dont see the transport synchronisation working with a jack1 svn version.
   you are still using only a sync callback.

   and you are relying on the transport to go through the
   JackTransportStarting state.

   this issue should be fixed.
   iirc we came to the conclusion, that seq24 is broken, and we will not
   revert the changes in jack, which break it.

   the quick and dirty fix on your side, would be to register an empty
   process_callback.

   but the issue still remains. seq24 is NOT a slow sync client. but it
   registers a sync_callback.
   and it even takes a lock in the sync callback.

   the patch for jack-session support didnt get merged either.
```

Another one (no need for a URL):

```
   I use seq24 for the majority of my projects but it isn't ideal (I should
   point out that I never finish anything). I don't like seq24's pianoroll
   editor, the way you do CC envelopes isn't ideal, it uses alsa-midi, there's
   unnecessary complexity in switching from pattern-trigger mode to song mode,
   and its insistence on being transport master while not even being able to
   adjust tempo when live is annoying
```

3.5 JACK References

- http://libremusicproduction.com/articles/demystifying-jack-%E2%80%93-beginners-guide
- http://jackaudio.org/files/docs/html/transport-design.html
- http://kxstudio.linuxaudio.org/Repositories

Chapter 4

User Testing of Sequencer64 with Yoshimi

Author(s) Chris Ahlstrom 2016-03-04

4.1 Introduction

This section describes user testing of Sequencer64 using Yoshimi. It will expand as we work our way through all the many use-cases that can be achieved with Sequencer64 and Yoshimi.

Please note that the most advanced and recent testing can be found currently in the document `contrib/notes/jack-testing.txt`. We will eventually merge the final tests here... someday.

4.2 Smoke Test

Every so often we run Sequencer64 with a software synthesizer to make sure we haven't broken any functionality via our major refactoring efforts. We call it a "smoke test". We fire up the two application, and see if anything smokes.

This smoke test sets up Yoshimi with a very simple ALSA setup, and no instruments are loaded. Instead, only the "Simple Sound" is used on all channels. We've been doing this test with Yoshimi 1.3.6. The current Debian Sid ("testing") version of Yoshimi is 1.3.6-2, pulled from SourceForge. It seems to have issues, so we've been cloning and pulling the code from:

```
https://github.com/Yoshimi/yoshimi.git
```

After getting the application build and installed, the next step is to run it, using ALSA for MIDI and for audio:

```
$ yoshimi -a -A &
```

Next, fix up the configuration files for Sequencer64, `~/.config/sequencer64/sequencer64.rc` and `~/.config/sequencer64/sequencer64.usr`.

First hide `sequencer64.usr` somewhere, or delete it, as it will determine what MIDI devices are available, and we don't want that (yet). Second, make sure that `sequencer64.rc` makes the following setting:

```
[manual-alsa-ports]

# Set to 1 if you want sequencer64 to create its own ALSA ports and
# not connect to other clients

0   # number of manual ALSA ports
```

Next, run the newly-built version of Sequencer64. If desired, use the –bus option described below to force the buss number to the buss you need, as shown in the second version of the command:

```
$ sequencer64/sequencer64 &
$ sequencer64/sequencer64 --bus 5 &
```

In *File / Options / MIDI Clock*, observe the MIDI inputs made available by your system. Our system shows:

```
[0] 14:0 (Midi Through Port-0)
[1] 128:0 (TiMidity port 0)
[2] 128:0 (TiMidity port 1)
[3] 128:0 (TiMidity port 2)
[4] 128:0 (TiMidity port 3)
[5] 129:0 (input)
```

For some reason (a bug in Yoshimi?), input "[5]" doesn't indicate that it is Yoshimi, but it is. Take note of that input number... that is the MIDI buss number that is needed to drive Yoshimi.

Also make sure that of the clock settings for those busses are "Off".

The next instruction still works, but it is easier to simply pass the option `–bus 5` to Sequencer64 when starting it up.

Now open the file `sequencer64/contrib/midi/b4uacuse-GM-format.midi` in Sequencer64. For all of the patterns (slots) that have lots of data in them, right click on the pattern and select *Midi Bus / [5] 129:0 (input)* and the desired channel number. (Doesn't matter much, just use up the lower channel numbers first).

Back in Yoshimi, select each Part corresponding to the channels you selected. Make sure *Enabled* is checked for each desired channel.

Back in Sequencer64, click on each pattern you want to hear, which highlights them in black. Now click the play button (green triangle). The song should play, with each part using the "Simple Sound". Not too bad for a bunch of sine waves, eh?

Now we can test the application more fully. Note that the instructions here are very light. Detailed instructions on the usage of Sequencer64 can be found in the following project, which contains a PDF file and the LaTeX code used to build it:

```
https://github.com/ahlstromcj/sequencer64-doc.git
```

Although it applies to an earlier version of the project, it still mostly holds true for Sequencer64.

4.3 Tests in the Patterns Window

The Patterns window is the inside portion of the main window, supported by the `mainwid` class. it contains a grid of boxes or slots, with each slot potentially containing a pattern, sequence, or track. Empty tracks (i.e. tracks that contain no events, like title-only tracks) are highlighted in yellow.

This window supports only a single variant of mouse-handling.

4.3.1 Button Clicks on a Pattern

A left-click on a pattern slot should cause the following to happen:

1. The pattern will be highlighted (white on a black background). This won't occur until the button is released.
2. During playback, the pattern will emit MIDI events and play its sequence.
3. If the pattern is dragged to another slot, whether playing is in progress or not, releasing the button in the destination slot will move the pattern to that slot.

A right-click on a pattern slot should cause the following to happen:

1. If the pattern is empty, then a pop-up menu to make a New pattern, paste a pattern, or make other selections will appear.
2. If the pattern is active, then a pop-up menu to Edit the pattern or make other selections will appear.
3. A second right-click, just off the menu, will dismiss the menu.

4.3.2 Patterns Window Key Shortcuts

First, note the selection of the File / Options / Keyboard / Show keys option. The tests here should work whether or not it is selected. The only difference is if the keys are shown.

We got a segfault during this test, when we weren't being systematic about it.

4.3.3 The Sequencer64 User File

To be discussed.

4.4 Tests Using Valgrind

Valgrind is a very useful tool for unearthing memory issues and other issues in an application, especially when one has the source code and can build the code with debugging information.

One runs the application from the command line, preceding its command line with valgrind and some of its options.

4.4.1 Valgrind Suppressions

One problem with valgrind is that it also uncovers errors in system libraries that one has no control over. These errors clutter the output, so we suppress them using a valgrind "suppressions" file. Here's how to create one:

```
$ valgrind --gen-suppressions=yes --log-file=val.supp ./Sequencer64/sequencer64
$ valgrind --gen-suppressions=all --log-file=val.supp ./Sequencer64/sequencer64
```

As the program runs, one is asked to print a suppression. If the error is due to a system or third-party library, answer "Y return", and then copy-and-paste the suppression to a file, giving it a name. For example, we provide a file `contrib/seq64.supp` containing suppressions of errors that annoy us. There are way too many "errors" in ALSA, GTK+, gtkmm, glibc, and more.

The second command collects all the suppressions. Passing the val.supp file through sed makes it immediately usable:

```
$ sed -i -e /^==/g val.supp
```

Running valgrind like this then shows mostly the errors we care about:

```
$ valgrind --suppressions=val.supp  ./Sequencer64/sequencer64
```

We've added some other suppression files to the `contrib` directory. Too much! For example:

https://github.com/dtrebbien/GNOME.supp

However, overall this process is very painful, and we're going to eventually do all the valgrind work on the unit-test project for Sequencer64:

https://github.com/ahlstromcj/seq64-tests

4.4.2 Full Valgrind Leak-Checking

Here's how to capture errors, while suppressing the system errors and while generating a log file:

```
$ valgrind --suppressions=contrib/seq64.supp --leak-check=full \
   --track-origins=yes --log-file=valgrind.log --show-leak-kinds=all \
   ./Sequencer64/sequencer64
```

The errors can be also be re-routed to a log-file via the "2> valgrind.log" shell redirection.

Another idea is to precede the valgrind command with the following construct:

```
$ G_SLICE=debug-blocks valgrind ...
```

G_SLICE=debug-blocks will turn off gtk's advanced memory management to allow valgrind to show correct results. This results in an amazing plethora or invalid read and invalid write errors in GNOME-related libraries. Sheesh!

And don't forget about Valgrind's "massif" memory-tracking tool! (More to come!)

4.4.2.1 Leak-Checking Basic Operation

For the first pass, just run Sequencer64, then immediately exit. Then scan the log file to see if any "errors" can be pinpointed to the application and library code.

Don't forget to run the same scenario without valgrind, in a console window, to see if any of our own debug/problem output occurs.

In any case, leakage tagged as "still reachable" isn't as bad as leakage tagged as "definitely lost" or "indirectly lost".

But good luck finding a Sequencer64 bug buried in the chaff of 3rd-party valgrind reports, even with some suppressions enabled. Apparently a lot of them have to do with data structures that are intended to last the full life of the application.

One can make the search a little easier by searching for the "seq64" namespace in the valgrind log.

4.5 Specific Fault Debugging

This section goes through specific debugging cases we encountered. They should be part of the regular testing of Sequencer64.

4.6 Snipping of a MIDI file.

In order to have a test file for the *seq64-tests* project, we loaded up the `b4uacuse-GM-format.midi` file, removed all but four of the tracks, and saved it as `b4uacuse-snipped.midi`. Loading this file into Sequencer64 caused the following:

```
   $ ./Sequencer64/sequencer64
[Reading user configuration /home/ahlstrom/.config/sequencer64/sequencer64.usr]
[Reading rc configuration /home/ahlstrom/.config/sequencer64/sequencer64.rc]
get_sequence(): m_seqs[4] not null
Segmentation fault
```

First step, fire up a debugger and see what happened. We use *cgdb* , a text-based front-end for gdb with a "vi" feel.

```
   $ cgdb ./Sequencer64/sequencer64
```

Just hit "r", do *File / Open* , navigate to `b4uacuse-snipped.midi`, select it, and watch what happens.

The "bt" (backtrace) command shows a pretty large stack, 52 items. Page up to the top of the stack, and select frame 1 ("fr 1"). This shows a mutex at a very low address, 0x650! Frame 2 shows we are in the automutex constructor, calling lock() on that same badly-located mutex. Frame 3 is in sequence::event_count(), same bad mutex, and the m_events member is at address 0x0. Obviously, we're dealing with an unallocated sequence.

Frame 4 is in mainwid::draw_sequence_on_pixmap(), just after we've retrieved the next sequence via perform↩ ::get_sequence(4). But that would be the fifth sequence (the sequence numbers start at 0), and we snipped all but 4 from the file before we saved it.

So, one thing we need to do is *check* the value returned by get_sequence() before we try to use it. The other thing to do is figure out how we got to the fifth sequence, and fix that code as well. Using the command "p perf().↩ sequence_count()", we verify that there are indeed only 4 sequences allocated.

Frame 5 is in mainwid::draw_sequences_on_pixmap(). That function tries to load all sequences on the current screen-set, from 0 to 31, without checking to see how many their actually are. Inefficient and dangerous.

Frame 6 is in mainwid::reset(). We could pass perf().sequence_count() here for checking, or get it in mainwid↩ ::draw_sequences_on_pixmap().

Before we fix this issue, we need to load a file that works, to see why it does not fail for most files. We will put a breakpoint at the top mainwid::draw_sequences_on_pixmap().

We hit the breakpoint before even loading a file, with a sequence_count() of 0. The call to valid_sequence(0) passes the test. We may want to make valid_sequence() take the sequence_count() into account. But the call to perf().is_active(0) prevents anything bad from happening at startup time.

Once we load a good file, the sequence_count() is 14 in mainwid::draw_sequences_on_pixmap(). We turn on the display of "offset" using the command "display offset", and "c" (for "continue") until offset = 14, which means we are beyond that last sequence. That bad access is prevented by perf().is_active(14).

So the fundamental problem is that perf().is_active(4) is not protecting the access when we load the "bad file". We need to find and fix that issue before papering over the problem with better access checks.

Start again, putting a breakpoint in the call to "new sequence(m_ppqn)" in midifile. This call sets up some members and clears the list of 256 playing notes. Add another breakpoint at "a_perf.add_sequence()" to see what's happening there.

What we find is that the first two tracks have proper sequence numbers as read from the MIDI file, 0 and 1. But the third one preserves the number from the old file, 4. We have a disjunction between the track number and the sequence number, a conceptual problem. We can leave it as is, and beef up the error-checking, or replace the sequence number with the track number when loading the file. What to do?

- Make sure that the is-active flag for all sequences is "false", that the pointers are always null, and make sure to test both of these items (depending on context) before doing anything with the sequence.
- Convert the sequence number to the track number upon saving the MIDI file, or upon reading the MIDI file, and use that number when adding the sequence to the perform object. This might affect some seq24/sequencer64 functionality, however. It's big move.

We need information on reading and importing.

First, if we look at a file that we created long ago by importing `b4uacuse.mid`, `b4uacuse-GM-format.↩ midi`, it has its fourteen sequence numbers identical to their track numbers. No problem.

Second, if we just read `b4uacuse.mid`, a non-seq24-created MIDI file, we see that each of its tracks have no sequence number – they are all zero. The perform::add_sequence() simple iterates from the beginning of m_seqs[] until it finds an inactive m_seqs[i], and uses that element to hold the sequence pointer.

But now it also segfaults! Let's fix all the non-checked get_sequence() calls right away, it is too big an issue to ignore.

In the end, we have to be aware that a screen-set can have blank (null) slots interspersed amongst the active slots.

Chapter 5

Speed Issue of Sequencer64

Author(s) Chris Ahlstrom 2017-03-27

5.1 Introduction

This section describes some speed issues of Sequencer64. Early on in our reboot of *seq24*, we noticed that some of our larger files took a noticeable time to load. It was only a few seconds, but seemed like a long time for such small files. We fixed the issue using an alternate container implementation.

We recently added a large MIDI file to test, `b4uacuse-stress.midi`, and all hell broke loose.

5.2 Initial Change of Containers

In the beginning, we noticed that the MIDI container implementation used the `std::list` container, and also that it called `std::list::sort()` after each event was added to the container.

Our first thought was to replace the `std::list` with an `std::multimap`. Insertions into this container are made in the appropriate location (rather than at the end), and so are automatically sorted. We kept the old code around, but enabled the new multimap code via the `SEQ64_USE_EVENT_MAP` macro. This decreased the time of loading.

(It also exposed a small number of bugs that users of *Sequencer64* discovered and fixed.)

At the back of our minds was the possibility that the longer time needed to increment a multimap iterator versus a list iterator would prove to limit the amount of data that could be played back. Once we finally created a large file, `b4uacuse-stress.midi`, a 1.5 Mb file, we experienced the limitations of that iterator during playback. On our main development laptop, a near-gaming `Intel i7` machine, there were minor artifacts in playback. On our old single-core laptop with 32-bit `Debian` installed, the sequence would not play, and would continually and visibly refresh the main window display.

5.3 Back to the Original Container

So then we re-enabled the old *seq24* list implementation, and found that the time needed to load `b4uacuse-stress.midi` was over 6 minutes on our near-gamer laptop and 13 minutes on the single-core laptop.

So, we had to find a way to get the fast loading speed of the `std::multimap` and the faster speed of the `std::list` iterator. The obvious way was to go back to the `std::list` container and stop sorting the container after every insert, when loading the MIDI file.

This worked, but had some side-effects that had to be fixed. We found that the `sequence::verify_and_link` function required that the container be sorted first, and so we had to find the places where that function was called, and make sure that the sorting had occurred.

Anyway, the current configuration for the usage of `std::multimap` versus `std::list` and the sorting of the MIDI container after every event insertion versus after all the events are now permanent and hardwired. The default is to not use the event multimap, and to not presort events. This makes loading fast, and playback able to handle more sequences. One can also try to use the multimap, or use the list with pre-sorting, if bugs appear when building the application with the default setting. However, we really want to get the post-sorted list implementation to work, to get fast loading speed and higher throughput at the same time.

The other options are available as a fallback in case one gets struck by bugs in the default, and can afford slower loads or less throughput.

5.4 What is Next, the Vector?

Or, what's your vector, Victor?

For playback, the `std::vector` iterator can be even faster than the `std::list` iterator, because the vector does not use stored pointers to the next element, and, since its storage layout is essentially like a standard C array, processor caching can add even more to the speed of access.

However, this change will require carefully analysis and even more careful work to correctly implement the change. We will log this as a future improvement.

Actually, now we have reverted back to the `std::list` implementation, with the key difference that, when loading a file, we do not sort until we have read all of the events. So we get a fast load time and higher maximum throughput during playback.

Now to test the hell out of the next version!

Chapter 6

Licenses

Library This application and its libraries, sub-applications, and documents.

Author(s) Chris Ahlstrom 2015-09-10

6.1 License Terms for the This Project.

Wherever the tag $XPC_SUITE_GPL_LICENSE$ appears, or wherever reference to the GPL licensing scheme (any version) is mentioned, substitute the appropriate license text, depending on whether the project is a library, application, documentation, or server software. We're not going to include paragraphs of licensing information in every module; you are responsible for coming here to read the licensing information.

These licenses apply to each sub-project and file artifact in the project with which this license description was packaged.

Wherever the term **XPC** is encountered in this project, it refers to my projects, which go beyond the package that contains this document.

6.2 XPC Application License

The **XPC** application license is either the **GNU GPLv2**. or the **GNU GPLv3**. Generally, projects that originate with me use the latter language, while projects I have extended may specify the former license.

Copyright (C) 2015-2015 by Chris Ahlstrom

This program is free software; you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation; either version 3 of the License, or (at your option) any later version.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the

```
Free Software Foundation, Inc.
51 Franklin Street, Fifth Floor
Boston, MA 02110-1301, USA.
```

The text of the GNU GPL version 3 license can also be found here:

http://www.gnu.org/licenses/gpl-3.0.txt

6.3 XPC Library License

The **XPC** library license is the **GNU LGPLv3**.

Copyright (C) 2015-2015 by Chris Ahlstrom

This library is free software; you can redistribute it and/or modify it under the terms of the GNU Lesser General Public License as published by the Free Software Foundation; either version 3 of the License, or (at your option) any later version.

This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Lesser Public License for more details.

You should have received a copy of the GNU Lesser General Public License along with this library; if not, write to the

```
Free Software Foundation, Inc.
51 Franklin Street, Fifth Floor
Boston, MA 02110-1301, USA.
```

The text of the GNU LGPL version 3 license can also be found here:

http://www.gnu.org/licenses/lgpl-3.0.txt

6.4 XPC Documentation License

The **XPC** documentation license is the **GNU FDLv1.3**.

Copyright (C) 2015-2015 by Chris Ahlstrom

This documentation is free documentation; you can redistribute it and/or modify it under the terms of the GNU Free Documentation License as published by the Free Software Foundation; either version 1.3 of the License, or (at your option) any later version.

This documentation is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU Free Documentation License for more details.

You should have received a copy of the GNU Free Documentation License along with this documentation; if not, write to the

```
Free Software Foundation, Inc.
51 Franklin Street, Fifth Floor
Boston, MA 02110-1301, USA.
```

The text of the GNU FDL version 1.3 license can also be found here:

http://www.gnu.org/licenses/fdl.txt

6.5 XPC Affero License

The **XPC** "Affero" license is the **GNU AGPLv3**.

Copyright (C) 2015-2015 by Chris Ahlstrom

This server software is free server software; you can redistribute it and/or modify it under the terms of the GNU Affero General Public License as published by the Free Software Foundation; either version 1.3 of the License, or (at your option) any later version.

This documentation is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU Free Documentation License for more details.

You should have received a copy of the GNU Affero General Public License along with this server software; if not, write to the

```
Free Software Foundation, Inc.
51 Franklin Street, Fifth Floor
Boston, MA 02110-1301, USA.
```

The text of the GNU AGPL version 3 license can also be found here:

http://www.gnu.org/licenses/agpl-3.0.txt

At the present time, no **XPC** project uses the "Affero" license.

6.6 XPC License Summary

Include one of these licenses in your Doxygen documentation with one of the following Doxygen tags specified above:

```
\ref gpl_license_subproject
\ref gpl_license_application
\ref gpl_license_library
\ref gpl_license_documentation
\ref gpl_license_affero
```

For more information on navigating GNU licensing, see this page:

```
http://www.gnu.org/licenses/
```

Copies of these licenses (and some logos) are provided in the `licenses` directory of the main project (or you can search for them at *gnu.org*).

Chapter 7

Todo List

File calculations.cpp

There are additional user-interface and MIDI scaling variables in the perfroll module that we need to move here.

File perfnames.cpp

When bringing up this dialog, and starting play from it, some extra horizontal lines are drawn for some of the sequences. This happens even in seq24, so this is long standing behavior. Is it useful, and how? Where is it done? In perfroll?

Global seq64::editable_events::save_events ()

Consider what to do about the sequence::m_is_modified flag.

Global seq64::eventedit::handle_save ()

Could also support writing the events to a new sequence, for added flexibility.

Global seq64::mainwid::timeout ()

We should use this callback to display the current time in the playback.

Global seq64::mainwnd::mainwnd (perform &p, bool allowperf2=true, int ppqn=SEQ64_USE_DEFAULT_↩ PPQN)

Offload most of the work into an initialization function like options does; make the perform parameter a reference; valgrind flags m_tooltips as lost data, but if we try to manage it ourselves, many more leaks occur.

Global seq64::mainwnd::on_key_release_event (GdkEventKey ∗ev)

Test this functionality in old and new application.

Global seq64::midi_jack::api_sysex (event ∗e24)

Flesh out this routine.

Global seq64::perfedit::perfedit (perform &p, bool second_perfedit=false, int ppqn=SEQ64_USE_DEFAU↩ LT_PPQN)

Offload most of the work into an initialization function like options does.

Global seq64::perform::add_sequence (sequence ∗seq, int perf)

Shouldn't we wrap around the sequence list if we can't find an empty sequence slot after prefnum?

This function needs some deeper analysis against the original, in my opinion.

Global seq64::perform::launch (int ppqn)

We probably need a bpm parameter for consistency at some point.

Global seq64::perform::m_seqs [c_max_sequence]

First, make the sequence array a vector, and second, put allof these flags into a structure and access those members indirectly.

Global seq64::perform::pop_trigger_undo ()

Look at seq32/src/perform.cpp and the perform :: push_trigger_undo(track) function, which has a track parameter that has a -1 values the supports all tracks. It requires two new vectors (one for undo, one for redo), two new flags (likewise). We've put this code in place, no longer macroed out, now permanent.

Global seq64::perform::set_left_tick (midipulse tick, bool setstart=true)

The perform::m_one_measure member is currently hardwired to PPQN ∗ 4.

Global seq64::perfroll::set_ppqn (int ppqn)

Resolve the issue of c_perf_scale_x versus m_perf_scale_x in perfroll.

Global seq64::perftime::set_ppqn (int ppqn)

We need make the 4 constant variable per the number of beats (quarter-notes) per bar, and also at least make 16 (4x4) a meaningful manifest constant.

Global seq64::pulses_to_string (midipulse p)

Still needs to be unit tested.

Global seq64::pulses_to_timestring (midipulse p, const midi_timing &timinginfo)

Still needs to be unit tested.

Global seq64::seqdata::on_scroll_event (GdkEventScroll ∗ev)

DOCUMENT the seqdata scrolling behavior in the documentation projects.

Global seq64::seqedit::get_measures ()

Create a sequence::set_units() function or a sequence::get_measures() function to forward to.

Global seq64::seqedit::seqedit (perform &perf, sequence &seq, int pos, int ppqn=SEQ64_USE_DEFAULT↩ _PPQN)

Offload most of the work into an initialization function like options does.

Global seq64::seqedit::set_beat_width (int bw)

Check if verification is needed at this point.

Global seq64::seqedit::set_beats_per_bar (int bpm)

Check if verification is needed at this point.

Global seq64::seqedit::set_measures (int lim)

Check if verification is needed at this point.

Global seq64::seqmenu::m_modified

We need to make sure that the perform object is in control of the modification flag.

Global seq64::seqmenu::seq_copy ()

Can be offloaded to a perform member function that accepts a sequence clipboard non-const reference parameter.

Global seq64::seqmenu::seq_cut ()

A lot of seq_cut() can be offloaded to a (new) perform member function that takes a sequence clipboard non-const reference parameter.

Global seq64::seqmenu::seq_paste ()

All of seq_paste() can be offloaded to a (new) perform member function with a const clipboard reference parameter.

Global seq64::seqtime::update_pixmap ()

Sizing needs to be controlled by font parameters. Instead of 19 or 20, estimate the width of 3 letters. Instead of 9 pixels down, use the height of the seqtime and the height of a character.

Global seq64::sequence::add_chord (int chord, midipulse tick, midipulse len, int note)

Add the ability to preserve the incoming velocity.

Global seq64::sequence::get_minmax_note_events (int &lowest, int &highest)

For efficency, we should calculate this only when the event set changes, and save the results and return them if good.

Global seq64::sequence::stream_event (event &ev)

When we feel like debugging, we will replace the global is-playing call with the parent perform's is-running call.

Global seq64::triggers::next (midipulse *tick_on, midipulse *tick_off, bool *selected, midipulse *tick_offset)

It would be a bit simpler to simply return a trigger object, wouldn't it?

Chapter 8

Deprecated List

Global seq64::clock_tick_duration_bogus (midibpm bpm, int ppqn)

This is a somewhat bogus calculation used only for "statistical" output in the old perform module. Name changed to reflect this unfortunate fact. Use pulse_length_us() instead.

Global seq64::sequence::get_name () const

Chapter 9

Namespace Index

9.1 Namespace List

Here is a list of all namespaces with brief descriptions:

Gtk 49
seq64
Define this macro to use the new seq24 v 49

Chapter 10

Hierarchical Index

10.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

seq64::AbstractPerfInput . . . 135
  seq64::FruityPerfInput . . . 265
  seq64::Seq24PerfInput . . . 856
seq64::automutex . . . 139
seq64::busarray . . . 140
seq64::businfo . . . 150
seq64::click . . . 156
seq64::configfile . . . 163
  seq64::optionsfile . . . 649
  seq64::userfile . . . 1124
Dialog
  seq64::options . . . 642
DrawingArea
  seq64::gui_palette_gtk2 . . . 300
    seq64::gui_drawingarea_gtk2 . . . 282
      seq64::eventslots . . . 241
      seq64::maintime . . . 397
      seq64::mainwid . . . 402
      seq64::perfnames . . . 672
      seq64::perfroll . . . 768
      seq64::perftime . . . 788
      seq64::seqdata . . . 862
      seq64::seqevent . . . 908
      seq64::seqkeys . . . 922
      seq64::seqroll . . . 947
      seq64::seqtime . . . 980
seq64::editable_events . . . 181
Entry
  seq64::keybindentry . . . 343
seq64::event . . . 190
  seq64::editable_event . . . 167
seq64::event_list::event_key . . . 211
seq64::event_list . . . 213
exception

seq64::rterror . . . 823
seq64::font . . . 260
seq64::FruitySeqEventInput . . . 271
seq64::FruitySeqRollInput . . . 274
seq64::gui_assistant . . . 276
seq64::gui_assistant_gtk2 . . . 279
seq64::jack_assistant . . . 316
seq64::jack_scratchpad . . . 340
seq64::jack_status_pair_t . . . 342
seq64::keys_perform . . . 346
seq64::keys_perform_gtk2 . . . 376
seq64::keys_perform_transfer . . . 379
seq64::keystroke . . . 383
seq64::lash . . . 388
seq64::mastermidibase . . . 438
seq64::mastermidibus . . . 460
seq64::mastermidibus . . . 460
seq64::midi_container . . . 495
seq64::midi_list . . . 549
seq64::midi_vector . . . 581
seq64::midi_control . . . 504
seq64::midi_info . . . 515
seq64::midi_alsa_info . . . 479
seq64::midi_jack_info . . . 542
seq64::midi_jack_data . . . 539
seq64::midi_measures . . . 553
seq64::midi_message . . . 556
seq64::midi_port_info . . . 564
seq64::midi_queue . . . 568
seq64::midi_splitter . . . 571
seq64::midi_timing . . . 577
seq64::midibase . . . 585
seq64::midi_api . . . 485
seq64::midi_alsa . . . 469
seq64::midi_in_alsa . . . 509
seq64::midi_out_alsa . . . 559
seq64::midi_jack . . . 526
seq64::midi_in_jack . . . 511
seq64::midi_out_jack . . . 561
seq64::rtmidi . . . 826
seq64::rtmidi_in . . . 834
seq64::rtmidi_out . . . 854
seq64::midibus . . . 607
seq64::midibus . . . 607
seq64::midifile . . . 619
seq64::mutex . . . 640
seq64::condition_var . . . 161
seq64::editable_event::name_value_t . . . 641
ObjectBase
seq64::seqmenu . . . 934
seq64::mainwid . . . 402
seq64::perfnames . . . 672
seq64::perform . . . 680
seq64::performcallback . . . 766
seq64::mainwnd . . . 417

seq64::midi_port_info::port_info_t . . . 797
seq64::rc_settings . . . 799
seq64::rect . . . 821
seq64::gui_drawingarea_gtk2::rect . . . 822
seq64::rtmidi_in_data . . . 838
seq64::rtmidi_info . . . 843
seq64::Seq24SeqEventInput . . . 860
seq64::sequence . . . 986
seq64::trigger . . . 1057
seq64::triggers . . . 1061
seq64::user_instrument . . . 1078
seq64::user_instrument_t . . . 1082
seq64::user_midi_bus . . . 1083
seq64::user_midi_bus_t . . . 1088
seq64::user_settings . . . 1088
Window
  seq64::gui_window_gtk2 . . . 312
    seq64::eventedit . . . 225
    seq64::lfownd . . . 392
    seq64::mainwnd . . . 417
    seq64::perfedit . . . 653
    seq64::seqedit . . . 875

Chapter 11

Data Structure Index

11.1 Data Structures

Here are the data structures with brief descriptions:

seq64::AbstractPerfInput
: Provides an abstract base class to provide the minimal interface for the various "perf input" classes . . . 135

seq64::automutex
: Provides a mutex that locks automatically when created, and unlocks when destroyed . . . 139

seq64::busarray
: Holds a number of businfo objects . . . 140

seq64::businfo
: A new class to consolidate a number of bus-related arrays into one array . . . 150

seq64::click
: Encapsulates any possible mouse click . . . 156

seq64::condition_var
: A mutex works best in conjunction with a condition variable . . . 161

seq64::configfile
: This class is the abstract base class for optionsfile and userfile . . . 163

seq64::editable_event
: Provides for the management of MIDI editable events . . . 167

seq64::editable_events
: Provides for the management of an ordered collection MIDI editable events . . . 181

seq64::event
: Provides events for management of MIDI events . . . 190

seq64::event_list::event_key
: Provides a key value for an event map . . . 211

seq64::event_list
: Receptable for MIDI events . . . 213

seq64::eventedit
: This class supports an Event Editor that is used to tweak the details of events and get a better idea of the mix of events in a sequence . . . 225

seq64::eventslots
: This class implements the left-side list of events in the pattern event-edit window . . . 241

seq64::font
: This class provides a wrapper for rendering fonts that are encoded as a 16 x 16 pixmap file in XPM format . . . 260

seq64::FruityPerfInput
: Implements the performance input of that certain fruity sequencer that people seem to like . . . 265

seq64::FruitySeqEventInput
This structure implements the interaction methods for the "fruity" mode of operation 271
seq64::FruitySeqRollInput
Implements the fruity mouse interaction paradigm for the seqroll 274
seq64::gui_assistant
This class provides an interface for some of the GUI support needed in Sequencer64 276
seq64::gui_assistant_gtk2
This class provides an interface for some of the Gtk/Gdk/Glib support needed in Sequencer64 279
seq64::gui_drawingarea_gtk2
Implements the basic drawing areas of the application 282
seq64::gui_palette_gtk2
Implements a stock palette of Gdk::Color elements 300
seq64::gui_window_gtk2
This class supports a basic interface for Gtk::Window-derived objects 312
seq64::jack_assistant
This class provides the performance mode JACK support 316
seq64::jack_scratchpad
Provide a temporary structure for passing data and results between a perform and jack_assistant object 340
seq64::jack_status_pair_t
Provides an internal type to make it easier to display a specific and accurate human-readable message when a JACK operation fails 342
seq64::keybindentry
Class for management of application key-bindings 343
seq64::keys_perform
This class supports the performance mode 346
seq64::keys_perform_gtk2
This class supports the performance mode 376
seq64::keys_perform_transfer
Provides a data-transfer structure to make it easier to fill in a keys_perform object's members using sscanf() 379
seq64::keystroke
Encapsulates any practical keystroke 383
seq64::lash
This class supports LASH operations, if compiled with LASH support (i.e 388
seq64::lfownd
One LFO window class 392
seq64::maintime
This class provides the drawing of the progress bar at the top of the main window, along with two "pills" that move in time with the beat and measure 397
seq64::mainwid
This class implements the piano roll area of the application 402
seq64::mainwnd
This class implements the functionality of the main window of the application, except for the Patterns Panel functionality, which is implemented in the mainwid class 417
seq64::mastermidibase
The class that "supervises" all of the midibus objects? 438
seq64::mastermidibus
The class that "supervises" all of the midibus objects 460
seq64::midi_alsa
This class implements the ALSA version of the midi_api 469
seq64::midi_alsa_info
The class for handling ALSA MIDI input 479
seq64::midi_api
Subclasses of midi_in_api and midi_out_api contain all API- and OS-specific code necessary to fully implement the rtmidi API 485
seq64::midi_container
This class is the abstract base class for a container of MIDI track information 495

seq64::midi_control
This class (formerly a struct) contains the control information for sequences that make up a live set . . . 504
seq64::midi_in_alsa
This class implements the ALSA version of a MIDI input object . . . 509
seq64::midi_in_jack
The class for handling JACK MIDI input . . . 511
seq64::midi_info
The class for holding basic information on the MIDI input and output ports currently present in the system . . . 515
seq64::midi_jack
This class implements with JACK version of the midi_alsa object . . . 526
seq64::midi_jack_data
Contains the JACK MIDI API data as a kind of scratchpad for this object . . . 539
seq64::midi_jack_info
The class for handling JACK MIDI port enumeration . . . 542
seq64::midi_list
This class is the std::list implementation of the midi_container . . . 549
seq64::midi_measures
Provides a data structure to hold the numeric equivalent of the measures string "measures:beats:divisions" ("m:b:d") . . . 553
seq64::midi_message
Provides a handy capsule for a MIDI message, based on the std::vector<unsigned char> data type from the RtMidi project . . . 556
seq64::midi_out_alsa
This class implements the ALSA version of a MIDI output object . . . 559
seq64::midi_out_jack
The JACK MIDI output API class . . . 561
seq64::midi_port_info
A class for holding port information . . . 564
seq64::midi_queue
Provides a queue of midi_message structures . . . 568
seq64::midi_splitter
This class handles the parsing and writing of MIDI files . . . 571
seq64::midi_timing
We anticipate the need to have a small structure holding the parameters needed to calculate MIDI times within an arbitrary song . . . 577
seq64::midi_vector
This class is the std::vector implementation of the midi_container . . . 581
seq64::midibase
This class implements with ALSA version of the midibase object . . . 585
seq64::midibus
This class implements with ALSA version of the midibus object . . . 607
seq64::midifile
This class handles the parsing and writing of MIDI files . . . 619
seq64::mutex
Simple wrapper for the pthread_mutex_t type used as a recursive mutex . . . 640
seq64::editable_event::name_value_t
Provides a type that contains the pair of values needed for the various lookup maps that are needed to manage editable events . . . 641
seq64::options
This class supports a full tabbed options dialog . . . 642
seq64::optionsfile
Provides a file for reading and writing the application' main configuration file . . . 649
seq64::perfedit
This class supports a Performance Editor that is used to arrange the patterns/sequences defined in the patterns panel . . . 653

seq64::perfnames
This class implements the left-side keyboard in the patterns window . . . 672
seq64::perform
This class supports the performance mode . . . 680
seq64::performcallback
Provides for notification of events . . . 766
seq64::perfroll
This class implements the performance roll user interface . . . 768
seq64::perftime
This class implements drawing the piano time at the top of the "performance window" (the "song editor") . . . 788
seq64::midi_port_info::port_info_t
Hold the information for a single port . . . 797
seq64::rc_settings
This class contains the options formerly named "global_xxxxxx" . . . 799
seq64::rect
A small helper class representing a rectangle . . . 821
seq64::gui_drawingarea_gtk2::rect
A small helper structure representing a rectangle . . . 822
seq64::rterror
Exception handling class for rtexmidi . . . 823
seq64::rtmidi
The main class of the rtmidi API . . . 826
seq64::rtmidi_in
A realtime MIDI input class . . . 834
seq64::rtmidi_in_data
The rtmidi_in_data structure is used to pass private class data to the MIDI input handling function or thread . . . 838
seq64::rtmidi_info
A class for enumerating MIDI clients and ports . . . 843
seq64::rtmidi_out
A realtime MIDI output class . . . 854
seq64::Seq24PerfInput
Implements the default (Seq24) performance input characteristics of this application . . . 856
seq64::Seq24SeqEventInput
This structure implement the normal interaction methods for Seq24 . . . 860
seq64::seqdata
This class supports drawing piano-roll eventis on a window . . . 862
seq64::seqedit
Implements the Pattern Editor, which has references to: . . . 875
seq64::seqevent
Implements the piano event drawing area . . . 908
seq64::seqkeys
This class implements the left side piano of the pattern/sequence editor . . . 922
seq64::seqmenu
This class handles the right-click menu of the sequence slots in the pattern window . . . 934
seq64::seqroll
Implements the piano roll section of the pattern editor . . . 947
seq64::seqtime
This class implements the piano time, whatever that is . . . 980
seq64::sequence
Firstly a receptable for a single track of MIDI data read from a MIDI file or edited into a pattern 986
seq64::trigger
This class hold a single trigger for a sequence object . . . 1057
seq64::triggers
Receptable the triggers that can be used with a sequence object . . . 1061
seq64::user_instrument
Provides data about the MIDI instruments, readable from the "user" configuration file . . . 1078

seq64::user_instrument_t
This structure corresponds to [user-instrument-N] definitions in the ~/.seq24usr or ~/.config/sequencer64/sequencer64.usr file 1082
seq64::user_midi_bus
Provides data about the MIDI busses, readable from the "user" configuration file 1083
seq64::user_midi_bus_t
This structure corresponds to [user-midi-bus-0] definitions in the ~/.seq24usr ("user") file (~/.config/sequencer64/sequencer64.usr in the latest version of the application) 1088
seq64::user_settings
Holds the current values of sequence settings and settings that can modify the number of sequences and the configuration of the user-interface 1088
seq64::userfile
Supports the user's ~/.config/sequencer64/sequencer64.usr and ~/.seq24usr configuration file 1124

Chapter 12

Namespace Documentation

12.1 Gtk Namespace Reference

12.2 seq64 Namespace Reference

Define this macro to use the new seq24 v.

Data Structures

- class AbstractPerfInput

  Provides an abstract base class to provide the minimal interface for the various "perf input" classes.
- class automutex

  Provides a mutex that locks automatically when created, and unlocks when destroyed.
- class busarray

  Holds a number of businfo objects.
- class businfo

  A new class to consolidate a number of bus-related arrays into one array.
- class click

  Encapsulates any possible mouse click.
- class condition_var

  A mutex works best in conjunction with a condition variable.
- class configfile

  This class is the abstract base class for optionsfile and userfile.
- class editable_event

  Provides for the management of MIDI editable events.
- class editable_events

  Provides for the management of an ordered collection MIDI editable events.
- class event

  Provides events for management of MIDI events.
- class event_list

  The event_list class is a receptable for MIDI events.
- class eventedit

  This class supports an Event Editor that is used to tweak the details of events and get a better idea of the mix of events in a sequence.

- class eventslots

  This class implements the left-side list of events in the pattern event-edit window.
- class font

  This class provides a wrapper for rendering fonts that are encoded as a 16 x 16 pixmap file in XPM format.
- class FruityPerfInput

  Implements the performance input of that certain fruity sequencer that people seem to like.
- struct FruitySeqEventInput

  This structure implements the interaction methods for the "fruity" mode of operation.
- class FruitySeqRollInput

  Implements the fruity mouse interaction paradigm for the seqroll.
- class gui_assistant

  This class provides an interface for some of the GUI support needed in Sequencer64.
- class gui_assistant_gtk2

  This class provides an interface for some of the Gtk/Gdk/Glib support needed in Sequencer64.
- class gui_drawingarea_gtk2

  Implements the basic drawing areas of the application.
- class gui_palette_gtk2

  Implements a stock palette of Gdk::Color elements.
- class gui_window_gtk2

  This class supports a basic interface for Gtk::Window-derived objects.
- class jack_assistant

  This class provides the performance mode JACK support.
- class jack_scratchpad

  Provide a temporary structure for passing data and results between a perform and jack_assistant object.
- struct jack_status_pair_t

  Provides an internal type to make it easier to display a specific and accurate human-readable message when a JACK operation fails.
- class keybindentry

  Class for management of application key-bindings.
- class keys_perform

  This class supports the performance mode.
- class keys_perform_gtk2

  This class supports the performance mode.
- struct keys_perform_transfer

  Provides a data-transfer structure to make it easier to fill in a keys_perform object's members using sscanf().
- class keystroke

  Encapsulates any practical keystroke.
- class lash

  This class supports LASH operations, if compiled with LASH support (i.e.
- class lfownd

  One LFO window class.
- class maintime

  This class provides the drawing of the progress bar at the top of the main window, along with two "pills" that move in time with the beat and measure.
- class mainwid

  This class implements the piano roll area of the application.
- class mainwnd

  This class implements the functionality of the main window of the application, except for the Patterns Panel functionality, which is implemented in the mainwid class.
- class mastermidibase

  The class that "supervises" all of the midibus objects?

- class mastermidibus

  The class that "supervises" all of the midibus objects.
- class midi_alsa

  This class implements the ALSA version of the midi_api.
- class midi_alsa_info

  The class for handling ALSA MIDI input.
- class midi_api

  Subclasses of midi_in_api and midi_out_api contain all API- and OS-specific code necessary to fully implement the rtmidi API.
- class midi_container

  This class is the abstract base class for a container of MIDI track information.
- class midi_control

  This class (formerly a struct) contains the control information for sequences that make up a live set.
- class midi_in_alsa

  This class implements the ALSA version of a MIDI input object.
- class midi_in_jack

  The class for handling JACK MIDI input.
- class midi_info

  The class for holding basic information on the MIDI input and output ports currently present in the system.
- class midi_jack

  This class implements with JACK version of the midi_alsa object.
- struct midi_jack_data

  Contains the JACK MIDI API data as a kind of scratchpad for this object.
- class midi_jack_info

  The class for handling JACK MIDI port enumeration.
- class midi_list

  This class is the std::list implementation of the midi_container.
- class midi_measures

  Provides a data structure to hold the numeric equivalent of the measures string "measures:beats:divisions" ("m:b:d").
- class midi_message

  Provides a handy capsule for a MIDI message, based on the std::vector<unsigned char> data type from the RtMidi project.
- class midi_out_alsa

  This class implements the ALSA version of a MIDI output object.
- class midi_out_jack

  The JACK MIDI output API class.
- class midi_port_info

  A class for holding port information.
- class midi_queue

  Provides a queue of midi_message structures.
- class midi_splitter

  This class handles the parsing and writing of MIDI files.
- class midi_timing

  We anticipate the need to have a small structure holding the parameters needed to calculate MIDI times within an arbitrary song.
- class midi_vector

  This class is the std::vector implementation of the midi_container.
- class midibase

  This class implements with ALSA version of the midibase object.
- class midibus

  This class implements with ALSA version of the midibus object.

- class midifile

  This class handles the parsing and writing of MIDI files.
- class mutex

  The mutex class provides a simple wrapper for the pthread_mutex_t type used as a recursive mutex.
- class options

  This class supports a full tabbed options dialog.
- class optionsfile

  Provides a file for reading and writing the application' main configuration file.
- class perfedit

  This class supports a Performance Editor that is used to arrange the patterns/sequences defined in the patterns panel.
- class perfnames

  This class implements the left-side keyboard in the patterns window.
- class perform

  This class supports the performance mode.
- struct performcallback

  Provides for notification of events.
- class perfroll

  This class implements the performance roll user interface.
- class perftime

  This class implements drawing the piano time at the top of the "performance window" (the "song editor").
- class rc_settings

  This class contains the options formerly named "global_xxxxxx".
- class rect

  A small helper class representing a rectangle.
- class rterror

  Exception handling class for rtexmidi.
- class rtmidi

  The main class of the rtmidi API.
- class rtmidi_in

  A realtime MIDI input class.
- class rtmidi_in_data

  The rtmidi_in_data structure is used to pass private class data to the MIDI input handling function or thread.
- class rtmidi_info

  A class for enumerating MIDI clients and ports.
- class rtmidi_out

  A realtime MIDI output class.
- class Seq24PerfInput

  Implements the default (Seq24) performance input characteristics of this application.
- struct Seq24SeqEventInput

  This structure implement the normal interaction methods for Seq24.
- class seqdata

  This class supports drawing piano-roll eventis on a window.
- class seqedit

  Implements the Pattern Editor, which has references to:
- class seqevent

  Implements the piano event drawing area.
- class seqkeys

  This class implements the left side piano of the pattern/sequence editor.
- class seqmenu

  This class handles the right-click menu of the sequence slots in the pattern window.

- class seqroll

  Implements the piano roll section of the pattern editor.
- class seqtime

  This class implements the piano time, whatever that is.
- class sequence

  The sequence class is firstly a receptable for a single track of MIDI data read from a MIDI file or edited into a pattern.
- class trigger

  This class hold a single trigger for a sequence object.
- class triggers

  The triggers class is a receptable the triggers that can be used with a sequence object.
- class user_instrument

  Provides data about the MIDI instruments, readable from the "user" configuration file.
- struct user_instrument_t

  This structure corresponds to `[user-instrument-N]` definitions in the `~/.seq24usr` or `~/.config/sequencer64/seq24usr` file.
- class user_midi_bus

  Provides data about the MIDI busses, readable from the "user" configuration file.
- struct user_midi_bus_t

  This structure corresponds to `[user-midi-bus-0]` definitions in the `~/.seq24usr` ("user") file (`~/.config/sequencer64/sequencer64.usr` in the latest version of the application).
- class user_settings

  Holds the current values of sequence settings and settings that can modify the number of sequences and the configuration of the user-interface.
- class userfile

  Supports the user's `~/.config/sequencer64/sequencer64.usr` and `~/.seq24usr` configuration file.

Typedefs

- typedef unsigned char midibyte

  Provides a fairly common type definition for a byte value.
- typedef unsigned char bussbyte

  Distinguishes a buss/bus number from other MIDI bytes.
- typedef unsigned short midishort

  Distinguishes a short value from the unsigned short values implicit in short-valued MIDI numbers.
- typedef unsigned long midilong

  Distinguishes a long value from the unsigned long values implicit in long-valued MIDI numbers.
- typedef long midipulse

  Distinguishes a long value from the unsigned long values implicit in MIDI time measurements.
- typedef double midibpm

  Provides the data type for BPM (beats per minute) values.
- typedef void(∗ rterror_callback) (rterror::Type type, const std::string &errormsg, void ∗userdata)

  rtmidi error callback function prototype.
- typedef void(∗ rtmidi_callback_t) (midi_message &message, void ∗userdata)

  MIDI caller callback function type definition.

Enumerations

- enum wave_type_t {
  WAVE_NONE,
  WAVE_SINE,
  WAVE_SAWTOOTH,
  WAVE_REVERSE_SAWTOOTH,
  WAVE_TRIANGLE }

  Provides a clear enumation of wave types supported by the wave function.
- enum seq_modifier_t {
  SEQ64_NO_MASK,
  SEQ64_SHIFT_MASK,
  SEQ64_LOCK_MASK,
  SEQ64_CONTROL_MASK,
  SEQ64_MOD1_MASK,
  SEQ64_MOD2_MASK,
  SEQ64_MOD3_MASK,
  SEQ64_MOD4_MASK,
  SEQ64_MOD5_MASK,
  SEQ64_BUTTON1_MASK,
  SEQ64_BUTTON2_MASK,
  SEQ64_BUTTON3_MASK,
  SEQ64_BUTTON4_MASK,
  SEQ64_BUTTON5_MASK,
  SEQ64_SUPER_MASK,
  SEQ64_HYPER_MASK,
  SEQ64_META_MASK,
  SEQ64_RELEASE_MASK,
  SEQ64_MASK_MAX }

  Types of modifiers, essentially copied from gtk-2.0/gdk/gdktypes.h.
- enum seq_event_type_t {
  SEQ64_NOTHING,
  SEQ64_DELETE,
  SEQ64_DESTROY,
  SEQ64_EXPOSE,
  SEQ64_MOTION_NOTIFY,
  SEQ64_BUTTON_PRESS,
  SEQ64_2BUTTON_PRESS,
  SEQ64_3BUTTON_PRESS,
  SEQ64_BUTTON_RELEASE,
  SEQ64_KEY_PRESS,
  SEQ64_KEY_RELEASE,
  SEQ64_SCROLL,
  SEQ64_EVENT_LAST }

  Event types copped from gtk-2.0/gdk/gdkevents.h for use with this application.
- enum seq_scroll_direction_t {
  SEQ64_SCROLL_UP,
  SEQ64_SCROLL_DOWN,
  SEQ64_SCROLL_LEFT,
  SEQ64_SCROLL_RIGHT }

  Types of scroll events, essentially copied from gtk-2.0/gdk/gdkevents.h.
- enum clock_e {
  e_clock_off,
  e_clock_pos,
  e_clock_mod }

  A clock enumeration, as used in the File / Options / MIDI Clock dialog.

- enum interaction_method_t {
  e_seq24_interaction,
  e_fruity_interaction,
  e_number_of_interactions }

  Provides codes for the mouse-handling used by the application.
- enum c_music_scales {
  c_scale_off,
  c_scale_major,
  c_scale_minor,
  c_scale_harmonic_minor,
  c_scale_melodic_minor,
  c_scale_c_whole_tone,
  c_scale_blues,
  c_scale_major_pentatonic,
  c_scale_minor_pentatonic,
  c_scale_size }

  Corresponds to the small number of musical scales that the application can handle.
- enum draw_type_t {
  DRAW_FIN,
  DRAW_NORMAL_LINKED,
  DRAW_NOTE_ON,
  DRAW_NOTE_OFF }

  Provides a set of methods for drawing certain items.
- enum mouse_action_e {
  e_action_select,
  e_action_draw,
  e_action_grow }

  Mouse actions, for the Pattern Editor.
- enum edit_action_t {
  c_select_all_notes,
  c_select_all_events,
  c_select_inverse_notes,
  c_select_inverse_events,
  c_quantize_notes,
  c_quantize_events,
  c_tighten_events,
  c_tighten_notes,
  c_transpose_notes,
  c_reserved,
  c_transpose_h,
  c_expand_pattern,
  c_compress_pattern,
  c_select_even_notes,
  c_select_odd_notes,
  c_swing_notes }

  Actions.
- enum rtmidi_api {
  RTMIDI_API_UNSPECIFIED,
  RTMIDI_API_LINUX_ALSA,
  RTMIDI_API_UNIX_JACK,
  RTMIDI_API_MAXIMUM }

  MIDI API specifier arguments.

Functions

- void swap (busarray &buses0, busarray &buses1)

This free function swaps the contents of two busarray objects.

- std::string wave_type_name (wave_type_t wavetype)

  Converts a wave type value to a string.

- bool extract_timing_numbers (const std::string &s, std::string &part_1, std::string &part_2, std::string &part_3, std::string &fraction)

  Extracts up to 4 numbers from a colon-delimited string.

- std::string pulses_to_string (midipulse p)

  Converts MIDI pulses (also known as ticks, clocks, or divisions) into a string.

- std::string pulses_to_measurestring (midipulse p, const midi_timing &seqparms)

  Converts a MIDI pulse/ticks/clock value into a string that represents "measures:beats:ticks" ("measures:beats:division").

- bool pulses_to_midi_measures (midipulse p, const midi_timing &seqparms, midi_measures &measures)

  Converts a MIDI pulse/ticks/clock value into a string that represents "measures:beats:ticks" ("measures:beats:division").

- std::string pulses_to_timestring (midipulse p, midibpm bpm, int ppqn)

  Converts a MIDI pulse/ticks/clock value into a string that represents "hours:minutes:seconds.fraction".

- std::string pulses_to_timestring (midipulse p, const midi_timing &timinginfo)

  Converts a MIDI pulse/ticks/clock value into a string that represents "hours:minutes:seconds.fraction".

- midipulse measurestring_to_pulses (const std::string &measures, const midi_timing &seqparms)

  Converts a string that represents "measures:beats:division" to a MIDI pulse/ticks/clock value.

- midipulse midi_measures_to_pulses (const midi_measures &measures, const midi_timing &seqparms)

  Converts a string that represents "measures:beats:division" to a MIDI pulse/ticks/clock value.

- midipulse timestring_to_pulses (const std::string &timestring, int bpm, int ppqn)
- midipulse string_to_pulses (const std::string &s, const midi_timing &mt)

  Converts a time string to pulses.

- midibyte string_to_midibyte (const std::string &s)

  Converts a string to a MIDI byte.

- std::string shorten_file_spec (const std::string &fpath, int leng)

  Shortens a file-specification to make sure it is no longer than the provided length value.

- bool string_not_void (const std::string &s)

  Tests that a string is not empty and has non-space characters.

- bool string_is_void (const std::string &s)

  Tests that a string is empty or has only white-space characters.

- bool strings_match (const std::string &target, const std::string &x)

  Compares two strings for a form of semantic equality, for the purposes of editable_event(), for example.

- int log2_time_sig_value (int tsd)

  Calculates the log-base-2 value of a number that is already a power of 2.

- void tempo_us_to_bytes (midibyte t[3], int tempo_us)

  Provide a way to convert a tempo value (microseconds per quarter note) into the three bytes needed as value in a Tempo meta event.

- int zoom_power_of_2 (int ppqn)

  Calculates a suitable starting zoom value for the given PPQN value.

- double bpm_from_tempo_us (double tempous)

  This function calculates the effective beats-per-minute based on the value of a Tempo meta-event.

- double tempo_us_from_bpm (midibpm bpm)

  Converts tempo (e.g.

- double pulse_length_us (midibpm bpm, int ppqn)

  Calculates pulse-length from the BPM (beats-per-minute) and PPQN (pulses-per-quarter-note) values.

- double delta_time_us_to_ticks (unsigned long us, midibpm bpm, int ppqn)

  Converts delta time in microseconds to ticks.

- double ticks_to_delta_time_us (midipulse delta_ticks, midibpm bpm, int ppqn)

Converts the time in ticks ("clocks") to delta time in microseconds.

- double clock_tick_duration_bogus (midibpm bpm, int ppqn)

  Calculates the duration of a clock tick based on PPQN and BPM settings.
- int clock_ticks_from_ppqn (int ppqn)

  A simple calculation to convert PPQN to MIDI clock ticks.
- double double_ticks_from_ppqn (int ppqn)

  A simple calculation to convert PPQN to MIDI clock ticks.
- midipulse pulses_per_measure (int ppqn=SEQ64_DEFAULT_PPQN)

  Calculates the pulses per measure.
- midipulse measures_to_ticks (midibpm bpm, int ppqn, int bw, int measures=1)

  Calculates the length of an integral number of measures, in ticks.
- double wave_func (double angle, wave_type_t wavetype)

  Calculates a wave function for use as an LFO (low-frequency oscillator) for modifying data values in a sequence.
- bool extract_port_names (const std::string &fullname, std::string &clientname, std::string &portname)

  Extracts the two names from the ALSA/JACK client/port name format, "[0] 128:0 clientname:portname".
- std::string extract_bus_name (const std::string &fullname)

  Extracts the buss name from "bus:port".
- std::string extract_port_name (const std::string &fullname)

  Extracts the port name from "bus:port".
- bool help_check (int argc, char ∗argv [])

  Checks to see if the first option is a help or version argument, just so we can skip the "Reading configuration ..." messages.
- bool parse_options_files (perform &p, std::string &errmessage, int argc, char ∗argv [])

  Provides the command-line option support, as well as some setup support, extracted from the main routine of Sequencer64.
- bool parse_mute_groups (perform &p, std::string &errmessage)

  Like parse_options_files(), but reads only the [mute-group] section.
- bool process_o_options (int argc, char ∗argv [])

  Checks the putative command-line arguments for any of the new "options" options.
- int parse_command_line_options (perform &p, int argc, char ∗argv [])

  Parses the command-line options on behalf of the application.
- bool write_options_files (const perform &p)

  Saves all options to the "rc" and "user" configuration files.
- std::string build_details ()

  Generates a string describing the features of the build.
- std::string message_concatenate (const char ∗m1, const char ∗m2)

  This function concatenates two C string pointers and returns them as a string message.
- bool info_message (const std::string &msg)

  Common-code for console messages.
- bool error_message (const std::string &msg)

  Common-code for error messages.
- bool is_note_off_velocity (midibyte status, midibyte data)

  This free function is used in the midifile module and in the event::is_note_off_recorded() member function.
- std::string to_string (const event &ev)

  A free function to convert an event into an informative string, just enough to save some debugging time.
- bool file_access (const std::string &targetfile, int mode)
- bool file_exists (const std::string &filename)

  Checks a file for existence.
- bool file_readable (const std::string &filename)

  Checks a file for readability.
- bool file_writable (const std::string &filename)

Checks a file for writability.

- bool file_accessible (const std::string &filename)

  Checks a file for readability and writability.
- bool file_executable (const std::string &filename)

  Checks a file for the ability to be executed.
- bool file_is_directory (const std::string &filename)

  Checks a file to see if it is a directory.
- bool make_directory (const std::string &pathname)

  A function to ensure that the ~/.config/sequencer64 directory exists.
- bool ppqn_is_valid (int ppqn)

  Common code for handling PPQN settings.
- int jack_sync_callback (jack_transport_state_t state, jack_position_t *pos, void *arg)

  Global functions for JACK support and JACK sessions.
- void jack_shutdown_callback (void *arg)

  This callback is to shut down JACK by clearing the jack_assistant :: m_jack_running flag.
- void jack_timebase_callback (jack_transport_state_t state, jack_nframes_t nframes, jack_position_t *pos, int new_pos, void *arg)

  The JACK timebase function defined here sets the JACK position structure.
- int jack_transport_callback (jack_nframes_t nframes, void *arg)
- jack_client_t * create_jack_client (const std::string &clientname, const std::string &uuid)

  A more full-featured initialization for a JACK client, which is meant to be called by the init() function.
- void show_jack_statuses (unsigned bits)

  Loops through the full set of JACK bits, showing the information for any bits that are set in the given parameter.
- long get_current_jack_position (void *arg)
- void jack_session_callback (jack_session_event_t *ev, void *arg)

  Set the m_jsession_ev (event) value of the perform object.
- bool invalid_key (unsigned int key)
- std::string keyval_name (unsigned int key)

  Obtains the name of the key.
- void keyval_normalize (keys_perform_transfer &k)

  For the case in which the "rc" file is missing or corrupt, this function makes sure that each control key has a reasonable value.
- bool create_lash_driver (perform &p, int argc, char **argv)

  Creates and starts a lash object.
- lash * lash_driver ()

  Provides access to the lash object.
- void delete_lash_driver ()

  Deletes the last object.
- void millisleep (unsigned long ms)
- bool is_null_midipulse (midipulse p)

  Compares a midipulse value to SEQ64_NULL_MIDIPULSE.
- void * output_thread_func (void *p)

  Global functions defined in perform.cpp.
- void * input_thread_func (void *myperf)

  Set up the performance, and set the process to realtime privileges.
- rc_settings & rc ()

  Returns a reference to the global rc_settings object.
- user_settings & usr ()

  Returns a reference to the global user_settings object, for better encapsulation.
- int choose_ppqn (int ppqn)

  Common code for handling PPQN settings.

- midipulse timestring_to_pulses (const std::string &timestring, midibpm bpm, int ppqn)

  Converts a string that represents "hours:minutes:seconds.fraction" into a MIDI pulse/ticks/clock value.
- static std::string get_compound_option (const std::string &compound, std::string &optionname)

  Gets a compound option argument.
- int jack_dummy_callback (jack_nframes_t, void *arg)

  Provides a dummy callback.
- const std::string & seq_app_name ()

  Returns the name of the application.
- const std::string & seq_client_name ()

  Returns the name of the client for the application.
- const std::string & seq_version ()

  Returns the version of the application.
- static std::string make_section_name (const std::string &label, int value)

  Provides a purely internal, ad hoc helper function to create numbered section names for the userfile class.
- font & font_render ()

  The p_font_renderer pointer was once created in the main module, sequencer64.cpp.
- Gtk::Adjustment & adjustment_dummy ()

  Provides a way to provide a dummy Gtk::Adjustment object, but not create one until it is actually needed, so that the Glib/Gtk infrastructure is ready for it.
- bool is_ctrl_key (GdkEventKey *ev)

  Encapsulates the safe test for the control key, as described here: `https://developer.gnome.↩org/gtk3/stable/checklist-modifiers.html`.
- bool is_shift_key (GdkEventKey *ev)

  Encapsulates the safe test for the shift key.
- bool is_no_modifier (GdkEventScroll *ev)

  Encapsulates the safe test for no modifier keys, for a scroll event.
- bool is_ctrl_key (GdkEventScroll *ev)

  Encapsulates the safe test for the control key for scrolling.
- bool is_shift_key (GdkEventScroll *ev)

  Encapsulates the safe test for the shift key.
- bool is_ctrl_key (GdkEventButton *ev)

  Encapsulates the safe test for the control key for buttons.
- bool is_shift_key (GdkEventButton *ev)

  Encapsulates the safe test for the shift key.
- bool is_ctrl_shift_key (GdkEventButton *ev)

  Encapsulates the safe test for the ctrl-shift key combination.
- bool is_super_key (GdkEventButton *ev)

  Encapsulates the test for the super (mod4, windows) key for buttons.
- void test_widget_click (GtkWidget *w)
- void update_mainwid_sequences ()

  This global function in the seq64 namespace calls mainwid :: update_sequences_on_window(), if the global mainwid object exists.
- void update_perfedit_sequences ()

  This global function in the seq64 namespace calls perfedit :: draw_sequences(), if the global perfedit objects exist.
- int FF_RW_timeout (void *arg)

  This global function in the seq64 namespace is passed to the gtk_timeout_add callback.
- static long clamp (long val, long low, long hi)

  An internal function used by the FruitySeqRollInput class.
- static long clamp (long val, long low, long hi)

  An internal function used by the FruitySeqRollInput class.
- void silence_jack_errors (bool silent)

This function silences JACK error output to the console.

- void silence_jack_info (bool silent)

  This function silences JACK info output to the console.
- std::string midi_api_name (int i)

  Function to get RtMidi API names in a reusable manner.
- int midi_probe ()

  Formerly the main program of the RtMidi test program midiprobe.
- bool midi_input_test (rtmidi_info &info, int portindex)

  Provides testing the MIDI input process for 10 seconds.
- long min (long a, long b)

  min() for long values.
- int jack_process_rtmidi_input (jack_nframes_t nframes, void *arg)

  Defines the JACK input process callback.
- int jack_process_rtmidi_output (jack_nframes_t nframes, void *arg)

  Defines the JACK process input callback.
- int jack_process_io (jack_nframes_t nframes, void *arg)

  Provides a JACK callback function that uses the callbacks defined in the midi_jack module.
- static void jack_message_bit_bucket (const char *)

  This function merely eats the string passed as a parameter.
- static void midi_input_callback (midi_message &message, void *)

  Provides the callback for midi_input_test().

Variables

- std::string c_controller_names [SEQ64_MIDI_COUNT_MAX]

  Provides the default names of MIDI controllers.
- const midibyte EVENT_STATUS_BIT

  This highest bit of the status byte is always 1.
- const midibyte EVENT_ANY

  Channel Voice Messages.
- const midibyte EVENT_NOTE_OFF
- const midibyte EVENT_NOTE_ON
- const midibyte EVENT_AFTERTOUCH
- const midibyte EVENT_CONTROL_CHANGE
- const midibyte EVENT_PROGRAM_CHANGE
- const midibyte EVENT_CHANNEL_PRESSURE
- const midibyte EVENT_PITCH_WHEEL
- const midibyte EVENT_MIDI_SYSEX

  System Messages.
- const midibyte EVENT_MIDI_QUARTER_FRAME
- const midibyte EVENT_MIDI_SONG_POS
- const midibyte EVENT_MIDI_SONG_SELECT
- const midibyte EVENT_MIDI_SONG_F4
- const midibyte EVENT_MIDI_SONG_F5
- const midibyte EVENT_MIDI_TUNE_SELECT
- const midibyte EVENT_MIDI_SYSEX_END
- const midibyte EVENT_MIDI_SYSEX_CONTINUE
- const midibyte EVENT_MIDI_CLOCK
- const midibyte EVENT_MIDI_SONG_F9
- const midibyte EVENT_MIDI_START
- const midibyte EVENT_MIDI_CONTINUE

- const midibyte EVENT_MIDI_STOP
- const midibyte EVENT_MIDI_SONG_FD
- const midibyte EVENT_MIDI_ACTIVE_SENS
- const midibyte EVENT_MIDI_RESET
- const midibyte EVENT_MIDI_META

  0xFF is a MIDI "escape code" used in MIDI files to introduce a MIDI meta event.
- const midibyte EVENT_NULL_CHANNEL

  This value of 0xFF is Sequencer64's channel value that indicates that the event's m_channel value is bogus.
- const midibyte EVENT_GET_CHAN_MASK

  These file masks are used to obtain or to mask off the channel data from a status byte.
- const midibyte EVENT_CLEAR_CHAN_MASK
- const int EVENTS_ALL

  Variable from the "stazed" extras.
- const int EVENTS_UNSELECTED
- const int c_midibus_output_size

  Manifest global constants.
- const int c_midibus_input_size

  The c_midibus_input_size value is passed, in mastermidibus, to snd_seq_set_input_buffer_size().
- const int c_midibus_sysex_chunk

  Controls the amount a SysEx data sent at one time, in the midibus module.
- const midilong c_midibus

  Provides tags used by the midifile class to control the reading and writing of the extra "proprietary" information stored in a Seq24 MIDI file.
- const midilong c_midich

  Track channel number.
- const midilong c_midiclocks

  Track clocking.
- const midilong c_triggers

  See c_triggers_new.
- const midilong c_notes

  Song data.
- const midilong c_timesig

  Track time signature.
- const midilong c_bpmtag

  Song beats/minute.
- const midilong c_triggers_new

  Track trigger data.
- const midilong c_mutegroups

  Song mute group data.
- const midilong c_midictrl

  Song MIDI control.
- const midilong c_musickey

  The track's key.
- const midilong c_musicscale

  The track's scale.
- const midilong c_backsequence

  Track background sequence.
- const midilong c_transpose

  Track transpose value.
- const midilong c_perf_bp_mes

  Perfedit beats/measure.

- const midilong c_perf_bw

  Perfedit beat-width.
- const int c_midi_track_ctrl

  Pseudo control values for associating MIDI events (I think) with automation of some of the controls in seq24.
- const int c_midi_control_bpm_up
- const int c_midi_control_bpm_dn
- const int c_midi_control_ss_up
- const int c_midi_control_ss_dn
- const int c_midi_control_mod_replace
- const int c_midi_control_mod_snapshot
- const int c_midi_control_mod_queue
- const int c_midi_control_mod_gmute
- const int c_midi_control_mod_glearn
- const int c_midi_control_play_ss
- const int c_midi_controls
- const int c_midi_control_playback
- const int c_midi_control_record
- const int c_midi_control_solo
- const int c_midi_control_thru
- const int c_midi_control_bpm_page_up
- const int c_midi_control_bpm_page_dn
- const int c_midi_control_16
- const int c_midi_control_17
- const int c_midi_control_18
- const int c_midi_control_19
- const int c_midi_controls_extended
- int g_midi_control_limit
- const bool c_scales_policy [c_scale_size][SEQ64_OCTAVE_SIZE]

  Each value in the kind of scale is denoted by a true value in these arrays.
- const int c_scales_transpose_up [c_scale_size][SEQ64_OCTAVE_SIZE]

  Increment values needed to transpose each scale up so that it remains in the same key.
- const int c_scales_transpose_dn [c_scale_size][SEQ64_OCTAVE_SIZE]

  Making these positive makes it easier to read, but the actual array contains negative values.
- const char c_scales_text [c_scale_size][20]

  The names of the currently-supported scales.
- const char c_key_text [SEQ64_OCTAVE_SIZE][4]

  Provides the entries for the Key dropdown menu in the Pattern Editor window.
- const char c_interval_text [16][4]

  Provides the entries for the Interval dropdown menu in the Pattern Editor window.
- const char c_chord_text [8][6]

  Provides the entries for the Chord dropdown menu in the Pattern Editor window.
- const int c_chord_number

  Additional support data for the chord-generation feature from Stazed's seq32 project.
- const char c_chord_table_text [c_chord_number][12]

  Additional support data for the chord-generation feature from Stazed's seq32 project.
- const int c_chord_size

  Provides the number of chord values in each chord's specification array.
- const int c_chord_table [c_chord_number][c_chord_size]

  Additional support data for the chord-generation feature from Stazed's seq32 project.
- const int c_max_instruments

  Provides the maximum number of instruments that can be defined in the ~/.seq24usr or ~/.config/sequencer64/sequencrc file.

- const int c_max_busses

  Provides the maximum number of MIDI buss definitions supported in the "user" file.
- static const std::string versiontext

  Sets up the "hardwired" version text for Sequencer64.
- static struct option long_options [ ]

  A structure for command parsing that provides the long forms of command-line arguments, and associates them with their respective short form.
- static const std::string s_arg_list

  Provides a complete list of the short options, and is passed to getopt_long().
- static const char *const s_help_1a

  Provides help text.
- static const char *const s_help_1b

  More help text.
- static const char *const s_help_2

  Still more help text.
- static const char *const s_help_3

  Still more help text.
- static const char *const s_help_4

  Still more help text.
- static const std::string s_build_alsamidi_support

  This section of variables provide static information about the options enabled or disabled during the build.
- static const std::string s_build_portmidi_support
- static const std::string s_build_rtmidi_support
- static const std::string s_build_highlight_empty
- static const std::string s_build_lash_support
- static const std::string s_build_jack_support
- static const std::string s_build_jack_session
- static const std::string s_event_editor
- static const std::string s_build_pause_support
- static const std::string s_build_use_event_map
- static const std::string s_build_chord_generator
- static const std::string s_build_edit_highlight
- static const std::string s_build_timesig_tempo
- static const std::string s_build_midi_vector
- static const std::string s_build_solid_grid
- static const std::string s_build_follow_progress
- static const std::string s_statistics_support
- static const std::string s_strip_empty_mutes
- static const std::string s_seq32_jack_support
- static const std::string s_seq32_transport
- static const std::string s_seq32_transpose
- static const std::string s_seq32_menu_buttons
- static const std::string s_seq32_lfo_support
- static const std::string s_debug_mode
- jack_status_pair_t s_status_pairs [ ]

  Provides a list of JACK status bits, and a brief string to explain the status bit.
- struct charpair_t s_character_mapping [ ]

  The array of mappings of the non-alphabetic characters.
- static lash * s_global_lash_driver

  The global pointer to the LASH driver instance.
- static const int c_status_replace

  Purely internal constants used with the functions that implement MIDI control for the application.

- static const int c_status_snapshot

  This value signals the "snapshot" functionality.
- static const int c_status_queue

  This value signals the "queue" functionality.
- static rc_settings g_rc_settings

  Provides the replacement for all of the other "global_xxx" variables.
- static user_settings g_user_settings

  Provides the replacement for all of the other settings in the "user" configuration file, plus some of the "constants" in the globals module.
- static const long s_handlesize

  An internal variable for handle size.
- static const int s_jitter_amount

  An internal variable for user-jitter control.
- static mainwid * gs_mainwid_pointer

  Holds a pointer to the single instance of mainwnd for the entire application, once it is created.
- const int c_mainwid_x

  The width of the main pattern/sequence grid, in pixels.
- const int c_mainwid_y
- static perfedit * gs_perfedit_pointer_0

  Holds a pointer to the first instance of perfedit for the entire application, once it is created.
- static perfedit * gs_perfedit_pointer_1

  Holds a pointer to the second instance of perfedit for the entire application, once it is created.
- static const long s_handlesize

  An internal variable for handle size.

12.2.1 Detailed Description

Do not document a namespace; it breaks Doxygen.

Obsolete Now a permanent option.

0.9.3 delta-tick calculation code. This code doesn't quite work for generating the proper rate of MIDI clocks, and so have disabled that code until we can figure out what it is we're doing wrong. Do not enable it unless you are willing to test it.

Provides a new option to save the Time Signature and Tempo data that may be present in a MIDI file (in the first track) in the sequence object, and write them back to the MIDI file when saved again, in Sequencer64 format. The SeqSpec events that Seq24 and Sequencer64 save for these "events" are not readable by other MIDI applications, such as QTractor. By enabling this macro, other sequencers can read the correct time-signature and tempo values.

```
#define SEQ64_HANDLE_TIMESIG_AND_TEMPO
```

12.2.2 Typedef Documentation

12.2.2.1 midibyte

```
typedef unsigned char seq64::midibyte
```

This can be used for a MIDI buss/port number or for a MIDI channel number. See the SEQ64_INVALID_MIDIBYTE macro.

12.2.2.2 bussbyte

```
typedef unsigned char seq64::bussbyte
```

12.2.2.3 midishort

```
typedef unsigned short seq64::midishort
```

12.2.2.4 midilong

```
typedef unsigned long seq64::midilong
```

12.2.2.5 midipulse

```
typedef long seq64::midipulse
```

HOWEVER, CURRENTLY, if you make this value unsigned, then perfroll won't show any notes in the sequence bars!!! Also, a number of manipulations of this type currently depend upon it being a signed value.

12.2.2.6 midibpm

```
typedef double seq64::midibpm
```

This value used to be an integer, but we need to provide more precision in order to support better tempo matching.

12.2.2.7 rterror_callback

```
typedef void(* seq64::rterror_callback) (rterror::Type type, const std::string &errormsg, void
*userdata)
```

Note that class behaviour is undefined after a critical error (not a warning) is reported.

Parameters

type	Type of error.
errorText	Error description.

12.2.2.8 rtmidi_callback_t

```
typedef void(* seq64::rtmidi_callback_t) (midi_message &message, void *userdata)
```

Used to be nested in the rtmidi_in class. The timestamp parameter has been folded into the midi_message class (a wrapper for std::vector<unsigned char>), and the pointer has been replaced by a reference.

12.2.3 Enumeration Type Documentation

12.2.3.1 wave_type_t

```
enum seq64::wave_type_t
```

We still have to clarify these type values, though.

Enumerator

WAVE_NONE	No waveform, never used.
WAVE_SINE	Sine wave modulation.
WAVE_SAWTOOTH	Saw-tooth (ramp) modulation.
WAVE_REVERSE_SAWTOOTH	Reverse saw-tooth (decay).
WAVE_TRIANGLE	No waveform, never used.

12.2.3.2 seq_modifier_t

```
enum seq64::seq_modifier_t
```

We have to tweak the names to avoid redeclaration errors and to "personalize" the values. We change "GDK" to "SEQ64".

Since we're getting events from, say Gtk-2.4, but using our (matching) values for comparison, use the CAST_EQ↩ UIVALENT() macro to compare them. Note that we might still end up having to a remapping (e.g. if trying to get the code to work with the Qt framework).

Enumerator

SEQ64_NO_MASK	
SEQ64_SHIFT_MASK	
SEQ64_LOCK_MASK	
SEQ64_CONTROL_MASK	
SEQ64_MOD1_MASK	
SEQ64_MOD2_MASK	
SEQ64_MOD3_MASK	
SEQ64_MOD4_MASK	
SEQ64_MOD5_MASK	

Enumerator

SEQ64_BUTTON1_MASK	
SEQ64_BUTTON2_MASK	
SEQ64_BUTTON3_MASK	
SEQ64_BUTTON4_MASK	
SEQ64_BUTTON5_MASK	
SEQ64_SUPER_MASK	Bits 13 and 14 are used by XKB, bits 15 to 25 are unused. Bit 29 is used internally.
SEQ64_HYPER_MASK	
SEQ64_META_MASK	
SEQ64_RELEASE_MASK	
SEQ64_MASK_MAX	

12.2.3.3 seq_event_type_t

enum seq64::seq_event_type_t

Only the values we need have been grabbed. We have to tweak the names to avoid redeclaration errors and to "personalize" the values. We change "GDK" to "SEQ64", but, for convenience (to hide errors? :-D), we keep the number the same.

Since we're getting events from, say Gtk-2.4, but using our (matching) values for comparison, use the CAST_EQ↩ UIVALENT() macro to compare them. Note that we might still end up having to a remapping (e.g. if trying to get the code to work with the Qt framework).

Enumerator

SEQ64_NOTHING	
SEQ64_DELETE	
SEQ64_DESTROY	
SEQ64_EXPOSE	
SEQ64_MOTION_NOTIFY	
SEQ64_BUTTON_PRESS	
SEQ64_2BUTTON_PRESS	
SEQ64_3BUTTON_PRESS	
SEQ64_BUTTON_RELEASE	
SEQ64_KEY_PRESS	
SEQ64_KEY_RELEASE	
SEQ64_SCROLL	
SEQ64_EVENT_LAST	

12.2.3.4 seq_scroll_direction_t

enum seq64::seq_scroll_direction_t

We have to tweak the names to avoid redeclaration errors and to "personalize" the values. We change "SEQ64" to "SEQ64".

Since we're getting events from, say Gtk-2.4, but using our (matching) values for comparison, use the CAST_EQ↩ UIVALENT() macro to compare them. Note that we might still end up having to a remapping (e.g. if trying to get the code to work with the Qt framework).

Enumerator

SEQ64_SCROLL_UP	
SEQ64_SCROLL_DOWN	
SEQ64_SCROLL_LEFT	
SEQ64_SCROLL_RIGHT	

12.2.3.5 clock_e

`enum seq64::clock_e`

This enumeration was also defined in midibus_portmidi.h, but we put it into this common module to avoid duplication.

Enumerator

e_clock_off	Corresponds to the "Off" selection in the MIDI Clock tab. With this setting, the MIDI Clock is disabled for the buss using this setting. Notes will still be sent that buss, of course. Some software synthesizer might require this setting in order to make a sound.
e_clock_pos	Corresponds to the "Pos" selection in the MIDI Clock tab. With this setting, MIDI Clock will be sent to this buss, and, if playback is starting beyond tick 0, then MIDI Song Position and MIDI Continue will also be sent on this buss.
e_clock_mod	Corresponds to the "Mod" selection in the MIDI Clock tab. With this setting, MIDI Clock and MIDI Start will be sent. But clocking won't begin until the Song Position has reached the start modulo (in 1/16th notes) that is specified.

12.2.3.6 interaction_method_t

`enum seq64::interaction_method_t`

Moved here from the globals.h module.

Enumerator

e_seq24_interaction	Use the normal mouse interactions.
e_fruity_interaction	The "fruity" mouse interactions.
e_number_of_interactions	Keep this last... a size value.

12.2.3.7 c_music_scales

enum seq64::c_music_scales

Scales can be shown in the piano roll as gray bars for reference purposes.

We've added three more scales; there are still a number of them that could be fruitfully added to the list of scales.

It would be good to offload this stuff into a new "scale" class.

Enumerator

c_scale_off	
c_scale_major	
c_scale_minor	
c_scale_harmonic_minor	
c_scale_melodic_minor	
c_scale_c_whole_tone	
c_scale_blues	
c_scale_major_pentatonic	
c_scale_minor_pentatonic	
c_scale_size	

12.2.3.8 draw_type_t

enum seq64::draw_type_t

These values are used in the sequence, seqroll, perfroll, and mainwid classes.

Enumerator

DRAW_FIN	Indicates that drawing is finished.
DRAW_NORMAL_LINKED	Used for drawing linked notes.
DRAW_NOTE_ON	For starting the drawing of a note.
DRAW_NOTE_OFF	For finishing the drawing of a note.

12.2.3.9 mouse_action_e

enum seq64::mouse_action_e

Enumerator

e_action_select	
e_action_draw	
e_action_grow	

12.2.3.10 edit_action_t

enum seq64::edit_action_t

These variables represent actions that can be applied to a selection of notes. One idea would be to add a swing-quantize action. We will reserve the value here, for notes only; not yet used or part of the action menu.

Enumerator

c_select_all_notes	
c_select_all_events	
c_select_inverse_notes	
c_select_inverse_events	
c_quantize_notes	
c_quantize_events	
c_tighten_events	
c_tighten_notes	
c_transpose_notes	
c_reserved	
c_transpose_h	
c_expand_pattern	
c_compress_pattern	
c_select_even_notes	
c_select_odd_notes	
c_swing_notes	

12.2.3.11 rtmidi_api

enum seq64::rtmidi_api

These items used to be nested in the rtmidi class, but that only worked when RtMidi.cpp/h were large monolithic modules.

Enumerator

RTMIDI_API_UNSPECIFIED	Search for a working compiled API.
RTMIDI_API_LINUX_ALSA	Advanced Linux Sound Architecture API.
RTMIDI_API_UNIX_JACK	JACK Low-Latency MIDI Server API.
RTMIDI_API_MAXIMUM	A count of APIs; an erroneous value.

12.2.4 Function Documentation

12.2.4.1 swap()

```
void seq64::swap (
            busarray & buses0,
            busarray & buses1 )
```

Parameters

buses0	Provides the first buss in the swap.
buses1	Provides the second buss in the swap.

12.2.4.2 wave_type_name()

```
std::string seq64::wave_type_name (
            wave_type_t wavetype )
```

These names are short because I cannot figure out how to get the window pad out to show the longer names.

Parameters

wavetype	The wave-type value to be displayed.

Returns

Returns a short description of the wave type.

12.2.4.3 extract_timing_numbers()

```
bool seq64::extract_timing_numbers (
            const std::string & s,
            std::string & part_1,
            std::string & part_2,
            std::string & part_3,
            std::string & fraction )
```

- measures : beats : divisions
  - "213:4:920"
  - "0:1:0"
- hours : minutes : seconds . fraction
  - "2:04:12.14"
  - "0:1:2"

Warning

This is not the most efficient implementation you'll ever see. At some point we will tighten it up. This function is tested in the seq64-tests project, in the "calculations_unit_test" module.

Parameters

	s	Provides the input time string, in measures or time format, to be processed.
out	*part↩ _1*	The destination reference for the first part of the time.
out	*part↩ _2*	The destination reference for the second part of the time.
out	*part↩ _3*	The destination reference for the third part of the time.
out	*fraction*	The destination reference for the fractional part of the time.

Returns

Returns true if a reasonable portion (3 numbers) was good for extraction. The fraction part will start with a period for easier conversion to fractional seconds.

12.2.4.4 pulses_to_string()

```
std::string seq64::pulses_to_string (
            midipulse p )
```

Todo Still needs to be unit tested.

Parameters

p	The MIDI pulse/tick value to be converted.

Returns

Returns the string as an unsigned ASCII integer number.

12.2.4.5 pulses_to_measurestring()

```
std::string seq64::pulses_to_measurestring (
            midipulse p,
            const midi_timing & seqparms )
```

Parameters

p	The number of MIDI pulses (clocks, divisions, ticks, you name it) to be converted. If the value is SEQ64_NULL_MIDIPULSE, it is converted to 0, because callers don't generally worry about such niceties, and the least we can do is convert illegal measure-strings (like "000:0:000") to a legal value.
seqparms	This small structure provides the beats/measure, beat-width, and PPQN that hold for the sequence involved in this calculation. These values are needed in the calculations.

Returns

Returns the string, in measures notation, for the absolute pulses that mark this duration.

12.2.4.6 pulses_to_midi_measures()

```
bool seq64::pulses_to_midi_measures (
            midipulse p,
            const midi_timing & seqparms,
            midi_measures & measures )
```

```
m = p * W / (4 * P * B)
```

Parameters

	p	Provides the MIDI pulses (as in "pulses per quarter note") that are to be converted to MIDI measures format.
	seqparms	This small structure provides the beats/measure (B), beat-width (W), and PPQN (P) that hold for the sequence involved in this calculation. The beats/minute (T for tempo) value is not needed.
out	*measures*	Provides the current MIDI song time structure to hold the results, which are the measures, beats, and divisions values for the time of interest. Note that the measures and beats are corrected to be re 1, not 0.

Returns

Returns true if the calculations were able to be made. The P, B, and W values all need to be greater than 0.

12.2.4.7 pulses_to_timestring() [1/2]

```
std::string seq64::pulses_to_timestring (
            midipulse p,
            midibpm bpm,
            int ppqn )
```

If the fraction part is 0, then it is not shown. Examples:

- "0:0:0"
- "0:0:0.102333"
- "12:3:1"
- "12:3:1.000001"

Parameters

p	Provides the number of ticks, pulses, or divisions in the MIDI event time.
bpm	Provides the tempo of the song, in beats/minute.
ppqn	Provides the pulses-per-quarter-note of the song.

Returns

Returns the time-string representation of the pulse (ticks) value.

12.2.4.8 pulses_to_timestring() [2/2]

```
std::string seq64::pulses_to_timestring (
            midipulse p,
            const midi_timing & timinginfo )
```

See the other pulses_to_timestring() overload.

Todo Still needs to be unit tested.

Parameters

p	Provides the number of ticks, pulses, or divisions in the MIDI event time.
timinginfo	Provides the tempo of the song, in beats/minute, and the pulse-per-quarter-note of the song.

Returns

Returns the return-value of the other pulses_to_timestring() function.

12.2.4.9 measurestring_to_pulses()

```
midipulse seq64::measurestring_to_pulses (
            const std::string & measures,
            const midi_timing & seqparms )
```

Parameters

measures	Provides the current MIDI song time in "measures:beats:divisions" format, where divisions are the MIDI pulses in "pulses-per-quarter-note".
seqparms	This small structure provides the beats/measure, beat-width, and PPQN that hold for the sequence involved in this calculation.

Returns

Returns the absolute pulses that mark this duration. If the input string is empty, then 0 is returned.

12.2.4.10 midi_measures_to_pulses()

```
midipulse seq64::midi_measures_to_pulses (
            const midi_measures & measures,
            const midi_timing & seqparms )
```

p = 4 ∗ P ∗ m ∗ B / W p == pulse count (ticks or pulses) m == number of measures B == beats per measure (constant) P == pulses per quarter-note (constant) W == beat width in beats per measure (constant)

Note that the 0-pulse MIDI measure is "1:1:0", which means "at the beginning of the first beat of the first measure, no pulses'. It is not "0:0:0" as one might expect.

Parameters

measures	Provides the current MIDI song time structure holding the measures, beats, and divisions values for the time of interest.
seqparms	This small structure provides the beats/measure, beat-width, and PPQN that hold for the sequence involved in this calculation.

Returns

Returns the absolute pulses that mark this duration. If the pulse-value cannot be calculated, then SEQ64_↩ NULL_MIDIPULSE is returned.

12.2.4.11 timestring_to_pulses() [1/2]

```
midipulse seq64::timestring_to_pulses (
            const std::string & timestring,
            int bpm,
            int ppqn )
```

12.2.4.12 string_to_pulses()

```
midipulse seq64::string_to_pulses (
            const std::string & s,
            const midi_timing & mt )
```

First, the type of string is deduced by the characters in the string. If the string contains two colons and a decimal point, it is assumed to be a time-string ("hh:mm:ss.frac"); in addition ss will have to be less than 60.

If the string just contains two colons, then it is assumed to be a measure-string ("measures:beats:divisions").

If it has none of the above, it is assumed to be pulses. Testing is not rigorous.

Parameters

s	Provides the string to convert to pulses.
mt	Provides the structure needed to provide BPM and other values needed for some of the conversions done by this function.

Returns

Returns the string as converted to MIDI pulses (or divisions, clocks, ticks, whatever you call it).

12.2.4.13 string_to_midibyte()

```
midibyte seq64::string_to_midibyte (
            const std::string & s )
```

This function bypasses characters until it finds a digit (whether part of the number or a "0x" construct), and then converts it.

Parameters

s	Provides the string to convert to a MIDI byte.

Returns

Returns the MIDI byte value represented by the string.

12.2.4.14 shorten_file_spec()

```
std::string seq64::shorten_file_spec (
            const std::string & fpath,
            int leng )
```

This is done by removing character in the middle, if necessary, and replacing them with an ellipse.

This function operates by first trying to find the `/home` directory. If found, it strips off `/home/username` and replace it with the Linux ~ replacement for the `$HOME` environment variable. This function assumes that the "username" portion *must* exist, and that there's no goofy stuff like double-slashes in the path.

Parameters

fpath	The file specification, including the full path to the file, and the name of the file.
leng	Provides the length to which to limit the string.

Returns

Returns the fpath parameter, possibly shortened to fit within the desired length.

12.2.4.15 string_not_void()

```
bool seq64::string_not_void (
            const std::string & s )
```

Provides essentially the opposite test that string_is_void() provides. The definition of white-space is provided by the std::isspace() function/macro.

Parameters

s	The string pointer to check for emptiness.

Returns

Returns true if the pointer is valid, the string has a non-zero length, and is not just white-space.

12.2.4.16 string_is_void()

```
bool seq64::string_is_void (
            const std::string & s )
```

Meant to have essentially the opposite result of string_not_void(). The meaning of empty is special here, as it refers to a string being useless as a token:

- The string is of zero length.
- The string has only white-space characters in it, where the isspace() macro provides the definition of white-space.

Parameters

s	The string pointer to check for emptiness.

Returns

Returns true if the string has a zero length, or is only white-space.

12.2.4.17 strings_match()

```
bool seq64::strings_match (
            const std::string & target,
            const std::string & x )
```

The strings_match() function returns true if the comparison items are identical, without case-sensitivity in character content up to the length of the secondary string. This allows abbreviations to match. (And, in scanning routines, the first match is immediately accepted.)

Parameters

target	The primary string in the comparison. This is the target string, the one we hope to match. It is *assumed* to be non-empty, and the result is false if it is empty..
x	The secondary string in the comparison. It must be no longer than the target string, or the match is false.

Returns

Returns true if both strings are are identical in characters, up to the length of the secondary string, with the case of the characters being insignificant. Otherwise, false is returned.

12.2.4.18 log2_time_sig_value()

```
int seq64::log2_time_sig_value (
            int tsd )
```

Useful in converting a time signature's denominator to a Time Signature meta event's "dd" value.

Parameters

tsd	The time signature denominator, which must be a power of 2: 2, 4, 8, 16, or 32.

Returns

Returns the power of 2 that achieves the *tsd* parameter value.

12.2.4.19 tempo_us_to_bytes()

```
void seq64::tempo_us_to_bytes (
            midibyte t[3],
            int tempo_us )
```

Recall the format of a Tempo event:

0 FF 51 03 t2 t1 t0 (tempo as number of microseconds per quarter note)

This code is the inverse of the lines of code around line 768 in midifile.cpp, which is basically `((t2 * 256) + t1) * 256 + t0` .

As a test case, note that the default tempo is 120 beats/minute, which is equivalent to tttttt=500000 (0x07A120).

Parameters

t	Provides a small array of 3 elements to hold each tempo byte.
tempo_us	Provides the temp value in microseconds per quarter note.

12.2.4.20 zoom_power_of_2()

```
int seq64::zoom_power_of_2 (
            int ppqn )
```

The default starting zoom is 2, but this value is suitable only for PPQN of 192 and below. Also, zoom currently works consistently only if it is a power of 2. For starters, we scale the zoom to the selected ppqn, and then shift it each way to get a suitable power of two.

Parameters

ppqn	The ppqn of interest.

Returns

Returns the power of 2 appropriate for the given PPQN value.

12.2.4.21 bpm_from_tempo_us()

```
double seq64::bpm_from_tempo_us (
            double tempous )  [inline]
```

The tempo event's numeric value is given in 3 bytes, and is in units of microseconds-per-quarter-note (us/qn).

Parameters

tempous	The value of the Tempo meta-event, in units of us/qn. If this value is 0, we'll get an arithmetic exception.

Returns

Returns the beats per minute. If the tempo value is 0, then 0 is returned.

12.2.4.22 tempo_us_from_bpm()

```
double seq64::tempo_us_from_bpm (
            midibpm bpm )  [inline]
```

120 beats/minute) to microseconds. This function is the inverse of bpm_from_tempo_us().

Parameters

bpm	The value of beats-per-minute. If this value is 0, we'll get an arithmetic exception.

Returns

Returns the tempo in qn/us. If the bpm value is 0, then 0 is returned.

12.2.4.23 pulse_length_us()

```
double seq64::pulse_length_us (
            midibpm bpm,
            int ppqn )  [inline]
```

The formula for the pulse-length in seconds is:

```
          60
P = ------------
    BPM * PPQN
```

Parameters

bpm	Provides the beats-per-minute value. No sanity check is made. If this value is 0, we'll get an arithmetic exception.
ppqn	Provides the pulses-per-quarter-note value. No sanity check is made. If this value is 0, we'll get an arithmetic exception.

Returns

Returns the pulse length in microseconds. If either parameter is invalid, then this function will crash. :-D

12.2.4.24 delta_time_us_to_ticks()

```
double seq64::delta_time_us_to_ticks (
            unsigned long us,
            midibpm bpm,
            int ppqn )  [inline]
```

This function is the inverse of ticks_to_delta_time_us().

Please note that terms "ticks" and "pulses" are equivalent, and refer to the "pulses" in "pulses per quarter note".

```
          beats       pulses           1 minute       1 sec
P = 120 ------ * 192 ------ * T us *  ---------  * ---------
        minute       beats            60 sec       1,000,000 us
```

```
Note that this formula assumes that a beat is a quarter note.  If a beat
is an eighth note, then the P value would be halved, because there would
be only 96 pulses per beat.  We will implement an additional function to
account for the beat; the current function merely blesses some
calculations made in the application.
```

Parameters

us	The number of microseconds in the delta time.
bpm	Provides the beats-per-minute value, otherwise known as the "tempo".
ppqn	Provides the pulses-per-quarter-note value, otherwise known as the "division".

Returns

Returns the tick value.

12.2.4.25 ticks_to_delta_time_us()

```
double seq64::ticks_to_delta_time_us (
            midipulse delta_ticks,
            midibpm bpm,
            int ppqn )  [inline]
```

The inverse of delta_time_us_to_ticks().

Please note that terms "ticks" and "pulses" are equivalent, and refer to the "pulses" in "pulses per quarter note".

Old: 60000000.0 * double(delta_ticks) / (double(bpm) * double(ppqn));

Parameters

delta_ticks	The number of ticks or "clocks".
bpm	Provides the beats-per-minute value, otherwise known as the "tempo".
ppqn	Provides the pulses-per-quarter-note value, otherwise known as the "division".

Returns

Returns the time value in microseconds.

12.2.4.26 clock_tick_duration_bogus()

```
double seq64::clock_tick_duration_bogus (
            midibpm bpm,
            int ppqn )  [inline]
```

Deprecated This is a somewhat bogus calculation used only for "statistical" output in the old perform module. Name changed to reflect this unfortunate fact. Use pulse_length_us() instead.

$$us = \frac{60000000 \; ppqn}{MIDI_CLOCK_IN_PPQN * bpm * ppqn}$$

MIDI_CLOCK_IN_PPQN is 24.

Parameters

bpm	Provides the beats-per-minute value. No sanity check is made. If this value is 0, we'll get an arithmetic exception.
ppqn	Provides the pulses-per-quarter-note value. No sanity check is made. If this value is 0, we'll get an arithmetic exception.

Returns

Returns the clock tick duration in microseconds. If either parameter is invalid, this will crash. Who wants to waste time on value checks here? :-D

12.2.4.27 clock_ticks_from_ppqn()

```
int seq64::clock_ticks_from_ppqn (
            int ppqn )  [inline]
```

Parameters

ppqn	The number of pulses per quarter note. For example, the default value for Seq24 is 192.

Returns

The integer value of ppqn / 24 [MIDI_CLOCK_IN_PPQN] is returned.

12.2.4.28 double_ticks_from_ppqn()

```
double seq64::double_ticks_from_ppqn (
            int ppqn )  [inline]
```

The same as clock_ticks_from_ppqn(), but returned as a double float.

Parameters

ppqn	The number of pulses per quarter note.

Returns

The double value of ppqn / 24 [SEQ64_MIDI_CLOCK_IN_PPQN]_is returned.

12.2.4.29 pulses_per_measure()

```
midipulse seq64::pulses_per_measure (
            int ppqn = SEQ64_DEFAULT_PPQN )  [inline]
```

This calculation is extremely simple, and it provides an important constraint to pulse (ticks) calculations: the number of pulses in a measure is always 4 times the PPQN value, regardless of the time signature. The number pulses in a 7/8 measure is the the same as in a 4/4/ measure.

12.2.4.30 measures_to_ticks()

```
midipulse seq64::measures_to_ticks (
            midibpm bpm,
            int ppqn,
            int bw,
            int measures = 1 )  [inline]
```

This function is called in seqedit::apply_length(), when the user selects a sequence length in measures. That function calculates the length in ticks. The number of pulses is given by the number of quarter notes times the pulses per quarter note. The number of quarter notes is given by the measures times the quarter notes per measure. The quarter notes per measure is given by the beats per measure times 4 divided by beat_width beats. So:

```
    p = 4 * P * m * B / W
        p == pulse count (ticks or pulses)
        m == number of measures
        B == beats per measure (constant)
        P == pulses per quarter-note (constant)
        W == beat width in beats per measure (constant)


For our "b4uacuse" MIDI file, M can be about 100 measures, B is 4,
P can be 192 (but we want to support higher values), and W is 4.
So p = 100 * 4 * 4 * 192 / 4 = 76800 ticks.

Note that 4 * P is a constraint encapsulated by the inline function
pulses_per_measure().
```

Parameters

bpm	The B value in the equation, beats/measure.
ppqn	The P value in the equation, pulses/qn.
bw	The W value in the equation, the denominator of the time signature. If this value is 0, we'll get an arithmetic exception (crash), so we just return 0 in this case.
measures	The M value in the equation. It defaults to 1, in case one desires a simple "ticks per measure" number.

Returns

Returns the L value (ticks or pulses) as calculated via the given equation. If bw is 0, then 0 is returned.

12.2.4.31 wave_func()

```
double seq64::wave_func (
            double angle,
            wave_type_t wavetype )
```

We extracted this function from mattias's lfownd module, as it is more generally useful. The angle parameter is provided by the lfownd object. It is calculated by

```
                speed * tick * BW
       angle = ------------------- + phase
                      seqlength
```

```
The speed ranges from 0 to 16; the ratio of tick/seqlength ranges from 0
to 1; BW (beat width) is generally 4; the phase ranges from 0 to 1.
```

Parameters

angle	Provides the radial angle to be applied. Units of radians, apparently.
wavetype	Provides the wave_type_t value to select the type of wave data-point to be generated.

12.2.4.32 extract_port_names()

```
bool seq64::extract_port_names (
            const std::string & fullname,
            std::string & clientname,
            std::string & portname )
```

It's a bit krufty to have to rely on that strict format; changes in the bus/port code could break this function.

And when a2jmidid is running, indeed this function breaks. The name of a port changes to

```
a2j:Midi Through [14] (playback): Midi Through Port-0
```

with "a2j" as the client name and the rest, including the second colon, as the port name.

TODO: FIX ME!!!!!!!

Parameters

	fullname	The full port specification to be split.
out	*clientname*	The destination for the client name portion, "clientname".
out	*portname*	The destination for the port name portion, "portname".

Returns

Returns true if all items are non-empty after the process.

12.2.4.33 extract_bus_name()

```
std::string seq64::extract_bus_name (
            const std::string & fullname )
```

Sometimes we don't need both parts at once.

However, when a2jmidid is active. the port name will have a colon in it.

Parameters

fullname	The "bus:port" name.

Returns

Returns the "bus" portion of the string. If there is no colon, then it is assumed there is no buss name, so an empty string is returned.

12.2.4.34 extract_port_name()

```
std::string seq64::extract_port_name (
            const std::string & fullname )
```

Sometimes we don't need both parts at once.

However, when a2jmidid is active. the port name will have a colon in it.

Parameters

fullname	The "bus:port" name.

Returns

Returns the "port" portion of the string. If there is no colon, then it is assumed that the name is a port name, and so *fullname* is returned.

12.2.4.35 help_check()

```
bool seq64::help_check (
            int argc,
            char * argv[] )
```

Also check for the –legacy option. Finally, it also checks for the "?" option that people sometimes use as a guess to get help.

Parameters

argc	The number of command-line arguments.
argv	The array of command-line argument pointers.

Returns

Returns true only if -v, -V, –version, -h, –help, or "?" were encountered. If the legacy options occurred, then rc().legacy_format(true) is called, as a side effect, because it will be needed before we parse the options.

12.2.4.36 parse_options_files()

```
bool seq64::parse_options_files (
            perform & p,
            std::string & errmessage,
            int argc,
            char * argv[] )
```

It probably requires this call preceding: Gtk::Main kit(argc, argv), to strip any GTK+-specific parameters the knowledgeable user may have added. Usage:

```
Gtk::Main kit(argc, argv);
seq64::gui_assistant_gtk2 gui;
seq64::perform p(gui);
```

It also requires the caller to call rc().set_defaults() and usr().set_defaults(). The caller can then use the command-line to make any modifications to the setting that will be used here. The biggest example is the -r/–reveal-alsa-ports option, which determines if the MIDI buss definition strings are read from the 'user' configuration file.

Instead of the legacy Seq24 names, we use the new configuration file-names, located in the ~/.config/sequencer64 directory. However, if they are not found, we no longer fall back to the legacy configuration file-names. If the –legacy option is in force, use only the legacy configuration file-name. The code also ensures the directory exists. CURRENTLY LINUX-SPECIFIC. See the rc_settings class for how this works.

```
std::string cfg_dir = seq64::rc().home_config_directory();
if (cfg_dir.empty())
    return EXIT_FAILURE;
```

Change Note ca 2016-04-03 We were parsing the user-file first, but we now need to parse the rc-file first, to get the manual-alsa-ports option, so that we can avoid overriding the port names that the ALSA system provides, if the manual-alsa-option is false.

Parameters

	p	Provides the perform object that will be affected by the new parameters.
out	*errmessage*	Provides a string into which to dump any error-message that might occur. Still not thoroughly supported in the "rc" and "user" configuration files.
	argc	The number of command-line arguments.
	argv	The array of command-line argument pointers.

Returns

Returns true if the reading of both configuration files succeeded.

12.2.4.37 parse_mute_groups()

```
bool seq64::parse_mute_groups (
            perform & p,
            std::string & errmessage )
```

12.2.4.38 process_o_options()

```
bool seq64::process_o_options (
            int argc,
            char * argv[] )
```

These are flagged by "-o" or "--option". These options are then passed to the user_settings module. Multiple options can be supplied; the whole command-line is processed.

Parameters

argc	The number of command-line parameters, including the name of the application as parameter 0.
argv	The array of pointers to the command-line parameters.

Returns

Returns true if any "options" option was found, and false otherwise. If the options flags ("-o" or "--option") were found, but were not valid options, then we break out of processing and return false.

12.2.4.39 parse_command_line_options()

```
int seq64::parse_command_line_options (
            perform & p,
            int argc,
            char * argv[] )
```

Note that, since we call this function twice (once before the configuration files are parsed, and once after), we have to make sure that the global value optind is reset to 0 before calling this function. Note that the traditional reset value for optind is 1, but 0 is used in GNU code to trigger the internal initialization routine of get_opt().

Parameters

p	The performance object that implements some of the command-line options.
argc	The number of command-line arguments.
argv	The array of command-line argument pointers.

Returns

Returns the value of optind if no help-related options were provided.

12.2.4.40 write_options_files()

```
bool seq64::write_options_files (
            const perform & p )
```

This function gets any legacy global variables, on the theory that they might have been changed.

Parameters

p	Provides the perform object that may provide new values for the parameters.

Returns

Returns true if both files were saved successfully. Otherwise returns false. But even if one write failed, the other might have succeeded.

12.2.4.41 build_details()

```
std::string seq64::build_details ( )
```

Returns

Returns an ordered, human-readable string enumerating the built-in features of this application.

12.2.4.42 message_concatenate()

```
std::string seq64::message_concatenate (
            const char * m1,
            const char * m2 )
```

Note that we don't bother with error-checking the pointers. You're on your own, Hoss.

Parameters

m1	The first message, often a **func** macro.
m2	The second message.

Returns

Returns "m1: m2" as a standard C++ string.

12.2.4.43 info_message()

```
bool seq64::info_message (
            const std::string & msg )
```

Adds markers and a newline.

Parameters

msg	The message to print, sans the newline.

Returns

Returns true.

12.2.4.44 error_message()

```
bool seq64::error_message (
            const std::string & msg )
```

Adds markers, and returns false.

Parameters

msg	The message to print, sans the newline.

Returns

Returns false for convenience/brevity in setting function return values.

12.2.4.45 is_note_off_velocity()

```
bool seq64::is_note_off_velocity (
            midibyte status,
            midibyte data )  [inline]
```

Parameters

status	The type of event, which might be EVENT_NOTE_ON.

12.2.4.46 to_string()

```
std::string seq64::to_string (
            const event & ev )
```

Nothing fancy. If you want that, use the midicvt project.

Parameters

ev	The event to put on show.

Returns

Returns the string representation of the event parameter.

12.2.4.47 file_access()

```
bool seq64::file_access (
            const std::string & targetfile,
            int mode )
```

12.2.4.48 file_exists()

```
bool seq64::file_exists (
            const std::string & filename )
```

Parameters

filename	Provides the name of the file to be checked.

Returns

Returns 'true' if the file exists.

12.2.4.49 file_readable()

```
bool seq64::file_readable (
            const std::string & filename )
```

Parameters

filename	Provides the name of the file to be checked.

Returns

Returns 'true' if the file is readable.

12.2.4.50 file_writable()

```
bool seq64::file_writable (
            const std::string & filename )
```

Parameters

filename	Provides the name of the file to be checked.

Returns

Returns 'true' if the file is writable.

12.2.4.51 file_accessible()

```
bool seq64::file_accessible (
            const std::string & filename )
```

An even stronger test than file_exists. At present, we see no need to distinguish read and write permissions. We assume the file is accessible only if the file has both permissions.

Parameters

filename	Provides the name of the file to be checked.

Returns

Returns 'true' if the file is readable and writable.

12.2.4.52 file_executable()

```
bool seq64::file_executable (
            const std::string & filename )
```

Parameters

filename	Provides the name of the file to be checked.

Returns

Returns 'true' if the file exists.

12.2.4.53 file_is_directory()

```
bool seq64::file_is_directory (
            const std::string & filename )
```

This function is also used in the function of the same name in fileutilities.cpp.

Parameters

filename	Provides the name of the directory to be checked.

Returns

Returns 'true' if the file is a directory.

12.2.4.54 make_directory()

```
bool seq64::make_directory (
            const std::string & pathname )
```

This function is actually a little more general than that, but it is not sufficiently general, in general.

Parameters

pathname	Provides the name of the path to create. The parent directory of the final directory must already exist.

Returns

Returns true if the path-name exists.

12.2.4.55 ppqn_is_valid()

```
bool seq64::ppqn_is_valid (
            int ppqn )  [inline]
```

Validates a PPQN value.

Parameters

ppqn	Provides the PPQN value to be used.

Returns

Returns true if the ppqn parameter is between MINIMUM_PPQN and MAXIMUM_PPQN, or is set to SE↩ Q64_USE_DEFAULT_PPQN (-1).

12.2.4.56 jack_sync_callback()

```
int seq64::jack_sync_callback (
            jack_transport_state_t state,
            jack_position_t * pos,
            void * arg )
```

This JACK synchronization callback informs the specified perform object of the current state and parameters of JACK.

The transport state will be:

```
-   JackTransportStopped when a new position is requested.
-   JackTransportStarting when the transport is waiting to start.
-   JackTransportRolling when the timeout has expired, and the
    position is now a moving target.
```

This is the slow-sync callback, which the stazed code replaces with jack_transport_callback().

Parameters

state	The JACK Transport state.
pos	The JACK position value.
arg	The pointer to the jack_assistant object. Currently not checked for nullity, nor dynamic-casted.

Returns

Returns 1 if the function works, and 0 if something was wrong.

12.2.4.57 jack_shutdown_callback()

```
void seq64::jack_shutdown_callback (
            void * arg )
```

Parameters

arg	Points to the jack_assistant in charge of JACK support for the perform object.

12.2.4.58 jack_timebase_callback()

```
void seq64::jack_timebase_callback (
            jack_transport_state_t state,
            jack_nframes_t nframes,
            jack_position_t * pos,
            int new_pos,
            void * arg )
```

The original version of the function worked properly with Hydrogen, but not with Klick. The new code seems to work with both. More testing and clarification is needed. This new code was "discovered" in the source-code for the "SooperLooper" project:

```
    http://essej.net/sooperlooper/
```

The first difference with the new code is that it handles the case where the JACK position is moved (new_pos == true). If this is true, and the JackPositionBBT bit is off in pos->valid, then the new BBT value is set.

The seconds set of differences are in the "else" clause. In the new code, it is very simple: calculate the new tick value, back it off by the number of ticks in a beat, and perhaps go to the first beat of the next bar.

In the old code (complex!), the simple BBT adjustment is always made. This changes (perhaps) the beats_per_bar, beat_type, etc. We need to make these settings use the actual global values for beats set for Sequencer64. Then, if transitioning from JackTransportStarting to JackTransportRolling (instead of checking new_pos!), the BBT values (bar, beat, and tick) are finally adjusted. Here are the steps, with old and new steps noted:

```
-#  Calculate the "delta" ticks based on the current frame, the
    ticks_per_beat, the beats_per_minute, and the frame_rate.  The old
    code saves this in a local, the new code assigns it to pos->tick.
-#  Old code: save this delta as a positive value.
-#  Figure out the settings and modify bar, beat, tick, and
    bar_start_tick.  The old and new code seem to have the same intent,
    but it seems like the new code is faster and also correct.
    -   Old code:  Calculations are made by division and mod
        operations.
    -   New code:  Calculations are made by increments and decrements
        in a while loop.
```

Stazed:

```
The call to jack_timebase_callback() to supply JACK with BBT, etc. would
occasionally fail when the pos information had zero or some garbage in
the pos.frame_rate variable. This would occur when there was a rapid
change of frame position by another client... i.e. qjackctl.  From the
JACK API:

    pos   address of the position structure for the next cycle;
    pos->frame will be its frame number. If new_pos is FALSE, this
    structure contains extended position information from the current
    cycle.  If TRUE, it contains whatever was set by the requester.
    The timebase_callback's task is to update the extended information
    here."

    The "If TRUE" line seems to be the issue. It seems that qjackctl
    does not always set pos.frame_rate so we get garbage and some
    strange BBT calculations that display in qjackctl. So we need to
    set it here and just use m_jack_frame_rate for calculations instead
    of pos.frame_rate.
```

Parameters

state	Indicates the current state of JACK transport.
nframes	The number of JACK frames in the current time period.
pos	Provides the position structure to be filled in, the address of the position structure for the next cycle; pos->frame will be its frame number. If new_pos is FALSE, this structure contains extended position information from the current cycle. If TRUE, it contains whatever was set by the requester. The timebase_callback's task is to update the extended information here.
new_pos	TRUE (non-zero) for a newly requested pos, or for the first cycle after the timebase_callback is defined. This is usually 0 in Sequencer64 at present, and 1 if one, say, presses "rewind" in qjackctl.
arg	Provides the jack_assistant pointer, currently unchecked for nullity.

12.2.4.59 jack_transport_callback()

```
int seq64::jack_transport_callback (
             jack_nframes_t nframes,
             void * arg )
```

12.2.4.60 create_jack_client()

```
jack_client_t * seq64::create_jack_client (
             const std::string & clientname,
             const std::string & uuid )
```

Do not call this function if the JACK client handle is already open.

Status bits for jack_status_t return pointer:

```
 JackNameNotUnique means that the client name was not unique. With
 JackUseExactName, this is fatal. Otherwise, the name was modified by
 appending a dash and a two-digit number in the range "-01" to "-99".
 The jack_get_client_name() function returns the exact string used. If
 the specified client_name plus these extra characters would be too
 long, the open fails instead.

 JackServerStarted means that the JACK server was started as a result
 of this operation. Otherwise, it was running already. In either case
 the caller is now connected to jackd, so there is no race condition.
 When the server shuts down, the client will find out.
```

JackOpenOptions:

```
JackSessionID | JackServerName | JackNoStartServer | JackUseExactName
```

helgrind:

```
Valgrind's helgrind tool shows


         Possible data race during read of size 4 at 0xF854E58 by thread #1
            by 0x267602: seq64::create_jack_client(...)
         This conflicts with a previous write of size 4 by thread #2
            by 0x267602: seq64::create_jack_client(...)


    So we add a static mutex to use with our automutex.  Does not prevent
    that message..... WHY?
```

We've never disabled the SEQ64_JACK_SESSION macro, and we like the error-reporting we get by that method. So we've commented out the following code in favor of using the session-uuid code:

ifdef SEQ64_JACK_SESSION

else

jack_status_t * pstatus = NULL; result = jack_client_open(name, JackNullOption, pstatus);

endif

Parameters

clientname	Provides the name of the client, used in the call to jack_client_open(). By default, this name is the macro SEQ64_PACKAGE (i.e. "sequencer64"). The name scope is local to each server. Unless forbidden by the JackUseExactName option, the server will modify this name to create a unique variant, if needed.
uuid	The optional UUID to assign to the new client. If empty, there is no UUID.

Returns

Returns a pointer to the JACK client if JACK has opened the client connection successfully. Otherwise, a null pointer is returned.

12.2.4.61 show_jack_statuses()

```
void seq64::show_jack_statuses (
            unsigned bits )
```

For reference, here are the enumeration values from /usr/include/jack/types.h:

```
        JackFailure         = 0x01
        JackInvalidOption   = 0x02
        JackNameNotUnique   = 0x04
        JackServerStarted   = 0x08
        JackServerFailed    = 0x10
        JackServerError     = 0x20
        JackNoSuchClient    = 0x40
        JackLoadFailure     = 0x80
        JackInitFailure     = 0x100
        JackShmFailure      = 0x200
        JackVersionError    = 0x400
        JackBackendError    = 0x800
        JackClientZombie    = 0x1000
```

Parameters

bits	The mask of the bits to be shown in the output.

12.2.4.62 get_current_jack_position()

```
long seq64::get_current_jack_position (
            void * arg )
```

Warning

Currently valgrind flags j->client() as uninitialized.

12.2.4.63 jack_session_callback()

```
void seq64::jack_session_callback (
            jack_session_event_t * ev,
            void * arg )
```

Glib is then used to connect in perform::jack_session_event(). However, the perform object's GUI-support interface is used instead of the following, so that the libseq64 library can be independent of a specific GUI framework:

```
Glib::signal_idle().
    connect(sigc::mem_fun(*jack, &jack_assistant::session_event));
```

Parameters

ev	The JACK event to be set.
arg	The pointer to the jack_assistant object. Currently not checked for nullity.

12.2.4.64 invalid_key()

```
bool seq64::invalid_key (
            unsigned int key )  [inline]
```

12.2.4.65 keyval_name()

```
std::string seq64::keyval_name (
            unsigned int key )
```

In gtkmm, this is done via the gdk_keyval_name() function. Here, in the base class, we just provide an easy-to-create string. Note that this is a free function, not a class member.

Parameters

key	Provides the key-number to be converted to a key name.

Returns

Returns the key name as looked up by the GDK infrastructure. If the key is not found, then an empty string is returned.

12.2.4.66 keyval_normalize()

```
void seq64::keyval_normalize (
            keys_perform_transfer & k )
```

Otherwise, random values, unchecked, can cause the application to crash.

Any field that is 0 or greater than 65536 is fixed. Not perfect, but better than allowing random values to be used.

Parameters

k	The structure to be validated and normalized.

12.2.4.67 create_lash_driver()

```
bool seq64::create_lash_driver (
            perform & p,
            int argc,
            char ** argv )
```

Initializes the lash driver (strips lash-specific command line arguments), then connects to the LASH daemon and polls events.

This function will always be called from the main routine, and called only once. Note that we don't need that darn SEQ64_LASH_SUPPORT macro in client code anymore.

Parameters

p	The perform object that needs to implement LASH support.
argc	The number of command-line arguments.
argv	The command-line arguments.

Returns

This function returns true if a lash object was created. This function will not create one if not configured to, if the command-line options did not specify the creation of the LASH driver, or if the LASH driver was already created.

12.2.4.68 lash_driver()

```
lash * seq64::lash_driver ( )
```

Returns

Returns the pointer to the LASH driver if it exists. Otherwise a null pointer is returned. The caller *must always check* the return value.

12.2.4.69 delete_lash_driver()

```
void seq64::delete_lash_driver ( )
```

This function will always be called from the main routine, once. The other lash-pointer functions will know if the pointer has been deleted.

12.2.4.70 millisleep()

```
void seq64::millisleep (
             unsigned long ms )
```

12.2.4.71 is_null_midipulse()

```
bool seq64::is_null_midipulse (
             midipulse p )  [inline]
```

By "null" in this case, we mean "unusable", not 0. Sigh, it's always something.

12.2.4.72 output_thread_func()

```
void * seq64::output_thread_func (
             void * myperf )
```

Set up the performance, set the process to realtime privileges, and then start the output function.

Parameters

myperf	Provides the perform object instance that is to be used. Its output_func() is called. Currently, this parameter is not validated, for speed.

Returns

Always returns nullptr.

12.2.4.73 input_thread_func()

```
void * seq64::input_thread_func (
            void * myperf )
```

Parameters

myperf	Provides the perform object instance that is to be used. Its output_func() is called. Currently, this parameter is not validated, for speed.

Returns

Always returns nullptr.

12.2.4.74 rc()

```
rc_settings & seq64::rc ( )
```

Why a function instead of direct variable access? Encapsulation. We are then free to change the way "global" settings are accessed, without changing client code.

Returns

Returns the global object g_rc_settings.

12.2.4.75 usr()

```
user_settings & seq64::usr ( )
```

Returns

Returns the global object g_user_settings.

12.2.4.76 choose_ppqn()

```
int seq64::choose_ppqn (
            int ppqn )
```

Putting it here means we can reduce the reliance on the global ppqn.

However, this function works completely only if the "user" configuration file has already been read. In some cases we may need to retrofit the desired PPQN value!

Parameters

ppqn	Provides the PPQN value to be used.

Returns

Returns the ppqn parameter, unless that parameter is SEQ64_USE_DEFAULT_PPQN (-1), then usr().midi_ppqn is returned. If that value is also -1, then we return SEQ64_DEFAULT_PPQN (192).

12.2.4.77 timestring_to_pulses() [2/2]

```
midipulse seq64::timestring_to_pulses (
            const std::string & timestring,
            midibpm bpm,
            int ppqn )
```

Parameters

timestring	The time value to be converted, which must be of the form "hh:mm:ss" or "hh:mm:ss.fraction".
bpm	The beats-per-minute tempo (e.g. 120) of the current MIDI song.
ppqn	The parts-per-quarter note precision (e.g. 192) of the current MIDI song.

Returns

Returns 0 if an error occurred or if the number actually translated to 0.

This conversion assumes that the fractional parts of the seconds is padded with zeroes on the left or right to 6 digits.

12.2.4.78 get_compound_option()

```
static std::string seq64::get_compound_option (
            const std::string & compound,
            std::string & optionname )  [static]
```

An option argument is a value flagged on the command line by the -o/–option options. Each option has a value associated with it, as the next argument on the command-line. A compound option is of the form name=value, of which one example is:

```
log=filename
```

This function extracts both the name and the value. If the name is empty, then the option is unsupported and should be ignored. If the value is empty, then there may be a default value to use.

Parameters

	compound	The putative compound option.
out	*optionname*	This value is filled in with the name of the option-value, if there is an equals sign in the *compound* parameter.

Returns

Returns the value part of the compound option, or just the compound parameter is there is no '=' sign. That is, it returns the option-value.

Side-effect(s) The name portion is returned in the optionname parameter.

12.2.4.79 jack_dummy_callback()

```
int seq64::jack_dummy_callback (
            jack_nframes_t ,
            void * arg )
```

Returns

Does nothing, always returns 0.

12.2.4.80 seq_app_name()

```
const std::string& seq64::seq_app_name ( )
```

We could continue to use the macro SEQ64_APP_NAME, but we might eventually want to make this name configurable. Not too likely, but possible.

Returns

Returns SEQ64_APP_NAME.

12.2.4.81 seq_client_name()

```
const std::string& seq64::seq_client_name ( )
```

We could continue to use the macro SEQ64_CLIENT_NAME, but we might eventually want to make this name configurable. More likely to be a configuration option in the future.

Returns

Returns SEQ64_CLIENT_NAME.

12.2.4.82 seq_version()

```
const std::string& seq64::seq_version ( )
```

We could continue to use the macro SEQ64_VERSION, but ... let's be consistent. :-D

Returns

Returns SEQ64_VERSION.

12.2.4.83 make_section_name()

```
static std::string seq64::make_section_name (
            const std::string & label,
            int value )  [static]
```

Parameters

label	The base-name of the section.
value	The numeric value to append to the section name.

Returns

Returns a string of the form "[basename-1]".

12.2.4.84 font_render()

```
font& seq64::font_render ( )  [inline]
```

We've going to render this pointer obsolete, though, and use a smart factory function to ensure the existence of this pointer, and return a reference to the font object.

We wanted to make the font a const object, but mainwid::on_realize() calls the font::init() function with its window object, and using const is impractical. We don't want to force every caller to deal with the overhead of passing even a null window pointer, either.

However, at some point we need some quarantee that the init() function is called before rendering a string. Right now, we guarantee it only by build order.

Returns

Returns a reference to the object pointed to by sp_font_renderer.

12.2.4.85 adjustment_dummy()

```
Gtk::Adjustment & seq64::adjustment_dummy ( )
```

This static object is used so we have an Adjustment to assign to the Adjustment members for classes that don't use them. Clumsy? We shall see.

Anyway, the parameters for this constructor are value, lower, upper, step-increment, and two more values.

12.2.4.86 is_ctrl_key() [1/3]

```
bool seq64::is_ctrl_key (
            GdkEventKey * ev )
```

It's a shame that GdkEventAny doesn't also encapsulate the keyboard state, since that is also available for other events, such as scroll events.

Parameters

ev	The keystroke event to be tested.

12.2.4.87 is_shift_key() [1/3]

```
bool seq64::is_shift_key (
            GdkEventKey * ev )
```

Parameters

ev	The keystroke event to be tested.

12.2.4.88 is_no_modifier()

```
bool seq64::is_no_modifier (
            GdkEventScroll * ev )
```

Parameters

ev	The scroll event to be tested.

12.2.4.89 is_ctrl_key() [2/3]

```
bool seq64::is_ctrl_key (
```

```
            GdkEventScroll * ev )
```

Parameters

ev	The keystroke event to be tested.

12.2.4.90 is_shift_key() [2/3]

```
bool seq64::is_shift_key (
            GdkEventScroll * ev )
```

Parameters

ev	The keystroke event to be tested.

12.2.4.91 is_ctrl_key() [3/3]

```
bool seq64::is_ctrl_key (
            GdkEventButton * ev )
```

Parameters

ev	The keystroke event to be tested.

12.2.4.92 is_shift_key() [3/3]

```
bool seq64::is_shift_key (
            GdkEventButton * ev )
```

Parameters

ev	The keystroke event to be tested.

12.2.4.93 is_ctrl_shift_key()

```
bool seq64::is_ctrl_shift_key (
            GdkEventButton * ev )
```

Parameters

ev	The keystroke event to be tested.

12.2.4.94 is_super_key()

```
bool seq64::is_super_key (
            GdkEventButton * ev )
```

Basically just masks off the MOD4 bit; the "safe" method does not work for this key.

Parameters

ev	The keystroke event to be tested.

12.2.4.95 test_widget_click()

```
void seq64::test_widget_click (
            GtkWidget * w )
```

12.2.4.96 update_mainwid_sequences()

```
void seq64::update_mainwid_sequences ( )
```

It is used by other objects that can modify the currently-edited sequence shown in the mainwid (main window).

12.2.4.97 update_perfedit_sequences()

```
void seq64::update_perfedit_sequences ( )
```

It is used by other objects (seqedit and eventedit) that can modify the currently-edited sequence shown in the perfedit (song window).

12.2.4.98 FF_RW_timeout()

```
int seq64::FF_RW_timeout (
            void * arg )  [inline]
```

Parameters

arg	Provides a putative pointer to the perform object that actually implements the timeout functionality.

Returns

Returns the value of the perform::FF_RW_timeout() call if seq32 transport support is enabled and the arg parameter is good, otherwise false is returned.

12.2.4.99 clamp() [1/2]

```
static long seq64::clamp (
            long val,
            long low,
            long hi )  [inline], [static]
```

12.2.4.100 clamp() [2/2]

```
static long seq64::clamp (
            long val,
            long low,
            long hi )  [inline], [static]
```

12.2.4.101 silence_jack_errors()

```
void seq64::silence_jack_errors (
            bool silent )
```

Probably not good to silence this output, but let's provide the option, for the sake of symmetry, consistency, what have you.

12.2.4.102 silence_jack_info()

```
void seq64::silence_jack_info (
            bool silent )
```

We were getting way too many informational message, to the point of obscuring the debug and error output.

12.2.4.103 midi_api_name()

```
std::string seq64::midi_api_name (
            int i )
```

Parameters

i	The integer value code for the desired API. Must range from int(RTMIDI_API_UNSPECIFIED) to int(RTMIDI_API_DUMMY).

Returns

Returns a human-readable name for the API.

12.2.4.104 midi_probe()

```
int seq64::midi_probe ( )
```

We will upgrade this function for some better testing eventually. It uses the functionality of the midi_info/rtmidi_info objects, plus its own version of some of that functionality.

Returns

Currently always returns 0.

12.2.4.105 midi_input_test()

```
bool seq64::midi_input_test (
            rtmidi_info & info,
            int portindex )
```

12.2.4.106 min()

```
long seq64::min (
            long a,
            long b )  [inline]
```

Parameters

a	First operand.
b	Second operand.

Returns

Returns the minimum value of a and b.

12.2.4.107 jack_process_rtmidi_input()

```
int seq64::jack_process_rtmidi_input (
            jack_nframes_t nframes,
            void * arg )
```

It is the JACK process callback for a MIDI output port (e.g. "system:midi_capture_1", which gives us the output of the Korg nanoKEY2 MIDI controller), also known as a "Readable Client" by qjackctl. It does the following:

This callback receives data from JACK and gives it to our application's input port.

This function does the following:

```
-#  Get the JACK port buffer and the MIDI event-count into this
    buffer.
-#  For each MIDI event, get the event from JACK and push it into a
    local midi_message object.
-#  Get the event time, converting it to a delta time if possible.
-#  If it is not a SysEx continuation, then:
    -#  If we're using a callback, pass the data to that callback.  Do
        we need this callback to interface with the midibus-based
        code?
    -#  Otherwise, add the midi_message container to the rtmidi input
        queue.  One can then grab this data in a midibase ::
        poll_for_midi() call.  We still ought to check the add
        success.
```

The ALSA code polls for events, and that model is also available here. We're still working exactly how it will work best.

This function used to be static, but now we make if available to midi_jack_info. Also note the s_null_detected flag. It is used only to have the apiprint() debug messages appear only once, for better trouble-shooting.

Parameters

nframes	The frame number to be processed.
arg	A pointer to the midi_jack_data structure to be processed.

Returns

Returns 0.

12.2.4.108 jack_process_rtmidi_output()

```
int seq64::jack_process_rtmidi_output (
            jack_nframes_t nframes,
            void * arg )
```

It is the JACK process callback for a MIDI input port (a midi_in_jack object associated with, for example, "system↩ :midi_playback_1", representing, for example, a Korg nanoKEY2 to which we can send information), also known as a "Writable Client" by qjackctl. Here's how it works:

```
-#  Get the JACK port buffer, for our local jack port.  Clear it.
-#  Loop while the number of bytes available for reading [via
    jack_ringbuffer_read_space()] is non-zero.  Note that the second
    parameter is where the data is copied.
-#  Get the size of each event, and allocate space for an event to be
    written to an event port buffer (the JACK "reserve" function).
-#  Read the data from the ringbuffer into this port buffer.  JACK
    should then send it to the remote port.
```

Since this is an output port, "buff" is the area to which we can write data, to send it to the "remote" (i.e. outside our application) port. The data is written to the ringbuffer in api_init_out(), and here we read the ring buffer and pass it to the output buffer.

We were wondering if, like the JACK midiseq example program, we need to wrap out process in a for-loop over the number of frames. In our tests, we are getting 1024 frames, and the code seems to work without that loop.

Parameters

nframes	The frame number to be processed.
arg	A pointer to the JackMIDIData structure to be processed.

Returns

Returns 0.

12.2.4.109 jack_process_io()

```
int seq64::jack_process_io (
            jack_nframes_t nframes,
            void * arg )
```

12.2.4.110 jack_message_bit_bucket()

```
static void seq64::jack_message_bit_bucket (
            const char *  )  [static]
```

12.2.4.111 midi_input_callback()

```
static void seq64::midi_input_callback (
            midi_message & message,
            void *  )  [static]
```

12.2.5 Variable Documentation

12.2.5.1 c_controller_names

```
std::string seq64::c_controller_names
```

This array is used only by the seqedit class.

12.2.5.2 EVENT_STATUS_BIT

```
const midibyte seq64::EVENT_STATUS_BIT
```

12.2.5.3 EVENT_ANY

```
const midibyte seq64::EVENT_ANY
```

The following MIDI events are channel messages. The comments represent the one or two data-bytes of the message.

Note that Channel Mode Messages use the same code as the Control Change, but uses reserved controller numbers ranging from 122 to 127.

The EVENT_ANY (0x00) value may prove to be useful in allowing any event to be dealt with. Not sure yet, but the cost is minimal.

12.2.5.4 EVENT_NOTE_OFF

```
const midibyte seq64::EVENT_NOTE_OFF
```

12.2.5.5 EVENT_NOTE_ON

```
const midibyte seq64::EVENT_NOTE_ON
```

12.2.5.6 EVENT_AFTERTOUCH

```
const midibyte seq64::EVENT_AFTERTOUCH
```

12.2.5.7 EVENT_CONTROL_CHANGE

```
const midibyte seq64::EVENT_CONTROL_CHANGE
```

12.2.5.8 EVENT_PROGRAM_CHANGE

```
const midibyte seq64::EVENT_PROGRAM_CHANGE
```

12.2.5.9 EVENT_CHANNEL_PRESSURE

```
const midibyte seq64::EVENT_CHANNEL_PRESSURE
```

12.2.5.10 EVENT_PITCH_WHEEL

```
const midibyte seq64::EVENT_PITCH_WHEEL
```

12.2.5.11 EVENT_MIDI_SYSEX

```
const midibyte seq64::EVENT_MIDI_SYSEX
```

The following MIDI events have no channel. We have included redundant constant variables for the SysEx Start and End bytes just to make it clear that they are part of this sequence of values, though usually treated separately.

Only the following constants are followed by some data bytes:

```
-   EVENT_MIDI_SYSEX            = 0xF0
-   EVENT_MIDI_QUARTER_FRAME    = 0xF1      // undefined?
-   EVENT_MIDI_SONG_POS         = 0xF2
-   EVENT_MIDI_SONG_SELECT      = 0xF3
```

A MIDI System Exclusive (SYSEX) message starts with F0, followed by the manufacturer ID (how many? bytes), a number of data bytes, and ended by an F7.

12.2.5.12 EVENT_MIDI_QUARTER_FRAME

```
const midibyte seq64::EVENT_MIDI_QUARTER_FRAME
```

12.2.5.13 EVENT_MIDI_SONG_POS

```
const midibyte seq64::EVENT_MIDI_SONG_POS
```

12.2.5.14 EVENT_MIDI_SONG_SELECT

```
const midibyte seq64::EVENT_MIDI_SONG_SELECT
```

12.2.5.15 EVENT_MIDI_SONG_F4

```
const midibyte seq64::EVENT_MIDI_SONG_F4
```

12.2.5.16 EVENT_MIDI_SONG_F5

```
const midibyte seq64::EVENT_MIDI_SONG_F5
```

12.2.5.17 EVENT_MIDI_TUNE_SELECT

```
const midibyte seq64::EVENT_MIDI_TUNE_SELECT
```

12.2.5.18 EVENT_MIDI_SYSEX_END

```
const midibyte seq64::EVENT_MIDI_SYSEX_END
```

12.2.5.19 EVENT_MIDI_SYSEX_CONTINUE

```
const midibyte seq64::EVENT_MIDI_SYSEX_CONTINUE
```

12.2.5.20 EVENT_MIDI_CLOCK

```
const midibyte seq64::EVENT_MIDI_CLOCK
```

12.2.5.21 EVENT_MIDI_SONG_F9

```
const midibyte seq64::EVENT_MIDI_SONG_F9
```

12.2.5.22 EVENT_MIDI_START

```
const midibyte seq64::EVENT_MIDI_START
```

12.2.5.23 EVENT_MIDI_CONTINUE

```
const midibyte seq64::EVENT_MIDI_CONTINUE
```

12.2.5.24 EVENT_MIDI_STOP

```
const midibyte seq64::EVENT_MIDI_STOP
```

12.2.5.25 EVENT_MIDI_SONG_FD

```
const midibyte seq64::EVENT_MIDI_SONG_FD
```

12.2.5.26 EVENT_MIDI_ACTIVE_SENS

```
const midibyte seq64::EVENT_MIDI_ACTIVE_SENS
```

12.2.5.27 EVENT_MIDI_RESET

```
const midibyte seq64::EVENT_MIDI_RESET
```

12.2.5.28 EVENT_MIDI_META

```
const midibyte seq64::EVENT_MIDI_META
```

12.2.5.29 EVENT_NULL_CHANNEL

```
const midibyte seq64::EVENT_NULL_CHANNEL
```

However, it also means that the channel is encoded in the m_status byte itself. This is our work around to be able to hold a multi-channel SMF 0 track in a sequence. In a Sequencer64 SMF 0 track, every event has a channel. In a Sequencer64 SMF 1 track, the events do not have a channel. Instead, the channel is a global value of the sequence, and is stuffed into each event when the event is played or is written to a MIDI file.

12.2.5.30 EVENT_GET_CHAN_MASK

```
const midibyte seq64::EVENT_GET_CHAN_MASK
```

12.2.5.31 EVENT_CLEAR_CHAN_MASK

```
const midibyte seq64::EVENT_CLEAR_CHAN_MASK
```

12.2.5.32 EVENTS_ALL

```
const int seq64::EVENTS_ALL
```

We reversed the parts of each token for consistency with the macros defined above.

12.2.5.33 EVENTS_UNSELECTED

```
const int seq64::EVENTS_UNSELECTED
```

12.2.5.34 c_midibus_output_size

```
const int seq64::c_midibus_output_size
```

These constants were also defined in midibus_portmidi.h, but we made them common to both implementations here.

The c_midibus_output_size value is passed, in mastermidibus, to snd_seq_set_output_buffer_size(). Not sure if the value needs to be so large.

12.2.5.35 c_midibus_input_size

```
const int seq64::c_midibus_input_size
```

Not sure if the value needs to be so large.

12.2.5.36 c_midibus_sysex_chunk

```
const int seq64::c_midibus_sysex_chunk
```

12.2.5.37 c_midibus

```
const midilong seq64::c_midibus
```

Some of the information is stored with each track (and in the midi_container-derived classes), and some is stored in the proprietary header.

Track (sequencer-specific) data:

```
            c_midibus
            c_midich
            c_timesig
            c_triggers (deprecated)
            c_triggers_new
            c_musickey (can be in footer, as well)
            c_musicscale (ditto)
            c_backsequence (ditto)
            c_transpose
```

Footer ("proprietary") data:

```
            c_midictrl
            c_midiclocks
            c_notes
            c_bpmtag (beats per minute)
            c_mutegroups
            c_perf_bp_mes (perfedit's beats-per-measure setting)
            c_perf_bw     (perfedit's beat-width setting)

Also see the PDF file in the following project for more information about
the "proprietary" data:

    https://github.com/ahlstromcj/sequencer64-doc.git

Note that the track data is read from the MIDI file, but not written
directly to the MIDI file.  Instead, it is stored in the MIDI container as
sequences are edited to used these "sequencer-specific" features.
Also note that c_triggers has been replaced by c_triggers_new as the code
that marks the triggers stored with a sequence.

As an extension, we can also grab the key, scale, and background sequence
value selected in a sequence and write these values as track data, where
they can be read in and applied to a specific sequence, when the seqedit
object is created.  These values would not be stored in the legacy format.

Something like this could be done in the "user" configuration file, but
then the key and scale would apply to all songs.  We don't want that.

We could also add snap and note-length to the per-song defaults, but
the "user" configuration file seems like a better place to store these
preferences.
```

Note

The new value c_transpose value is from Stazed's seq32 project. The code to support this option is turned on via the build-configurable SEQ64_STAZED_TRANSPOSE macro, but here we reserved the value even if that option is not enabled by the user. There are additional values from Stazed/seq32, not yet used.Track buss number.

12.2.5.38 c_midich

```
const midilong seq64::c_midich
```

12.2.5.39 c_midiclocks

```
const midilong seq64::c_midiclocks
```

12.2.5.40 c_triggers

```
const midilong seq64::c_triggers
```

12.2.5.41 c_notes

```
const midilong seq64::c_notes
```

12.2.5.42 c_timesig

```
const midilong seq64::c_timesig
```

12.2.5.43 c_bpmtag

```
const midilong seq64::c_bpmtag
```

12.2.5.44 c_triggers_new

```
const midilong seq64::c_triggers_new
```

12.2.5.45 c_mutegroups

```
const midilong seq64::c_mutegroups
```

12.2.5.46 c_midictrl

```
const midilong seq64::c_midictrl
```

12.2.5.47 c_musickey

```
const midilong seq64::c_musickey
```

12.2.5.48 c_musicscale

```
const midilong seq64::c_musicscale
```

12.2.5.49 c_backsequence

```
const midilong seq64::c_backsequence
```

12.2.5.50 c_transpose

```
const midilong seq64::c_transpose
```

12.2.5.51 c_perf_bp_mes

```
const midilong seq64::c_perf_bp_mes
```

12.2.5.52 c_perf_bw

```
const midilong seq64::c_perf_bw
```

12.2.5.53 c_midi_track_ctrl

```
const int seq64::c_midi_track_ctrl
```

The lowest value is c_seqs_in_set ∗ 2 = 64.

I think the reason for that value is to perhaps handle two sets or something like that. Will figure it out later.

The controls are read in from the "rc" configuration files, and are written to the c_midictrl section of the "proprietary" final track in a Seq24/Sequencer64 MIDI file.

Note that we are adding some more MIDI control entries to support the following additional functions:

```
-   Start
-   Pause
-   Stop
-   (any more???)
```

To help with backward compatibility, the old c_midi_controls limit is supplemented with a new, higher limit, c_midi↩ _controls_extended. We also add a number of placeholders so we don't have to adjust the new limit again later. To aid the transition, g_midi_control_limit replaces c_midi_controls, though, for now, it has the same value.

12.2.5.54 c_midi_control_bpm_up

```
const int seq64::c_midi_control_bpm_up
```

12.2.5.55 c_midi_control_bpm_dn

```
const int seq64::c_midi_control_bpm_dn
```

12.2.5.56 c_midi_control_ss_up

```
const int seq64::c_midi_control_ss_up
```

12.2.5.57 c_midi_control_ss_dn

```
const int seq64::c_midi_control_ss_dn
```

12.2.5.58 c_midi_control_mod_replace

```
const int seq64::c_midi_control_mod_replace
```

12.2.5.59 c_midi_control_mod_snapshot

```
const int seq64::c_midi_control_mod_snapshot
```

12.2.5.60 c_midi_control_mod_queue

```
const int seq64::c_midi_control_mod_queue
```

12.2.5.61 c_midi_control_mod_gmute

```
const int seq64::c_midi_control_mod_gmute
```

12.2.5.62 c_midi_control_mod_glearn

```
const int seq64::c_midi_control_mod_glearn
```

12.2.5.63 c_midi_control_play_ss

```
const int seq64::c_midi_control_play_ss
```

12.2.5.64 c_midi_controls

```
const int seq64::c_midi_controls
```

12.2.5.65 c_midi_control_playback

```
const int seq64::c_midi_control_playback
```

12.2.5.66 c_midi_control_record

```
const int seq64::c_midi_control_record
```

12.2.5.67 c_midi_control_solo

```
const int seq64::c_midi_control_solo
```

12.2.5.68 c_midi_control_thru

```
const int seq64::c_midi_control_thru
```

12.2.5.69 c_midi_control_bpm_page_up

```
const int seq64::c_midi_control_bpm_page_up
```

12.2.5.70 c_midi_control_bpm_page_dn

```
const int seq64::c_midi_control_bpm_page_dn
```

12.2.5.71 c_midi_control_16

```
const int seq64::c_midi_control_16
```

12.2.5.72 c_midi_control_17

```
const int seq64::c_midi_control_17
```

12.2.5.73 c_midi_control_18

```
const int seq64::c_midi_control_18
```

12.2.5.74 c_midi_control_19

```
const int seq64::c_midi_control_19
```

12.2.5.75 c_midi_controls_extended

```
const int seq64::c_midi_controls_extended
```

12.2.5.76 g_midi_control_limit

```
int seq64::g_midi_control_limit
```

12.2.5.77 c_scales_policy

```
const bool seq64::c_scales_policy[c_scale_size][SEQ64_OCTAVE_SIZE]
```

See the following sites for more information:

- http://method-behind-the-music.com/theory/scalesandkeys/
- https://en.wikipedia.org/wiki/Heptatonic_scale
- https://en.wikibooks.org/wiki/Music_Theory/Scales_and_Intervals

Note that melodic minor descends in the same way as the natural minor scale, so it descends differently than it ascends. We don't deal with that trick, at all. In the following table, the scales all start with C, but seq24/sequencer64 allow other starting notes (e.g. "keys").

```
   Chromatic           C  C# D  D# E  F  F# G  G# A  A# B   Notes, chord
   Major               C  .  D  .  E  F  .  G  .  A  .  B
   Minor               C  .  D  Eb .  F  .  G  Ab .  Bb .
   Harmonic Minor      C  .  D  Eb .  F  .  G  Ab .  .  B
   Melodic Minor       C  .  D  Eb .  F  .  G  .  A  .  B   Descending diff.
   C Whole Tone        C  .  D  .  E  .  F# .  G# .  A# .   C+7 chord
   Blues               C  .  .  Eb .  F  Gb G  .  .  Bb .
   Major Pentatonic    C  .  D  .  E  .  .  G  .  A  .  .
   Minor Pentatonic    C  .  .  Eb .  F  .  G  .  .  Bb .
   Octatonic 1         C  .  D  Eb .  F  Gb .  Ab A  .  B   Unimplemented
   Octatonic 2         C  Db .  Eb E  F  F# G  .  A  Bb .   Unimplemented
```

12.2.5.78 c_scales_transpose_up

```
const int seq64::c_scales_transpose_up[c_scale_size][SEQ64_OCTAVE_SIZE]
```

For example, if we simply add 1 semitone to each note, it remains a minor key, but it is in a different minor key. Using the transpositions in these arrays, the minor key remains the same minor key.

```
   Major               C  .  D  .  E  F  .  G  .  A  .  B
   Transpose up        2  0  2  0  1  2  0  2  0  2  0  1
   Result up           D  .  E  .  F  G  .  A  .  B  .  C
```

```
    Minor              C  .  D  D# .  F  .  G  G# .  A# .
    Transpose up       2  0  1  2  0  2  0  1  2  0  2  0
    Result up          D  .  D# F  .  G  .  G# A# .  C  .

    Harmonic minor     C  .  D  Eb .  F  .  G  Ab .  .  B
    Transpose up       2  .  1  2  .  2  .  1  3  .  .  1
    Result up          D  .  Eb F  .  G  .  Ab B  .  .  C

    Melodic minor      C  .  D  Eb .  F  .  G  .  A  .  B
    Transpose up       2  .  1  2  .  2  .  2  .  2  .  1
    Result up          D  .  Eb F  .  G  .  A  .  B  .  C

    C Whole Tone       C  .  D  .  E  .  F# .  G# .  A# .
    Transpose up       2  .  2  .  2  .  2  .  2  .  2  .
    Result up          D  .  E  .  F# .  G# .  A# .  C  .

    Blues              C  .  .  Eb .  F  Gb G  .  .  Bb .
    Transpose up       3  .  .  2  .  1  1  3  .  .  2  .
    Result up          Eb .  .  F  .  Gb G  Bb .  .  C  .

    Major Pentatonic   C  .  D  .  E  .  .  G  .  A  .  .
    Transpose up       2  .  2  .  3  .  .  2  .  3  .  .
    Result up          D  .  E  .  G  .  .  A  .  C  .  .

    Minor Pentatonic   C  .  .  Eb .  F  .  G  .  .  Bb .
    Transpose up       3  .  .  2  .  2  .  3  .  .  2  .
    Result up          Eb .  .  F  .  G  .  Bb .  .  C  .
```

12.2.5.79 c_scales_transpose_dn

```
const int seq64::c_scales_transpose_dn[c_scale_size][SEQ64_OCTAVE_SIZE]
```

```
    Major              C  .  D  .  E  F  .  G  .  A  .  B
    Transpose down     1  .  2  .  2  1  .  2  .  2  .  2
    Result down        B  .  C  .  D  E  .  F  .  G  .  A

    Minor              C  .  D  D# .  F  .  G  G# .  A# .
    Transpose down     2  .  2  1  .  2  .  2  1  .  2  .
    Result down        A# .  C  D  .  D# .  F  G  .  G# .

    Harmonic minor     C  .  D  Eb .  F  .  G  Ab .  .  B
    Transpose down     1  .  2  1  .  2  .  2  1  .  .  3
    Result down        B  .  C  D  .  Eb .  F  G  .  .  Ab

    Melodic minor      C  .  D  Eb .  F  .  G  .  A  .  B
    Transpose down     1  .  2  1  .  2  .  2  .  2  .  2
    Result down        B  .  C  D  .  Eb .  F  .  G  .  A

    C whole tone       C  .  D  .  E  .  F# .  G# .  A# .
    Transpose down     2  .  2  .  2  .  2  .  2  .  2  .
    Result down        A# .  C  .  D  .  E  .  F# .  G# .

    Blues              C  .  .  Eb .  F  Gb G  .  .  Bb .
    Transpose down     2  .  .  3  .  2  1  1  .  .  3  .
    Result down        Bb .  .  C  .  Eb F  Gb .  .  G  .

    Major Pentatonic   C  .  D  .  E  .  .  G  .  A  .  .
    Transpose down     3  .  2  .  2  .  .  3  .  2  .  .
    Result down        A  .  C  .  D  .  .  E  .  G  .  .

    Minor Pentatonic   C  .  .  Eb .  F  .  G  .  .  Bb .
    Transpose down     2  .  .  3  .  2  .  2  .  .  3  .
    Result down        Bb .  .  C  .  Eb .  F  .  .  G  .
```

12.2.5.80 c_scales_text

```
const char seq64::c_scales_text[c_scale_size][20]
```

12.2.5.81 c_key_text

```
const char seq64::c_key_text[SEQ64_OCTAVE_SIZE][4]
```

12.2.5.82 c_interval_text

```
const char seq64::c_interval_text[16][4]
```

12.2.5.83 c_chord_text

```
const char seq64::c_chord_text[8][6]
```

However, we have not seen this menu in the GUI! Ah, it only appears if the user has selected a musical scale like Major or Minor.

12.2.5.84 c_chord_number

```
const int seq64::c_chord_number
```

The chord-number is a count of the number of entries in c_chord_table_text. Will never change, luckily.

12.2.5.85 c_chord_table_text

```
const char seq64::c_chord_table_text[c_chord_number][12]
```

These chords appear in the sequence-editor chord-button dropdown menu. The longest string is 11 characters, and we add one for the null terminator. A good case for using std::string here. :-)

12.2.5.86 c_chord_size

```
const int seq64::c_chord_size
```

12.2.5.87 c_chord_table

```
const int seq64::c_chord_table[c_chord_number][c_chord_size]
```

These values indicate the note offsets needed for a particular kind of chord. 0 means no offset, and a -1 ends the list of note offsets for the chord.

12.2.5.88 c_max_instruments

```
const int seq64::c_max_instruments
```

With a value of 64, this is more of a sanity-check than a realistic number of instruments defined by a user.

12.2.5.89 c_max_busses

```
const int seq64::c_max_busses
```

12.2.5.90 versiontext

```
const std::string seq64::versiontext  [static]
```

This value ultimately comes from the configure.ac script.

This was too redundant:

SEQ64_PACKAGE " " SEQ64_VERSION " (" SEQ64_GIT_VERSION ") " **DATE** "\n"

This is out-of-date:

SEQ64_PACKAGE " " SEQ64_GIT_VERSION " " **DATE** "\n";

12.2.5.91 long_options

```
struct option seq64::long_options[]  [static]
```

Note the terminating null structure..

12.2.5.92 s_arg_list

```
const std::string seq64::s_arg_list  [static]
```

The following string keeps track of the characters used so far. An 'x' means the character is used; an 'o' means it is used for the legacy spelling of the option, which uses underscores instead of hyphens. An 'a' indicates we could repurpose the key with minimal impact. An asterisk indicates the option is reserved for application-specific options. Currently we will use it for options like "daemonize" in the seq64cli application.

```
        0123456789 @AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPpQqRrSsTtUuVvWwXxYyZz
         ooooooooo oxxxxxx x  xx  xx xxx xxxxxxx *xx xxxxx xxxxa   x

Previous arg-list, items missing! "ChVH:lRrb:q:Lni:jJmaAM:pPusSU:x:"
```

12.2.5.93 s_help_1a

```
const char* const seq64::s_help_1a  [static]
```

12.2.5.94 s_help_1b

```
const char* const seq64::s_help_1b  [static]
```

12.2.5.95 s_help_2

```
const char* const seq64::s_help_2  [static]
```

12.2.5.96 s_help_3

```
const char* const seq64::s_help_3  [static]
```

12.2.5.97 s_help_4

```
const char* const seq64::s_help_4  [static]
```

12.2.5.98 s_build_alsamidi_support

```
const std::string seq64::s_build_alsamidi_support  [static]
```

12.2.5.99 s_build_portmidi_support

```
const std::string seq64::s_build_portmidi_support  [static]
```

12.2.5.100 s_build_rtmidi_support

```
const std::string seq64::s_build_rtmidi_support  [static]
```

12.2.5.101 s_build_highlight_empty

```
const std::string seq64::s_build_highlight_empty  [static]
```

12.2.5.102 s_build_lash_support

```
const std::string seq64::s_build_lash_support  [static]
```

12.2.5.103 s_build_jack_support

```
const std::string seq64::s_build_jack_support  [static]
```

12.2.5.104 s_build_jack_session

```
const std::string seq64::s_build_jack_session  [static]
```

12.2.5.105 s_event_editor

```
const std::string seq64::s_event_editor  [static]
```

12.2.5.106 s_build_pause_support

```
const std::string seq64::s_build_pause_support  [static]
```

12.2.5.107 s_build_use_event_map

```
const std::string seq64::s_build_use_event_map  [static]
```

12.2.5.108 s_build_chord_generator

```
const std::string seq64::s_build_chord_generator  [static]
```

12.2.5.109 s_build_edit_highlight

```
const std::string seq64::s_build_edit_highlight  [static]
```

12.2.5.110 s_build_timesig_tempo

```
const std::string seq64::s_build_timesig_tempo  [static]
```

12.2.5.111 s_build_midi_vector

```
const std::string seq64::s_build_midi_vector  [static]
```

12.2.5.112 s_build_solid_grid

```
const std::string seq64::s_build_solid_grid  [static]
```

12.2.5.113 s_build_follow_progress

```
const std::string seq64::s_build_follow_progress  [static]
```

12.2.5.114 s_statistics_support

```
const std::string seq64::s_statistics_support  [static]
```

12.2.5.115 s_strip_empty_mutes

```
const std::string seq64::s_strip_empty_mutes  [static]
```

12.2.5.116 s_seq32_jack_support

```
const std::string seq64::s_seq32_jack_support  [static]
```

12.2.5.117 s_seq32_transport

```
const std::string seq64::s_seq32_transport  [static]
```

12.2.5.118 s_seq32_transpose

```
const std::string seq64::s_seq32_transpose  [static]
```

12.2.5.119 s_seq32_menu_buttons

```
const std::string seq64::s_seq32_menu_buttons  [static]
```

12.2.5.120 s_seq32_lfo_support

```
const std::string seq64::s_seq32_lfo_support  [static]
```

12.2.5.121 s_debug_mode

```
const std::string seq64::s_debug_mode  [static]
```

12.2.5.122 s_status_pairs

```
jack_status_pair_t seq64::s_status_pairs[]
```

Terminated by a 0 value and an empty string.

12.2.5.123 s_character_mapping

```
struct charpair_t seq64::s_character_mapping[]
```

12.2.5.124 s_global_lash_driver

```
lash* seq64::s_global_lash_driver  [static]
```

It is actually hidden in this module now, so that a function can be used in its place.

Like the font renderer, This item was once created in the main module, sequencer64.cpp. Now we make it a safer, more fool-proof, function. However, unlike the font-render, which always exists, the LASH driver is conditional, and might not be wanted. Therefore, we cannot return a reference, because there's no such thing as a null reference in C++. We have to return a pointer.

12.2.5.125 c_status_replace

```
const int seq64::c_status_replace  [static]
```

Note how they specify different bit values, as it they could be masked together to signal multiple functions.

This value signals the "replace" functionality. If this bit is set, then perform::sequence_playing_toggle() unsets this status and calls perform::off_sequences(), which calls sequence::set_playing(false) for all active sequences.

It works like this:

```
-#  The user presses the Replace key, or the MIDI control message for
    c_midi_control_mod_replace is received.
-#  This bit is OR'd into perform::m_control_status.  This status bit
    is used in perform::sequence_playing_toggle().
    -   Called in perform::sequence_key() so that keystrokes in
        the main window toggle patterns in the main window.
    -   Called in peform::toggle_other_seqs() to implement
        Shift-click to toggle all other patterns but the one
        clicked.
    -   Called in seqmenu::toggle_current_sequence(), called in
        mainwid to implement clicking on a pattern.
    -   Also used in MIDI control to toggle patterns 0 to 31,
        offset by the screen-set.
    -   perform::sequence_playing_off(), similarly used in MIDI control.
    -   perform::sequence_playing_on(), similarly used in MIDI control.
-#  When the key is released, this bit is AND'd out of
    perform::m_control_status.

Both the MIDI control and the keystoke set the sequence to be
"replaced".
```

12.2.5.126 c_status_snapshot

```
const int seq64::c_status_snapshot  [static]
```

By default, perform::sequence_playing_toggle() calls sequence::toggle_playing() on the given sequence number, plus what is noted for c_status_snapshot.

It works like this:

```
-#  The user presses the Snapshot key.
-#  This bit is OR'd into perform::m_control_status.
-#  The playing state of the patterns is saved by
    perform::save_playing_state().
-#  When the key is released, this bit is AND'd out of
    perform::m_control_status.
-#  The playing state of the patterns is restored by
    perform::restore_playing_state().
```

12.2.5.127 c_status_queue

```
const int seq64::c_status_queue  [static]
```

If this bit is set, then perform::sequence_playing_toggle() calls sequence::toggle_queued() on the given sequence number.

12.2.5.128 g_rc_settings

```
rc_settings seq64::g_rc_settings  [static]
```

12.2.5.129 g_user_settings

```
user_settings seq64::g_user_settings  [static]
```

12.2.5.130 s_handlesize [1/2]

```
const long seq64::s_handlesize  [static]
```

12.2.5.131 s_jitter_amount

```
const int seq64::s_jitter_amount  [static]
```

12.2.5.132 gs_mainwid_pointer

```
mainwid* seq64::gs_mainwid_pointer  [static]
```

We have decided that passing along a mainwnd reference among a number of constructors is too much and actually harder to understand and more error prone. This value is set at the end of the mainwnd constructor, but only the first time that constructor is called.

12.2.5.133 c_mainwid_x

```
const int seq64::c_mainwid_x
```

Affected by the c_mainwid_border and c_mainwid_spacing values.

12.2.5.134 c_mainwid_y

```
const int seq64::c_mainwid_y
```

12.2.5.135 gs_perfedit_pointer_0

```
perfedit* seq64::gs_perfedit_pointer_0  [static]
```

12.2.5.136 gs_perfedit_pointer_1

```
perfedit* seq64::gs_perfedit_pointer_1  [static]
```

12.2.5.137 s_handlesize [2/2]

```
const long seq64::s_handlesize  [static]
```

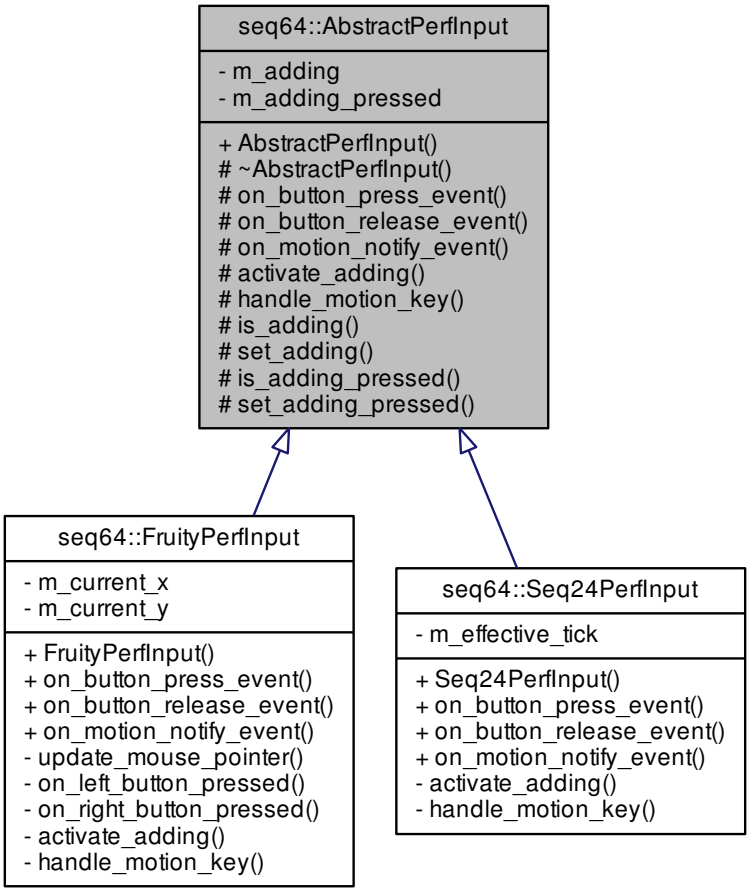
Chapter 13

Data Structure Documentation

13.1 seq64::AbstractPerfInput Class Reference

Provides an abstract base class to provide the minimal interface for the various "perf input" classes.

Inheritance diagram for seq64::AbstractPerfInput:



Public Member Functions

- AbstractPerfInput ()

  Default constructor.

Protected Member Functions

- virtual ~AbstractPerfInput ()

  Destructor, does nothing.
- virtual bool on_button_press_event (GdkEventButton *a_ev, perfroll &roll)=0
- virtual bool on_button_release_event (GdkEventButton *a_ev, perfroll &roll)=0
- virtual bool on_motion_notify_event (GdkEventMotion *a_ev, perfroll &roll)=0
- virtual void activate_adding (bool adding, perfroll &roll)=0
- virtual bool handle_motion_key (bool is_left, perfroll &roll)=0
- bool is_adding () const

  'Getter' function for member m_adding
- void set_adding (bool flag)

  'Setter' function for member m_adding
- bool is_adding_pressed () const

  'Getter' function for member m_adding_pressed
- void set_adding_pressed (bool flag)

  'Setter' function for member m_adding_pressed

Private Attributes

- bool m_adding

  Indicates we are in the middle of adding a sequence segment to the performance.
- bool m_adding_pressed

  Indicates if the left mouse button is pressed while in adding mode.

Friends

- class perfroll

13.1.1 Constructor & Destructor Documentation

13.1.1.1 AbstractPerfInput()

```
seq64::AbstractPerfInput::AbstractPerfInput ( )  [inline]
```

13.1.1.2 ~AbstractPerfInput()

```
virtual seq64::AbstractPerfInput::~AbstractPerfInput ( )  [inline], [protected], [virtual]
```

13.1.2 Member Function Documentation

13.1.2.1 on_button_press_event()

```
virtual bool seq64::AbstractPerfInput::on_button_press_event (
            GdkEventButton * a_ev,
            perfroll & roll )  [protected], [pure virtual]
```

Implemented in seq64::Seq24PerfInput, and seq64::FruityPerfInput.

13.1.2.2 on_button_release_event()

```
virtual bool seq64::AbstractPerfInput::on_button_release_event (
            GdkEventButton * a_ev,
            perfroll & roll )  [protected], [pure virtual]
```

Implemented in seq64::Seq24PerfInput, and seq64::FruityPerfInput.

13.1.2.3 on_motion_notify_event()

```
virtual bool seq64::AbstractPerfInput::on_motion_notify_event (
            GdkEventMotion * a_ev,
            perfroll & roll )  [protected], [pure virtual]
```

Implemented in seq64::Seq24PerfInput, and seq64::FruityPerfInput.

13.1.2.4 activate_adding()

```
virtual void seq64::AbstractPerfInput::activate_adding (
            bool adding,
            perfroll & roll )  [protected], [pure virtual]
```

Implemented in seq64::Seq24PerfInput, and seq64::FruityPerfInput.

13.1.2.5 handle_motion_key()

```
virtual bool seq64::AbstractPerfInput::handle_motion_key (
            bool is_left,
            perfroll & roll )  [protected], [pure virtual]
```

Implemented in seq64::Seq24PerfInput, and seq64::FruityPerfInput.

13.1.2.6 is_adding()

```
bool seq64::AbstractPerfInput::is_adding ( ) const  [inline], [protected]
```

13.1.2.7 set_adding()

```
void seq64::AbstractPerfInput::set_adding (
            bool flag )  [inline], [protected]
```

13.1.2.8 is_adding_pressed()

```
bool seq64::AbstractPerfInput::is_adding_pressed ( ) const  [inline], [protected]
```

13.1.2.9 set_adding_pressed()

```
void seq64::AbstractPerfInput::set_adding_pressed (
            bool flag )  [inline], [protected]
```

13.1.3 Friends And Related Function Documentation

13.1.3.1 perfroll

```
friend class perfroll  [friend]
```

13.1.4 Field Documentation

13.1.4.1 m_adding

```
bool seq64::AbstractPerfInput::m_adding  [private]
```

13.1.4.2 m_adding_pressed

```
bool seq64::AbstractPerfInput::m_adding_pressed  [private]
```

13.2 seq64::automutex Class Reference

Provides a mutex that locks automatically when created, and unlocks when destroyed.

Public Member Functions

- automutex (mutex &my_mutex)

  Principal constructor gets a reference to a mutex parameter, and then locks the mutex.
- ~automutex ()

  The destructor unlocks the mutex.

Private Member Functions

- automutex ()
- automutex (const automutex &)
- automutex & operator= (const automutex &)

Private Attributes

- mutex & m_safety_mutex

  Provides the mutex reference to be used for locking.

13.2.1 Detailed Description

This has a couple of benefits. First, it is threadsafe in the face of exception handling. Secondly, it can be done with just one line of code.

13.2.2 Constructor & Destructor Documentation

13.2.2.1 automutex() [1/3]

```
seq64::automutex::automutex ( )  [private]
```

13.2.2.2 automutex() [2/3]

```
seq64::automutex::automutex (
            const automutex &  )  [private]
```

13.2.2.3 automutex() [3/3]

```
seq64::automutex::automutex (
            mutex & my_mutex )  [inline]
```

Parameters

my_mutex	The caller's mutex to be used for locking.

13.2.2.4 ~automutex()

```
seq64::automutex::~automutex ( )  [inline]
```

13.2.3 Member Function Documentation

13.2.3.1 operator=()

```
automutex& seq64::automutex::operator= (
            const automutex &  )  [private]
```

13.2.4 Field Documentation

13.2.4.1 m_safety_mutex

```
mutex& seq64::automutex::m_safety_mutex  [private]
```

13.3 seq64::busarray Class Reference

Holds a number of businfo objects.

Public Member Functions

- busarray ()

  A new class to hold a number of MIDI busses and flags for more controlled access than using arrays of booleans and pointers.
- ~busarray ()

  Removes components from the container.
- bool add (midibus *bus, clock_e clock)

  Creates and adds a new midibus object to the list.
- bool add (midibus *bus, bool inputing)

  Creates and adds a new midibus object to the list.
- bool initialize ()

  Initializes all busses.
- int count () const
- midibus * bus (bussbyte b)
- void start ()

  Starts all of the busses; used for output busses only, but no check is made at present.
- void stop ()

  Stops all of the busses; used for output busses only, but no check is made at present.
- void continue_from (midipulse tick)

  Continues from the given tick for all of the busses; used for output busses only.
- void init_clock (midipulse tick)

  Initializes the clocking at the given tick for all of the busses; used for output busses only.
- void clock (midipulse tick)

  Clocks at the given tick for all of the busses; used for output busses only.
- void sysex (event *ev)

  Handles SysEx events; used for output busses.
- void play (bussbyte bus, event *e24, midibyte channel)

  Plays an event, if the bus is proper.
- bool set_clock (bussbyte bus, clock_e clocktype)

  Sets the clock type for the given bus, usually the output buss.
- void set_all_clocks ()

  Sets the clock type for all busses, usually the output buss.
- clock_e get_clock (bussbyte bus)

  Gets the clock type for the given bus, usually the output buss.
- std::string get_midi_bus_name (int bus)

  Get the MIDI output buss name (i.e.
- void print () const

  Print some information about the available MIDI input or output busses.
- void port_exit (int client, int port)

  Turn off the given port for the given client.
- bool set_input (bussbyte bus, bool inputing)

  Set the status of the given input buss, if a legal buss number.
- void set_all_inputs ()

  Set the status of all input busses.
- bool get_input (bussbyte bus)

  Get the input for the given (legal) buss number.
- bool is_system_port (bussbyte bus)

  Get the system-port status for the given (legal) buss number.
- bool poll_for_midi ()

  Initiate a poll() on the existing poll descriptors.
- bool get_midi_event (event *inev)

  Gets the first MIDI event in finds on an input bus.
- int replacement_port (int bus, int port)

  Provides a function to use in api_port_start(), to determine if the port is to be a "replacement" port.

Private Attributes

- std::vector< businfo > m_container

  The full set of businfo objects, only some of which will actually be used.

13.3.1 Constructor & Destructor Documentation

13.3.1.1 busarray()

```
seq64::busarray::busarray ( )
```

13.3.1.2 ~busarray()

```
seq64::busarray::~busarray ( )
```

However, now that we swap containers, we cannot call this functionality, because it deletes the bus's midibus pointer and nullifies it.

DISABLED, BUT WE NEED A WAY TO CLEAN UP AT EXIT TIME!!!

13.3.2 Member Function Documentation

13.3.2.1 add() [1/2]

```
bool seq64::busarray::add (
            midibus * bus,
            clock_e clock )
```

Then the clock value is set. This function is meant for output ports.

We need to belay the initialization until later, when we know the configured clock settings for the output ports. So initialization has been removed from the constructor and moved to the initialize() function.

Parameters

bus	The midibus to be hooked into the array of busses.
clock	The clocking value for the bus.

Returns

Returns true if the bus was added successfully, though, really, it cannot fail.

13.3.2.2 add() [2/2]

```
bool seq64::busarray::add (
            midibus * bus,
            bool inputing )
```

Then the inputing value is set. This function is meant for input ports.

We need to belay the initialization until later, when we know the configured inputing settings for the input ports. So initialization has been removed from the constructor and moved to the initialize() function. However, now we know the configured status and can apply it right away.

Parameters

bus	The midibus to be hooked into the array of busses.
inputing	The input flag value for the bus. If true, this value indicates that the user has selected this bus to be the input MIDI bus.

Returns

Returns true if the bus was added successfully, though, really, it cannot fail.

13.3.2.3 initialize()

```
bool seq64::busarray::initialize ( )
```

Not sure we need this function.

Returns

Returns true if all busses initialized successfully.

13.3.2.4 count()

```
int seq64::busarray::count ( ) const  [inline]
```

13.3.2.5 bus()

```
midibus* seq64::busarray::bus (
            bussbyte b )  [inline]
```

13.3.2.6 start()

```
void seq64::busarray::start ( )
```

13.3.2.7 stop()

```
void seq64::busarray::stop ( )
```

13.3.2.8 continue_from()

```
void seq64::busarray::continue_from (
            midipulse tick )
```

Parameters

tick	Provides the tick value for all busses to continue from.

13.3.2.9 init_clock()

```
void seq64::busarray::init_clock (
            midipulse tick )
```

Parameters

tick	Provides the tick value for all busses use as the clock tick.

13.3.2.10 clock()

```
void seq64::busarray::clock (
            midipulse tick )
```

Parameters

tick	Provides the tick value for all busses use as the clock tick.

13.3.2.11 sysex()

```
void seq64::busarray::sysex (
            event * ev )
```

Parameters

ev	Provides the SysEx event to handle.

13.3.2.12 play()

```
void seq64::busarray::play (
            bussbyte bus,
            event * e24,
            midibyte channel )
```

Parameters

bus	The MIDI buss on which to play the event.
e24	A pointer to the event to be played.
channel	The MIDI channel on which to play the event. Sequencer64 controls the actual channel of playback, no matter what the channel specified in the event.

13.3.2.13 set_clock()

```
bool seq64::busarray::set_clock (
            bussbyte bus,
            clock_e clocktype )
```

This code is a bit more restrictive than the original code in mastermidibus::set_clock().

Parameters

bus	The MIDI bus for which the clock is to be set.
clocktype	Provides the type of clocking for the buss.

13.3.2.14 set_all_clocks()

```
void seq64::busarray::set_all_clocks ( )
```

Note that the settings to apply are added when the add() call is made.

13.3.2.15 get_clock()

```
clock_e seq64::busarray::get_clock (
            bussbyte bus )
```

Parameters

bus	The MIDI bus for which the clock is to be set.

Returns

Returns the clock value set for the desired buss. If the buss is invalid, then e_clock_off is returned.

13.3.2.16 get_midi_bus_name()

```
std::string seq64::busarray::get_midi_bus_name (
            int bus )
```

the full display name) for the given (legal) buss number.

This function adds the retrieval of client and port numbers that are not needed in the portmidi implementation, but seem generally useful to support in all implementations. It's main use is to display the full portname in one of two forms:

- "[0] 0:0 clientname:portname"
- "[0] 0:0 portname"

The second version is chosen if "clientname" is already included in the port name, as many MIDI clients do that. However, the name gets modified to reflect the remote system port to which it will connect.

Parameters

bus	Provides the output buss number. Checked before usage. Actually should now be an index number

Returns

Returns the buss name as a standard C++ string, truncated to 80-1 characters. Also contains an indication that the buss is disconnected or unconnected. If the buss number is illegal, this string is empty.

13.3.2.17 print()

```
void seq64::busarray::print ( ) const
```

13.3.2.18 port_exit()

```
void seq64::busarray::port_exit (
            int client,
            int port )
```

Both the busses for the given client are stopped: that is, set to inactive.

This function is called by api_get_midi_event() when the ALSA event SND_SEQ_EVENT_PORT_EXIT is received. Since port_exit() has no direct API-specific code in it, we do not need to create a virtual api_port_exit() function to implement the port-exit event.

Parameters

client	The client to be matched and acted on. This value is actually an ALSA concept.
port	The port to be acted on. Both parameter must be matched before the buss is made inactive. This value is actually an ALSA concept.

13.3.2.19 set_input()

```
bool seq64::busarray::set_input (
            bussbyte bus,
            bool inputing )
```

There's currently no implementation-specific API function called directly here. What happens is that midibase::set_input() uses the *inputing* parameter to decide whether to call init_in() or deinit_in(), and these functions ultimately lead to an API specific called.

Note that the call to midibase::set_input() will set its m_inputing flag, and then call init_in() or deinit_in() if that flag changed. This change is important, so we have to call midibase::set_input() first. Then the call to businfo::init_input() will set that flag again (plus another flag). A bit confusing in sequence and in function naming.

This function should be used only for the input busarray, obviously.

Threadsafe

Parameters

bus	Provides the buss number.
inputing	True if the input bus will be inputting MIDI data.

Returns

Returns true if the buss number is valid and was active, and so could be set.

13.3.2.20 set_all_inputs()

```
void seq64::busarray::set_all_inputs ( )
```

There's no implementation-specific API function here. This function should be used only for the input busarray, obviously. Note that the input settings used here were stored when the add() function was called. They can be changed by the user via the Options / MIDI Input tab.

13.3.2.21 get_input()

```
bool seq64::busarray::get_input (
            bussbyte bus )
```

There's currently no implementation-specific API function here.

Parameters

bus	Provides the buss number.

Returns

If the buss is a system buss, always returns true. Otherwise, if the buss is inactive, returns false. Otherwise, the buss's get_input() status is returned.

13.3.2.22 is_system_port()

```
bool seq64::busarray::is_system_port (
            bussbyte bus )
```

Parameters

bus	Provides the buss number.

Returns

Returns the selected buss's is-system-port status. If the buss number is out of range, then false is returned.

13.3.2.23 poll_for_midi()

```
bool seq64::busarray::poll_for_midi ( )
```

This is a primitive poll, which exits when some data is obtained. It also applies only to the input busses.

Returns

Returns true if a MIDI event was detected on one of the busses. Note that this is a boolean value, while the midibase::poll_for_midi() function returns an integer.

13.3.2.24 get_midi_event()

```
bool seq64::busarray::get_midi_event (
            event * inev )
```

Note that this function risks starving the second input device if more than one is enabled in Sequencer64. We will figure that one out later.

Parameters

inev	A pointer to the event to be modified by incoming data, if any.

Returns

Returns true if an event's data was copied into the event pointer.

13.3.2.25 replacement_port()

```
int seq64::busarray::replacement_port (
            int bus,
            int port )
```

This function is meant only for the output buss (so far).

Still need to determine exactly what this function needs to do.

Parameters

bus	The buss to be affected.
port	The prot to be affected.

Returns

Returns -1 if no matching port is found, otherwise it returns the replacement-port number.

13.3.3 Field Documentation

13.3.3.1 m_container

```
std::vector<businfo> seq64::busarray::m_container  [private]
```

13.4 seq64::businfo Class Reference

A new class to consolidate a number of bus-related arrays into one array.

Public Member Functions

- businfo ()

  A new class to consolidate a number of bus-related arrays into one array.
- businfo (midibus *bus)

  Principal constructor.
- businfo (const businfo &rhs)

  Copy constructor.
- ~businfo ()

  We can't destroy the bus pointer.
- void remove ()

  Deletes and nullifies the m_bus pointer.
- const midibus * bus () const

  'Getter' function for member m_bus pointer, const version
- midibus * bus ()

  'Getter' function for member m_bus pointer
- bool active () const

  'Getter' function for member m_active
- bool initialize ()

  This function is called when the businfo object is added to the busarray.
- bool initialized () const

  'Getter' function for member m_initialized
- clock_e init_clock () const
- bool init_input () const
- void bus (midibus *b)
- void activate ()
- void deactivate ()
- void init_clock (clock_e clocktype)
- void init_input (bool flag)

Private Member Functions

- void start ()
- void stop ()
- void continue_from (midipulse tick)
- void init_clock (midipulse tick)
- void clock (midipulse tick)
- void sysex (event *ev)
- void print () const

  Print some information about the MIDI bus.

Private Attributes

- midibus * m_bus

  Points to an existing midibus object.
- bool m_active

  Indicates if the existing bus is active.
- bool m_initialized

  Indicates if the existing bus is initialized.
- clock_e m_init_clock

  Clock initialization.
- bool m_init_input

  Input initialization?

Friends

- class busarray

13.4.1 Detailed Description

There will be in input instance and an output instance of this object contained by mastermidibus.

13.4.2 Constructor & Destructor Documentation

13.4.2.1 businfo() [1/3]

```
seq64::businfo::businfo ( )
```

There will be in input instance and an output instance of this object contained by mastermidibus.

13.4.2.2 businfo() [2/3]

```
seq64::businfo::businfo (
            midibus * bus )
```

is_input_port():

```
Indicates if the midibus represents an input port (true) versus an
output port (false).
```

is_virtual_port():

```
Indicates if the midibus represents a virtual port (true) versus a
normal port (false).
```

Parameters

bus	Provides a pointer to the MIDI buss object to be represented by this object.

13.4.2.3 businfo() [3/3]

```
seq64::businfo::businfo (
            const businfo & rhs )
```

Currently it does not replicate the pointed-to object.

Parameters

rhs	The source object to be copied.

13.4.2.4 ~businfo()

```
seq64::businfo::~businfo ( )  [inline]
```

13.4.3 Member Function Documentation

13.4.3.1 remove()

```
void seq64::businfo::remove ( )  [inline]
```

13.4.3.2 bus() [1/3]

```
const midibus* seq64::businfo::bus ( ) const  [inline]
```

13.4.3.3 bus() [2/3]

```
midibus* seq64::businfo::bus ( )  [inline]
```

13.4.3.4 active()

```
bool seq64::businfo::active ( ) const  [inline]
```

13.4.3.5 initialize()

```
bool seq64::businfo::initialize ( )
```

It relies on the perform::launch() function to actually activate() all of the ports that have been flagged as "activated" here.

is_input_port():

```
 Indicates if the midibus represents an input port (true) versus an
 output port (false).  The way the mastermidibus currently works, it
 creates the API MIDI input objects there, so it does not need to be
 done here.  This falls under the heading of "tricky code".
```

is_virtual_port():

```
 Indicates if the midibus represents a manual/virtual port (true)
 versus a normal port (false).
```

The rules for port initialization follow those of seq24 for MIDI busses:

```
-   Manual (virtual) input and output ports always get their init
    functions called.  They are unconditionally marked as "active"
    and "initialized".
-   Normal output ports are marked as "active" and "initialized" if
    init_out() succeeds.
-   Normal input ports don't have init_in() called, but are marked
    as "active" and "initialized" anyway.  The settings from the "rc"
    file determine which inputs will operate.
```

Returns

Returns true if the buss is value, and it could be initialized (as an output port or a virtual output port.

13.4.3.6 initialized()

```
bool seq64::businfo::initialized ( ) const  [inline]
```

13.4.3.7 init_clock() [1/3]

```
clock_e seq64::businfo::init_clock ( ) const  [inline]
```

13.4.3.8 init_input() [1/2]

```
bool seq64::businfo::init_input ( ) const  [inline]
```

13.4.3.9 bus() [3/3]

```
void seq64::businfo::bus (
            midibus * b )  [inline]
```

13.4.3.10 activate()

```
void seq64::businfo::activate ( )  [inline]
```

13.4.3.11 deactivate()

```
void seq64::businfo::deactivate ( )  [inline]
```

13.4.3.12 init_clock() [2/3]

```
void seq64::businfo::init_clock (
            clock_e clocktype )  [inline]
```

13.4.3.13 init_input() [2/2]

```
void seq64::businfo::init_input (
            bool flag )  [inline]
```

13.4.3.14 start()

```
void seq64::businfo::start ( )  [inline], [private]
```

13.4.3.15 stop()

```
void seq64::businfo::stop ( )  [inline], [private]
```

13.4.3.16 continue_from()

```
void seq64::businfo::continue_from (
            midipulse tick )  [inline], [private]
```

13.4.3.17 init_clock() [3/3]

```
void seq64::businfo::init_clock (
            midipulse tick )  [inline], [private]
```

13.4.3.18 clock()

```
void seq64::businfo::clock (
            midipulse tick )  [inline], [private]
```

13.4.3.19 sysex()

```
void seq64::businfo::sysex (
            event * ev )  [inline], [private]
```

13.4.3.20 print()

```
void seq64::businfo::print ( ) const  [private]
```

13.4.4 Friends And Related Function Documentation

13.4.4.1 busarray

```
friend class busarray  [friend]
```

13.4.5 Field Documentation

13.4.5.1 m_bus

```
midibus* seq64::businfo::m_bus  [private]
```

13.4.5.2 m_active

```
bool seq64::businfo::m_active  [private]
```

13.4.5.3 m_initialized

```
bool seq64::businfo::m_initialized  [private]
```

13.4.5.4 m_init_clock

```
clock_e seq64::businfo::m_init_clock  [private]
```

13.4.5.5 m_init_input

```
bool seq64::businfo::m_init_input  [private]
```

13.5 seq64::click Class Reference

Encapsulates any possible mouse click.

Public Member Functions

- click ()

  The constructor for class click.
- click (int x, int y, int button=SEQ64_CLICK_BUTTON_LEFT, bool press=true, seq_modifier_t modkey=SEQ64_NO_MASK)

  Principal constructor for class click.
- click (const click &rhs)

  Provides a stock copy constructor.
- click & operator= (const click &rhs)

  Provides a stock principal assignment operator.
- bool is_press () const

  'Getter' function for member m_is_press
- bool is_left () const

  'Getter' function for member m_button to test for the left button.
- bool is_middle () const

  'Getter' function for member m_button to test for the middle button.
- bool is_right () const

  'Getter' function for member m_button to test for the right button.
- int x () const

  'Getter' function for member m_x
- int y () const

  'Getter' function for member m_y
- int button () const

  'Getter' function for member m_button
- seq_modifier_t modifier () const

  'Getter' function for member m_modifier
- bool mod_control () const

  'Getter' function for member m_modifier tested for Ctrl key.
- bool mod_control_shift () const

  'Getter' function for member m_modifier tested for Ctrl and Shift key.
- bool mod_super () const

  'Getter' function for member m_modifier tested for Mod4/Super/Windows key.

Private Attributes

- bool m_is_press

  Determines if the click was a press or a release event.
- int m_x

  The x-coordinate of the click.
- int m_y

  The y-coordinate of the click.
- int m_button

  The button that was pressed or released.
- seq_modifier_t m_modifier

  The optional modifier value.

13.5.1 Detailed Description

Useful in passing more generic events to non-GUI classes.

13.5.2 Constructor & Destructor Documentation

13.5.2.1 click() [1/3]

```
seq64::click::click ( )
```

Sets all members to false, zero, or the lowest good value.

13.5.2.2 click() [2/3]

```
seq64::click::click (
            int x,
            int y,
            int button = SEQ64_CLICK_BUTTON_LEFT,
            bool press = true,
            seq_modifier_t modkey = SEQ64_NO_MASK )
```

This function is the only way to set value for the click members (other than the copy constructor and principal assignment operator.

Parameters

x	The putative x value of the button click.
y	The putative y value of the button click.
button	The value of the button that was clicked, set to 1, 2, or 3.
press	Set to true if the event was a button press, false if it was a button release.
modkey	Indicates which modifier key (such as Ctrl or Alt), if any, was pressed at the same time as the click action.

13.5.2.3 click() [3/3]

```
seq64::click::click (
            const click & rhs )
```

It is nice to be explicit about these kinds of functions, even if it gets tedious.

Parameters

rhs	Provies the source object to be copied.

13.5.3 Member Function Documentation

13.5.3.1 operator=()

```
click & seq64::click::operator= (
            const click & rhs )
```

It is nice to be explicit about these kinds of functions, even if it gets tedious.

Parameters

rhs	Provies the source object to be assigned from. The assignment is not made if "this" has the same address as this parameter.

Returns

Returns a reference to self for usage in a string of assignments.

13.5.3.2 is_press()

```
bool seq64::click::is_press ( ) const  [inline]
```

13.5.3.3 is_left()

```
bool seq64::click::is_left ( ) const  [inline]
```

13.5.3.4 is_middle()

```
bool seq64::click::is_middle ( ) const  [inline]
```

13.5.3.5 is_right()

```
bool seq64::click::is_right ( ) const  [inline]
```

13.5.3.6 x()

```
int seq64::click::x ( ) const  [inline]
```

13.5.3.7 y()

```
int seq64::click::y ( ) const  [inline]
```

13.5.3.8 button()

```
int seq64::click::button ( ) const  [inline]
```

13.5.3.9 modifier()

```
seq_modifier_t seq64::click::modifier ( ) const  [inline]
```

13.5.3.10 mod_control()

```
bool seq64::click::mod_control ( ) const  [inline]
```

13.5.3.11 mod_control_shift()

```
bool seq64::click::mod_control_shift ( ) const  [inline]
```

13.5.3.12 mod_super()

```
bool seq64::click::mod_super ( ) const  [inline]
```

13.5.4 Field Documentation

13.5.4.1 m_is_press

```
bool seq64::click::m_is_press  [private]
```

13.5.4.2 m_x

```
int seq64::click::m_x  [private]
```

0 is the left-most coordinate.

13.5.4.3 m_y

```
int seq64::click::m_y  [private]
```

0 is the top-most coordinate.

13.5.4.4 m_button

```
int seq64::click::m_button  [private]
```

Left is 1, mmiddle is 2, and right is 3. These numbers are defined via macros, and are Linux-specific and Gtk-specific.

13.5.4.5 m_modifier

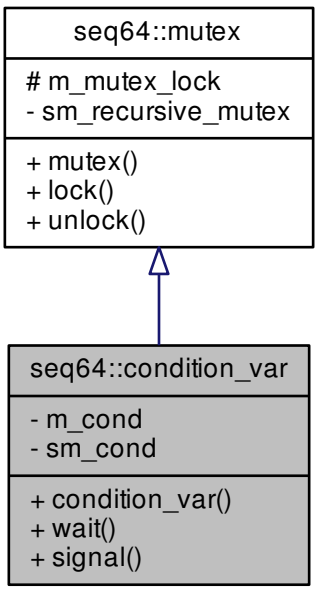
```
seq_modifier_t seq64::click::m_modifier  [private]
```

Note that SEQ64_NO_MASK is our word for 0, meaning "no modifier".

13.6 seq64::condition_var Class Reference

A mutex works best in conjunction with a condition variable.

Inheritance diagram for seq64::condition_var:



Public Member Functions

- condition_var ()

  Initialize the condition variable with the global variable.
- void wait ()

  Waits for the condition variable.
- void signal ()

  Signals the condition variable.

Private Attributes

- pthread_cond_t m_cond

  Provides a class-specific condition variable.

Static Private Attributes

- static const pthread_cond_t sm_cond

  Provides a "global" condition variable.

Additional Inherited Members

13.6.1 Detailed Description

Therefore this class derives from the mutex class. A "has-a" relationship might be more logical than this "is-a" relationship.

13.6.2 Constructor & Destructor Documentation

13.6.2.1 condition_var()

```
seq64::condition_var::condition_var ( )
```

13.6.3 Member Function Documentation

13.6.3.1 wait()

```
void seq64::condition_var::wait ( )
```

13.6.3.2 signal()

```
void seq64::condition_var::signal ( )
```

13.6.4 Field Documentation

13.6.4.1 sm_cond

```
const pthread_cond_t seq64::condition_var::sm_cond  [static], [private]
```

Define the static condition variable used by all mutex locks.

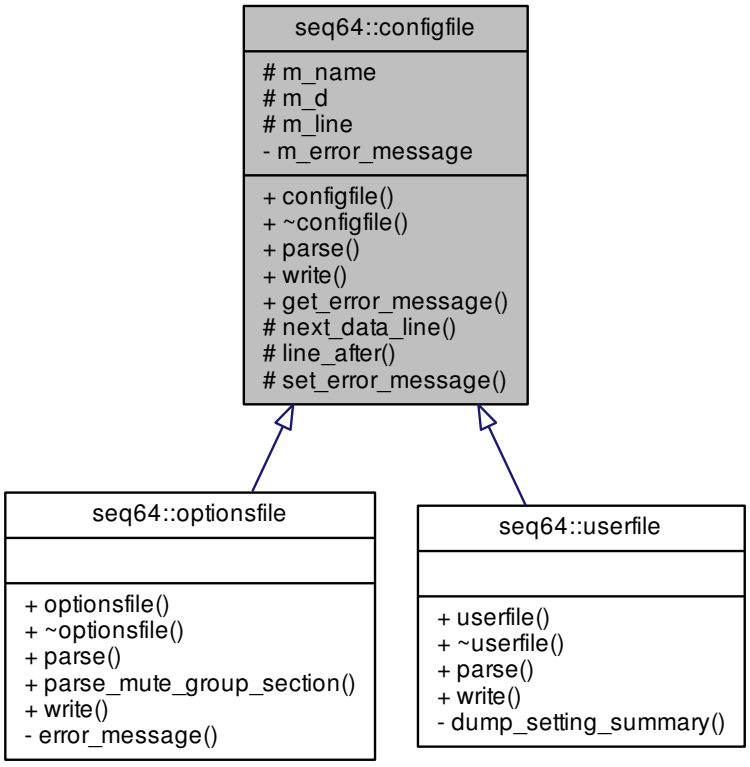
13.6.4.2 m_cond

```
pthread_cond_t seq64::condition_var::m_cond  [private]
```

13.7 seq64::configfile Class Reference

This class is the abstract base class for optionsfile and userfile.

Inheritance diagram for seq64::configfile:



Public Member Functions

- configfile (const std::string &name)

  Provides the string constructor for a configuration file.
- virtual ~configfile ()

  A rote destructor needed for a base class.
- virtual bool parse (perform &perf)=0
- virtual bool write (const perform &perf)=0
- const std::string & get_error_message () const

Protected Member Functions

- bool next_data_line (std::ifstream &file)

  Gets the next line of data from an input stream.
- bool line_after (std::ifstream &file, const std::string &tag)

  This function gets a specific line of text, specified as a tag.
- void set_error_message (const std::string &msg)

Protected Attributes

- std::string m_name

  Provides the name of the configuration file.
- char * m_d

  Points to an allocated buffer that holds the data for the configuration file.
- char m_line [SEQ64_LINE_MAX]

  The current line of text being processed.

Private Attributes

- std::string m_error_message

  Holds the last error message, if any.

13.7.1 Constructor & Destructor Documentation

13.7.1.1 configfile()

```
seq64::configfile::configfile (
            const std::string & name )
```

Parameters

name	The name of the configuration file.

13.7.1.2 ~configfile()

```
virtual seq64::configfile::~configfile ( )  [inline], [virtual]
```

13.7.2 Member Function Documentation

13.7.2.1 next_data_line()

```
bool seq64::configfile::next_data_line (
            std::ifstream & file )  [protected]
```

If the line starts with a number-sign, a space (!), or a null, it is skipped, to try the next line. This occurs until an EOF is encountered.

Member m_line is a "global" return value.

Parameters

file	Points to an input stream. We converted this item to a reference; pointers can be subject to problems. For example, what if someone passes a null pointer?

Returns

Returns true if a presumed data line was found. False is returned if not found before an EOF or a section marker ("[") is found. This is a a new (ca 2016-02-14) feature of this function, to assist in adding new data to the file.

13.7.2.2 line_after()

```
bool seq64::configfile::line_after (
            std::ifstream & file,
            const std::string & tag )  [protected]
```

Then it gets the next non-blank line (i.e. data line) after that.

This function always starts from the beginning of the file. Therefore, it can handle reading Sequencer64 configuration files that have had their tagged sections arranged in a different order. This feature makes the configuration file a little more robust against errors.

Parameters

file	Points to the input file stream.
tag	Provides a tag to be found. Lines are read until a match occurs with this tag. Normally, the tag is a section marker, such as "[user-interface]". Best to assume an exact match is needed.

Returns

Returns true if the tag was found. Otherwise, false is returned.

13.7.2.3 parse()

```
virtual bool seq64::configfile::parse (
            perform & perf )  [pure virtual]
```

Implemented in seq64::userfile, and seq64::optionsfile.

13.7.2.4 write()

```
virtual bool seq64::configfile::write (
            const perform & perf )  [pure virtual]
```

Implemented in seq64::optionsfile, and seq64::userfile.

13.7.2.5 get_error_message()

```
const std::string& seq64::configfile::get_error_message ( ) const  [inline]
```

13.7.2.6 set_error_message()

```
void seq64::configfile::set_error_message (
            const std::string & msg )  [inline], [protected]
```

13.7.3 Field Documentation

13.7.3.1 m_error_message

```
std::string seq64::configfile::m_error_message  [private]
```

Not a 100% foolproof yet.

13.7.3.2 m_name

```
std::string seq64::configfile::m_name  [protected]
```

13.7.3.3 m_d

```
char* seq64::configfile::m_d  [protected]
```

13.7.3.4 m_line

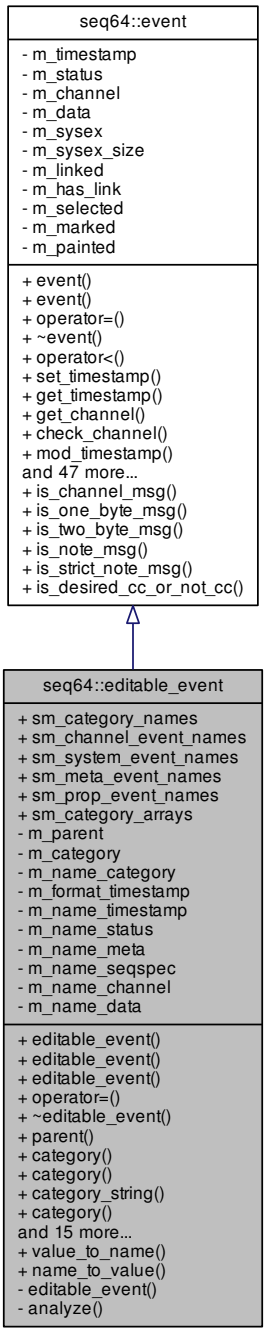
```
char seq64::configfile::m_line[SEQ64_LINE_MAX]  [protected]
```

This member receives an input line, and so needs to be a character buffer.

13.8 seq64::editable_event Class Reference

Provides for the management of MIDI editable events.

Inheritance diagram for seq64::editable_event:



Data Structures

- struct name_value_t

  Provides a type that contains the pair of values needed for the various lookup maps that are needed to manage editable events.

Public Types

- enum category_t {
  category_name,
  category_channel_message,
  category_system_message,
  category_meta_event,
  category_prop_event }

  These values determine the major kind of event, which determines what types of events are possible for this editable event object.
- enum timestamp_format_t {
  timestamp_measures,
  timestamp_time,
  timestamp_pulses }

  Provides a code to indicate the desired timestamp format.

Public Member Functions

- editable_event (const editable_events &parent)

  This constructor simply initializes all of the class members.
- editable_event (const editable_events &parent, const event &ev)

  Event constructor.
- editable_event (const editable_event &rhs)

  This copy constructor initializes most of the class members.
- editable_event & operator= (const editable_event &rhs)
- virtual ~editable_event ()

  This destructor current is a rote virtual function override.
- const editable_events & parent () const

  'Getter' function for member m_parent
- category_t category () const

  'Getter' function for member m_category
- void category (category_t c)

  'Setter' function for member m_category by value Also keeps the m_name_category member in synchrony.
- const std::string & category_string () const

  'Getter' function for member m_category
- void category (const std::string &cs)

  'Setter' function for member m_category by name Also keeps the m_name_category member in synchrony, but looks up the name, rather than using the name parameter, to avoid storing abbreviations.
- const std::string & timestamp_string () const

  'Getter' function for member m_name_timestamp
- midipulse timestamp () const

  'Getter' function for member event::get_timestamp() Implemented to allow a uniform naming convention that is not slavish to the get/set crowd [this ain't Java].
- void timestamp (midipulse ts)

  'Setter' function for member event::set_timestamp() Implemented to allow a uniform naming convention that is not slavish to the get/set crowd [this ain't Java].
- void timestamp (const std::string &ts_string)

  'Setter' function for member event::set_timestamp() [string version]
- std::string time_as_pulses ()

  Converts the current time-stamp to a string representation in units of pulses.
- std::string time_as_measures ()

  Converts the current time-stamp to a string representation in units of measures, beats, and divisions.

- std::string time_as_minutes ()

  Converts the current time-stamp to a string representation in units of hours, minutes, seconds, and fraction.
- void set_status_from_string (const std::string &ts, const std::string &s, const std::string &sd0, const std::string &sd1)

  Converts a string into an event status, along with timestamp and data bytes.
- std::string format_timestamp ()

  Formats the current timestamp member as a string.
- std::string stock_event_string ()

  Converts the event into a string desribing the full event.
- std::string status_string () const

  'Getter' function for member m_name_status
- std::string meta_string () const

  'Getter' function for member m_name_meta
- std::string seqspec_string () const

  'Getter' function for member m_name_seqspec
- std::string channel_string () const

  'Getter' function for member m_name_channel
- std::string data_string () const

  'Getter' function for member m_name_data

Static Public Member Functions

- static std::string value_to_name (midibyte value, category_t cat)

  Provides a static lookup function that returns the name, if any, associated with a midibyte value.
- static unsigned short name_to_value (const std::string &name, category_t cat)

  Provides a static lookup function that returns the value, if any, associated with a name string.

Static Public Attributes

- static const name_value_t sm_category_names [ ]

  An array of event categories and their names.
- static const name_value_t sm_channel_event_names [ ]

  An array of MIDI channel events and their names.
- static const name_value_t sm_system_event_names [ ]

  An array of MIDI system events and their names.
- static const name_value_t sm_meta_event_names [ ]

  An array of Meta events and their names.
- static const name_value_t sm_prop_event_names [ ]

  An array of Sequencer64-specific events and their names.
- static const name_value_t *const sm_category_arrays [ ]

  Provides for fast access (no ifs) to the correct name array for the given category.

Private Member Functions

- editable_event ()
- void analyze ()

  Analyzes an editable-event to make all the settings it needs.

Private Attributes

- const editable_events & m_parent

  Provides a reference to the container that holds this event.
- category_t m_category

  Indicates the overall category of this event, which will be category_channel_message, category_system_message, category_meta_event, and category_prop_event.
- std::string m_name_category

  Holds the name of the event category for this event.
- timestamp_format_t m_format_timestamp

  Indicates the format to display the time-stamp.
- std::string m_name_timestamp

  Holds the string version of the MIDI pulses time-stamp.
- std::string m_name_status

  Holds the name of the status value for this event.
- std::string m_name_meta

  Holds the name of the meta message, if applicable.
- std::string m_name_seqspec

  If we eventually implement the editing of the Seq24/Sequencer64 "proprietary" meta sequencer-specific events, the name of the SeqSpec will be stored here.
- std::string m_name_channel

  Holds the channel description, if applicable.
- std::string m_name_data

  Holds the data description, if applicable.

13.8.1 Detailed Description

It makes the following members of an event modifiable using human-readable strings:

```
-   m_timestamp
-   m_status
-   m_channel
-   m_data[]
```

Eventually, it would be nice to be able to edit, or at least view, the SysEx events and the Meta events. Those two will require extensions to make events out of them (SysEx is partly supported).

To the concepts of event, the editable_event class adds a category field and strings to represent all of these members.

13.8.2 Member Enumeration Documentation

13.8.2.1 category_t

```
enum seq64::editable_event::category_t
```

These tags are accompanied by category names in sm_category_names[]. The enum values are cast to midibyte values for the purposes of using the lookup infrastructure.

Enumerator

category_name	Indicates that the lookup needs to be done on the category names, as listed in sm_category_names[].
category_channel_message	Indicates a channel event, with a value ranging from 0x80 through 0xEF. Some examples are note on/off, control change, and program change. Values are looked up in sm_channel_event_names[].
category_system_message	Indicates a system event, with a value ranging from 0xF0 through 0xFF. Some examples are SysEx start/end, song position, and stop/start/continue/reset. Values are looked up in sm_system_event_names[].
category_meta_event	Indicates a meta event, and there is a second value that is used to look up the name of the meta event, in sm_meta_event_names[].
category_prop_event	Indicates a "proprietary", Sequencer64 event. Indicates to look up the name of the event in sm_prop_event_names[]. Not sure if these kinds of events will be stored separately.

13.8.2.2 timestamp_format_t

```
enum seq64::editable_event::timestamp_format_t
```

Three are supported. All editable events will share the same timestamp format, but it seems good to make this a event class member, rather than something imposed from an outside static value. We shall see.

Enumerator

timestamp_measures	This format displays the time in "measures:beats:divisions" format, where measures and beats start at 1. Thus, "1:1:0" is equivalent to 0 pulses or to "0:0:0.0" in normal time values.
timestamp_time	This format displays the time in "hh:mm:second.fraction" format. The value displayed should not depend upon the internal timing parameters of the event.
timestamp_pulses	This format specifies a bare pulse format for the timestamp – a long integer ranging from 0 on up. Obviously, this representation depends on the PPQN value for the sequence holding this event.

13.8.3 Constructor & Destructor Documentation

13.8.3.1 editable_event() [1/4]

```
seq64::editable_event::editable_event ( )  [private]
```

13.8.3.2 editable_event() [2/4]

```
seq64::editable_event::editable_event (
            const editable_events & parent )
```

editable_event::editable_event () : event (), m_category (category_name), m_name_category (), m_format_↩ timestamp (timestamp_measures), m_name_timestamp (), m_name_status (), m_name_meta (), m_name_↩ seqspec (), m_name_channel (), m_name_data () { // Empty body } Principal constructor.

Parameters

parent	Provides the overall editable-events object that manages the whole set of editable-event.

13.8.3.3 editable_event() [3/4]

```
seq64::editable_event::editable_event (
            const editable_events & parent,
            const event & ev )
```

This function basically adds all of the extra editable_event stuff to a standard event, so that the resulting editable↩ _event is container-ready.

13.8.3.4 editable_event() [4/4]

```
seq64::editable_event::editable_event (
            const editable_event & rhs )
```

This function is currently geared only toward support of the SMF 0 channel-splitting feature. Many of the members are not set to useful values when the MIDI file is read, so we don't handle them for now.

Warning

This function does not yet copy the SysEx data. The inclusion of SysEx editable_events was not complete in Seq24, and it is still not complete in Sequencer64. Nor does it currently bother with the links.

Parameters

rhs	Provides the editable_event object to be copied.

13.8.3.5 ~editable_event()

```
virtual seq64::editable_event::~editable_event ( )  [inline], [virtual]
```

13.8.4 Member Function Documentation

13.8.4.1 value_to_name()

```
std::string seq64::editable_event::value_to_name (
            midibyte value,
            editable_event::category_t cat )  [static]
```

Parameters

value	The MIDI byte value to look up.
cat	The category of the MIDI byte. Each category calls a different name array into play.

Returns

Returns the name associated with the value. If there is no such name, then an empty string is returned.

13.8.4.2 name_to_value()

```
unsigned short seq64::editable_event::name_to_value (
            const std::string & name,
            editable_event::category_t cat )  [static]
```

The string_match() function, which can match abbreviations, case-insensitively, is used to make the string comparisons.

Parameters

name	The string value to look up.
cat	The category of the MIDI byte. Each category calls a different name array into play.

Returns

Returns the value associated with the name. If there is no such value, then SEQ64_END_OF_MIDIBYTE_↩ TABLE is returned.

13.8.4.3 operator=()

```
editable_event & seq64::editable_event::operator= (
            const editable_event & rhs )
```

13.8.4.4 parent()

```
const editable_events& seq64::editable_event::parent ( ) const  [inline]
```

13.8.4.5 category() [1/3]

```
category_t seq64::editable_event::category ( ) const  [inline]
```

13.8.4.6 category() [2/3]

```
void seq64::editable_event::category (
            category_t c )
```

Note that a bad value is translated to the value of category_name.

Parameters

c	Provides the category value to set.

13.8.4.7 category_string()

```
const std::string& seq64::editable_event::category_string ( ) const  [inline]
```

13.8.4.8 category() [3/3]

```
void seq64::editable_event::category (
            const std::string & name )
```

Note that a bad value is translated to the value of category_name.

Parameters

name	Provides the category name for the category value to set.

13.8.4.9 timestamp_string()

```
const std::string& seq64::editable_event::timestamp_string ( ) const  [inline]
```

13.8.4.10 timestamp() [1/3]

```
midipulse seq64::editable_event::timestamp ( ) const  [inline]
```

13.8.4.11 timestamp() [2/3]

```
void seq64::editable_event::timestamp (
            midipulse ts )
```

Plus, we also have to set the string version at the same time.

The format of the string representation is of the format selected by the m_format_timestamp member and is set by the format_timestamp() function.

Parameters

ts	Provides the timestamp in units of MIDI pulses.

13.8.4.12 timestamp() [3/3]

```
void seq64::editable_event::timestamp (
            const std::string & ts_string )
```

The format of the string representation is of the format selected by the m_format_timestamp member and is set by the format_timestamp() function.

Parameters

ts_string	Provides the timestamp in units of MIDI pulses.

13.8.4.13 time_as_pulses()

```
std::string seq64::editable_event::time_as_pulses ( )  [inline]
```

13.8.4.14 time_as_measures()

```
std::string seq64::editable_event::time_as_measures ( )
```

Cannot be inlined because of a circular dependency between the editable_event and editable_events classes.

13.8.4.15 time_as_minutes()

```
std::string seq64::editable_event::time_as_minutes ( )
```

Cannot be inlined because of a circular dependency between the editable_event and editable_events classes.

13.8.4.16 set_status_from_string()

```
void seq64::editable_event::set_status_from_string (
            const std::string & ts,
            const std::string & s,
            const std::string & sd0,
            const std::string & sd1 )
```

Currently, this function handles only the following two messages:

- category_channel_message
- category_system_message

After all of the numbering member items have been set, they are converted and assigned to the string versions via a call to the analyze() function.

Parameters

ts	Provides the time-stamp string of the event.
s	Provides the name of the event, such as "Program Change".
sd0	Provides the string defining the first data byte of the event.
sd1	Provides the string defining the second data byte of the event, if applicable to the event.

13.8.4.17 format_timestamp()

```
std::string seq64::editable_event::format_timestamp ( )
```

The format of the string representation is of the format selected by the m_format_timestamp member.

13.8.4.18 stock_event_string()

```
std::string seq64::editable_event::stock_event_string ( )
```

We get the time-stamp as a string, make sure the event is fully analyzed so that all items and strings are set correctly.

Returns

Returns a human-readable string describing this event.

13.8.4.19 status_string()

```
std::string seq64::editable_event::status_string ( ) const  [inline]
```

13.8.4.20 meta_string()

```
std::string seq64::editable_event::meta_string ( ) const  [inline]
```

13.8.4.21 seqspec_string()

```
std::string seq64::editable_event::seqspec_string ( ) const  [inline]
```

13.8.4.22 channel_string()

```
std::string seq64::editable_event::channel_string ( ) const  [inline]
```

13.8.4.23 data_string()

```
std::string seq64::editable_event::data_string ( ) const  [inline]
```

13.8.4.24 analyze()

```
void seq64::editable_event::analyze ( )  [private]
```

Used in the constructors. Some of the setters indirectly set the appropriate string representation, as well.

Category:

```
This function can figure out if the status byte implies a channel
message or a system message, and set the category string as well.
However, at this time, detection of Meta events (0xFF) or
Proprietary/SeqSpec events (0xFF with 0x2424) doesn't work due to lack
of context here (and due to the fact that currently such events are
not yet stored in a Sequencer64 sequence/track, and the
least-significant-byte gets masked off anyway.)
```

Status:

```
We distinguish between channel and system messages, and then one- and
two-byte messages, but don't yet distinguish the data values fully.
```

13.8.5 Field Documentation

13.8.5.1 sm_category_names

```
const editable_event::name_value_t seq64::editable_event::sm_category_names  [static]
```

Initializes the array of event/name pairs for the MIDI events categories.

Terminated by an empty string, the latter being the preferred test, for consistency with the other arrays and because 0 is often a legitimate code value.

13.8.5.2 sm_channel_event_names

```
const editable_event::name_value_t seq64::editable_event::sm_channel_event_names  [static]
```

Initializes the array of event/name pairs for the channel MIDI events.

We split channel and system messages into two arrays, for semantic reasons and for faster linear lookups.

Terminated by an empty string.

13.8.5.3 sm_system_event_names

```
const editable_event::name_value_t seq64::editable_event::sm_system_event_names  [static]
```

Initializes the array of event/name pairs for the system MIDI events.

We split channel and system messages into two arrays, for semantic reasons and for faster linear lookups.

Terminated by an empty string.

13.8.5.4 sm_meta_event_names

```
const editable_event::name_value_t seq64::editable_event::sm_meta_event_names  [static]
```

Initializes the array of event/name pairs for all of the Meta events.

Terminated only by the empty string.

13.8.5.5 sm_prop_event_names

```
const editable_event::name_value_t seq64::editable_event::sm_prop_event_names  [static]
```

Initializes the array of event/name pairs for all of the seq24/sequencer64-specific events.

Terminated only by the empty string. Note that the numbers reflect the masking off of the high-order bits by 0x242400FF.

13.8.5.6 sm_category_arrays

```
const editable_event::name_value_t *const seq64::editable_event::sm_category_arrays  [static]
```

Contains pointers (references cannot be stored in an array) to the desired array for a given category.

Too bad that an array of references is not possible.

This code could be considered a bit rococo.

13.8.5.7 m_parent

```
const editable_events& seq64::editable_event::m_parent  [private]
```

The container's "children" need to go to their "parent" to get certain items of information.

13.8.5.8 m_category

```
category_t seq64::editable_event::m_category  [private]
```

The category_name value is not set here, since that category is used only for looking up the human-readable form of the category.

13.8.5.9 m_name_category

```
std::string seq64::editable_event::m_name_category  [private]
```

13.8.5.10 m_format_timestamp

```
timestamp_format_t seq64::editable_event::m_format_timestamp  [private]
```

The default is to display in timestamp_measures format.

13.8.5.11 m_name_timestamp

```
std::string seq64::editable_event::m_name_timestamp  [private]
```

13.8.5.12 m_name_status

```
std::string seq64::editable_event::m_name_status  [private]
```

It will include the names of the channel messages and the system messages. The latter includes SysEx and Meta messages.

13.8.5.13 m_name_meta

```
std::string seq64::editable_event::m_name_meta  [private]
```

If not applicable, this name will be empty.

13.8.5.14 m_name_seqspec

```
std::string seq64::editable_event::m_name_seqspec  [private]
```

13.8.5.15 m_name_channel

```
std::string seq64::editable_event::m_name_channel  [private]
```

13.8.5.16 m_name_data

```
std::string seq64::editable_event::m_name_data  [private]
```

13.9 seq64::editable_events Class Reference

Provides for the management of an ordered collection MIDI editable events.

Public Member Functions

- editable_events (sequence &seq, midibpm bpm)

  This constructor hooks into the sequence object.
- editable_events (const editable_events &rhs)

  This copy constructor initializes most of the class members.
- editable_events & operator= (const editable_events &rhs)

  This principal assignment operator sets most of the class members.
- virtual ~editable_events ()

  This destructor current is a rote virtual function override.
- const midi_timing & timing () const

  'Getter' function for member m_midi_parameters
- midipulse string_to_pulses (const std::string &ts_string) const

  Calculates the MIDI pulses (divisions) from a string using one of the free functions of the calculations module.
- bool load_events ()

  Accesses the sequence's event-list, iterating through it from beginning to end, wrapping each event in the list in an editable event and inserting it into the editable-event container.
- bool save_events ()

  Erases the sequence's event container and recreates it using the edited container of editable events.
- Events & events ()

'Getter' function for member m_events

- iterator begin ()

  'Getter' function for member m_events.begin(), non-constant version.
- const_iterator begin () const

  'Getter' function for member m_events.begin(), constant version.
- iterator end ()

  'Getter' function for member m_events.end(), non-constant version.
- const_iterator end () const

  'Getter' function for member m_events.end(), constant version.
- int count () const

  Returns the number of events stored in m_events.
- bool add (const event &e)

  Adds an event, converted to an editable_event, to the internal event list.
- bool add (const editable_event &e)

  Adds an editable event to the internal event list.
- bool replace (iterator ie, const editable_event &e)

  Provides a wrapper for the iterator form of erase(), which is the only one that the editable_events container uses.
- void remove (iterator ie)

  Provides a wrapper for the iterator form of erase(), which is the only one that sequence uses.
- void clear ()

  Provides a wrapper for clear().
- iterator current_event () const

  'Getter' function for member m_current_event The caller must make sure the iterator is not Events::end().

Static Public Member Functions

- static editable_event & dref (iterator ie)

  Dereference access for list or map.
- static const editable_event & dref (const_iterator ie)

  Dereference const access for list or map.

Private Types

- typedef event_list::event_key Key

  Types to use to with the multimap implementation.
- typedef std::pair< Key, editable_event > EventsPair
- typedef std::multimap< Key, editable_event > Events
- typedef std::multimap< Key, editable_event >::iterator iterator
- typedef std::multimap< Key, editable_event >::const_iterator const_iterator

Private Member Functions

- editable_events ()
- void current_event (iterator cei)

  'Setter' function for member m_current_event

Private Attributes

- Events m_events

  Holds the editable_events.
- iterator m_current_event

  Points to the current event, which is the event that has just been inserted.
- sequence & m_sequence

  Provides a reference to the sequence containing the events to be edited.
- midi_timing m_midi_parameters

  Holds the current settings for the sequence (and usually for the whole MIDI tune as well).

Friends

- class eventslots

13.9.1 Member Typedef Documentation

13.9.1.1 Key

```
typedef event_list::event_key seq64::editable_events::Key  [private]
```

These typenames are identical to those used in event_list, but of course they are in the editable_events scope instead. See the event_list class.

13.9.1.2 EventsPair

```
typedef std::pair<Key, editable_event> seq64::editable_events::EventsPair  [private]
```

13.9.1.3 Events

```
typedef std::multimap<Key, editable_event> seq64::editable_events::Events  [private]
```

13.9.1.4 iterator

```
typedef std::multimap<Key, editable_event>::iterator seq64::editable_events::iterator  [private]
```

13.9.1.5 const_iterator

```
typedef std::multimap<Key, editable_event>::const_iterator seq64::editable_events::const_↩
iterator  [private]
```

13.9.2 Constructor & Destructor Documentation

13.9.2.1 editable_events() [1/3]

```
seq64::editable_events::editable_events ( )  [private]
```

13.9.2.2 editable_events() [2/3]

```
seq64::editable_events::editable_events (
            sequence & seq,
            midibpm bpm )
```

Parameters

seq	Provides a reference to the sequence object, which provides the events and some of the MIDI timing parameters.
bpm	Provides the beats/minute value, which the caller figures out how to get and provides in this parameter.

13.9.2.3 editable_events() [3/3]

```
seq64::editable_events::editable_events (
            const editable_events & rhs )
```

Note that we need to reconstitute the event links here, as well.

Parameters

rhs	Provides the editable_events object to be copied.

13.9.2.4 ~editable_events()

```
virtual seq64::editable_events::~editable_events ( )  [inline], [virtual]
```

13.9.3 Member Function Documentation

13.9.3.1 operator=()

```
editable_events & seq64::editable_events::operator= (
            const editable_events & rhs )
```

Note that we need to reconstitute the event links here, as well.

Parameters

rhs	Provides the editable_events object to be assigned.

Returns

Returns a reference to "this" object, to support the serial assignment of editable_eventss.

13.9.3.2 timing()

```
const midi_timing& seq64::editable_events::timing ( ) const  [inline]
```

13.9.3.3 string_to_pulses()

```
midipulse seq64::editable_events::string_to_pulses (
            const std::string & ts_string ) const  [inline]
```

13.9.3.4 load_events()

```
bool seq64::editable_events::load_events ( )
```

Note that the new events will not have valid links (actually, no links). These links are used for associating Note Off events with their respective Note On events. To be consistent, we must take the time to reconstitute these links, using event_list::verify_and_link().

Returns

Returns true if the size of the final editable_event container matches the size of the original events container.

13.9.3.5 save_events()

```
bool seq64::editable_events::save_events ( )
```

Note that the old events are replaced only if the container of editable events is not empty. There are safer ways for the user to erase all the events.

Todo Consider what to do about the sequence::m_is_modified flag.

Returns

Returns true if the size of the final event container matches the size of the original editable_events container.

13.9.3.6 events()

```
Events& seq64::editable_events::events ( )  [inline]
```

13.9.3.7 begin() [1/2]

```
iterator seq64::editable_events::begin ( )  [inline]
```

13.9.3.8 begin() [2/2]

```
const_iterator seq64::editable_events::begin ( ) const  [inline]
```

13.9.3.9 end() [1/2]

```
iterator seq64::editable_events::end ( )  [inline]
```

13.9.3.10 end() [2/2]

```
const_iterator seq64::editable_events::end ( ) const  [inline]
```

13.9.3.11 dref() [1/2]

```
static editable_event& seq64::editable_events::dref (
            iterator ie )  [inline], [static]
```

Parameters

ie	Provides the iterator to the event to which to get a reference.

13.9.3.12 dref() [2/2]

```
static const editable_event& seq64::editable_events::dref (
            const_iterator ie )  [inline], [static]
```

Parameters

ie	Provides the iterator to the event to which to get a reference.

13.9.3.13 count()

```
int seq64::editable_events::count ( ) const  [inline]
```

We like returning an integer instead of size_t, and rename the function so nobody is fooled.

13.9.3.14 add() [1/2]

```
bool seq64::editable_events::add (
            const event & e )
```

Parameters

e	Provides the regular event to be added to the list of editable events.

Returns

Returns true if the insertion succeeded, as evidenced by an increment in container size.

13.9.3.15 add() [2/2]

```
bool seq64::editable_events::add (
            const editable_event & e )
```

For the std::multimap implementation, This is an option if we want to make sure the insertion succeed.

```
std::pair<Events::iterator, bool> result = m_events.insert(p);
return result.second;
```

Parameters

e	Provides the regular event to be added to the list of editable events.

Returns

Returns true if the insertion succeeded, as evidenced by an increment in container size.

Side-effect(s) Sets m_current_event, which can be used right-away in a single-threaded context to get an iterator to the event via the current_event() accessor.

13.9.3.16 replace()

```
bool seq64::editable_events::replace (
            iterator ie,
            const editable_event & e )  [inline]
```

13.9.3.17 remove()

```
void seq64::editable_events::remove (
            iterator ie )  [inline]
```

13.9.3.18 clear()

```
void seq64::editable_events::clear ( )  [inline]
```

13.9.3.19 current_event() [1/2]

```
iterator seq64::editable_events::current_event ( ) const  [inline]
```

13.9.3.20 current_event() [2/2]

```
void seq64::editable_events::current_event (
            iterator cei )  [inline], [private]
```

Parameters

cei	Provide an iterator to the event to set as the current event.

13.9.4 Friends And Related Function Documentation

13.9.4.1 eventslots

```
friend class eventslots  [friend]
```

13.9.5 Field Documentation

13.9.5.1 m_events

```
Events seq64::editable_events::m_events  [private]
```

13.9.5.2 m_current_event

```
iterator seq64::editable_events::m_current_event  [private]
```

(From this event we can get the current time and other parameters.) If the container were a plain map, we could instead use a key to access it. But we can at least use an iterator, rather than a bare pointer.

13.9.5.3 m_sequence

```
sequence& seq64::editable_events::m_sequence  [private]
```

Besides the events, this object also holds the beats/measure, beat-width, and the PPQN value. The beats/minute have to be obtained from the application's perform object, and passed to the editable_events constructor by the caller.

13.9.5.4 m_midi_parameters

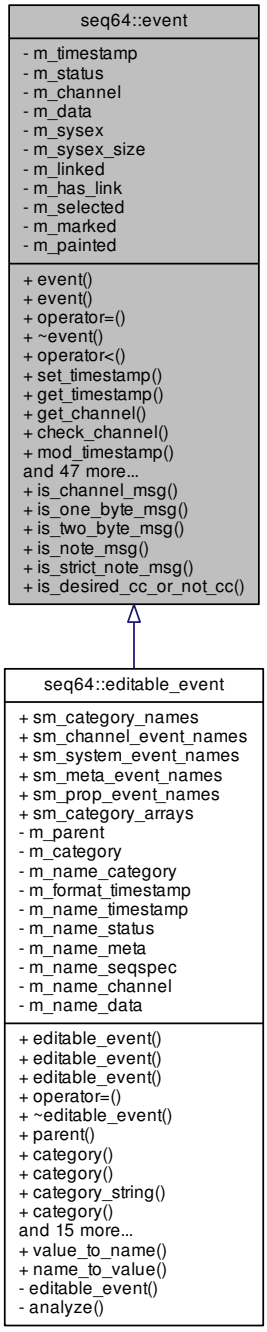
```
midi_timing seq64::editable_events::m_midi_parameters  [private]
```

It holds the beats/minute, beats/measure, beat-width, and PPQN values needed to properly convert MIDI pulse timestamps to time and measure values.

13.10 seq64::event Class Reference

Provides events for management of MIDI events.

Inheritance diagram for seq64::event:



Public Types

- typedef std::vector< midibyte > SysexContainer

  Provides a type definition for a vector of midibytes.

Public Member Functions

- event ()

  This constructor simply initializes all of the class members.
- event (const event &rhs)

  This copy constructor initializes most of the class members.
- event & operator= (const event &rhs)

  This principal assignment operator sets most of the class members.
- virtual ~event ()

  This destructor explicitly deletes m_sysex and sets it to null.
- bool operator< (const event &rhsevent) const

  If the current timestamp equal the event's timestamp, then this function returns true if the current rank is less than the event's rank.
- void set_timestamp (midipulse time)

  'Setter' function for member m_timestamp
- midipulse get_timestamp () const

  'Getter' function for member m_timestamp
- midibyte get_channel () const

  'Getter' function for member m_channel
- bool check_channel (int channel) const

  Checks the channel number to see if the event's channel matches it, or if the event has no channel.
- void mod_timestamp (midipulse modtick)

  Calculates the value of the current timestamp modulo the given parameter.
- void set_status (midibyte status)

  Sets the m_status member to the value of status.
- void set_status (midibyte eventcode, midibyte channel)

  This overload is useful when synthesizing events, such as converting a Note On event with a velocity of zero to a Note Off event.
- void set_status_keep_channel (midibyte eventcode)

  This function is used in recording to preserve the input channel information for deciding what to do with an incoming MIDI event.
- void set_channel (midibyte channel)

  Sets the channel "nybble", without modifying the status "nybble".
- midibyte get_status () const

  'Getter' function for member m_status
- bool non_cc_match (midibyte status)

  Returns true if the event's status is not a control-change, but does match the given status.
- bool cc_match (midibyte st, midibyte cc)

  Returns true if the event's status is a control-change that matches the given status, and has a control value matching the given control-change value.
- void set_data (midibyte d1)

  Clears the most-significant-bit of the d1 parameter, and sets it into the first byte of m_data.
- void set_data (midibyte d1, midibyte d2)

  Clears the most-significant-bit of both parameters, and sets them into the first and second bytes of m_data.
- void get_data (midibyte &d0, midibyte &d1) const

  Retrieves the two data bytes from m_data[] and copies each into its respective parameter.
- void increment_data1 ()

  Increments the first data byte (m_data[0]) and clears the most significant bit.
- void decrement_data1 ()

  Decrements the first data byte (m_data[0]) and clears the most significant bit.
- void increment_data2 ()

  Increments the second data byte (m_data[1]) and clears the most significant bit.

- void decrement_data2 ()

  Decrements the second data byte (m_data[1]) and clears the most significant bit.
- bool append_sysex (midibyte *data, int len)

  Appends SYSEX data to a new buffer.
- bool append_sysex (midibyte data)

  An overload for obtaining SYSEX data byte-by-byte.
- void restart_sysex ()

  Deletes and clears out the SYSEX buffer.
- SysexContainer & get_sysex ()

  'Getter' function for member m_sysex from stazed, non-const version for use by midibus.
- const SysexContainer & get_sysex () const

  'Getter' function for member m_sysex from stazed
- void set_sysex_size (int len)

  'Setter' function for member m_sysex and m_sysex_size from stazed
- int get_sysex_size () const

  'Getter' function for member m_sysex_size
- void link (event *ev)

  Sets m_has_link and sets m_link to the provided event pointer.
- event * get_linked () const

  'Getter' function for member m_linked
- bool is_linked () const

  'Getter' function for member m_has_link
- void clear_link ()

  'Setter' function for member m_has_link and m_linked
- void paint ()

  'Setter' function for member m_painted
- void unpaint ()

  'Setter' function for member m_painted
- bool is_painted () const

  'Getter' function for member m_painted
- void mark ()

  'Setter' function for member m_marked
- void unmark ()

  'Setter' function for member m_marked
- bool is_marked () const

  'Getter' function for member m_marked
- void select ()

  'Setter' function for member m_selected
- void unselect ()

  'Setter' function for member m_selected
- bool is_selected () const

  'Getter' function for member m_selected
- void make_clock ()

  Sets m_status to EVENT_MIDI_CLOCK;.
- midibyte data (int index) const

  'Getter' function for member m_data[]
- midibyte get_note () const

  Assuming m_data[] holds a note, get the note number, which is in the first data byte, m_data[0].
- void set_note (midibyte note)

  Sets the note number, clearing off the most-significant-bit and assigning it to the first data byte, m_data[0].
- void transpose_note (int tn)

Transpose the note, if possible.

- midibyte get_note_velocity () const

  'Getter' function for member m_data[1], the note velocity.

- void set_note_velocity (int vel)

  Sets the note velocity, which is held in the second data byte, and clearing off the most-significant-bit, storing it in m_data[1].

- bool is_note_on () const

  Check for the Note On value in m_status.

- bool is_note_off () const

  Check for the Note Off value in m_status.

- bool is_note () const

  Returns true if m_status is a Note On, Note Off, or Aftertouch message.

- bool is_note_off_recorded () const

  Some keyboards send Note On with velocity 0 for Note Off, so we provide this function to test that during recording.

- void print () const

  Prints out the timestamp, data size, the current status byte, any SYSEX data if present, or the two data bytes for the status byte.

- int get_rank () const

  This function is used in sorting MIDI status events (e.g.

Static Public Member Functions

- static bool is_channel_msg (midibyte m)

  Static test for the channel message/statuse values: Note On, Note Off, Aftertouch, Control Change, Program Change, Channel Pressure, and Pitch Wheel.

- static bool is_one_byte_msg (midibyte m)

  Static test for channel messages that have only one data byte: Program Change and Channel Pressure.

- static bool is_two_byte_msg (midibyte m)

  Static test for channel messages that have two data bytes: Note On, Note Off, Control Change, Aftertouch, and Pitch Wheel.

- static bool is_note_msg (midibyte m)

  Static test for messages that involve notes and velocity: Note On, Note Off, and Aftertouch.

- static bool is_strict_note_msg (midibyte m)

  Static test for messages that involve notes only: Note On and Note Off.

- static bool is_desired_cc_or_not_cc (midibyte m, midibyte cc, midibyte datum)

  Static test for channel messages that are either not control-change messages, or are and match the given controller value.

Private Attributes

- midipulse m_timestamp

  Provides the MIDI timestamp in ticks, otherwise known as the "pulses" in "pulses per quarter note" (PPQN).

- midibyte m_status

  This is the status byte without the channel.

- midibyte m_channel

  In order to be able to handle MIDI channel-splitting of an SMF 0 file, we need to store the channel, even if we override it when playing the MIDI data.

- midibyte m_data [SEQ64_MIDI_DATA_BYTE_COUNT]

  The two bytes of data for the MIDI event.

- SysexContainer m_sysex

The data buffer for SYSEX messages.

- int m_sysex_size

  Gives the size of the SYSEX message.

- event * m_linked

  This event is used to link Note Ons and Offs together.

- bool m_has_link

  Indicates that a link has been made.

- bool m_selected

  Answers the question "is this event selected in editing.".

- bool m_marked

  Answers the question "is this event marked in processing.".

- bool m_painted

  Answers the question "is this event being painted.".

13.10.1 Detailed Description

A MIDI event consists of 3 bytes:

```
-#  Status byte, 1sssnnn, where the sss bits specify the type of
    message, and the nnnn bits denote the channel number.
    The status byte always starts with 0.
-#  The first data byte, 0xxxxxxx, where the data byte always
    start with 0, and the xxxxxxx values range from 0 to 127.
-#  The second data byte, 0xxxxxxx.
```

This class may have too many member functions.

13.10.2 Member Typedef Documentation

13.10.2.1 SysexContainer

```
typedef std::vector<midibyte> seq64::event::SysexContainer
```

13.10.3 Constructor & Destructor Documentation

13.10.3.1 event() [1/2]

```
seq64::event::event ( )
```

13.10.3.2 event() [2/2]

```
seq64::event::event (
            const event & rhs )
```

This function is currently geared only toward support of the SMF 0 channel-splitting feature. Many of the members are not set to useful values when the MIDI file is read, so we don't handle them for now.

Note that now events are also copied when creating the editable_events container, so this function is even more important. The event links, for linking Note Off events to their respective Note On events, are dropped. Generally, they will need to be reconstituted by calling the event_list::verify_and_link() function.

Warning

This function does not yet copy the SysEx data. The inclusion of SysEx events was not complete in Seq24, and it is still not complete in Sequencer64. Nor does it currently bother with the links, as noted above.

Parameters

rhs	Provides the event object to be copied.

13.10.3.3 ~event()

```
seq64::event::~event ( )  [virtual]
```

The restart_sysex() function does what we need. But now that m_sysex is a vector, no action is needed.

13.10.4 Member Function Documentation

13.10.4.1 operator=()

```
event & seq64::event::operator= (
            const event & rhs )
```

This function is currently geared only toward support of the SMF 0 channel-splitting feature. Many of the member are not set to useful value when the MIDI file is read, so we don't handle them for now.

Warning

This function now copies the SysEx data, but the inclusion of SysEx events was not complete in Seq24, and it is still not complete in Sequencer64. Nor does it currently bother with the link the event might have.

Parameters

rhs	Provides the event object to be assigned.

Returns

Returns a reference to "this" object, to support the serial assignment of events.

13.10.4.2 operator<()

```
bool seq64::event::operator< (
            const event & rhs ) const
```

Otherwise, it returns true if the current timestamp is less than the event's timestamp.

Warning

The less-than operator is supposed to support a "strict weak ordering", and is supposed to leave equivalent values in the same order they were before the sort. However, every time we load and save our sample MIDI file, events get reversed. Here are program-changes that get reversed:

```
    Save N:     0070: 6E 00 C4 48 00 C4 0C 00  C4 57 00 C4 19 00 C4 26
    Save N+1:   0070: 6E 00 C4 26 00 C4 19 00  C4 57 00 C4 0C 00 C4 48


   The 0070 is the offset within the versions of the
   b4uacuse-seq24.midi file.

   Because of this mis-feature, and the very slow speed of loading a MIDI
   file when Sequencer64 is built for debugging, we are exploring using
   an std::mulitmap instead of an std::list.  Search for occurrences of
   the SEQ64_USE_EVENT_MAP macro. (This actually works better than a
   list, for loading MIDI event, we have found, but may cause the upper
   limit of the number of playing sequences to drop a little, due to the
   overhead of incrementing multimap iterators versus list iterators).
```

Parameters

rhs	The object to be compared against.

Returns

Returns true if the time-stamp and "rank" are less than those of the comparison object.

13.10.4.3 set_timestamp()

```
void seq64::event::set_timestamp (
            midipulse time )  [inline]
```

Parameters

time	Provides the time value, in ticks, to set as the timestamp.

13.10.4.4 get_timestamp()

```
midipulse seq64::event::get_timestamp ( ) const  [inline]
```

13.10.4.5 get_channel()

```
midibyte seq64::event::get_channel ( ) const  [inline]
```

13.10.4.6 check_channel()

```
bool seq64::event::check_channel (
            int channel ) const  [inline]
```

Used in the SMF 0 track-splitting code.

Parameters

channel	The channel to check.

Returns

Returns true if the given channel matches the event's channel.

13.10.4.7 is_channel_msg()

```
static bool seq64::event::is_channel_msg (
            midibyte m )  [inline], [static]
```

This function requires that the channel data have already been masked off.

Parameters

m	The channel status or message byte to be tested, with the channel bits masked off.

We could add an optional boolean to cause the channel nybble to be explicitly cleared.

Returns

Returns true if the byte represents a MIDI channel message.

13.10.4.8 is_one_byte_msg()

```
static bool seq64::event::is_one_byte_msg (
            midibyte m )  [inline], [static]
```

The rest of the channel messages have two data bytes. This function requires that the channel data have already been masked off.

Parameters

m	The channel status or message byte to be tested, with the channel bits masked off.

We could add an optional boolean to cause the channel nybble to be explicitly cleared.

Returns

Returns true if the byte represents a MIDI channel message that has only one data byte. However, if this function returns false, it might not be a channel message at all, so be careful.

13.10.4.9 is_two_byte_msg()

```
static bool seq64::event::is_two_byte_msg (
            midibyte m )  [inline], [static]
```

This function requires that the channel data have already been masked off.

Parameters

m	The channel status or message byte to be tested, with the channel bits masked off.

We could add an optional boolean to cause the channel nybble to be explicitly cleared.

Returns

Returns true if the byte represents a MIDI channel message that has two data bytes. However, if this function returns false, it might not be a channel message at all, so be careful.

13.10.4.10 is_note_msg()

```
static bool seq64::event::is_note_msg (
            midibyte m )  [inline], [static]
```

This function requires that the channel nybble has already been masked off.

Parameters

m	The channel status or message byte to be tested, with the channel bits masked off.

We could add an optional boolean to cause the channel nybble to be explicitly cleared.

Returns

Returns true if the byte represents a MIDI note message.

13.10.4.11 is_strict_note_msg()

```
static bool seq64::event::is_strict_note_msg (
            midibyte m )  [inline], [static]
```

Parameters

m	The channel status or message byte to be tested, with the channel bits masked off.

Returns

Returns true if the byte represents a MIDI note on/off message.

13.10.4.12 is_desired_cc_or_not_cc()

```
static bool seq64::event::is_desired_cc_or_not_cc (
            midibyte m,
            midibyte cc,
            midibyte datum )  [inline], [static]
```

Note

The old logic was the first line, but can be simplified to the second line; the third line shows the abstract representation. Also made sure of this using a couple truth tables.

```
(m != EVENT_CONTROL_CHANGE) || (m == EVENT_CONTROL_CHANGE && d == cc)
(m != EVENT_CONTROL_CHANGE) || (d == cc)
a || (! a && b)  =>  a || b
```

```
\param m
     The channel status or message byte to be tested, with the channel
     bits masked off.

\param cc
     The desired cc value, which the datum must match, if the message is
     a control-change message.

\param datum
     The current datum, to be compared to cc, if the message is a
     control-change message.

\return
     Returns true if the message is not a control-change, or if it is
     and the cc and datum parameters match.
```

13.10.4.13 mod_timestamp()

```
void seq64::event::mod_timestamp (
            midipulse modtick )  [inline]
```

Parameters

modtick	The tick value to mod the timestamp against.

Returns

Returns a value ranging from 0 to _mod-1.

13.10.4.14 set_status() [1/2]

```
void seq64::event::set_status (
            midibyte status )
```

If a_status is a channel event, then the channel portion of the status is cleared using a bitwise AND against EVE↩ NT_CLEAR_CHAN_MASK.

Found in yet another fork of seq24:

```
// ORL fait de la merde
```

He also provided a very similar routine: set_status_midibus().

Stazed:

```
The record parameter, if true, does not clear channel portion
on record for channel specific recording. The channel portion is
cleared in sequence::stream_event() by calling set_status() (a_record
= false) after the matching channel is determined.  Otherwise, we use
a bitwise AND to clear the channel portion of the status.  All events
will be stored without the channel nybble.  This is necessary since
the channel is appended by midibus::play() based on the track.
```

Instead of adding a "record" parameter to set_status(), we provide a more specific function, set_status_keep_↩ channel(), for use in the mastermidibus class. This usage also has the side-effect of allowing the usage of channel in the MIDI-control feature.

Parameters

status	The status byte, perhaps read from a MIDI file or edited in the sequencer's event editor. Sometime, this byte will have the channel nybble masked off. If that is the case, the eventcode/channel overload of this function is more appropriate.

13.10.4.15 set_status() [2/2]

```
void seq64::event::set_status (
            midibyte eventcode,
            midibyte channel )
```

Parameters

eventcode	The status byte, perhaps read from a MIDI file. This byte is assumed to have already had its low nybble cleared by masking against EVENT_CLEAR_CHAN_MASK.
channel	The channel byte. Combined with the event-code, this makes a valid MIDI "status" byte. This byte is assume to have already had its high nybble cleared by masking against EVENT_GET_CHAN_MASK.

13.10.4.16 set_status_keep_channel()

```
void seq64::event::set_status_keep_channel (
            midibyte eventcode )  [inline]
```

It replaces stazed's set_status() that had an optional "record" parameter. This call allows channel to be detected and used in MIDI control events.

Parameters

eventcode	The status byte, generally read from the MIDI buss.

13.10.4.17 set_channel()

```
void seq64::event::set_channel (
            midibyte channel )  [inline]
```

It actually just sets the m_channel member. Note that the sequence channel generally overrides this value in the usage of the event.

Parameters

channel	The channel byte to be set.

13.10.4.18 get_status()

```
midibyte seq64::event::get_status ( ) const  [inline]
```

13.10.4.19 non_cc_match()

```
bool seq64::event::non_cc_match (
            midibyte status )  [inline]
```

Parameters

status	The status to be checked.

13.10.4.20 cc_match()

```
bool seq64::event::cc_match (
            midibyte st,
            midibyte cc )  [inline]
```

Parameters

st	The status to be checked.
cc	The control-change value to be checked against the events current "d0" value.

13.10.4.21 set_data() [1/2]

```
void seq64::event::set_data (
            midibyte d1 )  [inline]
```

The second byte of data is zeroed. The data bytes are in a two-byte array member, m_data. This setter is useful for Program Change and Channel Pressure events.

Parameters

d1	The byte value to set as the first data byte.

13.10.4.22 set_data() [2/2]

```
void seq64::event::set_data (
            midibyte d1,
            midibyte d2 )  [inline]
```

Parameters

d1	The first byte value to set.
d2	The second byte value to set.

13.10.4.23 get_data()

```
void seq64::event::get_data (
            midibyte & d0,
            midibyte & d1 ) const  [inline]
```

Parameters

d0	[out] The return reference for the first byte.
d1	[out] The return reference for the first byte.

13.10.4.24 increment_data1()

```
void seq64::event::increment_data1 ( )  [inline]
```

13.10.4.25 decrement_data1()

```
void seq64::event::decrement_data1 ( )  [inline]
```

13.10.4.26 increment_data2()

```
void seq64::event::increment_data2 ( )  [inline]
```

13.10.4.27 decrement_data2()

```
void seq64::event::decrement_data2 ( )  [inline]
```

13.10.4.28 append_sysex() [1/2]

```
bool seq64::event::append_sysex (
            midibyte * data,
            int dsize )
```

We now use a vector instead of an array, so there is no need for reallocation and copying of the current SYSEX data. The data represented by data and dsize is appended to that data buffer.

Parameters

data	Provides the additional SYSEX data. If not provided, nothing is done, and false is returned.
dsize	Provides the size of the additional SYSEX data. If not provided, nothing is done.

Returns

Returns false if there was an EVENT_MIDI_SYSEX_END byte in the appended data, or if an error occurred, and the caller needs to stop trying to process the data. We're not quite sure what to do with any extra data remains.

13.10.4.29 append_sysex() [2/2]

```
bool seq64::event::append_sysex (
            midibyte data )
```

Parameters

data	A single MIDI byte of data, assumed to be part of a SYSEX message event.

13.10.4.30 restart_sysex()

```
void seq64::event::restart_sysex ( )
```

(The m_sysex member used to be a pointer.)

13.10.4.31 get_sysex() [1/2]

```
SysexContainer& seq64::event::get_sysex ( )  [inline]
```

13.10.4.32 get_sysex() [2/2]

```
const SysexContainer& seq64::event::get_sysex ( ) const  [inline]
```

13.10.4.33 set_sysex_size()

```
void seq64::event::set_sysex_size (
            int len )  [inline]
```

13.10.4.34 get_sysex_size()

```
int seq64::event::get_sysex_size ( ) const  [inline]
```

13.10.4.35 link()

```
void seq64::event::link (
            event * ev )  [inline]
```

Parameters

ev	Provides a pointer to the event value to set. If null, then m_has_link is set to false, to guarantee that is_linked() is correct.

13.10.4.36 get_linked()

```
event* seq64::event::get_linked ( ) const  [inline]
```

13.10.4.37 is_linked()

```
bool seq64::event::is_linked ( ) const  [inline]
```

13.10.4.38 clear_link()

```
void seq64::event::clear_link ( )  [inline]
```

13.10.4.39 paint()

```
void seq64::event::paint ( )  [inline]
```

13.10.4.40 unpaint()

```
void seq64::event::unpaint ( )  [inline]
```

13.10.4.41 is_painted()

```
bool seq64::event::is_painted ( ) const  [inline]
```

13.10.4.42 mark()

```
void seq64::event::mark ( )  [inline]
```

13.10.4.43 unmark()

```
void seq64::event::unmark ( )  [inline]
```

13.10.4.44 is_marked()

```
bool seq64::event::is_marked ( ) const  [inline]
```

13.10.4.45 select()

```
void seq64::event::select ( )  [inline]
```

13.10.4.46 unselect()

```
void seq64::event::unselect ( )  [inline]
```

13.10.4.47 is_selected()

```
bool seq64::event::is_selected ( ) const  [inline]
```

13.10.4.48 make_clock()

```
void seq64::event::make_clock ( )  [inline]
```

13.10.4.49 data()

```
midibyte seq64::event::data (
            int index ) const  [inline]
```

13.10.4.50 get_note()

```
midibyte seq64::event::get_note ( ) const  [inline]
```

13.10.4.51 set_note()

```
void seq64::event::set_note (
            midibyte note )  [inline]
```

Parameters

note	Provides the note value to set.

13.10.4.52 transpose_note()

```
void seq64::event::transpose_note (
            int tn )
```

Parameters

tn	The amount (positive or negative) to transpose a note. If the result is out of range, the transposition is not performed.

13.10.4.53 get_note_velocity()

```
midibyte seq64::event::get_note_velocity ( ) const  [inline]
```

13.10.4.54 set_note_velocity()

```
void seq64::event::set_note_velocity (
            int vel )  [inline]
```

Parameters

vel	Provides the velocity value to set.

13.10.4.55 is_note_on()

```
bool seq64::event::is_note_on ( ) const  [inline]
```

Currently assumes that the channel nybble has already been stripped.

Returns

Returns true if m_status is EVENT_NOTE_ON.

13.10.4.56 is_note_off()

```
bool seq64::event::is_note_off ( ) const  [inline]
```

Currently assumes that the channel nybble has already been stripped.

Returns

Returns true if m_status is EVENT_NOTE_OFF.

13.10.4.57 is_note()

```
bool seq64::event::is_note ( ) const  [inline]
```

All of these are notes, associated with a MIDI key value. Uses the static function is_note_msg().

Returns

The return value of is_note_msg() is returned.

13.10.4.58 is_note_off_recorded()

```
bool seq64::event::is_note_off_recorded ( ) const  [inline]
```

The channel nybble is masked off before the test, but this is unnecessary since the velocity byte doesn't contain the channel! And it is a nasty bug!

"(m_data[1] & EVENT_CLEAR_CHAN_MASK) == 0" is wrong!

"m_status == EVENT_NOTE_ON && m_data[1] == 0" replaced by an inline function call for robustness.

Returns

Returns true if the event is a Note On event with velocity of 0.

13.10.4.59 print()

```
void seq64::event::print ( ) const
```

13.10.4.60 get_rank()

```
int seq64::event::get_rank ( ) const
```

The ranking, from high to low, is note off, note on, aftertouch, channel pressure, and pitch wheel, control change, and program changes.

note on/off, aftertouch, control change, etc.) The sort order is not determined by the actual status values.

The lower the ranking the more upfront an item comes in the sort order.

Returns

Returns the rank of the current m_status byte.

13.10.5 Field Documentation

13.10.5.1 m_timestamp

```
midipulse seq64::event::m_timestamp  [private]
```

13.10.5.2 m_status

```
midibyte seq64::event::m_status  [private]
```

The channel is included when recording MIDI, but, once a sequence with a matching channel is found, the channel nybble is cleared for storage. The channel will be added back on the MIDI bus upon playback. The high nybble = type of event; The low nybble = channel. Bit 7 is present in all status bytes.

13.10.5.3 m_channel

```
midibyte seq64::event::m_channel  [private]
```

This member adds another 4 bytes to the event object, most likely.

13.10.5.4 m_data

```
midibyte seq64::event::m_data[SEQ64_MIDI_DATA_BYTE_COUNT]  [private]
```

Remember that the most-significant bit of a data byte is always 0. A one-byte message uses only the 0th index.

13.10.5.5 m_sysex

```
SysexContainer seq64::event::m_sysex  [private]
```

Adapted from Stazed's Seq32 project on GitHub.

13.10.5.6 m_sysex_size

```
int seq64::event::m_sysex_size  [private]
```

Perhaps redundant.

13.10.5.7 m_linked

```
event* seq64::event::m_linked  [private]
```

13.10.5.8 m_has_link

```
bool seq64::event::m_has_link  [private]
```

This item is used [via the get_link() and link() accessors] in the sequence class.

13.10.5.9 m_selected

```
bool seq64::event::m_selected  [private]
```

13.10.5.10 m_marked

```
bool seq64::event::m_marked  [private]
```

13.10.5.11 m_painted

```
bool seq64::event::m_painted  [private]
```

13.11 seq64::event_list::event_key Class Reference

Provides a key value for an event map.

Public Member Functions

- event_key (midipulse tstamp, int rank)
  Principal event_key constructor.
- event_key (const event &e)
  Event-based constructor.
- bool operator< (const event_key &rhs) const
  Provides the minimal operator needed to sort events using an event_key.

Private Attributes

- midipulse m_timestamp
  The primary key-value for the key.
- int m_rank
  The sub-key-value for the key.

13.11.1 Detailed Description

Its types match the m_timestamp and get_rank() function of this event class.

13.11.2 Constructor & Destructor Documentation

13.11.2.1 event_key() [1/2]

```
seq64::event_list::event_key::event_key (
            midipulse tstamp,
            int rank )
```

Parameters

tstamp	The time-stamp is the primary part of the key. It is the most important key item.
rank	Rank is an arbitrary number used to prioritize events that have the same time-stamp. See the event::get_rank() function for more information.

13.11.2.2 event_key() [2/2]

```
seq64::event_list::event_key::event_key (
            const event & rhs )
```

This constructor makes it even easier to create an event_key. Note that the call to event::get_rank() makes a simple calculation based on the status of the event.

Parameters

rhs	Provides the event key to be copied.

13.11.3 Member Function Documentation

13.11.3.1 operator<()

```
bool seq64::event_list::event_key::operator< (
            const event_key & rhs ) const
```

Parameters

rhs	Provides the event key to be compared against.

Returns

Returns true if the rank and timestamp of the current object are less than those of rhs.

13.11.4 Field Documentation

13.11.4.1 m_timestamp

```
midipulse seq64::event_list::event_key::m_timestamp  [private]
```

13.11.4.2 m_rank

```
int seq64::event_list::event_key::m_rank  [private]
```

13.12 seq64::event_list Class Reference

The event_list class is a receptable for MIDI events.

Data Structures

- class event_key

  Provides a key value for an event map.

Public Member Functions

- event_list ()

  Principal constructor.
- event_list (const event_list &a_rhs)

  Copy constructor.
- event_list & operator= (const event_list &a_rhs)

  Principal assignment operator.
- ~event_list ()

  A rote destructor.
- iterator begin ()

  'Getter' function for member m_events.begin(), non-constant version.
- const_iterator begin () const

  'Getter' function for member m_events.begin(), constant version.
- iterator end ()

  'Getter' function for member m_events.end(), non-constant version.
- const_iterator end () const

  'Getter' function for member m_events.end(), constant version.
- int count () const

  Returns the number of events stored in m_events.
- bool empty () const

  Returns true if there are no events.
- bool add (const event &e)

Adds an event to the internal event list in an optionally sorted manner.

- bool append (const event &e)

  Adds an event to the internal event list without sorting.
- void push_back (const event &)

  The multimap version of this function does nothing.
- bool is_modified () const

  'Getter' function for member m_is_modified
- void unmodify ()

  'Setter' function for member m_is_modified This function may be needed by some of the sequence editors.
- void remove (iterator ie)

  Provides a wrapper for the iterator form of erase(), which is the only one that sequence uses.
- void clear ()

  Provides a wrapper for clear().
- void merge (event_list &el, bool presort=true)

  Provides a merge operation for the event multimap analogous to the merge operation for the event list.
- void sort ()

  TEMPORARILY HERE for gdb.

Static Public Member Functions

- static event & dref (iterator ie)

  Dereference access for list or map.
- static const event & dref (const_iterator ie)

  Dereference const access for list or map.

Private Types

- typedef std::multimap< event_key, event > Events

  Types to use to swap between list and multimap implementations.
- typedef std::pair< event_key, event > EventsPair
- typedef std::multimap< event_key, event >::iterator iterator
- typedef std::multimap< event_key, event >::const_iterator const_iterator

Private Member Functions

- void link_new ()

  Links a new event.
- void clear_links ()

  Clears all event links and unmarks them all.
- void verify_and_link (midipulse slength)

  This function verifies state: all note-ons have an off, and it links note-offs with their note-ons.
- bool mark_selected ()

  Marks all selected events.
- void mark_out_of_range (midipulse slength)

  Marks all events that have a time-stamp that is out of range.
- void mark_all ()

  Marks all events.
- void unmark_all ()

  Unmarks all events.

- bool remove_marked ()

  Removes marked events.
- void unpaint_all ()

  Unpaints all list-events.
- int count_selected_notes () const

  Counts the selected note-on events in the event list.
- bool any_selected_notes () const

  Indicates that at least one note is selected.
- int count_selected_events (midibyte status, midibyte cc) const

  Counts the selected events, with the given status, in the event list.
- void select_all ()

  Selects all events, unconditionally.
- void unselect_all ()

  Deselects all events, unconditionally.
- void print () const

  Prints a list of the currently-held events.
- const Events & events () const

  'Getter' function for member m_events

Private Attributes

- Events m_events

  This list holds the current pattern/sequence events.
- bool m_is_modified

  A new flag to indicate if an event was added or removed.

Friends

- class editable_events
- class midifile
- class midi_container
- class midi_splitter
- class sequence

13.12.1 Detailed Description

Two implementations, an std::multimap, and the original, an std::list, are provided for comparison, and are selected at build time, by manually defining the SEQ64_USE_EVENT_MAP macro near the top of this module.

13.12.2 Member Typedef Documentation

13.12.2.1 Events

```
typedef std::multimap<event_key, event> seq64::event_list::Events  [private]
```

13.12.2.2 EventsPair

```
typedef std::pair<event_key, event> seq64::event_list::EventsPair  [private]
```

13.12.2.3 iterator

```
typedef std::multimap<event_key, event>::iterator seq64::event_list::iterator  [private]
```

13.12.2.4 const_iterator

```
typedef std::multimap<event_key, event>::const_iterator seq64::event_list::const_iterator
[private]
```

13.12.3 Constructor & Destructor Documentation

13.12.3.1 event_list() [1/2]

```
seq64::event_list::event_list ( )
```

13.12.3.2 event_list() [2/2]

```
seq64::event_list::event_list (
            const event_list & rhs )
```

Parameters

rhs	Provides the event list to be copied.

13.12.3.3 ~event_list()

```
seq64::event_list::~event_list ( )
```

13.12.4 Member Function Documentation

13.12.4.1 operator=()

```
event_list & seq64::event_list::operator= (
            const event_list & rhs )
```

Follows the stock rules for such an operator, just assigning member values.

Parameters

rhs	Provides the event list to be assigned.

13.12.4.2 begin() [1/2]

```
iterator seq64::event_list::begin ( )  [inline]
```

13.12.4.3 begin() [2/2]

```
const_iterator seq64::event_list::begin ( ) const  [inline]
```

13.12.4.4 end() [1/2]

```
iterator seq64::event_list::end ( )  [inline]
```

13.12.4.5 end() [2/2]

```
const_iterator seq64::event_list::end ( ) const  [inline]
```

13.12.4.6 count()

```
int seq64::event_list::count ( ) const  [inline]
```

We like returning an integer instead of size_t, and rename the function so nobody is fooled.

13.12.4.7 empty()

```
bool seq64::event_list::empty ( ) const  [inline]
```

return m_events.size() == 0;

13.12.4.8 add()

```
bool seq64::event_list::add (
            const event & e )  [inline]
```

Parameters

e	Provides the event to be added to the list.

Returns

Returns true. We assume the insertion succeeded, and no longer care about an increment in container size. It's a multimap, so it always inserts, and if we don't have memory left, all bets are off anyway.

13.12.4.9 append()

```
bool seq64::event_list::append (
            const event & e )
```

It is a wrapper, wrapper for insert() or push_front(), with an option to call sort().

The add() function without sorting, useful to speed up the initial container loading into the event-list.

For the std::multimap implementation, This is an option if we want to make sure the insertion succeed.

If the std::list implementation has been built in, then the event list is sorted after the addition. This is a time-consuming operation.

Warning

This pushing (and, in writing the MIDI file, the popping), causes events with identical timestamps to be written in reverse order. Doesn't affect functionality, but it's puzzling until one understands what is happening. That's why we're now preferring to use a multimap as the container.

Parameters

e	Provides the event to be added to the list.

Returns

Returns true. We assume the insertion succeeded, and no longer care about an increment in container size. It's a multimap, so it always inserts, and if we don't have memory left, all bets are off anyway.

13.12.4.10 push_back()

```
void seq64::event_list::push_back (
            const event &  )  [inline]
```

13.12.4.11 is_modified()

```
bool seq64::event_list::is_modified ( ) const  [inline]
```

13.12.4.12 unmodify()

```
void seq64::event_list::unmodify ( )  [inline]
```

But use it with great caution.

13.12.4.13 remove()

```
void seq64::event_list::remove (
            iterator ie )  [inline]
```

Currently, no check on removal is performed. Sets the modified-flag.

Parameters

ie	Provides the iterator to the event to be removed.

13.12.4.14 clear()

```
void seq64::event_list::clear ( )  [inline]
```

Sets the modified-flag.

13.12.4.15 merge()

```
void seq64::event_list::merge (
            event_list & el,
            bool presort = true )
```

We have certain constraints to preserve, as the following discussion shows.

For std::list, sequence merges list T into list A by first calling T.sort(), and then A.merge(T). The merge() operation merges T into A by transferring all of its elements, at their respective ordered positions, into A. Both containers must already be ordered.

The merge effectively removes all the elements in T (which becomes empty), and inserts them into their ordered position within container (which expands in size by the number of elements transferred). The operation is performed without constructing nor destroying any element, whether T is an lvalue or an rvalue, or whether the value-type supports move-construction or not.

Each element of T is inserted at the position that corresponds to its value according to the strict weak ordering defined by operator $<$. The resulting order of equivalent elements is stable (i.e. equivalent elements preserve the relative order they had before the call, and existing elements precede those equivalent inserted from x). The function does nothing if (&x == this).

For std::multimap, sorting is automatic. However, unless move-construction is supported, merging will be less efficient than for the list version. Also, we need a way to include duplicates of each event, so we need to use a multimap. Once all this setup, merging is really just insertion. And, since sorting isn't needed, the multimap actually turns out to be faster.

Parameters

el	Provides the event list to be merged into the current event list.
presort	If true, the events are presorted. This is a requirement for merging an std::list, but is a no-op for the std::multimap implementation.

13.12.4.16 sort()

```
void seq64::event_list::sort ( )
```

13.12.4.17 dref() [1/2]

```
static event& seq64::event_list::dref (
            iterator ie )  [inline], [static]
```

Parameters

ie	Provides the iterator to the event to which to get a reference.

13.12.4.18 dref() [2/2]

```
static const event& seq64::event_list::dref (
            const_iterator ie )  [inline], [static]
```

Parameters

ie	Provides the iterator to the event to which to get a reference.

13.12.4.19 link_new()

```
void seq64::event_list::link_new ( )  [private]
```

This function checks for a note on, then look for its note off. This function is provided in the event_list because it does not depend on any external data. Also note that any desired thread-safety must be provided by the caller.

13.12.4.20 clear_links()

```
void seq64::event_list::clear_links ( )  [private]
```

13.12.4.21 verify_and_link()

```
void seq64::event_list::verify_and_link (
            midipulse slength )  [private]
```

Stazed (seq32):

```
This function now deletes any notes that are >= m_length, so any
resize or move of notes must modify for wrapping if Note Off is >=
m_length.
```

Not threadsafe As in most case, the caller will use an automutex to call this function safely.

Parameters

slength	Provides the length beyond which events will be pruned.

13.12.4.22 mark_selected()

```
bool seq64::event_list::mark_selected ( )  [private]
```

Returns

Returns true if there was even one event selected and marked.

13.12.4.23 mark_out_of_range()

```
void seq64::event_list::mark_out_of_range (
            midipulse slength )  [private]
```

Used for killing (pruning) those events not in range. If the current time-stamp is greater than the length, then the event is marked for pruning.

Note

This code was comparing the timestamp as greater than or equal to the sequence length. However, being equal is fine. This may explain why the midifile code would add one tick to the length of the last note when processing the end-of-track.

Parameters

slength	Provides the length beyond which events will be pruned.

13.12.4.24 mark_all()

```
void seq64::event_list::mark_all ( )  [private]
```

Not yet used, but might come in handy with the event editor dialog.

13.12.4.25 unmark_all()

```
void seq64::event_list::unmark_all ( )  [private]
```

13.12.4.26 remove_marked()

```
bool seq64::event_list::remove_marked ( )  [private]
```

Note how this function handles removing a value to avoid incrementing a now-invalid iterator.

Threadsafe

Returns

Returns true if at least one event was removed.

13.12.4.27 unpaint_all()

```
void seq64::event_list::unpaint_all ( )  [private]
```

13.12.4.28 count_selected_notes()

```
int seq64::event_list::count_selected_notes ( ) const  [private]
```

13.12.4.29 any_selected_notes()

```
bool seq64::event_list::any_selected_notes ( ) const  [private]
```

Acts like event_list::count_selected_notes(), but stops after finding a selected note. We could add a flag to count_selected_notes() to break, I suppose.

Returns

Returns true if at least one note is selected.

13.12.4.30 count_selected_events()

```
int seq64::event_list::count_selected_events (
            midibyte status,
            midibyte cc ) const  [private]
```

If the event is a control change (CC), then it must also match the given CC value.

Parameters

status	The desired status value to count.
cc	The desired control-change to count. Used only if the status parameter indicates a control-change event.

Returns

Returns the number of selected events.

13.12.4.31 select_all()

```
void seq64::event_list::select_all ( )  [private]
```

13.12.4.32 unselect_all()

```
void seq64::event_list::unselect_all ( )  [private]
```

13.12.4.33 print()

```
void seq64::event_list::print ( ) const  [private]
```

13.12.4.34 events()

```
const Events& seq64::event_list::events ( ) const  [inline], [private]
```

13.12.5 Friends And Related Function Documentation

13.12.5.1 editable_events

```
friend class editable_events  [friend]
```

13.12.5.2 midifile

```
friend class midifile  [friend]
```

13.12.5.3 midi_container

```
friend class midi_container  [friend]
```

13.12.5.4 midi_splitter

```
friend class midi_splitter  [friend]
```

13.12.5.5 sequence

```
friend class sequence  [friend]
```

13.12.6 Field Documentation

13.12.6.1 m_events

```
Events seq64::event_list::m_events  [private]
```

13.12.6.2 m_is_modified

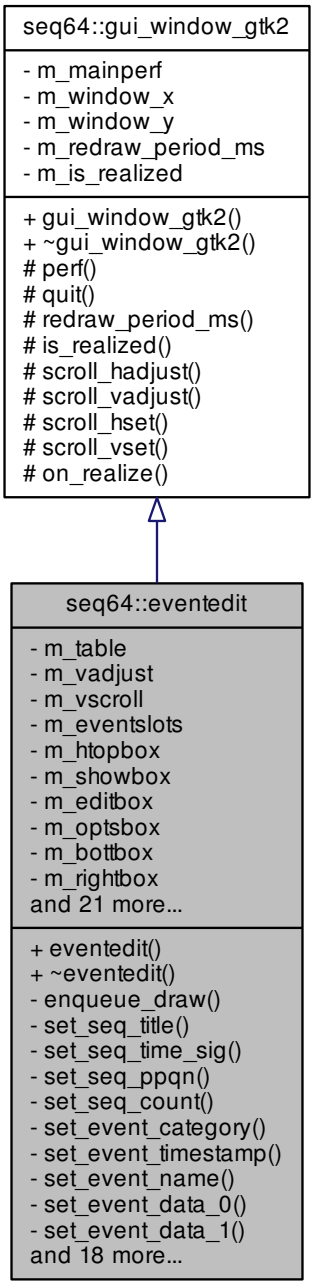
```
bool seq64::event_list::m_is_modified  [private]
```

We may need to give client code a way to reload the sequence. This is currently an issue when a seqroll and an eventedit/eventslots are active for the same sequence.

13.13 seq64::eventedit Class Reference

This class supports an Event Editor that is used to tweak the details of events and get a better idea of the mix of events in a sequence.

Inheritance diagram for seq64::eventedit:



Public Member Functions

- eventedit (perform &p, sequence &seq)

  Principal constructor, has a reference to a perform object.
- virtual ~eventedit ()

  This rote constructor does nothing.

Private Member Functions

- void enqueue_draw ()

  Helper wrapper for calling eventslots::queue_draw().
- void set_seq_title (const std::string &title)

  Sets m_label_seq_name to the title.
- void set_seq_time_sig (const std::string &sig)

  Sets m_label_time_sig to the time-signature string.
- void set_seq_ppqn (const std::string &p)

  Sets m_label_ppqn to the parts-per-quarter-note string.
- void set_seq_count ()

  Sets m_label_ev_count to the number-of-events string.
- void set_event_category (const std::string &c)

  Sets m_label_category to the category string.
- void set_event_timestamp (const std::string &ts)

  Sets m_entry_ev_timestamp to the time-stamp string.
- void set_event_name (const std::string &n)

  Sets m_entry_ev_name to the name-of-event string.
- void set_event_data_0 (const std::string &d)

  Sets m_entry_ev_data_0 to the first data byte string.
- void set_event_data_1 (const std::string &d)

  Sets m_entry_data_1 to the second data byte string.
- void perf_modify ()

  Provides a way to mark the perform object as modified, when the modified sequence is saved.
- void set_dirty (bool flag=true)

  Sets the "modified" status of the user-interface.
- void v_adjustment (int value)

  Sets the parameters for the vertical scroll-bar, using only the value parameter.
- void v_adjustment (int value, int lower, int upper)

  Sets the parameters for the vertical scroll-bar that is associated with the eventslots event-list user-interface.
- void change_focus (bool set_it=true)

  Changes what perform and mainwid see as the "current sequence".
- void close_out ()

  Handles closing the sequence editor, common code for handle_cancel() and handle_close().
- void handle_close ()

  Handles closing the sequence editor.
- void handle_delete ()

  Initiates the deletion of the current editable event.
- void handle_insert ()

  Initiates the insertion of a new editable event.
- void handle_modify ()

  Passes the edited fields to the current editable event in the eventslot.
- void handle_save ()

  Handles saving the edited data back to the original sequence.
- void handle_cancel ()

  Cancels the edits and closes the dialog box.
- void on_realize ()

  This callback function calls the base-class on_realize() function.
- void on_set_focus (Widget *focus)

  On receiving focus, attempt to tell mainwid that this sequence is now the current sequence.
- bool on_focus_in_event (GdkEventFocus *)

Implements the on-focus event handling.

- bool on_focus_out_event (GdkEventFocus ∗)

  Implements the on-unfocus event handling.

- bool on_key_press_event (GdkEventKey ∗ev)

  This function is the callback for a key-press event.

- bool on_delete_event (GdkEventAny ∗event)

  Handles an on-delete event.

Private Attributes

- Gtk::Table ∗ m_table

  A whole horde of GUI elements.

- Gtk::Adjustment ∗ m_vadjust

  Vertical paging for event list.

- Gtk::VScrollbar ∗ m_vscroll

  Vertical scroll for event list.

- eventslots ∗ m_eventslots

  Drawing area for events.

- Gtk::HBox ∗ m_htopbox

  Padding at the top of the dialog.

- Gtk::VBox ∗ m_showbox

  Area for sequence information.

- Gtk::VBox ∗ m_editbox

  Text-edits and buttons for data.

- Gtk::VBox ∗ m_optsbox

  Reserved for future options.

- Gtk::HBox ∗ m_bottbox

  Holds the Save and Close buttons.

- Gtk::VBox ∗ m_rightbox

  Used for padding on right side.

- Gtk::Button ∗ m_button_del

  "Delete Current Event (∗)" button.

- Gtk::Button ∗ m_button_ins

  "Insert New Event" button.

- Gtk::Button ∗ m_button_modify

  "Modify New Event" button.

- Gtk::Button ∗ m_button_save

  "Save to Sequence" button.

- Gtk::Button ∗ m_button_cancel

  "Close" button.

- Gtk::Label ∗ m_label_seq_name

  Items for the inside of the m_showbox member.

- Gtk::Label ∗ m_label_time_sig

  Shows time signature for pattern.

- Gtk::Label ∗ m_label_ppqn

  Shows the parts per quarter note.

- Gtk::Label ∗ m_label_channel

  Shows channel number of pattern.

- Gtk::Label ∗ m_label_ev_count

  Shows the count of pattern events.

- Gtk::Label * m_label_spacer

  Spacer for the showbox elements.
- Gtk::Label * m_label_modified

  Shows "[Modified]" if edited.
- Gtk::Label * m_label_category

  Items for the inside of the m_editbox member.
- Gtk::Entry * m_entry_ev_timestamp

  Text edit for event time-stamp.
- Gtk::Entry * m_entry_ev_name

  Text edit for MIDI event name.
- Gtk::Entry * m_entry_ev_data_0

  Text edit for first event datum.
- Gtk::Entry * m_entry_ev_data_1

  Text edit for second event datum.
- Gtk::Label * m_label_time_fmt

  Optsbox item, only "Sequencer64".
- Gtk::Label * m_label_right

  Padding at the right of dialog.
- sequence & m_seq

  A reference to the sequence being edited, to control its editing flag.
- bool m_have_focus

  Indicates that the focus has already been changed to this sequence.

Friends

- class eventslots

Additional Inherited Members

13.13.1 Constructor & Destructor Documentation

13.13.1.1 eventedit()

```
seq64::eventedit::eventedit (
            perform & p,
            sequence & seq )
```

We've reordered the pointer members and put them in the initializer list to make the constructor a bit cleaner.

Adjustment parameters:

```
value           initial value
lower           minimum value
upper           maximum value
step_increment  step increment
page_increment  page increment
page_size       page size
```

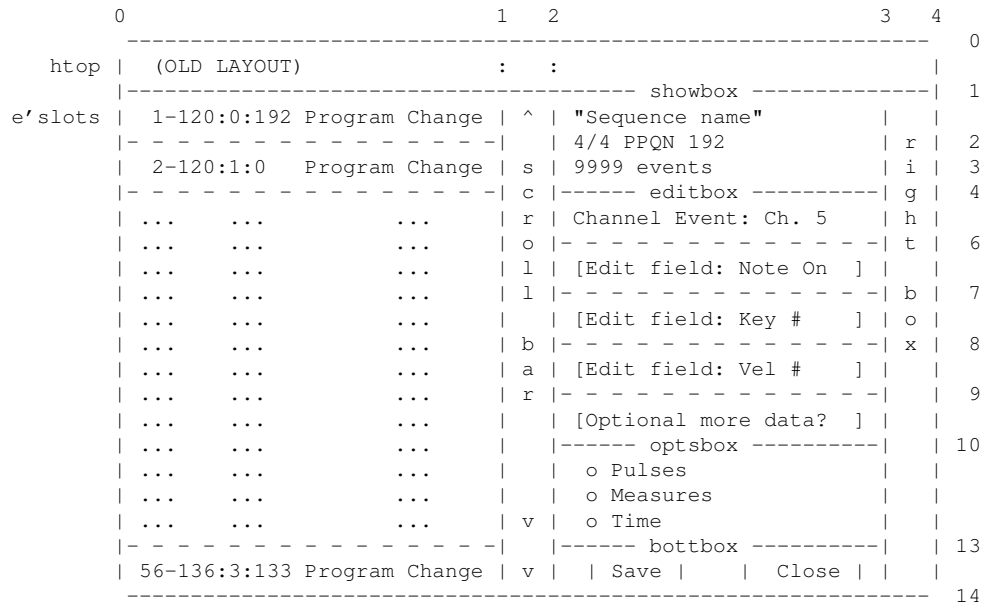
```
Table constructor parameters:


        rows
        columns
        homogenous


Table attach() parameters:


        child           widget to add.
        left_attach     column number to attach left side of a child widget
        right_attach    column number to attach right side of a child widget
        top_attach      row number to attach the top of a child widget
        bottom_attach   row number to attach the bottom of a child widget
        xoptions        properties of the child widget when table resized
        yoptions        same as xoptions, except vertical.
        xpadding        padding on L and R of widget added to table
        ypadding        amount of padding above and below the child widget
```

Layout:



Parameters

p	Refers to the main performance object.
seq	Refers to the sequence holding the event data to be edited.

The seqedit class indirectly sets the sequence dirty flags, and this allows the sequence's pattern slot to be updated, which, for example, allows the new experimental in-edit-highlight feature to work. To get the eventedit to also show the in-edit highlighting, we can make the sequence::set_dirty_mp() call. This call does not cause a prompt for saving the file when exiting.

13.13.1.2 ~eventedit()

```
seq64::eventedit::~eventedit ( )  [virtual]
```

We're going to have to run the application through valgrind to make sure that nothing is left behind.

13.13.2 Member Function Documentation

13.13.2.1 enqueue_draw()

```
void seq64::eventedit::enqueue_draw ( )  [private]
```

13.13.2.2 set_seq_title()

```
void seq64::eventedit::set_seq_title (
            const std::string & title )  [private]
```

Parameters

title	The name of the sequence.

13.13.2.3 set_seq_time_sig()

```
void seq64::eventedit::set_seq_time_sig (
            const std::string & sig )  [private]
```

Parameters

sig	The time signature of the sequence.

13.13.2.4 set_seq_ppqn()

```
void seq64::eventedit::set_seq_ppqn (
            const std::string & p )  [private]
```

Parameters

p	The parts-per-quarter-note string for the sequence.

13.13.2.5 set_seq_count()

```
void seq64::eventedit::set_seq_count ( )  [private]
```

13.13.2.6 set_event_category()

```
void seq64::eventedit::set_event_category (
            const std::string & c )  [private]
```

Parameters

c	The category string for the current event.

13.13.2.7 set_event_timestamp()

```
void seq64::eventedit::set_event_timestamp (
            const std::string & ts )  [private]
```

Parameters

ts	The time-stamp string for the current event.

13.13.2.8 set_event_name()

```
void seq64::eventedit::set_event_name (
            const std::string & n )  [private]
```

Parameters

n	The name-of-event string for the current event.

13.13.2.9 set_event_data_0()

```
void seq64::eventedit::set_event_data_0 (
            const std::string & d )  [private]
```

Parameters

d	The first data byte string for the current event.

13.13.2.10 set_event_data_1()

```
void seq64::eventedit::set_event_data_1 (
            const std::string & d )  [private]
```

Parameters

d	The second data byte string for the current event.

13.13.2.11 perf_modify()

```
void seq64::eventedit::perf_modify ( )  [private]
```

13.13.2.12 set_dirty()

```
void seq64::eventedit::set_dirty (
            bool flag = true )  [private]
```

This includes changing a label and enabling/disabling the Save button.

Parameters

flag	If true, the modified status is indicated, otherwise it is cleared.

13.13.2.13 v_adjustment() [1/2]

```
void seq64::eventedit::v_adjustment (
            int value )  [private]
```

This function overload provides a common use case.

Parameters

value	The new current value to be indicated by the scroll-bar.

13.13.2.14 v_adjustment() [2/2]

```
void seq64::eventedit::v_adjustment (
            int value,
```

```
            int lower,
            int upper )  [private]
```

It keeps the frame scroll-bar in sync with the frame movement actions. Some of the parameters are obtained from the eventslots object:

```
-   Page size comes from eventslots::line_maximum().
-   Page increment is a little less than the page-size value.
```

Parameters

value	The current value to be indicated by the scroll-bar. It will lie between the lower and upper parameter.
lower	The lowest value to be indicated by the scroll-bar.
upper	The highest value to be indicated by the scroll-bar.

13.13.2.15 change_focus()

```
void seq64::eventedit::change_focus (
            bool set_it = true )  [private]
```

Similar to the same function in seqedit.

Parameters

set_it	If true (the default value), indicates we want focus, otherwise we want to give up focus.

13.13.2.16 close_out()

```
void seq64::eventedit::close_out ( )  [private]
```

13.13.2.17 handle_close()

```
void seq64::eventedit::handle_close ( )  [private]
```

Simply calls close_out().

13.13.2.18 handle_delete()

```
void seq64::eventedit::handle_delete ( )  [private]
```

13.13.2.19 handle_insert()

```
void seq64::eventedit::handle_insert ( )  [private]
```

The event's location will be determined by the timestamp and existing events. Note that we have to recalibrate the scroll-bar when we insert/delete events by calling v_adjustment().

13.13.2.20 handle_modify()

```
void seq64::eventedit::handle_modify ( )  [private]
```

Note that there are two cases to worry about. If the timestamp has not changed, then we can simply modify the existing current event in place. Otherwise, we need to delete the old event and insert the new one. But that is done for us by eventslots::modify_current_event().

13.13.2.21 handle_save()

```
void seq64::eventedit::handle_save ( )  [private]
```

The event list in the original sequence is cleared, and the editable events are converted to plain events, and added to the container, one by one.

Todo Could also support writing the events to a new sequence, for added flexibility.

13.13.2.22 handle_cancel()

```
void seq64::eventedit::handle_cancel ( )  [private]
```

In order for removing the current-highlighting in the mainwd or perfedit windows, some of the work of handle_close() needs to be done here as well.

13.13.2.23 on_realize()

```
void seq64::eventedit::on_realize ( )  [private]
```

Then it sets the vertical adjustment to account for the number of events in the eventslot.

13.13.2.24 on_set_focus()

```
void seq64::eventedit::on_set_focus (
            Widget * focus )  [private]
```

Only works in certain circumstances.

Parameters

focus	The widget that has the focus. Merely passed on to gui_window_gtk2's version of this function.

13.13.2.25 on_focus_in_event()

```
bool seq64::eventedit::on_focus_in_event (
            GdkEventFocus *  )  [private]
```

It sets the focus flag and calls change_focus().

13.13.2.26 on_focus_out_event()

```
bool seq64::eventedit::on_focus_out_event (
            GdkEventFocus *  )  [private]
```

It resets the focus flag and calls change_focus().

13.13.2.27 on_key_press_event()

```
bool seq64::eventedit::on_key_press_event (
            GdkEventKey * ev )  [private]
```

If the Up or Down arrow is pressed (later, k and j :-), then we tell the eventslots object to move the "current event" highlighting up or down. In Gtkmm, these arrows also cause movement from one edit field to the next, so we disable that process if the event was handled here.

Note that the Delete key is needed for the edit fields. For now, we replace it with the asterisk, which is easy to access from the numeric pad of a keyboard, and allows for rapid deletion. The Insert key also causes confusing effects in the edit fields, so we replaced it by the slash, but that didn't work. Note that the asterisk and slash should not be required in any of the edit fields. HOWEVER, "/" still gets passed the edit fields (!), so you'll just have to click the button to insert an event. Let's try the backslash! No go there, either.

Parameters

ev	The key event to process.

Returns

Returns true if the event got handled somewhere along the line.

13.13.2.28 on_delete_event()

```
bool seq64::eventedit::on_delete_event (
            GdkEventAny * event )  [private]
```

It sets the sequence object's editing flag to false, and deletes "this". This function is called if the "Close" ("X") button in the window's title bar is clicked. That is a different action from clicking the Close button.

Returns

Always returns false.

13.13.3 Friends And Related Function Documentation

13.13.3.1 eventslots

```
friend class eventslots  [friend]
```

13.13.4 Field Documentation

13.13.4.1 m_table

```
Gtk::Table* seq64::eventedit::m_table  [private]
```

Provides the layout table for UI.

13.13.4.2 m_vadjust

```
Gtk::Adjustment* seq64::eventedit::m_vadjust  [private]
```

13.13.4.3 m_vscroll

```
Gtk::VScrollbar* seq64::eventedit::m_vscroll  [private]
```

13.13.4.4 m_eventslots

```
eventslots* seq64::eventedit::m_eventslots  [private]
```

13.13.4.5 m_htopbox

```
Gtk::HBox* seq64::eventedit::m_htopbox  [private]
```

13.13.4.6 m_showbox

```
Gtk::VBox* seq64::eventedit::m_showbox  [private]
```

13.13.4.7 m_editbox

```
Gtk::VBox* seq64::eventedit::m_editbox  [private]
```

13.13.4.8 m_optsbox

```
Gtk::VBox* seq64::eventedit::m_optsbox  [private]
```

13.13.4.9 m_bottbox

```
Gtk::HBox* seq64::eventedit::m_bottbox  [private]
```

13.13.4.10 m_rightbox

```
Gtk::VBox* seq64::eventedit::m_rightbox  [private]
```

13.13.4.11 m_button_del

```
Gtk::Button* seq64::eventedit::m_button_del  [private]
```

13.13.4.12 m_button_ins

```
Gtk::Button* seq64::eventedit::m_button_ins  [private]
```

13.13.4.13 m_button_modify

```
Gtk::Button* seq64::eventedit::m_button_modify  [private]
```

13.13.4.14 m_button_save

```
Gtk::Button* seq64::eventedit::m_button_save  [private]
```

13.13.4.15 m_button_cancel

```
Gtk::Button* seq64::eventedit::m_button_cancel  [private]
```

13.13.4.16 m_label_seq_name

```
Gtk::Label* seq64::eventedit::m_label_seq_name  [private]
```

Shows the name of the pattern.

13.13.4.17 m_label_time_sig

```
Gtk::Label* seq64::eventedit::m_label_time_sig  [private]
```

13.13.4.18 m_label_ppqn

```
Gtk::Label* seq64::eventedit::m_label_ppqn  [private]
```

13.13.4.19 m_label_channel

```
Gtk::Label* seq64::eventedit::m_label_channel  [private]
```

13.13.4.20 m_label_ev_count

```
Gtk::Label* seq64::eventedit::m_label_ev_count  [private]
```

13.13.4.21 m_label_spacer

```
Gtk::Label* seq64::eventedit::m_label_spacer  [private]
```

13.13.4.22 m_label_modified

```
Gtk::Label* seq64::eventedit::m_label_modified  [private]
```

13.13.4.23 m_label_category

```
Gtk::Label* seq64::eventedit::m_label_category  [private]
```

Shows the type of MIDI event.

13.13.4.24 m_entry_ev_timestamp

```
Gtk::Entry* seq64::eventedit::m_entry_ev_timestamp  [private]
```

13.13.4.25 m_entry_ev_name

```
Gtk::Entry* seq64::eventedit::m_entry_ev_name  [private]
```

13.13.4.26 m_entry_ev_data_0

```
Gtk::Entry* seq64::eventedit::m_entry_ev_data_0  [private]
```

13.13.4.27 m_entry_ev_data_1

```
Gtk::Entry* seq64::eventedit::m_entry_ev_data_1  [private]
```

13.13.4.28 m_label_time_fmt

```
Gtk::Label* seq64::eventedit::m_label_time_fmt  [private]
```

13.13.4.29 m_label_right

```
Gtk::Label* seq64::eventedit::m_label_right  [private]
```

13.13.4.30 m_seq

```
sequence& seq64::eventedit::m_seq  [private]
```

13.13.4.31 m_have_focus

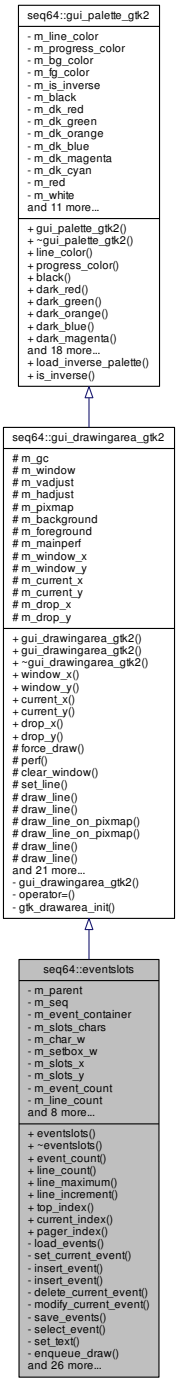
```
bool seq64::eventedit::m_have_focus  [private]
```

This item is to modify the mainwid and perfedit "edit-sequence" value in order to highlight pattern slot of the pattern/event editor that currently has the user-input focus.

13.14 seq64::eventslots Class Reference

This class implements the left-side list of events in the pattern event-edit window.

Inheritance diagram for seq64::eventslots:



Public Member Functions

- eventslots (perform &p, eventedit &parent, sequence &seq, Gtk::Adjustment &vadjust)

  Principal constructor for this user-interface object.
- virtual ~eventslots ()

  Let's provide a do-nothing virtual destructor.
- int event_count () const

'Getter' function for member m_event_count Returns the number of total events in the sequence represented by the eventslots object.

- int line_count () const

  'Getter' function for member m_line_count Returns the current number of rows (events) in the eventslots's display.

- int line_maximum () const

  'Getter' function for member m_line_maximum Returns the maximum number of rows (events) in the eventslots's display.

- int line_increment () const

  Provides the "page increment" or "line increment" of the frame, This value is the current line-maximum of the frame minus its overlap value.

- int top_index () const

  'Getter' function for member m_top_index

- int current_index () const

  'Getter' function for member m_current_index

- int pager_index () const

  'Getter' function for member m_pager_index

Private Member Functions

- bool load_events ()

  Grabs the event list from the sequence and uses it to fill the editable-event list.

- void set_current_event (const editable_events::iterator ei, int index, bool full_redraw=true)

  Set the current event, which is the event that is highlighted.

- bool insert_event (const editable_event &edev)

  Inserts an event.

- bool insert_event (const std::string &evtimestamp, const std::string &evname, const std::string &evdata0, const std::string &evdata1)

  Inserts an event based on the setting provided, which the eventedit object gets from its Entry fields.

- bool delete_current_event ()

  Deletes the current event, and makes adjustments due to that deletion.

- bool modify_current_event (const std::string &evtimestamp, const std::string &evname, const std::string &evdata0, const std::string &evdata1)

  Modifies the data in the currently-selected event.

- bool save_events ()

  Writes the events back to the sequence.

- void select_event (int event_index=SEQ64_NULL_EVENT_INDEX, bool full_redraw=true)

  Selects and highlights the event that is located in the frame at the given event index.

- void set_text (const std::string &evcategory, const std::string &evtimestamp, const std::string &evname, const std::string &evdata0, const std::string &evdata1)

  Sets the text in the parent dialog, eventedit.

- void enqueue_draw ()

  Wraps queue_draw().

- int convert_y (int y)

  Converts a y-value into an event index relative to 0 (the top of the eventslots window/pixmap) and returns it.

- void draw_event (editable_events::iterator ei, int index)

  Draw the given slot/event.

- void draw_events ()

  Draws all of the events in the current eventslots frame.

- void change_vert ()

  Change the vertical offset of events.

- void page_movement (int new_value)

Adjusts the vertical position of the frame according to the given new scrollbar/vadjust value.

- void page_topper (editable_events::iterator newcurrent)

  Adjusts the vertical position of the frame according to the given new bottom iterator.

- int decrement_top ()

  Decrements the top iterator, if possible.

- int increment_top ()

  Increments the top iterator, if possible.

- int decrement_current ()

  Decrements the current iterator, if possible.

- int increment_current ()

  Increments the current iterator, if possible.

- int decrement_bottom ()

  Decrements the bottom iterator, if possible.

- int increment_bottom ()

  Increments the bottom iterator, if possible.

- void on_realize ()

  Handles the callback when the window is realized.

- bool on_expose_event (GdkEventExpose ∗ev)

  Handles an on-expose event.

- bool on_button_press_event (GdkEventButton ∗ev)

  Provides the callback for a button press, and it handles only a left mouse button.

- bool on_button_release_event (GdkEventButton ∗ev)

  Currently does nothing.

- bool on_focus_in_event (GdkEventFocus ∗ev)

  This callback is an attempt to get keyboard focus into the eventslots pixmap area.

- bool on_focus_out_event (GdkEventFocus ∗ev)

  This callback handles an out-of-focus event by resetting the flag HAS_FOCUS.

- bool on_scroll_event (GdkEventScroll ∗ev)

  Handle the scrolling of the window.

- void on_size_allocate (Gtk::Allocation &)

  Handles a size-allocation event.

- void on_move_up ()

  Move to the previous event.

- void on_move_down ()

  Move to the next event.

- void on_frame_up ()

  Move to the previous frame.

- void on_frame_down ()

  Move to the next frame.

- void on_frame_home ()

  Move to the first frame.

- void on_frame_end ()

  Move to the last frame.

Private Attributes

- eventedit & m_parent

  Provides a link to the eventedit that created this object.
- sequence & m_seq

  Provides a reference to the sequence that this dialog is meant to view or modify.
- editable_events m_event_container

  Holds the editable events for this sequence.
- int m_slots_chars

  Provides the number of the characters in the name box.
- int m_char_w

  Provides the "real" width of a character.
- int m_setbox_w

  Provides the width of the "set number" box.
- int m_slots_x

  Provides the width of the names box, which is the width of a character for 24 characters.
- int m_slots_y

  Provides the height of the names box, which is hardwired to 24 pixels.
- int m_event_count

  The current number of events in the edited container.
- int m_line_count

  Counts the number of displayed events, which depends on how many events there are (m_event_count) and the size of the event list (m_line_maximum).
- int m_line_maximum

  Counts the maximum number of displayed events, which depends on the size of the event list (and thus the size of the dialog box for the event editor).
- int m_line_overlap

  Provides a little overlap for paging through the frame.
- int m_top_index

  The index of the event that is 0th in the visible list of events.
- int m_current_index

  Indicates the index of the current event within the frame.
- editable_events::iterator m_top_iterator

  Provides the top "pointer" to the start of the editable-events section that is being shown in the user-interface.
- editable_events::iterator m_bottom_iterator

  Provides the bottom "pointer" to the end of the editable-events section that is being shown in the user-interface.
- editable_events::iterator m_current_iterator

  Provides the "pointer" to the event currently in focus.
- int m_pager_index

  Indicates the event index that matches the index value of the vertical pager.

Friends

- class eventedit

Additional Inherited Members

13.14.1 Constructor & Destructor Documentation

13.14.1.1 eventslots()

```
seq64::eventslots::eventslots (
            perform & p,
            eventedit & parent,
            sequence & seq,
            Gtk::Adjustment & vadjust )
```

13.14.1.2 ~eventslots()

```
virtual seq64::eventslots::~eventslots ( )  [inline], [virtual]
```

13.14.2 Member Function Documentation

13.14.2.1 event_count()

```
int seq64::eventslots::event_count ( ) const  [inline]
```

13.14.2.2 line_count()

```
int seq64::eventslots::line_count ( ) const  [inline]
```

13.14.2.3 line_maximum()

```
int seq64::eventslots::line_maximum ( ) const  [inline]
```

13.14.2.4 line_increment()

```
int seq64::eventslots::line_increment ( ) const  [inline]
```

13.14.2.5 top_index()

```
int seq64::eventslots::top_index ( ) const  [inline]
```

13.14.2.6 current_index()

```
int seq64::eventslots::current_index ( ) const  [inline]
```

13.14.2.7 pager_index()

```
int seq64::eventslots::pager_index ( ) const  [inline]
```

13.14.2.8 load_events()

```
bool seq64::eventslots::load_events ( )  [private]
```

Determines how many events can be shown in the GUI [later] and adjusts the top and bottom editable-event iterators to show the first page of events.

Returns

Returns true if the event iterators were able to be set up as valid.

13.14.2.9 set_current_event()

```
void seq64::eventslots::set_current_event (
            const editable_events::iterator ei,
            int index,
            bool full_redraw = true )  [private]
```

Note in the snprintf() calls that the first digit is part of the data byte, so that translation is easier.

Parameters

ei	The iterator that points to the event.
index	The index (re 0) of the event, starting at the top line of the frame. It is a frame index, not a container index.
full_redraw	If true (the default) does a full redraw of the frame. Otherwise, only the current event is drawn. Generally, the only time a single event (actually, two adjacent events) is convenient to draw is when using the arrow keys, where the speed of keystroke auto-repeats makes the full-frame update scrolling very flickery and disconcerting.

13.14.2.10 insert_event() [1/2]

```
bool seq64::eventslots::insert_event (
```

```
            const editable_event & edev )  [private]
```

What actually happens here depends if the new event is before the frame, within the frame, or after the frame, based on the timestamp.

If before the frame: To keep the previous events visible, we do not need to increment the iterators (insertion does not affect multimap iterators), but we do need to increment their indices. The contents shown in the frame should not change.

If at the frame top: The new timestamp equals the top timestamp. We don't know exactly where the new event goes in the multimap, but we do have an new event.

If at the frame bottom: TODO

If after the frame: No action needed if the bottom event is actually at the bottom of the frame. But if the frame is not yet filled, we need to increment the bottom iterator, and its index.

Note

Actually, it is far easier to just adjust all the counts and iterators and redraw the screen, as done by the page_topper() function.

Parameters

edev	The event to insert, prebuilt.

Returns

Returns true if the event was inserted.

13.14.2.11 insert_event() [2/2]

```
bool seq64::eventslots::insert_event (
            const std::string & evtimestamp,
            const std::string & evname,
            const std::string & evdata0,
            const std::string & evdata1 )  [private]
```

It calls the other insert_event() overload.

Note that we need to qualify the temporary event class object we create below, with the seq64 namespace, otherwise the compiler thinks we're trying to access some Gtkmm thing.

Parameters

evtimestamp	The time-stamp of the new event, as obtained from the event-edit timestamp field.
evname	The type name (status name) of the new event, as obtained from the event-edit event-name field.
evdata0	The first data byte of the new event, as obtained from the event-edit data 1 field.
evdata1	The second data byte of the new event, as obtained from the event-edit data 2 field. Used only for two-parameter events.

Returns

Returns true if the event was inserted.

13.14.2.12 delete_current_event()

```
bool seq64::eventslots::delete_current_event ( )  [private]
```

To delete the current event, this function moves the current iterator to the next event, deletes the previously-current iterator, adjusts the event count and the bottom iterator, and redraws the pixmap. The exact changes depend upon whether the deleted event was at the top of the visible frame, within the visible frame, or at the bottom the visible frame. Note that only visible events can be the current event, and thus get deleted.

```
Event Index
 0
 1
 2         Top
 3  <--------- Top case: The new top iterator, index becomes 2
 4
 .
 .         Inside of Visible Frame
 .
43
44         Bottom
45  <--------- Top case: The new bottom iterator, index becomes 44
46             Bottom case: Same result


Basically, when an event is deleted, the frame (delimited by the
event-index members) stays in place, while the frame iterators move to the
previous event.  If the top of the frame would move to before the first
event, then the frame must shrink.

Top case: If the current iterator is the top (of the frame) iterator, then
the top iterator needs to be incremented.  The new top event has the same
index as the now-gone top event. The index of the bottom event is
decremented, since an event before it is now gone.  The bottom iterator
moves to the next event, which is now at the bottom of the frame.  The
current event is treated like the top event.

Inside case: If the current iterator is in the middle of the frame, the top
iterator and index remain unchanged.  The current iterator is incremented,
but its index is now the same as the old bottom index.  Same for the bottom
iterator.

Bottom case: If the current iterator (and bottom iterator) point to the
last event in the frame, then both of them need to be
decremented.  The frame needs to be moved up by one event, so that the
current event remains at the bottom (it's just simpler to manage that way).

If there is no event after the bottom of the frame, the iterators that now
point to end() must backtrack one event.  If the container becomes empty,
then everything is invalidated.
```

Returns

Returns true if the delete was possible. If the container was empty or became empty, then false is returned.

13.14.2.13 modify_current_event()

```
bool seq64::eventslots::modify_current_event (
            const std::string & evtimestamp,
            const std::string & evname,
            const std::string & evdata0,
            const std::string & evdata1 )  [private]
```

If the timestamp has changed, however, we can't just modify the event in place. Instead, we finish modifying the event, but tell the caller to delete and reinsert the new event (in its proper new location based on timestamp).

This function always copies the original event, modifiies the copy, deletes the original event, and inserts the "new" event into the editable-event container.

Parameters

evtimestamp	Provides the new event time-stamp as edited by the user.
evname	Provides the event name as edited by the user.
evdata0	Provides the first data byte as edited by the user.
evdata1	Provides the second data byte as edited by the user.

Returns

Returns true simply if the event-count is greater than 0.

13.14.2.14 save_events()

```
bool seq64::eventslots::save_events ( )  [private]
```

Also sets the dirty flag for the sequence, via the sequence::add_event() function, but this doesn't seem to set the perform dirty flag. So now we pass the modification buck to the parent, who passes it to the perform object.

We added a copy_events() function in the sequence class to replace add_event() for the purpose of reconstructing the events container for the sequence. It is locked by a mutex, and so will not draw until all is done, preventing a nasty segfault (all segfaults are nasty).

We create a new plain event container here, and then passing it to the new locked/threadsafe sequence::copy_↩ events() function that clears the sequence container and copies the events from the parameter container.

Note that this code will operate event if all events were deleted.

Returns

Returns true if the operations succeeded.

13.14.2.15 select_event()

```
void seq64::eventslots::select_event (
            int event_index = SEQ64_NULL_EVENT_INDEX,
            bool full_redraw = true )  [private]
```

The event index is provided by converting the y-coordinate of the mouse pointer into a slot number, and then an event index (actually the slot-distance from the m_top_iterator. Confusing, yes no?

Note that, if the event index is negative, then we just queue up a draw operation, which should paint an empty frame – the event container is empty.

Parameters

event_index	Provides the numeric index of the event in the event frame, or SEQ64_NULL_EVENT if there is no event to draw.
full_redraw	Defaulting to true, this parameter can be set to false in some case to reduce the flickering of the frame under fast movement.

13.14.2.16 set_text()

```
void seq64::eventslots::set_text (
            const std::string & evcategory,
            const std::string & evtimestamp,
            const std::string & evname,
            const std::string & evdata0,
            const std::string & evdata1 )  [private]
```

Parameters

evcategory	The category of event to be set in the parent.
evtimestamp	The event time-stamp to be set in the parent.
evname	The event name to be set in the parent.
evdata0	The first event data byte to be set in the parent.
evdata1	The second event data byte to be set in the parent.

13.14.2.17 enqueue_draw()

```
void seq64::eventslots::enqueue_draw ( )  [private]
```

13.14.2.18 convert_y()

```
int seq64::eventslots::convert_y (
            int y )  [private]
```

Parameters

y	The y coordinate of the position of the mouse click in the eventslot window/pixmap.

Returns

Returns the index of the event position in the user-interface, which should range from 0 to m_line_count.

13.14.2.19 draw_event()

```
void seq64::eventslots::draw_event (
            editable_events::iterator ei,
            int index )  [private]
```

The slot contains the event details in (so far) one line of text in the box:

| timestamp | event kind | channel | data 0 name + value | data 1 name + value

Currently, this view shows only events that get copied to the sequence's event list. This rules out the following items from the view:

- MThd (song header)
- MTrk and Meta TrkEnd (track marker, a sequence has only one track)
- SeqNr (sequence number)
- SeqSpec (but there are three that might appear, see below)
- Meta TrkName

The events that are shown in this view are:

- One-data-value events:
  - Program Change
  - Channel Pressure
- Two-data-value events:
  - Note Off
  - Note On
  - Aftertouch
  - Control Change
  - Pitch Wheel
- Other:
  - SysEx events, with partial show of data bytes
  - SeqSpec events (TBD):
    - Key
    - Scale
    - Background sequence

The index of the event is shown in the editor portion of the eventedit dialog.

13.14.2.20 draw_events()

```
void seq64::eventslots::draw_events ( )  [private]
```

It first clears the whole bitmap to white, so that no artifacts from the previous state of the frame are left behind.

Need to figure out how to calculate the number of displayable events.

```
m_line_maximum = ???
```

13.14.2.21 change_vert()

```
void seq64::eventslots::change_vert ( )  [private]
```

Note that m_vadjust is the Gtk::Adjustment object that the eventedit parent passes to the gui_drawingarea_gtk2 constructor.

The top-event and bottom-event indices (and their corresponding editable-event iterators) delimit the part of the event container that is displayed in the eventslots user-interface. The top-event index starts at 0, and the bottom-event is larger (initially, by 42 slots).

When the scroll-bar thumb moves up or down, we need to change both event indices and both event iterators by the corresponding amount. Luckily, the std::multimap iterator is bidirectional.

Note that we may need to reduce the movement of events to a value less than a page; it can be limited backwards by the value of the top index, and forward by the value of the bottom index.

13.14.2.22 page_movement()

```
void seq64::eventslots::page_movement (
            int new_value )  [private]
```

The adjustment is done via movement from the current position.

Do we even need a way to detect excess movement? The scrollbar, if properly set up, should never move the frame too high or too low. Verified by testing.

Parameters

new_value	Provides the new value of the scrollbar position.

13.14.2.23 page_topper()

```
void seq64::eventslots::page_topper (
            editable_events::iterator newcurrent )  [private]
```

The adjustment is done "from scratch". We've found page movement to be an insoluable problem in some editing circumstances. So now we move to the inserted event, and make it the top event.

However, always moving an inserted event to the top is a bit annoying. So now we backtrack so that the inserted event is at the bottom.

Parameters

newcurrent	Provides the iterator to the event to be shown at the bottom of the frame.

13.14.2.24 decrement_top()

```
int seq64::eventslots::decrement_top ( )  [private]
```

Returns

Returns 0, or SEQ64_NULL_EVENT_INDEX if the iterator could not be decremented.

13.14.2.25 increment_top()

```
int seq64::eventslots::increment_top ( )  [private]
```

Also handles the top-event index, so that the GUI can display the proper event numbers.

Returns

Returns the top index, or SEQ64_NULL_EVENT_INDEX if the iterator could not be incremented, or would increment to the end of the container.

13.14.2.26 decrement_current()

```
int seq64::eventslots::decrement_current ( )  [private]
```

Returns

Returns the decremented index, or SEQ64_NULL_EVENT_INDEX if the iterator could not be decremented. Remember that the index ranges only from 0 to m_line_count-1, and that is enforced here.

13.14.2.27 increment_current()

```
int seq64::eventslots::increment_current ( )  [private]
```

Returns

Returns the incremented index, or SEQ64_NULL_EVENT_INDEX if the iterator could not be incremented. Remember that the index ranges only from 0 to m_line_count-1, and that is enforced here.

13.14.2.28 decrement_bottom()

```
int seq64::eventslots::decrement_bottom ( )  [private]
```

Returns

Returns 0, or SEQ64_NULL_EVENT_INDEX if the iterator could not be decremented.

13.14.2.29 increment_bottom()

```
int seq64::eventslots::increment_bottom ( )  [private]
```

There is an issue in paging down using the scrollbar where, at the bottom of the scrolling, the bottom iterator ends up bad. Not yet sure how this happens, so for now we backtrack one event if this happens.

Returns

Returns the incremented index, or SEQ64_NULL_EVENT_INDEX if the iterator could not be incremented.

13.14.2.30 on_realize()

```
void seq64::eventslots::on_realize ( )  [private]
```

It first calls the base-class version of on_realize(). Then it allocates any additional resources needed.

13.14.2.31 on_expose_event()

```
bool seq64::eventslots::on_expose_event (
            GdkEventExpose * ev )  [private]
```

It draws all of the sequences.

13.14.2.32 on_button_press_event()

```
bool seq64::eventslots::on_button_press_event (
            GdkEventButton * ev )  [private]
```

13.14.2.33 on_button_release_event()

```
bool seq64::eventslots::on_button_release_event (
            GdkEventButton * ev )  [private]
```

13.14.2.34 on_focus_in_event()

```
bool seq64::eventslots::on_focus_in_event (
            GdkEventFocus * ev )  [private]
```

See the same function in the perfroll module.

13.14.2.35 on_focus_out_event()

```
bool seq64::eventslots::on_focus_out_event (
            GdkEventFocus * ev )  [private]
```

13.14.2.36 on_scroll_event()

```
bool seq64::eventslots::on_scroll_event (
            GdkEventScroll * ev )  [private]
```

13.14.2.37 on_size_allocate()

```
void seq64::eventslots::on_size_allocate (
            Gtk::Allocation & a )  [private]
```

It first calls the base-class version of this function.

13.14.2.38 on_move_up()

```
void seq64::eventslots::on_move_up ( )  [private]
```

We must scroll up if the event is now before the frame, and should be made the new top event of the frame. Note that this function isn't really an event-response callback. It is called by eventedit::on_key_press_event().

13.14.2.39 on_move_down()

```
void seq64::eventslots::on_move_down ( )  [private]
```

We must scroll down if the event is now after the frame. Note that this function isn't really an event-response callback. It is called byh eventedit::on_key_press_event().

13.14.2.40 on_frame_up()

```
void seq64::eventslots::on_frame_up ( )  [private]
```

13.14.2.41 on_frame_down()

```
void seq64::eventslots::on_frame_down ( )  [private]
```

13.14.2.42 on_frame_home()

```
void seq64::eventslots::on_frame_home ( )  [private]
```

13.14.2.43 on_frame_end()

```
void seq64::eventslots::on_frame_end ( )  [private]
```

13.14.3 Friends And Related Function Documentation

13.14.3.1 eventedit

```
friend class eventedit  [friend]
```

13.14.4 Field Documentation

13.14.4.1 m_parent

```
eventedit& seq64::eventslots::m_parent  [private]
```

13.14.4.2 m_seq

```
sequence& seq64::eventslots::m_seq  [private]
```

13.14.4.3 m_event_container

```
editable_events seq64::eventslots::m_event_container  [private]
```

13.14.4.4 m_slots_chars

```
int seq64::eventslots::m_slots_chars  [private]
```

Pretty much hardwired to 64 at present. It helps determine the m_slots_x value (the width of the eventslots list).

13.14.4.5 m_char_w

```
int seq64::eventslots::m_char_w  [private]
```

This value is obtained from a font-renderer accessor function.

13.14.4.6 m_setbox_w

```
int seq64::eventslots::m_setbox_w  [private]
```

This used to be hardwired to $6 * 2$ (character-width times two).

13.14.4.7 m_slots_x

```
int seq64::eventslots::m_slots_x  [private]
```

13.14.4.8 m_slots_y

```
int seq64::eventslots::m_slots_y  [private]
```

This value was once 22 pixels, but we need a little extra room for our new font. This extra room is compatible enough with the old font, as well.

13.14.4.9 m_event_count

```
int seq64::eventslots::m_event_count  [private]
```

13.14.4.10 m_line_count

```
int seq64::eventslots::m_line_count  [private]
```

13.14.4.11 m_line_maximum

```
int seq64::eventslots::m_line_maximum  [private]
```

13.14.4.12 m_line_overlap

```
int seq64::eventslots::m_line_overlap  [private]
```

13.14.4.13 m_top_index

```
int seq64::eventslots::m_top_index  [private]
```

It is used in numbering the events that are shown in the event-slot frame. Do not confuse it with m_current_index, which is relative to the frame, not the container-beginning.

13.14.4.14 m_current_index

```
int seq64::eventslots::m_current_index  [private]
```

This event will also be pointed to by the m_current_event iterator. Do not confuse it with m_top_index, which is relative to the container-beginning, not the frame.

13.14.4.15 m_top_iterator

```
editable_events::iterator seq64::eventslots::m_top_iterator  [private]
```

13.14.4.16 m_bottom_iterator

```
editable_events::iterator seq64::eventslots::m_bottom_iterator  [private]
```

13.14.4.17 m_current_iterator

```
editable_events::iterator seq64::eventslots::m_current_iterator  [private]
```

13.14.4.18 m_pager_index

```
int seq64::eventslots::m_pager_index  [private]
```

13.15 seq64::font Class Reference

This class provides a wrapper for rendering fonts that are encoded as a 16 x 16 pixmap file in XPM format.

Public Types

- enum Color {
  BLACK,
  WHITE,
  BLACK_ON_YELLOW,
  YELLOW_ON_BLACK,
  BLACK_ON_CYAN,
  CYAN_ON_BLACK }

  A simple enumeration to describe the basic colors used in writing text.

Public Member Functions

- font ()

  Rote default constructor, except that it does add 1 to the cf_text_h or co_text_h values to use in m_padded_h.
- void init (Glib::RefPtr< Gdk::Window > windo)

  Initialization function for a window on which fonts will be drawn.
- void render_string_on_drawable (Glib::RefPtr< Gdk::GC > m_gc, int x, int y, Glib::RefPtr< Gdk::Drawable > drawable, const char *str, font::Color col, bool invert=false) const

  Draws a text string.
- int char_width () const

  'Getter' function for member m_font_w
- int char_height () const

  'Getter' function for member m_font_h
- int padded_height () const

  'Getter' function for member m_padded_h

Private Attributes

- bool m_use_new_font

  If true, use the new font, which is a little bit more modern looking, and is also thicker, and thus a little easier to see.
- int m_cell_w

  Specifies the cell width of the whole character cell.
- int m_cell_h

  Specfies the cell height of the whole character cell.
- int m_font_w

  Specifies the exact width of a character cell, in pixels.
- int m_font_h

  Specifies the exact height of a character cell, in pixels.
- int m_offset

Provides an ad hoc small horizontal or vertical offset for printing strings.

- int m_padded_h

  Provides a common constant used by much of the drawing code, but only marginally related to the padded character height.

- const Glib::RefPtr< Gdk::Pixmap > * m_pixmap

  Points to the current pixmap (m_black_pixmap or m_white_pixmap) to use to render a string.

- Glib::RefPtr< Gdk::Pixmap > m_black_pixmap

  The pixmap in the file `src/pixmaps/font_b.xpm` is loaded into this object.

- Glib::RefPtr< Gdk::Pixmap > m_white_pixmap

  The pixmap in the file `src/pixmaps/font_w.xpm` is loaded into this object.

- Glib::RefPtr< Gdk::Pixmap > m_b_on_y_pixmap

  The pixmap in the file `src/pixmaps/font_y.xpm` is loaded into this object.

- Glib::RefPtr< Gdk::Pixmap > m_y_on_b_pixmap

  The pixmap in the file `src/pixmaps/font_yb.xpm` is loaded into this object.

- Glib::RefPtr< Gdk::Pixmap > m_b_on_c_pixmap

  The pixmap in the file `src/pixmaps/cyan_wenfont_y.xpm` is loaded into this object.

- Glib::RefPtr< Gdk::Pixmap > m_c_on_b_pixmap

  The pixmap in the file `src/pixmaps/cyan_wenfont_yb.xpm` is loaded into this object.

- Glib::RefPtr< Gdk::Bitmap > m_clip_mask

  This object is instantiated as a default object.

13.15.1 Member Enumeration Documentation

13.15.1.1 Color

`enum seq64::font::Color`

Basically, these two values cause the selection of one or another pixmap (font_b_xpm and font_w_xpm). We've added two more pixmaps to draw black text on a yellow background (font_y.xpm) and yellow text on a black background (font_yb.xpm). Oh, and couple more for cyan and black text-blitting.

Enumerator

BLACK	The first supported color. A black font on a white background.
WHITE	The second supported color. A white font on a black background.
BLACK_ON_YELLOW	A new color, for drawing black text on a yellow background.
YELLOW_ON_BLACK	A new color, for drawing yellow text on a black background.
BLACK_ON_CYAN	A new color, for drawing black text on a cyan background.
CYAN_ON_BLACK	A new color, for drawing cyan text on a black background.

13.15.2 Constructor & Destructor Documentation

13.15.2.1 font()

```
seq64::font::font ( )
```

13.15.3 Member Function Documentation

13.15.3.1 init()

```
void seq64::font::init (
            Glib::RefPtr< Gdk::Window > wp )
```

This function loads four pixmaps that contain the characters to be used to draw text strings.

One pixmap has white characters on a black background, one has black characters on a white background, one has yellow characters on a black background, and one has black characters on a yellow background.

Parameters

wp	Provides the windows pointer for the window that holds the color map.

13.15.3.2 render_string_on_drawable()

```
void seq64::font::render_string_on_drawable (
            Glib::RefPtr< Gdk::GC > gc,
            int x,
            int y,
            Glib::RefPtr< Gdk::Drawable > a_draw,
            const char * str,
            font::Color col,
            bool invert = false ) const
```

This function grabs the proper font bitmap, extracts the current character pixmap from it, and slaps it down where it needs to be to render the character in the string.

Parameters

gc	Provides the graphics context for drawing the text using GTK+.
x	The horizontal location of the text.
y	The vertical location of the text.
a_draw	The drawable object on which to draw the text.
str	The string to draw. Should use a constant string reference instead.
col	The font color to use to draw the string. The supported values are font::BLACK, font::WHITE, font::BLACK_ON_YELLOW, font::YELLOW_ON_BLACK. The actual correct colors are provided by selecting one of four font pixmaps, as described in the init() function.
invert	If true, apply color inversion, if specified.

13.15.3.3 char_width()

```
int seq64::font::char_width ( ) const  [inline]
```

13.15.3.4 char_height()

```
int seq64::font::char_height ( ) const  [inline]
```

13.15.3.5 padded_height()

```
int seq64::font::padded_height ( ) const  [inline]
```

13.15.4 Field Documentation

13.15.4.1 m_use_new_font

```
bool seq64::font::m_use_new_font  [private]
```

13.15.4.2 m_cell_w

```
int seq64::font::m_cell_w  [private]
```

13.15.4.3 m_cell_h

```
int seq64::font::m_cell_h  [private]
```

13.15.4.4 m_font_w

```
int seq64::font::m_font_w  [private]
```

Currently defaults to cf_text_w = 6. Note that a lot of stuff depends on this being 6 at present, even with our new, slightly wider, font.

13.15.4.5 m_font_h

```
int seq64::font::m_font_h  [private]
```

Currently defaults to cf_text_h = 10. Note that a lot of stuff depends on this being 10 at present, even with our new, slightly wider, font. But some of the drawing code doesn't use the character height, but the padded character height.

13.15.4.6 m_offset

```
int seq64::font::m_offset  [private]
```

13.15.4.7 m_padded_h

```
int seq64::font::m_padded_h  [private]
```

13.15.4.8 m_pixmap

```
const Glib::RefPtr<Gdk::Pixmap>* seq64::font::m_pixmap  [mutable], [private]
```

This member used to be an object, but it's probably a bit faster to just use a pointer (or a reference).

13.15.4.9 m_black_pixmap

```
Glib::RefPtr<Gdk::Pixmap> seq64::font::m_black_pixmap  [private]
```

It contains a black font on a white background. The new-style font, if selected, is in the `resources/pixmaps/wenfont_b.xmp` pixmap.

13.15.4.10 m_white_pixmap

```
Glib::RefPtr<Gdk::Pixmap> seq64::font::m_white_pixmap  [private]
```

It contains a black font on a white background. The new-style font, if selected, is in the `resources/pixmaps/wenfont_w.xmp` pixmap.

13.15.4.11 m_b_on_y_pixmap

```
Glib::RefPtr<Gdk::Pixmap> seq64::font::m_b_on_y_pixmap  [private]
```

It contains a black font on a yellow background. The new-style font, if selected, is in the `resources/pixmaps/wenfont_y.xmp` pixmap.

13.15.4.12 m_y_on_b_pixmap

```
Glib::RefPtr<Gdk::Pixmap> seq64::font::m_y_on_b_pixmap  [private]
```

It contains a yellow font on a black background. The new-style font, if selected, is `resources/pixmaps/wenfont_yb.xmp` pixmap.

13.15.4.13 m_b_on_c_pixmap

```
Glib::RefPtr<Gdk::Pixmap> seq64::font::m_b_on_c_pixmap  [private]
```

It contains a black font on a cyan background. It is available only for the new font-style.

13.15.4.14 m_c_on_b_pixmap

```
Glib::RefPtr<Gdk::Pixmap> seq64::font::m_c_on_b_pixmap  [private]
```

It contains a cyan font on a black background. It is available only for the new font-style.

13.15.4.15 m_clip_mask

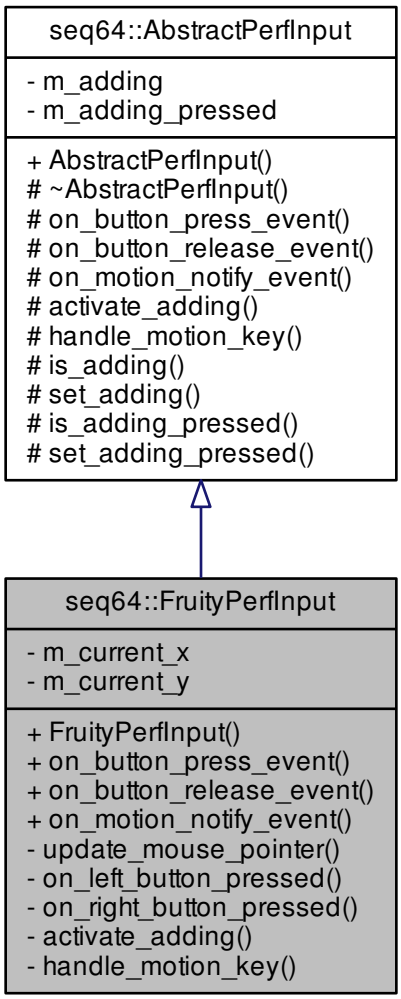
```
Glib::RefPtr<Gdk::Bitmap> seq64::font::m_clip_mask  [private]
```

All we know is it seems to be a requirement for creating a pixmap object from an XMP file.

13.16 seq64::FruityPerfInput Class Reference

Implements the performance input of that certain fruity sequencer that people seem to like.

Inheritance diagram for seq64::FruityPerfInput:



Public Member Functions

- FruityPerfInput ()

  Default constructor.

- bool on_button_press_event (GdkEventButton ∗ev, perfroll &roll)

  Handles a button-press event in the Fruity manner.

- bool on_button_release_event (GdkEventButton ∗ev, perfroll &roll)

  Handles a button-release event.

- bool on_motion_notify_event (GdkEventMotion ∗ev, perfroll &roll)

  Handles a Fruity motion-notify event.

Private Member Functions

- void update_mouse_pointer (perfroll &roll)

  Updates the mouse pointer, implementing a context-sensitive mouse.
- bool on_left_button_pressed (GdkEventButton ∗ev, perfroll &roll)

  Handles the left button of the mouse.
- bool on_right_button_pressed (GdkEventButton ∗ev, perfroll &roll)

  Handles the right button of the mouse.
- virtual void activate_adding (bool, perfroll &)
- virtual bool handle_motion_key (bool, perfroll &)

Private Attributes

- long m_current_x

  The current x value of the mouse.
- long m_current_y

  The current y value of the mouse.

Friends

- class perfroll

Additional Inherited Members

13.16.1 Constructor & Destructor Documentation

13.16.1.1 FruityPerfInput()

```
seq64::FruityPerfInput::FruityPerfInput ( )  [inline]
```

13.16.2 Member Function Documentation

13.16.2.1 on_button_press_event()

```
bool seq64::FruityPerfInput::on_button_press_event (
            GdkEventButton * ev,
            perfroll & roll )  [virtual]
```

Parameters

ev	The button-press event to process.
roll	The song editor piano roll that is the "parent" of this class.

Returns

Returns true if a modification occurred.

Implements seq64::AbstractPerfInput.

13.16.2.2 on_button_release_event()

```
bool seq64::FruityPerfInput::on_button_release_event (
            GdkEventButton * ev,
            perfroll & roll )  [virtual]
```

Why is m_adding_pressed modified conditionally when the same modification is then made unconditionally?

Parameters

ev	The button-release event to process.
roll	The song editor piano roll that is the "parent" of this class.

Returns

Returns true if a modification occurred.

Implements seq64::AbstractPerfInput.

13.16.2.3 on_motion_notify_event()

```
bool seq64::FruityPerfInput::on_motion_notify_event (
            GdkEventMotion * ev,
            perfroll & roll )  [virtual]
```

Parameters

ev	The motion-notify event to process.
roll	The song editor piano roll that is the "parent" of this class.

Returns

Returns true if a modification occurred, and sets the perform modified flag based on that result.

Implements seq64::AbstractPerfInput.

13.16.2.4 update_mouse_pointer()

```
void seq64::FruityPerfInput::update_mouse_pointer (
            perfroll & roll )  [private]
```

Note that perform::convert_xy() returns its values via side-effects on the last two parameters.

Parameters

roll	The song editor piano roll that is the "parent" of this class.

13.16.2.5 on_left_button_pressed()

```
bool seq64::FruityPerfInput::on_left_button_pressed (
            GdkEventButton * ev,
            perfroll & roll )  [private]
```

It can handle splitting triggers (?), adding notes, and the following clicks to resize the event, or move it, depending on where clicked:

```
-   clicked left side: begin a grow/shrink for the left side
-   clicked right side: grow/shrink the right side
-   clicked in the middle - move it
```

I don't get it, though... all three buttons are handled in the generic button-press callback. Oh, this is just a helper function.

Parameters

ev	The left-button-press event to process.
roll	The song editor piano roll that is the "parent" of this class.

Returns

Now returns true if a modification occurred.

13.16.2.6 on_right_button_pressed()

```
bool seq64::FruityPerfInput::on_right_button_pressed (
            GdkEventButton * ev,
            perfroll & roll )  [private]
```

I don't get it, though... all three buttons are handled in the generic button-press callback. Oh, this is a helper function.

Parameters

ev	The right-button-press event to process.
roll	The song editor piano roll that is the "parent" of this class.

Returns

Returns true if a modification occurred.

13.16.2.7 activate_adding()

```
virtual void seq64::FruityPerfInput::activate_adding (
            bool ,
            perfroll &  )  [inline], [private], [virtual]
```

Implements seq64::AbstractPerfInput.

13.16.2.8 handle_motion_key()

```
virtual bool seq64::FruityPerfInput::handle_motion_key (
            bool ,
            perfroll &  )  [inline], [private], [virtual]
```

Implements seq64::AbstractPerfInput.

13.16.3 Friends And Related Function Documentation

13.16.3.1 perfroll

```
friend class perfroll  [friend]
```

13.16.4 Field Documentation

13.16.4.1 m_current_x

```
long seq64::FruityPerfInput::m_current_x  [private]
```

13.16.4.2 m_current_y

```
long seq64::FruityPerfInput::m_current_y  [private]
```

13.17 seq64::FruitySeqEventInput Struct Reference

This structure implements the interaction methods for the "fruity" mode of operation.

Public Member Functions

- FruitySeqEventInput ()
  Default constructor.
- void update_mouse_pointer (seqevent &ths)
  Provides support for a context-sensitive mouse.
- bool on_button_press_event (GdkEventButton *ev, seqevent &ths)
  Implements the on-button-press event callback.
- bool on_button_release_event (GdkEventButton *ev, seqevent &ths)
  Implements the on-button-release callback.
- bool on_motion_notify_event (GdkEventMotion *ev, seqevent &ths)
  Implements the on-motion-notify callback.

Data Fields

- bool m_justselected_one
  Indicates that the left mouse button was click to start a selection.
- bool m_is_drag_pasting_start
  Set to true when the mouse button is pressed and we're starting to drag some notes to move them and paste them to a different location.
- bool m_is_drag_pasting
  Set to true when the left mouse button is pressed for dragging and pasting, set to false when the mouse button is released to drop the pasted items.

13.17.1 Constructor & Destructor Documentation

13.17.1.1 FruitySeqEventInput()

```
seq64::FruitySeqEventInput::FruitySeqEventInput ( )  [inline]
```

13.17.2 Member Function Documentation

13.17.2.1 update_mouse_pointer()

```
void seq64::FruitySeqEventInput::update_mouse_pointer (
            seqevent & seqev )
```

Parameters

seqev	Provides the seqevent pane (actually a strip on the seqedit window) to update to show the proper mouse cursor (left pointer, center pointer, and pencil).

13.17.2.2 on_button_press_event()

```
bool seq64::FruitySeqEventInput::on_button_press_event (
            GdkEventButton * ev,
            seqevent & seqev )
```

Handles dragging and other actions.

The first thing is to set the values for dragging, then reset the box that holds the dirty redraw spot. If pasting, undo the clipboard, and paste the selected events.

Otherwise, process the mouse actions. The current steps shown below are my initial guesses, to be verified at some point.

1. Left button:
   (a) Click:
      i. A click and release without a drag, or without a Ctrl-Shift, deselects the events.
      ii. A direct click on an event selects only that event.
   (b) Click-drag:
      i. If events already selected, adds note and length to the selected notes.
      ii. Otherwise, select the notes and events.
      iii. If no events selected in the end, undo the selection.

- Ctrl-left button:
  – TODO.

The opening part of this function matches that of Seq24SeqEventInput :: on_button_press_event().

Parameters

ev	The button event for the press of a mouse button.
seqev	Provides the seqevent strip to be affected by this button event.

Returns

Returns true if a modification was made. It used to return true all the time.

13.17.2.3 on_button_release_event()

```
bool seq64::FruitySeqEventInput::on_button_release_event (
            GdkEventButton * ev,
            seqevent & seqev )
```

Parameters

ev	The button event for the press of a mouse button.
seqev	Provides the seqevent strip to be affected by this button event.

Returns

Returns true if a modification was made. It used to return true all the time.

13.17.2.4 on_motion_notify_event()

```
bool seq64::FruitySeqEventInput::on_motion_notify_event (
            GdkEventMotion * ev,
            seqevent & seqev )
```

Parameters

ev	The button event for the press of a mouse button.
seqev	Provides the seqevent strip to be affected by this button event.

Returns

Returns true if a modification occurred, and sets the perform modified flag based on that result.

13.17.3 Field Documentation

13.17.3.1 m_justselected_one

```
bool seq64::FruitySeqEventInput::m_justselected_one
```

13.17.3.2 m_is_drag_pasting_start

```
bool seq64::FruitySeqEventInput::m_is_drag_pasting_start
```

13.17.3.3 m_is_drag_pasting

```
bool seq64::FruitySeqEventInput::m_is_drag_pasting
```

13.18 seq64::FruitySeqRollInput Class Reference

Implements the fruity mouse interaction paradigm for the seqroll.

Public Member Functions

- FruitySeqRollInput ()
  Default constructor.
- void update_mouse_pointer (seqroll &ths)
  Updates the mouse pointer, implementing a context-sensitive mouse.
- bool on_button_press_event (GdkEventButton *ev, seqroll &ths)
  Implements the fruity on-button-press callback.
- bool on_button_release_event (GdkEventButton *ev, seqroll &ths)
  Implements the fruity handling for the on-button-release event.
- bool on_motion_notify_event (GdkEventMotion *ev, seqroll &ths)
  Implements the fruity handling for the on-motion-notify event.

Private Attributes

- bool m_erase_painting
  Set to tru if we hold the right mouse button down (in "fruity" mode) and start to drag the mouse around, erasing notes.
- int m_drag_paste_start_pos [2]
  Holds the original position of the mouse when ctrl-left-click-drag is done, and is used to make sure that the action doesn't occur until a movement of at least 6 pixels has occurred, to avoid unintended actions caused by minimal jitter in the user's hands.

13.18.1 Constructor & Destructor Documentation

13.18.1.1 FruitySeqRollInput()

```
seq64::FruitySeqRollInput::FruitySeqRollInput ( )  [inline]
```

13.18.2 Member Function Documentation

13.18.2.1 update_mouse_pointer()

```
void seq64::FruitySeqRollInput::update_mouse_pointer (
            seqroll & sroll )
```

Parameters

sroll	Provides the "parent" of this interaction class.

13.18.2.2 on_button_press_event()

```
bool seq64::FruitySeqRollInput::on_button_press_event (
            GdkEventButton * ev,
            seqroll & sroll )
```

This function now uses the needs_update flag to determine if the perform object should modify().

Parameters

ev	The button event.
sroll	The parent of this "fruity" interaction class.

Returns

Returns the value of needs_update. It used to return only true.

13.18.2.3 on_button_release_event()

```
bool seq64::FruitySeqRollInput::on_button_release_event (
            GdkEventButton * ev,
            seqroll & sroll )
```

Parameters

ev	The button event.
sroll	The parent of this "fruity" interaction class.

Returns

Returns the value of needs_update. It used to return only true.

If in moving mode, adjust for snap and convert deltas into screen coordinates. Since delta_note was from delta_y, it will be flipped (delta_y[0] = note[127], etc.), so we have to adjust.

13.18.2.4 on_motion_notify_event()

```
bool seq64::FruitySeqRollInput::on_motion_notify_event (
            GdkEventMotion * ev,
            seqroll & sroll )
```

Parameters

ev	The motion event.
sroll	The parent of this "fruity" interaction class. (Why not just inherit and save all these indirect accesses to the seqroll? Well, that would make it more difficult to change the mode of interation, in the Options menu, on the fly.)

Returns

Returns the value of needs_update.

In "fruity" interatction mode, ctrl-left-click-drag on selected note(s) starts a copy/unselect/paste. Doesn't begin the paste until the mouse moves a few pixels, to filter out the unsteady hand.

13.18.3 Field Documentation

13.18.3.1 m_erase_painting

```
bool seq64::FruitySeqRollInput::m_erase_painting  [private]
```

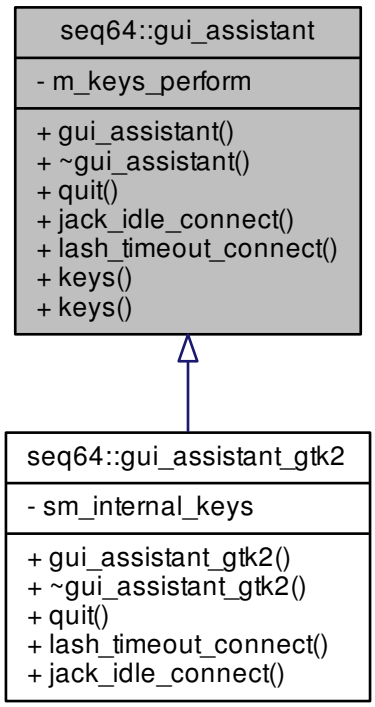
13.18.3.2 m_drag_paste_start_pos

```
int seq64::FruitySeqRollInput::m_drag_paste_start_pos[2]  [private]
```

13.19 seq64::gui_assistant Class Reference

This class provides an interface for some of the GUI support needed in Sequencer64.

Inheritance diagram for seq64::gui_assistant:



Public Member Functions

- gui_assistant (keys_perform &kp)

  This constructor wires in some externally (for now) created objects.
- virtual ~gui_assistant ()

  Stock base-class implementation of a virtual destructor.
- virtual void quit ()

  Handles the GUI's exiting.
- virtual void jack_idle_connect (jack_assistant &)

  Handles connecting the "idle" signal to the session-event function.
- virtual void lash_timeout_connect (lash *)

  Handles connecting the "timeout" signal to the process-event function.
- const keys_perform & keys () const

  'Getter' function for member m_keys_perform The const getter.
- keys_perform & keys ()

  'Getter' function for member m_keys_perform The un-const getter.

Private Attributes

- keys_perform & m_keys_perform

  Provides a reference to the app-specific GUI-specific keys_perform-derived object that an application is going to use for handling sequence-control keys.

13.19.1 Detailed Description

It also contain a number of helper objects that all kind of go together; only this assistant object will need to be passed around (by non-GUI code).

13.19.2 Constructor & Destructor Documentation

13.19.2.1 gui_assistant()

```
seq64::gui_assistant::gui_assistant (
            keys_perform & kp )
```

Parameters

kp	Provides a set of key codes to be used by the perform object to control patterns and their performance.

13.19.2.2 ~gui_assistant()

```
virtual seq64::gui_assistant::~gui_assistant ( )  [inline], [virtual]
```

13.19.3 Member Function Documentation

13.19.3.1 quit()

```
virtual void seq64::gui_assistant::quit ( )  [inline], [virtual]
```

However, with the new command-line support, we now need a default implementation that does nothing.

Reimplemented in seq64::gui_assistant_gtk2.

13.19.3.2 jack_idle_connect()

```
virtual void seq64::gui_assistant::jack_idle_connect (
            jack_assistant &  )  [inline], [virtual]
```

But we now need a default implementation that does nothing.

Reimplemented in seq64::gui_assistant_gtk2.

13.19.3.3 lash_timeout_connect()

```
virtual void seq64::gui_assistant::lash_timeout_connect (
            lash * )  [inline], [virtual]
```

But we now need a default implementation that does nothing.

Reimplemented in seq64::gui_assistant_gtk2.

13.19.3.4 keys() [1/2]

```
const keys_perform& seq64::gui_assistant::keys ( ) const  [inline]
```

13.19.3.5 keys() [2/2]

```
keys_perform& seq64::gui_assistant::keys ( )  [inline]
```

13.19.4 Field Documentation

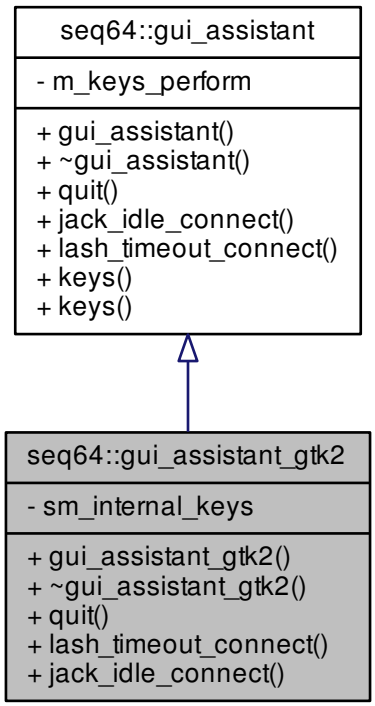
13.19.4.1 m_keys_perform

```
keys_perform& seq64::gui_assistant::m_keys_perform  [private]
```

13.20 seq64::gui_assistant_gtk2 Class Reference

This class provides an interface for some of the Gtk/Gdk/Glib support needed in Sequencer64.

Inheritance diagram for seq64::gui_assistant_gtk2:



Public Member Functions

- gui_assistant_gtk2 ()

  This class provides an interface for some of the Gtk/Gdk/Glib support needed in Sequencer64.
- virtual ~gui_assistant_gtk2 ()

  Virtual classes require a virtual destructor.
- virtual void quit ()

  Calls the Glib Main object's quit() function.
- virtual void lash_timeout_connect (lash *lashobject)

  Connects the LASH timeout-event callback to the Glib timeout object.
- virtual void jack_idle_connect (jack_assistant &jack)

  Connects the JACK session-event callback to the Glib idle object.

Static Private Attributes

- static keys_perform_gtk2 sm_internal_keys

  Provides a pre-made keys_perform object.

13.20.1 Constructor & Destructor Documentation

13.20.1.1 gui_assistant_gtk2()

```
seq64::gui_assistant_gtk2::gui_assistant_gtk2 ( )
```

13.20.1.2 ~gui_assistant_gtk2()

```
virtual seq64::gui_assistant_gtk2::~gui_assistant_gtk2 ( )  [inline], [virtual]
```

13.20.2 Member Function Documentation

13.20.2.1 quit()

```
void seq64::gui_assistant_gtk2::quit ( )  [virtual]
```

Reimplemented from seq64::gui_assistant.

13.20.2.2 lash_timeout_connect()

```
void seq64::gui_assistant_gtk2::lash_timeout_connect (
            lash * lashobject )  [virtual]
```

The time-out value is set to 250 ms.

Reimplemented from seq64::gui_assistant.

13.20.2.3 jack_idle_connect()

```
void seq64::gui_assistant_gtk2::jack_idle_connect (
            jack_assistant & jack )  [virtual]
```

If JACK session support is not enabled, we might emit a message. This mainly prevents a compiler warning about an unused parameter.

Reimplemented from seq64::gui_assistant.

13.20.3 Field Documentation

13.20.3.1 sm_internal_keys

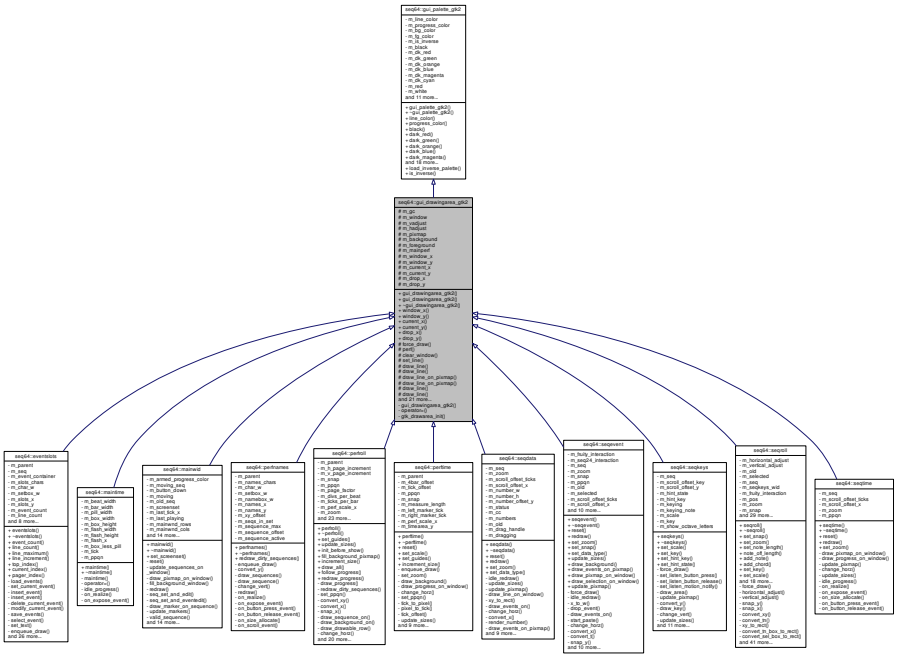
`keys_perform_gtk2 seq64::gui_assistant_gtk2::sm_internal_keys [static], [private]`

This object is set into the reference provided in the gui_assistant base class.

13.21 seq64::gui_drawingarea_gtk2 Class Reference

Implements the basic drawing areas of the application.

Inheritance diagram for seq64::gui_drawingarea_gtk2:



Data Structures

- struct rect

  A small helper structure representing a rectangle.

Public Member Functions

- gui_drawingarea_gtk2 (perform &p, int window_x=0, int window_y=0)

  Perform-only constructor.
- gui_drawingarea_gtk2 (perform &a_perf, Gtk::Adjustment &a_hadjust, Gtk::Adjustment &a_vadjust, int window_x=0, int window_y=0)

  Principal constructor.
- virtual ~gui_drawingarea_gtk2 ()

  Provides a destructor to delete allocated objects.
- int window_x () const

'Getter' function for member m_window_x

- int window_y () const

  'Getter' function for member m_window_y

- int current_x () const

  'Getter' function for member m_current_x

- int current_y () const

  'Getter' function for member m_current_y

- int drop_x () const

  'Getter' function for member m_drop_x

- int drop_y () const

  'Getter' function for member m_drop_y

Protected Member Functions

- virtual void force_draw ()

  Provides a common function for redrawing.

- perform & perf ()

  'Getter' function for member m_mainperf

- void clear_window ()

  Clears the main window.

- void set_line (Gdk::LineStyle ls, int width=1)

  A small wrapper function for readability in line-drawing.

- void draw_line (int x1, int y1, int x2, int y2)

  A small wrapper function to draw a line on the window.

- void draw_line (const Color &c, int x1, int y1, int x2, int y2)

  A small wrapper function to draw a line on the window after setting the given foreground color.

- void draw_line_on_pixmap (int x1, int y1, int x2, int y2)

  A small wrapper function to draw a line on the pixmap.

- void draw_line_on_pixmap (const Color &c, int x1, int y1, int x2, int y2)

  A small wrapper function to draw a line on the pixmap after setting the given foreground color.

- void draw_line (Glib::RefPtr< Gdk::Pixmap > &pixmap, int x1, int y1, int x2, int y2)

  A small wrapper function to draw a line on any pixmap (not a drawable, though, due to a compiler error after setting the given foreground color.

- void draw_line (Glib::RefPtr< Gdk::Pixmap > &pixmap, const Color &c, int x1, int y1, int x2, int y2)

  A small wrapper function to draw a line on the pixmap after setting the given foreground color.

- void draw_line (Glib::RefPtr< Gdk::Drawable > &drawable, int x1, int y1, int x2, int y2)

  A small wrapper function to draw a line on any pixmap (not a drawable, though, due to a compiler error after setting the given foreground color.

- void draw_line (Glib::RefPtr< Gdk::Drawable > &drawable, const Color &c, int x1, int y1, int x2, int y2)

  A small wrapper function to draw a line on the drawable after setting the given foreground color.

- void render_string (int x, int y, const std::string &s, font::Color color, bool invert=false)

  A small wrapper function for readability in string-drawing to the window.

- void render_string_on_pixmap (int x, int y, const std::string &s, font::Color color, bool invert=false)

  A small wrapper function for readability in string-drawing to the pixmap.

- void draw_rectangle (int x, int y, int lx, int ly, bool fill=true)

  A small wrapper function for readability in box-drawing on the window.

- void draw_rectangle (const Color &c, int x, int y, int lx, int ly, bool fill=true)

  A small wrapper function for readability in box-drawing.

- void draw_rectangle (Glib::RefPtr< Gdk::Drawable > &drawable, int x, int y, int lx, int ly, bool fill=true)

  A small wrapper function for readability in box-drawing on a "drawable" context, where the foreground color has already been specified.

- void draw_rectangle (Glib::RefPtr< Gdk::Drawable > &drawable, const Color &c, int x, int y, int lx, int ly, bool fill=true)

  A small wrapper function for readability in box-drawing on any drawable context.
- void draw_rectangle (Glib::RefPtr< Gdk::Pixmap > &pixmap, int x, int y, int lx, int ly, bool fill=true)

  A small wrapper function for readability in box-drawing on a "pixmap" context, where the foreground color has already been specified.
- void draw_rectangle (Glib::RefPtr< Gdk::Pixmap > &pixmap, const Color &c, int x, int y, int lx, int ly, bool fill=true)

  A small wrapper function for readability in box-drawing on any pixmap context.
- void draw_rectangle_on_pixmap (int x, int y, int lx, int ly, bool fill=true)

  A small wrapper function for readability in box-drawing on the pixmap.
- void draw_rectangle_on_pixmap (const Color &c, int x, int y, int lx, int ly, bool fill=true)

  A small wrapper function for readability in box-drawing on the pixmap.
- void draw_normal_rectangle_on_pixmap (int x, int y, int lx, int ly, bool fill=true)

  A small wrapper function for readability in box-drawing on the pixmap.
- void draw_drawable (int xsrc, int ysrc, int xdest, int ydest, int width, int height)

  Provides the most common use case for redrawing.
- void scroll_hadjust (Gtk::Adjustment &hadjust, double step)

  This function provides optimization for the on_scroll_event() functions, and should provide support for having the seqedit/seqroll/seqtime/seqdata panes follow the scrollbar, in a future upgrade (now partly in place).
- void scroll_vadjust (Gtk::Adjustment &vadjust, double step)

  This function is the vertical version of the scroll_hadjust() function, intended for adding keystroke vertical scrolling using the Page-Up and Page-Down keys, as a new feature of Sequencer64.
- void scroll_hset (Gtk::Adjustment &hadjust, double value)
- void scroll_vset (Gtk::Adjustment &vadjust, double value)
- void set_current_drop_x (int x)

  Sets the current x value and the drop x value.
- void set_current_drop_y (int y)

  Sets the current y value and the drop y value.
- void on_realize ()

  For this GTK callback, on realization of window, initialize the shiz.

Protected Attributes

- Glib::RefPtr< Gdk::GC > m_gc

  The graphics context, which is required for ever drawing and rendering operation.
- Glib::RefPtr< Gdk::Window > m_window

  Provides the default "window".
- Gtk::Adjustment & m_vadjust

  Provides an object for vertical "adjustments".
- Gtk::Adjustment & m_hadjust

  Provides an object for horizontal "adjustments".
- Glib::RefPtr< Gdk::Pixmap > m_pixmap

  Provides the default "pixmap".
- Glib::RefPtr< Gdk::Pixmap > m_background

  Another pixmap, used for backgrounds.
- Glib::RefPtr< Gdk::Pixmap > m_foreground

  Another pixmap, used for foregrounds.
- perform & m_mainperf

  A frequent hook into the main perform object.
- int m_window_x

Window sizes.

- int m_window_y

  Window height value.

- int m_current_x

  The x and y value of the current location of the mouse (during dragging?)

- int m_current_y

  Current mouse y value.

- int m_drop_x

  These values are used when roping and highlighting a bunch of events.

- int m_drop_y

  Current mouse y-drop value.

Private Member Functions

- gui_drawingarea_gtk2 (const gui_drawingarea_gtk2 &)
- gui_drawingarea_gtk2 & operator= (const gui_drawingarea_gtk2 &)
- void gtk_drawarea_init ()

  Does basic initialization for each of the constructors.

Additional Inherited Members

13.21.1 Detailed Description

Note that this class really "isn't" a gui_pallete_gtk2; it should simply "have" one. But that base class must be derived from Gtk::DrawingArea. We don't want to waste some space by using a "has-a" relationship, and also put up with having to access the palette indirectly. So, in this case, we tolerate the less strict implementation.

13.21.2 Constructor & Destructor Documentation

13.21.2.1 gui_drawingarea_gtk2() [1/3]

```
seq64::gui_drawingarea_gtk2::gui_drawingarea_gtk2 (
            const gui_drawingarea_gtk2 &  )  [private]
```

13.21.2.2 gui_drawingarea_gtk2() [2/3]

```
seq64::gui_drawingarea_gtk2::gui_drawingarea_gtk2 (
            perform & p,
            int window_x = 0,
            int window_y = 0 )
```

13.21.2.3 gui_drawingarea_gtk2() [3/3]

```
seq64::gui_drawingarea_gtk2::gui_drawingarea_gtk2 (
            perform & a_perf,
            Gtk::Adjustment & a_hadjust,
            Gtk::Adjustment & a_vadjust,
            int window_x = 0,
            int window_y = 0 )
```

13.21.2.4 ~gui_drawingarea_gtk2()

```
seq64::gui_drawingarea_gtk2::~gui_drawingarea_gtk2 ( )  [virtual]
```

13.21.3 Member Function Documentation

13.21.3.1 operator=()

```
gui_drawingarea_gtk2& seq64::gui_drawingarea_gtk2::operator= (
            const gui_drawingarea_gtk2 &  )  [private]
```

13.21.3.2 window_x()

```
int seq64::gui_drawingarea_gtk2::window_x ( ) const  [inline]
```

13.21.3.3 window_y()

```
int seq64::gui_drawingarea_gtk2::window_y ( ) const  [inline]
```

13.21.3.4 current_x()

```
int seq64::gui_drawingarea_gtk2::current_x ( ) const  [inline]
```

13.21.3.5 current_y()

```
int seq64::gui_drawingarea_gtk2::current_y ( ) const  [inline]
```

13.21.3.6 drop_x()

```
int seq64::gui_drawingarea_gtk2::drop_x ( ) const  [inline]
```

13.21.3.7 drop_y()

```
int seq64::gui_drawingarea_gtk2::drop_y ( ) const  [inline]
```

13.21.3.8 force_draw()

```
virtual void seq64::gui_drawingarea_gtk2::force_draw ( )  [inline], [protected], [virtual]
```

This function forces a redraw. Some classes extend this function.

Reimplemented in seq64::seqroll, seq64::seqevent, and seq64::seqkeys.

13.21.3.9 perf()

```
perform& seq64::gui_drawingarea_gtk2::perf ( )  [inline], [protected]
```

13.21.3.10 clear_window()

```
void seq64::gui_drawingarea_gtk2::clear_window ( )  [inline], [protected]
```

One less need to access m_window directly.

13.21.3.11 set_line()

```
void seq64::gui_drawingarea_gtk2::set_line (
            Gdk::LineStyle ls,
            int width = 1 )  [inline], [protected]
```

Sets the attributes of a line to be drawn.

Parameters

ls	Provides the Gtk-specific line style.
width	Provides the width of the line to be drawn. It defaults to the most common value, 1.

13.21.3.12 draw_line() [1/6]

```
void seq64::gui_drawingarea_gtk2::draw_line (
             int x1,
             int y1,
             int x2,
             int y2 )  [inline], [protected]
```

Parameters

x1	The x coordinate of the starting point.
y1	The y coordinate of the starting point.
x2	The x coordinate of the ending point.
y2	The y coordinate of the ending point.

13.21.3.13 draw_line() [2/6]

```
void seq64::gui_drawingarea_gtk2::draw_line (
             const Color & c,
             int x1,
             int y1,
             int x2,
             int y2 )  [protected]
```

Parameters

c	The foreground color in which to draw the line.
x1	The x coordinate of the starting point.
y1	The y coordinate of the starting point.
x2	The x coordinate of the ending point.
y2	The y coordinate of the ending point.

13.21.3.14 draw_line_on_pixmap() [1/2]

```
void seq64::gui_drawingarea_gtk2::draw_line_on_pixmap (
             int x1,
```

```
            int y1,
            int x2,
            int y2 )  [inline], [protected]
```

Parameters

x1	The x coordinate of the starting point.
y1	The y coordinate of the starting point.
x2	The x coordinate of the ending point.
y2	The y coordinate of the ending point.

13.21.3.15 draw_line_on_pixmap() [2/2]

```
void seq64::gui_drawingarea_gtk2::draw_line_on_pixmap (
            const Color & c,
            int x1,
            int y1,
            int x2,
            int y2 )  [protected]
```

Parameters

c	The foreground color in which to draw the line.
x1	The x coordinate of the starting point.
y1	The y coordinate of the starting point.
x2	The x coordinate of the ending point.
y2	The y coordinate of the ending point.

13.21.3.16 draw_line() [3/6]

```
void seq64::gui_drawingarea_gtk2::draw_line (
            Glib::RefPtr< Gdk::Pixmap > & pixmap,
            int x1,
            int y1,
            int x2,
            int y2 )  [inline], [protected]
```

Parameters

pixmap	Provides the Gdk::Pixmap pointer needed to draw the line.
x1	The x coordinate of the starting point.
y1	The y coordinate of the starting point.
x2	The x coordinate of the ending point.
y2	The y coordinate of the ending point.

13.21.3.17 draw_line() [4/6]

```
void seq64::gui_drawingarea_gtk2::draw_line (
            Glib::RefPtr< Gdk::Pixmap > & pixmap,
            const Color & c,
            int x1,
            int y1,
            int x2,
            int y2 )  [protected]
```

Parameters

pixmap	Provides the Gdk::Drawable pointer needed to draw the line.
c	The foreground color in which to draw the line.
x1	The x coordinate of the starting point.
y1	The y coordinate of the starting point.
x2	The x coordinate of the ending point.
y2	The y coordinate of the ending point.

13.21.3.18 draw_line() [5/6]

```
void seq64::gui_drawingarea_gtk2::draw_line (
            Glib::RefPtr< Gdk::Drawable > & drawable,
            int x1,
            int y1,
            int x2,
            int y2 )  [inline], [protected]
```

Parameters

drawable	Provides the Gdk::Drawable pointer needed to draw the line.
x1	The x coordinate of the starting point.
y1	The y coordinate of the starting point.
x2	The x coordinate of the ending point.
y2	The y coordinate of the ending point.

13.21.3.19 draw_line() [6/6]

```
void seq64::gui_drawingarea_gtk2::draw_line (
            Glib::RefPtr< Gdk::Drawable > & drawable,
            const Color & c,
            int x1,
```

```
            int y1,
            int x2,
            int y2 )  [protected]
```

Parameters

drawable	Provides the Gdk::Drawable pointer needed to draw the line.
c	The foreground color in which to draw the line.
x1	The x coordinate of the starting point.
y1	The y coordinate of the starting point.
x2	The x coordinate of the ending point.
y2	The y coordinate of the ending point.

13.21.3.20 render_string()

```
void seq64::gui_drawingarea_gtk2::render_string (
            int x,
            int y,
            const std::string & s,
            font::Color color,
            bool invert = false )  [inline], [protected]
```

Parameters

x	The x-coordinate of the origin.
y	The y-coordinate of the origin.
s	The string to be drawn.
color	The color with which to draw the string.
invert	If true, apply color inversion, if active. Defaults to false.

13.21.3.21 render_string_on_pixmap()

```
void seq64::gui_drawingarea_gtk2::render_string_on_pixmap (
            int x,
            int y,
            const std::string & s,
            font::Color color,
            bool invert = false )  [inline], [protected]
```

Parameters

x	The x-coordinate of the origin.
y	The y-coordinate of the origin.
s	The string to be drawn.
color	The color with which to draw the string.
invert	If true, apply color inversion, if active. Defaults to false.

13.21.3.22 draw_rectangle() [1/6]

```
void seq64::gui_drawingarea_gtk2::draw_rectangle (
            int x,
            int y,
            int lx,
            int ly,
            bool fill = true )  [inline], [protected]
```

Parameters

x	The x-coordinate of the origin.
y	The y-coordinate of the origin.
lx	The width of the box.
ly	The height of the box.
fill	If true, fill the rectangle with the current foreground color, as set by m_gc->set_foreground(color). Defaults to true.

13.21.3.23 draw_rectangle() [2/6]

```
void seq64::gui_drawingarea_gtk2::draw_rectangle (
            const Color & c,
            int x,
            int y,
            int lx,
            int ly,
            bool fill = true )  [protected]
```

It adds setting the foreground color to the draw_rectangle() function.

Parameters

c	Provides the foreground color to set.
x	The x-coordinate of the origin.
y	The y-coordinate of the origin.
lx	The width of the box.
ly	The height of the box.
fill	If true, fill the rectangle with the current foreground color, as set by m_gc->set_foreground(color). Defaults to true.

13.21.3.24 draw_rectangle() [3/6]

```
void seq64::gui_drawingarea_gtk2::draw_rectangle (
            Glib::RefPtr< Gdk::Drawable > & drawable,
```

```
            int x,
            int y,
            int lx,
            int ly,
            bool fill = true )  [inline], [protected]
```

Parameters

drawable	The object on which to draw the rectangle.
x	The x-coordinate of the origin.
y	The y-coordinate of the origin.
lx	The width of the box.
ly	The height of the box.
fill	If true, fill the rectangle with the current foreground color, as set by m_gc->set_foreground(color). Defaults to true.

13.21.3.25 draw_rectangle() [4/6]

```
void seq64::gui_drawingarea_gtk2::draw_rectangle (
            Glib::RefPtr< Gdk::Drawable > & drawable,
            const Color & c,
            int x,
            int y,
            int lx,
            int ly,
            bool fill = true )  [protected]
```

It also supports setting the foreground color to the draw_rectangle() function.

We have a number of such functions: for the main window, for the main pixmap, and for any drawing surface. Is the small bit of conciseness worth it?

Parameters

drawable	The surface on which to draw the box.
c	Provides the foreground color to set.
x	The x-coordinate of the origin.
y	The y-coordinate of the origin.
lx	The width of the box.
ly	The height of the box.
fill	If true, fill the rectangle with the current foreground color, as set by m_gc->set_foreground(color). Defaults to true.

13.21.3.26 draw_rectangle() [5/6]

```
void seq64::gui_drawingarea_gtk2::draw_rectangle (
            Glib::RefPtr< Gdk::Pixmap > & pixmap,
```

```
            int x,
            int y,
            int lx,
            int ly,
            bool fill = true )  [inline], [protected]
```

Parameters

pixmap	The object on which to draw the rectangle.
x	The x-coordinate of the origin.
y	The y-coordinate of the origin.
lx	The width of the box.
ly	The height of the box.
fill	If true, fill the rectangle with the current foreground color, as set by m_gc->set_foreground(color). Defaults to true.

13.21.3.27 draw_rectangle() [6/6]

```
void seq64::gui_drawingarea_gtk2::draw_rectangle (
            Glib::RefPtr< Gdk::Pixmap > & pixmap,
            const Color & c,
            int x,
            int y,
            int lx,
            int ly,
            bool fill = true )  [protected]
```

It also supports setting the foreground color to the draw_rectangle() function.

We have a number of such functions: for the main window, for the main pixmap, and for any drawing surface. Is the small bit of conciseness worth it?

Parameters

pixmap	The surface on which to draw the box.
c	Provides the foreground color to set.
x	The x-coordinate of the origin.
y	The y-coordinate of the origin.
lx	The width of the box.
ly	The height of the box.
fill	If true, fill the rectangle with the current foreground color, as set by m_gc->set_foreground(color). Defaults to true.

13.21.3.28 draw_rectangle_on_pixmap() [1/2]

```
void seq64::gui_drawingarea_gtk2::draw_rectangle_on_pixmap (
            int x,
```

```
            int y,
            int lx,
            int ly,
            bool fill = true )  [inline], [protected]
```

Parameters

x	The x-coordinate of the origin.
y	The y-coordinate of the origin.
lx	The width of the box.
ly	The height of the box.
fill	If true, fill the rectangle with the current foreground color, as set by m_gc->set_foreground(color). Defaults to true.

13.21.3.29 draw_rectangle_on_pixmap() [2/2]

```
void seq64::gui_drawingarea_gtk2::draw_rectangle_on_pixmap (
            const Color & c,
            int x,
            int y,
            int lx,
            int ly,
            bool fill = true )  [protected]
```

It adds setting the foreground color to the draw_rectangle() function.

Parameters

c	Provides the foreground color to set.
x	The x-coordinate of the origin.
y	The y-coordinate of the origin.
lx	The width of the box.
ly	The height of the box.
fill	If true, fill the rectangle with the current foreground color, as set by m_gc->set_foreground(color). Defaults to true.

13.21.3.30 draw_normal_rectangle_on_pixmap()

```
void seq64::gui_drawingarea_gtk2::draw_normal_rectangle_on_pixmap (
            int x,
            int y,
            int lx,
            int ly,
            bool fill = true )  [protected]
```

It uses Gtk to get the proper background styling for the rectangle.

Parameters

x	The x-coordinate of the origin.
y	The y-coordinate of the origin.
lx	The width of the box.
ly	The height of the box.
fill	If true, fill the rectangle with the current foreground color, as set by m_gc->set_foreground(color). Defaults to true.

13.21.3.31 draw_drawable()

```
void seq64::gui_drawingarea_gtk2::draw_drawable (
             int xsrc,
             int ysrc,
             int xdest,
             int ydest,
             int width,
             int height )  [inline], [protected]
```

13.21.3.32 scroll_hadjust()

```
void seq64::gui_drawingarea_gtk2::scroll_hadjust (
             Gtk::Adjustment & hadjust,
             double step )  [protected]
```

This function is currently duplicated in the gui_drawingarea_gtk2 and gui_window_gtk2 modules.

Parameters

hadjust	Provides a reference to the adjustment object to be adjusted. Do we really need this to be a parameter? Why not just use the m_hadjust member? (Note that this member is not present in the similar gui_window_gtk2 class.)
step	Provides the step value to use for adjusting the horizontal scrollbar. If negative, the adjustment is leftward. If positive, the adjustment is rightward. It can be the value of m_hadjust->get_step_increment(), or provided especially to keep up with the progress bar.

13.21.3.33 scroll_vadjust()

```
void seq64::gui_drawingarea_gtk2::scroll_vadjust (
             Gtk::Adjustment & vadjust,
             double step )  [protected]
```

Parameters

vadjust	Provides a reference to the adjustment object to be adjusted.
step	Provides the step value to use for adjusting the vertical scrollbar. If negative, the adjustment is upward. If positive, the adjustment is downward. It can be the value of m_vadjust->get_step_increment().

13.21.3.34 scroll_hset()

```
void seq64::gui_drawingarea_gtk2::scroll_hset (
            Gtk::Adjustment & hadjust,
            double value )  [protected]
```

13.21.3.35 scroll_vset()

```
void seq64::gui_drawingarea_gtk2::scroll_vset (
            Gtk::Adjustment & vadjust,
            double value )  [protected]
```

13.21.3.36 set_current_drop_x()

```
void seq64::gui_drawingarea_gtk2::set_current_drop_x (
            int x )  [inline], [protected]
```

Parameters

x	The x value to be set.

13.21.3.37 set_current_drop_y()

```
void seq64::gui_drawingarea_gtk2::set_current_drop_y (
            int y )  [inline], [protected]
```

Parameters

y	The y value to be set.

13.21.3.38 gtk_drawarea_init()

```
void seq64::gui_drawingarea_gtk2::gtk_drawarea_init ( )  [private]
```

13.21.3.39 on_realize()

```
void seq64::gui_drawingarea_gtk2::on_realize ( )  [protected]
```

It allocates any additional resources that weren't initialized in the constructor.

13.21.4 Field Documentation

13.21.4.1 m_gc

```
Glib::RefPtr<Gdk::GC> seq64::gui_drawingarea_gtk2::m_gc  [protected]
```

13.21.4.2 m_window

```
Glib::RefPtr<Gdk::Window> seq64::gui_drawingarea_gtk2::m_window  [protected]
```

Wrapper functions with undecorated wrapper names are used for accessing this item. We hope to be able to hide this items completely some day.

13.21.4.3 m_vadjust

```
Gtk::Adjustment& seq64::gui_drawingarea_gtk2::m_vadjust  [protected]
```

13.21.4.4 m_hadjust

```
Gtk::Adjustment& seq64::gui_drawingarea_gtk2::m_hadjust  [protected]
```

13.21.4.5 m_pixmap

```
Glib::RefPtr<Gdk::Pixmap> seq64::gui_drawingarea_gtk2::m_pixmap  [protected]
```

Wrapper functions with undecorated wrapper names are used for accessing this item. We hope to be able to hide this items completely some day.

13.21.4.6 m_background

```
Glib::RefPtr<Gdk::Pixmap> seq64::gui_drawingarea_gtk2::m_background  [protected]
```

Our wrappers still leave this member exposed (giggle).

13.21.4.7 m_foreground

```
Glib::RefPtr<Gdk::Pixmap> seq64::gui_drawingarea_gtk2::m_foreground  [protected]
```

Our wrappers still leave this member exposed.

13.21.4.8 m_mainperf

```
perform& seq64::gui_drawingarea_gtk2::m_mainperf  [protected]
```

We could move this into yet another base class, since a number of classes don't need it. Probably not worth the effort at this time.

13.21.4.9 m_window_x

```
int seq64::gui_drawingarea_gtk2::m_window_x  [protected]
```

Could make this constant, but some windows are resizable.Window width value.

13.21.4.10 m_window_y

```
int seq64::gui_drawingarea_gtk2::m_window_y  [protected]
```

13.21.4.11 m_current_x

```
int seq64::gui_drawingarea_gtk2::m_current_x  [protected]
```

Current mouse x value.

13.21.4.12 m_current_y

```
int seq64::gui_drawingarea_gtk2::m_current_y  [protected]
```

13.21.4.13 m_drop_x

```
int seq64::gui_drawingarea_gtk2::m_drop_x  [protected]
```

Provides the x and y value of where the dragging started.Current mouse x-drop value.

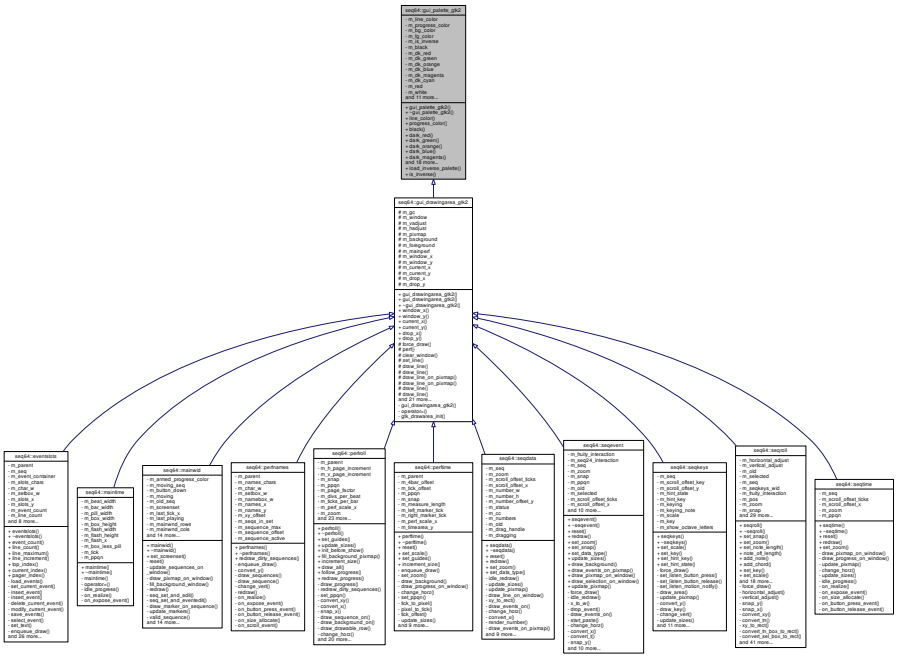
13.21.4.14 m_drop_y

```
int seq64::gui_drawingarea_gtk2::m_drop_y  [protected]
```

13.22 seq64::gui_palette_gtk2 Class Reference

Implements a stock palette of Gdk::Color elements.

Inheritance diagram for seq64::gui_palette_gtk2:



Public Member Functions

- gui_palette_gtk2 ()

  Principal constructor.
- ~gui_palette_gtk2 ()

  Provides a destructor to delete allocated objects.
- const Color & line_color () const

  'Getter' function for member m_line_color Provides an experimental way to change some line colors from black to something else.
- const Color & progress_color () const

'Getter' function for member m_progress_color Provides an experimental way to change the progress line color from black to something else.

- const Color & black () const

  'Getter' function for member m_black Although these color getters return static values (if so compiled), these colors are used only in the window and drawing-area classes, so no need to make these functions static.

- const Color & dark_red () const

  'Getter' function for member m_dk_red

- const Color & dark_green () const

  'Getter' function for member m_dk_green

- const Color & dark_orange () const

  'Getter' function for member m_dk_orange

- const Color & dark_blue () const

  'Getter' function for member m_dk_blue

- const Color & dark_magenta () const

  'Getter' function for member m_dk_magenta

- const Color & dark_cyan () const

  'Getter' function for member m_dk_cyan

- const Color & white () const

  'Getter' function for member m_white

- const Color & grey () const

  'Getter' function for member m_grey

- const Color & dark_grey () const

  'Getter' function for member m_dk_grey

- const Color & light_grey () const

  'Getter' function for member m_lt_grey

- const Color & red () const

  'Getter' function for member m_red

- const Color & orange () const

  'Getter' function for member m_orange

- const Color & yellow () const

  'Getter' function for member m_yellow

- const Color & green () const

  'Getter' function for member m_green

- const Color & blue () const

  'Getter' function for member m_blue

- const Color & black_paint () const

  'Getter' function for member m_blk_paint

- const Color & white_paint () const

  'Getter' function for member m_wht_paint

- const Color & black_key () const

  'Getter' function for member m_blk_key

- const Color & white_key () const

  'Getter' function for member m_wht_key

- const Color & bg_color () const

  'Getter' function for member m_bg_color

- void bg_color (const Color &c)

  'Setter' function for member m_bg_color

- const Color & fg_color () const

  'Getter' function for member m_fg_color

- void fg_color (const Color &c)

  'Setter' function for member m_fg_color

Static Public Member Functions

- static void load_inverse_palette (bool inverse=true)

  Provides an alternate color palette, somewhat constrained by the colors in the font bitmaps.
- static bool is_inverse ()

  Indicates if the inverse color palette is loaded.

Protected Types

- typedef Gdk::Color Color

  Provides a type for the color object.

Private Attributes

- Color m_line_color

  Provides the line color.
- Color m_progress_color

  Provides the progress bar color.
- Color m_bg_color

  The current background color.
- Color m_fg_color

  The current foreground color.

Static Private Attributes

- static bool m_is_inverse

  Flags the presense of the inverse color palette.
- static const Color m_black

  Provides the black color.
- static const Color m_dk_red

  Provides a blood-red color.
- static const Color m_dk_green

  Provides a dark green color.
- static const Color m_dk_orange

  Provides a dark orange color.
- static const Color m_dk_blue

  Provides the dark blue color.
- static const Color m_dk_magenta

  Provides the dark cyan color.
- static const Color m_dk_cyan

  Provides the dark cyan color.
- static const Color m_red

  Provides the red color.
- static const Color m_white

  Provides the white color.
- static const Color m_orange

  Provides the orange color.
- static const Color m_yellow

  Provides the yellow color.

- static const Color m_green
  Provides the green color.
- static const Color m_blue
  Provides the blue color.
- static Color m_grey
  Provides the grey color.
- static Color m_dk_grey
  Provides the dark grey color.
- static Color m_lt_grey
  Provides the light grey color.
- static Color m_blk_paint
  An invertible black color.
- static Color m_wht_paint
  An invertible white color.
- static Color m_blk_key
  Provides the color of a black key.
- static Color m_wht_key
  Provides the color of a white key.

13.22.1 Detailed Description

Note that this class must be derived from Gtk::DrawingArea (or Gtk::Widget) in order to get access to the get_↩ default_colormap() function used in the constructor.

13.22.2 Member Typedef Documentation

13.22.2.1 Color

```
typedef Gdk::Color seq64::gui_palette_gtk2::Color  [protected]
```

The following uses are made of each color:

- Black. The background color of armed patterns. The color of most lines in the user interface, including the main grid lines. The default color of progress lines and text.
- White. The default background color of just about everything drawn in the application.
- Grey. The color of minor grid lines and the markers for the currently-selected scale.
- Dark grey. The color of some grid lines, and the background of a queued pattern slot.
- Light grey. The color of some grid lines.
- Red. The optional color of progress bars.
- Orange. The fill-in color for selected notes and events.
- Dark orange. The color of selected event data lines and the color of the selection box for events to be pasted.

- Yellow. The background of the pattern and name slots for empty patterns. The text color for selected empty pattern slots.
- Green. Not yet used.
- Blue. Not yet used.
- Dark cyan. The background color of muted patterns currently in edit, or the pattern that contains the original data for an imported SMF 0 song. The text color of an unmuted pattern currently in edit. These colors apply to the pattern editor and the song editor. The color of the selected background pattern in the song editor.
- Line color. The generic line color, meant for expansion. Currently black.
- Progress color. The progress line color. Black by default, but can be set to red.
- Background color. The currently-in-use background color. Can vary a lot when a pixmap is being redrawn.
- Foreground color. The currently-in-use foreground color. Can vary a lot when a pixmap is being redrawn.

13.22.3 Constructor & Destructor Documentation

13.22.3.1 gui_palette_gtk2()

```
seq64::gui_palette_gtk2::gui_palette_gtk2 ( )
```

In the constructor one can only allocate colors; get_window() returns 0 because this window has not yet been realized. Also note that the possible color names that can be used are found in /usr/share/X11/rgb.txt.

13.22.3.2 ~gui_palette_gtk2()

```
seq64::gui_palette_gtk2::~gui_palette_gtk2 ( )
```

13.22.4 Member Function Documentation

13.22.4.1 load_inverse_palette()

```
void seq64::gui_palette_gtk2::load_inverse_palette (
            bool inverse = true )  [static]
```

Inverse is not a complete inverse. It is more like a "night" mode. However, there are still some bright colors even in this mode. Some colors, such as the selection color (orange) are the same in either mode.

Parameters

inverse	If true, load the alternate palette. Otherwise, load the default palette.

13.22.4.2 is_inverse()

```
static bool seq64::gui_palette_gtk2::is_inverse ( )  [inline], [static]
```

13.22.4.3 line_color()

```
const Color& seq64::gui_palette_gtk2::line_color ( ) const  [inline]
```

Might eventually be selectable from the "user" configuration file

13.22.4.4 progress_color()

```
const Color& seq64::gui_palette_gtk2::progress_color ( ) const  [inline]
```

Now selectable from the "user" configuration file.

13.22.4.5 black()

```
const Color& seq64::gui_palette_gtk2::black ( ) const  [inline]
```

13.22.4.6 dark_red()

```
const Color& seq64::gui_palette_gtk2::dark_red ( ) const  [inline]
```

13.22.4.7 dark_green()

```
const Color& seq64::gui_palette_gtk2::dark_green ( ) const  [inline]
```

13.22.4.8 dark_orange()

```
const Color& seq64::gui_palette_gtk2::dark_orange ( ) const  [inline]
```

13.22.4.9 dark_blue()

```
const Color& seq64::gui_palette_gtk2::dark_blue ( ) const  [inline]
```

13.22.4.10 dark_magenta()

```
const Color& seq64::gui_palette_gtk2::dark_magenta ( ) const  [inline]
```

13.22.4.11 dark_cyan()

```
const Color& seq64::gui_palette_gtk2::dark_cyan ( ) const  [inline]
```

13.22.4.12 white()

```
const Color& seq64::gui_palette_gtk2::white ( ) const  [inline]
```

13.22.4.13 grey()

```
const Color& seq64::gui_palette_gtk2::grey ( ) const  [inline]
```

13.22.4.14 dark_grey()

```
const Color& seq64::gui_palette_gtk2::dark_grey ( ) const  [inline]
```

13.22.4.15 light_grey()

```
const Color& seq64::gui_palette_gtk2::light_grey ( ) const  [inline]
```

13.22.4.16 red()

```
const Color& seq64::gui_palette_gtk2::red ( ) const  [inline]
```

13.22.4.17 orange()

```
const Color& seq64::gui_palette_gtk2::orange ( ) const  [inline]
```

13.22.4.18 yellow()

```
const Color& seq64::gui_palette_gtk2::yellow ( ) const  [inline]
```

13.22.4.19 green()

```
const Color& seq64::gui_palette_gtk2::green ( ) const  [inline]
```

13.22.4.20 blue()

```
const Color& seq64::gui_palette_gtk2::blue ( ) const  [inline]
```

13.22.4.21 black_paint()

```
const Color& seq64::gui_palette_gtk2::black_paint ( ) const  [inline]
```

13.22.4.22 white_paint()

```
const Color& seq64::gui_palette_gtk2::white_paint ( ) const  [inline]
```

13.22.4.23 black_key()

```
const Color& seq64::gui_palette_gtk2::black_key ( ) const  [inline]
```

13.22.4.24 white_key()

```
const Color& seq64::gui_palette_gtk2::white_key ( ) const  [inline]
```

13.22.4.25 bg_color() [1/2]

```
const Color& seq64::gui_palette_gtk2::bg_color ( ) const  [inline]
```

13.22.4.26 bg_color() [2/2]

```
void seq64::gui_palette_gtk2::bg_color (
            const Color & c )  [inline]
```

13.22.4.27 fg_color() [1/2]

```
const Color& seq64::gui_palette_gtk2::fg_color ( ) const  [inline]
```

13.22.4.28 fg_color() [2/2]

```
void seq64::gui_palette_gtk2::fg_color (
            const Color & c )  [inline]
```

13.22.5 Field Documentation

13.22.5.1 m_is_inverse

```
bool seq64::gui_palette_gtk2::m_is_inverse  [static], [private]
```

By default, the inverse color palette is not loaded.

13.22.5.2 m_black

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_black  [static], [private]
```

13.22.5.3 m_dk_red

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_dk_red  [static], [private]
```

13.22.5.4 m_dk_green

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_dk_green  [static], [private]
```

13.22.5.5 m_dk_orange

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_dk_orange  [static], [private]
```

13.22.5.6 m_dk_blue

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_dk_blue  [static], [private]
```

13.22.5.7 m_dk_magenta

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_dk_magenta  [static], [private]
```

13.22.5.8 m_dk_cyan

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_dk_cyan  [static], [private]
```

13.22.5.9 m_red

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_red  [static], [private]
```

13.22.5.10 m_white

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_white  [static], [private]
```

13.22.5.11 m_orange

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_orange  [static], [private]
```

13.22.5.12 m_yellow

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_yellow  [static], [private]
```

13.22.5.13 m_green

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_green  [static], [private]
```

13.22.5.14 m_blue

```
const STATIC_COLOR seq64::gui_palette_gtk2::m_blue  [static], [private]
```

13.22.5.15 m_grey

```
STATIC_COLOR seq64::gui_palette_gtk2::m_grey  [static], [private]
```

13.22.5.16 m_dk_grey

```
STATIC_COLOR seq64::gui_palette_gtk2::m_dk_grey  [static], [private]
```

13.22.5.17 m_lt_grey

```
STATIC_COLOR seq64::gui_palette_gtk2::m_lt_grey  [static], [private]
```

13.22.5.18 m_blk_paint

```
STATIC_COLOR seq64::gui_palette_gtk2::m_blk_paint  [static], [private]
```

13.22.5.19 m_wht_paint

```
STATIC_COLOR seq64::gui_palette_gtk2::m_wht_paint  [static], [private]
```

13.22.5.20 m_blk_key

STATIC_COLOR seq64::gui_palette_gtk2::m_blk_key [static], [private]

13.22.5.21 m_wht_key

STATIC_COLOR seq64::gui_palette_gtk2::m_wht_key [static], [private]

13.22.5.22 m_line_color

Color seq64::gui_palette_gtk2::m_line_color [private]

13.22.5.23 m_progress_color

Color seq64::gui_palette_gtk2::m_progress_color [private]

13.22.5.24 m_bg_color

Color seq64::gui_palette_gtk2::m_bg_color [private]

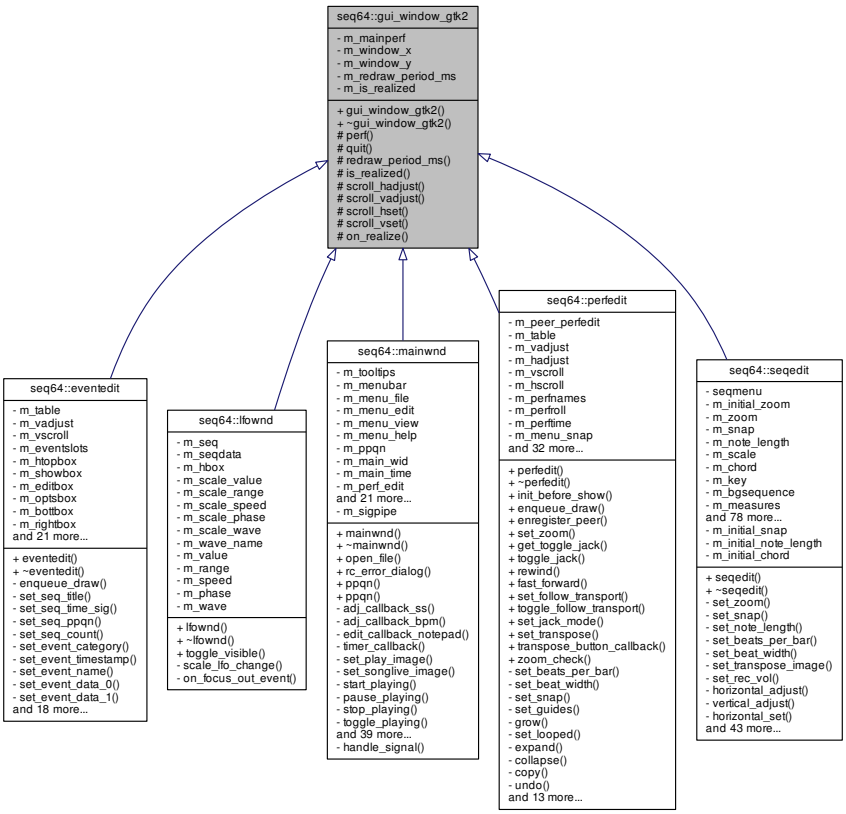
13.22.5.25 m_fg_color

Color seq64::gui_palette_gtk2::m_fg_color [private]

13.23 seq64::gui_window_gtk2 Class Reference

This class supports a basic interface for Gtk::Window-derived objects.

Inheritance diagram for seq64::gui_window_gtk2:



Public Member Functions

- gui_window_gtk2 (perform &p, int window_x=0, int window_y=0)

  Principal constructor, has a reference to the all-important perform object.
- virtual ~gui_window_gtk2 ()

  This rote constructor does nothing.

Protected Member Functions

- perform & perf ()

  'Getter' function for member m_mainperf
- virtual void quit ()

  Provides "quit" functionality that WE HAVE OVERLOOKED!!! At some point we need to rectify this situation, probably for the sake of session support.
- int redraw_period_ms () const

  'Getter' function for member m_redraw_period_ms
- bool is_realized () const

'Getter' function for member m_is_realized

- void scroll_hadjust (Gtk::Adjustment &hadjust, double step)

  This function provides optimization for the on_scroll_event() functions, and should provide support for having the seqedit/seqroll/seqtime/seqdata panes follow the scrollbar, in a future upgrade.
- void scroll_vadjust (Gtk::Adjustment &vadjust, double step)

  This function is the vertical version of scroll_hadjust().
- void scroll_hset (Gtk::Adjustment &hadjust, double value)

  This function is the horizontal scroll setter.
- void scroll_vset (Gtk::Adjustment &vadjust, double value)

  This function is the vertical scroll setter.
- void on_realize ()

  This callback function calls the base-class on_realize() function, and sets the m_is_realized flag.

Private Attributes

- perform & m_mainperf

  The master object, sort of a sequence buss for all of the sequence.
- int m_window_x

  Window sizes.
- int m_window_y

  The height of the window.
- int m_redraw_period_ms

  Provides the timer period for the eventedit timer, used to determine the rate of redrawing.
- bool m_is_realized

  Indicates if on_realize() has been called.

13.23.1 Constructor & Destructor Documentation

13.23.1.1 gui_window_gtk2()

```
seq64::gui_window_gtk2::gui_window_gtk2 (
            perform & p,
            int window_x = 0,
            int window_y = 0 )
```

Note

We've collected the redraw timeouts into a base-class member. Most were valued at c_redraw_ms (40 ms), but mainwnd used 25 ms, so beware. We will eventually make this a user-interface parameter.

Parameters

p	Refers to the main performance object.
window_x	The width of the window.
window_y	The height of the window.

13.23.1.2 ~gui_window_gtk2()

```
seq64::gui_window_gtk2::~gui_window_gtk2 ( )  [virtual]
```

13.23.2 Member Function Documentation

13.23.2.1 perf()

```
perform& seq64::gui_window_gtk2::perf ( )  [inline], [protected]
```

13.23.2.2 quit()

```
virtual void seq64::gui_window_gtk2::quit ( )  [inline], [protected], [virtual]
```

13.23.2.3 redraw_period_ms()

```
int seq64::gui_window_gtk2::redraw_period_ms ( ) const  [inline], [protected]
```

13.23.2.4 is_realized()

```
bool seq64::gui_window_gtk2::is_realized ( ) const  [inline], [protected]
```

13.23.2.5 scroll_hadjust()

```
void seq64::gui_window_gtk2::scroll_hadjust (
            Gtk::Adjustment & hadjust,
            double step )  [protected]
```

This function is currently duplicated in the gui_drawingarea_gtk2 and gui_window_gtk2 modules.

Parameters

hadjust	Provides a reference to the adjustment object to be adjusted.
step	Provides the step value to use for adjusting the horizontal scrollbar. If negative, the adjustment is leftward. If positive, the adjustment is rightward. It can be the value of m_hadjust->get_step_increment(), or provided especially to keep up with the progress bar.

13.23.2.6 scroll_vadjust()

```
void seq64::gui_window_gtk2::scroll_vadjust (
            Gtk::Adjustment & vadjust,
            double step )  [protected]
```

Parameters

vadjust	Provides a reference to the adjustment object to be adjusted.
step	Provides the step value to use for adjusting the vertical scrollbar. If greater than 0, the movement is downward. If less than zero, the movement is upward.

13.23.2.7 scroll_hset()

```
void seq64::gui_window_gtk2::scroll_hset (
            Gtk::Adjustment & hadjust,
            double value )  [protected]
```

Parameters

hadjust	Provides a reference to the adjustment object to be set. It is clamped as necessary.
value	Provides the value to use for setting the horizontal scrollbar.

13.23.2.8 scroll_vset()

```
void seq64::gui_window_gtk2::scroll_vset (
            Gtk::Adjustment & vadjust,
            double value )  [protected]
```

Parameters

vadjust	Provides a reference to the vertical adjustment object to be set. It is clamped as necessary.
value	Provides the value to use for setting the vertical scrollbar.

13.23.2.9 on_realize()

```
void seq64::gui_window_gtk2::on_realize ( )  [protected]
```

13.23.3 Field Documentation

13.23.3.1 m_mainperf

```
perform& seq64::gui_window_gtk2::m_mainperf  [private]
```

And a whole lot more than that.

13.23.3.2 m_window_x

```
int seq64::gui_window_gtk2::m_window_x  [private]
```

Could make this constant, but some windows are resizable.The width of the window.

13.23.3.3 m_window_y

```
int seq64::gui_window_gtk2::m_window_y  [private]
```

13.23.3.4 m_redraw_period_ms

```
int seq64::gui_window_gtk2::m_redraw_period_ms  [private]
```

This is currently hardwired to 40 ms in Linux, and 20 ms in Windows. Note that mainwnd used 25 ms.

13.23.3.5 m_is_realized

```
bool seq64::gui_window_gtk2::m_is_realized  [private]
```

In some cases, we don't want to draw in objects that haven't yet appeared, otherwise crashes occur.

13.24 seq64::jack_assistant Class Reference

This class provides the performance mode JACK support.

Public Member Functions

- jack_assistant (perform &parent, midibpm bpminute=SEQ64_DEFAULT_BPM, int ppqn=SEQ64_USE_DE↩ FAULT_PPQN, int bpm=SEQ64_DEFAULT_BEATS_PER_MEASURE, int beatwidth=SEQ64_DEFAULT_↩ BEAT_WIDTH)

  This constructor initializes a number of member variables, some of them public!
- ~jack_assistant ()

  The destructor doesn't need to do anything yet.
- perform & parent ()

  'Getter' function for member m_jack_parent Needed for external callbacks.
- const perform & parent () const

  'Getter' function for member m_jack_parent, const version
- bool is_running () const

  'Getter' function for member m_jack_running
- bool is_master () const

  'Getter' function for member m_jack_master
- int get_ppqn () const

  'Getter' function for member m_ppqn
- int get_beat_width () const

  'Getter' function for member m_beat_width
- void set_beat_width (int bw)

  'Setter' function for member m_beat_width
- int get_beats_per_measure () const

  'Getter' function for member m_beats_per_measure
- void set_beats_per_measure (int bpm)

  'Setter' function for member m_beats_per_measure
- midibpm get_beats_per_minute () const

  'Getter' function for member m_beats_per_minute
- void set_beats_per_minute (midibpm bpminute)

  'Setter' function for member m_beats_per_minute For the future, changing the BPM (beats/minute) internally.
- jack_transport_state_t transport_state () const

  'Getter' function for member m_jack_transport_state
- bool transport_not_starting () const

  Returns true if the JACK transport state is not JackTransportStarting.
- bool init ()

  Initializes JACK support.
- bool deinit ()

  Tears down the JACK infrastructure.
- bool session_event ()

  Writes the MIDI file named "<jack session dir>-file.mid" using a midifile object, quits if told to by JACK, and can free the JACK session event.
- bool activate ()

  Activate JACK here.
- void start ()

  If JACK is supported, starts the JACK transport.
- void stop ()

  If JACK is supported, stops the JACK transport.
- void position (bool state, midipulse tick=0)

  If JACK is supported and running, sets the position of the transport to the new frame number, frame 0.
- bool output (jack_scratchpad &pad)

  Performance output function for JACK, called by the perform function of the same name.

- void set_ppqn (int ppqn)

  'Setter' function for member m_ppqn For the future, changing the PPQN internally.
- double get_jack_tick () const

  'Getter' function for member m_jack_tick
- const jack_position_t & get_jack_pos () const

  'Getter' function for member m_jack_pos
- void toggle_jack_mode ()

  'Setter' function for member m_toggle_jack
- void set_jack_mode (bool mode)

  'Setter' function for member m_toggle_jack
- bool get_jack_mode () const

  'Getter' function for member m_toggle_jack Seems misnamed.
- midipulse get_jack_stop_tick () const

  'Getter' function for member m_jack_stop_tick
- void set_jack_stop_tick (long tick)

  'Setter' function for member m_jack_stop_tick
- jack_nframes_t jack_frame_rate () const

  'Getter' function for member m_jack_frame_rate
- bool get_follow_transport () const

  'Getter' function for member m_follow_transport
- void set_follow_transport (bool aset)

  'Setter' function for member m_follow_transport
- void toggle_follow_transport ()

  'Setter' function for member m_follow_transport
- bool toggle_song_start_mode ()

  'Setter' function for member parent().toggle_song_start_mode()
- bool song_start_mode () const

  'Getter' function for member parent().song_start_mode()
- void set_start_from_perfedit (bool start)

  'Setter' function for member parent().start_from_perfedit()
- jack_client_t * client () const
- const std::string & client_name () const

  'Getter' function for member m_jack_client_name
- const std::string & client_uuid () const

  'Getter' function for member m_jack_client_uuid

Private Member Functions

- void set_jack_running (bool flag)

  'Setter' function for member m_jack_running
- double tick_multiplier () const

  Convenience function for internal use.
- jack_client_t * client_open (const std::string &clientname)

  A member wrapper function for the new free function create_jack_client().
- void get_jack_client_info ()

  Tries to obtain the best information on the JACK client and the UUID assigned to this client.
- void show_position (const jack_position_t &pos) const

  Shows a one-line summary of a JACK position structure.
- int sync (jack_transport_state_t state=(jack_transport_state_t)(-1))

  A helper function for syncing up with JACK parameters.
- void set_position (midipulse currenttick)

  Provides the code that was effectively commented out in the perform::position_jack() function.

Static Private Member Functions

- static bool info_message (const std::string &msg)

  Common-code for console messages.
- static bool error_message (const std::string &msg)

  Common-code for error messages.

Private Attributes

- perform & m_jack_parent

  Provides the perform object that needs this JACK assistant/scratchpad class.
- jack_client_t * m_jack_client

  Provides a handle into JACK, so that the application, as a JACK client, can issue commands and retrieve status information from JACK.
- std::string m_jack_client_name

  A new member to hold the actual name of the client assigned by JACK.
- std::string m_jack_client_uuid

  A new member to hold the actual UUID of the client assigned by JACK.
- jack_nframes_t m_jack_frame_current

  Holds the current frame number obtained from JACK transport, via a call to jack_get_current_transport_frame().
- jack_nframes_t m_jack_frame_last

  Holds the last frame number we got from JACK, so that progress can be tracked.
- jack_position_t m_jack_pos

  Provides positioning information on JACK playback.
- jack_transport_state_t m_jack_transport_state

  Holds the JACK transport state.
- jack_transport_state_t m_jack_transport_state_last

  Holds the last JACK transport state.
- double m_jack_tick

  The tick/pulse value derived from the current frame number, the ticks/beat value, the beats/minute value, and the frame rate.
- jack_session_event_t * m_jsession_ev

  Provides a kind of handle to the JACK session manager.
- bool m_jack_running

  Indicates if JACK Sync has been enabled successfully.
- bool m_jack_master

  Indicates if JACK Sync has been enabled successfully, with the application running as JACK Master.
- jack_nframes_t m_jack_frame_rate

  Holds the current frame rate.
- bool m_toggle_jack

  Ostensibly a toggle, the functions that access this member are called "jack_mode" functions.
- midipulse m_jack_stop_tick

  Used in jack_process_callback() to reposition when JACK transport is not rolling or starting.
- bool m_follow_transport

  TBD.
- int m_ppqn

  Holds the global PPQN value for the Sequencer64 session.
- int m_beats_per_measure

  Holds the song's beats/measure value for using in setting JACK position.
- int m_beat_width

  Holds the song's beat width value (denominator of the time signature) for using in setting JACK position.
- midibpm m_beats_per_minute

  Holds the song's beats/minute (BPM) value for using in setting JACK position.

Static Private Attributes

- static jack_status_pair_t sm_status_pairs [ ]

  Pairs the JACK status bits with human-readable descriptions of each one.

Friends

- int jack_transport_callback (jack_nframes_t nframes, void ∗arg)
- void jack_shutdown_callback (void ∗arg)

  This callback is to shut down JACK by clearing the jack_assistant :: m_jack_running flag.
- int jack_sync_callback (jack_transport_state_t state, jack_position_t ∗pos, void ∗arg)

  Global functions for JACK support and JACK sessions.
- void jack_timebase_callback (jack_transport_state_t state, jack_nframes_t nframes, jack_position_t ∗pos, int new_pos, void ∗arg)

  The JACK timebase function defined here sets the JACK position structure.
- long get_current_jack_position (void ∗arg)
- void jack_session_callback (jack_session_event_t ∗ev, void ∗arg)

  Set the m_jsession_ev (event) value of the perform object.

13.24.1 Constructor & Destructor Documentation

13.24.1.1 jack_assistant()

```
seq64::jack_assistant::jack_assistant (
            perform & parent,
            midibpm bpminute = SEQ64_DEFAULT_BPM,
            int ppqn = SEQ64_USE_DEFAULT_PPQN,
            int bpmeasure = SEQ64_DEFAULT_BEATS_PER_MEASURE,
            int beatwidth = SEQ64_DEFAULT_BEAT_WIDTH )
```

Note that the perform object currently calls jack_assistant::init(), but that call could be made here instead.

Parameters

parent	Provides a reference to the main perform object that needs to control JACK event.
bpminute	The beats/minute to set up JACK to use (applies to Master setup).
ppqn	The parts-per-quarter-note setting in force for the present tune.
bpmeasure	The beats/measure (time signature numerator) in force for the present tune.
beatwidth	The beat-width (time signature denominator) in force for the present tune.

13.24.1.2 ∼jack_assistant()

```
seq64::jack_assistant::~jack_assistant ( )
```

The perform object currently calls jack_assistant::deinit(), but that call could be made here instead.

13.24.2 Member Function Documentation

13.24.2.1 parent() [1/2]

```
perform& seq64::jack_assistant::parent ( )  [inline]
```

13.24.2.2 parent() [2/2]

```
const perform& seq64::jack_assistant::parent ( ) const  [inline]
```

13.24.2.3 is_running()

```
bool seq64::jack_assistant::is_running ( ) const  [inline]
```

13.24.2.4 is_master()

```
bool seq64::jack_assistant::is_master ( ) const  [inline]
```

13.24.2.5 get_ppqn()

```
int seq64::jack_assistant::get_ppqn ( ) const  [inline]
```

13.24.2.6 get_beat_width()

```
int seq64::jack_assistant::get_beat_width ( ) const  [inline]
```

13.24.2.7 set_beat_width()

```
void seq64::jack_assistant::set_beat_width (
            int bw )  [inline]
```

Parameters

bw	Provides the beat-width (denominator of the time signature) value to set.

13.24.2.8 get_beats_per_measure()

```
int seq64::jack_assistant::get_beats_per_measure ( ) const  [inline]
```

13.24.2.9 set_beats_per_measure()

```
void seq64::jack_assistant::set_beats_per_measure (
            int bpm )  [inline]
```

Parameters

bpm	Provides the beats/measure (numerator of the time signature) value to set.

13.24.2.10 get_beats_per_minute()

```
midibpm seq64::jack_assistant::get_beats_per_minute ( ) const  [inline]
```

13.24.2.11 set_beats_per_minute()

```
void seq64::jack_assistant::set_beats_per_minute (
            midibpm bpminute )  [inline]
```

We should consider adding validation. However, perform::set_beats_per_minute() does validate already.

Parameters

bpminute	Provides the beats/minute value to set.

13.24.2.12 transport_state()

```
jack_transport_state_t seq64::jack_assistant::transport_state ( ) const  [inline]
```

13.24.2.13 transport_not_starting()

```
bool seq64::jack_assistant::transport_not_starting ( ) const  [inline]
```

13.24.2.14 init()

```
bool seq64::jack_assistant::init ( )
```

Then we become a new client of the JACK server.

A sync callback is needed for polling of slow-sync clients. But seq24/sequencer64 are not slow-sync clients. We don't really need to be a slow-sync client, as far as we can tell. We can't get JACK working exactly the way it does in seq24 without the callback in place. Plus, it does things important to the setup of JACK. So now this setup is permanent.

Jack transport settings:

```
There are three settings:  On, Master, and Master Conditional.
Currently, they can all be selected in the user-interface's File /
Options / JACK/LASH page.  We really want only the proper combinations
to be set, for clarity (the user-interface now takes care of this.  We
need to initialize if any of them are set, and the
rc_settings::with_jack() function tells us that.
```

jack_set_process_callback() patch:

```
Implemented first patch from freddix/seq24 GitHub project, to fix JACK
transport.  One line of code.  Well, we added some error-checking. :-)
Found some old notes on the Web the this patch really only works (to
prevent seq24 freeze) if seq24 is set as JACK Master, or if another
client application, such as Qtractor, is running as JACK Master (and
then seq24 will apparently follow it).
```

STAZED: The call to jack_timebase_callback() to supply jack with BBT, etc would occasionally fail when the *pos information had zero or some garbage in the pos.frame_rate variable. This would occur when there was a rapid change of frame position by another client... i.e. qjackctl. From the jack API:

"pos address of the position structure for the next cycle; pos->frame will be its frame number. If new_pos is FALSE, this structure contains extended position information from the current cycle. If TRUE, it contains whatever was set by the requester. The timebase_callback's task is to update the extended information here."

The "If TRUE" line seems to be the issue. It seems that qjackctl does not always set pos.frame_rate so we get garbage and some strange BBT calculations that display in qjackctl. So we need to set it here and just use m_↩ jack_frame_rate for calculations instead of pos.frame_rate.

Returns

Returns true if JACK is now considered to be running (or if it was already running.)

13.24.2.15 deinit()

```
bool seq64::jack_assistant::deinit ( )
```

Returns

Returns the value of m_jack_running, which should be false.

13.24.2.16 session_event()

```
bool seq64::jack_assistant::session_event ( )
```

ca 2015-07-24 Just a note: The OMA (OpenMandrivaAssociation) patch was already applied to seq24 v.0.9.2. It put quotes around the –file argument. However, the –file option doesn't work, so let's change that line.

```
sequencer64 --file \"${SESSION_DIR}file.mid\" --jack_session_uuid
```

Why are we using a Glib::ustring here? Convenience. But with C++11, we could use a lexical_cast<>. No more ustring, baby! It doesn't really matter; this function can call Gtk::Main::quit(), via the parent's gui().quit() function.

Returns

Always returns false.

13.24.2.17 activate()

```
bool seq64::jack_assistant::activate ( )
```

Returns

Returns true if the m_jack_client pointer is null, which means only that we're not running JACK. Also returns true if the pointer exists and the jack_active() call succeeds.

Side-effect(s) The m_jack_running and m_jack_master flags are falsified in jack_activate() fails.

13.24.2.18 start()

```
void seq64::jack_assistant::start ( )
```

This function assumes that m_jack_client is not null, if m_jack_running is true.

Found this note in the Hydrogen code:

```
When jack_transport_start() is called, it takes effect from the next
processing cycle.  The location info from the timebase_master, if
there is one, will not be available until the _next_ next cycle.  The
code must therefore wait one cycle before syncing up with
timebase_master.
```

13.24.2.19 stop()

```
void seq64::jack_assistant::stop ( )
```

This function assumes that m_jack_client is not null, if m_jack_running is true.

13.24.2.20 position()

```
void seq64::jack_assistant::position (
            bool songmode,
            midipulse tick = 0 )
```

This new position takes effect in two process cycles. If there are slow-sync clients and the transport is already rolling, it will enter the JackTransportStarting state and begin invoking their sync_callbacks until ready. This function is realtime-safe.

```
http://jackaudio.org/files/docs/html/transport-design.html
```

This position() function is called via perform::position_jack() in the mainwnd, perfedit, perfroll, and seqroll graphical user-interface support objects.

The code that was disabled sets the current tick to 0 or, if state was true, to the leftmost tick (which is probably the position of the L marker). The current tick is then converted to a frame number, and then we locate the transport to that position. We're going to enable this code, but make it dependent on a new boolean parameter that defaults to false, in anticipation of trying it out later.

Stazed:

```
The jack_frame calculation is all that is needed to change JACK
position. The BBT calculation can be sent, but will be overridden by the
first call to jack_timebase_callback() of any Master set. If no Master
is set, then the BBT will display the new position but will not change
it, even if the transport is rolling. There is no need to send BBT on
position change -- the fact that jack_transport_locate() exists and only
uses the frame position is proof that BBT is not needed! Upon further
reflection, why not send BBT?  Because other programs do not... let's
follow convention.  The calculation for jack_transport_locate(), works,
is simpler, and does not send BBT. The calculation for
jack_transport_reposition() will be commented out again.
jack_BBT_position() is not necessary to change jack position!
```

Note that there are potentially a couple of divide-by-zero opportunities in this function.

Helgrind complains about a possible data race involving jack_transport_locate() when starting playing.

Parameters

songmode	True if the caller wants to position while in Song mode.

Alternate parameter to_left_tick (non-seq32 version):

```
If true, the current tick is set to the leftmost tick, instead of the
0th tick.  Now used, but only if relocate is true.  One question is,
do we want to perform this function if rc().with_jack_transport() is
true?  Seems like we should be able to do it only if m_jack_master is
true.
```

Parameters

tick	If using Song mode for this call then this value is set as the "current tick" value. If it's value is bad (SEQ64_NULL_MIDIPULSE), then this parameter is set to 0 before being used.

13.24.2.21 output()

```
bool seq64::jack_assistant::output (
            jack_scratchpad & pad )
```

This code comes from perform::output_func() from seq24.

Note

Follow up on this note found "out there": "Maybe I'm wrong but if I understood correctly, recent jack1 transport no longer goes into Jack_Transport_Starting state before going to Jack_Transport_Rolling (this was deliberately dropped), but seq24 currently needs this to start off with JACK transport." On the other hand, some people have no issues. This may have been due to the lack of m_jack_pos initialization.

Stazed:

```
Another note about JACK.  If another JACK client supplies tempo/BBT
different from seq42 (as Master), the perfroll grid will be incorrect.
Perfroll uses internal temp/BBT and cannot update on the fly. Even if
seq42 could support tempo/BBT changes, all info would have to be
available before the transport start, to work.  For this reason, the
tempo/BBT info will be plugged from the seq42 internal settings here,
always. This is the method used by probably all other JACK clients
with some sort of time-line. The JACK API indicates that BBT is
optional and AFIK, other sequencers only use frame & frame_rate from
JACK for internal calculations. The tempo and BBT info is always
internal. Also, if there is no Master set, then we would need to plug
it here to follow the JACK frame anyways.
```

Parameters

pad	Provides a JACK scratchpad for sharing certain items between the perform object and the jack_assistant object.

Returns

Returns true if JACK is running.

13.24.2.22 set_ppqn()

```
void seq64::jack_assistant::set_ppqn (
            int ppqn )  [inline]
```

We should consider adding validation. But it is used by perform.

Parameters

ppqn	Provides the PPQN value to set.

13.24.2.23 get_jack_tick()

```
double seq64::jack_assistant::get_jack_tick ( ) const  [inline]
```

13.24.2.24 get_jack_pos()

```
const jack_position_t& seq64::jack_assistant::get_jack_pos ( ) const  [inline]
```

13.24.2.25 toggle_jack_mode()

```
void seq64::jack_assistant::toggle_jack_mode ( )  [inline]
```

13.24.2.26 set_jack_mode()

```
void seq64::jack_assistant::set_jack_mode (
            bool mode )  [inline]
```

13.24.2.27 get_jack_mode()

```
bool seq64::jack_assistant::get_jack_mode ( ) const  [inline]
```

13.24.2.28 get_jack_stop_tick()

```
midipulse seq64::jack_assistant::get_jack_stop_tick ( ) const  [inline]
```

13.24.2.29 set_jack_stop_tick()

```
void seq64::jack_assistant::set_jack_stop_tick (
            long tick )  [inline]
```

13.24.2.30 jack_frame_rate()

```
jack_nframes_t seq64::jack_assistant::jack_frame_rate ( ) const  [inline]
```

13.24.2.31 get_follow_transport()

```
bool seq64::jack_assistant::get_follow_transport ( ) const  [inline]
```

13.24.2.32 set_follow_transport()

```
void seq64::jack_assistant::set_follow_transport (
            bool aset )  [inline]
```

13.24.2.33 toggle_follow_transport()

```
void seq64::jack_assistant::toggle_follow_transport ( )  [inline]
```

13.24.2.34 toggle_song_start_mode()

```
bool seq64::jack_assistant::toggle_song_start_mode ( )
```

13.24.2.35 song_start_mode()

```
bool seq64::jack_assistant::song_start_mode ( ) const
```

13.24.2.36 set_start_from_perfedit()

```
void seq64::jack_assistant::set_start_from_perfedit (
            bool start )
```

13.24.2.37 client()

```
jack_client_t * seq64::jack_assistant::client ( ) const
```

13.24.2.38 client_name()

```
const std::string& seq64::jack_assistant::client_name ( ) const  [inline]
```

13.24.2.39 client_uuid()

```
const std::string& seq64::jack_assistant::client_uuid ( ) const  [inline]
```

13.24.2.40 set_jack_running()

```
void seq64::jack_assistant::set_jack_running (
            bool flag )  [inline], [private]
```

Parameters

flag	Provides the is-running value to set.

13.24.2.41 tick_multiplier()

```
double seq64::jack_assistant::tick_multiplier ( ) const  [inline], [private]
```

Should we change 4.0 to a member value? What does it mean?

Returns

Returns the multiplier to convert a JACK tick value according to the PPQN, ticks/beat, and beat-type settings.

13.24.2.42 client_open()

```
jack_client_t * seq64::jack_assistant::client_open (
            const std::string & clientname )  [private]
```

Parameters

clientname	Provides the name of the client, used in the call to create_jack_client(). By default, this name is the macro SEQ64_PACKAGE (i.e. "sequencer64").

Returns

Returns a pointer to the JACK client if JACK has opened the client connection successfully. Otherwise, a null pointer is returned.

13.24.2.43 get_jack_client_info()

```
void seq64::jack_assistant::get_jack_client_info ( )  [private]
```

Sets m_jack_client_name and m_jack_client_info as side-effects.

13.24.2.44 show_position()

```
void seq64::jack_assistant::show_position (
            const jack_position_t & pos ) const  [private]
```

This function is meant for experimenting and learning.

The fields of this structure are as follows. Only the fields we care about are shown.

```
    jack_nframes_t      frame_rate:     current frame rate (per second)
    jack_nframes_t      frame:          frame number, always present
    jack_position_bits_t valid:         which other fields are valid


JackPositionBBT:
    int32_t             bar:            current bar
    int32_t             beat:           current beat-within-bar
    int32_t             tick:           current tick-within-beat
    double              bar_start_tick
    float               beats_per_bar:  time signature "numerator"
    float               beat_type:      time signature "denominator"
    double              ticks_per_beat
    double              beats_per_minute


JackBBTFrameOffset:
    jack_nframes_t      bbt_offset;     frame offset for the BBT fields


Only the most "important" and time-varying fields are shown. The format
output is brief and inscrutable unless you read this format example:
```

```
    nnnnn frame B:B:T N/D TPB BPM BBT
      ^     ^     ^   ^ ^  ^   ^   ^
      |     |     |   | |  |   |   |
      |     |     |   | |  |   |    -------- bbt_offset (frame), even if invalid
      |     |     |   | |  |    ------------ beats_per_minute
      |     |     |   | |   ----------------- ticks_per_beat (PPQN * 10?)
      |     |     |   |  ------------------- beat_type (denominator)
      |     |     |    ---------------------- beats_per_bar (numerator)
      |     |      -------------------------- bar : beat : tick
      |      ------------------------------- frame (number)
       ---------------------------------- the "valid" bits


The "valid" field is shown as bits in the same bit order as shown here, but
represented as a five-character string, "nnnnn", n = 0 or 1:


    JackVideoFrameOffset = 0x100
    JackAudioVideoRatio  = 0x080
    JackBBTFrameOffset   = 0x040
    JackPositionTimecode = 0x020
    JackPositionBBT      = 0x010


We care most about nnnnn = "00101" in our experiments (the most common
output will be "00001").  And we don't worry about non-integer
measurements... we truncate them to integers.  Change the output format if
you want to play with non-Western timings.
```

Parameters

pos	The JACK position structure to dump.

13.24.2.45 sync()

```
int seq64::jack_assistant::sync (
            jack_transport_state_t state = (jack_transport_state_t)(-1) )  [private]
```

Sequencer64 is not a slow-sync client (and Stazed support doesn't use it), so that callback is not really needed, but we probably need this sub-function here to start out with the right values for interacting with JACK.

Note the call to jack_transport_query(). This call is *not* is seq24, but seems to be needed in sequencer64 because we put m_jack_pos in the initializer list, which sets all its fields to 0. Seq24 accesses m_jack_pos before it ever gets set, but its fields have values. These values are bogus, but are consistent from run to run on my computer, and allow seq24 to follow another JACK Master, on some computers. It explains why people had different experiences with JACK sync.

If we explicity call jack_transport_query() here, without changing the *state* parameter, then sequencer64 also can follow another JACK Master. (CURRENTLY BUGGY!)

Note that we should consider massaging the following jack_position_t members to set them to 0 (or 0.0) if less than 1.0 or 0.5:

- bar_start_tick
- ticks_per_beat
- beats_per_minute
- frame_time
- next_time
- audio_frames_per_video_frame

Also, why does bbt_offset start at 2128362496?

Parameters

state	The JACK transport state to be set.

13.24.2.46 set_position()

```
void seq64::jack_assistant::set_position (
            midipulse currenttick )  [private]
```

We might be able to use it in other functions.

Computing the BBT information from the frame number is relatively simple here, but would become complex if we supported tempo or time signature changes at specific locations in the transport timeline.

```
ticks * 10 = jack ticks;
jack ticks / ticks per beat = num beats;
num beats / beats per minute = num minutes
num minutes * 60 = num seconds
num secords * frame_rate  = frame
```

Parameters

currenttick	Provides the current position to be set.

13.24.2.47 info_message()

```
bool seq64::jack_assistant::info_message (
            const std::string & msg )  [static], [private]
```

Adds markers and a newline.

Parameters

msg	The message to print, sans the newline.

Returns

Returns true.

13.24.2.48 error_message()

```
bool seq64::jack_assistant::error_message (
            const std::string & msg )  [static], [private]
```

Adds markers, and sets m_jack_running to false.

Parameters

msg	The message to print, sans the newline.

Returns

Returns false for convenience/brevity in setting function return values.

13.24.3 Friends And Related Function Documentation

13.24.3.1 jack_transport_callback

```
int jack_transport_callback (
            jack_nframes_t nframes,
            void * arg )  [friend]
```

13.24.3.2 jack_shutdown_callback

```
void jack_shutdown_callback (
            void * arg )  [friend]
```

Parameters

arg	Points to the jack_assistant in charge of JACK support for the perform object.

13.24.3.3 jack_sync_callback

```
int jack_sync_callback (
            jack_transport_state_t state,
            jack_position_t * pos,
            void * arg )  [friend]
```

This JACK synchronization callback informs the specified perform object of the current state and parameters of JACK.

The transport state will be:

```
-   JackTransportStopped when a new position is requested.
-   JackTransportStarting when the transport is waiting to start.
-   JackTransportRolling when the timeout has expired, and the
    position is now a moving target.
```

This is the slow-sync callback, which the stazed code replaces with jack_transport_callback().

Parameters

state	The JACK Transport state.
pos	The JACK position value.
arg	The pointer to the jack_assistant object. Currently not checked for nullity, nor dynamic-casted.

Returns

Returns 1 if the function works, and 0 if something was wrong.

13.24.3.4 jack_timebase_callback

```
void jack_timebase_callback (
             jack_transport_state_t state,
             jack_nframes_t nframes,
             jack_position_t * pos,
             int new_pos,
             void * arg )  [friend]
```

The original version of the function worked properly with Hydrogen, but not with Klick. The new code seems to work with both. More testing and clarification is needed. This new code was "discovered" in the source-code for the "SooperLooper" project:

```
    http://essej.net/sooperlooper/
```

The first difference with the new code is that it handles the case where the JACK position is moved (new_pos == true). If this is true, and the JackPositionBBT bit is off in pos->valid, then the new BBT value is set.

The seconds set of differences are in the "else" clause. In the new code, it is very simple: calculate the new tick value, back it off by the number of ticks in a beat, and perhaps go to the first beat of the next bar.

In the old code (complex!), the simple BBT adjustment is always made. This changes (perhaps) the beats_per_bar, beat_type, etc. We need to make these settings use the actual global values for beats set for Sequencer64. Then, if transitioning from JackTransportStarting to JackTransportRolling (instead of checking new_pos!), the BBT values (bar, beat, and tick) are finally adjusted. Here are the steps, with old and new steps noted:

```
-#  Calculate the "delta" ticks based on the current frame, the
    ticks_per_beat, the beats_per_minute, and the frame_rate.  The old
    code saves this in a local, the new code assigns it to pos->tick.
-#  Old code: save this delta as a positive value.
-#  Figure out the settings and modify bar, beat, tick, and
    bar_start_tick.  The old and new code seem to have the same intent,
    but it seems like the new code is faster and also correct.
    -   Old code:  Calculations are made by division and mod
        operations.
    -   New code:  Calculations are made by increments and decrements
        in a while loop.
```

Stazed:

```
The call to jack_timebase_callback() to supply JACK with BBT, etc. would
occasionally fail when the pos information had zero or some garbage in
the pos.frame_rate variable. This would occur when there was a rapid
change of frame position by another client... i.e. qjackctl.  From the
JACK API:

    pos   address of the position structure for the next cycle;
    pos->frame will be its frame number. If new_pos is FALSE, this
    structure contains extended position information from the current
    cycle.  If TRUE, it contains whatever was set by the requester.
    The timebase_callback's task is to update the extended information
    here."

    The "If TRUE" line seems to be the issue. It seems that qjackctl
    does not always set pos.frame_rate so we get garbage and some
    strange BBT calculations that display in qjackctl. So we need to
    set it here and just use m_jack_frame_rate for calculations instead
    of pos.frame_rate.
```

Parameters

state	Indicates the current state of JACK transport.
nframes	The number of JACK frames in the current time period.
pos	Provides the position structure to be filled in, the address of the position structure for the next cycle; pos->frame will be its frame number. If new_pos is FALSE, this structure contains extended position information from the current cycle. If TRUE, it contains whatever was set by the requester. The timebase_callback's task is to update the extended information here.
new_pos	TRUE (non-zero) for a newly requested pos, or for the first cycle after the timebase_callback is defined. This is usually 0 in Sequencer64 at present, and 1 if one, say, presses "rewind" in qjackctl.
arg	Provides the jack_assistant pointer, currently unchecked for nullity.

13.24.3.5 get_current_jack_position

```
long get_current_jack_position (
             void * arg )  [friend]
```

Warning

Currently valgrind flags j->client() as uninitialized.

13.24.3.6 jack_session_callback

```
void jack_session_callback (
             jack_session_event_t * ev,
             void * arg )  [friend]
```

Glib is then used to connect in perform::jack_session_event(). However, the perform object's GUI-support interface is used instead of the following, so that the libseq64 library can be independent of a specific GUI framework:

```
Glib::signal_idle().
    connect(sigc::mem_fun(*jack, &jack_assistant::session_event));
```

Parameters

ev	The JACK event to be set.
arg	The pointer to the jack_assistant object. Currently not checked for nullity.

13.24.4 Field Documentation

13.24.4.1 sm_status_pairs

```
jack_status_pair_t seq64::jack_assistant::sm_status_pairs[]  [static], [private]
```

13.24.4.2 m_jack_parent

```
perform& seq64::jack_assistant::m_jack_parent  [private]
```

13.24.4.3 m_jack_client

```
jack_client_t* seq64::jack_assistant::m_jack_client  [mutable], [private]
```

13.24.4.4 m_jack_client_name

```
std::string seq64::jack_assistant::m_jack_client_name  [private]
```

We might show this in the user-interface at some point.

13.24.4.5 m_jack_client_uuid

```
std::string seq64::jack_assistant::m_jack_client_uuid  [private]
```

We might show this in the user-interface at some point.

13.24.4.6 m_jack_frame_current

```
jack_nframes_t seq64::jack_assistant::m_jack_frame_current  [private]
```

13.24.4.7 m_jack_frame_last

```
jack_nframes_t seq64::jack_assistant::m_jack_frame_last  [private]
```

Also used in incrementing m_jack_tick.

13.24.4.8 m_jack_pos

```
jack_position_t seq64::jack_assistant::m_jack_pos  [private]
```

This structure is filled via a call to jack_transport_query(). It holds, among other items, the frame rate (often 48000), the ticks/beat, and the beats/minute.

13.24.4.9 m_jack_transport_state

```
jack_transport_state_t seq64::jack_assistant::m_jack_transport_state  [private]
```

Common values are JackTransportStopped, JackTransportRolling, and JackTransportLooping.

13.24.4.10 m_jack_transport_state_last

```
jack_transport_state_t seq64::jack_assistant::m_jack_transport_state_last  [private]
```

13.24.4.11 m_jack_tick

```
double seq64::jack_assistant::m_jack_tick  [private]
```

13.24.4.12 m_jsession_ev

```
jack_session_event_t* seq64::jack_assistant::m_jsession_ev  [private]
```

Used in the session_event() function.

13.24.4.13 m_jack_running

```
bool seq64::jack_assistant::m_jack_running  [private]
```

13.24.4.14 m_jack_master

```
bool seq64::jack_assistant::m_jack_master  [private]
```

13.24.4.15 m_jack_frame_rate

```
jack_nframes_t seq64::jack_assistant::m_jack_frame_rate  [private]
```

Just in case. QJackCtl does not always set pos.frame_rate, so we get garbage and some strange BBT calculations displayed in qjackctl.

13.24.4.16 m_toggle_jack

```
bool seq64::jack_assistant::m_toggle_jack  [private]
```

13.24.4.17 m_jack_stop_tick

```
midipulse seq64::jack_assistant::m_jack_stop_tick  [private]
```

Repositions the transport marker.

13.24.4.18 m_follow_transport

```
bool seq64::jack_assistant::m_follow_transport  [private]
```

13.24.4.19 m_ppqn

```
int seq64::jack_assistant::m_ppqn  [private]
```

It is used for calculating ticks/beat (pulses/beat) and for setting the tick position.

13.24.4.20 m_beats_per_measure

```
int seq64::jack_assistant::m_beats_per_measure  [private]
```

13.24.4.21 m_beat_width

```
int seq64::jack_assistant::m_beat_width  [private]
```

13.24.4.22 m_beats_per_minute

```
midibpm seq64::jack_assistant::m_beats_per_minute  [private]
```

13.25 seq64::jack_scratchpad Class Reference

Provide a temporary structure for passing data and results between a perform and jack_assistant object.

Data Fields

- double js_current_tick
  Holds current location.
- double js_total_tick
  Current location ignoring L/R.
- double js_clock_tick
  Identical to js_total_tick.
- bool js_jack_stopped
  Flags perform::inner_stop().
- bool js_dumping
  Non-JACK playback in progress?
- bool js_init_clock
  We now have a good JACK lock.
- bool js_looping
  seqedit loop button is active.
- bool js_playback_mode
  Song mode (versus live mode).
- double js_ticks_converted
  Keeps track of ...?
- double js_ticks_delta
  Minor difference in tick.
- double js_ticks_converted_last
  Keeps track of position?
- long js_delta_tick_frac
  More precision for seq24 0.9.3.

13.25.1 Detailed Description

The jack_assistant class already has access to the members of perform, but it needs access to and modification of "local" variables in perform::output_func(). This scratchpad is useful even if JACK support is not enabled.

13.25.2 Field Documentation

13.25.2.1 js_current_tick

```
double seq64::jack_scratchpad::js_current_tick
```

13.25.2.2 js_total_tick

```
double seq64::jack_scratchpad::js_total_tick
```

13.25.2.3 js_clock_tick

```
double seq64::jack_scratchpad::js_clock_tick
```

13.25.2.4 js_jack_stopped

```
bool seq64::jack_scratchpad::js_jack_stopped
```

13.25.2.5 js_dumping

```
bool seq64::jack_scratchpad::js_dumping
```

13.25.2.6 js_init_clock

```
bool seq64::jack_scratchpad::js_init_clock
```

13.25.2.7 js_looping

```
bool seq64::jack_scratchpad::js_looping
```

13.25.2.8 js_playback_mode

```
bool seq64::jack_scratchpad::js_playback_mode
```

13.25.2.9 js_ticks_converted

```
double seq64::jack_scratchpad::js_ticks_converted
```

13.25.2.10 js_ticks_delta

```
double seq64::jack_scratchpad::js_ticks_delta
```

13.25.2.11 js_ticks_converted_last

```
double seq64::jack_scratchpad::js_ticks_converted_last
```

13.25.2.12 js_delta_tick_frac

```
long seq64::jack_scratchpad::js_delta_tick_frac
```

13.26 seq64::jack_status_pair_t Struct Reference

Provides an internal type to make it easier to display a specific and accurate human-readable message when a JACK operation fails.

Data Fields

- unsigned jf_bit

  Holds one of the bit-values from jack_status_t, which is defined as an "enum JackStatus" type.
- std::string jf_meaning

  Holds a textual description of the corresponding status bit.

13.26.1 Field Documentation

13.26.1.1 jf_bit

```
unsigned seq64::jack_status_pair_t::jf_bit
```

13.26.1.2 jf_meaning

```
std::string seq64::jack_status_pair_t::jf_meaning
```

13.27 seq64::keybindentry Class Reference

Class for management of application key-bindings.

Inherits Entry.

Public Member Functions

- keybindentry (type t, unsigned int *location_to_write=nullptr, perform *p=nullptr, long s=0)

  This constructor initializes the member with values dependent on the value type provided in the first parameter.
- void set (unsigned int val)

  Gets the key name from the integer value; if there is one, then it is printed into a temporary buffer, otherwise the value is printed into that buffer as is.
- virtual bool on_key_press_event (GdkEventKey *event)

  Handles a key press by calling set() with the event's key value.

Private Types

- enum type {
  location,
  events,
  groups }

  Provides the type of keybindings that can be made.

Private Attributes

- unsigned int * m_key

  Points to the value of the key that is part of this key-binding.
- type m_type

  Stores the type of key-binding.
- perform * m_perf

  Stores an optional pointer to a perform object.
- long m_slot

  Provides an index into a set of group-keys or event-keys.

Friends

- class options

13.27.1 Member Enumeration Documentation

13.27.1.1 type

```
enum seq64::keybindentry::type  [private]
```

Enumerator

location	Used for handling a keystroke made while a keyboard-options field is active, for selecting a key via the keyboard, and binding to pattern/sequence boxes, we think. It is used in the options class to associate a key with the binding.
events	Used for binding to events.
groups	Used for binding to groups.

13.27.2 Constructor & Destructor Documentation

13.27.2.1 keybindentry()

```
seq64::keybindentry::keybindentry (
            type t,
            unsigned int * location_to_write = nullptr,
            perform * p = nullptr,
            long s = 0 )
```

Usage In options, a pointer to a new key-binding entry is managed by calling `keybindentry(keybindentry::location, &perf->keyname)`.

Parameters

t	Provides the type of key-binding: location, events, or groups.
location_to_write	The location that holds the value of the key associated with the key-binding. The default value of this parameter is the null pointer.
p	Points to the performance object used with this key-binding. The default value of this parameter is the null pointer.
s	Provides the slot value for this key-binding. The default value of this parameter is zero.

13.27.3 Member Function Documentation

13.27.3.1 set()

```
void seq64::keybindentry::set (
            unsigned int val )
```

Then we call set_text(buf). The set_width_char() function is then called.

13.27.3.2 on_key_press_event()

```
bool seq64::keybindentry::on_key_press_event (
            GdkEventKey * event )  [virtual]
```

This value is used to set the event or key depending on the value of m_type.

Parameters

event	Provides the key-press event.

Returns

Returns the result of the call to Entry::on_key_press_event().

13.27.4 Friends And Related Function Documentation

13.27.4.1 options

```
friend class options  [friend]
```

13.27.5 Field Documentation

13.27.5.1 m_key

```
unsigned int* seq64::keybindentry::m_key  [private]
```

Not yet sure by the address of this key value is needed. It can be a null pointer, as well.

13.27.5.2 m_type

```
type seq64::keybindentry::m_type  [private]
```

13.27.5.3 m_perf

```
perform* seq64::keybindentry::m_perf  [private]
```

13.27.5.4 m_slot

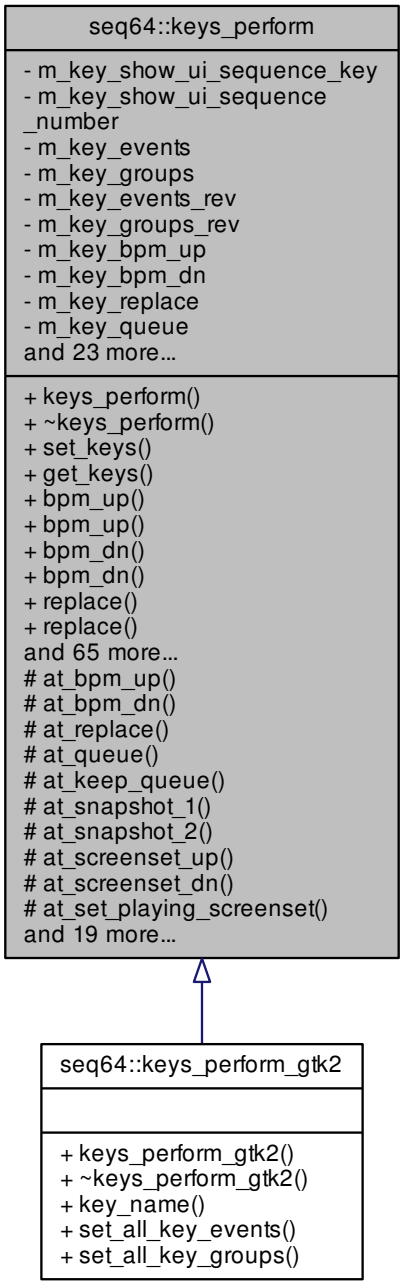
```
long seq64::keybindentry::m_slot  [private]
```

(This item should be changed to unsigned int, though.)

13.28 seq64::keys_perform Class Reference

This class supports the performance mode.

Inheritance diagram for seq64::keys_perform:



Public Member Functions

- keys_perform ()

  This construction initializes a vast number of member variables, some of them public!
- virtual ~keys_perform ()

  The destructor sets some running flags to false, signals this condition, then joins the input and output threads if the were launched.

- void set_keys (const keys_perform_transfer &kpt)

  Copies fields from the transfer structure in this object.
- void get_keys (keys_perform_transfer &kpt)

  Copies fields from this object into the transfer structure.
- unsigned int bpm_up () const

  'Getter' function for member m_key_bpm_up
- void bpm_up (unsigned int x)

  'Setter' function for member m_key_bpm_up
- unsigned int bpm_dn () const

  'Getter' function for member m_key_bpm_dn
- void bpm_dn (unsigned int x)

  'Setter' function for member m_key_bpm_dn
- unsigned int replace () const

  'Getter' function for member m_key_replace
- void replace (unsigned int x)

  'Setter' function for member m_key_replace
- unsigned int queue () const

  'Getter' function for member m_key_queue
- void queue (unsigned int x)

  'Setter' function for member m_key_queue
- unsigned int keep_queue () const

  'Getter' function for member m_key_keep_queue
- void keep_queue (unsigned int x)

  'Setter' function for member m_key_keep_queue
- unsigned int snapshot_1 () const

  'Getter' function for member m_key_snapshot_1
- void snapshot_1 (unsigned int x)

  'Setter' function for member m_key_snapshot_1
- unsigned int snapshot_2 () const

  'Getter' function for member m_key_snapshot_2
- void snapshot_2 (unsigned int x)

  'Setter' function for member m_key_snapshot_2
- unsigned int screenset_up () const

  'Getter' function for member m_key_screenset_up
- void screenset_up (unsigned int x)

  'Setter' function for member m_key_screenset_up
- unsigned int screenset_dn () const

  'Getter' function for member m_key_screenset_dn
- void screenset_dn (unsigned int x)

  'Setter' function for member m_key_screenset_dn
- unsigned int set_playing_screenset () const

  'Getter' function for member m_key_playing_screenset
- void set_playing_screenset (unsigned int x)

  'Setter' function for member m_key_playing_screenset
- unsigned int group_on () const

  'Getter' function for member m_key_group_on
- void group_on (unsigned int x)

  'Setter' function for member m_key_group_on
- unsigned int group_off () const

  'Getter' function for member m_key_group_off
- void group_off (unsigned int x)

'Setter' function for member m_key_group_off

- unsigned int group_learn () const

  'Getter' function for member m_key_group_learn
- void group_learn (unsigned int x)

  'Setter' function for member m_key_group_learn
- unsigned int start () const

  'Getter' function for member m_key_start
- void start (unsigned int x)

  'Setter' function for member m_key_start
- unsigned int pause () const

  'Getter' function for member m_key_pause
- void pause (unsigned int x)

  'Setter' function for member m_key_pause
- unsigned int pattern_edit () const

  'Getter' function for member m_key_pattern_edit
- void pattern_edit (unsigned int x)

  'Setter' function for member m_key_pattern_edit
- unsigned int event_edit () const

  'Getter' function for member m_key_event_edit
- void event_edit (unsigned int x)

  'Setter' function for member m_key_event_edit
- unsigned int stop () const

  'Getter' function for member m_key_stop
- void stop (unsigned int x)

  'Setter' function for member m_key_stop
- unsigned int song_mode () const
- void song_mode (unsigned int key)
- unsigned int menu_mode () const
- void menu_mode (unsigned int key)
- unsigned int follow_transport () const
- void follow_transport (unsigned int key)
- unsigned int fast_forward () const
- void fast_forward (unsigned int key)
- unsigned int rewind () const
- void rewind (unsigned int key)
- unsigned int pointer_position () const
- void pointer_position (unsigned int key)
- unsigned int toggle_mutes () const
- void toggle_mutes (unsigned int key)
- unsigned int toggle_jack () const
- void toggle_jack (unsigned int key)
- unsigned int tap_bpm () const
- void tap_bpm (unsigned int key)
- bool show_ui_sequence_key () const

  'Getter' function for member m_key_show_ui_sequency_key
- void show_ui_sequence_key (bool flag)

  'Setter' function for member m_key_show_ui_sequency_key
- bool show_ui_sequence_number () const

  'Getter' function for member m_key_show_ui_sequence_number
- void show_ui_sequence_number (bool flag)

  'Setter' function for member m_key_show_ui_sequence_key
- SlotMap & get_key_events ()

'Getter' function for member m_key_events

- SlotMap & get_key_groups ()

  'Getter' function for member m_key_groups
- RevSlotMap & get_key_events_rev ()

  'Getter' function for member m_key_events_rev
- RevSlotMap & get_key_groups_rev ()

  'Getter' function for member m_key_groups_rev
- unsigned int lookup_keyevent_key (long seqnum)

  'Getter' function for member m_key_events_rev[seqnum];
- long lookup_keyevent_seq (unsigned int keycode)

  'Getter' function for member m_key_events_rev[keycode];
- unsigned int lookup_keygroup_key (long groupnum)

  'Getter' function for member m_key_events_rev[groupnum];
- long lookup_keygroup_group (unsigned int keycode)

  'Getter' function for member m_key_events_rev[keycode];
- virtual std::string key_name (unsigned int key) const

  Obtains the name of the key.
- virtual void set_all_key_events ()

  Provides base class functionality.
- virtual void set_all_key_groups ()

  Provides base class functionality.
- void set_key_event (unsigned int keycode, long sequence_slot)

  At construction time, this function sets up one keycode and one event slot.
- void set_key_group (unsigned int keycode, long group_slot)

  At construction time, this function sets up one keycode and one group slot.

Protected Types

- typedef std::map< unsigned int, long > SlotMap

  This typedef defines a map in which the key is the keycode, that is, the integer value of a keystroke, and the value is the pattern/sequence number or slot.
- typedef std::map< long, unsigned int > RevSlotMap

  This typedef is like SlotMap, but used for lookup in the other direction.

Protected Member Functions

- unsigned int * at_bpm_up ()

  The following are tricky ways to get at address of the key and group operation values so that we don't directly expose the members to manipulation.
- unsigned int * at_bpm_dn ()

  'Getter' function for member m_key_bpm_dn
- unsigned int * at_replace ()

  'Getter' function for member m_key_replace
- unsigned int * at_queue ()

  'Getter' function for member m_key_queue
- unsigned int * at_keep_queue ()

  'Getter' function for member m_key_keep_queue
- unsigned int * at_snapshot_1 ()

  'Getter' function for member m_key_snapshot_1
- unsigned int * at_snapshot_2 ()

'Getter' function for member m_key_snapshot_2

- unsigned int * at_screenset_up ()

  'Getter' function for member m_key_screenset_up

- unsigned int * at_screenset_dn ()

  'Getter' function for member m_key_screenset_dn

- unsigned int * at_set_playing_screenset ()

  'Getter' function for member m_key_playing_screenset

- unsigned int * at_group_on ()

  'Getter' function for member m_key_group_on

- unsigned int * at_group_off ()

  'Getter' function for member m_key_group_off

- unsigned int * at_group_learn ()

  'Getter' function for member m_key_group_learn

- unsigned int * at_start ()

  'Getter' function for member m_key_start

- unsigned int * at_pause ()

  'Getter' function for member m_key_pause

- unsigned int * at_song_mode ()

  'Getter' function for member m_key_song_mode

- unsigned int * at_toggle_jack ()

  'Getter' function for member m_key_toggle_jack

- unsigned int * at_menu_mode ()

  'Getter' function for member m_key_menu_mode

- unsigned int * at_follow_transport ()

  'Getter' function for member m_key_follow_transport

- unsigned int * at_fast_forward ()

  'Getter' function for member m_key_fast_forward

- unsigned int * at_rewind ()

  'Getter' function for member m_key_rewind

- unsigned int * at_pointer_position ()

  'Getter' function for member m_key_pointer_position

- unsigned int * at_toggle_mutes ()

  'Getter' function for member m_key_toggle_mutes

- unsigned int * at_tap_bpm ()

  'Getter' function for member m_key_tap_bpm

- unsigned int * at_pattern_edit ()

  'Getter' function for member m_key_pattern_edit

- unsigned int * at_event_edit ()

  'Getter' function for member m_key_event_edit

- unsigned int * at_stop ()

  'Getter' function for member m_key_stop

- bool * at_show_ui_sequence_key ()

  'Getter' function for member m_key_show_ui_sequence_key

- bool * at_show_ui_sequence_number ()

  'Getter' function for member m_key_show_ui_sequence_number

Private Attributes

- bool m_key_show_ui_sequence_key

  If set, shows the shortcut-keys on each filled pattern slot in the main window.
- bool m_key_show_ui_sequence_number

  If set, shows the sequence number on each filled pattern and empty pattern slot in the main window.
- SlotMap m_key_events

  Holds the mapping of keys to the pattern slots.
- SlotMap m_key_groups

  Holds the mapping of keys to the mute groups.
- RevSlotMap m_key_events_rev

  Holds the reverse mapping of the pattern slots to the keys.
- RevSlotMap m_key_groups_rev

  Holds the reverse mapping of the mute groups to the keys.
- unsigned int m_key_bpm_up

  Provides key assignments for some key sequencer features.
- unsigned int m_key_bpm_dn

  BPM down, semicolon.
- unsigned int m_key_replace

  Replace, Ctrl-L.
- unsigned int m_key_queue

  Queue, Ctrl-R.
- unsigned int m_key_keep_queue

  Keep queue, backslash.
- unsigned int m_key_snapshot_1

  Snapshot 1, Alt-L.
- unsigned int m_key_snapshot_2

  Snapshot 1, Alt-R.
- unsigned int m_key_screenset_up

  Set up, Right-].
- unsigned int m_key_screenset_dn

  Set down, Left-[.
- unsigned int m_key_set_playing_screenset

  Set set, Home key.
- unsigned int m_key_group_on

  Group on, igrave key.
- unsigned int m_key_group_off

  Group off, apostrophe!
- unsigned int m_key_group_learn

  Group learn, Insert.
- unsigned int m_key_start

  Start play, Space key.
- unsigned int m_key_pause

  Pause play, Period.
- unsigned int m_key_song_mode

  Song versus Live mode.
- unsigned int m_key_toggle_jack

  Toggle JACK connect.
- unsigned int m_key_menu_mode

  Menu enabled/disabled.
- unsigned int m_key_follow_transport

Toggle following JACK.

- unsigned int m_key_rewind

  Start rewind.
- unsigned int m_key_fast_forward

  Start fast-forward.
- unsigned int m_key_pointer_position

  Set progress to mouse.
- unsigned int m_key_toggle_mutes

  Toggle all patterns.
- unsigned int m_key_tap_bpm

  To tap out the BPM.
- unsigned int m_key_pattern_edit

  Show pattern editor.
- unsigned int m_key_event_edit

  Show event editor.
- unsigned int m_key_stop

  Stop play, Escape.

Friends

- class options
- class perform
- class optionsfile

13.28.1 Detailed Description

It provides a way a mapping keystrokes to sequencer actions and song settings.

13.28.2 Member Typedef Documentation

13.28.2.1 SlotMap

```
typedef std::map<unsigned int, long> seq64::keys_perform::SlotMap  [protected]
```

13.28.2.2 RevSlotMap

```
typedef std::map<long, unsigned int> seq64::keys_perform::RevSlotMap  [protected]
```

13.28.3 Constructor & Destructor Documentation

13.28.3.1 keys_perform()

```
seq64::keys_perform::keys_perform ( )
```

13.28.3.2 ~keys_perform()

```
seq64::keys_perform::~keys_perform ( )  [virtual]
```

Finally, any active patterns/sequences are deleted.

13.28.4 Member Function Documentation

13.28.4.1 set_keys()

```
void seq64::keys_perform::set_keys (
            const keys_perform_transfer & kpt )
```

This structure holds all of the key settings from the File / Options / Keyboard tab dialog.

Parameters

kpt	The structure that holds the values of the keys to be used for various purposes in controlling a performance live.

13.28.4.2 get_keys()

```
void seq64::keys_perform::get_keys (
            keys_perform_transfer & kpt )
```

Parameters

kpt	The structure that holds the values of the keys to be used for various purposes in controlling a performance live.

13.28.4.3 bpm_up() [1/2]

```
unsigned int seq64::keys_perform::bpm_up ( ) const  [inline]
```

13.28.4.4 bpm_up() [2/2]

```
void seq64::keys_perform::bpm_up (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.5 bpm_dn() [1/2]

```
unsigned int seq64::keys_perform::bpm_dn ( ) const  [inline]
```

13.28.4.6 bpm_dn() [2/2]

```
void seq64::keys_perform::bpm_dn (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.7 replace() [1/2]

```
unsigned int seq64::keys_perform::replace ( ) const  [inline]
```

13.28.4.8 replace() [2/2]

```
void seq64::keys_perform::replace (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.9 queue() [1/2]

```
unsigned int seq64::keys_perform::queue ( ) const  [inline]
```

13.28.4.10 queue() [2/2]

```
void seq64::keys_perform::queue (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.11 keep_queue() [1/2]

```
unsigned int seq64::keys_perform::keep_queue ( ) const  [inline]
```

13.28.4.12 keep_queue() [2/2]

```
void seq64::keys_perform::keep_queue (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.13 snapshot_1() [1/2]

```
unsigned int seq64::keys_perform::snapshot_1 ( ) const  [inline]
```

13.28.4.14 snapshot_1() [2/2]

```
void seq64::keys_perform::snapshot_1 (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.15 snapshot_2() [1/2]

```
unsigned int seq64::keys_perform::snapshot_2 ( ) const  [inline]
```

13.28.4.16 snapshot_2() [2/2]

```
void seq64::keys_perform::snapshot_2 (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.17 screenset_up() [1/2]

```
unsigned int seq64::keys_perform::screenset_up ( ) const  [inline]
```

13.28.4.18 screenset_up() [2/2]

```
void seq64::keys_perform::screenset_up (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.19 screenset_dn() [1/2]

```
unsigned int seq64::keys_perform::screenset_dn ( ) const  [inline]
```

13.28.4.20 screenset_dn() [2/2]

```
void seq64::keys_perform::screenset_dn (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.21 set_playing_screenset() [1/2]

```
unsigned int seq64::keys_perform::set_playing_screenset ( ) const  [inline]
```

13.28.4.22 set_playing_screenset() [2/2]

```
void seq64::keys_perform::set_playing_screenset (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.23 group_on() [1/2]

```
unsigned int seq64::keys_perform::group_on ( ) const  [inline]
```

13.28.4.24 group_on() [2/2]

```
void seq64::keys_perform::group_on (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.25 group_off() [1/2]

```
unsigned int seq64::keys_perform::group_off ( ) const  [inline]
```

13.28.4.26 group_off() [2/2]

```
void seq64::keys_perform::group_off (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.27 group_learn() [1/2]

```
unsigned int seq64::keys_perform::group_learn ( ) const  [inline]
```

13.28.4.28 group_learn() [2/2]

```
void seq64::keys_perform::group_learn (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.29 start() [1/2]

```
unsigned int seq64::keys_perform::start ( ) const  [inline]
```

13.28.4.30 start() [2/2]

```
void seq64::keys_perform::start (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.31 pause() [1/2]

```
unsigned int seq64::keys_perform::pause ( ) const  [inline]
```

13.28.4.32 pause() [2/2]

```
void seq64::keys_perform::pause (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.33 pattern_edit() [1/2]

```
unsigned int seq64::keys_perform::pattern_edit ( ) const  [inline]
```

13.28.4.34 pattern_edit() [2/2]

```
void seq64::keys_perform::pattern_edit (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.35 event_edit() [1/2]

```
unsigned int seq64::keys_perform::event_edit ( ) const  [inline]
```

13.28.4.36 event_edit() [2/2]

```
void seq64::keys_perform::event_edit (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.37 stop() [1/2]

```
unsigned int seq64::keys_perform::stop ( ) const  [inline]
```

13.28.4.38 stop() [2/2]

```
void seq64::keys_perform::stop (
            unsigned int x )  [inline]
```

Parameters

x	The key value to assign to the operation.

13.28.4.39 song_mode() [1/2]

```
unsigned int seq64::keys_perform::song_mode ( ) const  [inline]
```

13.28.4.40 song_mode() [2/2]

```
void seq64::keys_perform::song_mode (
            unsigned int key )  [inline]
```

13.28.4.41 menu_mode() [1/2]

```
unsigned int seq64::keys_perform::menu_mode ( ) const  [inline]
```

13.28.4.42 menu_mode() [2/2]

```
void seq64::keys_perform::menu_mode (
            unsigned int key )  [inline]
```

13.28.4.43 follow_transport() [1/2]

```
unsigned int seq64::keys_perform::follow_transport ( ) const  [inline]
```

13.28.4.44 follow_transport() [2/2]

```
void seq64::keys_perform::follow_transport (
            unsigned int key )  [inline]
```

13.28.4.45 fast_forward() [1/2]

```
unsigned int seq64::keys_perform::fast_forward ( ) const  [inline]
```

13.28.4.46 fast_forward() [2/2]

```
void seq64::keys_perform::fast_forward (
            unsigned int key )  [inline]
```

13.28.4.47 rewind() [1/2]

```
unsigned int seq64::keys_perform::rewind ( ) const  [inline]
```

13.28.4.48 rewind() [2/2]

```
void seq64::keys_perform::rewind (
            unsigned int key )  [inline]
```

13.28.4.49 pointer_position() [1/2]

```
unsigned int seq64::keys_perform::pointer_position ( ) const  [inline]
```

13.28.4.50 pointer_position() [2/2]

```
void seq64::keys_perform::pointer_position (
            unsigned int key )  [inline]
```

13.28.4.51 toggle_mutes() [1/2]

```
unsigned int seq64::keys_perform::toggle_mutes ( ) const  [inline]
```

13.28.4.52 toggle_mutes() [2/2]

```
void seq64::keys_perform::toggle_mutes (
            unsigned int key )  [inline]
```

13.28.4.53 toggle_jack() [1/2]

```
unsigned int seq64::keys_perform::toggle_jack ( ) const  [inline]
```

13.28.4.54 toggle_jack() [2/2]

```
void seq64::keys_perform::toggle_jack (
            unsigned int key )  [inline]
```

13.28.4.55 tap_bpm() [1/2]

```
unsigned int seq64::keys_perform::tap_bpm ( ) const  [inline]
```

13.28.4.56 tap_bpm() [2/2]

```
void seq64::keys_perform::tap_bpm (
            unsigned int key )  [inline]
```

13.28.4.57 show_ui_sequence_key() [1/2]

```
bool seq64::keys_perform::show_ui_sequence_key ( ) const  [inline]
```

Used in mainwid, options, optionsfile, userfile, and perform.

13.28.4.58 show_ui_sequence_key() [2/2]

```
void seq64::keys_perform::show_ui_sequence_key (
            bool flag )  [inline]
```

Parameters

flag	The flag for showing the sequence key characters in each pattern slot.

13.28.4.59 show_ui_sequence_number() [1/2]

```
bool seq64::keys_perform::show_ui_sequence_number ( ) const  [inline]
```

Used in mainwid, options, optionsfile, userfile, and perform.

13.28.4.60 show_ui_sequence_number() [2/2]

```
void seq64::keys_perform::show_ui_sequence_number (
            bool flag )  [inline]
```

Parameters

flag	The flag for showing the sequence number in each pattern slot.

13.28.4.61 get_key_events()

```
SlotMap& seq64::keys_perform::get_key_events ( )  [inline]
```

13.28.4.62 get_key_groups()

```
SlotMap& seq64::keys_perform::get_key_groups ( )  [inline]
```

13.28.4.63 get_key_events_rev()

```
RevSlotMap& seq64::keys_perform::get_key_events_rev ( )  [inline]
```

13.28.4.64 get_key_groups_rev()

```
RevSlotMap& seq64::keys_perform::get_key_groups_rev ( )  [inline]
```

13.28.4.65 lookup_keyevent_key()

```
unsigned int seq64::keys_perform::lookup_keyevent_key (
            long seqnum )  [inline]
```

Parameters

seqnum	Provides the sequence number to look up in the reverse key map for patterns/sequences. If the count for this value is 0, then a question mark character is returned. Not checked for maximum!

13.28.4.66 lookup_keyevent_seq()

```
long seq64::keys_perform::lookup_keyevent_seq (
            unsigned int keycode )  [inline]
```

Parameters

keycode	Provides the keycode to look up in the (forward) key map for patterns/sequences. If the count for this value is 0, then a 0 is returned.

13.28.4.67 lookup_keygroup_key()

```
unsigned int seq64::keys_perform::lookup_keygroup_key (
            long groupnum )  [inline]
```

Parameters

groupnum	Provides the group number to look up in the reverse key map for groups. If the count for this value is 0, then a question mark character is returned.

13.28.4.68 lookup_keygroup_group()

```
long seq64::keys_perform::lookup_keygroup_group (
            unsigned int keycode )  [inline]
```

Parameters

keycode	Provides the sequence number to look up in the reverse key map for groups. If the count for this value is 0, then a 0 is returned.

13.28.4.69 key_name()

```
std::string seq64::keys_perform::key_name (
            unsigned int key ) const  [virtual]
```

In gtkmm, this is done via the gdk_keyval_name() function. Here, in the base class, we just provide an easy-to-create string.

Parameters

key	Provides the numeric value of the keystroke.

Returns

Returns the name of the key, in the format "Key 0xkkkk".

Reimplemented in seq64::keys_perform_gtk2.

13.28.4.70 set_all_key_events()

```
virtual void seq64::keys_perform::set_all_key_events ( )  [inline], [virtual]
```

Must be called by the derived-class's override of this function.

Reimplemented in seq64::keys_perform_gtk2.

13.28.4.71 set_all_key_groups()

```
virtual void seq64::keys_perform::set_all_key_groups ( )  [inline], [virtual]
```

Must be called by the derived-class's override of this function.

Reimplemented in seq64::keys_perform_gtk2.

13.28.4.72 set_key_event()

```
void seq64::keys_perform::set_key_event (
            unsigned int keycode,
            long sequence_slot )
```

It is called 32 times, corresponding the pattern/sequence slots in the Patterns window.

Parameters

keycode	The key to be assigned.
sequence_slot	The perform event slot into which the keycode will be assigned.

13.28.4.73 set_key_group()

```
void seq64::keys_perform::set_key_group (
            unsigned int keycode,
            long group_slot )
```

It is called 32 times, corresponding the pattern/sequence slots in the Patterns window.

Parameters

keycode	The key to be assigned.
group_slot	The perform group slot into which the keycode will be assigned.

13.28.4.74 at_bpm_up()

```
unsigned int* seq64::keys_perform::at_bpm_up ( )  [inline], [protected]
```

They are used in the options module, and, for brevity, are accessed using the PREFKEY_ADDR() macro. *'Getter' function* for member *m_key_bpm_up*

Address getter for the bpm_up operation.

13.28.4.75 at_bpm_dn()

```
unsigned int* seq64::keys_perform::at_bpm_dn ( )  [inline], [protected]
```

Address getter for the bpm_dn operation.

13.28.4.76 at_replace()

```
unsigned int* seq64::keys_perform::at_replace ( )  [inline], [protected]
```

Address getter for the replace operation.

13.28.4.77 at_queue()

```
unsigned int* seq64::keys_perform::at_queue ( )  [inline], [protected]
```

Address getter for the queue operation.

13.28.4.78 at_keep_queue()

```
unsigned int* seq64::keys_perform::at_keep_queue ( )  [inline], [protected]
```

Address getter for the keep_queue operation.

13.28.4.79 at_snapshot_1()

```
unsigned int* seq64::keys_perform::at_snapshot_1 ( )  [inline], [protected]
```

Address getter for the snapshot_1 operation.

13.28.4.80 at_snapshot_2()

```
unsigned int* seq64::keys_perform::at_snapshot_2 ( )  [inline], [protected]
```

Address getter for the snapshot_2 operation.

13.28.4.81 at_screenset_up()

```
unsigned int* seq64::keys_perform::at_screenset_up ( )  [inline], [protected]
```

Address getter for the screenset_up operation.

13.28.4.82 at_screenset_dn()

```
unsigned int* seq64::keys_perform::at_screenset_dn ( )  [inline], [protected]
```

Address getter for the screenset_dn operation.

13.28.4.83 at_set_playing_screenset()

```
unsigned int* seq64::keys_perform::at_set_playing_screenset ( )  [inline], [protected]
```

Address getter for the set_playing_screenset operation.

13.28.4.84 at_group_on()

```
unsigned int* seq64::keys_perform::at_group_on ( )  [inline], [protected]
```

Address getter for the group_on operation.

13.28.4.85 at_group_off()

```
unsigned int* seq64::keys_perform::at_group_off ( )  [inline], [protected]
```

Address getter for the group_off operation.

13.28.4.86 at_group_learn()

```
unsigned int* seq64::keys_perform::at_group_learn ( )  [inline], [protected]
```

Address getter for the group_learn operation.

13.28.4.87 at_start()

```
unsigned int* seq64::keys_perform::at_start ( )  [inline], [protected]
```

Address getter for the start operation.

13.28.4.88 at_pause()

```
unsigned int* seq64::keys_perform::at_pause ( )  [inline], [protected]
```

Address getter for the pause operation.

13.28.4.89 at_song_mode()

```
unsigned int* seq64::keys_perform::at_song_mode ( )  [inline], [protected]
```

Address getter for the song-mode operation.

13.28.4.90 at_toggle_jack()

```
unsigned int* seq64::keys_perform::at_toggle_jack ( )  [inline], [protected]
```

Address getter for the toggle-jack operation.

13.28.4.91 at_menu_mode()

```
unsigned int* seq64::keys_perform::at_menu_mode ( )  [inline], [protected]
```

Address getter for the menu-mode operation.

13.28.4.92 at_follow_transport()

```
unsigned int* seq64::keys_perform::at_follow_transport ( )  [inline], [protected]
```

Address getter for the follow-transport operation.

13.28.4.93 at_fast_forward()

```
unsigned int* seq64::keys_perform::at_fast_forward ( )  [inline], [protected]
```

Address getter for the fast-forward operation.

13.28.4.94 at_rewind()

```
unsigned int* seq64::keys_perform::at_rewind ( )  [inline], [protected]
```

Address getter for the rewind operation.

13.28.4.95 at_pointer_position()

```
unsigned int* seq64::keys_perform::at_pointer_position ( )  [inline], [protected]
```

Address getter for the pointer operation.

13.28.4.96 at_toggle_mutes()

```
unsigned int* seq64::keys_perform::at_toggle_mutes ( )  [inline], [protected]
```

Address getter for the toggle-mutes operation.

13.28.4.97 at_tap_bpm()

```
unsigned int* seq64::keys_perform::at_tap_bpm ( )  [inline], [protected]
```

Address getter for the tap_bpm operation.

13.28.4.98 at_pattern_edit()

```
unsigned int* seq64::keys_perform::at_pattern_edit ( )  [inline], [protected]
```

Address getter for the pattern-edit operation.

13.28.4.99 at_event_edit()

```
unsigned int* seq64::keys_perform::at_event_edit ( )  [inline], [protected]
```

Address getter for the event-edit operation.

13.28.4.100 at_stop()

```
unsigned int* seq64::keys_perform::at_stop ( )  [inline], [protected]
```

Address getter for the stop operation.

13.28.4.101 at_show_ui_sequence_key()

```
bool* seq64::keys_perform::at_show_ui_sequence_key ( )  [inline], [protected]
```

Address getter for the show_ui_sequence_key value.

13.28.4.102 at_show_ui_sequence_number()

```
bool* seq64::keys_perform::at_show_ui_sequence_number ( )  [inline], [protected]
```

Address getter for the show_ui_sequence_number value.

13.28.5 Friends And Related Function Documentation

13.28.5.1 options

```
friend class options  [friend]
```

13.28.5.2 perform

```
friend class perform  [friend]
```

13.28.5.3 optionsfile

```
friend class optionsfile  [friend]
```

13.28.6 Field Documentation

13.28.6.1 m_key_show_ui_sequence_key

```
bool seq64::keys_perform::m_key_show_ui_sequence_key  [private]
```

13.28.6.2 m_key_show_ui_sequence_number

```
bool seq64::keys_perform::m_key_show_ui_sequence_number  [private]
```

Also shows the sequence number as part of the sequence name in the performance window (song editor). Always disabled in legacy mode.

13.28.6.3 m_key_events

```
SlotMap seq64::keys_perform::m_key_events  [private]
```

Do not access directly, use the set/lookup functions declared below.

13.28.6.4 m_key_groups

```
SlotMap seq64::keys_perform::m_key_groups  [private]
```

Do not access directly, use the set/lookup functions declared below.

13.28.6.5 m_key_events_rev

```
RevSlotMap seq64::keys_perform::m_key_events_rev  [private]
```

Do not access directly, use the set/lookup functions declared below.

13.28.6.6 m_key_groups_rev

```
RevSlotMap seq64::keys_perform::m_key_groups_rev  [private]
```

Do not access directly, use the set/lookup functions declared below.

13.28.6.7 m_key_bpm_up

```
unsigned int seq64::keys_perform::m_key_bpm_up  [private]
```

Used in mainwnd, options, optionsfile, perfedit, seqroll, userfile, and perform.

We could instead use the keys_perform_transfer structure instead of all these individual members.BPM up, apostrophe!!!

13.28.6.8 m_key_bpm_dn

```
unsigned int seq64::keys_perform::m_key_bpm_dn  [private]
```

13.28.6.9 m_key_replace

```
unsigned int seq64::keys_perform::m_key_replace  [private]
```

13.28.6.10 m_key_queue

```
unsigned int seq64::keys_perform::m_key_queue  [private]
```

13.28.6.11 m_key_keep_queue

```
unsigned int seq64::keys_perform::m_key_keep_queue  [private]
```

13.28.6.12 m_key_snapshot_1

```
unsigned int seq64::keys_perform::m_key_snapshot_1  [private]
```

13.28.6.13 m_key_snapshot_2

```
unsigned int seq64::keys_perform::m_key_snapshot_2  [private]
```

13.28.6.14 m_key_screenset_up

```
unsigned int seq64::keys_perform::m_key_screenset_up  [private]
```

13.28.6.15 m_key_screenset_dn

```
unsigned int seq64::keys_perform::m_key_screenset_dn  [private]
```

13.28.6.16 m_key_set_playing_screenset

```
unsigned int seq64::keys_perform::m_key_set_playing_screenset  [private]
```

13.28.6.17 m_key_group_on

```
unsigned int seq64::keys_perform::m_key_group_on  [private]
```

13.28.6.18 m_key_group_off

```
unsigned int seq64::keys_perform::m_key_group_off  [private]
```

13.28.6.19 m_key_group_learn

```
unsigned int seq64::keys_perform::m_key_group_learn  [private]
```

13.28.6.20 m_key_start

```
unsigned int seq64::keys_perform::m_key_start  [private]
```

13.28.6.21 m_key_pause

```
unsigned int seq64::keys_perform::m_key_pause  [private]
```

13.28.6.22 m_key_song_mode

```
unsigned int seq64::keys_perform::m_key_song_mode  [private]
```

13.28.6.23 m_key_toggle_jack

```
unsigned int seq64::keys_perform::m_key_toggle_jack  [private]
```

13.28.6.24 m_key_menu_mode

```
unsigned int seq64::keys_perform::m_key_menu_mode  [private]
```

13.28.6.25 m_key_follow_transport

```
unsigned int seq64::keys_perform::m_key_follow_transport  [private]
```

13.28.6.26 m_key_rewind

```
unsigned int seq64::keys_perform::m_key_rewind  [private]
```

13.28.6.27 m_key_fast_forward

```
unsigned int seq64::keys_perform::m_key_fast_forward  [private]
```

13.28.6.28 m_key_pointer_position

```
unsigned int seq64::keys_perform::m_key_pointer_position  [private]
```

13.28.6.29 m_key_toggle_mutes

```
unsigned int seq64::keys_perform::m_key_toggle_mutes  [private]
```

13.28.6.30 m_key_tap_bpm

```
unsigned int seq64::keys_perform::m_key_tap_bpm  [private]
```

13.28.6.31 m_key_pattern_edit

```
unsigned int seq64::keys_perform::m_key_pattern_edit  [private]
```

13.28.6.32 m_key_event_edit

```
unsigned int seq64::keys_perform::m_key_event_edit  [private]
```

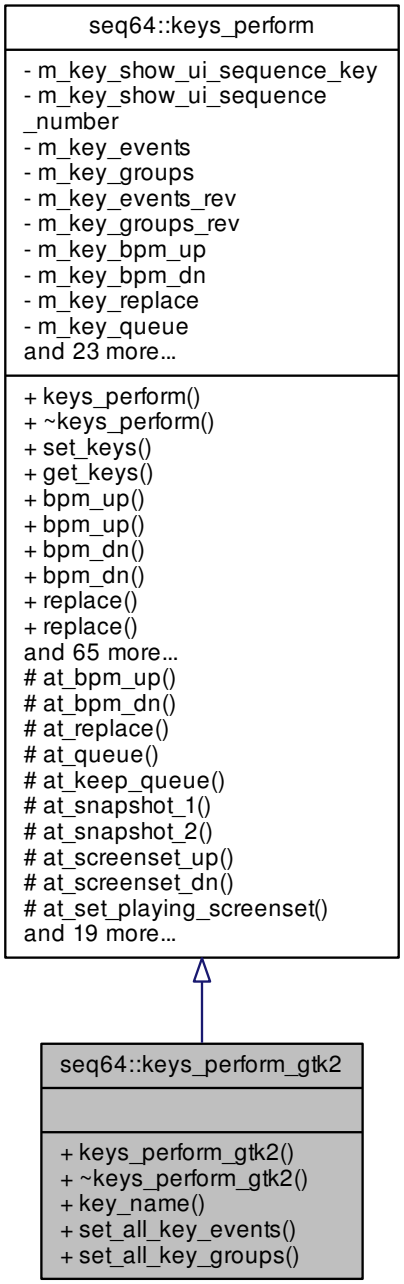
13.28.6.33 m_key_stop

```
unsigned int seq64::keys_perform::m_key_stop  [private]
```

13.29 seq64::keys_perform_gtk2 Class Reference

This class supports the performance mode.

Inheritance diagram for seq64::keys_perform_gtk2:



Public Member Functions

- keys_perform_gtk2 ()

  This construction initializes a vast number of member variables, some of them public!
- virtual ~keys_perform_gtk2 ()

  A rote virtual destructor.
- virtual std::string key_name (unsigned int key) const

- virtual void set_all_key_events ()

  Sets up the keys for arming/unmuting events in the Gtk-2 environment.
- virtual void set_all_key_groups ()

  Sets up the keys for group events in the Gtk-2 environment.

Additional Inherited Members

13.29.1 Detailed Description

It has way too many data members, many of the public. Might be ripe for refactoring.

13.29.2 Constructor & Destructor Documentation

13.29.2.1 keys_perform_gtk2()

```
seq64::keys_perform_gtk2::keys_perform_gtk2 ( )
```

13.29.2.2 ~keys_perform_gtk2()

```
seq64::keys_perform_gtk2::~keys_perform_gtk2 ( )  [virtual]
```

No action.

13.29.3 Member Function Documentation

13.29.3.1 key_name()

```
virtual std::string seq64::keys_perform_gtk2::key_name (
            unsigned int key ) const  [inline], [virtual]
```

Reimplemented from seq64::keys_perform.

13.29.3.2 set_all_key_events()

```
void seq64::keys_perform_gtk2::set_all_key_events ( )  [virtual]
```

The base-class function call makes sure the the related lists are cleared before rebuilding them here.

Reimplemented from seq64::keys_perform.

13.29.3.3 set_all_key_groups()

```
void seq64::keys_perform_gtk2::set_all_key_groups ( )  [virtual]
```

The base-class function call makes sure the the related lists are cleared before rebuilding them here.

Reimplemented from seq64::keys_perform.

13.30 seq64::keys_perform_transfer Struct Reference

Provides a data-transfer structure to make it easier to fill in a keys_perform object's members using sscanf().

Data Fields

- unsigned int kpt_bpm_up
- unsigned int kpt_bpm_dn
- unsigned int kpt_screenset_up
- unsigned int kpt_screenset_dn
- unsigned int kpt_set_playing_screenset
- unsigned int kpt_group_on
- unsigned int kpt_group_off
- unsigned int kpt_group_learn
- unsigned int kpt_replace
- unsigned int kpt_queue
- unsigned int kpt_keep_queue
- unsigned int kpt_snapshot_1
- unsigned int kpt_snapshot_2
- unsigned int kpt_start
- unsigned int kpt_stop
- bool kpt_show_ui_sequence_key
- bool kpt_show_ui_sequence_number
- unsigned int kpt_pattern_edit
- unsigned int kpt_event_edit
- unsigned int kpt_tap_bpm
- unsigned int kpt_pause
- unsigned int kpt_song_mode
- unsigned int kpt_toggle_jack
- unsigned int kpt_menu_mode
- unsigned int kpt_follow_transport
- unsigned int kpt_fast_forward
- unsigned int kpt_rewind
- unsigned int kpt_pointer_position
- unsigned int kpt_toggle_mutes

13.30.1 Field Documentation

13.30.1.1 kpt_bpm_up

```
unsigned int seq64::keys_perform_transfer::kpt_bpm_up
```

13.30.1.2 kpt_bpm_dn

```
unsigned int seq64::keys_perform_transfer::kpt_bpm_dn
```

13.30.1.3 kpt_screenset_up

```
unsigned int seq64::keys_perform_transfer::kpt_screenset_up
```

13.30.1.4 kpt_screenset_dn

```
unsigned int seq64::keys_perform_transfer::kpt_screenset_dn
```

13.30.1.5 kpt_set_playing_screenset

```
unsigned int seq64::keys_perform_transfer::kpt_set_playing_screenset
```

13.30.1.6 kpt_group_on

```
unsigned int seq64::keys_perform_transfer::kpt_group_on
```

13.30.1.7 kpt_group_off

```
unsigned int seq64::keys_perform_transfer::kpt_group_off
```

13.30.1.8 kpt_group_learn

```
unsigned int seq64::keys_perform_transfer::kpt_group_learn
```

13.30.1.9 kpt_replace

```
unsigned int seq64::keys_perform_transfer::kpt_replace
```

13.30.1.10 kpt_queue

```
unsigned int seq64::keys_perform_transfer::kpt_queue
```

13.30.1.11 kpt_keep_queue

```
unsigned int seq64::keys_perform_transfer::kpt_keep_queue
```

13.30.1.12 kpt_snapshot_1

```
unsigned int seq64::keys_perform_transfer::kpt_snapshot_1
```

13.30.1.13 kpt_snapshot_2

```
unsigned int seq64::keys_perform_transfer::kpt_snapshot_2
```

13.30.1.14 kpt_start

```
unsigned int seq64::keys_perform_transfer::kpt_start
```

13.30.1.15 kpt_stop

```
unsigned int seq64::keys_perform_transfer::kpt_stop
```

13.30.1.16 kpt_show_ui_sequence_key

```
bool seq64::keys_perform_transfer::kpt_show_ui_sequence_key
```

13.30.1.17 kpt_show_ui_sequence_number

```
bool seq64::keys_perform_transfer::kpt_show_ui_sequence_number
```

13.30.1.18 kpt_pattern_edit

```
unsigned int seq64::keys_perform_transfer::kpt_pattern_edit
```

13.30.1.19 kpt_event_edit

```
unsigned int seq64::keys_perform_transfer::kpt_event_edit
```

13.30.1.20 kpt_tap_bpm

```
unsigned int seq64::keys_perform_transfer::kpt_tap_bpm
```

13.30.1.21 kpt_pause

```
unsigned int seq64::keys_perform_transfer::kpt_pause
```

13.30.1.22 kpt_song_mode

```
unsigned int seq64::keys_perform_transfer::kpt_song_mode
```

13.30.1.23 kpt_toggle_jack

```
unsigned int seq64::keys_perform_transfer::kpt_toggle_jack
```

13.30.1.24 kpt_menu_mode

```
unsigned int seq64::keys_perform_transfer::kpt_menu_mode
```

13.30.1.25 kpt_follow_transport

```
unsigned int seq64::keys_perform_transfer::kpt_follow_transport
```

13.30.1.26 kpt_fast_forward

```
unsigned int seq64::keys_perform_transfer::kpt_fast_forward
```

13.30.1.27 kpt_rewind

```
unsigned int seq64::keys_perform_transfer::kpt_rewind
```

13.30.1.28 kpt_pointer_position

```
unsigned int seq64::keys_perform_transfer::kpt_pointer_position
```

13.30.1.29 kpt_toggle_mutes

```
unsigned int seq64::keys_perform_transfer::kpt_toggle_mutes
```

13.31 seq64::keystroke Class Reference

Encapsulates any practical keystroke.

Public Member Functions

- keystroke ()

  The default constructor for class keystroke.
- keystroke (unsigned int key, bool press=SEQ64_KEYSTROKE_PRESS, int modkey=int(SEQ64_NO_MASK))

  The principal constructor.
- keystroke (const keystroke &rhs)

  Provides the rote copy constructor.
- keystroke & operator= (const keystroke &rhs)

  Provides the rote principal assignment operator.
- bool is_press () const

  'Getter' function for member m_is_press
- bool is_letter (unsigned int ch=SEQ64_KEYSTROKE_BAD_VALUE) const

  'Getter' function for member m_key to test letters, handles ASCII only.
- bool is (unsigned int ch) const

  Tests the key value to see if it matches the given character exactly (no case-insensitivity).
- bool is_delete () const

  'Getter' function for member m_key to test for a delete-causing key.
- unsigned int key () const

  'Getter' function for member m_key
- void shift_lock ()

  If a lower-case letter, a number, or another character on the "main" part of the keyboard, shift the m_key value to upper-case or the character shifted on a standard American keyboard.
- seq_modifier_t modifier () const

  'Getter' function for member m_modifier
- bool mod_control () const

  'Getter' function for member m_modifier tested for Ctrl key.
- bool mod_control_shift () const

  'Getter' function for member m_modifier tested for Ctrl and Shift key.
- bool mod_super () const

  'Getter' function for member m_modifier tested for Mod4/Super/Windows key.

Private Attributes

- bool m_is_press

  Determines if the key was a press or a release.
- unsigned int m_key

  The key that was pressed or released.
- seq_modifier_t m_modifier

  The optional modifier value.

13.31.1 Detailed Description

Useful in passing more generic events to non-GUI classes.

13.31.2 Constructor & Destructor Documentation

13.31.2.1 keystroke() [1/3]

```
seq64::keystroke::keystroke ( )
```

13.31.2.2 keystroke() [2/3]

```
seq64::keystroke::keystroke (
            unsigned int key,
            bool press = SEQ64_KEYSTROKE_PRESS,
            int modkey = int(SEQ64_NO_MASK) )
```

Parameters

key	The keystroke number of the key that was pressed or released.
press	If true, the keystroke action was a press, otherwise it was a release.
modkey	The modifier key combination that was pressed, if any, in the form of a bit-mask, as defined in the gdk_basic_keys module. Common mask values are SEQ64_SHIFT_MASK, SEQ64_CONTROL_MASK, SEQ64_MOD1_MASK, and SEQ64_MOD4_MASK. If no modifier, this value is SEQ64_NO_MASK.

13.31.2.3 keystroke() [3/3]

```
seq64::keystroke::keystroke (
            const keystroke & rhs )
```

Parameters

rhs	The object to be copied.

13.31.3 Member Function Documentation

13.31.3.1 operator=()

```
keystroke & seq64::keystroke::operator= (
            const keystroke & rhs )
```

Parameters

rhs	The object to be assigned.

Returns

Returns the reference to the current object, for use in assignment chains.

13.31.3.2 is_press()

```
bool seq64::keystroke::is_press ( ) const  [inline]
```

13.31.3.3 is_letter()

```
bool seq64::keystroke::is_letter (
            unsigned int ch = SEQ64_KEYSTROKE_BAD_VALUE ) const
```

Parameters

ch	An optional character to test as an ASCII letter.

Returns

If a character is not provided, true is returned if it is an upper or lower-case letter. Otherwise, true is returned if the m_key value matches the character case-insensitively.

Tricky Code

13.31.3.4 is()

```
bool seq64::keystroke::is (
            unsigned int ch ) const  [inline]
```

Parameters

ch	The character to be tested.

Returns

Returns true if m_key == ch.

13.31.3.5 is_delete()

```
bool seq64::keystroke::is_delete ( ) const  [inline]
```

13.31.3.6 key()

```
unsigned int seq64::keystroke::key ( ) const  [inline]
```

13.31.3.7 shift_lock()

```
void seq64::keystroke::shift_lock ( )
```

Currently also assumes the ASCII character set.

There's an oddity here: the shift of '2' is the '@' character, but seq24 seems to have treated it like the "" character. Some others were treated the same:

```
    Key:        1 2 3 4 5 6 7 8 9 0
    Shift:      ! @ # $ % ^ & * ( )
    Seq24:      ! " # $ % & ’ ( ) space
```

```
This function is meant to avoid using the Caps-Lock when picking a
group-learn character in the group-learn mode.
```

13.31.3.8 modifier()

```
seq_modifier_t seq64::keystroke::modifier ( ) const  [inline]
```

13.31.3.9 mod_control()

```
bool seq64::keystroke::mod_control ( ) const  [inline]
```

13.31.3.10 mod_control_shift()

```
bool seq64::keystroke::mod_control_shift ( ) const  [inline]
```

13.31.3.11 mod_super()

```
bool seq64::keystroke::mod_super ( ) const  [inline]
```

13.31.4 Field Documentation

13.31.4.1 m_is_press

```
bool seq64::keystroke::m_is_press  [private]
```

See the SEQ64_KEYSTROKE_PRESS and SEQ64_KEYSTROKE_RELEASE readability macros.

13.31.4.2 m_key

```
unsigned int seq64::keystroke::m_key  [private]
```

Generally, the extended ASCII range (0 to 255) is supported. However, Gtk-2.x/3.x will generally support the full gamut of characters defined in the gdk_basic_keys.h module. We define minimum and maximum range macros for keystrokes that are a bit generous.

13.31.4.3 m_modifier

```
seq_modifier_t seq64::keystroke::m_modifier  [private]
```

Note that SEQ64_NO_MASK is our word for 0, meaning "no modifier".

13.32 seq64::lash Class Reference

This class supports LASH operations, if compiled with LASH support (i.e.

Public Member Functions

- lash (perform &p, int argc, char **argv)
  This constructor calls lash_extract(), using the command-line arguments, if SEQ64_LASH_SUPPORT is enabled.
- void set_alsa_client_id (int id)
  Make ourselves a LASH ALSA client.
- void start ()
  Process any LASH events every 250 msec, which is an arbitrarily chosen interval.
- bool process_events ()
  Process LASH events.

Private Member Functions

- bool init ()
  Initializes LASH support, if enabled.
- void handle_event (lash_event_t *conf)
  Handle a LASH event.
- void handle_config (lash_config_t *conf)
  Handle a LASH configuration item.

Private Attributes

- perform & m_perform

  A hook into the single perform object in the application.
- lash_client_t * m_client

  Holds the client "handle" returned by the lash_init() function.
- lash_args_t * m_lash_args

  Holds the command-line arguments used by the lash_init() function.
- bool m_is_lash_supported

  Indicates if LASH support has been compiled into the library.

13.32.1 Detailed Description

SEQ64_LASH_SUPPORT is defined). All of the ifdef skeleton work is done in this class in such a way that any other part of the code can use this class whether or not lash support is actually built in; the functions will just do nothing.

13.32.2 Constructor & Destructor Documentation

13.32.2.1 lash()

```
seq64::lash::lash (
            perform & p,
            int argc,
            char ** argv )
```

We fixed the crazy usage of argc and argv here and in the client code in the seq24 module.

Parameters

p	The perform object that needs to implement LASH support.
argc	The number of command-line arguments.
argv	The command-line arguments.

13.32.3 Member Function Documentation

13.32.3.1 set_alsa_client_id()

```
void seq64::lash::set_alsa_client_id (
            int id )
```

/param id The ALSA client ID to be set.

13.32.3.2 start()

```
void seq64::lash::start ( )
```

13.32.3.3 process_events()

```
bool seq64::lash::process_events ( )
```

Returns

Always returns true.

13.32.3.4 init()

```
bool seq64::lash::init ( )  [private]
```

Returns

Returns true if the LASH subsystem was able to be initialized, and a LASH client representative (m_client) was allocated.

13.32.3.5 handle_event()

```
void seq64::lash::handle_event (
            lash_event_t * ev )  [private]
```

Parameters

ev	Provides the event to be handled.

13.32.3.6 handle_config()

```
void seq64::lash::handle_config (
            lash_config_t * conf )  [private]
```

Currently incomplete.

Parameters

conf	Provides the configuration item to handle.

13.32.4 Field Documentation

13.32.4.1 m_perform

```
perform& seq64::lash::m_perform  [private]
```

13.32.4.2 m_client

```
lash_client_t* seq64::lash::m_client  [private]
```

13.32.4.3 m_lash_args

```
lash_args_t* seq64::lash::m_lash_args  [private]
```

13.32.4.4 m_is_lash_supported

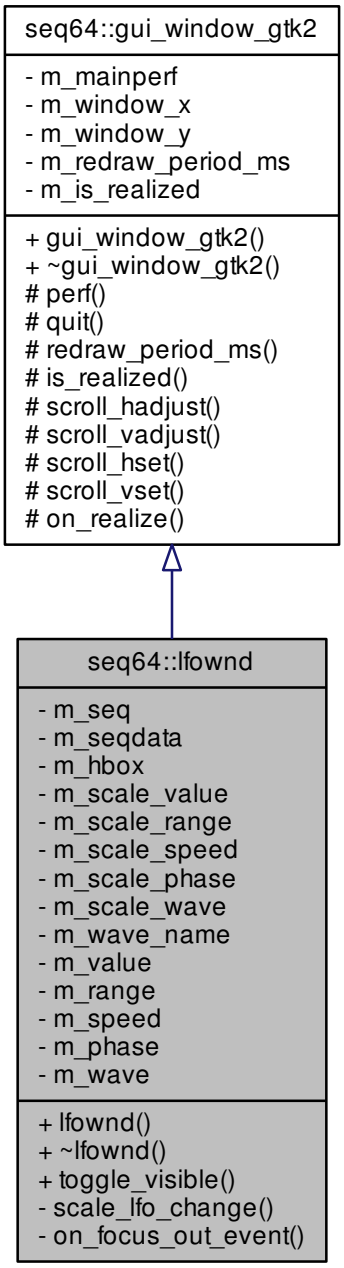
```
bool seq64::lash::m_is_lash_supported  [private]
```

Is set to true if SEQ64_LASH_SUPPORT is defined. This variable is not used, but we will keep it around for the possibility of testing LASH support at run time.

13.33 seq64::lfownd Class Reference

One LFO window class.

Inheritance diagram for seq64::lfownd:



Public Member Functions

- lfownd (perform &p, sequence &seq, seqdata &sdata)

Constructs the LFO window.

- virtual ~lfownd ()
- void toggle_visible ()

Private Member Functions

- void scale_lfo_change ()
- bool on_focus_out_event (GdkEventFocus *p0)

Private Attributes

- sequence & m_seq

  The sequence associated with this window.
- seqdata & m_seqdata

  The seqdata associated with this window.
- Gtk::HBox * m_hbox

  The main horizontal packing box.
- Gtk::VScale * m_scale_value

  Vertical slider for value.
- Gtk::VScale * m_scale_range

  Vertical slider for range.
- Gtk::VScale * m_scale_speed

  Vertical slider for speed.
- Gtk::VScale * m_scale_phase

  Vertical slider for phase.
- Gtk::VScale * m_scale_wave

  Vertical slider for wave type.
- Gtk::Label * m_wave_name

  Human readable name for wave type.
- double m_value

  Value.
- double m_range

  Range.
- double m_speed

  Speed.
- double m_phase

  Phase.
- wave_type_t m_wave

  Wave type.

Additional Inherited Members

13.33.1 Detailed Description

Personally, it seems a bit of a odd duck to be included in Sequencer64, so we're thinking of a better way to manage the data managed by this window.

13.33.2 Constructor & Destructor Documentation

13.33.2.1 lfownd()

```
seq64::lfownd::lfownd (
            perform & p,
            sequence & seq,
            seqdata & sdata )
```

Parameters

p	The performance object, which holds parameters necessary for manipulating events.
seq	The sequence/pattern that is to be affected by the LFO window. It holds the actual MIDI events being modified.
sdata	The data pane/panel of the pattern editor window representing the sequence. We need to tell it to redraw.

13.33.2.2 ~lfownd()

```
seq64::lfownd::~lfownd ( )  [virtual]
```

13.33.3 Member Function Documentation

13.33.3.1 toggle_visible()

```
void seq64::lfownd::toggle_visible ( )
```

13.33.3.2 scale_lfo_change()

```
void seq64::lfownd::scale_lfo_change ( )  [private]
```

13.33.3.3 on_focus_out_event()

```
bool seq64::lfownd::on_focus_out_event (
            GdkEventFocus * p0 )  [private]
```

13.33.4 Field Documentation

13.33.4.1 m_seq

```
sequence& seq64::lfownd::m_seq  [private]
```

13.33.4.2 m_seqdata

```
seqdata& seq64::lfownd::m_seqdata  [private]
```

13.33.4.3 m_hbox

```
Gtk::HBox* seq64::lfownd::m_hbox  [private]
```

13.33.4.4 m_scale_value

```
Gtk::VScale* seq64::lfownd::m_scale_value  [private]
```

13.33.4.5 m_scale_range

```
Gtk::VScale* seq64::lfownd::m_scale_range  [private]
```

13.33.4.6 m_scale_speed

```
Gtk::VScale* seq64::lfownd::m_scale_speed  [private]
```

13.33.4.7 m_scale_phase

```
Gtk::VScale* seq64::lfownd::m_scale_phase  [private]
```

13.33.4.8 m_scale_wave

```
Gtk::VScale* seq64::lfownd::m_scale_wave  [private]
```

13.33.4.9 m_wave_name

```
Gtk::Label* seq64::lfownd::m_wave_name  [private]
```

13.33.4.10 m_value

```
double seq64::lfownd::m_value  [private]
```

13.33.4.11 m_range

```
double seq64::lfownd::m_range  [private]
```

13.33.4.12 m_speed

```
double seq64::lfownd::m_speed  [private]
```

13.33.4.13 m_phase

```
double seq64::lfownd::m_phase  [private]
```

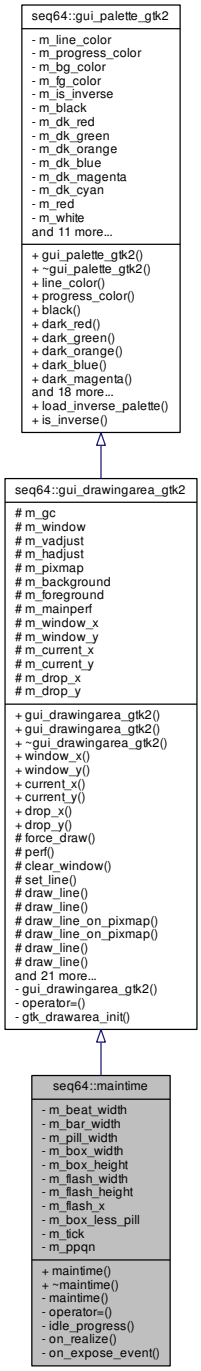
13.33.4.14 m_wave

```
wave_type_t seq64::lfownd::m_wave  [private]
```

13.34 seq64::maintime Class Reference

This class provides the drawing of the progress bar at the top of the main window, along with two "pills" that move in time with the beat and measure.

Inheritance diagram for seq64::maintime:



Public Member Functions

- maintime (perform &p, int ppqn=SEQ64_USE_DEFAULT_PPQN)

This constructor sets up the colors black, white, and grey, and then allocates them.

- virtual ~maintime ()

  Let's provide a do-nothing virtual destructor.

Private Member Functions

- maintime (const maintime &)
- maintime & operator= (const maintime &)
- int idle_progress (midipulse ticks)

  This function clears the window, sets the foreground to black, draws the "time" window's rectangle, and then draws a rectangle for noting the progress of the beat, and the progress for a bar.
- void on_realize ()

  Handles realization of the window.
- bool on_expose_event (GdkEventExpose *ev)

  This function merely idles.

Private Attributes

- const int m_beat_width

  Provides the divisor for ticks to produce a beat value.
- const int m_bar_width

  Provides the divisor for ticks to produce a bar value.
- const int m_pill_width

  Provides the width of the pills, little black squares that show the progress of a beat and a bar (measure).
- const int m_box_width

  The width/length of the rectangle to be drawn inside the maintime window.
- const int m_box_height

  The height of the rectangle to be drawn inside the maintime window.
- const int m_flash_width

  The width/length of the flashing rectangle to be drawn inside the maintime window.
- const int m_flash_height

  The height of the flashing rectangle to be drawn inside the maintime window.
- const int m_flash_x

  The x value at which a flash should occur.
- const int m_box_less_pill

  The width/length of the maintime window minus the width of the pill.
- midipulse m_tick

  Saves the tick value for on_expose_event().
- int m_ppqn

  Provides the active PPQN value.

Friends

- class mainwnd

Additional Inherited Members

13.34.1 Detailed Description

We added a lot of members to hold the results of calculations that involve what are essentially constant. This saves CPU time, and maybe a little memory for the code to make those calculations more than once.

13.34.2 Constructor & Destructor Documentation

13.34.2.1 maintime() [1/2]

```
seq64::maintime::maintime (
            const maintime &  )  [private]
```

13.34.2.2 maintime() [2/2]

```
seq64::maintime::maintime (
            perform & p,
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

In the constructor you can only allocate colors; get_window() would return 0 because the windows has not yet been realized.

13.34.2.3 ~maintime()

```
virtual seq64::maintime::~maintime ( )  [inline], [virtual]
```

13.34.3 Member Function Documentation

13.34.3.1 operator=()

```
maintime& seq64::maintime::operator= (
            const maintime &  )  [private]
```

13.34.3.2 idle_progress()

```
int seq64::maintime::idle_progress (
            midipulse ticks )  [private]
```

Idle hands do the devil's work. We should eventually support some generic coloring for "dark themes". The default coloring is better for "light themes".

Parameters

ticks	Provides the main tick setting. This setting is provided by mainwnd(), in its timer callback.

Returns

Always returns 1 (it used to return "true"!).

13.34.3.3 on_realize()

```
void seq64::maintime::on_realize ( )  [private]
```

It performs the base class's on_realize() function. It then allocates some additional resources: a window, a GC (?), and it clears the window. Then it sets the default size of the window, specified by GUI constructor parameters.

13.34.3.4 on_expose_event()

```
bool seq64::maintime::on_expose_event (
            GdkEventExpose * a_e )  [private]
```

We don't need the m_tick member, the function works as well if 0 is passed in. We've removed m_tick permanently.

Actually, it might be useful after all, to avoid flickering under JACK transport. Let's put it back for now. (It doesn't help, but we will leave it in, the overhead is small.)

13.34.4 Friends And Related Function Documentation

13.34.4.1 mainwnd

```
friend class mainwnd  [friend]
```

13.34.5 Field Documentation

13.34.5.1 m_beat_width

```
const int seq64::maintime::m_beat_width  [private]
```

Currently, this value is hardwired to 4, but will eventually be wired up as usr().midi_beat_width().

13.34.5.2 m_bar_width

```
const int seq64::maintime::m_bar_width  [private]
```

Currently, this value is hardwired to 16, but will eventually be wired up as usr().midi_beat_width() * usr().midi_↩ beats_per_bar().

13.34.5.3 m_pill_width

```
const int seq64::maintime::m_pill_width  [private]
```

13.34.5.4 m_box_width

```
const int seq64::maintime::m_box_width  [private]
```

This item absolutely depends on the main window being non-resizable.

13.34.5.5 m_box_height

```
const int seq64::maintime::m_box_height  [private]
```

This item absolutely depends on the main window being non-resizable.

13.34.5.6 m_flash_width

```
const int seq64::maintime::m_flash_width  [private]
```

Just a bit smaller than m_box_width.

13.34.5.7 m_flash_height

```
const int seq64::maintime::m_flash_height  [private]
```

Just a bit smaller than m_box_width.

13.34.5.8 m_flash_x

```
const int seq64::maintime::m_flash_x  [private]
```

13.34.5.9 m_box_less_pill

```
const int seq64::maintime::m_box_less_pill  [private]
```

13.34.5.10 m_tick

```
midipulse seq64::maintime::m_tick  [private]
```

It might actually be useful after all. And the overhead is tiny.

13.34.5.11 m_ppqn

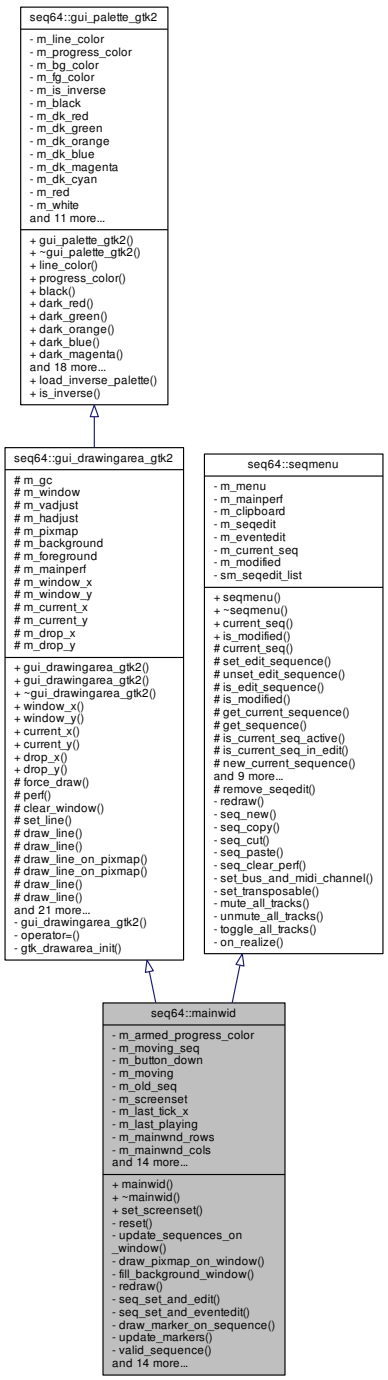
```
int seq64::maintime::m_ppqn  [private]
```

While this is effectively a constant for the duration of a tune, it might change as different tunes are loaded.

13.35 seq64::mainwid Class Reference

This class implements the piano roll area of the application.

Inheritance diagram for seq64::mainwid:



Public Member Functions

- mainwid (perform &p)

  This constructor sets all of the members.
- virtual ~mainwid ()

  A rote destructor.
- void set_screenset (int ss, bool setperf=false)

  Set the current screen-set.

Private Member Functions

- void reset ()

  This function redraws everything and queues up a redraw operation.
- void update_sequences_on_window ()

  Updates the image of multiple sequencer/pattern slots.
- void draw_pixmap_on_window ()

  This function queues the blit of pixmap to window.
- void fill_background_window ()

  This function updates the background window, clearing it.
- virtual void redraw (int seq)

  This virtual function, overridden from the seqmenu base class, draws the the given pattern/sequence again.
- virtual void seq_set_and_edit (int seqnum)

  Calculates the sequence number based on the screenset and then calls the base-class function to bring up the pattern/sequence editor.
- virtual void seq_set_and_eventedit (int seqnum)

  Calculates the sequence number based on the screenset and then calls the base-class function to bring up the event editor.
- void draw_marker_on_sequence (int seq, int tick)

  Does the actual drawing of one pattern/sequence position marker, a vertical progress bar.
- void update_markers (int ticks)

  Draw the cursors (long vertical bars) on each sequence, so that they follow the playing progress of each sequence in the mainwid (Patterns Panel).
- bool valid_sequence (int seq)

  Common-code helper function.
- void draw_sequence_on_pixmap (int seq)

  This function draws a specific pattern/sequence on the pixmap located in the main window of the application, the Patterns Panel.
- void draw_sequences_on_pixmap ()

  This function fills the pixmap with sequences.
- void draw_sequence_pixmap_on_window (int seq)

  This function draws a sequence pixmap in the Patterns Panel.
- int seq_from_xy (int x, int y)

  Translates XY coordiinates in the Patterns Panel to a sequence number.
- int timeout ()

  Provides a stock callback, because some kind of callback is needed.
- void calculate_base_sizes (int seq, int &basex, int &basey)

  Provides a way to calculate the base x and y size values for the pattern map.
- void select_fg_bg_colors (int seqnum)

  Picks the foreground and background colors based on the sequence in edit and the SEQ64_EDIT_SEQUENCE_↩ HIGHLIGHT macro.
- void on_realize ()

  For this GTK callback, on realization of window, initialize the shiz.
- bool on_expose_event (GdkEventExpose ∗ev)

  Implements the GTK expose event callback.
- bool on_button_press_event (GdkEventButton ∗ev)

  Handles a press of a mouse button in one of the sequence/pattern slots.
- bool on_button_release_event (GdkEventButton ∗ev)

  Handles a release of a mouse button.
- bool on_motion_notify_event (GdkEventMotion ∗p0)

  Handle the motion of the mouse if a mouse button is down and in another sequence and if the current sequence is not in edit mode.

- bool on_focus_in_event (GdkEventFocus *)

  Handles an on-focus event.
- bool on_focus_out_event (GdkEventFocus *)

  Handles an out-of-focus event.

Private Attributes

- Color m_armed_progress_color

  Holds the progress color for armed sequences, which have a black background.
- sequence m_moving_seq

  Holds a partial copy of the sequence we are moving on the patterns panel.
- bool m_button_down

  Indicates that the mouse button is still down.
- bool m_moving

  Indicates that we are still in the middle of a drag-and-drop operation.
- int m_old_seq

  Holds the sequence number of a sequence being drag-and-dropped.
- int m_screenset

  Indicates the current screenset that is visible.
- long m_last_tick_x [c_max_sequence]

  Holds the last active tick for each sequence, used in erasing the progress bar.
- long m_last_playing [c_max_sequence]

  Holds the last playing tick for each sequence.
- int m_mainwnd_rows

  These values are assigned to the values given by the constants of similar names in globals.h, and we will make them parameters or user-interface configuration items later.
- int m_mainwnd_cols

  Number of columns, unused in settings.
- int m_seqarea_x

  Roughly with width of the main window.
- int m_seqarea_y

  Roughly with height of the main window.
- int m_seqarea_seq_x

  To be determined.
- int m_seqarea_seq_y

  To be determined.
- int m_mainwid_x

  To be determined.
- int m_mainwid_y

  To be determined.
- int m_mainwid_border

  Main-window border, unused setting.
- int m_mainwid_spacing

  Main-window spacing, unused setting.
- int m_text_size_x

  Text width, varies with font in use.
- int m_text_size_y

  Text height, varies with font in use.
- int m_max_sets

  The maximum number of sets, use all over.

- int m_screenset_slots

  Provides a convenience variable for avoiding multiplications.
- int m_screenset_offset

  Provides a convenience variable for avoiding multiplications.
- int m_progress_height

  Provides the height of the progress bar, to save calculations and for consistency between drawing and erasing the progress bar.

Friends

- class mainwnd
- void update_mainwid_sequences ()

  This global function in the seq64 namespace calls mainwid :: update_sequences_on_window(), if the global mainwid object exists.

Additional Inherited Members

13.35.1 Detailed Description

It inherits from gui_drawingarea_gtk2 to support the font, color, and other GUI functionality, and from seqmenu to support the right-click Edit/New/Cut right-click menu. The friend class and function are for updating the current sequence and for control via the mainwnd object.

13.35.2 Constructor & Destructor Documentation

13.35.2.1 mainwid()

```
seq64::mainwid::mainwid (
            perform & p )
```

And it asks for a size of c_mainwid_x by c_mainwid_y. It adds GDK masks for button presses, releases, motion, key presses, and focus changes. Also logs a self-referential singleton pointer to use for the current-edit highlighting support.

Parameters

p	Provides the reference to the all-important perform object.

13.35.2.2 ~mainwid()

```
seq64::mainwid::~mainwid ( )  [virtual]
```

13.35.3 Member Function Documentation

13.35.3.1 set_screenset()

```
void seq64::mainwid::set_screenset (
            int ss,
            bool setperf = false )
```

The clamping algorithm for the screeset is a bit weird: if less than 0, we set m_screenset to its maximum, and if greater than the maximum, we set it to its minimum. Not sure if this matters.

Note that m_screenset_slots = m_mainwnd_rows * m_mainwnd_cols.

We will likely replace this with perform::set_screenset(), which recapitulates the code above completely, whereas perform::set-offset() recapitulates only the line of code immediately above it. However, note that there is a back-and-forth between setting the screenset via perform (using MIDI control) versus the GUI in the mainwnd class. Probably useful to add a default boolean to prevent circular manipulation.

Parameters

ss	Provides the screen-set number to set.
setperf	If true, then also call perfrom::set_screenset(). Defaults to false. It might be better if it defaults to true.

13.35.3.2 reset()

```
void seq64::mainwid::reset ( )  [inline], [private]
```

13.35.3.3 update_sequences_on_window()

```
void seq64::mainwid::update_sequences_on_window ( )  [inline], [private]
```

Used by the friend class mainwnd, but also useful for our new feature to fully highlight the current sequence. Calls reset() if SEQ64_EDIT_SEQUENCE_HIGHLIGHT is defined.

13.35.3.4 draw_pixmap_on_window()

```
void seq64::mainwid::draw_pixmap_on_window ( )  [inline], [private]
```

13.35.3.5 fill_background_window()

```
void seq64::mainwid::fill_background_window ( )  [inline], [private]
```

13.35.3.6 redraw()

```
void seq64::mainwid::redraw (
            int seqnum )  [private], [virtual]
```

Parameters

seqnum	Provides the number of the sequence to draw.

Implements seq64::seqmenu.

13.35.3.7 seq_set_and_edit()

```
void seq64::mainwid::seq_set_and_edit (
            int seqnum )  [private], [virtual]
```

Used with the '=' key selection, by default.

Reimplemented from seq64::seqmenu.

13.35.3.8 seq_set_and_eventedit()

```
void seq64::mainwid::seq_set_and_eventedit (
            int seqnum )  [private], [virtual]
```

Used with the '-' key selection, by default.

Reimplemented from seq64::seqmenu.

13.35.3.9 draw_marker_on_sequence()

```
void seq64::mainwid::draw_marker_on_sequence (
            int seqnum,
            int tick )  [private]
```

If the sequence has no events, this function doesn't bother drawing a position marker.

Note that, when Sequencer64 first comes up, and perform::is_dirty_main() is called, no sequences exist yet. Also, currently the redraw() is hit when seq_edit() is called, but not when seq_event_edit() is called, which makes the latter not paint the in-edit highlight colors (if enabled). Why?

Parameters

seqnum	Provides the number of the sequence to draw.
tick	Provides the location to draw the marker. If pause support is compiled in (i.e. no –disable-pause in the configuration), then this parameter is ignored, and is replaced by the sequences' get_lask_tick() value. This causes correct stop/pause/play progress-bar behavior in each pattern slot.

13.35.3.10 update_markers()

```
void seq64::mainwid::update_markers (
            int tick )  [private]
```

Parameters

tick	Starting point for drawing the markers.

13.35.3.11 valid_sequence()

```
bool seq64::mainwid::valid_sequence (
            int seqnum )  [private]
```

Parameters

seqnum	Provides the number of the sequence to validate.

Returns

Returns true if the sequence number is valid for the current m_screenset value.

13.35.3.12 draw_sequence_on_pixmap()

```
void seq64::mainwid::draw_sequence_on_pixmap (
            int seqnum )  [private]
```

The sequence is drawn only if it is in the current screen set (indicated by m_screenset). Also, we ignore the sequence if it does not exist.

Note

If only the main window is up, then the sequences just play (muted by default) – the progress bars move in each pattern. Gaps in the sequence in the Song (performance) Editor don't change the appearance of the patterns if only the main window is up. But, if the Song Editor window is up, and the song is started using the controls in the Song Editor, then the active patterns are black while playing, and white when gaps in the sequence are encountered. The muting status in the main window is ignored. The muting in the Song (performance) windows is in force. This setup holds for ALSA, but not for JACK transport.

Parameters

seqnum	Provides the number of the sequence slot that needs to be drawn. It is checked for validity before usage.

13.35.3.13 draw_sequences_on_pixmap()

```
void seq64::mainwid::draw_sequences_on_pixmap ( )  [private]
```

Please note that draw_sequence_on_pixmap() also draws the empty slots of inactive sequences, so we cannot take shortcuts here.

13.35.3.14 draw_sequence_pixmap_on_window()

```
void seq64::mainwid::draw_sequence_pixmap_on_window (
            int seqnum )  [private]
```

The sequence is drawn only if it is in the current screen set (indicated by m_screenset. This function is used when dragging a pattern from one pattern-slot to another pattern-slot.

We have to add 1 pixel to the y height in order to avoid leaving behind a line at the bottom of an empty pattern-slot.

Parameters

seqnum	Provides the number of the sequence to draw.

13.35.3.15 seq_from_xy()

```
int seq64::mainwid::seq_from_xy (
            int x,
            int y )  [private]
```

Parameters

x	Provides the x coordinate.
y	Provides the y coordinate.

Returns

Returns -1 if the sequence number cannot be calculated.

13.35.3.16 timeout()

```
int seq64::mainwid::timeout ( )  [private]
```

Todo We should use this callback to display the current time in the playback.

Returns

Always returns true.

13.35.3.17 calculate_base_sizes()

```
void seq64::mainwid::calculate_base_sizes (
            int seqnum,
            int & basex,
            int & basey )  [private]
```

The values are returned as side-effects.

Parameters

	seqnum	Provides the number of the sequence to calculate.
out	*basex*	A return parameter for the x coordinate of the base size.
out	*basey*	A return parameter for the y coordinate of the base size.

13.35.3.18 select_fg_bg_colors()

```
void seq64::mainwid::select_fg_bg_colors (
            int seqnum )  [private]
```

13.35.3.19 on_realize()

```
void seq64::mainwid::on_realize ( )  [private]
```

It allocates any additional resources that weren't initialized in the constructor.

This function used to call font::init(), and was the only place where the font::init() function was called. The init() function gets a color-map from the window. We need a more fool-proof was to do this!

13.35.3.20 on_expose_event()

```
bool seq64::mainwid::on_expose_event (
            GdkEventExpose * ev )  [private]
```

Parameters

ev	The expose event.

Returns

Always returns true.

13.35.3.21 on_button_press_event()

```
bool seq64::mainwid::on_button_press_event (
            GdkEventButton * ev )  [private]
```

If the press is a single left-click, and no Ctrl key is pressed, then this function grabs the focus, calculates the pattern/sequence over which the button press occurred, and sets the m_button_down flag if it is over a pattern. In the release event callback, this then causes the sequence arming/muting to be toggled.

If the press is a single Ctrl-left-click, this function brings up the New or Edit menu. The New menu is brought up if the grid slot is empty, and the Edit menu otherwise. Another way to bring up the same functionality is described in the next paragraph.

If the press is a double-click, it first acts just like two single-clicks (which might confuse the user at first, because it toggles the mute state twice). Then it brings up the Edit menu for the sequence. This new behavior is closer to what users have come to expect from a double-click. I miss the double-click when running seq24.

We also try to handle a Ctrl-double-click as a signal to do an event edit, instead of a sequence edit. The event editor provides a way to look at all events in detail, without having to select the type of event to see. However, this doesn't work, the event is treated like a ctrl-single-click. And we use the Alt key to enable window movement or resizing in our window manager, so that's out.

Parameters

ev	Provides the parameters of the button event.

Returns

Always returns true.

13.35.3.22 on_button_release_event()

```
bool seq64::mainwid::on_button_release_event (
            GdkEventButton * ev )  [private]
```

This event is a lot more complex than a press. The left button toggles playback status. The right button brings up a popup menu. If the slot is empty, then a "New" popup is presented, otherwise an "Edit" and selection popup is presented.

Also now implements the new "toggle all other patterns" action, initiated via Shift-Left-Click.

Parameters

ev	Provides the parameters of the button event.

Returns

Always returns true.

Tried disabling the setting of the current sequence; it completely disables drag-n-drop. But leaving it in removes the current-sequence highlighting, which otherwise is fine. So we do it only if moving a pattern (drag-and-drop).

13.35.3.23 on_motion_notify_event()

```
bool seq64::mainwid::on_motion_notify_event (
            GdkEventMotion * ev )  [private]
```

This function moves the selected pattern to another pattern slot. The perform::delete_sequence() function sets the perform modification flag.

Parameters

ev	Provides the parameters of the button event.

Returns

Always returns true.

13.35.3.24 on_focus_in_event()

```
bool seq64::mainwid::on_focus_in_event (
            GdkEventFocus *  )  [private]
```

Just sets the Gtk::HAS_FOCUS flag.

Returns

Always returns false.

13.35.3.25 on_focus_out_event()

```
bool seq64::mainwid::on_focus_out_event (
            GdkEventFocus *  )  [private]
```

Just unsets the Gtk::HAS_FOCUS flag.

Returns

Always returns false.

13.35.4 Friends And Related Function Documentation

13.35.4.1 mainwnd

```
friend class mainwnd  [friend]
```

13.35.4.2 update_mainwid_sequences

```
void update_mainwid_sequences ( )  [friend]
```

It is used by other objects that can modify the currently-edited sequence shown in the mainwid (main window).

13.35.5 Field Documentation

13.35.5.1 m_armed_progress_color

```
Color seq64::mainwid::m_armed_progress_color  [private]
```

If the progress color is black(), we want to change it to white for unmuted patterns.

13.35.5.2 m_moving_seq

```
sequence seq64::mainwid::m_moving_seq  [private]
```

The assignment is made by sequence::partial_copy(), which behaves like the legacy seq24 code.

13.35.5.3 m_button_down

```
bool seq64::mainwid::m_button_down  [private]
```

Used in the drag-and-drop functionality.

13.35.5.4 m_moving

```
bool seq64::mainwid::m_moving  [private]
```

13.35.5.5 m_old_seq

```
int seq64::mainwid::m_old_seq  [private]
```

13.35.5.6 m_screenset

```
int seq64::mainwid::m_screenset  [private]
```

13.35.5.7 m_last_tick_x

```
long seq64::mainwid::m_last_tick_x[c_max_sequence]  [private]
```

13.35.5.8 m_last_playing

```
long seq64::mainwid::m_last_playing[c_max_sequence]  [private]
```

This doesn't seem to be used anywhere, even though values are logged, so it is macroed out.

13.35.5.9 m_mainwnd_rows

```
int seq64::mainwid::m_mainwnd_rows  [private]
```

Some of them already have counterparts in the user_settings class.Number of rows, unused part of settings.

13.35.5.10 m_mainwnd_cols

```
int seq64::mainwid::m_mainwnd_cols  [private]
```

13.35.5.11 m_seqarea_x

```
int seq64::mainwid::m_seqarea_x  [private]
```

13.35.5.12 m_seqarea_y

```
int seq64::mainwid::m_seqarea_y  [private]
```

13.35.5.13 m_seqarea_seq_x

```
int seq64::mainwid::m_seqarea_seq_x  [private]
```

13.35.5.14 m_seqarea_seq_y

```
int seq64::mainwid::m_seqarea_seq_y  [private]
```

13.35.5.15 m_mainwid_x

```
int seq64::mainwid::m_mainwid_x  [private]
```

13.35.5.16 m_mainwid_y

```
int seq64::mainwid::m_mainwid_y  [private]
```

13.35.5.17 m_mainwid_border

```
int seq64::mainwid::m_mainwid_border  [private]
```

13.35.5.18 m_mainwid_spacing

```
int seq64::mainwid::m_mainwid_spacing  [private]
```

13.35.5.19 m_text_size_x

```
int seq64::mainwid::m_text_size_x  [private]
```

13.35.5.20 m_text_size_y

```
int seq64::mainwid::m_text_size_y  [private]
```

13.35.5.21 m_max_sets

```
int seq64::mainwid::m_max_sets  [private]
```

13.35.5.22 m_screenset_slots

```
int seq64::mainwid::m_screenset_slots  [private]
```

It is equal to m_mainwnd_rows ∗ m_mainwnd_cols.

13.35.5.23 m_screenset_offset

```
int seq64::mainwid::m_screenset_offset  [private]
```

It is equally to m_screenset_slots ∗ m_screenset.

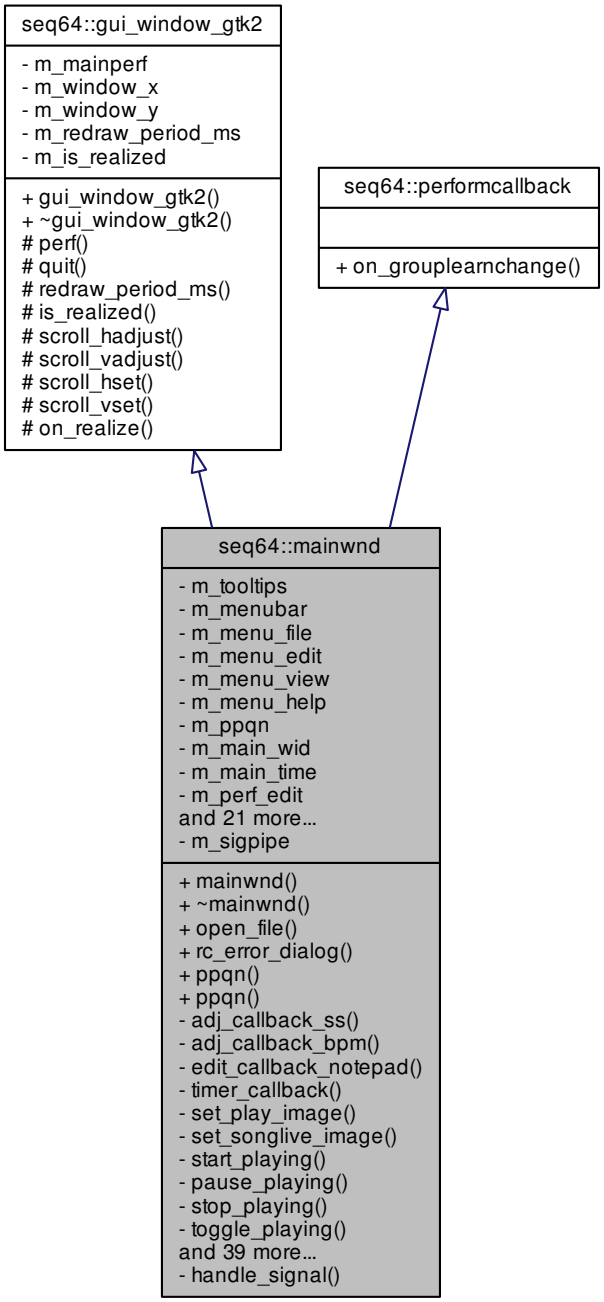
13.35.5.24 m_progress_height

```
int seq64::mainwid::m_progress_height  [private]
```

13.36 seq64::mainwnd Class Reference

This class implements the functionality of the main window of the application, except for the Patterns Panel functionality, which is implemented in the mainwid class.

Inheritance diagram for seq64::mainwnd:



Public Member Functions

- mainwnd (perform &p, bool allowperf2=true, int ppqn=SEQ64_USE_DEFAULT_PPQN)

  The constructor the main window of the application.
- virtual ~mainwnd ()

  This destructor must explicitly delete some allocated resources.
- void open_file (const std::string &filename)

Opens and parses (reads) a MIDI file.

- void rc_error_dialog (const std::string &message)

  Tells the user that the "rc" file is erroneous.

- int ppqn () const

  'Getter' function for member m_ppqn

- void ppqn (int ppqn)

  'Setter' function for member m_ppqn We can't set the PPQN value when the mainwnd is created, we have to do it later, using this function.

Private Member Functions

- void adj_callback_ss ()

  This function is the callback for adjusting the screen-set value.

- void adj_callback_bpm ()

  This function is the callback for adjusting the BPM value.

- void edit_callback_notepad ()

  A callback function for handling an edit to the screen-set notepad.

- bool timer_callback ()

  This function is the GTK timer callback, used to draw our current time and BPM on_events (the main window).

- void set_play_image (bool isrunning)

  Changes the image used for the pause/play button.

- void set_songlive_image (bool issong)

  Changes the image used for the song/live mode button.

- void start_playing ()

  Starts playing of the song.

- void pause_playing ()

  Pauses the playing of the song, leaving the progress bar where it stopped.

- void stop_playing ()

  Stops the playing of the song.

- void toggle_playing ()

  Reverses the state of playback.

- void learn_toggle ()

  Toggle the group-learn status.

- void open_performance_edit ()

  Opens the Performance Editor (Song Editor).

- void open_performance_edit_2 ()

  Opens the second Performance Editor (Song Editor).

- void enregister_perfedits ()

  This function brings together the two perfedit objects, so that they can tell each other when to queue up a draw operation.

- void sequence_key (int seq)

  Use the sequence key to toggle the playing of an active pattern in the current screen-set.

- void apply_song_transpose ()

  Apply full song transposition, if enabled.

- void clear_mute_groups ()

  Clear all mute-group settings.

- void reload_mute_groups ()

  Reload all mute-group settings from the "rc" file.

- void update_window_title ()

  Updates the title shown in the title bar of the window.

- void toLower (std::string &)

  Converts a string to lower-case letters.
- void file_new ()

  A callback function for the File / New menu entry.
- void file_open ()

  A callback function for the File / Open menu entry.
- void file_save ()

  A callback function for the File / Save menu entry.
- void set_song_mute (perform::mute_op_t op)

  Sets the song-mute mode.
- void file_import_dialog ()

  Presents a file dialog to import a MIDI file.
- void options_dialog ()

  Opens the File / Options dialog.
- void jack_dialog ()

  Opens the File / Options dialog to show only the JACK page.
- void about_dialog ()

  Presents a Help / About dialog.
- void build_info_dialog ()

  Presents a Help / Build Info dialog.
- int query_save_changes ()

  Queries the user to save the changes made while the application was running.
- void new_open_error_dialog ()

  Tells the user to close all the edit windows first.
- void file_save_as (bool do_export=false)

  A callback function for the File / Save As menu entry.
- void file_exit ()

  A callback function for the File / Exit menu entry.
- void new_file ()

  Actually does the work of setting up for a new file.
- bool save_file ()

  Saves the current state in a MIDI file.
- void choose_file ()

  Creates a file-chooser dialog.
- bool is_save ()

  If the data is modified, then the user is queried, and the file is save if okayed.
- bool install_signal_handlers ()

  Installs the signal handlers and pipe code.
- bool signal_action (Glib::IOCondition condition)

  Handles saving or exiting actions when signalled.
- bool edit_field_has_focus () const

  Check if one of the edit fields (BPM spinbutton, screenset spinbutton, or the Name field) has focus.
- void populate_menu_file ()

  Populates the File menu: File menu items; their accelerator keys; and their hot keys.
- void populate_menu_edit ()

  Populates the Edit menu: Edit menu items; their accelerator keys; and their hot keys.
- void populate_menu_help ()

  Populates the Help menu.
- void populate_menu_view ()

  Populates the View menu: View menu items and their hot keys.
- bool on_delete_event (GdkEventAny ∗ev)

This callback function handles a delete event from ...?

- bool on_key_press_event (GdkEventKey *ev)

  Handles a key press event.

- bool on_key_release_event (GdkEventKey *ev)

  Handles a key release event.

- void on_realize ()

  We are trying to work around an apparent Gtk+ bug (which occurs on my 64-bit Debian Sid laptop, but not on my 32-bit Debian Jessie laptop) that causes Sequencer64 to freeze, emitting Gtk errors, if one tries to access the main menu via Alt-F, Alt-E, etc.

- virtual void on_grouplearnchange (bool state)

  Notification handler for learn mode toggle.

Static Private Member Functions

- static void handle_signal (int sig)

  This function is the handler for system signals (SIGUSR1, SIGINT...) It writes a message to the pipe and leaves as soon as possible.

Private Attributes

- Gtk::Tooltips * m_tooltips

  A repository for tooltips.

- Gtk::MenuBar * m_menubar

  Theses objects support the menu and its sub-menus.

- Gtk::Menu * m_menu_file

  The File menu entry.

- Gtk::Menu * m_menu_edit

  The (new) Edit menu entry.

- Gtk::Menu * m_menu_view

  The View menu entry.

- Gtk::Menu * m_menu_help

  The Help menu entry.

- int m_ppqn

  Saves the PPQN value obtained from the MIDI file (or the default value, the global ppqn, if SEQ64_USE_DEFAUL↩ T_PPQN was specified in reading the MIDI file.

- mainwid * m_main_wid

  The biggest sub-components of mainwnd.

- maintime * m_main_time

  Is this the bar at the top that shows moving squares, also known as "pills"? Why yes, it is.

- perfedit * m_perf_edit

  A pointer to the first song/performance editor.

- perfedit * m_perf_edit_2

  A pointer to an optional second song/performance editor.

- options * m_options

  A pointer to the program options.

- Gdk::Cursor m_main_cursor

  Mouse cursor?

- Gtk::Image * m_image_play

  Provides a pointer to hold the images for the pause/play button.

- Gtk::Button * m_button_learn

This button is the learn button, otherwise known as the "L" button.

- Gtk::Button * m_button_stop

  Implements the red square stop button.

- Gtk::Button * m_button_play

  Implements the green triangle play button.

- Gtk::Button * m_button_perfedit

  The button for bringing up the Song Editor (Performance Editor).

- Gtk::Button * m_button_jack

  Sets and indicates the current mode of Sequencer64: JACK, Master, and ALSA.

- Gtk::Adjustment * m_adjust_bpm

  The spin/adjustment controls for the BPM (beats-per-minute) value.

- Gtk::SpinButton * m_spinbutton_bpm

  BPM spin-button object.

- Gtk::Adjustment * m_adjust_ss

  The spin/adjustment controls for the screenset value.

- Gtk::SpinButton * m_spinbutton_ss

  Screenset adjustment.

- Gtk::Adjustment * m_adjust_load_offset

  The spin/adjustment controls for the load offset value.

- Gtk::SpinButton * m_spinbutton_load_offset

  Spin button for import.

- Gtk::Entry * m_entry_notes

  This item provides user-interface access to the screenset notepad editor.

- bool m_is_running

  Holds the current status of running, for use in display the play versus pause icon.

- sigc::connection m_timeout_connect

  Provides a timeout handler.

- bool m_menu_mode

  Indicates if the menu bar is to be greyed out or not.

- bool m_call_seq_edit

  Indicates that this object is in a mode where the usual mute/unmute keystroke will instead bring up the pattern slot for editing.

- bool m_call_seq_eventedit

  Indicates that this object is in a mode where the usual mute/unmute keystroke will instead bring up the pattern slot for event-editing.

Static Private Attributes

- static int m_sigpipe [2]

  This small array holds the "handles" for the pipes need to intercept the system signals SIGINT and SIGUSR1, so that the application shuts down gracefully when aborted.

Additional Inherited Members

13.36.1 Constructor & Destructor Documentation

13.36.1.1 mainwnd()

```
seq64::mainwnd::mainwnd (
            perform & p,
            bool allowperf2 = true,
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

This constructor is way too large; it would be nicer to provide a number of well-named initialization functions.

Parameters

p	Refers to the main performance object.
allowperf2	Indicates if a second perfedit window should be created. This is currently a run-time option, selectable in the "user" configuration file.
ppqn	An optional PPQN value to use in the song.

Todo Offload most of the work into an initialization function like options does; make the perform parameter a reference; valgrind flags m_tooltips as lost data, but if we try to manage it ourselves, many more leaks occur.

Top panel items, including the logo (updated for the new version of this application) and the "timeline" progress bar.

13.36.1.2 ~mainwnd()

```
seq64::mainwnd::~mainwnd ( )  [virtual]
```

13.36.2 Member Function Documentation

13.36.2.1 open_file()

```
void seq64::mainwnd::open_file (
            const std::string & fn )
```

We leave the ppqn parameter set to the SEQ64_USE_DEFAULT for now, to preserve the legacy behavior of using the global ppqn, and scaling the running time against the PPQN read from the MIDI file. Later, we can provide a value like 0, that will certainly be changed by reading the MIDI file.

We don't need to specify the "oldformat" or "global sequence" parameters of the midifile constructor when reading the MIDI file, since reading handles both the old and new formats, dealing with new constructs only if they are present in the file.

Parameters

fn	Provides the file-name for the MIDI file to be opened.

13.36.2.2 rc_error_dialog()

```
void seq64::mainwnd::rc_error_dialog (
            const std::string & message )
```

We can't yet display the specific error, except in a terminal window.

Parameters

message	Provides the error message returned by the configuration file.

13.36.2.3 ppqn() [1/2]

```
int seq64::mainwnd::ppqn ( ) const  [inline]
```

13.36.2.4 ppqn() [2/2]

```
void seq64::mainwnd::ppqn (
            int ppqn )  [inline]
```

m_ppqn = choose_ppqn(ppqn);

13.36.2.5 handle_signal()

```
void seq64::mainwnd::handle_signal (
            int sig )  [static], [private]
```

13.36.2.6 adj_callback_ss()

```
void seq64::mainwnd::adj_callback_ss ( )  [private]
```

Its sets the screen-set value in the Performance/Song window, the Patterns, and something about setting the text based on a screen-set notepad from the Performance/Song window. We let the perform object keep track of modifications.

13.36.2.7 adj_callback_bpm()

```
void seq64::mainwnd::adj_callback_bpm ( )  [private]
```

Let the perform object keep track of modifications.

13.36.2.8 edit_callback_notepad()

```
void seq64::mainwnd::edit_callback_notepad ( )  [private]
```

Let the perform object keep track of modifications.

13.36.2.9 timer_callback()

```
bool seq64::mainwnd::timer_callback ( )  [private]
```

It also supports the ALSA pause functionality.

Note

When Sequencer64 first starts up, and no MIDI tune is loaded, the call to mainwid::update_markers() leads to trying to do some work on sequences that don't yet exist. Also, if a sequence is changed by the event editor, we get a crash; need to find out how seqedit gets away with the changes.

Returns

Always returns true.

13.36.2.10 set_play_image()

```
void seq64::mainwnd::set_play_image (
            bool isrunning )  [private]
```

Parameters

isrunning	If true, set the image to the "Pause" icon, since playback is running. Otherwise, set it to the "Play" button, since playback is not running.

13.36.2.11 set_songlive_image()

```
void seq64::mainwnd::set_songlive_image (
            bool issong )  [private]
```

Parameters

issong	If true, set the image to the "Song" icon. Otherwise, set it to the "Live" button.

13.36.2.12 start_playing()

```
void seq64::mainwnd::start_playing ( )  [private]
```

An accessor to perform::start_playing(). This function is actually a callback for the pause/play button. Now very similar to perfedit::start_playing(), except that the implicit songmode == false parameter is used here.

We still need to see if pause_key() is workable with Stazed JACK support in force. Doesn't pause at present.

13.36.2.13 pause_playing()

```
void seq64::mainwnd::pause_playing ( )  [private]
```

Currently, it is just the same as stop_playing(), but we will get it to work.

13.36.2.14 stop_playing()

```
void seq64::mainwnd::stop_playing ( )  [private]
```

An accessor to perform's stop_playing() function. Also calls the mainwid::update_sequences_on_window() function. Not sure that we need this call, since the slots seem to update anyway. But we've noticed that, with this call in place, hitting the Stop button causes a subtle change in the appearance of the first non-empty pattern of the "allofarow.mid" file.

After the Stop button is pushed (in ALSA mode), then the Space key ("start") doesn't work properly. The song starts, then quickly stops. It doesn't matter if update_sequences_on_window() is called or not. This happens even in seq24! This bug has proven incredibly difficult to track down, still working on it.

13.36.2.15 toggle_playing()

```
void seq64::mainwnd::toggle_playing ( )  [private]
```

Meant only to be called when the "Play" button is pressed, if the pause feature has been compiled into the application.

13.36.2.16 learn_toggle()

```
void seq64::mainwnd::learn_toggle ( )  [inline], [private]
```

Simply forwards the call to perform::learn_toggle().

13.36.2.17 open_performance_edit()

```
void seq64::mainwnd::open_performance_edit ( )  [private]
```

We will let perform keep track of modifications, and not just set an is-modified flag just because we opened the song editor. We're going to centralize the modification flag in the perform object, and see if it can work.

13.36.2.18 open_performance_edit_2()

```
void seq64::mainwnd::open_performance_edit_2 ( )  [private]
```

Experiment: open a second one and see what happens. It works, but one needs to tell the other to redraw if a change is made.

13.36.2.19 enregister_perfedits()

```
void seq64::mainwnd::enregister_perfedits ( )  [private]
```

13.36.2.20 sequence_key()

```
void seq64::mainwnd::sequence_key (
            int seq )  [inline], [private]
```

13.36.2.21 apply_song_transpose()

```
void seq64::mainwnd::apply_song_transpose ( )  [private]
```

Then reset the perfedit transpose setting to 0.

13.36.2.22 clear_mute_groups()

```
void seq64::mainwnd::clear_mute_groups ( )  [private]
```

Sets all values to false/zero.

13.36.2.23 reload_mute_groups()

```
void seq64::mainwnd::reload_mute_groups ( )  [private]
```

13.36.2.24 update_window_title()

```
void seq64::mainwnd::update_window_title ( )  [private]
```

Note that the name of the application is obtained by the "(SEQ64_PACKAGE)" construction.

The format of the caption bar is the name of the package/application, followed by the file-specification (shortened if necessary so that the name of the file itself can be seen), ending with the PPQN value in parentheses.

13.36.2.25 toLower()

```
void seq64::mainwnd::toLower (
            std::string & s )  [private]
```

13.36.2.26 file_new()

```
void seq64::mainwnd::file_new ( )  [inline], [private]
```

13.36.2.27 file_open()

```
void seq64::mainwnd::file_open ( )  [inline], [private]
```

13.36.2.28 file_save()

```
void seq64::mainwnd::file_save ( )  [inline], [private]
```

13.36.2.29 set_song_mute()

```
void seq64::mainwnd::set_song_mute (
            perform::mute_op_t op )  [inline], [private]
```

13.36.2.30 file_import_dialog()

```
void seq64::mainwnd::file_import_dialog ( )  [private]
```

Note that every track of the MIDI file will be imported, even if the track is only a label track (without any MIDI events), or a very long track.

The main difference between the Open operation and the Import operation seems to be that the latter can read MIDI files into a screen-set greater than screen-set 0. No, that's not true, so far. No matter what the current screen-set setting, the import is appended after the current data in screen-set 0. Then, if it overflows that screen-set, the overflow goes into the next screen-set.

It might be nice to have the option of importing a MIDI file into a specific screen-set, for better organization, as well as being able to offset the sequence number.

Also, it is important to note that perf().clear_all() is not called by this routine, as we are merely adding to what might already be there.

13.36.2.31 options_dialog()

```
void seq64::mainwnd::options_dialog ( )  [private]
```

13.36.2.32 jack_dialog()

```
void seq64::mainwnd::jack_dialog ( )  [private]
```

13.36.2.33 about_dialog()

```
void seq64::mainwnd::about_dialog ( )  [private]
```

I (Chris) took the liberty of tacking my name at the end, and hope to have done eventually enough work to warrant having it there. Hmmmmm....

13.36.2.34 build_info_dialog()

```
void seq64::mainwnd::build_info_dialog ( )  [private]
```

It is similar to the "--version" option on the command line. The AboutDialog doesn't seem to have a way to left-align the text, so we're trying the MessageDialog.

13.36.2.35 query_save_changes()

```
int seq64::mainwnd::query_save_changes ( )  [private]
```

13.36.2.36 new_open_error_dialog()

```
void seq64::mainwnd::new_open_error_dialog ( )  [private]
```

13.36.2.37 file_save_as()

```
void seq64::mainwnd::file_save_as (
            bool do_export = false )  [private]
```

Please note that Sequencer64 will not adopt the "c_seq32_midi" type of file, because it already saves its files in a format that other sequencers should be able to read.

Stazed on the intent of the export functionality:

```
The original intent was to be able to play an exported song in
something like TiMIDIty. After I completed things I realized that
there could be an editing benefit as well. I like to record from my
MIDI keyboard, improvised to a drum beat, on a long sequence (64
measures). Some is junk, but there are usually parts that I can use.
In original seq24, to cut out the good or bad stuff, you would have to
search the sequence by listening, then cut and move or copy and paste
to a new sequence. It could be done but was always tedious.  The paste
box for the sequence sometimes made it difficult to find the correct
note location, measure, and beat. Also, on a long sequence, you need
to zoom out to see the copy location as it played, but zoom in for the
precise paste location. In addition if you wanted to change the
measure of the notes, it became a trial and error of copy/paste,
listen, move, listen, move....

With the added Song editor feature of split trigger to mouse and copy
paste trigger to mouse, you can now do all the editing from the song
editor. Listen to the sequence, cut out the good or bad parts and
reassemble. Move or copy all good trigger parts to the left start and
delete all the bad stuff. Now you can use the song export to create
the new sequence. Just mute all other tracks and export. Re-import and
the new cleaned sequence is already done. Also I use it for importing
drum beats from a single '32/'42 file that contains dozens of
different styles with intros and endings. I like to sync two instances
of '32 or '42 together with jack, then play/experiment with the
different beats. If I find something I like, create the song trigger
for the part I like in the drum file, export and import.

I actually do not use the song export for anything but editing.
```

Note that the split trigger variant of Stazed, where it doesn't just split the section in half, is not yet implemented (2016-08-05).

Parameters

do_export	If true, then just write out the file and don't change the name of the current file based on the file-name the user selected. The default value of this parameter is false.

13.36.2.38 file_exit()

```
void seq64::mainwnd::file_exit ( )  [private]
```

13.36.2.39 new_file()

```
void seq64::mainwnd::new_file ( )  [private]
```

Not sure that we need to clear the modified flag here, especially since it is now centralizeed in the perform object. Let perf().clear_all() handle it now.

13.36.2.40 save_file()

```
bool seq64::mainwnd::save_file ( )  [private]
```

Here we specify the current value of m_ppqn, which was set when reading the MIDI file. We also let midifile tell the perform that saving worked, so that the "is modified" flag can be cleared. The midifile class is already a friend of perform.

13.36.2.41 choose_file()

```
void seq64::mainwnd::choose_file ( )  [private]
```

Change Note layk 2016-10-11 Issue #43 Added filters for upper-case MIDI-file extensions.

13.36.2.42 is_save()

```
bool seq64::mainwnd::is_save ( )  [private]
```

13.36.2.43 install_signal_handlers()

```
bool seq64::mainwnd::install_signal_handlers ( )  [private]
```

13.36.2.44 signal_action()

```
bool seq64::mainwnd::signal_action (
            Glib::IOCondition condition )  [private]
```

Returns

Returns true if the signalling was able to be completed, even if it was an unexpected signal.

13.36.2.45 edit_field_has_focus()

```
bool seq64::mainwnd::edit_field_has_focus ( ) const  [private]
```

Returns

Returns true if one of the three editable/modifiable fields has the keyboard focus.

13.36.2.46 populate_menu_file()

```
void seq64::mainwnd::populate_menu_file ( )  [private]
```

Provided to make the constructor more readable and manageable.

13.36.2.47 populate_menu_edit()

```
void seq64::mainwnd::populate_menu_edit ( )  [private]
```

Provided to make the constructor more readable and manageable.

13.36.2.48 populate_menu_help()

```
void seq64::mainwnd::populate_menu_help ( )  [private]
```

Provided to make the constructor more readable and manageable.

13.36.2.49 populate_menu_view()

```
void seq64::mainwnd::populate_menu_view ( )  [private]
```

It repeats the song editor edit command, just to help those whose muscle memory is already seq32-oriented. Provided to make the constructor more readable and manageable. View menu items and their hot keys.

13.36.2.50 on_delete_event()

```
bool seq64::mainwnd::on_delete_event (
            GdkEventAny * ev )  [private]
```

Any changed data is saved. If the pattern is playing, then it is stopped. We now use perform::is_pattern_playing().

13.36.2.51 on_key_press_event()

```
bool seq64::mainwnd::on_key_press_event (
            GdkEventKey * ev )  [private]
```

It also handles the control-key and modifier-key combinations matching the entries in its list of if statements.

Also, we now effectively press the CAPS LOCK key for the user if in group-learn mode, via the keystroke::shift_lock() function.

13.36.2.52 on_key_release_event()

```
bool seq64::mainwnd::on_key_release_event (
            GdkEventKey * ev )  [private]
```

Is this worth turning into a switch statement? Or offloading to a perform member function? The latter. Also, we now effectively press the CAPS LOCK key for the user if in group-learn mode. The function that does this is keystroke::shift_lock().

Todo Test this functionality in old and new application.

Returns

Always returns false. This matches seq24 behavior.

13.36.2.53 on_realize()

```
void seq64::mainwnd::on_realize ( )  [private]
```

without first moving the mouse to the main window. Weird with a beard!

13.36.2.54 on_grouplearnchange()

```
void seq64::mainwnd::on_grouplearnchange (
            bool state )  [private], [virtual]
```

This handler responds to a learn-mode change from perf().

Reimplemented from seq64::performcallback.

13.36.3 Field Documentation

13.36.3.1 m_sigpipe

```
int seq64::mainwnd::m_sigpipe  [static], [private]
```

This static member provides a couple of pipes for signalling/messaging.

13.36.3.2 m_tooltips

```
Gtk::Tooltips* seq64::mainwnd::m_tooltips  [private]
```

13.36.3.3 m_menubar

```
Gtk::MenuBar* seq64::mainwnd::m_menubar  [private]
```

The whole menu bar.

13.36.3.4 m_menu_file

```
Gtk::Menu* seq64::mainwnd::m_menu_file  [private]
```

13.36.3.5 m_menu_edit

```
Gtk::Menu* seq64::mainwnd::m_menu_edit  [private]
```

13.36.3.6 m_menu_view

```
Gtk::Menu* seq64::mainwnd::m_menu_view  [private]
```

13.36.3.7 m_menu_help

```
Gtk::Menu* seq64::mainwnd::m_menu_help  [private]
```

13.36.3.8 m_ppqn

```
int seq64::mainwnd::m_ppqn  [private]
```

We need it early here to be able to pass it along to child objects.

13.36.3.9 m_main_wid

```
mainwid* seq64::mainwnd::m_main_wid  [private]
```

The first is the Patterns Panel, which the mainwid helps implement. We end up sharing this object with perfedit, perfnames, and seqedit in order to allow the seqedit object to notify the mainwid (indirectly) of the currently-edited sequence.

13.36.3.10 m_main_time

```
maintime* seq64::mainwnd::m_main_time  [private]
```

13.36.3.11 m_perf_edit

```
perfedit* seq64::mainwnd::m_perf_edit  [private]
```

13.36.3.12 m_perf_edit_2

```
perfedit* seq64::mainwnd::m_perf_edit_2  [private]
```

The second makes it easy to line up two different patterns that cannot be seen together on one performance editor.

13.36.3.13 m_options

```
options* seq64::mainwnd::m_options  [private]
```

13.36.3.14 m_main_cursor

```
Gdk::Cursor seq64::mainwnd::m_main_cursor  [private]
```

13.36.3.15 m_image_play

```
Gtk::Image* seq64::mainwnd::m_image_play  [private]
```

13.36.3.16 m_button_learn

```
Gtk::Button* seq64::mainwnd::m_button_learn  [private]
```

13.36.3.17 m_button_stop

```
Gtk::Button* seq64::mainwnd::m_button_stop  [private]
```

13.36.3.18 m_button_play

```
Gtk::Button* seq64::mainwnd::m_button_play  [private]
```

If configured to support pause, it also supports the pause pixmap and functionality.

13.36.3.19 m_button_perfedit

```
Gtk::Button* seq64::mainwnd::m_button_perfedit  [private]
```

13.36.3.20 m_button_jack

```
Gtk::Button* seq64::mainwnd::m_button_jack  [private]
```

13.36.3.21 m_adjust_bpm

```
Gtk::Adjustment* seq64::mainwnd::m_adjust_bpm  [private]
```

BPM adjustment object.

13.36.3.22 m_spinbutton_bpm

```
Gtk::SpinButton* seq64::mainwnd::m_spinbutton_bpm  [private]
```

13.36.3.23 m_adjust_ss

```
Gtk::Adjustment* seq64::mainwnd::m_adjust_ss  [private]
```

Screenset adjustment.

13.36.3.24 m_spinbutton_ss

```
Gtk::SpinButton* seq64::mainwnd::m_spinbutton_ss  [private]
```

13.36.3.25 m_adjust_load_offset

```
Gtk::Adjustment* seq64::mainwnd::m_adjust_load_offset  [private]
```

These controls are used in the File / Import dialog to change where the imported file will be loaded in the sequences space, which ranges from 0 to 1024 in blocks of 32 patterns.Load number for import.

13.36.3.26 m_spinbutton_load_offset

```
Gtk::SpinButton* seq64::mainwnd::m_spinbutton_load_offset  [private]
```

13.36.3.27 m_entry_notes

```
Gtk::Entry* seq64::mainwnd::m_entry_notes  [private]
```

This is just a long text-edit field that can be used to enter a long name or a short description of the current screenset.

13.36.3.28 m_is_running

```
bool seq64::mainwnd::m_is_running  [private]
```

13.36.3.29 m_timeout_connect

```
sigc::connection seq64::mainwnd::m_timeout_connect  [private]
```

13.36.3.30 m_menu_mode

```
bool seq64::mainwnd::m_menu_mode  [private]
```

This is a "stazed" feature that might be generally useful.

13.36.3.31 m_call_seq_edit

```
bool seq64::mainwnd::m_call_seq_edit  [private]
```

Currently, the hard-wired key for this function is the equals key.

13.36.3.32 m_call_seq_eventedit

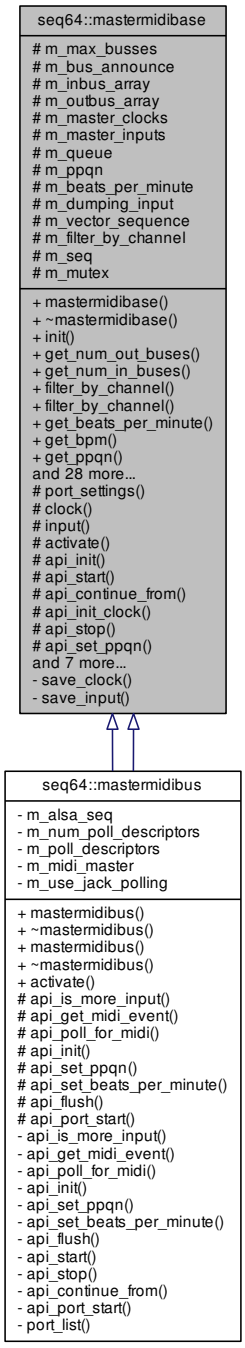
```
bool seq64::mainwnd::m_call_seq_eventedit  [private]
```

Currently, the hard-wired key for this function is the minus key.

13.37 seq64::mastermidibase Class Reference

The class that "supervises" all of the midibus objects?

Inheritance diagram for seq64::mastermidibase:



Public Member Functions

- mastermidibase (int ppqn=SEQ64_USE_DEFAULT_PPQN, midibpm bpm=SEQ64_DEFAULT_BPM)

  The mastermidibase default constructor fills the array with our busses.

- virtual ~mastermidibase ()

  The virtual destructor deletes all of the output busses, clears out the ALSA events, stops and frees the queue, and closes ALSA for this application.

- virtual void init (int ppqn, midibpm bpm)

  Initialize the mastermidibus using the implementation-specific API function.
- int get_num_out_buses () const

  'Getter' function for member m_num_out_buses
- int get_num_in_buses () const

  'Getter' function for member m_num_in_buses
- bool filter_by_channel () const

  'Getter' function for member m_filter_by_channel
- void filter_by_channel (bool flag)

  'Setter' function for member m_filter_by_channel
- midibpm get_beats_per_minute () const

  'Getter' function for member m_beats_per_minute
- midibpm get_bpm () const

  'Getter' function for member m_beats_per_minute This is a second version.
- int get_ppqn () const

  'Getter' function for member m_ppqn
- bool is_dumping () const

  'Getter' function for member m_dumping_input
- sequence * get_sequence () const

  'Getter' function for member m_seq
- void start ()

  Starts all of the configured output busses up to m_num_out_buses.
- void stop ()

  Stops each of the MIDI output busses.
- void port_start (int client, int port)

  Start the given MIDI port.
- void port_exit (int client, int port)

  Turn off the given port for the given client.
- void play (bussbyte bus, event *e24, midibyte channel)

  Handle the playing of MIDI events on the MIDI buss given by the parameter, as long as it is a legal buss number.
- void continue_from (midipulse tick)

  Gets the MIDI output busses running again.
- void init_clock (midipulse tick)

  Initializes the clock of each of the MIDI output busses.
- void emit_clock (midipulse tick)

  Generates the MIDI clock for each of the output busses.
- void sysex (event *event)

  Handle the sending of SYSEX events.
- void print () const

  Print some information about the available MIDI input and output busses.
- void flush ()

  Flushes our local queue events out The implementation-specific API function is called.
- void set_sequence_input (bool state, sequence *seq)

  Set the input sequence object, and set the m_dumping_input value to the given state.
- void dump_midi_input (event in)

  This function augments the recording functionality by looking for a sequence that has a matching channel number, logging the event to that sequence, and then immediately exiting.
- bool initialize_buses ()

  Initializes all fo the busses in the input and output buss arrays.
- std::string get_midi_out_bus_name (bussbyte bus)

  Get the MIDI output buss name for the given (legal) buss number.

- std::string get_midi_in_bus_name (bussbyte bus)

  Get the MIDI input buss name for the given (legal) buss number.
- int poll_for_midi ()

  Initiate a poll() on the existing poll descriptors.
- bool is_more_input ()

  Test the sequencer to see if any more input is pending.
- bool get_midi_event (event *in)

  Grab a MIDI event via the currently-selected MIDI API.
- bool set_clock (bussbyte bus, clock_e clock_type)

  Set the clock for the given (legal) buss number.
- bool set_input (bussbyte bus, bool inputing)

  Set the status of the given input buss, if a legal buss number.
- bool get_input (bussbyte bus)

  Get the input for the given (legal) buss number.
- bool is_input_system_port (bussbyte bus)

  Get the system-buss status for the given (legal) buss number.
- clock_e get_clock (bussbyte bus)

  Gets the clock setting for the given (legal) buss number.
- void set_ppqn (int ppqn)

  Set the PPQN value (parts per quarter note).
- void set_beats_per_minute (midibpm bpm)

  Set the BPM value (beats per minute).

Protected Member Functions

- void port_settings (const std::vector< clock_e > &clocks, const std::vector< bool > &inputs)
- clock_e clock (int bus)
- bool input (int bus)
- virtual bool activate ()

  Initializes and ctivates the busses, in a partly API-dependent manner.
- virtual void api_init (int ppqn, midibpm bpm)=0
- virtual void api_start ()

  Provides MIDI API-specific functionality for the start() function.
- virtual void api_continue_from (midipulse)

  Provides MIDI API-specific functionality for the continue_from() function.
- virtual void api_init_clock (midipulse)

  Provides MIDI API-specific functionality for the init_clock() function.
- virtual void api_stop ()

  Provides MIDI API-specific functionality for the stop() function.
- virtual void api_set_ppqn (int)

  Provides MIDI API-specific functionality for the set_ppqn() function.
- virtual void api_set_beats_per_minute (midibpm)

  Provides MIDI API-specific functionality for the set_beats_per_minute() function.
- virtual void api_flush ()

  Provides MIDI API-specific functionality for the flush() function.
- virtual void api_clock ()

  Provides MIDI API-specific functionality for the clock() function.
- virtual void api_port_start (int, int)
- virtual bool api_is_more_input ()=0
- virtual bool api_get_midi_event (event *inev)=0
- virtual int api_poll_for_midi ()=0

Protected Attributes

- int m_max_busses

  The maximum number of busses supported.
- midibus * m_bus_announce

  MIDI buss announcer?
- busarray m_inbus_array

  Encapsulates information about the input busses.
- busarray m_outbus_array

  Encapsulates information about the output busses.
- std::vector< clock_e > m_master_clocks

  Saves the clock settings obtained from the "rc" (options) file so that they can be loaded into the mastermidibus once it is created.
- std::vector< bool > m_master_inputs

  Saves the input settings obtained from the "[midi-input] section of the "rc" (options) file, so that they can be loaded into the mastermidibus once it is created.
- int m_queue

  The ID of the MIDI queue.
- int m_ppqn

  Resolution in parts per quarter note.
- midibpm m_beats_per_minute

  BPM (beats per minute).
- bool m_dumping_input

  For dumping MIDI input to a sequence for recording.
- std::vector< sequence * > m_vector_sequence

  Used for the new "stazed" feature of filtering MIDI channels so that a sequence gets only the channels meant for it.
- bool m_filter_by_channel

  If true, the m_vector_sequence container is used to divert incoming data to the sequence that has the channel it is meant for.
- sequence * m_seq

  Points to the sequence object.
- mutex m_mutex

  The locking mutex.

Private Member Functions

- bool save_clock (bussbyte bus, clock_e clock)

  Saves the given clock value in m_master_clocks[bus].
- bool save_input (bussbyte bus, bool inputing)

  Saves the input status (as selected in the MIDI Input tab).

Friends

- class perform
- class midi_alsa_info

13.37.1 Constructor & Destructor Documentation

13.37.1.1 mastermidibase()

```
seq64::mastermidibase::mastermidibase (
            int ppqn = SEQ64_USE_DEFAULT_PPQN,
            midibpm bpm = SEQ64_DEFAULT_BPM )
```

Parameters

ppqn	Provides the PPQN value for this object. However, in most cases, the default, SEQ64_USE_DEFAULT_PPQN should be specified. Then the caller of this constructor should call mastermidibase::set_ppqn() to set up the proper PPQN value.
bpm	Provides the beats per minute value, which defaults to c_beats_per_minute.

13.37.1.2 ~mastermidibase()

```
seq64::mastermidibase::~mastermidibase ( )  [virtual]
```

Valgrind indicates we might have issues caused by the following functions:

```
-   snd_config_hook_load()
-   snd_config_update_r() via snd_seq_open()
-   _dl_init() and other GNU function
-   init_gtkmm_internals() [version 2.4]
```

13.37.2 Member Function Documentation

13.37.2.1 init()

```
virtual void seq64::mastermidibase::init (
            int ppqn,
            midibpm bpm )  [inline], [virtual]
```

A return value would be nice.

Parameters

ppqn	The PPQN value to which to initialize the master MIDI buss.
bpm	The beats/minute value to which to initialize the master MIDI buss.

13.37.2.2 get_num_out_buses()

```
int seq64::mastermidibase::get_num_out_buses ( ) const  [inline]
```

13.37.2.3 get_num_in_buses()

```
int seq64::mastermidibase::get_num_in_buses ( ) const  [inline]
```

13.37.2.4 filter_by_channel() [1/2]

```
bool seq64::mastermidibase::filter_by_channel ( ) const  [inline]
```

13.37.2.5 filter_by_channel() [2/2]

```
void seq64::mastermidibase::filter_by_channel (
            bool flag )  [inline]
```

13.37.2.6 get_beats_per_minute()

```
midibpm seq64::mastermidibase::get_beats_per_minute ( ) const  [inline]
```

13.37.2.7 get_bpm()

```
midibpm seq64::mastermidibase::get_bpm ( ) const  [inline]
```

13.37.2.8 get_ppqn()

```
int seq64::mastermidibase::get_ppqn ( ) const  [inline]
```

13.37.2.9 is_dumping()

```
bool seq64::mastermidibase::is_dumping ( ) const  [inline]
```

13.37.2.10 get_sequence()

```
sequence* seq64::mastermidibase::get_sequence ( ) const  [inline]
```

13.37.2.11 start()

```
void seq64::mastermidibase::start ( )
```

Calls the implementation-specific API function for starting.

Threadsafe

13.37.2.12 stop()

```
void seq64::mastermidibase::stop ( )
```

Then calls the implementation-specific API function to finalize the stoppage. (See the ALSA implementation in the seq_alsamidi library, for example. It is the original Sequencer64 implementation.)

Threadsafe

13.37.2.13 port_start()

```
void seq64::mastermidibase::port_start (
            int client,
            int port )
```

This function is called by api_get_midi_event() when the ALSA event SND_SEQ_EVENT_PORT_START is received. Unlike port_exit(), the port_start() function does rely on API-specific code, so we do need to create a virtual api_port_start() function to implement the port-start event.

Threadsafe Quite a lot is done during the lock for the ALSA implimentation.

Parameters

client	Provides the client number, which is actually an ALSA concept.
port	Provides the client port, which is actually an ALSA concept.

13.37.2.14 port_exit()

```
void seq64::mastermidibase::port_exit (
            int client,
            int port )
```

Both the input and output busses for the given client are stopped: that is, set to inactive.

This function is called by api_get_midi_event() when the ALSA event SND_SEQ_EVENT_PORT_EXIT is received. Since port_exit() has no direct API-specific code in it, we do not need to create a virtual api_port_exit() function to implement the port-exit event.

Threadsafe

Parameters

client	The client to be matched and acted on. This value is actually an ALSA concept.
port	The port to be acted on. Both parameter must be matched before the buss is made inactive. This value is actually an ALSA concept.

13.37.2.15 play()

```
void seq64::mastermidibase::play (
            bussbyte bus,
            event * e24,
            midibyte channel )
```

There's currently no implementation-specific API function here.

Threadsafe

Parameters

bus	The buss to start play on. Ooh, we just noticed that value should be checked before usage!
e24	The seq24 event to play on the buss. For speed, we don't bother to check the pointer.
channel	The channel on which to play the event.

13.37.2.16 continue_from()

```
void seq64::mastermidibase::continue_from (
            midipulse tick )
```

This function calls the implementation-specific API function, and then calls midibus::continue_from() for all of the MIDI output busses.

Threadsafe

Parameters

tick	Provides the tick value to continue from.

13.37.2.17 init_clock()

```
void seq64::mastermidibase::init_clock (
            midipulse tick )
```

Calls the implementation-specific API function, and then calls midibus::init_clock() for each of the MIDI output busses.

Threadsafe

Parameters

tick	Provides the tick value with which to initialize the buss clock.

13.37.2.18 emit_clock()

```
void seq64::mastermidibase::emit_clock (
            midipulse tick )
```

Also calls the api_clock() function, which does nothing for the original ALSA implementation and the PortMidi implementation.

Threadsafe

Parameters

tick	Provides the tick value with which to set the buss clock.

13.37.2.19 sysex()

```
void seq64::mastermidibase::sysex (
            event * ev )
```

The event is sent to all MIDI output busses. Then flush() is called.

There's currently no implementation-specific API function for this call.

Threadsafe

Parameters

ev	Provides the event pointer to be set.

13.37.2.20 print()

```
void seq64::mastermidibase::print ( ) const
```

13.37.2.21 flush()

```
void seq64::mastermidibase::flush ( )
```

For example, ALSA provides a function to "drain" the output.

Threadsafe

13.37.2.22 set_sequence_input()

```
void seq64::mastermidibase::set_sequence_input (
            bool state,
            sequence * seq )
```

The portmidi version only sets m_seq and m_dumping_input, but it seems like all the code below would apply to any mastermidibus.

Threadsafe

Parameters

state	Provides the dumping-input (recording) state to be set. This value, as used in seqedit, can represent the state of the thru button or the record button.
seq	Provides the sequence object to be logged as the mastermidibase's sequence. Can also be used to set a null pointer, to disable the sequence setting.

13.37.2.23 dump_midi_input()

```
void seq64::mastermidibase::dump_midi_input (
            event ev )
```

Parameters

ev	The event that was recorded, passed as a copy.

13.37.2.24 initialize_buses()

```
bool seq64::mastermidibase::initialize_buses ( )
```

Returns

Returns true if both busses were successfully initialized.

13.37.2.25 get_midi_out_bus_name()

```
std::string seq64::mastermidibase::get_midi_out_bus_name (
            bussbyte bus )
```

This function is used for display purposes, and is also written to the options ("rc") file.

This function adds the retrieval of client and port numbers that are not needed in the portmidi implementation, but seem generally useful to support in all implementations.

Also, if the client name is already part of the port name, as in "client:client port 0", then we remove the "client:" portion to make the listing look cleaner.

Parameters

bus	Provides the output buss number. Checked before usage. Actually should now be an index number

Returns

Returns the buss name as a standard C++ string. Also contains an indication that the buss is disconnected or unconnected. If the buss number is illegal, this string is empty.

13.37.2.26 get_midi_in_bus_name()

```
std::string seq64::mastermidibase::get_midi_in_bus_name (
            bussbyte bus )
```

This function adds the retrieval of client and port numbers that are not needed in the portmidi implementation, but seem generally useful to support in all implementations.

Parameters

bus	Provides the input buss number.

Returns

Returns the buss name as a standard C++ string. Also contains an indication that the buss is disconnected or unconnected.

13.37.2.27 poll_for_midi()

```
int seq64::mastermidibase::poll_for_midi ( )
```

This base-class implementation could be made identical to portmidi's poll_for_midi() function, maybe. But currently it is better just call the implementation-specific API function.

Do we need to use a mutex lock? NO! It causes a deadlock!!!

Returns

Returns the result of the poll, or 0 if the API is not supported.

13.37.2.28 is_more_input()

```
bool seq64::mastermidibase::is_more_input ( )
```

Calls the implementation-specific API function.

Note that the ALSA implementation calls a single "input-pending" function, while the PortMidi implementation loops through all of the input midibus objects, calling the poll_for_midi() function of each.

Threadsafe

Returns

Returns true if ALSA is supported, and the returned size is greater than 0, or false otherwise.

13.37.2.29 get_midi_event()

```
bool seq64::mastermidibase::get_midi_event (
            event * ev )
```

Parameters

ev	The event to be set based on the found input event.

13.37.2.30 set_clock()

```
bool seq64::mastermidibase::set_clock (
            bussbyte bus,
            clock_e clocktype )
```

The legality checks are a little loose, however.

There's currently no implementation-specific API function here.

Threadsafe

Parameters

bus	The buss to start play on. Checked before usage.
clocktype	The type of clock to be set, either "off", "pos", or "mod", as noted in the midibus_common module.

13.37.2.31 set_input()

```
bool seq64::mastermidibase::set_input (
            bussbyte bus,
            bool inputing )
```

Why is another buss-count constant, and a global one at that, being used? And I thought there was only one input buss anyway! Well, there is only one ALSA input buss, but more can be used with JACK, apparently.

There's currently no implementation-specific API function here.

Threadsafe

Parameters

bus	Provides the buss number.
inputing	True if the input bus will be inputting MIDI data.

Returns

Returns true if the input buss array item could be set and then saved into the status container.

13.37.2.32 get_input()

```
bool seq64::mastermidibase::get_input (
            bussbyte bus )
```

There's currently no implementation-specific API function here.

Parameters

bus	Provides the buss number.

Returns

Returns the value of the busarray::get_input(bus) call.

13.37.2.33 is_input_system_port()

```
bool seq64::mastermidibase::is_input_system_port (
            bussbyte bus )
```

Parameters

bus	Provides the buss number.

Returns

Returns the value of the busarray::get_input(bus) call.

13.37.2.34 get_clock()

```
clock_e seq64::mastermidibase::get_clock (
            bussbyte bus )
```

There's currently no implementation-specific API function here.

Parameters

bus	Provides the buss number to read. Checked before usage.

Returns

If the buss number is legal, and the buss is active, then its clock setting is returned. Otherwise, e_clock_off is returned.

13.37.2.35 set_ppqn()

```
void seq64::mastermidibase::set_ppqn (
            int ppqn )
```

Then call the implementation-specific API function to complete the PPQN setting.

Threadsafe

Parameters

ppqn	The PPQN value to be set.

13.37.2.36 set_beats_per_minute()

```
void seq64::mastermidibase::set_beats_per_minute (
            midibpm bpm )
```

Then call the implementation-specific API function to complete the BPM setting.

Threadsafe

Parameters

bpm	Provides the beats-per-minute value to set.

13.37.2.37 port_settings()

```
void seq64::mastermidibase::port_settings (
            const std::vector< clock_e > & clocks,
            const std::vector< bool > & inputs )  [inline], [protected]
```

13.37.2.38 clock()

```
clock_e seq64::mastermidibase::clock (
            int bus )  [inline], [protected]
```

13.37.2.39 input()

```
bool seq64::mastermidibase::input (
            int bus )  [inline], [protected]
```

13.37.2.40 activate()

```
virtual bool seq64::mastermidibase::activate ( )  [inline], [protected], [virtual]
```

Currently re-implemented only in the rtmidi JACK API.

Reimplemented in seq64::mastermidibus.

13.37.2.41 api_init()

```
virtual void seq64::mastermidibase::api_init (
            int ppqn,
            midibpm bpm )  [protected], [pure virtual]
```

Implemented in seq64::mastermidibus, and seq64::mastermidibus.

13.37.2.42 api_start()

```
virtual void seq64::mastermidibase::api_start ( )  [inline], [protected], [virtual]
```

Reimplemented in seq64::mastermidibus.

13.37.2.43 api_continue_from()

```
virtual void seq64::mastermidibase::api_continue_from (
            midipulse  )  [inline], [protected], [virtual]
```

Reimplemented in seq64::mastermidibus.

13.37.2.44 api_init_clock()

```
virtual void seq64::mastermidibase::api_init_clock (
            midipulse  )  [inline], [protected], [virtual]
```

13.37.2.45 api_stop()

```
virtual void seq64::mastermidibase::api_stop ( )  [inline], [protected], [virtual]
```

Reimplemented in seq64::mastermidibus.

13.37.2.46 api_set_ppqn()

```
virtual void seq64::mastermidibase::api_set_ppqn (
            int  )  [inline], [protected], [virtual]
```

Reimplemented in seq64::mastermidibus, and seq64::mastermidibus.

13.37.2.47 api_set_beats_per_minute()

```
virtual void seq64::mastermidibase::api_set_beats_per_minute (
            midibpm  )  [inline], [protected], [virtual]
```

Reimplemented in seq64::mastermidibus, and seq64::mastermidibus.

13.37.2.48 api_flush()

```
virtual void seq64::mastermidibase::api_flush ( )  [inline], [protected], [virtual]
```

Reimplemented in seq64::mastermidibus, and seq64::mastermidibus.

13.37.2.49 api_clock()

```
virtual void seq64::mastermidibase::api_clock ( )  [inline], [protected], [virtual]
```

13.37.2.50 api_port_start()

```
virtual void seq64::mastermidibase::api_port_start (
            int ,
            int  )  [inline], [protected], [virtual]
```

Reimplemented in seq64::mastermidibus.

13.37.2.51 api_is_more_input()

```
virtual bool seq64::mastermidibase::api_is_more_input ( )  [protected], [pure virtual]
```

Implemented in seq64::mastermidibus, and seq64::mastermidibus.

13.37.2.52 api_get_midi_event()

```
virtual bool seq64::mastermidibase::api_get_midi_event (
            event * inev )  [protected], [pure virtual]
```

Implemented in seq64::mastermidibus, and seq64::mastermidibus.

13.37.2.53 api_poll_for_midi()

```
virtual int seq64::mastermidibase::api_poll_for_midi ( )  [protected], [pure virtual]
```

Implemented in seq64::mastermidibus, and seq64::mastermidibus.

13.37.2.54 save_clock()

```
bool seq64::mastermidibase::save_clock (
            bussbyte bus,
            clock_e clock )  [private]
```

Parameters

bus	Provides the desired buss to be set.
clock	Provides the clocking value to set.

Returns

Returns true if the buss value is valid.

13.37.2.55 save_input()

```
bool seq64::mastermidibase::save_input (
            bussbyte bus,
            bool inputing )  [private]
```

Now, we were checking this bus number against the size of the vector as gotten from the perform object, which it got the from the "rc" file's [midi-input] section. However, the "rc" file won't necessarily match what is on the system now. So we might have to adjust.

Do we also have to adjust the perform's vector?

Parameters

bus	Provides the buss number.
inputing	True if the input bus will be inputting MIDI data.

Returns

Returns true, always.

13.37.3 Friends And Related Function Documentation

13.37.3.1 perform

```
friend class perform  [friend]
```

13.37.3.2 midi_alsa_info

```
friend class midi_alsa_info  [friend]
```

13.37.4 Field Documentation

13.37.4.1 m_max_busses

```
int seq64::mastermidibase::m_max_busses  [protected]
```

Set to c_max_busses (SEQ64_DEFAULT_BUSS_MAX = 32) for now.

13.37.4.2 m_bus_announce

```
midibus* seq64::mastermidibase::m_bus_announce  [protected]
```

13.37.4.3 m_inbus_array

```
busarray seq64::mastermidibase::m_inbus_array  [protected]
```

13.37.4.4 m_outbus_array

```
busarray seq64::mastermidibase::m_outbus_array  [protected]
```

13.37.4.5 m_master_clocks

```
std::vector<clock_e> seq64::mastermidibase::m_master_clocks  [protected]
```

13.37.4.6 m_master_inputs

```
std::vector<bool> seq64::mastermidibase::m_master_inputs  [protected]
```

However, these items will be modified if the actual enumerated input ports do not match the port read from the "rc" file.

13.37.4.7 m_queue

```
int seq64::mastermidibase::m_queue  [protected]
```

13.37.4.8 m_ppqn

```
int seq64::mastermidibase::m_ppqn  [protected]
```

13.37.4.9 m_beats_per_minute

```
midibpm seq64::mastermidibase::m_beats_per_minute  [protected]
```

We had to lengthen this name; way too easy to confuse it with "bpm" for "beats per measure".

13.37.4.10 m_dumping_input

```
bool seq64::mastermidibase::m_dumping_input  [protected]
```

This value is set to true when a sequence editor window is open and the user has clicked the "record MIDI" or "thru MIDI" button.

13.37.4.11 m_vector_sequence

```
std::vector<sequence *> seq64::mastermidibase::m_vector_sequence  [protected]
```

We want to make this a run-time, non-legacy option.

13.37.4.12 m_filter_by_channel

```
bool seq64::mastermidibase::m_filter_by_channel  [protected]
```

13.37.4.13 m_seq

```
sequence* seq64::mastermidibase::m_seq  [protected]
```

13.37.4.14 m_mutex

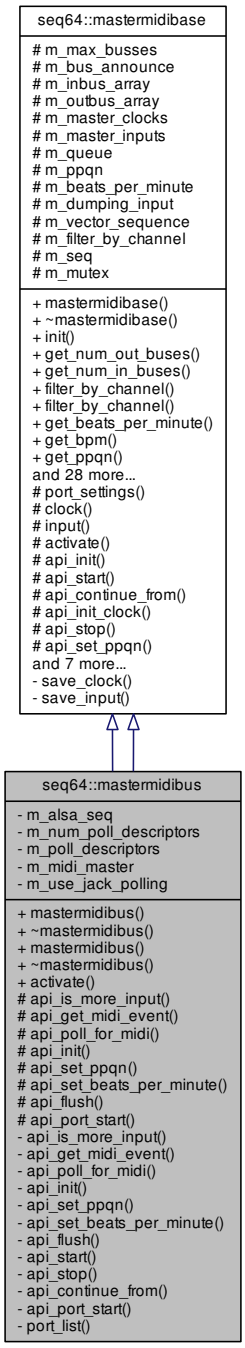
```
mutex seq64::mastermidibase::m_mutex  [protected]
```

This object is passed to an automutex object that lends exception-safety to the mutex locking.

13.38 seq64::mastermidibus Class Reference

The class that "supervises" all of the midibus objects.

Inheritance diagram for seq64::mastermidibus:



Public Member Functions

- mastermidibus (int ppqn=SEQ64_USE_DEFAULT_PPQN, midibpm bpm=SEQ64_DEFAULT_BPM)

The base-class constructor fills the array for our busses.

- virtual ~mastermidibus ()

  The destructor deletes all of the output busses, and terminates the Windows MIDI manager.
- mastermidibus (int ppqn=SEQ64_USE_DEFAULT_PPQN, midibpm bpm=SEQ64_DEFAULT_BPM)
- virtual ~mastermidibus ()
- virtual bool activate ()

  Activates the mastermidibase code and the rtmidi_info object via its api_connect() function.

Protected Member Functions

- virtual bool api_is_more_input ()
- virtual bool api_get_midi_event (event *in)
- virtual int api_poll_for_midi ()
- virtual void api_init (int ppqn, midibpm bpm)
- virtual void api_set_ppqn (int p)

  Provides MIDI API-specific functionality for the set_ppqn() function.
- virtual void api_set_beats_per_minute (midibpm b)

  Provides MIDI API-specific functionality for the set_beats_per_minute() function.
- virtual void api_flush ()
- virtual void api_port_start (mastermidibus &masterbus, int bus, int port)

Private Member Functions

- virtual bool api_is_more_input ()

  Test the ALSA sequencer to see if any more input is pending.
- virtual bool api_get_midi_event (event *in)

  Grab a MIDI event.
- virtual int api_poll_for_midi ()

  Initiate a poll() on the existing poll descriptors.
- virtual void api_init (int ppqn, midibpm bpm)

  Initializes the RtMidi implementation.
- virtual void api_set_ppqn (int ppqn)
- virtual void api_set_beats_per_minute (midibpm bpm)
- virtual void api_flush ()
- virtual void api_start ()
- virtual void api_stop ()
- virtual void api_continue_from (midipulse tick)
- virtual void api_port_start (int client, int port)
- void port_list (const std::string &tag)

  Shows a list of discovered ports in debug mode.

Private Attributes

- snd_seq_t * m_alsa_seq

  The ALSA sequencer client handle.
- int m_num_poll_descriptors

  The number of descriptors for polling.
- struct pollfd * m_poll_descriptors

  Points to the list of descriptors for polling.
- rtmidi_info m_midi_master

  Holds the basic MIDI input and output information for later re-use in the construction of midibus objects.
- bool m_use_jack_polling

  Indicates we are running with JACK MIDI enabled, and need to use each port's ability to poll for and get MIDI events, rather than use ALSA's method of calling functions from the "MIDI master" object.

Friends

- class midi_alsa_info
- class midi_jack_info

Additional Inherited Members

13.38.1 Detailed Description

This implementation uses the PortMidi library, which supports Linux and Windows, but not JACK or Mac OSX.

13.38.2 Constructor & Destructor Documentation

13.38.2.1 mastermidibus() [1/2]

```
seq64::mastermidibus::mastermidibus (
            int ppqn = SEQ64_USE_DEFAULT_PPQN,
            midibpm bpm = SEQ64_DEFAULT_BPM )
```

Parameters

ppqn	Provides the PPQN value for this object. However, in most cases, the default value, SEQ64_USE_DEFAULT_PPQN should be specified.
bpm	Provides the beats per minute value, which defaults to c_beats_per_minute.

13.38.2.2 ~mastermidibus() [1/2]

```
seq64::mastermidibus::~mastermidibus ( )  [virtual]
```

13.38.2.3 mastermidibus() [2/2]

```
seq64::mastermidibus::mastermidibus (
            int ppqn = SEQ64_USE_DEFAULT_PPQN,
            midibpm bpm = SEQ64_DEFAULT_BPM )
```

13.38.2.4 ~mastermidibus() [2/2]

```
virtual seq64::mastermidibus::~mastermidibus ( )  [virtual]
```

13.38.3 Member Function Documentation

13.38.3.1 api_is_more_input() [1/2]

```
bool seq64::mastermidibus::api_is_more_input ( )  [private], [virtual]
```

Similar to api_poll_for_midi(), except it is threadsafe. We got some cleanup to do!

Threadsafe

Implements seq64::mastermidibase.

13.38.3.2 api_get_midi_event() [1/2]

```
bool seq64::mastermidibus::api_get_midi_event (
            event * inev )  [private], [virtual]
```

For the ALSA implementation, this call

Threadsafe

Implements seq64::mastermidibase.

13.38.3.3 api_poll_for_midi() [1/2]

```
int seq64::mastermidibus::api_poll_for_midi ( )  [private], [virtual]
```

This is a primitive poll, which exits when some data is obtained.

```
    m_midi_master.api_poll_for_midi();       // NON-FUNCTIONAL!
```

Implements seq64::mastermidibase.

13.38.3.4 api_init() [1/2]

```
void seq64::mastermidibus::api_init (
            int ppqn,
            midibpm bpm )  [private], [virtual]
```

Two different styles are supported. If the –manual-alsa-ports option is in force, then 16 virtual output ports and one virtual input port are created. They are given names that make it clear which application (seq64) has set them up. They are not connected to anything. The user will have to use a connection GUI (such as qjackctl) or a session manager to make the connections.

Otherwise, the system MIDI input and output ports are scanned (via the rtmidi_info member) and passed to the midibus constructor calls. For every MIDI input port found on the system, this function creates a corresponding output port, and connects to the system MIDI input. For example, for an input port found called "qmidiarp:in 1", we want to create a "shadow" output port called "seq64:qmidiarp in 1".

For every MIDI output found on the system this function creates a corresponding input port, and connects it to the system MIDI output. For For example, for an output port found called "qmidiarp:out 1", we want to create a "shadow" input port called "seq64:qmidiarp out 1".

This code creates a midibus in the conventional manner. Then the busarray::add() function makes a new businfo object with the desired "output" and "isvirtual" parameters; the businfo object then decides whether to call init_in(), init_out(), init_in_sub(), or init_out_sub().

Are these good conventions, or potentially confusing to users? They match what the legacy seq24 and sequencer64 do for ALSA.

Parameters

ppqn	Provides the (possibly new) value of PPQN to set. ALSA has a function that sets its idea of the PPQN. JACK, as far as we know, does not.
bpm	Provides the (possibly new) value of BPM (beats per minute) to set. ALSA has a function that sets its idea of the BPM. JACK, as far as we know, does not.

Implements seq64::mastermidibase.

13.38.3.5 api_set_ppqn() [1/2]

```
virtual void seq64::mastermidibus::api_set_ppqn (
            int ppqn )  [private], [virtual]
```

Reimplemented from seq64::mastermidibase.

13.38.3.6 api_set_beats_per_minute() [1/2]

```
virtual void seq64::mastermidibus::api_set_beats_per_minute (
            midibpm bpm )  [private], [virtual]
```

Reimplemented from seq64::mastermidibase.

13.38.3.7 api_flush() [1/2]

```
virtual void seq64::mastermidibus::api_flush ( )  [private], [virtual]
```

Reimplemented from seq64::mastermidibase.

13.38.3.8 api_start()

```
virtual void seq64::mastermidibus::api_start ( )  [private], [virtual]
```

Reimplemented from seq64::mastermidibase.

13.38.3.9 api_stop()

```
virtual void seq64::mastermidibus::api_stop ( )  [private], [virtual]
```

Reimplemented from seq64::mastermidibase.

13.38.3.10 api_continue_from()

```
virtual void seq64::mastermidibus::api_continue_from (
            midipulse tick )  [private], [virtual]
```

Reimplemented from seq64::mastermidibase.

13.38.3.11 api_port_start() [1/2]

```
virtual void seq64::mastermidibus::api_port_start (
            int client,
            int port )  [private], [virtual]
```

Reimplemented from seq64::mastermidibase.

13.38.3.12 activate()

```
bool seq64::mastermidibus::activate ( )  [virtual]
```

Reimplemented from seq64::mastermidibase.

13.38.3.13 api_is_more_input() [2/2]

```
virtual bool seq64::mastermidibus::api_is_more_input ( )  [protected], [virtual]
```

Implements seq64::mastermidibase.

13.38.3.14 api_get_midi_event() [2/2]

```
virtual bool seq64::mastermidibus::api_get_midi_event (
            event * in )  [protected], [virtual]
```

Implements seq64::mastermidibase.

13.38.3.15 api_poll_for_midi() [2/2]

```
virtual int seq64::mastermidibus::api_poll_for_midi ( )  [protected], [virtual]
```

Implements seq64::mastermidibase.

13.38.3.16 api_init() [2/2]

```
virtual void seq64::mastermidibus::api_init (
            int ppqn,
            midibpm bpm )  [protected], [virtual]
```

Implements seq64::mastermidibase.

13.38.3.17 api_set_ppqn() [2/2]

```
virtual void seq64::mastermidibus::api_set_ppqn (
            int p )  [inline], [protected], [virtual]
```

Reimplemented from seq64::mastermidibase.

13.38.3.18 api_set_beats_per_minute() [2/2]

```
virtual void seq64::mastermidibus::api_set_beats_per_minute (
            midibpm b )  [inline], [protected], [virtual]
```

Reimplemented from seq64::mastermidibase.

13.38.3.19 api_flush() [2/2]

```
virtual void seq64::mastermidibus::api_flush ( )  [inline], [protected], [virtual]
```

Reimplemented from seq64::mastermidibase.

13.38.3.20 api_port_start() [2/2]

```
virtual void seq64::mastermidibus::api_port_start (
            mastermidibus & masterbus,
            int bus,
            int port )  [inline], [protected], [virtual]
```

13.38.3.21 port_list()

```
void seq64::mastermidibus::port_list (
            const std::string & tag )  [private]
```

Parameters

tag	Provides a string label indicate the context of this list.

13.38.4 Friends And Related Function Documentation

13.38.4.1 midi_alsa_info

```
friend class midi_alsa_info  [friend]
```

13.38.4.2 midi_jack_info

```
friend class midi_jack_info  [friend]
```

13.38.5 Field Documentation

13.38.5.1 m_alsa_seq

```
snd_seq_t* seq64::mastermidibus::m_alsa_seq  [private]
```

13.38.5.2 m_num_poll_descriptors

```
int seq64::mastermidibus::m_num_poll_descriptors  [private]
```

13.38.5.3 m_poll_descriptors

```
struct pollfd* seq64::mastermidibus::m_poll_descriptors  [private]
```

13.38.5.4 m_midi_master

rtmidi_info seq64::mastermidibus::m_midi_master [private]

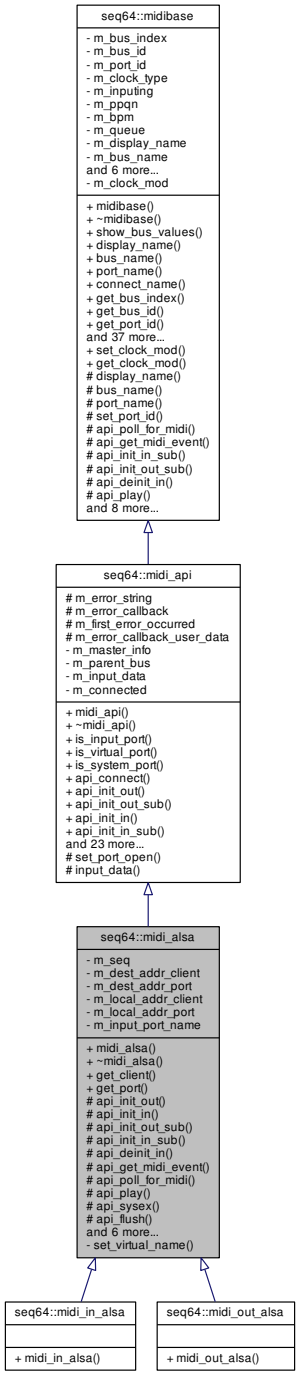
13.38.5.5 m_use_jack_polling

bool seq64::mastermidibus::m_use_jack_polling [private]

13.39 seq64::midi_alsa Class Reference

This class implements the ALSA version of the midi_api.

Inheritance diagram for seq64::midi_alsa:



Public Member Functions

- midi_alsa (midibus &parentbus, midi_info &masterinfo)

  Provides a constructor with client number, port number, ALSA sequencer support, name of client, name of port, etc., mostly contained within an already-initialized midi_info object.

- virtual ~midi_alsa ()

  A rote empty destructor.

- virtual int get_client () const

  'Getter' function for member m_dest_addr_client The address of client.
- virtual int get_port () const

  'Getter' function for member m_dest_addr_port Can we replace it with get_port_id()?

Protected Member Functions

- virtual bool api_init_out ()

  Initialize the MIDI output port.
- virtual bool api_init_in ()

  Initialize the MIDI input port.
- virtual bool api_init_out_sub ()

  Initialize the output in a different way.
- virtual bool api_init_in_sub ()

  Initialize the output in a different way?
- virtual bool api_deinit_in ()

  Deinitialize the MIDI input.
- virtual bool api_get_midi_event (event *)

  ALSA get MIDI events via the midi_alsa_info object at present.
- virtual int api_poll_for_midi ()

  This function is supposed to poll for MIDI data, but the current ALSA implementation DOES NOT USE THIS FUN↩ CTION.
- virtual void api_play (event *e24, midibyte channel)

  This play() function takes a native event, encodes it to an ALSA MIDI sequencer event, sets the broadcasting to the subscribers, sets the direct-passing mode to send the event without queueing, and puts it in the queue.
- virtual void api_sysex (event *e24)

  Takes a native SYSEX event, encodes it to an ALSA event, and then puts it in the queue.
- virtual void api_flush ()

  Flushes our local queue events out into ALSA.
- virtual void api_continue_from (midipulse tick, midipulse beats)
- virtual void api_start ()

  This function gets the MIDI clock a-runnin', if the clock type is not e_clock_off.
- virtual void api_stop ()

  Stop the MIDI buss.
- virtual void api_clock (midipulse tick)

  Generates the MIDI clock, starting at the given tick value.
- virtual void api_set_ppqn (int ppqn)
- virtual void api_set_beats_per_minute (midibpm bpm)

  Set the BPM value (beats per minute).

Private Member Functions

- bool set_virtual_name (int portid, const std::string &portname)

  Gets information directly from ALSA.

Private Attributes

- snd_seq_t *const m_seq
  ALSA sequencer client handle.
- const int m_dest_addr_client
  Destination address of client.
- const int m_dest_addr_port
  Destination port of client.
- const int m_local_addr_client
  Local address of client.
- int m_local_addr_port
  Local port of client.
- const std::string m_input_port_name
  Holds the port name for the ALSA MIDI input port.

Additional Inherited Members

13.39.1 Constructor & Destructor Documentation

13.39.1.1 midi_alsa()

```
seq64::midi_alsa::midi_alsa (
            midibus & parentbus,
            midi_info & masterinfo )
```

This constructor is the only one that is used for the MIDI input and output busses, whether the [manual-alsa-ports] option is in force or not. The actual setup of a normal or virtual port is done in the api_*_init_*() routines.

Also used for the announce buss, and in the mastermidi_alsa::port_start() function. There's currently some overlap between local/dest client and port numbers and the buss and port numbers of the new midibase interface.

Also, note that the optionsfile module uses the master buss to get the buss names when it writes the file.

Parameters

parentbus	Provides much of the infor about this ALSA buss.
masterinfo	Provides the information about the desired port, and more.

13.39.1.2 ~midi_alsa()

```
seq64::midi_alsa::~midi_alsa ( )  [virtual]
```

13.39.2 Member Function Documentation

13.39.2.1 get_client()

```
virtual int seq64::midi_alsa::get_client ( ) const  [inline], [virtual]
```

Can we replace it with get_client_id()?

13.39.2.2 get_port()

```
virtual int seq64::midi_alsa::get_port ( ) const  [inline], [virtual]
```

13.39.2.3 api_init_out()

```
bool seq64::midi_alsa::api_init_out ( )  [protected], [virtual]
```

This initialization is done when the "manual ALSA ports" option is not in force.

This initialization is like the "open_port()" function of the RtMidi library, with the addition of the snd_seq_connect_to() call involving the local and destination ports.

Tricky Code One important thing to note is that this output port is initialized with the SND_SEQ_PORT_CAP_R↩ EAD flag, which means this is really an input port. We connect this input port with a system output port that was discovered. This is backwards of the way RtMidi does it.

Returns

Returns true unless setting up ALSA MIDI failed in some way.

Implements seq64::midi_api.

13.39.2.4 api_init_in()

```
bool seq64::midi_alsa::api_init_in ( )  [protected], [virtual]
```

Subscription handlers:

In ALSA library, subscription is done via snd_seq_subscribe_port() function. It takes the argument of snd_seq_↩ port_subscribe_t record pointer. Suppose that you have a client which will receive data from a MIDI input device. The source and destination addresses are like the below:

```
    snd_seq_addr_t sender, dest;
    sender.client = MIDI_input_client;
    sender.port = MIDI_input_port;
    dest.client = my_client;
    dest.port = my_port;

To set these values as the connection call like this.

    snd_seq_port_subscribe_t *subs;
    snd_seq_port_subscribe_alloca(&subs);
    snd_seq_port_subscribe_set_sender(subs, &sender);
    snd_seq_port_subscribe_set_dest(subs, &dest);
    snd_seq_subscribe_port(handle, subs);
```

Tricky Code One important thing to note is that this input port is initialized with the SND_SEQ_PORT_CAP_W↩ RITE flag, which means this is really an output port. We connect this output port with a system input port that was discovered. This is backwards of the way RtMidi does it.

Returns

Returns true unless setting up ALSA MIDI failed in some way.

Implements seq64::midi_api.

13.39.2.5 api_init_out_sub()

```
bool seq64::midi_alsa::api_init_out_sub ( )  [protected], [virtual]
```

This version of initialization is used by mastermidi_alsa in the "manual ALSA ports" clause. This code is also very similar to the same function in the midibus::api_init_out_sub() function of midibus::api_init_out_sub().

Returns

Returns true unless setting up the ALSA port failed in some way.

Implements seq64::midi_api.

13.39.2.6 api_init_in_sub()

```
bool seq64::midi_alsa::api_init_in_sub ( )  [protected], [virtual]
```

Returns

Returns true unless setting up the ALSA port failed in some way.

Implements seq64::midi_api.

13.39.2.7 api_deinit_in()

```
bool seq64::midi_alsa::api_deinit_in ( )  [protected], [virtual]
```

Set the input and the output ports. The destination port is actually our local port.

Returns

Returns true, unless an error occurs.

Implements seq64::midi_api.

13.39.2.8 api_get_midi_event()

```
virtual bool seq64::midi_alsa::api_get_midi_event (
            event * )  [inline], [protected], [virtual]
```

Implements seq64::midi_api.

13.39.2.9 api_poll_for_midi()

```
int seq64::midi_alsa::api_poll_for_midi ( )  [protected], [virtual]
```

TODO? See seq_alsamidi's mastermidibus::api_poll_for_midi(). Right now we'd need to forward this call to midi_alsa_info.

```
return poll(m_poll_descriptors, m_num_poll_descriptors, 1000);
```

This kills startup:

```
return master_info().api_poll_for_midi();
```

Returns

Always returns 0.

Implements seq64::midi_api.

13.39.2.10 api_play()

```
void seq64::midi_alsa::api_play (
            event * e24,
            midibyte channel )  [protected], [virtual]
```

Threadsafe

Parameters

e24	The event to be played on this bus. For speed, we don't bother to check the pointer.
channel	The channel of the playback.

Implements seq64::midi_api.

13.39.2.11 api_sysex()

```
void seq64::midi_alsa::api_sysex (
            event * e24 )  [protected], [virtual]
```

Parameters

e24	The event to be handled.

Implements seq64::midi_api.

13.39.2.12 api_flush()

```
void seq64::midi_alsa::api_flush ( )  [protected], [virtual]
```

This is also a midi_alsa_info function.

Implements seq64::midi_api.

13.39.2.13 api_continue_from()

```
void seq64::midi_alsa::api_continue_from (
            midipulse tick,
            midipulse beats )  [protected], [virtual]
```

Implements seq64::midi_api.

13.39.2.14 api_start()

```
void seq64::midi_alsa::api_start ( )  [protected], [virtual]
```

Implements seq64::midi_api.

13.39.2.15 api_stop()

```
void seq64::midi_alsa::api_stop ( )  [protected], [virtual]
```

Implements seq64::midi_api.

13.39.2.16 api_clock()

```
void seq64::midi_alsa::api_clock (
            midipulse tick )  [protected], [virtual]
```

Also sets the event tag to 127 so the sequences won't remove it.

Threadsafe

Parameters

tick	Provides the starting tick, unused in the ALSA implementation.

Implements seq64::midi_api.

13.39.2.17 api_set_ppqn()

```
void seq64::midi_alsa::api_set_ppqn (
            int ppqn )  [protected], [virtual]
```

Implements seq64::midi_api.

13.39.2.18 api_set_beats_per_minute()

```
void seq64::midi_alsa::api_set_beats_per_minute (
            midibpm bpm )  [protected], [virtual]
```

This is done by creating an ALSA tempo structure, adding tempo information to it, and then setting the ALSA sequencer object with this information.

We fill the ALSA tempo structure (snd_seq_queue_tempo_t) with the current tempo information, set the BPM value, put it in the tempo structure, and give the tempo value to the ALSA queue.

Note

Consider using snd_seq_change_queue_tempo() here if the ALSA queue has already been started. It's arguments would be m_alsa_seq, m_queue, tempo (microseconds), and null.

Threadsafe

Parameters

bpm	Provides the beats-per-minute value to set.

Implements seq64::midi_api.

13.39.2.19 set_virtual_name()

```
bool seq64::midi_alsa::set_virtual_name (
            int portid,
            const std::string & portname )  [private]
```

The problem this function solves is that the midibus constructor for a virtual ALSA port doesn't not have all of the information it needs at that point. Here, we can get this information and get the actual data we need to rename the port to something accurate. Same as the seq_alsamidi version of this function.

Returns

Returns true if all of the information could be obtained. If false is returned, then the caller should not use the side-effects.

Side-effect(s) Passes back the values found.

13.39.3 Field Documentation

13.39.3.1 m_seq

```
snd_seq_t* const seq64::midi_alsa::m_seq  [private]
```

13.39.3.2 m_dest_addr_client

```
const int seq64::midi_alsa::m_dest_addr_client  [private]
```

Could potentially be replaced by midibase::m_bus_id.

13.39.3.3 m_dest_addr_port

```
const int seq64::midi_alsa::m_dest_addr_port  [private]
```

Could potentially be replaced by midibase::m_port_id.

13.39.3.4 m_local_addr_client

```
const int seq64::midi_alsa::m_local_addr_client  [private]
```

13.39.3.5 m_local_addr_port

```
int seq64::midi_alsa::m_local_addr_port  [private]
```

13.39.3.6 m_input_port_name

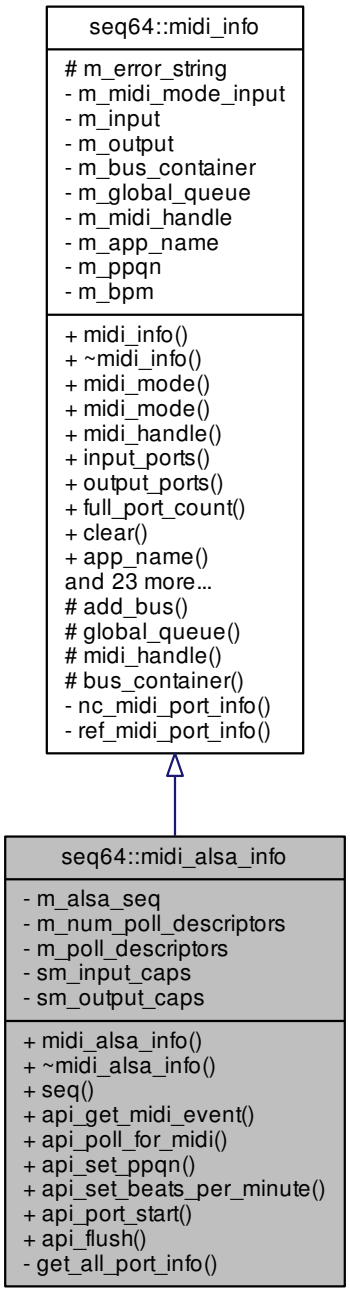
```
const std::string seq64::midi_alsa::m_input_port_name  [private]
```

It is derived from the (optionally configured) official client name for the application with the word "in" appended.

13.40 seq64::midi_alsa_info Class Reference

The class for handling ALSA MIDI input.

Inheritance diagram for seq64::midi_alsa_info:



Public Member Functions

- midi_alsa_info (const std::string &appname, int ppqn=SEQ64_DEFAULT_PPQN, midibpm bpm=SEQ64_↩ DEFAULT_BPM)

Principal constructor.

- virtual ~midi_alsa_info ()

  Destructor.

- snd_seq_t * seq ()

  'Getter' function for member m_alsa_seq This is the platform-specific version of midi_handle().

- virtual bool api_get_midi_event (event *inev)

  Grab a MIDI event.

- virtual int api_poll_for_midi ()

  Polls for any ALSA MIDI information using a timeout value of 1000 milliseconds.

- virtual void api_set_ppqn (int p)

  Sets the PPQN numeric value, then makes ALSA calls to set up the PPQ tempo.

- virtual void api_set_beats_per_minute (midibpm b)

  Sets the BPM numeric value, then makes ALSA calls to set up the BPM tempo.

- virtual void api_port_start (mastermidibus &masterbus, int bus, int port)

  Start the given ALSA MIDI port.

- virtual void api_flush ()

  Flushes our local queue events out into ALSA.

Private Member Functions

- virtual int get_all_port_info ()

  Gets information on ALL ports, putting input data into one midi_info container, and putting output data into another container.

Private Attributes

- snd_seq_t * m_alsa_seq

  Holds the ALSA sequencer client pointer so that it can be used by the midibus objects.

- int m_num_poll_descriptors

  The number of descriptors for polling.

- struct pollfd * m_poll_descriptors

  Points to the list of descriptors for polling.

Static Private Attributes

- static unsigned sm_input_caps

  Flags that denote queries for input (read) ports.

- static unsigned sm_output_caps

  Flags that denote queries for output (write) ports.

Additional Inherited Members

13.40.1 Constructor & Destructor Documentation

13.40.1.1 midi_alsa_info()

```
seq64::midi_alsa_info::midi_alsa_info (
            const std::string & appname,
            int ppqn = SEQ64_DEFAULT_PPQN,
            midibpm bpm = SEQ64_DEFAULT_BPM )
```

Parameters

appname	Provides the name of the application.
ppqn	Provides the PPQN value needed by this object.
bpm	Provides the beats/minute value needed by this object.

13.40.1.2 ~midi_alsa_info()

```
seq64::midi_alsa_info::~midi_alsa_info ( )  [virtual]
```

Closes a connection if it exists, shuts down the input thread, and then cleans up any API resources in use.

13.40.2 Member Function Documentation

13.40.2.1 seq()

```
snd_seq_t* seq64::midi_alsa_info::seq ( )  [inline]
```

13.40.2.2 api_get_midi_event()

```
bool seq64::midi_alsa_info::api_get_midi_event (
            event * inev )  [virtual]
```

First, a rather large buffer is allocated on the stack to hold the MIDI event data. Next, if the –alsa-manual-ports option is not in force, then we check to see if the event is a port-start, port-exit, or port-change event, and we prcess it, and are done.

Otherwise, we create a "MIDI event parser" and decode the MIDI event.

Parameters

inev	The event to be set based on the found input event.

Returns

This function returns false if we are not using virtual/manual ports and the event is an ALSA port-start, port-exit, or port-change event. It also returns false if there is no event to decode. Otherwise, it returns true.

We will only get EVENT_SYSEX on the first packet of MIDI data; the rest we have to poll for. SysEx processing is currently disabled.

Implements seq64::midi_info.

13.40.2.3 api_poll_for_midi()

```
int seq64::midi_alsa_info::api_poll_for_midi ( )  [virtual]
```

Returns

Returns the result of the call to poll() on the global ALSA poll descriptors.

Implements seq64::midi_info.

13.40.2.4 api_set_ppqn()

```
void seq64::midi_alsa_info::api_set_ppqn (
            int p )  [virtual]
```

Parameters

p	The desired new PPQN value to set.

Reimplemented from seq64::midi_info.

13.40.2.5 api_set_beats_per_minute()

```
void seq64::midi_alsa_info::api_set_beats_per_minute (
            midibpm b )  [virtual]
```

Parameters

b	The desired new BPM value to set.

Reimplemented from seq64::midi_info.

13.40.2.6 api_port_start()

```
void seq64::midi_alsa_info::api_port_start (
            mastermidibus & masterbus,
```

```
    int bus,
    int port )  [virtual]
```

This function is called by api_get_midi_event() when an ALSA event SND_SEQ_EVENT_PORT_START is received.

- Get the API's client and port information.
- Do some capability checks.
- Find the client/port combination among the set of input/output busses. If it exists and is not active, then mark it as a replacement. If it is not a replacement, it will increment the number of input/output busses.

We can simplify this code a bit by using elements already present in midi_alsa_info.

Parameters

masterbus	Provides the object that is need to get access to the busses that need to be started.
bus	Provides the ALSA bus/client number.
port	Provides the ALSA client port.

Reimplemented from seq64::midi_info.

13.40.2.7 api_flush()

```
void seq64::midi_alsa_info::api_flush ( )  [virtual]
```

This is also a midi_alsa function.

Implements seq64::midi_info.

13.40.2.8 get_all_port_info()

```
int seq64::midi_alsa_info::get_all_port_info ( )  [private], [virtual]
```

For ALSA input, the first item added is the ALSA MIDI system "announce" buss. It has the client:port value of "0:1", denoted by the ALSA macros SND_SEQ_CLIENT_SYSTEM:SND_SEQ_PORT_SYSTEM_ANNOUNCE.

Returns

Returns the total number of ports found. For an ALSA setup, finding no ALSA ports can be considered an error. However, finding no ports for other APIS may be fine. So, we set the result to -1 to flag a true error.

Implements seq64::midi_info.

13.40.3 Field Documentation

13.40.3.1 sm_input_caps

```
unsigned seq64::midi_alsa_info::sm_input_caps  [static], [private]
```

13.40.3.2 sm_output_caps

```
unsigned seq64::midi_alsa_info::sm_output_caps  [static], [private]
```

13.40.3.3 m_alsa_seq

```
snd_seq_t* seq64::midi_alsa_info::m_alsa_seq  [private]
```

This is actually an opaque pointer; there is no way to get the actual fields in this structure; they can only be accessed through functions in the ALSA API.

13.40.3.4 m_num_poll_descriptors

```
int seq64::midi_alsa_info::m_num_poll_descriptors  [private]
```

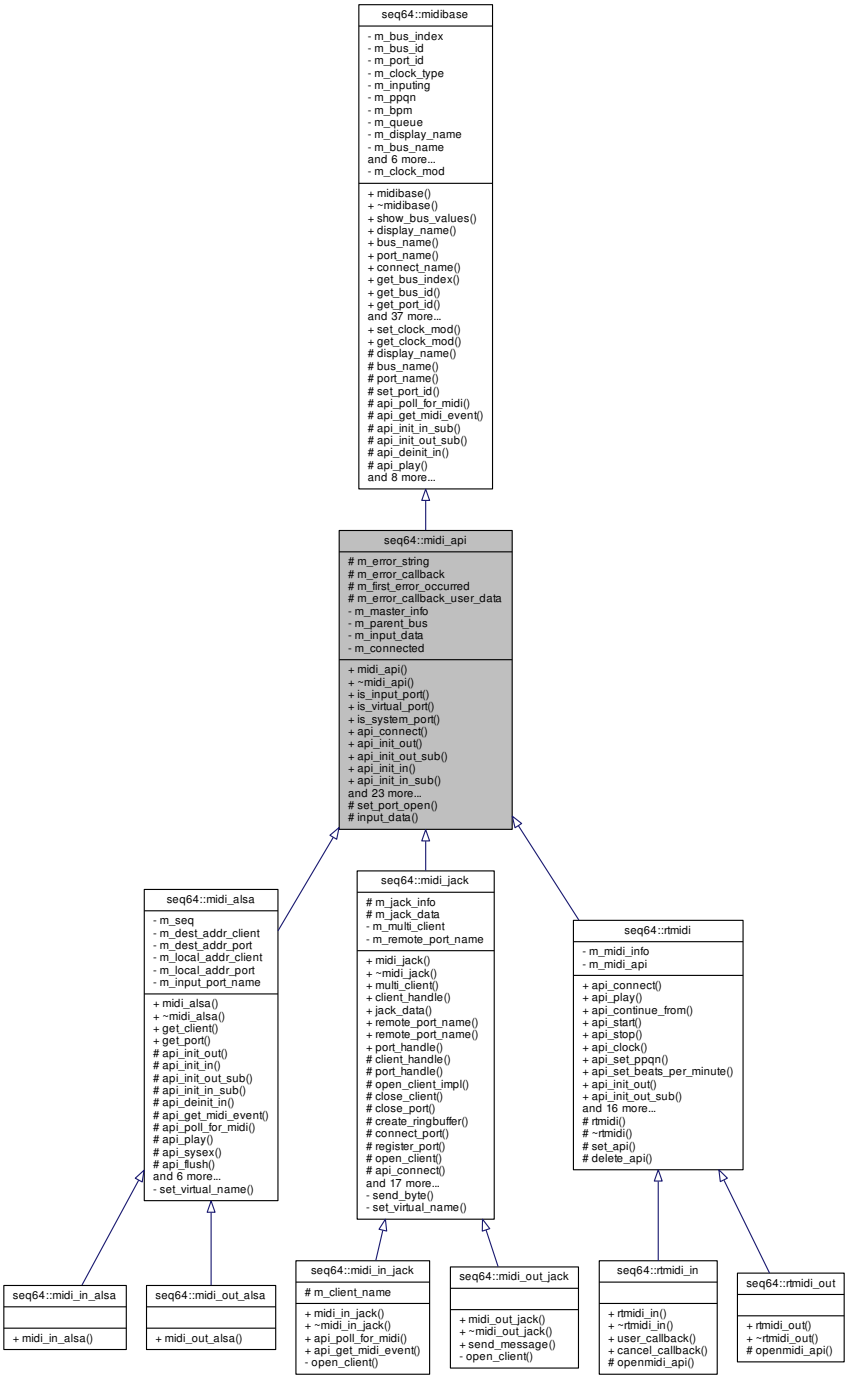
13.40.3.5 m_poll_descriptors

```
struct pollfd* seq64::midi_alsa_info::m_poll_descriptors  [private]
```

13.41 seq64::midi_api Class Reference

Subclasses of midi_in_api and midi_out_api contain all API- and OS-specific code necessary to fully implement the rtmidi API.

Inheritance diagram for seq64::midi_api:



Public Member Functions

- midi_api (midibus &parentbus, midi_info &masterinfo)

Principle constructor.

- virtual ~midi_api ()

  Destructor, needed because it is virtual.
- bool is_input_port () const
- bool is_virtual_port () const
- bool is_system_port () const
- virtual bool api_connect ()

  No code; only midi_jack overrides this function at present.
- virtual bool api_init_out ()=0
- virtual bool api_init_out_sub ()=0
- virtual bool api_init_in ()=0
- virtual bool api_init_in_sub ()=0
- virtual bool api_deinit_in ()=0
- virtual bool api_get_midi_event (event *)=0
- virtual int api_poll_for_midi ()=0
- virtual void api_play (event *e24, midibyte channel)=0
- virtual void api_sysex (event *e24)=0
- virtual void api_continue_from (midipulse tick, midipulse beats)=0
- virtual void api_start ()=0
- virtual void api_stop ()=0
- virtual void api_flush ()=0
- virtual void api_clock (midipulse tick)=0
- virtual void api_set_ppqn (int ppqn)=0
- virtual void api_set_beats_per_minute (midibpm bpm)=0
- virtual std::string api_get_bus_name ()
- virtual std::string api_get_port_name ()
- bool is_port_open () const

  'Getter' function for member m_connected
- midi_info & master_info ()

  'Getter' function for member m_master_info
- const midi_info & master_info () const

  'Getter' function for member m_master_info The const version.
- midibus & parent_bus ()

  'Getter' function for member m_parent_bus
- const midibus & parent_bus () const

  'Getter' function for member m_parent_bus The const version.
- void master_midi_mode (bool input)

  'Getter' function for member m_master_info.midi_mode() This function makes it a bit simpler on the caller.
- void error (rterror::Type type, const std::string &errorstring)

  Provides an error handler that can support an error callback.
- void user_callback (rtmidi_callback_t callback, void *userdata)

  Wires in a MIDI input callback function.
- void cancel_callback ()

  Removes the MIDI input callback and some items related to it.

Protected Member Functions

- void set_port_open ()

  'Setter' function for member m_connected
- rtmidi_in_data * input_data ()

  'Getter' function for member &m_input_data

Protected Attributes

- std::string m_error_string

  Holds the last error message, if in force.
- rterror_callback m_error_callback

  Holds the error callback function pointer, if any.
- bool m_first_error_occurred

  Indicates that the first error has happened.
- void * m_error_callback_user_data

  Holds data needed by the error-callback.

Private Attributes

- midi_info & m_master_info

  Contains information about the ports (system or client) enumerated by the API.
- midibus & m_parent_bus

  Contains a reference to the parent midibus/midibase object.
- rtmidi_in_data m_input_data

  Although this really is useful only for MIDI input objects, the split of the midi_api is not as convenient for re-use as is the split for derived classes like midi_in_jack/midi_out_jack.
- bool m_connected

  Set to true if the port was opened, activated, and connected without issue.

Additional Inherited Members

13.41.1 Detailed Description

Note that midi_in_api and midi_out_api are abstract base classes and cannot be explicitly instantiated. rtmidi_in and rtmidi_out will create instances of a midi_in_api or midi_out_api subclass.

13.41.2 Constructor & Destructor Documentation

13.41.2.1 midi_api()

```
seq64::midi_api::midi_api (
            midibus & parentbus,
            midi_info & masterinfo )
```

13.41.2.2 ~midi_api()

```
seq64::midi_api::~midi_api ( )  [virtual]
```

13.41.3 Member Function Documentation

13.41.3.1 is_input_port()

```
bool seq64::midi_api::is_input_port ( ) const
```

13.41.3.2 is_virtual_port()

```
bool seq64::midi_api::is_virtual_port ( ) const
```

13.41.3.3 is_system_port()

```
bool seq64::midi_api::is_system_port ( ) const
```

13.41.3.4 api_connect()

```
virtual bool seq64::midi_api::api_connect ( )  [inline], [virtual]
```

Reimplemented in seq64::midi_jack, and seq64::rtmidi.

13.41.3.5 api_init_out()

```
virtual bool seq64::midi_api::api_init_out ( )  [pure virtual]
```

Implements seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.6 api_init_out_sub()

```
virtual bool seq64::midi_api::api_init_out_sub ( )  [pure virtual]
```

Reimplemented from seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.7 api_init_in()

```
virtual bool seq64::midi_api::api_init_in ( )  [pure virtual]
```

Implements seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.8 api_init_in_sub()

```
virtual bool seq64::midi_api::api_init_in_sub ( )  [pure virtual]
```

Reimplemented from seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.9 api_deinit_in()

```
virtual bool seq64::midi_api::api_deinit_in ( )  [pure virtual]
```

Reimplemented from seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.10 api_get_midi_event()

```
virtual bool seq64::midi_api::api_get_midi_event (
            event * )  [pure virtual]
```

Reimplemented from seq64::midibase.

Implemented in seq64::midi_in_jack, seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.11 api_poll_for_midi()

```
virtual int seq64::midi_api::api_poll_for_midi ( )  [pure virtual]
```

Reimplemented from seq64::midibase.

Implemented in seq64::midi_in_jack, seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.12 api_play()

```
virtual void seq64::midi_api::api_play (
            event * e24,
            midibyte channel )  [pure virtual]
```

Implements seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.13 api_sysex()

```
virtual void seq64::midi_api::api_sysex (
            event * e24 )  [pure virtual]
```

Reimplemented from seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.14 api_continue_from()

```
virtual void seq64::midi_api::api_continue_from (
            midipulse tick,
            midipulse beats )  [pure virtual]
```

Implements seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.15 api_start()

```
virtual void seq64::midi_api::api_start ( )  [pure virtual]
```

Implements seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.16 api_stop()

```
virtual void seq64::midi_api::api_stop ( )  [pure virtual]
```

Implements seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.17 api_flush()

```
virtual void seq64::midi_api::api_flush ( )  [pure virtual]
```

Reimplemented from seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.18 api_clock()

```
virtual void seq64::midi_api::api_clock (
            midipulse tick )  [pure virtual]
```

Implements seq64::midibase.

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.19 api_set_ppqn()

```
virtual void seq64::midi_api::api_set_ppqn (
            int ppqn )  [pure virtual]
```

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.20 api_set_beats_per_minute()

```
virtual void seq64::midi_api::api_set_beats_per_minute (
            midibpm bpm )  [pure virtual]
```

Implemented in seq64::midi_jack, seq64::midi_alsa, and seq64::rtmidi.

13.41.3.21 api_get_bus_name()

```
virtual std::string seq64::midi_api::api_get_bus_name ( )  [inline], [virtual]
```

13.41.3.22 api_get_port_name()

```
virtual std::string seq64::midi_api::api_get_port_name ( )  [inline], [virtual]
```

Reimplemented in seq64::midi_jack.

13.41.3.23 is_port_open()

```
bool seq64::midi_api::is_port_open ( ) const  [inline]
```

13.41.3.24 master_info() [1/2]

```
midi_info& seq64::midi_api::master_info ( )  [inline]
```

13.41.3.25 master_info() [2/2]

```
const midi_info& seq64::midi_api::master_info ( ) const  [inline]
```

13.41.3.26 parent_bus() [1/2]

```
midibus& seq64::midi_api::parent_bus ( )  [inline]
```

13.41.3.27 parent_bus() [2/2]

```
const midibus& seq64::midi_api::parent_bus ( ) const  [inline]
```

13.41.3.28 master_midi_mode()

```
void seq64::midi_api::master_midi_mode (
            bool input )
```

13.41.3.29 error()

```
void seq64::midi_api::error (
            rterror::Type type,
            const std::string & errorstring )
```

Exceptions

If	the error is not just a warning, then an rterror object is thrown.

Parameters

type	The type of the error.
errorstring	The error message, which gets copied if this is the first error.

13.41.3.30 user_callback()

```
void seq64::midi_api::user_callback (
            rtmidi_callback_t callback,
            void * userdata )
```

We moved it into the base class, trading convenience for the chance of confusion.

Parameters

callback	Provides the callback function.
userdata	Provides the user data needed by the callback function.

13.41.3.31 cancel_callback()

```
void seq64::midi_api::cancel_callback ( )
```

We moved it into the base class, trading convenience for the chance of confusion.

13.41.3.32 set_port_open()

```
void seq64::midi_api::set_port_open ( )  [inline], [protected]
```

13.41.3.33 input_data()

```
rtmidi_in_data* seq64::midi_api::input_data ( )  [inline], [protected]
```

13.41.4 Field Documentation

13.41.4.1 m_master_info

```
midi_info& seq64::midi_api::m_master_info  [private]
```

13.41.4.2 m_parent_bus

```
midibus& seq64::midi_api::m_parent_bus  [private]
```

This object is needed to get parameters that are peculiar to the port as it is actually set up, rather than information from the midi_info object.

13.41.4.3 m_input_data

```
rtmidi_in_data seq64::midi_api::m_input_data  [private]
```

13.41.4.4 m_connected

```
bool seq64::midi_api::m_connected  [private]
```

13.41.4.5 m_error_string

```
std::string seq64::midi_api::m_error_string  [protected]
```

This is an original RtMidi concept.

13.41.4.6 m_error_callback

```
rterror_callback seq64::midi_api::m_error_callback  [protected]
```

This is an original RtMidi concept.

13.41.4.7 m_first_error_occurred

```
bool seq64::midi_api::m_first_error_occurred  [protected]
```

This is an original RtMidi concept. I have to confess I am not sure how it is/should be used, yet.

13.41.4.8 m_error_callback_user_data

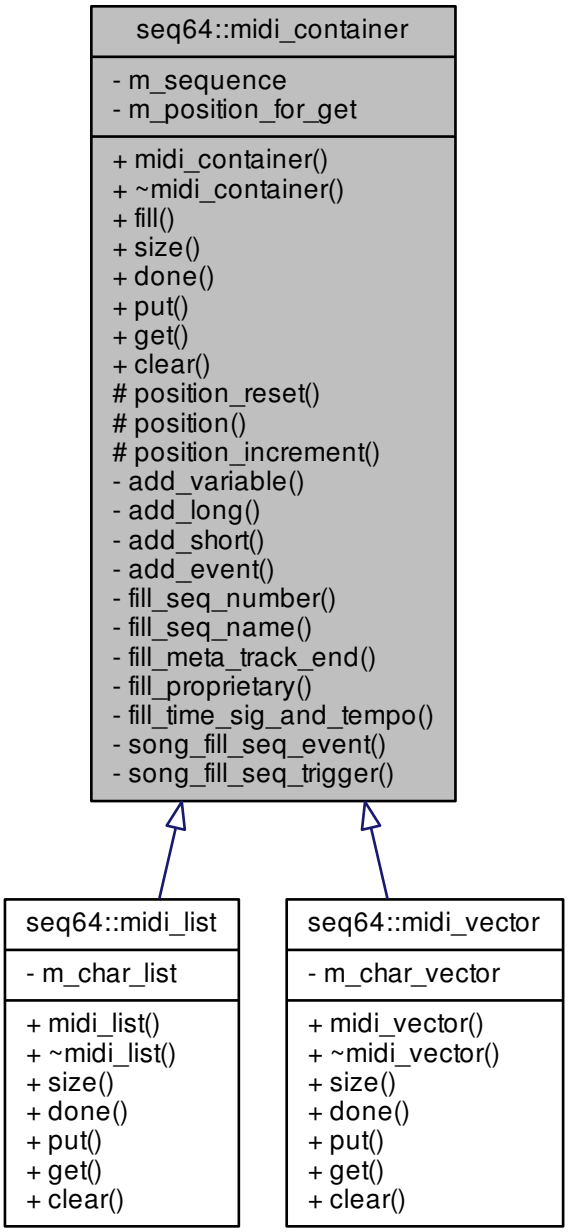
```
void* seq64::midi_api::m_error_callback_user_data  [protected]
```

This is an original RtMidi concept. I have to confess I am not sure how it is/should be used, yet.

13.42 seq64::midi_container Class Reference

This class is the abstract base class for a container of MIDI track information.

Inheritance diagram for seq64::midi_container:



Public Member Functions

- midi_container (sequence &seq)

Fills in the few members of this class.

- virtual ~midi_container ()

  A rote constructor needed for a base class.
- void fill (int tracknumber, const perform &p)

  This function fills the given track (sequence) with MIDI data from the current sequence, preparatory to writing it to a file.
- virtual std::size_t size () const

  Returns the size of the container, in midibytes.
- virtual bool done () const

  Instead of checking for the size of the container when "emptying" it [see the midifile::write() function], use this function, which is overridden to match the type of container being used.
- virtual void put (midibyte b)=0

  Provides a way to add a MIDI byte into the container.
- virtual midibyte get () const =0

  Provide a way to get the next byte from the container.
- virtual void clear ()=0

  Provides a way to clear the container.

Protected Member Functions

- unsigned int position_reset () const

  'Setter' function for member m_position_for_get Sets the position to 0 and then returns that value.
- unsigned int position () const

  'Getter' function for member m_position_for_get Returns the current position.
- void position_increment () const

  'Getter' function for member m_position_for_get Increments the current position.

Private Member Functions

- void add_variable (midipulse v)

  This function masks off the lower 8 bits of the long parameter, then shifts it right 7, and, if there are still set bits, it encodes it into the buffer in reverse order.
- void add_long (midipulse x)

  Adds a long value (a MIDI pulse/tick value) to the container.
- void add_short (midishort x)

  Adds a short value (two bytes) to the container.
- void add_event (const event &e, midipulse deltatime)

  Adds an event to the container.
- void fill_seq_number (int seq)

  Fills in the sequence number.
- void fill_seq_name (const std::string &name)

  Fills in the sequence name.
- void fill_meta_track_end (midipulse deltatime)
- void fill_proprietary ()

  Fills in the Sequencer64-specific information for the current sequence: The MIDI buss number, the time-signature, and the MIDI channel.
- void fill_time_sig_and_tempo (const perform &p)

  Fill in the time-signature and tempo information.
- midipulse song_fill_seq_event (const trigger &trig, midipulse prev_timestamp)

  Fills in sequence events based on the trigger and events in the sequence associated with this midi_container.
- void song_fill_seq_trigger (const trigger &trig, midipulse len, midipulse prev_timestamp)

  Fills in the trigger for the whole sequence.

Private Attributes

- sequence & m_sequence

  Provide a hook into a sequence so that we can exchange data with a sequence object.
- unsigned int m_position_for_get

  Provides the position in the container when making a series of get() calls on the container.

Friends

- class midifile

13.42.1 Detailed Description

It is the base class for midi_list and midi_vector.

13.42.2 Constructor & Destructor Documentation

13.42.2.1 midi_container()

```
seq64::midi_container::midi_container (
            sequence & seq )
```

Parameters

seq	Provides a reference to the sequence/track for which this container holds MIDI data.

13.42.2.2 ~midi_container()

```
virtual seq64::midi_container::~midi_container ( )  [inline], [virtual]
```

13.42.3 Member Function Documentation

13.42.3.1 fill()

```
void seq64::midi_container::fill (
            int tracknumber,
            const perform & p )
```

Note that some of the events might not come out in the same order they were stored in (we see that with program-change events). This function replaces sequence::fill_list().

Now, for sequence 0, an alternate format for writing the sequencer number chunk is "FF 00 00". But that format can only occur in the first track, and the rest of the tracks then don't need a sequence number, since it is assumed to increment. This application doesn't use that shortcut.

Stazed:

```
The "stazed" (seq32) code implements a function like this one
using a function sequence::fill_proprietary_list() that we
don't need for our implementation... it is part of our
midi_container::fill() function.
```

Triggers:

```
Triggers are added by first calling add_variable(0), which is needed
because why?

Then 0xFF 0x7F is written, followed by the length value, which is the
number of triggers at 3 long integers per trigger, plus the 4-byte
code for triggers, c_triggers_new = 0x24240008.
```

Not threadsafe The sequence object bound to this container needs to provide the locking mechanism when calling this function.

Parameters

tracknumber	Provides the track number. This number is masked into the track information.
p	The performance object that will hold some of the parameters needed when filling the MIDI container.

To allow other sequencers to read Seq24/Sequencer64 files, we should provide the Time Signature and Tempo meta events, in the 0th (first) track (sequence). These events must precede any "real" MIDI events. They are not included if the legacy-format option is in force.

13.42.3.2 size()

```
virtual std::size_t seq64::midi_container::size ( ) const  [inline], [virtual]
```

Must be overridden in the derived class, though not pure.

Reimplemented in seq64::midi_list, and seq64::midi_vector.

13.42.3.3 done()

```
virtual bool seq64::midi_container::done ( ) const  [inline], [virtual]
```

Reimplemented in seq64::midi_vector, and seq64::midi_list.

13.42.3.4 put()

```
virtual void seq64::midi_container::put (
            midibyte b )  [pure virtual]
```

The original seq24 container used an std::list and a push_front operation.

Implemented in seq64::midi_vector, and seq64::midi_list.

13.42.3.5 get()

```
virtual midibyte seq64::midi_container::get ( ) const  [pure virtual]
```

It also increments m_position_for_get.

Implemented in seq64::midi_vector, and seq64::midi_list.

13.42.3.6 clear()

```
virtual void seq64::midi_container::clear ( )  [pure virtual]
```

Implemented in seq64::midi_vector, and seq64::midi_list.

13.42.3.7 position_reset()

```
unsigned int seq64::midi_container::position_reset ( ) const  [inline], [protected]
```

13.42.3.8 position()

```
unsigned int seq64::midi_container::position ( ) const  [inline], [protected]
```

13.42.3.9 position_increment()

```
void seq64::midi_container::position_increment ( ) const  [inline], [protected]
```

13.42.3.10 add_variable()

```
void seq64::midi_container::add_variable (
            midipulse v )  [private]
```

This function "replaces" sequence::add_list_var().

Parameters

v	The data value to be added to the current event in the MIDI container.

13.42.3.11 add_long()

```
void seq64::midi_container::add_long (
            midipulse x )  [private]
```

What is the difference between this function and add_list_var()? This function "replaces" sequence::add_long_list(). This was a *global* internal function called addLongList(). Let's at least make it a private member now, and hew to the naming conventions of this class.

Parameters

x	Provides the timestamp (pulse value) to be added to the container.

13.42.3.12 add_short()

```
void seq64::midi_container::add_short (
            midishort x )  [private]
```

Parameters

x	Provides the timestamp (pulse value) to be added to the container.

13.42.3.13 add_event()

```
void seq64::midi_container::add_event (
            const event & e,
            midipulse deltatime )  [private]
```

If the sequence's MIDI channel is EVENT_NULL_CHANNEL == 0xFF, then it is the copy of an SMF 0 sequence that the midi_splitter created. We want to be able to save it along with the other tracks, but won't be able to read it back if all the channels are bad. So we just use the channel from the event.

13.42.3.14 fill_seq_number()

```
void seq64::midi_container::fill_seq_number (
            int seq )  [private]
```

Writes 0xFF 0x00 0x02, and then the number. This function is used in the new midifile::write_song() function, which should be ready to go by the time you're reading this.

Compare this function to the beginning of midi_container::fill().

Parameters

seq	The sequence/track number to write.

13.42.3.15 fill_seq_name()

```
void seq64::midi_container::fill_seq_name (
            const std::string & name )  [private]
```

Writes 0xFF 0x03, and then the track name. This function is used in the new midifile::write_song() function, which should be ready to go by the time you're reading this.

Compare this function to the beginning of midi_container::fill().

Parameters

name	The sequence/track name to set. We could get this item from m_sequence, but the parameter allows the flexibility to change the name.

13.42.3.16 fill_meta_track_end()

```
void seq64::midi_container::fill_meta_track_end (
            midipulse deltatime )  [private]
```

13.42.3.17 fill_proprietary()

```
void seq64::midi_container::fill_proprietary ( )  [private]
```

Then, if we're not using the legacy output format, we add the "events" for the musical key, musical scale, and the background sequence for the current sequence. Finally, if tranpose support has been compiled into the program, we add that information as well. New feature: save more sequence-specific values, if not legacy format and not saved globally. We use a single byte for the key and scale, and a long for the background sequence. We save these values only if they are different from the defaults; in most cases they will have been left alone by the user. We save per-sequence values here only if the global-background-sequence feature is not in force.

For the new "transposable" flag (tagged by the value c_transpose) we really only care about saving the value of "false", because otherwise we can assume the value is true for the given sequence, and save space by not saving it... generally only drum patterns will not be transposable.

However, for now, write it anyway for consistency with Seq32.

13.42.3.18 fill_time_sig_and_tempo()

```
void seq64::midi_container::fill_time_sig_and_tempo (
            const perform & p )  [private]
```

This function is used only for the first track, The sizes of these meta events are defined as SEQ64_TIME_TEMP↩
O_SIZE. However, we do not have to add that value in, as it is already counted in the intrinsic size of the container.

We now make sure that the proper values are part of the perform object for usage in this particular track. For export, we cannot guarantee that the first (0th) track/sequence is exportable.

Parameters

p	Provides the performance object from which we get some global MIDI parameters.

13.42.3.19 song_fill_seq_event()

```
midipulse seq64::midi_container::song_fill_seq_event (
            const trigger & trig,
            midipulse prev_timestamp )  [private]
```

Parameters

trig	The current trigger to be processed.
prev_timestamp	The time-stamp of the previous event.

Returns

The next time-stamp value is returned.

13.42.3.20 song_fill_seq_trigger()

```
void seq64::midi_container::song_fill_seq_trigger (
            const trigger & trig,
            midipulse length,
            midipulse prev_timestamp )  [private]
```

For a song-performance, there will be only one trigger, covering the beginning to the end of the fully unlooped track.

Parameters

trig	The current trigger to be processed.
length	Provides the total length of the sequence.
prev_timestamp	The time-stamp of the previous event, which is actually the first event.

13.42.4 Friends And Related Function Documentation

13.42.4.1 midifile

```
friend class midifile  [friend]
```

13.42.5 Field Documentation

13.42.5.1 m_sequence

```
sequence& seq64::midi_container::m_sequence  [private]
```

13.42.5.2 m_position_for_get

```
unsigned int seq64::midi_container::m_position_for_get  [mutable], [private]
```

13.43 seq64::midi_control Class Reference

This class (formerly a struct) contains the control information for sequences that make up a live set.

Public Types

- enum action {
  action_toggle,
  action_on,
  action_off }

Public Member Functions

- midi_control ()

  This default constructor creates a "zero" object.
- bool active () const
- bool inverse_active () const
- int status () const
- int data () const
- int min_value () const
- int max_value () const
- void set (int values[6])

  Not so sure if this really saves trouble for the caller.
- void set (midibyte values[6])

  Not so sure if this really saves trouble for the caller.
- bool match (midibyte status, midibyte data) const

  Handles a common check in the perform module.
- bool in_range (midibyte data) const

  Handles a common check in the perform module.

Private Attributes

- bool m_active

  Provides the value for active.
- bool m_inverse_active

  Provides the value for inverse-active.
- int m_status

  Provides the value for the status.
- int m_data

  Provides the value for the data.
- int m_min_value

  Provides the minimum value for the controller.
- int m_max_value

  Provides the value for the controller.

13.43.1 Detailed Description

Note that, although we've converted this to a full-fledged class, the ordering of variables and the data arrays used to fill them is very signifcant. See the midifile and optionsfile modules.

The perform module sets up the three following arrays for each of the MIDI controls that can be defined in the "rc" file:

```
    m_midi_cc_toggle[]
    m_midi_cc_on[]
    m_midi_cc_off[]
```

```
These three arrays are specified in the "rc" by a line like the following:

    n [0 0   0   0   0   0] [0 0   0   0   0   0] [0 0   0   0   0   0]

where n ranges from 0 to 73 or 83.  Lines 0 to 31 provide controller values for
the "pattern group", one line for each of the 32 pattern slots.  Lines 32
to 63 provide controller values for the "mute in group", one line for each
of the 32 pattern slots.  The rest of the lines provide entries for
control of: BPM up, BPM down, Screen-set up, Screen-set down, Mod
Replaces, Mod Snapshot, Mod Queue, Mod gmute (group mute), Mod glearn
(group learn), and Screen-set Play.  Additional controls are currently in
the works.

In each of the bracketed sections, the values correspond to the members in
this order: m_active, m_inverse_active, m_status, m_data, m_min_value, and
m_max_value.

Why are the status, data, and min/max values long?  A character or
midibyte would be enough.  We'll fix that later, once we have tested this
stuff.  We do need to convert them from long to int, though, and do that
in the scanning and output done by optionsfile.
```

13.43.2 Member Enumeration Documentation

13.43.2.1 action

```
enum seq64::midi_control::action
```

Enumerator

action_toggle	Provides the kind of MIDI control event found, used in the new perform::handle_midi_control_ex() function. Toggles the status of the given control. For the "playback" status, indicates the "pause" functionality.
action_on	Turns on the status of the given control. For the "playback" status, indicates the "start" functionality.
action_off	Turns off the status of the given control. For the "playback" status, indicates the "stop" functionality.

13.43.3 Constructor & Destructor Documentation

13.43.3.1 midi_control()

```
seq64::midi_control::midi_control ( )  [inline]
```

Every member is either false or zero.

13.43.4 Member Function Documentation

13.43.4.1 active()

```
bool seq64::midi_control::active ( ) const  [inline]
```

13.43.4.2 inverse_active()

```
bool seq64::midi_control::inverse_active ( ) const  [inline]
```

13.43.4.3 status()

```
int seq64::midi_control::status ( ) const  [inline]
```

13.43.4.4 data()

```
int seq64::midi_control::data ( ) const  [inline]
```

13.43.4.5 min_value()

```
int seq64::midi_control::min_value ( ) const  [inline]
```

13.43.4.6 max_value()

```
int seq64::midi_control::max_value ( ) const  [inline]
```

13.43.4.7 set() [1/2]

```
void seq64::midi_control::set (
            int values[6] )  [inline]
```

It fits in with the big-ass sscanf() call in optionsfile.

Parameters

values	Provides the six values, in an integer array, to set into the members in this order: m_active, m_inverse_active, m_status, m_data, m_min_value, and m_max_value.

13.43.4.8 set() [2/2]

```
void seq64::midi_control::set (
            midibyte values[6] )  [inline]
```

It fits in with the usage in midifile.

Parameters

values	Provides the six values, in a byte array, to set into the members in this order: m_active, m_inverse_active, m_status, m_data, m_min_value, and m_max_value.

13.43.4.9 match()

```
bool seq64::midi_control::match (
            midibyte status,
            midibyte data ) const  [inline]
```

Parameters

status	Provides the status byte, which is checked against m_status.
data	Provides the data byte, which is checked against m_data.

13.43.4.10 in_range()

```
bool seq64::midi_control::in_range (
            midibyte data ) const  [inline]
```

13.43.5 Field Documentation

13.43.5.1 m_active

```
bool seq64::midi_control::m_active  [private]
```

13.43.5.2 m_inverse_active

```
bool seq64::midi_control::m_inverse_active  [private]
```

13.43.5.3 m_status

```
int seq64::midi_control::m_status  [private]
```

Big question is, is the channel included here? Yes. So the next question is, is it ignored? We don't think so.

13.43.5.4 m_data

```
int seq64::midi_control::m_data  [private]
```

13.43.5.5 m_min_value

```
int seq64::midi_control::m_min_value  [private]
```

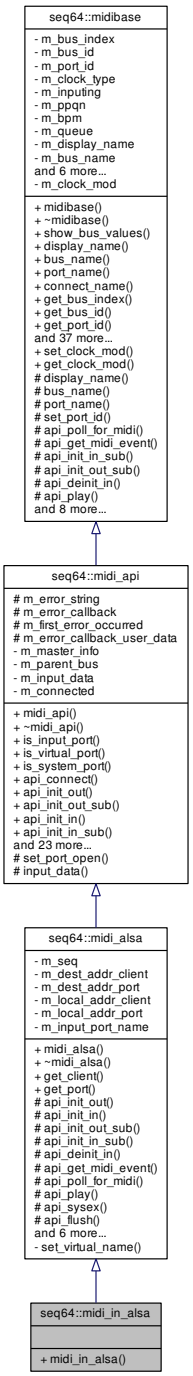
13.43.5.6 m_max_value

```
int seq64::midi_control::m_max_value  [private]
```

13.44 seq64::midi_in_alsa Class Reference

This class implements the ALSA version of a MIDI input object.

Inheritance diagram for seq64::midi_in_alsa:



Public Member Functions

- midi_in_alsa (midibus &parentbus, midi_info &masterinfo)

  ALSA MIDI input normal port or virtual port constructor.

Additional Inherited Members

13.44.1 Constructor & Destructor Documentation

13.44.1.1 midi_in_alsa()

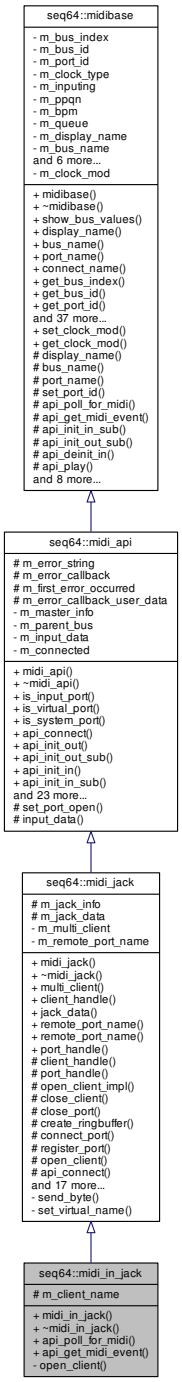
```
seq64::midi_in_alsa::midi_in_alsa (
            midibus & parentbus,
            midi_info & masterinfo )
```

The kind of port is determine by which port-initialization function the mastermidibus calls.

13.45 seq64::midi_in_jack Class Reference

The class for handling JACK MIDI input.

Inheritance diagram for seq64::midi_in_jack:



Public Member Functions

- midi_in_jack (midibus &parentbus, midi_info &masterinfo)

  Principal constructor.
- virtual ~midi_in_jack ()

  Destructor.
- virtual int api_poll_for_midi ()

Checks the rtmidi_in_data queue for the number of items in the queue.

- virtual bool api_get_midi_event (event *)

  Gets a MIDI event.

Protected Attributes

- std::string m_client_name

Private Member Functions

- virtual bool open_client ()

  This function is virtual, so we don't call it in the constructor, using open_client_impl() directly instead.

Additional Inherited Members

13.45.1 Constructor & Destructor Documentation

13.45.1.1 midi_in_jack()

```
seq64::midi_in_jack::midi_in_jack (
            midibus & parentbus,
            midi_info & masterinfo )
```

For Sequencer64, we don't current need to create a midi_in_jack object; all that is needed is created via the api_↩ init_in*() functions. Also, this constructor still needs to do something with queue size.

Parameters

parentbus	Provides the buss object that determines buss-specific parameters of this class.
masterinfo	Provides information about the JACK system as found on this machine.

13.45.1.2 ~midi_in_jack()

```
seq64::midi_in_jack::~midi_in_jack ( )  [virtual]
```

Currently the base class closes the port, closes the JACK client, and cleans up the API data structure.

13.45.2 Member Function Documentation

13.45.2.1 api_poll_for_midi()

```
int seq64::midi_in_jack::api_poll_for_midi ( )  [virtual]
```

WE MAY NEED LOCKING.

Returns

Returns the value of rtindata->queue().count(), unless the caller is using an rtmidi callback function, in which case 0 is always returned.

Reimplemented from seq64::midi_jack.

13.45.2.2 api_get_midi_event()

```
bool seq64::midi_in_jack::api_get_midi_event (
            event * inev )  [virtual]
```

This implementation gets a midi_message off the front of the queue and converts it to an sequence64 event.

Parameters

inev	Provides the destination for the MIDI event.

Returns

Returns true if a MIDI event was obtained, indicating that the return parameter can be used.

We will only get EVENT_SYSEX on the first packet of MIDI data; the rest we have to poll for. SysEx processing is currently disabled. The code that follows has a big bug!

Reimplemented from seq64::midi_jack.

13.45.2.3 open_client()

```
virtual bool seq64::midi_in_jack::open_client ( )  [inline], [private], [virtual]
```

This function replaces the RtMidi function "connect()".

Implements seq64::midi_jack.

13.45.3 Field Documentation

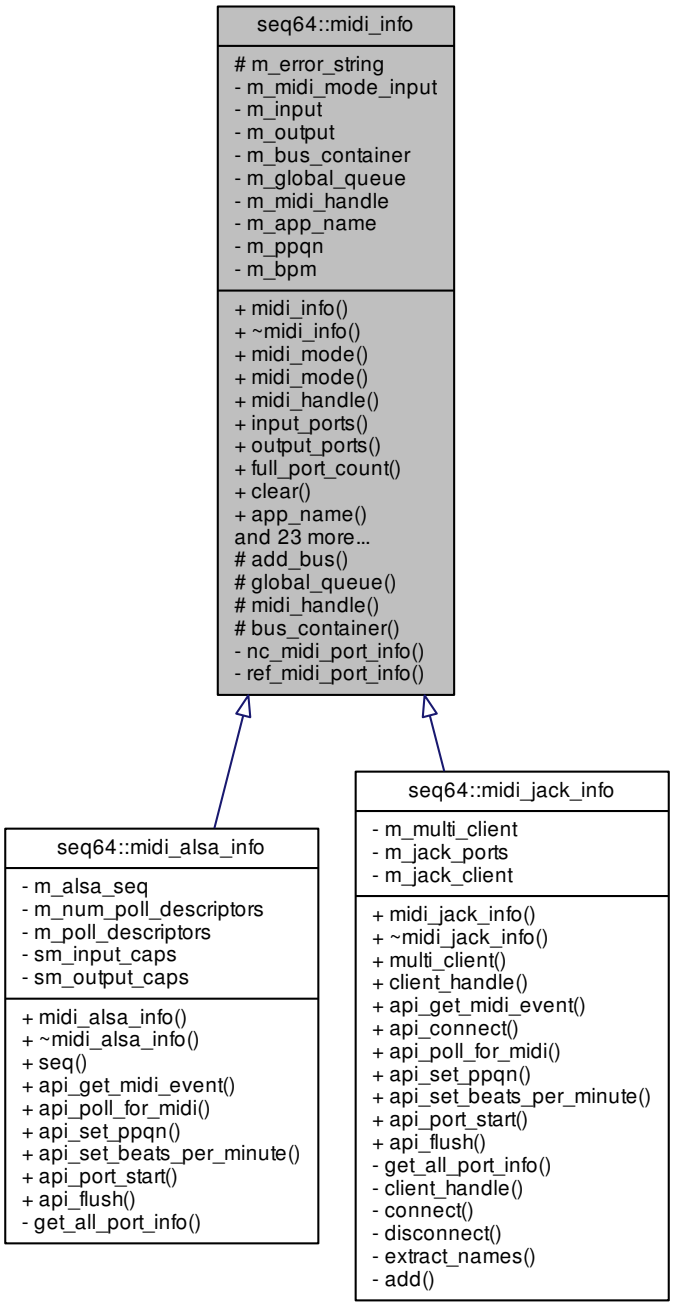
13.45.3.1 m_client_name

```
std::string seq64::midi_in_jack::m_client_name  [protected]
```

13.46 seq64::midi_info Class Reference

The class for holding basic information on the MIDI input and output ports currently present in the system.

Inheritance diagram for seq64::midi_info:



Public Member Functions

- midi_info (const std::string &appname, int ppqn=SEQ64_DEFAULT_PPQN, midibpm bpm=SEQ64_DEFA↩ ULT_BPM)

  Principal constructor.
- virtual ~midi_info ()
- bool midi_mode () const

  'Getter' function for member m_midi_mode_input
- void midi_mode (bool flag)

  'Setter' function for member m_midi_mode_input
- void * midi_handle ()

  'Getter' function for member m_midi_handle
- midi_port_info & input_ports ()

  'Getter' function for member m_input
- midi_port_info & output_ports ()

  'Getter' function for member m_output
- int full_port_count () const

  'Getter' function for member Total port count.
- void clear ()
- const std::string & app_name () const

  'Getter' function for member m_app_name
- int ppqn () const

  'Getter' function for member m_ppqn, simple version, also see api_set_ppqn().
- midibpm bpm () const

  'Getter' function for member m_bpm, simple version, also see api_set_beats_per_minute().
- virtual void api_set_ppqn (int p)

  Special setter.
- virtual void api_set_beats_per_minute (midibpm b)

  Special setter.
- virtual void api_port_start (mastermidibus &, int, int)

  An ALSA-specific function at the moment.
- virtual bool api_get_midi_event (event *inev)=0
- virtual int api_poll_for_midi ()=0
- virtual void api_flush ()=0
- virtual bool api_connect ()

  Used only in the midi_jack_info class.
- virtual int get_port_count () const
- virtual int get_bus_id (int index) const
- virtual std::string get_bus_name (int index) const
- virtual int get_port_id (int index) const
- virtual std::string get_port_name (int index) const
- virtual bool get_input (int index) const
- virtual bool get_virtual (int index) const
- virtual bool get_system (int index) const
- virtual int queue_number (int index) const
- std::string connect_name (int index) const
- std::string port_list () const

  Generates a string listing all of the ports present in the port container.
- int global_queue () const
- void error (rterror::Type type, const std::string &errorstring)

  A basic error reporting function for midi_info classes.
- virtual int get_all_port_info ()=0

Protected Member Functions

- void add_bus (const midibus *m)

  Adds the midibus to a quick list of all ports for use in the api_connect() call in mastermidibus.
- void global_queue (int q)

  'Setter' function for member m_global_queue
- void midi_handle (void *h)

  'Setter' function for member m_midi_handle
- std::vector< midibus * > & bus_container ()

  'Getter' function for member m_bus_container

Protected Attributes

- std::string m_error_string

  Error string for the midi_info interface.

Private Member Functions

- const midi_port_info & nc_midi_port_info () const

  'Getter' function for member m_input or m_output Used for retrieving values from the input or output containers.
- midi_port_info & ref_midi_port_info ()

  'Getter' function for member m_input or m_output

Private Attributes

- bool m_midi_mode_input

  Indicates which mode we're in, input or output.
- midi_port_info m_input

  Holds data on the ALSA/JACK/Core/WinMM inputs.
- midi_port_info m_output

  Holds data on the ALSA/JACK/Core/WinMM outputs.
- std::vector< midibus * > m_bus_container

  Holds pointers to the ports that were created, so that, after activation, we can call the connect_port() function on those that are not virtual.
- int m_global_queue

  The ID of the ALSA MIDI queue.
- void * m_midi_handle

  Provides a handle to the main ALSA or JACK implementation object.
- const std::string m_app_name

  Holds this value for passing along, to reduce the number of arguments needed.
- int m_ppqn

  Hold this value for passing along to some ports that get created.
- midibpm m_bpm

  Hold this value for passing along to some ports that get created.

Friends

- class rtmidi_info

13.46.1 Constructor & Destructor Documentation

13.46.1.1 midi_info()

```
seq64::midi_info::midi_info (
            const std::string & appname,
            int ppqn = SEQ64_DEFAULT_PPQN,
            midibpm bpm = SEQ64_DEFAULT_BPM )
```

13.46.1.2 ~midi_info()

```
virtual seq64::midi_info::~midi_info ( )  [inline], [virtual]
```

13.46.2 Member Function Documentation

13.46.2.1 midi_mode() [1/2]

```
bool seq64::midi_info::midi_mode ( ) const  [inline]
```

13.46.2.2 midi_mode() [2/2]

```
void seq64::midi_info::midi_mode (
            bool flag )  [inline]
```

13.46.2.3 midi_handle() [1/2]

```
void* seq64::midi_info::midi_handle ( )  [inline]
```

13.46.2.4 input_ports()

```
midi_port_info& seq64::midi_info::input_ports ( )  [inline]
```

13.46.2.5 output_ports()

```
midi_port_info& seq64::midi_info::output_ports ( )  [inline]
```

13.46.2.6 full_port_count()

```
int seq64::midi_info::full_port_count ( ) const  [inline]
```

13.46.2.7 clear()

```
void seq64::midi_info::clear ( )  [inline]
```

13.46.2.8 app_name()

```
const std::string& seq64::midi_info::app_name ( ) const  [inline]
```

13.46.2.9 ppqn()

```
int seq64::midi_info::ppqn ( ) const  [inline]
```

13.46.2.10 bpm()

```
midibpm seq64::midi_info::bpm ( ) const  [inline]
```

13.46.2.11 api_set_ppqn()

```
virtual void seq64::midi_info::api_set_ppqn (
            int p )  [inline], [virtual]
```

Reimplemented in seq64::midi_jack_info, and seq64::midi_alsa_info.

13.46.2.12 api_set_beats_per_minute()

```
virtual void seq64::midi_info::api_set_beats_per_minute (
            midibpm b )  [inline], [virtual]
```

Reimplemented in seq64::midi_jack_info, and seq64::midi_alsa_info.

13.46.2.13 api_port_start()

```
virtual void seq64::midi_info::api_port_start (
            mastermidibus & ,
            int ,
            int  )  [inline], [virtual]
```

Reimplemented in seq64::midi_jack_info, and seq64::midi_alsa_info.

13.46.2.14 api_get_midi_event()

```
virtual bool seq64::midi_info::api_get_midi_event (
            event * inev )  [pure virtual]
```

Implemented in seq64::midi_jack_info, and seq64::midi_alsa_info.

13.46.2.15 api_poll_for_midi()

```
virtual int seq64::midi_info::api_poll_for_midi ( )  [pure virtual]
```

Implemented in seq64::midi_jack_info, and seq64::midi_alsa_info.

13.46.2.16 api_flush()

```
virtual void seq64::midi_info::api_flush ( )  [pure virtual]
```

Implemented in seq64::midi_jack_info, and seq64::midi_alsa_info.

13.46.2.17 api_connect()

```
virtual bool seq64::midi_info::api_connect ( )  [inline], [virtual]
```

Reimplemented in seq64::midi_jack_info.

13.46.2.18 get_port_count()

```
virtual int seq64::midi_info::get_port_count ( ) const  [inline], [virtual]
```

13.46.2.19 get_bus_id()

```
virtual int seq64::midi_info::get_bus_id (
            int index ) const  [inline], [virtual]
```

13.46.2.20 get_bus_name()

```
virtual std::string seq64::midi_info::get_bus_name (
            int index ) const  [inline], [virtual]
```

13.46.2.21 get_port_id()

```
virtual int seq64::midi_info::get_port_id (
            int index ) const  [inline], [virtual]
```

13.46.2.22 get_port_name()

```
virtual std::string seq64::midi_info::get_port_name (
            int index ) const  [inline], [virtual]
```

13.46.2.23 get_input()

```
virtual bool seq64::midi_info::get_input (
            int index ) const  [inline], [virtual]
```

13.46.2.24 get_virtual()

```
virtual bool seq64::midi_info::get_virtual (
            int index ) const  [inline], [virtual]
```

13.46.2.25 get_system()

```
virtual bool seq64::midi_info::get_system (
            int index ) const  [inline], [virtual]
```

13.46.2.26 queue_number()

```
virtual int seq64::midi_info::queue_number (
            int index ) const  [inline], [virtual]
```

13.46.2.27 connect_name()

```
std::string seq64::midi_info::connect_name (
            int index ) const  [inline]
```

13.46.2.28 port_list()

```
std::string seq64::midi_info::port_list ( ) const
```

Useful for debugging and probing.

Returns

Returns a multi-line ASCII string enumerating all of the ports.

13.46.2.29 global_queue() [1/2]

```
int seq64::midi_info::global_queue ( ) const  [inline]
```

13.46.2.30 error()

```
void seq64::midi_info::error (
            rterror::Type type,
            const std::string & errorstring )
```

Provides an error handler.

Unlike the midi_api version, it cannot support an error callback.

Exceptions

If	the error is not just a warning, then an rterror object is thrown.

Parameters

type	The type of the error.
errorstring	The error message, which gets copied if this is the first error.

13.46.2.31 get_all_port_info()

```
virtual int seq64::midi_info::get_all_port_info ( )  [pure virtual]
```

Implemented in seq64::midi_jack_info, and seq64::midi_alsa_info.

13.46.2.32 add_bus()

```
void seq64::midi_info::add_bus (
            const midibus * m )  [inline], [protected]
```

We could add the midibus pointer to the midi_port_info structure, but that information is strictly for representing data obtained by querying the system via the selected API.

13.46.2.33 global_queue() [2/2]

```
void seq64::midi_info::global_queue (
            int q )  [inline], [protected]
```

13.46.2.34 midi_handle() [2/2]

```
void seq64::midi_info::midi_handle (
            void * h )  [inline], [protected]
```

13.46.2.35 bus_container()

```
std::vector<midibus *>& seq64::midi_info::bus_container ( )  [inline], [protected]
```

13.46.2.36 nc_midi_port_info()

```
const midi_port_info& seq64::midi_info::nc_midi_port_info ( ) const  [inline], [private]
```

The caller must insure the proper container by calling the midi_mode() function with the value of true (SEQ64_MI↩ DI_INPUT_PORT) or false (SEQ64_MIDI_OUTPUT_PORT) first. Ugly stuff. I hate it.

13.46.2.37 ref_midi_port_info()

```
midi_port_info& seq64::midi_info::ref_midi_port_info ( )  [inline], [private]
```

13.46.3 Friends And Related Function Documentation

13.46.3.1 rtmidi_info

```
friend class rtmidi_info  [friend]
```

13.46.4 Field Documentation

13.46.4.1 m_midi_mode_input

```
bool seq64::midi_info::m_midi_mode_input  [private]
```

We have to pick the mode we need to be in with the set_mode() function before we do a series of operations. This clumsy two-step is needed in order to preserve the midi_api interface.

13.46.4.2 m_input

```
midi_port_info seq64::midi_info::m_input  [private]
```

13.46.4.3 m_output

```
midi_port_info seq64::midi_info::m_output  [private]
```

13.46.4.4 m_bus_container

```
std::vector<midibus *> seq64::midi_info::m_bus_container  [private]
```

See the add_bus() and bus_container() member functions.

13.46.4.5 m_global_queue

```
int seq64::midi_info::m_global_queue  [private]
```

13.46.4.6 m_midi_handle

```
void* seq64::midi_info::m_midi_handle  [private]
```

Created by the class derived from midi_info.

13.46.4.7 m_app_name

```
const std::string seq64::midi_info::m_app_name  [private]
```

This value is the main application name as determined at ./configure time.

13.46.4.8 m_ppqn

```
int seq64::midi_info::m_ppqn  [private]
```

Some APIs can use this value.

13.46.4.9 m_bpm

```
midibpm seq64::midi_info::m_bpm  [private]
```

Some APIs can use this value.

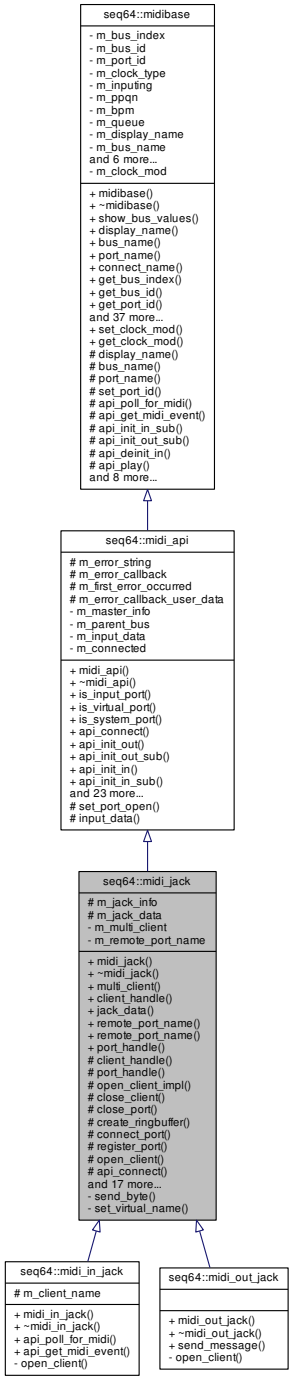
13.46.4.10 m_error_string

```
std::string seq64::midi_info::m_error_string  [protected]
```

13.47 seq64::midi_jack Class Reference

This class implements with JACK version of the midi_alsa object.

Inheritance diagram for seq64::midi_jack:



Public Member Functions

- midi_jack (midibus &parentbus, midi_info &masterinfo)

We still need to figure out if we want a "master" client handle, or a handle to each port.

- virtual ~midi_jack ()

  This could be a rote empty destructor if we offload this destruction to the midi_jack_data structure.
- bool multi_client () const

  'Getter' function for member m_multi_client
- jack_client_t * client_handle ()

  'Getter' function for member m_jack_client This is the platform-specific version of midi_handle().
- midi_jack_data & jack_data ()

  'Getter' function for member m_jack_data
- const std::string & remote_port_name () const

  'Getter' function for member m_remote_port_name
- void remote_port_name (const std::string &s)

  'Setter' function for member m_remote_port_name
- jack_port_t * port_handle ()

  'Getter' function for member m_jack_port This is the platform-specific version of midi_handle().

Protected Member Functions

- void client_handle (jack_client_t *handle)

  'Setter' function for member m_jack_data.m_jack_client
- void port_handle (jack_port_t *handle)

  'Setter' function for member m_jack_data.m_jack_port
- bool open_client_impl (bool input)

  Opens input or output JACK clients, sets up the input or output callback, and actives the JACK client.
- void close_client ()

  Closes the JACK client handle.
- void close_port ()

  Closes the MIDI port by calling jack_port_unregister() and nullifying the port pointer.
- bool create_ringbuffer (size_t rbsize)

  Creates the JACK ring-buffers.
- bool connect_port (bool input, const std::string &sourceportname, const std::string &destportname)

  Connects two named JACK ports.
- bool register_port (bool input, const std::string &portname)

  Registers a named JACK port.
- virtual bool open_client ()=0
- virtual bool api_connect ()

  Assumes that the port has already been registered, and that JACK activation has already occurred.
- virtual bool api_init_out ()

  Initialize the MIDI output port.
- virtual bool api_init_in ()

  This function is called when we are processing the list of system input ports.
- virtual bool api_init_out_sub ()
- virtual bool api_init_in_sub ()

  Initializes a virtual/manual input port.
- virtual bool api_deinit_in ()

  We could define these in the opposite order.
- virtual bool api_get_midi_event (event *)
- virtual int api_poll_for_midi ()
- virtual void api_play (event *e24, midibyte channel)

  We could push the bytes of the event into a midibyte vector, as done in send_message().

- virtual void api_sysex (event *e24)
- virtual void api_flush ()

  It seems like JACK doesn't have the concept of flushing event.
- virtual void api_continue_from (midipulse tick, midipulse beats)

  jack_transport_locate(), jack_transport_reposition(), or something else? What is used by jack_assistant?
- virtual void api_start ()

  Starts this JACK client and sends MIDI start.
- virtual void api_stop ()

  Stops this JACK client and sends MIDI stop.
- virtual void api_clock (midipulse tick)

  Sends a MIDI clock event.
- virtual void api_set_ppqn (int ppqn)
- virtual void api_set_beats_per_minute (midibpm bpm)
- virtual std::string api_get_port_name ()

  Gets the name of the current port via jack_port_name().

Protected Attributes

- midi_jack_info & m_jack_info

  This reference is needed in order for this midi_jack object to add itself to the main midi_jack_info list when running in single-JACK client mode.
- midi_jack_data m_jack_data

  Holds the data needed for JACK processing.

Private Member Functions

- void send_byte (midibyte evbyte, midipulse tick=SEQ64_NULL_MIDIPULSE)

  An internal helper function for sending MIDI clock bytes.
- bool set_virtual_name (int portid, const std::string &portname)

  Gets information directly from JACK.

Private Attributes

- bool m_multi_client

  Set to true if each JACK port should be its own client.
- std::string m_remote_port_name

  Preserves the original name of the remote port, so it can be used later for connection.

Friends

- class midi_jack_info

Additional Inherited Members

13.47.1 Constructor & Destructor Documentation

13.47.1.1 midi_jack()

```
seq64::midi_jack::midi_jack (
            midibus & parentbus,
            midi_info & masterinfo )
```

Same for the JACK data item. Currently, we provide the m_multi_client member so that we can experiment, but "multi-client" mode is currently incompletely implemented.

Note that this constructor also adds its object to the midi_jack_info port list, so that the JACK callback functions can iterate through all of the JACK ports in use by this application, performing work on them.

Parameters

parentbus	Provides a reference to the midibus that represents this object.
masterinfo	Provides a reference to the midi_jack_info object that may provide extra informatino that is needed by this port. Too many entities!

13.47.1.2 ~midi_jack()

```
seq64::midi_jack::~midi_jack ( )  [virtual]
```

However, other than the initialization, that structure is currently "dumb".

13.47.2 Member Function Documentation

13.47.2.1 multi_client()

```
bool seq64::midi_jack::multi_client ( ) const  [inline]
```

13.47.2.2 client_handle() [1/2]

```
jack_client_t* seq64::midi_jack::client_handle ( )  [inline]
```

13.47.2.3 jack_data()

```
midi_jack_data& seq64::midi_jack::jack_data ( )  [inline]
```

13.47.2.4 remote_port_name() [1/2]

```
const std::string& seq64::midi_jack::remote_port_name ( ) const  [inline]
```

13.47.2.5 remote_port_name() [2/2]

```
void seq64::midi_jack::remote_port_name (
            const std::string & s )  [inline]
```

13.47.2.6 port_handle() [1/2]

```
jack_port_t* seq64::midi_jack::port_handle ( )  [inline]
```

13.47.2.7 client_handle() [2/2]

```
void seq64::midi_jack::client_handle (
            jack_client_t * handle )  [inline], [protected]
```

13.47.2.8 port_handle() [2/2]

```
void seq64::midi_jack::port_handle (
            jack_port_t * handle )  [inline], [protected]
```

13.47.2.9 open_client_impl()

```
bool seq64::midi_jack::open_client_impl (
            bool input )  [protected]
```

This code is combined from the former versions of the midi_in_jack::connect() and midi_out_jack::connect() functions for better readability and re-use in the input and output open_client() functions.

For input, it connects the MIDI input port. The following calls are made:

- jack_client_open(), to initialize JACK client.
- jack_set_process_callback(), to set jack_process_rtmidi_input() or jack_process_rtmidi_output().

Note that jack_activate() is no longer called here.

For output, connects the MIDI output port. The following calls are made:

```
-   jack_ringbuffer_create(), called twice, to initialize the
    output ringbuffers
-   jack_client_open(), to initialize JACK client
-   jack_set_process_callback(), to set jack_process_inpu()
```

Note that jack_activate() is no longer called here.

If the midi_jack_data client member is already set, this function returns immediately. Only one client needs to be open for each midi_jack object.

Let's replace JackNullOption with JackNoStartServer. We might also want to OR in the JackUseExactName option.

The former name of this function was a bit of a misnomer, since it does not actually call jack_connect(). That call is made in other functions.

Which "client" name? Let's start with the full name, connect_name(). Is UUID an output-only, input-only option, or both?

```
    const char * name = master_info().get_bus_name(get_bus_index()).c_str();
    const char * name = master_info().get_port_name(get_bus_index()).c_str();
```

Parameters

input	True if an input connection is to be made, and false if an output connection is to be made.

13.47.2.10 close_client()

```
void seq64::midi_jack::close_client ( )  [protected]
```

13.47.2.11 close_port()

```
void seq64::midi_jack::close_port ( )  [protected]
```

13.47.2.12 create_ringbuffer()

```
bool seq64::midi_jack::create_ringbuffer (
            size_t rbsize )  [protected]
```

13.47.2.13 connect_port()

```
bool seq64::midi_jack::connect_port (
            bool input,
            const std::string & srcportname,
            const std::string & destportname )  [protected]
```

First, we register the local port. If this is nominally a local input port, it is really doing output, and this is the source-port name. If this is nominally a local output port, it is really accepting input, and this is the destination-port name.

This code is disabled for now because the order of JACK setup calls that works is

```
-   jack_port_register()
-   jack_activate()
-   jack_connect()
```

So we have to break this up.

Parameters

input	Indicates true if the port to register and connect is an input port, and false if the port is an output port. Useful macros for readability: SEQ64_MIDI_INPUT_PORT and SEQ64_MIDI_OUTPUT_PORT.
srcportname	Provides the destination port-name for the connection. For input, this should be the name associated with the JACK client handle; it is the port that gets registered. For output, this should be the full name of the port that was enumerated at start-up. The JackPortFlags of the source port must include JackPortIsOutput.
destportname	For input, this should be full name of port that was enumerated at start-up. For output, this should be the name associated with the JACK client handle; it is the port that gets registered. The JackPortFlags of the destination port must include JackPortIsInput. Now, if this name is empty, that basically means that there is no such port, and we create a virtual port in this case. So jack_connect() is not called in this case. We do not treat this case as an error.

Returns

If the jack_connect() call succeeds, true is returned. If the port is a virtual (manual) port, then it is not connected, and true is returned without any action.

13.47.2.14 register_port()

```
bool seq64::midi_jack::register_port (
            bool input,
            const std::string & portname )  [protected]
```

We made this function to encapsulate some otherwise cut-and-paste functionality.

For jack_port_register(), the port-name must be the actual port-name, not the full-port name ("busname:portname").

Note that the buffer size of non-built-in port type is 0, and so it is ignored.

Tricky Code If we are registering an input port, this means that we got the input port from the system. In order to connect to that port, we have to register as an output port, even though the application calls it in input port (midi_in_jack). Confusing, but the same thing was implicit in the ALSA implementation, and so we have to apply that same setup here.

Parameters

input	Indicates true if the port to register input port, and false if the port is an output port. Two macros can be used for this purpose: SEQ64_MIDI_INPUT_PORT and SEQ64_MIDI_OUTPUT_PORT.
portname	Provides the local name of the port. This is the full name ("clientname:portname"), but the "portname" part is extracted to fit the requirements of the jack_port_register() function. There is an issue here when a2jmidid is running. We may see a client name of "seq64", but a port name of "a2j Midi Through [1] capture: Midi Through Port-0", which as a colon in it. What to do? Just not extract the port name from the portname parameter. If we have an issue here, we'll ahve to fix it in the caller.

13.47.2.15 open_client()

```
virtual bool seq64::midi_jack::open_client ( )  [protected], [pure virtual]
```

Implemented in seq64::midi_out_jack, and seq64::midi_in_jack.

13.47.2.16 api_connect()

```
bool seq64::midi_jack::api_connect ( )  [protected], [virtual]
```

Returns

Returns true if all steps of the connection succeeded.

Reimplemented from seq64::midi_api.

13.47.2.17 api_init_out()

```
bool seq64::midi_jack::api_init_out ( )  [protected], [virtual]
```

This initialization is done when the "manual ports" option is not in force. This code is basically what was done by midi_out_jack::open_port() in RtMidi.

For jack_connect(), the first port-name is the source port, and the source port must include the JackPortIsOutput flag. The second port-name is the destination port, and the destination port must include the JackPortIsInput flag. For this function, the source/output port is this port, and the destination/input is....

Note that connect_port() [which calls jack_connect()] cannot usefully be called until jack_activate() has been called.

Returns

Returns true unless setting up JACK MIDI failed in some way.

Implements seq64::midi_api.

13.47.2.18 api_init_in()

```
bool seq64::midi_jack::api_init_in ( )  [protected], [virtual]
```

We want to create an output port of a similar name, but with the application as client, and connect it to this sytem input port. We want to follow the model we got from seq24, rather than the RtMidi model, so that we do not have to rework (and probably break) the seq24 model.

We can't use the API port name here at this time, because it comes up empty. It comes up empty because we haven't yet registered the ports, including the source ports. So we register it first; connect_port() will not try to register it again.

Based on the comments in the jack.txt note file, here is what we need to do:

```
-#  open_client_impl(INPUT).
    -#  Get port name via master_info().connect_name().
    -#  Call jack_client_open() with or without a UUID.
    -#  Call jack_set_process_callback() for input/output.
    -#  Call jack_activate().  Premature?
-#  register_port(INPUT...).  The flag is JackPortIsInput.
-#  connect_port(INPUT...).  Call jack_connect(srcport, destport).
```

Unlike the corresponding virtual port, this input port is actually an output port.

Returns

Returns true if the function was successful, and sets the flag indicating that the port is open.

Implements seq64::midi_api.

13.47.2.19 api_init_out_sub()

```
bool seq64::midi_jack::api_init_out_sub ( )  [protected], [virtual]
```

Implements seq64::midi_api.

13.47.2.20 api_init_in_sub()

```
bool seq64::midi_jack::api_init_in_sub ( )  [protected], [virtual]
```

Returns

Returns true if all steps of the initialization succeeded.

Implements seq64::midi_api.

13.47.2.21 api_deinit_in()

```
bool seq64::midi_jack::api_deinit_in ( )  [protected], [virtual]
```

Implements seq64::midi_api.

13.47.2.22 api_get_midi_event()

```
virtual bool seq64::midi_jack::api_get_midi_event (
            event * )  [inline], [protected], [virtual]
```

Returns

Returns false, since this is an input function that is implemented fully only by midi_in_jack.

Implements seq64::midi_api.

Reimplemented in seq64::midi_in_jack.

13.47.2.23 api_poll_for_midi()

```
virtual int seq64::midi_jack::api_poll_for_midi ( )  [inline], [protected], [virtual]
```

Returns

Returns 0, since this is an input function that is implemented fully only by midi_in_jack.

Implements seq64::midi_api.

Reimplemented in seq64::midi_in_jack.

13.47.2.24 api_play()

```
void seq64::midi_jack::api_play (
            event * e24,
            midibyte channel )  [protected], [virtual]
```

The ALSA code (seq_alsamidi/src/midibus.cpp) sticks the event bytes in an array, which might be a little faster than using push_back(), but let's try the vector first. The rtmidi code here is from midi_out_jack::send_message().

Implements seq64::midi_api.

13.47.2.25 api_sysex()

```
void seq64::midi_jack::api_sysex (
            event * e24 )  [protected], [virtual]
```

Todo Flesh out this routine.

Implements seq64::midi_api.

13.47.2.26 api_flush()

```
void seq64::midi_jack::api_flush ( )  [protected], [virtual]
```

Implements seq64::midi_api.

13.47.2.27 api_continue_from()

```
void seq64::midi_jack::api_continue_from (
            midipulse tick,
            midipulse beats )  [protected], [virtual]
```

Parameters

tick	Provides the tick value to continue from.

The param beats is currently unused.

Implements seq64::midi_api.

13.47.2.28 api_start()

```
void seq64::midi_jack::api_start ( )  [protected], [virtual]
```

Note that the jack_assistant code (which implements JACK transport) checks if JACK is running, but a check of the JACK client handle here should be enough.

Implements seq64::midi_api.

13.47.2.29 api_stop()

```
void seq64::midi_jack::api_stop ( )  [protected], [virtual]
```

Note that the jack_assistant code (which implements JACK transport) checks if JACK is running, but a check of the JACK client handle here should be enough.

Implements seq64::midi_api.

13.47.2.30 api_clock()

```
void seq64::midi_jack::api_clock (
            midipulse tick )  [protected], [virtual]
```

Parameters

tick	The value of the tick to use, but currently unused.

Implements seq64::midi_api.

13.47.2.31 api_set_ppqn()

```
void seq64::midi_jack::api_set_ppqn (
            int ppqn )  [protected], [virtual]
```

Implements seq64::midi_api.

13.47.2.32 api_set_beats_per_minute()

```
void seq64::midi_jack::api_set_beats_per_minute (
            midibpm bpm )  [protected], [virtual]
```

Implements seq64::midi_api.

13.47.2.33 api_get_port_name()

```
std::string seq64::midi_jack::api_get_port_name ( )  [protected], [virtual]
```

This is different from get_port_name(index), which simply looks up the port-name in the attached midi_info object.

Returns

Returns the full port name ("clientname:portname") if the port has already been opened/registered; otherwise an empty string is returned.

Reimplemented from seq64::midi_api.

13.47.2.34 send_byte()

```
void seq64::midi_jack::send_byte (
            midibyte evbyte,
            midipulse tick = SEQ64_NULL_MIDIPULSE )  [private]
```

Based on the GitHub project "jack_midi_clock", we could try to bypass the ringbuffer used here and convert the ticks to jack_nframes_t, and use the following code:

```
uint8_t * buffer = jack_midi_event_reserve(port_buf, time, 1);
if (buffer)
    buffer[0] = rt_msg;
```

We generally need to send the (realtime) MIDI clock messages Start, Stop, and Continue if the JACK transport state changed.

Parameters

evbyte Provides the tick value, if applicable. We will eventually implement this, along with an "impossible" default value that means "ignore the tick".

13.47.2.35 set_virtual_name()

```
bool seq64::midi_jack::set_virtual_name (
            int portid,
            const std::string & portname )  [private]
```

The problem this function solves is that the midibus constructor for a virtual JACK port doesn't not have all of the information it needs at that point. Here, we can get this information and get the actual data we need to rename the port to something accurate.

```
const char * pname = jack_port_name(const jack_port_t *);
```

Returns

Returns true if all of the information could be obtained. If false is returned, then the caller should not use the side-effects.

Side-effect(s) Passes back the values found.

13.47.3 Friends And Related Function Documentation

13.47.3.1 midi_jack_info

```
friend class midi_jack_info  [friend]
```

13.47.4 Field Documentation

13.47.4.1 m_multi_client

```
bool seq64::midi_jack::m_multi_client  [private]
```

In this case, the functions api_init_in(), api_init_out(), api_init_in_sub(), and api_init_out_sub() need to open their own JACK client. Otherwise, they will use the JACK client created in the midi_jack_info class.

13.47.4.2 m_remote_port_name

```
std::string seq64::midi_jack::m_remote_port_name  [private]
```

13.47.4.3 m_jack_info

```
midi_jack_info& seq64::midi_jack::m_jack_info  [protected]
```

13.47.4.4 m_jack_data

```
midi_jack_data seq64::midi_jack::m_jack_data  [protected]
```

Please do not confuse this item with the m_midi_handle of the midi_api base class. This object holds a JACK-client pointer and a JACK-port pointer.

13.48 seq64::midi_jack_data Struct Reference

Contains the JACK MIDI API data as a kind of scratchpad for this object.

Public Member Functions

- midi_jack_data ()

  Constructor midi_jack_data
- ~midi_jack_data ()

  This destructor currently does nothing.
- bool valid_buffer () const

  Tests that the buffer is good.

Data Fields

- jack_client_t * m_jack_client

  Holds the JACK sequencer client pointer so that it can be used by the midibus objects.
- jack_port_t * m_jack_port

  Holds the JACK port information of the JACK client.
- jack_ringbuffer_t * m_jack_buffsize

  Holds the size of data for communicating between the client ring-buffer and the JACK port's internal buffer.
- jack_ringbuffer_t * m_jack_buffmessage

  Holds the data for communicating between the client ring-buffer and the JACK port's internal buffer.
- jack_time_t m_jack_lasttime

  The last time-stamp obtained.
- rtmidi_in_data * m_jack_rtmidiin

  Holds special data peculiar to the client and its MIDI input processing.

13.48.1 Detailed Description

This guy needs a constructor taking parameters for an rtmidi_in_data pointer.

13.48.2 Constructor & Destructor Documentation

13.48.2.1 midi_jack_data()

```
seq64::midi_jack_data::midi_jack_data ( )  [inline]
```

13.48.2.2 ~midi_jack_data()

```
seq64::midi_jack_data::~midi_jack_data ( )  [inline]
```

We rely on the enclosing class to close out the things that it created.

13.48.3 Member Function Documentation

13.48.3.1 valid_buffer()

```
bool seq64::midi_jack_data::valid_buffer ( ) const  [inline]
```

13.48.4 Field Documentation

13.48.4.1 m_jack_client

```
jack_client_t* seq64::midi_jack_data::m_jack_client
```

This is actually an opaque pointer; there is no way to get the actual fields in this structure; they can only be accessed through functions in the JACK API. Note that it is also stored as a void pointer in midi_info::m_midi_handle. This item can either be the single JACK client created by the midi_jack_info object, or a JACK client created by the midi_jack object in the "multi-client" mode (which is not yet complete or usable).

13.48.4.2 m_jack_port

```
jack_port_t* seq64::midi_jack_data::m_jack_port
```

13.48.4.3 m_jack_buffsize

```
jack_ringbuffer_t* seq64::midi_jack_data::m_jack_buffsize
```

13.48.4.4 m_jack_buffmessage

```
jack_ringbuffer_t* seq64::midi_jack_data::m_jack_buffmessage
```

13.48.4.5 m_jack_lasttime

```
jack_time_t seq64::midi_jack_data::m_jack_lasttime
```

Use for calculating the delta time, I would imagine.

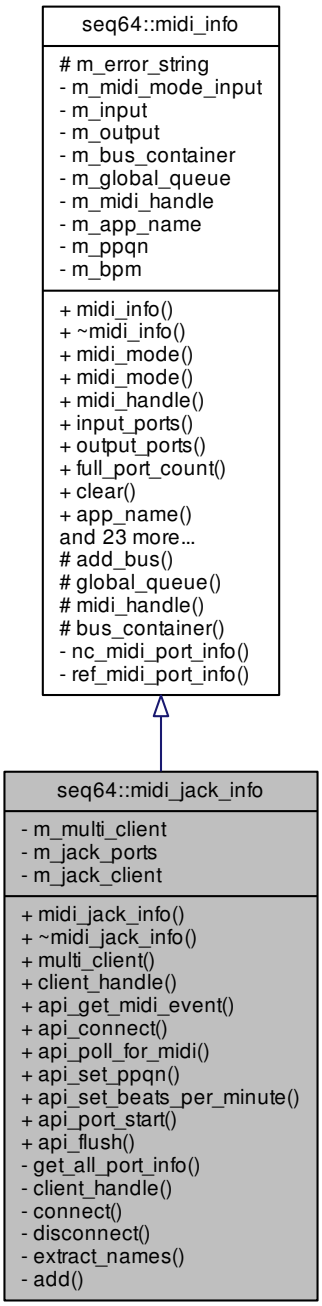
13.48.4.6 m_jack_rtmidiin

```
rtmidi_in_data* seq64::midi_jack_data::m_jack_rtmidiin
```

13.49 seq64::midi_jack_info Class Reference

The class for handling JACK MIDI port enumeration.

Inheritance diagram for seq64::midi_jack_info:



Public Member Functions

- midi_jack_info (const std::string &appname, int ppqn=SEQ64_DEFAULT_PPQN, midibpm bpm=SEQ64_↩ DEFAULT_BPM)

Principal constructor.

- virtual ~midi_jack_info ()

  Destructor.

- bool multi_client () const

  'Getter' function for member m_multi_client

- jack_client_t * client_handle ()

  'Getter' function for member m_jack_client This is the platform-specific version of midi_handle().

- virtual bool api_get_midi_event (event *inev)

  Grab a MIDI event.

- virtual bool api_connect ()

  Sets up all of the ports, represented by midibus objects, that have been created.

- virtual int api_poll_for_midi ()

  MUCH TO DO!

- virtual void api_set_ppqn (int p)

  Sets the PPQN numeric value, then makes JACK calls to set up the PPQ tempo.

- virtual void api_set_beats_per_minute (midibpm b)

  Sets the BPM numeric value, then makes JACK calls to set up the BPM tempo.

- virtual void api_port_start (mastermidibus &masterbus, int bus, int port)

  Start the given JACK MIDI port.

- virtual void api_flush ()

  Flushes our local queue events out into JACK.

Private Member Functions

- virtual int get_all_port_info ()

  Gets information on ALL ports, putting input data into one midi_info container, and putting output data into another midi_info container.

- void client_handle (jack_client_t *j)

  'Getter' function for member m_jack_client This is the platform-specific version of midi_handle().

- jack_client_t * connect ()

  Local JACK connection for enumerating the ports.

- void disconnect ()

  The opposite of connect().

- void extract_names (const std::string &fullname, std::string &clientname, std::string &portname)

  Extracts the two names from the JACK port-name format, "clientname:portname".

- bool add (midi_jack &mj)

  Adds a pointer to a JACK port.

Private Attributes

- bool m_multi_client

  Set to true if each JACK port should be its own client.

- std::vector< midi_jack * > m_jack_ports

  Holds the port data.

- jack_client_t * m_jack_client

  Holds the JACK sequencer client pointer so that it can be used by the midibus objects.

Friends

- class midi_jack
- int jack_process_io (jack_nframes_t nframes, void *arg)

  Provides a JACK callback function that uses the callbacks defined in the midi_jack module.

Additional Inherited Members

13.49.1 Constructor & Destructor Documentation

13.49.1.1 midi_jack_info()

```
seq64::midi_jack_info::midi_jack_info (
            const std::string & appname,
            int ppqn = SEQ64_DEFAULT_PPQN,
            midibpm bpm = SEQ64_DEFAULT_BPM )
```

Note the m_multi_client member. We may want each JACK port to have its own client, as in the original RtMidi implementation.

Parameters

appname	Provides the name of the application.
ppqn	Provides the desired value of the PPQN (pulses per quarter note).
bpm	Provides the desired value of the BPM (beats per minute).

13.49.1.2 ~midi_jack_info()

```
seq64::midi_jack_info::~midi_jack_info ( )  [virtual]
```

Deactivates (disconnects and closes) any ports maintained by the JACK client, then closes the JACK client, shuts down the input thread, and then cleans up any API resources in use.

13.49.2 Member Function Documentation

13.49.2.1 multi_client()

```
bool seq64::midi_jack_info::multi_client ( ) const  [inline]
```

13.49.2.2 client_handle() [1/2]

```
jack_client_t* seq64::midi_jack_info::client_handle ( )  [inline]
```

13.49.2.3 api_get_midi_event()

```
bool seq64::midi_jack_info::api_get_midi_event (
            event * inev )  [virtual]
```

Parameters

inev	The event to be set based on the found input event. We should make this value a reference someday. Not used here.

Returns

Always returns false. Will eventually delete this function.

Implements seq64::midi_info.

13.49.2.4 api_connect()

```
bool seq64::midi_jack_info::api_connect ( )  [virtual]
```

If multi-client usage has been specified, each non-virtual port that has been set up (with its own JACK client pointer) is activated, and then connected to its corresponding remote system port.

Otherwise, the main JACK client is activated, and then all non-virtual ports are simply connected.

Each JACK port's midi_jack::api_connect() function decides, based on multi-client status, whether or not to activate before making the connection.

Returns

Returns true if activation succeeds.

Reimplemented from seq64::midi_info.

13.49.2.5 api_poll_for_midi()

```
int seq64::midi_jack_info::api_poll_for_midi ( )  [virtual]
```

Implements seq64::midi_info.

13.49.2.6 api_set_ppqn()

```
void seq64::midi_jack_info::api_set_ppqn (
            int p )  [virtual]
```

Parameters

p	The desired new PPQN value to set.

Reimplemented from seq64::midi_info.

13.49.2.7 api_set_beats_per_minute()

```
void seq64::midi_jack_info::api_set_beats_per_minute (
            midibpm b )  [virtual]
```

Parameters

b	The desired new BPM value to set.

Reimplemented from seq64::midi_info.

13.49.2.8 api_port_start()

```
void seq64::midi_jack_info::api_port_start (
            mastermidibus & masterbus,
            int bus,
            int port )  [virtual]
```

This function is called by api_get_midi_event() when an JACK event SND_SEQ_EVENT_PORT_START is received.

- Get the API's client and port information.
- Do some capability checks.
- Find the client/port combination among the set of input/output busses. If it exists and is not active, then mark it as a replacement. If it is not a replacement, it will increment the number of input/output busses.

We can simplify this code a bit by using elements already present in midi_jack_info.

Parameters

masterbus	Provides the object needed to get access to the array of input and output buss objects.
bus	Provides the JACK bus/client number.
port	Provides the JACK client port.

Reimplemented from seq64::midi_info.

13.49.2.9 api_flush()

```
void seq64::midi_jack_info::api_flush ( )  [virtual]
```

This is also a midi_jack function.

Implements seq64::midi_info.

13.49.2.10 get_all_port_info()

```
int seq64::midi_jack_info::get_all_port_info ( )  [private], [virtual]
```

Tricky Code When we want to connect to a system input port, we want to use an output port to do that. When we want to connect to a system output port, we want to use an input port to do that. Therefore, we search for the *opposite* kind of port.

If in multi-client mode, then this function disconnects the JACK client afterward. At this point, we have got all the data we need, and are not providing a client to each JACK port we create.

If there is no system input port, or no system output port, then we add a virtual port of that type so that the application has something to work with.

Note that, at some pointer, we ought to consider how to deal with transitory system JACK clients and ports, and adjust for it. A kind of miniature form of session management. Also, don't forget about the usefulness of jack_get↩
_port_by_id() and jack_get_port_by_name().

Error handling:

Not having any JACK input ports present isn't necessarily an error. There may not be any, and there may still be at least one output port.

```
m_error_string = func_message("no JACK input ports available");
error(rterror::WARNING, m_error_string);
```

Also, if there are none, we try to make a virtual port so that the application has something to work with. The only issue is the client number. Currently all virtual ports we create have a client number of 0.

JackPortIsPhysical:

If this flag is added, then only ports corresponding to a physical device are get detected and connected. This might be a useful option to add at a later date.

Returns

Returns the total number of ports found. Note that 0 ports is not necessarily an error; there may be no JACK apps running with exposed ports. If there is no JACK client, then -1 is returned.

Implements seq64::midi_info.

13.49.2.11 client_handle() [2/2]

```
void seq64::midi_jack_info::client_handle (
            jack_client_t * j )  [inline], [private]
```

13.49.2.12 connect()

```
jack_client_t * seq64::midi_jack_info::connect ( )  [private]
```

Note that this name will be used for normal ports, so we make sure it reflects the application name.

Note that this function does not call jack_connect(). We need to add a call to jack_on_shutdown() to set up a shutdown callback. We also need to wait on the activation call until we have registered all the ports. Then we (actually the mastermidibus) can call the api_connect() function to activate this JACK client and connect all the ports.

jack_activate(result);

13.49.2.13 disconnect()

```
void seq64::midi_jack_info::disconnect ( )  [private]
```

13.49.2.14 extract_names()

```
void seq64::midi_jack_info::extract_names (
            const std::string & fullname,
            std::string & clientname,
            std::string & portname )  [private]
```

13.49.2.15 add()

```
bool seq64::midi_jack_info::add (
            midi_jack & mj )  [inline], [private]
```

13.49.3 Friends And Related Function Documentation

13.49.3.1 midi_jack

```
friend class midi_jack  [friend]
```

13.49.3.2 jack_process_io

```
int jack_process_io (
            jack_nframes_t nframes,
            void * arg )  [friend]
```

13.49.4 Field Documentation

13.49.4.1 m_multi_client

```
bool seq64::midi_jack_info::m_multi_client  [private]
```

In this case, the functions api_init_in(), api_init_out(), api_init_in_sub(), and api_init_out_sub() need to open their own JACK client. Otherwise, they will use the JACK client created here. And this class will have to close out its own client so it will not persist in the JACK client list (e.g. in QJackCtl).

13.49.4.2 m_jack_ports

```
std::vector<midi_jack *> seq64::midi_jack_info::m_jack_ports  [private]
```

Not for use with the multi-client option. This list is iterated in the input and output portions of the JACK process callback.

13.49.4.3 m_jack_client

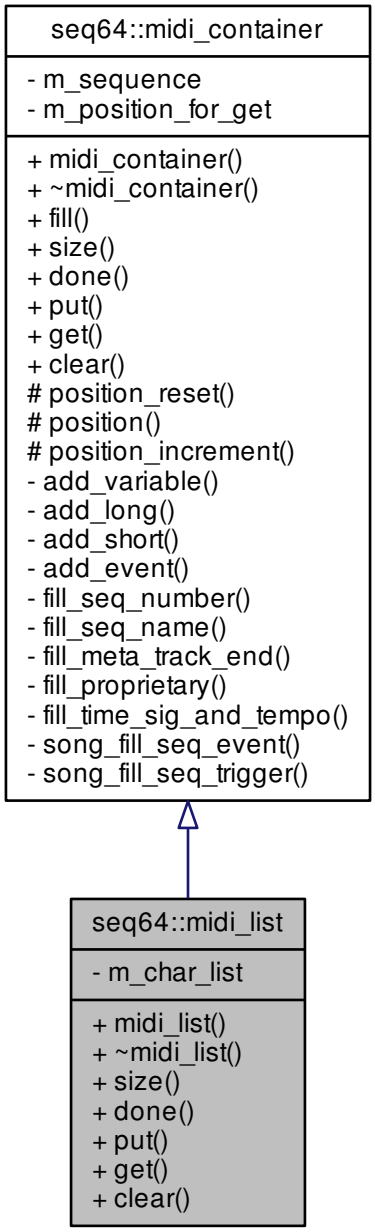
```
jack_client_t* seq64::midi_jack_info::m_jack_client  [private]
```

This is actually an opaque pointer; there is no way to get the actual fields in this structure; they can only be accessed through functions in the JACK API. Note that it is also stored as a void pointer in midi_info::m_midi_handle.

13.50 seq64::midi_list Class Reference

This class is the std::list implementation of the midi_container.

Inheritance diagram for seq64::midi_list:



Public Member Functions

- midi_list (sequence &seq)

  This constructor fills in the members.
- virtual ~midi_list ()

  A rote constructor needed for a base class.
- virtual std::size_t size () const

Returns the size of the container, in midibytes.

- virtual bool done () const

  For popping data from the MIDI list, we are done when the container is empty.

- virtual void put (midibyte b)

  Provides a way to add a MIDI byte into the list.

- virtual midibyte get () const

  Provide a way to get the next byte from the container.

- virtual void clear ()

  Provides a way to clear the container.

Private Types

- typedef std::list< midibyte > CharList

  Provides the type of this container.

Private Attributes

- CharList m_char_list

  The container itself.

Additional Inherited Members

13.50.1 Member Typedef Documentation

13.50.1.1 CharList

```
typedef std::list<midibyte> seq64::midi_list::CharList  [private]
```

This type is basically the same as the midifile::m_char_list container in the midifile module.

13.50.2 Constructor & Destructor Documentation

13.50.2.1 midi_list()

```
seq64::midi_list::midi_list (
            sequence & seq )
```

Parameters

seq	The sequence/track object that is using this container.

13.50.2.2 ~midi_list()

```
virtual seq64::midi_list::~midi_list ( )  [inline], [virtual]
```

13.50.3 Member Function Documentation

13.50.3.1 size()

```
virtual std::size_t seq64::midi_list::size ( ) const  [inline], [virtual]
```

Reimplemented from seq64::midi_container.

13.50.3.2 done()

```
virtual bool seq64::midi_list::done ( ) const  [inline], [virtual]
```

Reimplemented from seq64::midi_container.

13.50.3.3 put()

```
virtual void seq64::midi_list::put (
            midibyte b )  [inline], [virtual]
```

The original seq24 list used an std::list and a push_front operation.

Implements seq64::midi_container.

13.50.3.4 get()

```
virtual midibyte seq64::midi_list::get ( ) const  [inline], [virtual]
```

In this implementation, m_position_for_get is not used. The elements of the container are popped off backward! This modifies the character list, so it has to be mutable.

Implements seq64::midi_container.

13.50.3.5 clear()

```
virtual void seq64::midi_list::clear ( )  [inline], [virtual]
```

Implements seq64::midi_container.

13.50.4 Field Documentation

13.50.4.1 m_char_list

```
CharList seq64::midi_list::m_char_list  [mutable], [private]
```

It has to be mutable because the const-function get() actually modifies the container when getting a byte.

13.51 seq64::midi_measures Class Reference

Provides a data structure to hold the numeric equivalent of the measures string "measures:beats:divisions" ("m:b↩:d").

Public Member Functions

- midi_measures ()
  Default constructor for midi_measures.
- midi_measures (int measures, int beats, int divisions)
  Principal constructor for midi_measures.
- int measures () const
  'Getter' function for member m_measures
- void measures (int m)
  'Setter' function for member m_measures
- int beats () const
  'Getter' function for member m_beats
- void beats (int b)
  'Setter' function for member m_beats
- int divisions () const
  'Getter' function for member m_divisions
- void divisions (int d)
  'Setter' function for member m_divisions

Private Attributes

- int m_measures
  The integral number of measures in the measures-based time.
- int m_beats
  The integral number of beats in the measures-based time.
- int m_divisions
  The integral number of divisions/pulses in the measures-based time.

13.51.1 Detailed Description

More commonly known as "bars:beats:ticks", or "BBT".

13.51.2 Constructor & Destructor Documentation

13.51.2.1 midi_measures() [1/2]

```
seq64::midi_measures::midi_measures ( )
```

13.51.2.2 midi_measures() [2/2]

```
seq64::midi_measures::midi_measures (
            int measures,
            int beats,
            int divisions )
```

Parameters

measures	Copied into the m_measures member.
beats	Copied into the m_beats member.
divisions	Copied into the m_divisions member.

13.51.3 Member Function Documentation

13.51.3.1 measures() [1/2]

```
int seq64::midi_measures::measures ( ) const  [inline]
```

13.51.3.2 measures() [2/2]

```
void seq64::midi_measures::measures (
            int m )  [inline]
```

Parameters

m	The value to which to set the number of measures. We can add validation later.

13.51.3.3 beats() [1/2]

```
int seq64::midi_measures::beats ( ) const  [inline]
```

13.51.3.4 beats() [2/2]

```
void seq64::midi_measures::beats (
            int b )  [inline]
```

Parameters

b	The value to which to set the number of beats. We can add validation later.

13.51.3.5 divisions() [1/2]

```
int seq64::midi_measures::divisions ( ) const  [inline]
```

13.51.3.6 divisions() [2/2]

```
void seq64::midi_measures::divisions (
            int d )  [inline]
```

Parameters

d	The value to which to set the number of divisions. We can add validation later.

13.51.4 Field Documentation

13.51.4.1 m_measures

```
int seq64::midi_measures::m_measures  [private]
```

13.51.4.2 m_beats

```
int seq64::midi_measures::m_beats  [private]
```

13.51.4.3 m_divisions

```
int seq64::midi_measures::m_divisions  [private]
```

There are two possible translations of the two bytes of a division. If the top bit of the 16 bits is 0, then the time division is in "ticks per beat" (or “pulses per quarter note”). If the top bit is 1, then the time division is in "frames per second". This member deals only with the ticks/beat definition.

13.52 seq64::midi_message Class Reference

Provides a handy capsule for a MIDI message, based on the std::vector<unsigned char> data type from the RtMidi project.

Public Types

- typedef std::vector< midibyte > container
  Holds the data of the MIDI message.

Public Member Functions

- midi_message ()
  Constructs an empty MIDI message.
- midibyte operator[ ] (int i) const
- midibyte & at (int i)
- const midibyte & at (int i) const
- const char * array () const
- int count () const
- bool empty () const
- void push (midibyte b)
- double timestamp () const
- void timestamp (double t)

Private Attributes

- container m_bytes
  Holds the event status and data bytes.
- double m_timestamp
  Holds the (optional) timestamp of the MIDI message.

13.52.1 Detailed Description

Please note that the ALSA module in sequencer64's rtmidi infrastructure uses the seq64::event rather than the seq64::midi_message object. For the moment, we will translate between them until we have the interactions between the old and new modules under control.

13.52.2 Member Typedef Documentation

13.52.2.1 container

```
typedef std::vector<midibyte> seq64::midi_message::container
```

Callers should use midi_message::container rather than using the vector directly. Bytes are added by the push() function, and are safely accessed (with bounds-checking) by operator [].

13.52.3 Constructor & Destructor Documentation

13.52.3.1 midi_message()

```
seq64::midi_message::midi_message ( )
```

13.52.4 Member Function Documentation

13.52.4.1 operator[]()

```
midibyte seq64::midi_message::operator[] (
            int i ) const  [inline]
```

13.52.4.2 at() [1/2]

```
midibyte& seq64::midi_message::at (
            int i )  [inline]
```

13.52.4.3 at() [2/2]

```
const midibyte& seq64::midi_message::at (
            int i ) const  [inline]
```

13.52.4.4 array()

```
const char* seq64::midi_message::array ( ) const  [inline]
```

13.52.4.5 count()

```
int seq64::midi_message::count ( ) const  [inline]
```

13.52.4.6 empty()

```
bool seq64::midi_message::empty ( ) const  [inline]
```

13.52.4.7 push()

```
void seq64::midi_message::push (
            midibyte b )  [inline]
```

13.52.4.8 timestamp() [1/2]

```
double seq64::midi_message::timestamp ( ) const  [inline]
```

13.52.4.9 timestamp() [2/2]

```
void seq64::midi_message::timestamp (
            double t )  [inline]
```

13.52.5 Field Documentation

13.52.5.1 m_bytes

```
container seq64::midi_message::m_bytes  [private]
```

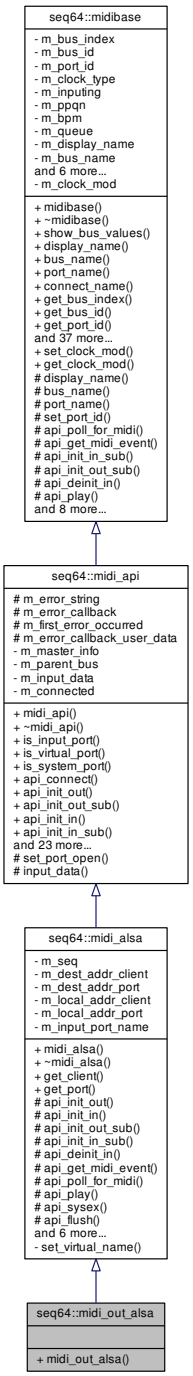
13.52.5.2 m_timestamp

```
double seq64::midi_message::m_timestamp  [private]
```

13.53 seq64::midi_out_alsa Class Reference

This class implements the ALSA version of a MIDI output object.

Inheritance diagram for seq64::midi_out_alsa:



Public Member Functions

- midi_out_alsa (midibus &parentbus, midi_info &masterinfo)

  ALSA MIDI output normal port or virtual port constructor.

Additional Inherited Members

13.53.1 Constructor & Destructor Documentation

13.53.1.1 midi_out_alsa()

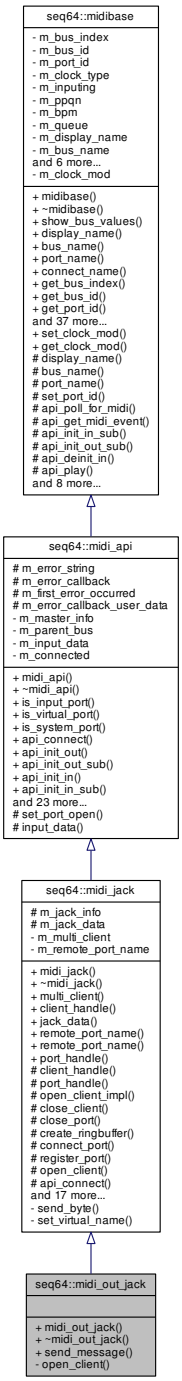
```
seq64::midi_out_alsa::midi_out_alsa (
            midibus & parentbus,
            midi_info & masterinfo )
```

The kind of port is determine by which port-initialization function the mastermidibus calls.

13.54 seq64::midi_out_jack Class Reference

The JACK MIDI output API class.

Inheritance diagram for seq64::midi_out_jack:



Public Member Functions

- midi_out_jack (midibus &parentbus, midi_info &masterinfo)

  Principal constructor.
- virtual ~midi_out_jack ()

  Destructor.
- virtual bool send_message (const midi_message::container &message)

  Sends a JACK MIDI output message.

Private Member Functions

- virtual bool open_client ()

  This function is virtual, so we don't call it in the constructor, using open_client_impl() directly instead.

Additional Inherited Members

13.54.1 Constructor & Destructor Documentation

13.54.1.1 midi_out_jack()

```
seq64::midi_out_jack::midi_out_jack (
            midibus & parentbus,
            midi_info & masterinfo )
```

For Sequencer64, we don't current need to create a midi_out_jack object; all that is needed is created via the api_init_out∗() functions.

Parameters

parentbus	Provides the buss object that determines buss-specific parameters of this class.
masterinfo	Provides information about the JACK system as found on this machine.

13.54.1.2 ∼midi_out_jack()

```
seq64::midi_out_jack::~midi_out_jack ( )  [virtual]
```

Currently the base class closes the port, closes the JACK client, and cleans up the API data structure.

13.54.2 Member Function Documentation

13.54.2.1 send_message()

```
bool seq64::midi_out_jack::send_message (
            const midi_message::container & message )  [virtual]
```

It writes the full message size and the message itself to the JACK ring buffer.

Parameters

message	Provides the vector of message bytes to send.

Returns

Returns true if the buffer message and buffer size seem to be written correctly.

13.54.2.2 open_client()

```
virtual bool seq64::midi_out_jack::open_client ( )  [inline], [private], [virtual]
```

This function replaces the RtMidi function "connect()".

Implements seq64::midi_jack.

13.55 seq64::midi_port_info Class Reference

A class for holding port information.

Data Structures

- struct port_info_t

  Hold the information for a single port.

Public Member Functions

- midi_port_info ()

  Principal constructor.
- void add (int clientnumber, const std::string &clientname, int portnumber, const std::string &portname, bool makevirtual, bool makesystem, bool makeinput, int queuenumber=SEQ64_BAD_QUEUE_ID)

  Adds a set of port information to the port container.
- void add (const midibus *m)

  Adds values from a midibus (actually a midibase-derived class).
- void clear ()

  This function is useful in replacing the discovered system ports with the manual/virtual ports added in "manual" mode.
- int get_port_count () const
- int get_bus_id (int index) const
- std::string get_bus_name (int index) const
- int get_port_id (int index) const
- std::string get_port_name (int index) const
- bool get_input (int index) const
- bool get_virtual (int index) const
- bool get_system (int index) const
- int get_queue_number (int index) const
- std::string connect_name (int index) const

  Provides the bus name and port name in canonical JACK format: "busname:portname".

Private Attributes

- int m_port_count

  Holds the number of ports counted.
- std::vector< port_info_t > m_port_container

  Holds information on all of the ports that were "scanned".

13.55.1 Constructor & Destructor Documentation

13.55.1.1 midi_port_info()

```
seq64::midi_port_info::midi_port_info ( )
```

13.55.2 Member Function Documentation

13.55.2.1 add() [1/2]

```
void seq64::midi_port_info::add (
            int clientnumber,
            const std::string & clientname,
            int portnumber,
            const std::string & portname,
            bool makevirtual,
            bool makesystem,
            bool makeinput,
            int queuenumber = SEQ64_BAD_QUEUE_ID )
```

Parameters

clientnumber	Provides the client or buss number for the port. This is a value like
clientname	Provides the system or user-supplied name for the client or buss.
portnumber	Provides the port number, usually re 0.
portname	Provides the system or user-supplied name for the port.
makevirtual	If the system currently has no input or output port available, then we want to create a virtual port so that the application has something to work with.
makesystem	In some systems, we need to create and activate a system port, such as a timer port or an ALSA announce port. For all other ports, this value is false.
makeinput	Indicates if the port is an input port or an output port.
queuenumber	Provides the optional queue number, if applicable. For example, the sequencer64 application grabs the client number (normally valued at 1) from the ALSA subsystem.

13.55.2.2 add() [2/2]

```
void seq64::midi_port_info::add (
            const midibus * m )
```

13.55.2.3 clear()

```
void seq64::midi_port_info::clear ( )  [inline]
```

13.55.2.4 get_port_count()

```
int seq64::midi_port_info::get_port_count ( ) const  [inline]
```

13.55.2.5 get_bus_id()

```
int seq64::midi_port_info::get_bus_id (
            int index ) const  [inline]
```

13.55.2.6 get_bus_name()

```
std::string seq64::midi_port_info::get_bus_name (
            int index ) const  [inline]
```

13.55.2.7 get_port_id()

```
int seq64::midi_port_info::get_port_id (
            int index ) const  [inline]
```

13.55.2.8 get_port_name()

```
std::string seq64::midi_port_info::get_port_name (
            int index ) const  [inline]
```

13.55.2.9 get_input()

```
bool seq64::midi_port_info::get_input (
            int index ) const  [inline]
```

13.55.2.10 get_virtual()

```
bool seq64::midi_port_info::get_virtual (
            int index ) const  [inline]
```

13.55.2.11 get_system()

```
bool seq64::midi_port_info::get_system (
            int index ) const  [inline]
```

13.55.2.12 get_queue_number()

```
int seq64::midi_port_info::get_queue_number (
            int index ) const  [inline]
```

13.55.2.13 connect_name()

```
std::string seq64::midi_port_info::connect_name (
            int index ) const  [inline]
```

This function is basically the same as midibase::connect_name() function. If either the bus name or port name are empty, then an empty string is returned.

13.55.3 Field Documentation

13.55.3.1 m_port_count

```
int seq64::midi_port_info::m_port_count  [private]
```

13.55.3.2 m_port_container

```
std::vector<port_info_t> seq64::midi_port_info::m_port_container  [private]
```

13.56 seq64::midi_queue Class Reference

Provides a queue of midi_message structures.

Public Member Functions

- midi_queue ()

  Default constructor.
- ~midi_queue ()

  Destructor.
- bool empty () const

  'Getter' function for member m_size == 0
- int count () const

  'Getter' function for member m_size == 0
- bool full () const
- bool add (const midi_message &mmsg)

  As long as we haven't reached our queue size limit, push the message.
- void pop ()

  Pops, so to speak, the front message out of the queue, effectively throwing it away.
- midi_message pop_front ()

  Pops a copy of the front message.
- void allocate (unsigned queuesize=SEQ64_DEFAULT_QUEUE_SIZE)

  This would be better off as a constructor operation.
- void deallocate ()

  This would be better off as a destructor operation.
- const midi_message & front () const

  'Getter' function for member m_ring[m_front]

Private Attributes

- unsigned m_front
- unsigned m_back
- unsigned m_size
- unsigned m_ring_size
- midi_message * m_ring

13.56.1 Detailed Description

This entity used to be a plain structure nested in the midi_in_api class. We made it a class to encapsulate some common operations to save a burden on the callers.

13.56.2 Constructor & Destructor Documentation

13.56.2.1 midi_queue()

```
seq64::midi_queue::midi_queue ( )
```

13.56.2.2 ~midi_queue()

```
seq64::midi_queue::~midi_queue ( )
```

13.56.3 Member Function Documentation

13.56.3.1 empty()

```
bool seq64::midi_queue::empty ( ) const  [inline]
```

13.56.3.2 count()

```
int seq64::midi_queue::count ( ) const  [inline]
```

13.56.3.3 full()

```
bool seq64::midi_queue::full ( ) const  [inline]
```

Returns

Returns true if the queue size is at maximum.

13.56.3.4 add()

```
bool seq64::midi_queue::add (
            const midi_message & mmsg )
```

13.56.3.5 pop()

```
void seq64::midi_queue::pop ( )
```

One useful call sequence is:

```
    midi_message latest = queue.front();
    queue.pop();
```

```
An alternative is to use the pop_front() function instead.
```

13.56.3.6 pop_front()

```
midi_message seq64::midi_queue::pop_front ( )
```

Could be a little inefficient, since a couple of copies are made, and we cannot use return-code optimization.

Perhaps at some point we could use move semantics?

Returns

Returns a copy of the message that was in front before the popping. If the queue is empty, an empty (all zeros) message is returned. Can be checked with the midi_message::empty() function.

13.56.3.7 allocate()

```
void seq64::midi_queue::allocate (
            unsigned queuesize = SEQ64_DEFAULT_QUEUE_SIZE )
```

But one step at a time.

13.56.3.8 deallocate()

```
void seq64::midi_queue::deallocate ( )
```

But one step at a time.

13.56.3.9 front()

```
const midi_message& seq64::midi_queue::front ( ) const  [inline]
```

13.56.4 Field Documentation

13.56.4.1 m_front

```
unsigned seq64::midi_queue::m_front  [private]
```

13.56.4.2 m_back

```
unsigned seq64::midi_queue::m_back  [private]
```

13.56.4.3 m_size

```
unsigned seq64::midi_queue::m_size  [private]
```

13.56.4.4 m_ring_size

```
unsigned seq64::midi_queue::m_ring_size  [private]
```

13.56.4.5 m_ring

```
midi_message* seq64::midi_queue::m_ring  [private]
```

13.57 seq64::midi_splitter Class Reference

This class handles the parsing and writing of MIDI files.

Public Member Functions

- midi_splitter (int ppqn=SEQ64_USE_DEFAULT_PPQN)

  Principal constructor.
- ~midi_splitter ()

  A rote destructor.
- bool log_main_sequence (sequence &seq, int seqnum)

  Logs the main sequence (an SMF 0 track) for later usage in splitting the track.
- void initialize ()

  Resets the SMF 0 support variables in preparation for parsing a new MIDI file.
- void increment (int channel)

  Processes a channel number by raising its flag in the m_smf0_channels[] array.
- bool split (perform &p, int screenset)

  This function splits an SMF 0 file, splitting all of the channels in the sequence out into separate sequences, and adding each to the perform object.
- int ppqn () const

  'Getter' function for member m_ppqn Provides a way to get the actual value of PPQN used in processing the sequences when parse() was called.
- int count () const

  'Getter' function for member m_smf0_channels_count

Private Member Functions

- bool split_channel (const sequence &main_seq, sequence *seq, int channel)

  This function splits the given sequence into new sequences, one for each channel found in the SMF 0 track.

Private Attributes

- int m_ppqn

  Provides the current value of the PPQN, which used to be constant and is now only the macro DEFAULT_PPQN.
- bool m_use_default_ppqn

  Indicates that the default PPQN is in force.
- int m_smf0_channels_count

  Provides support for SMF 0, indicates how many channels were found in the file in a single sequence.
- bool m_smf0_channels [16]

  Provides support for SMF 0, holds a bool value that indicates the occurrence of a given channel.
- sequence * m_smf0_main_sequence

  Provides support for SMF 0, points to the initial SMF 0 sequence, from which the single-channel sequences will be created.
- int m_smf0_seq_number

  Provides support for SMF 0, holds the prospective sequence number of the main (SMF 0) sequence.

13.57.1 Detailed Description

In addition to the standard MIDI tracks, it also handles some "private" or "proprietary" tracks specific to Seq24. It does not, however, handle SYSEX events.

13.57.2 Constructor & Destructor Documentation

13.57.2.1 midi_splitter()

```
seq64::midi_splitter::midi_splitter (
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

Parameters

ppqn	Provides the initial value of the PPQN setting. It is handled differently for parsing (reading) versus writing the MIDI file. • Reading. – If set to SEQ64_USE_DEFAULT_PPQN, the legacy application behavior is used. The m_ppqn member is set to the default PPQN, DEFAULT_PPQN. The value read from the MIDI file, ppqn, is then use to scale the running-time of the sequence relative to DEFAULT_PPQN. – Otherwise, m_ppqn is set to the value read from the MIDI file. No scaling is done. Since the value gets written, specify ppqn as 0, an obviously bogus value, to get this behavior. • Writing. This value is written to the MIDI file in the header chunk of the song. Note that the caller must query for the PPQN set during parsing, and pass it to the constructor when preparing to write the file. See how it is done in the mainwnd class.

13.57.2.2 ~midi_splitter()

```
seq64::midi_splitter::~midi_splitter ( )
```

13.57.3 Member Function Documentation

13.57.3.1 log_main_sequence()

```
bool seq64::midi_splitter::log_main_sequence (
            sequence & seq,
            int seqnum )
```

/param seq The main sequence to be logged.

/param seqnum The sequence number of the main sequence.

/return Returns true if the main sequence's address was logged, and false if it was already logged.

13.57.3.2 initialize()

```
void seq64::midi_splitter::initialize ( )
```

13.57.3.3 increment()

```
void seq64::midi_splitter::increment (
            int channel )
```

If it is the first entry for that channel, m_smf0_channels_count is incremented. We won't check the channel number, to save time, until someday we segfault :-D

Parameters

channel	The MIDI channel number. The caller is responsible to make sure it ranges from 0 to 15.

13.57.3.4 split()

```
bool seq64::midi_splitter::split (
            perform & p,
            int screenset )
```

Lastly, it adds the SMF 0 track as the last track; the user can then examine it before removing it. Is this worth the effort?

There is a little oddity, in that, if the SMF 0 track has events for only one channel, this code will still create a new sequence, as well as the main sequence. Not sure if this is worth extra code to just change the channels on the main sequence and put it into the correct track for the one channel it contains. In fact, we just want to keep it in pattern slot number 16, to keep it out of the way.

Parameters

p	Provides a reference to the perform object into which sequences/tracks are to be added.
screenset	The screen-set offset to be used when loading a sequence (track) from the file.

Returns

Returns true if the parsing succeeded. Returns false if no SMF 0 main sequence was logged.

13.57.3.5 ppqn()

```
int seq64::midi_splitter::ppqn ( ) const  [inline]
```

The PPQN will be either the global ppqn (legacy behavior) or the value read from the file, depending on the ppqn parameter passed to the midi_splitter constructor.

13.57.3.6 count()

```
int seq64::midi_splitter::count ( ) const  [inline]
```

13.57.3.7 split_channel()

```
bool seq64::midi_splitter::split_channel (
            const sequence & main_seq,
            sequence * s,
            int channel )  [private]
```

Note that the events that are read from the MIDI file have delta times. Sequencer64 converts these delta times to cumulative times. We need to preserve that here. Conversion back to delta times is needed only when saving the sequences to a file. This is done in midi_container::fill().

We have to accumulate the delta times in order to be able to set the length of the sequence in pulses.

Luckily, we don't have to worry about copying triggers, since the imported SMF 0 track won't have any Seq24/↩ Sequencer24 triggers.

It doesn't set the sequence number of the sequence; that is set when the sequence is added to the perform object.

Parameters

main_seq	This parameter is the whole SMF 0 track that was read from the MIDI file. It contains all of the channel data that needs to be split into separate sequences.
s	Provides the new sequence that needs to have its settings made, and all of the selected channel events added to it.
channel	Provides the MIDI channel number (re 0) that marks the channel data the needs to be extracted and added to the new sequence.

Returns

Returns true if at least one event got added. If none were added, the caller should delete the sequence object represented by parameter *s*.

13.57.4 Field Documentation

13.57.4.1 m_ppqn

```
int seq64::midi_splitter::m_ppqn  [private]
```

13.57.4.2 m_use_default_ppqn

```
bool seq64::midi_splitter::m_use_default_ppqn  [private]
```

13.57.4.3 m_smf0_channels_count

```
int seq64::midi_splitter::m_smf0_channels_count  [private]
```

SMF 1 file parsing will only warn about more than one channel found in a given sequence.

13.57.4.4 m_smf0_channels

```
bool seq64::midi_splitter::m_smf0_channels[16]  [private]
```

Obviously, we don't have to worry about multiple MIDI busses.

13.57.4.5 m_smf0_main_sequence

```
sequence* seq64::midi_splitter::m_smf0_main_sequence  [private]
```

13.57.4.6 m_smf0_seq_number

```
int seq64::midi_splitter::m_smf0_seq_number  [private]
```

We want to be able to add that sequence last, for easier and cleaner removal of that sequence by the user.

13.58 seq64::midi_timing Class Reference

We anticipate the need to have a small structure holding the parameters needed to calculate MIDI times within an arbitrary song.

Public Member Functions

- midi_timing ()
  Defaults constructor for midi_timing.
- midi_timing (midibpm bpminute, int bpmeasure, int beatwidth, int ppqn)
  Principal constructor for midi_timing.
- midibpm beats_per_minute () const
  'Getter' function for member m_beats_per_minute
- void beats_per_minute (midibpm b)
  'Setter' function for member m_beats_per_minute
- int beats_per_measure () const
  'Getter' function for member m_beats_per_measure
- void beats_per_measure (int b)
  'Setter' function for member m_beats_per_measure
- int beat_width () const
  'Getter' function for member m_beats_per_beat_width
- void beat_width (int bw)
  'Setter' function for member m_beats_per_beat_width
- int ppqn () const
  'Getter' function for member m_ppqn
- void ppqn (int p)
  'Setter' function for member m_ppqn

Private Attributes

- midibpm m_beats_per_minute

  This value should match the BPM value selected when editing the song.
- int m_beats_per_measure

  This value should match the numerator value selected when editing the sequence.
- int m_beat_width

  This value should match the denominator value selected when editing the sequence.
- int m_ppqn

  This value provides the precision of the MIDI song.

13.58.1 Detailed Description

Although Seq24/Sequencer64 currently are heavily dependent on hard-wired values, that will be rectified eventually, so let us get ready for it.

13.58.2 Constructor & Destructor Documentation

13.58.2.1 midi_timing() [1/2]

```
seq64::midi_timing::midi_timing ( )
```

13.58.2.2 midi_timing() [2/2]

```
seq64::midi_timing::midi_timing (
            midibpm bpminute,
            int bpmeasure,
            int beatwidth,
            int ppqn )
```

Parameters

bpminute	Copied into the m_beats_per_minute member.
bpmeasure	Copied into the m_beats_per_measure member.
beatwidth	Copied into the m_beat_width member.
ppqn	Copied into the m_ppqn member.

13.58.3 Member Function Documentation

13.58.3.1 beats_per_minute() [1/2]

```
midibpm seq64::midi_timing::beats_per_minute ( ) const  [inline]
```

13.58.3.2 beats_per_minute() [2/2]

```
void seq64::midi_timing::beats_per_minute (
            midibpm b )  [inline]
```

Parameters

b	The value to which to set the number of beats/minute. We can add validation later.

13.58.3.3 beats_per_measure() [1/2]

```
int seq64::midi_timing::beats_per_measure ( ) const  [inline]
```

13.58.3.4 beats_per_measure() [2/2]

```
void seq64::midi_timing::beats_per_measure (
            int b )  [inline]
```

Parameters

b	The value to which to set the number of beats/measure. We can add validation later.

13.58.3.5 beat_width() [1/2]

```
int seq64::midi_timing::beat_width ( ) const  [inline]
```

13.58.3.6 beat_width() [2/2]

```
void seq64::midi_timing::beat_width (
            int bw )  [inline]
```

Parameters

bw	The value to which to set the number of beats in the denominator of the time signature. We can add validation later.

13.58.3.7 ppqn() [1/2]

```
int seq64::midi_timing::ppqn ( ) const  [inline]
```

13.58.3.8 ppqn() [2/2]

```
void seq64::midi_timing::ppqn (
            int p )  [inline]
```

Parameters

p	The value to which to set the PPQN member. We can add validation later.

13.58.4 Field Documentation

13.58.4.1 m_beats_per_minute

```
midibpm seq64::midi_timing::m_beats_per_minute  [private]
```

This value is most commonly set to 120, but is also read from the MIDI file. This value is needed if one want to calculate durations in true time units such as seconds, but is not needed to calculate the number of pulses/ticks/divisions.

13.58.4.2 m_beats_per_measure

```
int seq64::midi_timing::m_beats_per_measure  [private]
```

This value is most commonly set to 4.

13.58.4.3 m_beat_width

```
int seq64::midi_timing::m_beat_width  [private]
```

This value is most commonly set to 4, meaning that the fundamental beat unit is the quarter note.

13.58.4.4 m_ppqn

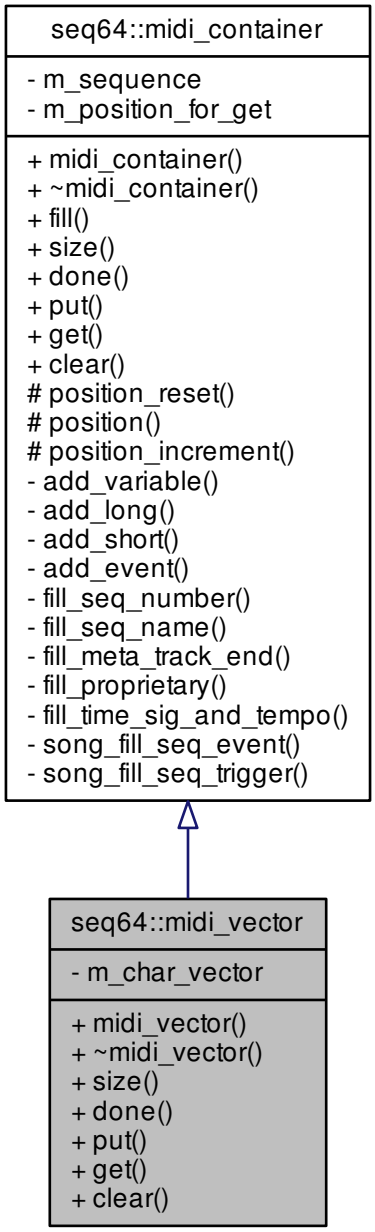
```
int seq64::midi_timing::m_ppqn  [private]
```

This value is most commonly set to 192, but is also read from the MIDI file. We are still working getting "non-standard" values to work.

13.59 seq64::midi_vector Class Reference

This class is the std::vector implementation of the midi_container.

Inheritance diagram for seq64::midi_vector:



Public Member Functions

- midi_vector (sequence &seq)

  This constructor fills in the members of this class.
- virtual ~midi_vector ()

  A rote constructor needed for a base class.
- virtual std::size_t size () const

- virtual bool done () const

  For iterating through the data in the MIDI vector, we are done when we've gotten the last element of the container.
- virtual void put (midibyte b)

  Provides a way to add a MIDI byte into the list.
- virtual midibyte get () const

  Provide a way to get the next byte from the container.
- virtual void clear ()

  Provides a way to clear the container.

Private Types

- typedef std::vector< midibyte > CharVector

  Provides the type of this container.

Private Attributes

- CharVector m_char_vector

  The container itself.

Additional Inherited Members

13.59.1 Member Typedef Documentation

13.59.1.1 CharVector

```
typedef std::vector<midibyte> seq64::midi_vector::CharVector  [private]
```

13.59.2 Constructor & Destructor Documentation

13.59.2.1 midi_vector()

```
seq64::midi_vector::midi_vector (
            sequence & seq )
```

Parameters

seq	Provides a reference to the sequence/track for which this container holds MIDI data.

13.59.2.2 ~midi_vector()

```
virtual seq64::midi_vector::~midi_vector ( )  [inline], [virtual]
```

13.59.3 Member Function Documentation

13.59.3.1 size()

```
virtual std::size_t seq64::midi_vector::size ( ) const  [inline], [virtual]
```

Returns

Returns the size of the container, in midibytes.

Reimplemented from seq64::midi_container.

13.59.3.2 done()

```
virtual bool seq64::midi_vector::done ( ) const  [inline], [virtual]
```

Returns

Returns true if the position is greater than or equal to the size of the character vector.

Reimplemented from seq64::midi_container.

13.59.3.3 put()

```
virtual void seq64::midi_vector::put (
            midibyte b )  [inline], [virtual]
```

The original seq24 list used an std::list and a push_front operation.

Parameters

b	Provides the MIDI byte to push_back() into the character vector.

Implements seq64::midi_container.

13.59.3.4 get()

```
virtual midibyte seq64::midi_vector::get ( ) const  [inline], [virtual]
```

In this implementation, m_position_for_get is used. As a side-effect, the position value is incremented.

Returns

Returns the next byte in the character vector.

Implements seq64::midi_container.

13.59.3.5 clear()

```
virtual void seq64::midi_vector::clear ( )  [inline], [virtual]
```

Implements seq64::midi_container.

13.59.4 Field Documentation

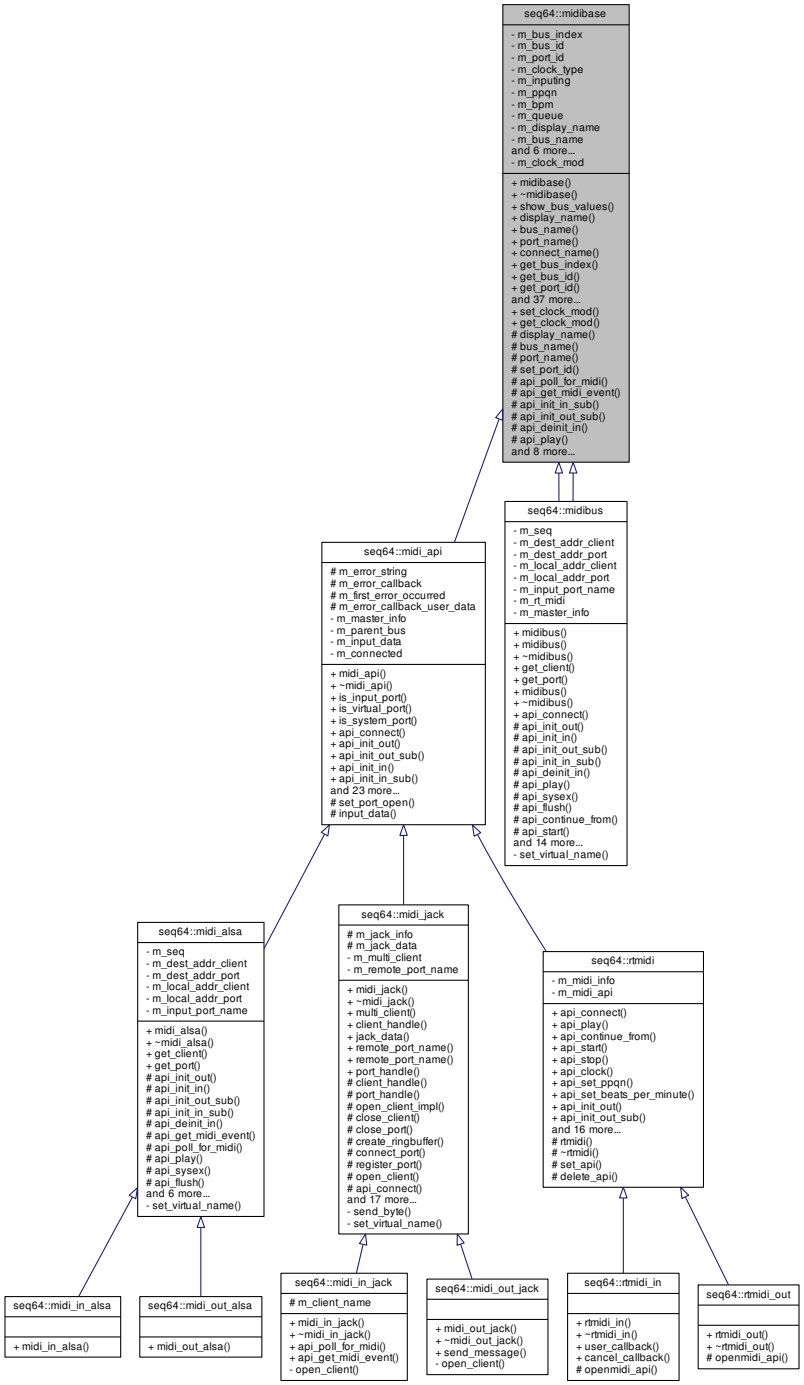
13.59.4.1 m_char_vector

```
CharVector seq64::midi_vector::m_char_vector  [private]
```

13.60 seq64::midibase Class Reference

This class implements with ALSA version of the midibase object.

Inheritance diagram for seq64::midibase:



Public Member Functions

- midibase (const std::string &appname, const std::string &busname="", const std::string &portname="", int index=0, int bus_id=SEQ64_NO_BUS, int port_id=SEQ64_NO_PORT, int queue=SEQ64_NO_QUEUE, int ppqn=SEQ64_USE_DEFAULT_PPQN, midibpm bpm=SEQ64_DEFAULT_BPM, bool makevirtual=false, bool isinput=false, bool makesystem=false)

  Creates a normal MIDI port, which will correspond to an existing system MIDI port, such as one provided by Timidity or a running JACK application, or a virtual port, which has a name made up by the application.

- virtual ~midibase ()

  A rote empty destructor.
- void show_bus_values ()

  Shows most midibase members.
- const std::string & display_name () const

  'Getter' function for member m_display_name
- const std::string & bus_name () const

  'Getter' function for member m_bus_name
- const std::string & port_name () const

  'Getter' function for member m_port_name
- std::string connect_name () const

  'Getter' function for member m_bus_name and m_port_name Concatenates the bus and port names into a string of the form "busname:portname".
- int get_bus_index () const

  'Getter' function for member m_bus_index
- int get_bus_id () const

  'Getter' function for member m_bus_id
- int get_port_id () const

  'Getter' function for member m_port_id
- int ppqn () const

  'Getter' function for member m_ppqn;
- midibpm bpm () const

  'Getter' function for member m_bpm;
- bool match (int bus, int port)

  Checks if the given parameters match the current bus and port numbers.
- bool is_virtual_port () const

  'Getter' function for member m_is_virtual_port
- void is_virtual_port (bool flag)

  'Setter' function for member m_is_virtual_port This function is needed in the rtmidi library to set the is-virtual flag in the api_init_*_sub() functions, so that midi_alsa, midi_jack (and any other additional APIs that end up supported by our heavily-refactored rtmidi library), as well as the original midibus, can know that they represent a virtual port.
- bool is_input_port () const

  'Getter' function for member m_is_input_port
- bool is_output_port () const

  'Getter' function for member ! m_is_input_port
- void is_input_port (bool flag)

  'Setter' function for member m_is_input_port
- bool is_system_port () const

  'Getter' function for member m_is_system_port
- void set_system_port_flag ()

  'Setter' function for member m_is_system_port Can only set it to true.
- void set_clock (clock_e clocktype)

  'Setter' function for member m_clock_type
- clock_e get_clock () const

  'Getter' function for member m_clock_type
- void set_clock_status (clock_e clocktype)

  'Setter' function for member m_clock_type
- bool get_input () const

  'Getter' function for member m_inputing
- void set_input_status (bool flag)

  'Setter' function for member m_inputing

- int queue_number () const

  'Getter' function for member m_queue
- void set_bus_id (int id)

  'Setter' function for member m_bus_id Useful for setting the buss ID when using the rtmidi_info object to create a list of busses and ports.
- void set_name (const std::string &appname, const std::string &busname, const std::string &portname)

  Sets the name of the buss by assembling the name components obtained from the system in a straightforward manner:
- void set_alt_name (const std::string &appname, const std::string &busname, const std::string &portname)

  Sets the name of the buss in a different way.
- void set_multi_name (const std::string &appname, const std::string &localbusname, const std::string &remoteportname)

  Sets the name of the buss in yet another different way, suitable for the multiclient mode of some APIs (such as JACK).
- int poll_for_midi ()

  Polls for MIDI events.
- bool get_midi_event (event *inev)

  Obtains a MIDI event.
- bool init_out ()

  Initialize the MIDI output port.
- bool init_in ()

  Initialize the MIDI input port.
- bool deinit_in ()

  Deinitialize the MIDI input.
- bool init_out_sub ()

  Initialize the output in a different way?
- bool init_in_sub ()

  Initialize the output in a different way?
- void play (event *e24, midibyte channel)

  This play() function takes a native event, encodes it to a MIDI sequencer event, sets the broadcasting to the subscribers, sets the direct-passing mode to send the event without queueing, and puts it in the queue.
- void sysex (event *e24)

  Takes a native SYSEX event, encodes it to an ALSA event, and then puts it in the queue.
- void flush ()

  Flushes our local queue events out into ALSA.
- void start ()

  This function gets the MIDI clock a-runnin', if the clock type is not e_clock_off.
- void stop ()

  Stop the MIDI buss.
- void clock (midipulse tick)

  Generates the MIDI clock, starting at the given tick value.
- void continue_from (midipulse tick)

  Continue from the given tick.
- void init_clock (midipulse tick)

  Initialize the clock, continuing from the given tick.
- void print ()

  Prints m_name.
- bool set_input (bool inputing)

  Set status to of "inputting" to the given value.

Static Public Member Functions

- static void set_clock_mod (int clockmod)

  Set the clock mod to the given value, if legal.
- static int get_clock_mod ()

  Get the clock mod value.

Protected Member Functions

- void display_name (const std::string &name)

  'Setter' function for member m_display_name
- void bus_name (const std::string &name)

  'Setter' function for member m_bus_name
- void port_name (const std::string &name)

  'Setter' function for member m_port_name
- void set_port_id (int id)

  'Setter' function for member m_port_id Useful for setting the port ID when using the rtmidi_info object to inspect and create a list of busses and ports.
- virtual int api_poll_for_midi ()

  Now defined in the ALSA implementation, and used by mastermidibus.
- virtual bool api_get_midi_event (event *inev)

  Used in the JACK implementation.
- virtual bool api_init_in_sub ()

  Not defined in the PortMidi implementation.
- virtual bool api_init_out_sub ()

  Not defined in the PortMidi implementation.
- virtual bool api_deinit_in ()

  Not defined in the PortMidi implementation.
- virtual void api_play (event *e24, midibyte channel)=0
- virtual void api_sysex (event *)

  Handles implementation details for SysEx messages.
- virtual void api_flush ()

  Handles implementation details for the flush() function.
- virtual bool api_init_in ()=0
- virtual bool api_init_out ()=0
- virtual void api_continue_from (midipulse tick, midipulse beats)=0
- virtual void api_start ()=0
- virtual void api_stop ()=0
- virtual void api_clock (midipulse tick)=0

Private Attributes

- const int m_bus_index

  Provides the index of the midibase object in either the input list or the output list.
- int m_bus_id

  The buss ID of the midibase object.
- int m_port_id

  The port ID of the midibase object.
- clock_e m_clock_type

  The type of clock to use.

- bool m_inputing

  This flag indicates if an input bus has been selected for action as an input device (such as a MIDI controller).

- int m_ppqn

  Provides the PPQN value in force, currently a constant.

- midibpm m_bpm

  Provides the PPQN value in force, currently a constant.

- int m_queue

  Another ID of the MIDI queue? This is an implementation-dependent value.

- std::string m_display_name

  Holds the full display name of the bus, index, ID numbers, and item names.

- std::string m_bus_name

  The name of the MIDI buss.

- std::string m_port_name

  The name of the MIDI port.

- midipulse m_lasttick

  The last (most recent? final?) tick.

- bool m_is_virtual_port

  Indicates if the port is to be a virtual port.

- bool m_is_input_port

  Indicates if the port is to be an input (versus output) port.

- bool m_is_system_port

  Indicates if the port is a system port.

- mutex m_mutex

  Locking mutex.

Static Private Attributes

- static int m_clock_mod

  This is another name for "16 ∗ 4".

Friends

- class mastermidibus

  The master MIDI bus sets up the buss.

13.60.1 Constructor & Destructor Documentation

13.60.1.1 midibase()

```
seq64::midibase::midibase (
            const std::string & appname,
            const std::string & busname = "",
            const std::string & portname = "",
            int index = 0,
            int bus_id = SEQ64_NO_BUS,
            int port_id = SEQ64_NO_PORT,
            int queue = SEQ64_NO_QUEUE,
            int ppqn = SEQ64_USE_DEFAULT_PPQN,
            midibpm bpm = SEQ64_DEFAULT_BPM,
            bool makevirtual = false,
            bool isinput = false,
            bool makesystem = false )
```

Provides a constructor with client number, port number, name of client, name of port.

This constructor is the one that seems to be the one that is used for the MIDI input and output busses, when the [manual-alsa-ports] option is *not* in force. Also used for the announce buss, and in the mastermidibase::port_start() function.

Parameters

appname	Provides the the name of the application. The derived class will determine this name.
busname	Provides the ALSA client name or the MIDI subsystem name (e.g. "TiMidity"). If empty, a name will be assembled by the derived class at port-setup time.
portname	Provides the port name. This item defaults to empty, which means the port name should be obtained via the API, or be assembled by the derived class at port-setup time.
index	Provides the ordinal of this buss/port, mostly for display purposes.
bus_id Indicates the port ID. Defaults to SEQ64_NO_PORT. If SEQ64_NO_PORT, the derived class will get the port ID at port-setup time.	
queue Provides the PPQN value. Defaults to SEQ64_USE_DEFAULT_PPQN.	
bpm	Provides the BPM value. Defaults to SEQ64_DEFAULT_BPM.
makevirtual	Indicates that the port represented by this object is to be virtual. Defaults to false. This could also be set via the init_in(), init_out(), init_in_sub(), or init_out_sub() routines. Doing it here seems okay.
isinput	Indicates that this midibus represents and input port, as opposed to an output port.
makesystem	Indicates that the port represented by this object is a system port. Currently true only for ALSA system ports (timer or announce ports).

13.60.1.2 ~midibase()

```
seq64::midibase::~midibase ( )  [virtual]
```

13.60.2 Member Function Documentation

13.60.2.1 show_bus_values()

```
void seq64::midibase::show_bus_values ( )
```

13.60.2.2 display_name() [1/2]

```
const std::string& seq64::midibase::display_name ( ) const  [inline]
```

13.60.2.3 bus_name() [1/2]

```
const std::string& seq64::midibase::bus_name ( ) const  [inline]
```

13.60.2.4 port_name() [1/2]

```
const std::string& seq64::midibase::port_name ( ) const  [inline]
```

13.60.2.5 connect_name()

```
std::string seq64::midibase::connect_name ( ) const
```

If either name is empty, an empty string is returned.

13.60.2.6 get_bus_index()

```
int seq64::midibase::get_bus_index ( ) const  [inline]
```

13.60.2.7 get_bus_id()

```
int seq64::midibase::get_bus_id ( ) const  [inline]
```

13.60.2.8 get_port_id()

```
int seq64::midibase::get_port_id ( ) const  [inline]
```

13.60.2.9 ppqn()

```
int seq64::midibase::ppqn ( ) const  [inline]
```

13.60.2.10 bpm()

```
midibpm seq64::midibase::bpm ( ) const  [inline]
```

13.60.2.11 match()

```
bool seq64::midibase::match (
            int bus,
            int port )  [inline]
```

13.60.2.12 is_virtual_port() [1/2]

```
bool seq64::midibase::is_virtual_port ( ) const  [inline]
```

13.60.2.13 is_virtual_port() [2/2]

```
void seq64::midibase::is_virtual_port (
            bool flag )  [inline]
```

13.60.2.14 is_input_port() [1/2]

```
bool seq64::midibase::is_input_port ( ) const  [inline]
```

13.60.2.15 is_output_port()

```
bool seq64::midibase::is_output_port ( ) const  [inline]
```

13.60.2.16 is_input_port() [2/2]

```
void seq64::midibase::is_input_port (
            bool flag )  [inline]
```

13.60.2.17 is_system_port()

```
bool seq64::midibase::is_system_port ( ) const  [inline]
```

13.60.2.18 set_system_port_flag()

```
void seq64::midibase::set_system_port_flag ( )  [inline]
```

13.60.2.19 set_clock()

```
void seq64::midibase::set_clock (
            clock_e clocktype )  [inline]
```

Parameters

clocktype	The value used to set the clock-type.

13.60.2.20 get_clock()

```
clock_e seq64::midibase::get_clock ( ) const  [inline]
```

13.60.2.21 set_clock_status()

```
void seq64::midibase::set_clock_status (
            clock_e clocktype )  [inline]
```

13.60.2.22 get_input()

```
bool seq64::midibase::get_input ( ) const  [inline]
```

13.60.2.23 set_input_status()

```
void seq64::midibase::set_input_status (
            bool flag )  [inline]
```

13.60.2.24 queue_number()

```
int seq64::midibase::queue_number ( ) const  [inline]
```

13.60.2.25 set_bus_id()

```
void seq64::midibase::set_bus_id (
            int id )  [inline]
```

Would be protected, but midi_alsa needs to change this value to reflect the user-client ID actually assigned by ALSA. (That value ranges from 128 to 191.)

13.60.2.26 set_name()

```
void seq64::midibase::set_name (
            const std::string & appname,
            const std::string & busname,
            const std::string & portname )
```

[0] 128:2 seq64:seq64 port 2

Parameters

appname	This is the name of the client, or application. Not to be confused with the ALSA client-name, which is actually a buss or subsystem name.
busname	Provides the name of the sub-system, such as "Midi Through" or "TiMidity".
portname	Provides the name of the port. In ALSA, this is something like "busname port X".

13.60.2.27 set_alt_name()

```
void seq64::midibase::set_alt_name (
            const std::string & appname,
            const std::string & busname,
            const std::string & portname )
```

If the port is virtual, this function just calls set_name(). Otherwise, it reassembles the name so that it refers to a port found on the system, but modified to make it a unique application port. For example:

```
[0] 128:0 yoshimi:midi in
```

is transformed to this:

```
[0] 128:0 seq64:yoshimi midi in
```

As a side-effect, the "short" portname is changed, from (for example) "midi in" to "yoshimi midi in".

Parameters

appname	This is the name of the client, or application. Not to be confused with the ALSA/JACK client-name, which is actually a buss or subsystem name.
busname	Provides the name of the sub-system, such as "Midi Through", "TiMidity", or "seq64".
portname	Provides the name of the port. In JACK, this should be the full port name, such as "qmidiarp:in".

13.60.2.28 set_multi_name()

```
void seq64::midibase::set_multi_name (
            const std::string & appname,
            const std::string & localbusname,
            const std::string & remoteportname )
```

If the port is virtual, this function just calls set_name(). Otherwise, it reassembles the name so that it refers to a port found on the system, but modified to make it a unique client port. For example:

```
[0] 128:0 yoshimi:midi in
```

is transformed to this:

```
[0] 128:0 seq64-yoshimi:midi in
```

The name in the latter is the original buss name, "seq64" plus the remote port's buss name (extracted from the long name), plus the remote port's short port name (extracted from the long name).

Internal parameter:

Parameters

appname	This is the name of the client, or application. Not to be confused with the ALSA client-name, which is actually a buss or subsystem name.
localbusname	Provides the name of the sub-system, such as "Midi Through", "TiMidity", "yoshimi", or "seq64". It is assumed this parameter has already been set properly.
remoteportname	Provides the name of the port. In JACK, this should be the long port name, such as "qmidiarp:in" or "yoshimi:midi in". It is assumed this parameter has already been set properly.

13.60.2.29 set_clock_mod()

```
static void seq64::midibase::set_clock_mod (
            int clockmod )  [inline], [static]
```

Parameters

clockmod	If this value is not equal to 0, it is used to set the static member m_clock_mod.

13.60.2.30 get_clock_mod()

```
static int seq64::midibase::get_clock_mod ( )  [inline], [static]
```

13.60.2.31 poll_for_midi()

```
int seq64::midibase::poll_for_midi ( )
```

Returns

Returns a value greater than 0 if MIDI events are available. Otherwise 0 is returned, or -1 for some APIs (ALSA) when an internal error occurs.

13.60.2.32 get_midi_event()

```
bool seq64::midibase::get_midi_event (
            event * inev )
```

Parameters

inev	Points the event to be filled with the MIDI event data.

Returns

Returns true if an event was found, thus making the return parameter useful.

13.60.2.33 init_out()

```
bool seq64::midibase::init_out ( )
```

Returns

Returns true unless setting up MIDI failed in some way.

13.60.2.34 init_in()

```
bool seq64::midibase::init_in ( )
```

Returns

Returns true unless setting up MIDI failed in some way.

13.60.2.35 deinit_in()

```
bool seq64::midibase::deinit_in ( )
```

Set the input and the output ports. The destination port is actually our local port.

Returns

Returns true, unless an error occurs.

13.60.2.36 init_out_sub()

```
bool seq64::midibase::init_out_sub ( )
```

Returns

Returns true unless setting up the ALSA port failed in some way.

13.60.2.37 init_in_sub()

```
bool seq64::midibase::init_in_sub ( )
```

Returns

Returns true unless setting up the ALSA port failed in some way.

13.60.2.38 play()

```
void seq64::midibase::play (
            event * e24,
            midibyte channel )
```

Threadsafe

Parameters

e24	The event to be played on this bus. For speed, we don't bother to check the pointer.
channel	The channel of the playback.

13.60.2.39 sysex()

```
void seq64::midibase::sysex (
            event * e24 )
```

Parameters

e24	The event to be handled.

13.60.2.40 flush()

```
void seq64::midibase::flush ( )
```

13.60.2.41 start()

```
void seq64::midibase::start ( )
```

13.60.2.42 stop()

```
void seq64::midibase::stop ( )
```

13.60.2.43 clock()

```
void seq64::midibase::clock (
            midipulse tick )
```

Threadsafe

Parameters

tick	Provides the starting tick.

13.60.2.44 continue_from()

```
void seq64::midibase::continue_from (
            midipulse tick )
```

Tell the device that we are going to start at a certain position (starting_tick). If there is anything left, then wait for next beat (16th note) to start clocking.

Parameters

tick	The continuing tick.

13.60.2.45 init_clock()

```
void seq64::midibase::init_clock (
            midipulse tick )
```

This function doesn't depend upon the MIDI API in use.

Parameters

tick	The starting tick.

13.60.2.46 print()

```
void seq64::midibase::print ( )
```

13.60.2.47 set_input()

```
bool seq64::midibase::set_input (
            bool inputing )
```

If the parameter is true, then init_in() is called; otherwise, deinit_in() is called.

Parameters

inputing	The inputing value to set. For input system ports, it is always set to true, no matter how it is configured in the "rc" file.

13.60.2.48 display_name() [2/2]

```
void seq64::midibase::display_name (
            const std::string & name )  [inline], [protected]
```

13.60.2.49 bus_name() [2/2]

```
void seq64::midibase::bus_name (
            const std::string & name )  [inline], [protected]
```

13.60.2.50 port_name() [2/2]

```
void seq64::midibase::port_name (
            const std::string & name )  [inline], [protected]
```

13.60.2.51 set_port_id()

```
void seq64::midibase::set_port_id (
            int id )  [inline], [protected]
```

13.60.2.52 api_poll_for_midi()

```
virtual int seq64::midibase::api_poll_for_midi ( )  [inline], [protected], [virtual]
```

Also used in the JACK implementation.

Reimplemented in seq64::midi_in_jack, seq64::midi_jack, seq64::midi_alsa, seq64::rtmidi, seq64::midi_api, and seq64::midibus.

13.60.2.53 api_get_midi_event()

```
virtual bool seq64::midibase::api_get_midi_event (
            event * inev )  [inline], [protected], [virtual]
```

Reimplemented in seq64::midi_in_jack, seq64::midi_jack, seq64::midi_alsa, seq64::midi_api, seq64::rtmidi, and seq64::midibus.

13.60.2.54 api_init_in_sub()

```
virtual bool seq64::midibase::api_init_in_sub ( )  [inline], [protected], [virtual]
```

Reimplemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::midi_api, seq64::rtmidi, and seq64::midibus.

13.60.2.55 api_init_out_sub()

```
virtual bool seq64::midibase::api_init_out_sub ( )  [inline], [protected], [virtual]
```

Reimplemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::midi_api, seq64::rtmidi, and seq64::midibus.

13.60.2.56 api_deinit_in()

```
virtual bool seq64::midibase::api_deinit_in ( )  [inline], [protected], [virtual]
```

Reimplemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::midi_api, seq64::rtmidi, and seq64::midibus.

13.60.2.57 api_play()

```
virtual void seq64::midibase::api_play (
            event * e24,
            midibyte channel )  [protected], [pure virtual]
```

Implemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::midi_api, seq64::midibus, and seq64::rtmidi.

13.60.2.58 api_sysex()

```
virtual void seq64::midibase::api_sysex (
            event *  )  [inline], [protected], [virtual]
```

The *e24* parameter, the SysEx event pointer, is unused here.

Reimplemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::rtmidi, and seq64::midi_api.

13.60.2.59 api_flush()

```
virtual void seq64::midibase::api_flush ( )  [inline], [protected], [virtual]
```

Reimplemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::rtmidi, and seq64::midi_api.

13.60.2.60 api_init_in()

```
virtual bool seq64::midibase::api_init_in ( )  [protected], [pure virtual]
```

Implemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::midi_api, seq64::rtmidi, and seq64::midibus.

13.60.2.61 api_init_out()

```
virtual bool seq64::midibase::api_init_out ( )  [protected], [pure virtual]
```

Implemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::midi_api, seq64::rtmidi, and seq64::midibus.

13.60.2.62 api_continue_from()

```
virtual void seq64::midibase::api_continue_from (
            midipulse tick,
            midipulse beats )  [protected], [pure virtual]
```

Implemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::midi_api, seq64::midibus, and seq64::rtmidi.

13.60.2.63 api_start()

```
virtual void seq64::midibase::api_start ( )  [protected], [pure virtual]
```

Implemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::midi_api, seq64::midibus, and seq64::rtmidi.

13.60.2.64 api_stop()

```
virtual void seq64::midibase::api_stop ( )  [protected], [pure virtual]
```

Implemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::midi_api, seq64::midibus, and seq64::rtmidi.

13.60.2.65 api_clock()

```
virtual void seq64::midibase::api_clock (
            midipulse tick )  [protected], [pure virtual]
```

Implemented in seq64::midi_jack, seq64::midibus, seq64::midi_alsa, seq64::midi_api, seq64::midibus, and seq64::rtmidi.

13.60.3 Friends And Related Function Documentation

13.60.3.1 mastermidibus

```
friend class mastermidibus  [friend]
```

13.60.4 Field Documentation

13.60.4.1 m_clock_mod

```
int seq64::midibase::m_clock_mod  [static], [private]
```

Initialize this static member.

13.60.4.2 m_bus_index

```
const int seq64::midibase::m_bus_index  [private]
```

Otherwise, it is currently -1.

13.60.4.3 m_bus_id

```
int seq64::midibase::m_bus_id  [private]
```

For example, on one system the IDs are 14 (MIDI Through), 128 (TiMidity), and 129 (Yoshimi).

13.60.4.4 m_port_id

```
int seq64::midibase::m_port_id  [private]
```

13.60.4.5 m_clock_type

```
clock_e seq64::midibase::m_clock_type  [private]
```

13.60.4.6 m_inputing

```
bool seq64::midibase::m_inputing  [private]
```

It is turned on if the user selects the port in the Options / MIDI Input tab.

13.60.4.7 m_ppqn

```
int seq64::midibase::m_ppqn  [private]
```

Some APIs can control or use this value.

13.60.4.8 m_bpm

```
midibpm seq64::midibase::m_bpm  [private]
```

Some APIs can control or use this value.

13.60.4.9 m_queue

```
int seq64::midibase::m_queue  [private]
```

For ALSA, it is the ALSA queue number. For PortMidi, this is the old "m_pm_num" value. For RtMidi, it is not currently used.

13.60.4.10 m_display_name

```
std::string seq64::midibase::m_display_name  [private]
```

Assembled by the set_name() function.

13.60.4.11 m_bus_name

```
std::string seq64::midibase::m_bus_name  [private]
```

This should be something like a major device name or the name of a subsystem such as Timidity.

13.60.4.12 m_port_name

```
std::string seq64::midibase::m_port_name  [private]
```

This should be the name of a specific device or port on a major device.

13.60.4.13 m_lasttick

```
midipulse seq64::midibase::m_lasttick  [private]
```

13.60.4.14 m_is_virtual_port

```
bool seq64::midibase::m_is_virtual_port  [private]
```

The default is to create a system port (true).

13.60.4.15 m_is_input_port

```
bool seq64::midibase::m_is_input_port  [private]
```

It matters when we are creating the name of the port, where we don't want an input virtual port to have the same name as an output virtual port... one of them will fail.

13.60.4.16 m_is_system_port

```
bool seq64::midibase::m_is_system_port  [private]
```

Two examples are the ALSA System Timer buss and the ALSA System Announce bus, the latter being necessary for input subscription and notification. For most ports, this value will be false. A restricted setter is provided. Only the rtmidi ALSA implementation sets this flag.

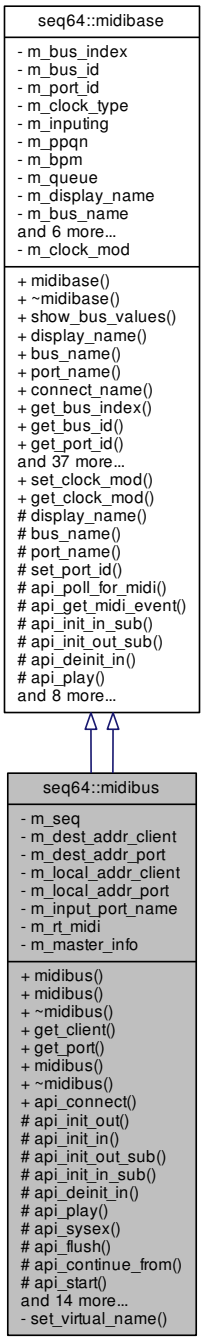
13.60.4.17 m_mutex

```
mutex seq64::midibase::m_mutex  [private]
```

13.61 seq64::midibus Class Reference

This class implements with ALSA version of the midibus object.

Inheritance diagram for seq64::midibus:



Public Member Functions

- midibus (int localclient, int destclient, int destport, snd_seq_t *seq, const std::string &client_name, const std::string &port_name, int index, int queue, int ppqn=SEQ64_USE_DEFAULT_PPQN, midibpm bpm=SE↩ Q64_DEFAULT_BPM)
- midibus (int localclient, snd_seq_t *seq, int index, int bus_id, int queue, int ppqn=SEQ64_USE_DEFAULT↩ _PPQN, midibpm bpm=SEQ64_DEFAULT_BPM)

- virtual ~midibus ()

  The destructor closes out the RtMidi MIDI infrastructure.
- virtual int get_client () const

  'Getter' function for member m_dest_addr_client The address of client.
- virtual int get_port () const

  'Getter' function for member m_dest_addr_port
- midibus (rtmidi_info &rt, int index, bool makevirtual=SEQ64_MIDI_NORMAL_PORT, bool isinput=SEQ64_↩ MIDI_OUTPUT_PORT, int bussoverride=SEQ64_NO_BUS, bool makesystem=false)

  Normal-port and virtual-port constructor.
- virtual ~midibus ()
- virtual bool api_connect ()

  Connects to another port.

Protected Member Functions

- virtual bool api_init_out ()

  Initializes the MIDI output port.
- virtual bool api_init_in ()

  Initializes the MIDI input port.
- virtual bool api_init_out_sub ()

  Initializes the MIDI virtual output port.
- virtual bool api_init_in_sub ()

  Initializes the MIDI virtual input port.
- virtual bool api_deinit_in ()

  Forwards the de-initialization call to the API object that implements it.
- virtual void api_play (event *e24, midibyte channel)

  Takes a native event, and encodes to a Windows message, and writes it to the queue.
- virtual void api_sysex (event *e24)
- virtual void api_flush ()
- virtual void api_continue_from (midipulse tick, midipulse beats)

  Continue from the given tick.
- virtual void api_start ()

  Sets the MIDI clock a-runnin', if the clock type is not e_clock_off.
- virtual void api_stop ()

  Stops the MIDI clock, if the clock-type is not e_clock_off.
- virtual void api_clock (midipulse tick)

  Generates MIDI clock.
- virtual bool api_init_in ()
- virtual bool api_init_in_sub ()
- virtual bool api_init_out ()
- virtual bool api_init_out_sub ()
- virtual bool api_deinit_in ()
- virtual bool api_get_midi_event (event *inev)

  Gets a MIDI event.
- virtual int api_poll_for_midi ()

  Polls for MIDI events.
- virtual void api_continue_from (midipulse tick, midipulse beats)
- virtual void api_start ()
- virtual void api_stop ()
- virtual void api_clock (midipulse tick)
- virtual void api_play (event *e24, midibyte channel)

Private Member Functions

- bool set_virtual_name (int portid, const std::string &portname)

Private Attributes

- snd_seq_t *const m_seq
  ALSA sequencer client handle.
- const int m_dest_addr_client
  Destination address of client.
- const int m_dest_addr_port
  Destination port of client.
- const int m_local_addr_client
  Local address of client.
- int m_local_addr_port
  Local port of client.
- const std::string m_input_port_name
  Holds the port name for the ALSA MIDI input port.
- rtmidi * m_rt_midi
  The RtMidi API interface object this midibus will be creating and then using.
- rtmidi_info & m_master_info
  For Sequencer64, the ALSA model used requires that all the midibus objects use the same ASLA sequencer "handle".

Friends

- class mastermidibus
  The master MIDI bus sets up the buss.

Additional Inherited Members

13.61.1 Detailed Description

This class implements with rtmidi version of the midibus object.

13.61.2 Constructor & Destructor Documentation

13.61.2.1 midibus() [1/3]

```
seq64::midibus::midibus (
            int localclient,
            int destclient,
            int destport,
            snd_seq_t * seq,
            const std::string & client_name,
            const std::string & port_name,
            int index,
            int queue,
            int ppqn = SEQ64_USE_DEFAULT_PPQN,
            midibpm bpm = SEQ64_DEFAULT_BPM )
```

13.61.2.2 midibus() [2/3]

```
seq64::midibus::midibus (
            int localclient,
            snd_seq_t * seq,
            int index,
            int bus_id,
            int queue,
            int ppqn = SEQ64_USE_DEFAULT_PPQN,
            midibpm bpm = SEQ64_DEFAULT_BPM )
```

13.61.2.3 ~midibus() [1/2]

```
seq64::midibus::~midibus ( )  [virtual]
```

13.61.2.4 midibus() [3/3]

```
seq64::midibus::midibus (
            rtmidi_info & rt,
            int index,
            bool makevirtual = SEQ64_MIDI_NORMAL_PORT,
            bool isinput = SEQ64_MIDI_OUTPUT_PORT,
            int bussoverride = SEQ64_NO_BUS,
            bool makesystem = false )
```

Parameters

rt	Provides the rtmidi_info object to use to obtain the client ID (buss ID), port ID, and port name, as obtained via calls to the ALSA, JACK, Core MIDI, or Windows MM subsystems. We need it to provide the single ALSA "handle" needed in the in Sequencer64 buss model, where the master MIDI buss provides it to be used by all the MIDI buss objects.
index	This is the index into the rtmidi object, and is used to get the desired client and port information. It is an index into the info container held by the rtmidi object.
makevirtual	Indicates that the port is virtual, as opposed to normal.
isinput	Indicates that the port is an input port, as opposed to an output port.
bussoverride	Optional buss ID, if not equal to the index parameter.
makesystem	Indicates that the port is also a system port (i.e. always present).

13.61.2.5 ~midibus() [2/2]

```
virtual seq64::midibus::~midibus ( )  [virtual]
```

13.61.3 Member Function Documentation

13.61.3.1 get_client()

```
virtual int seq64::midibus::get_client ( ) const  [inline], [virtual]
```

13.61.3.2 get_port()

```
virtual int seq64::midibus::get_port ( ) const  [inline], [virtual]
```

13.61.3.3 api_init_out() [1/2]

```
bool seq64::midibus::api_init_out ( )  [protected], [virtual]
```

Currently, we use the default values for the rtmidi API, the queue number, and the queue size.

Returns

Returns true if the output port was successfully opened.

Implements seq64::midibase.

13.61.3.4 api_init_in() [1/2]

```
bool seq64::midibus::api_init_in ( )  [protected], [virtual]
```

Returns

Returns true if the input port was successfully opened.

Implements seq64::midibase.

13.61.3.5 api_init_out_sub() [1/2]

```
bool seq64::midibus::api_init_out_sub ( )  [protected], [virtual]
```

Returns

Returns true if the output port was successfully opened.

Reimplemented from seq64::midibase.

13.61.3.6 api_init_in_sub() [1/2]

```
bool seq64::midibus::api_init_in_sub ( )  [protected], [virtual]
```

Returns

Returns true if the input port was successfully opened.

Reimplemented from seq64::midibase.

13.61.3.7 api_deinit_in() [1/2]

```
bool seq64::midibus::api_deinit_in ( )  [protected], [virtual]
```

We don't bother checking the m_rt_midi pointer. If it is null, it is the programmer's fault.

Returns

Returns the result of the m_rt_midi->api_deinit_in() call.

Reimplemented from seq64::midibase.

13.61.3.8 api_play() [1/2]

```
void seq64::midibus::api_play (
            event * e24,
            midibyte channel )  [protected], [virtual]
```

It fills a small byte buffer, sets the MIDI channel, make a message of it, and writes the message.

Again, DO WE NEED to distinguish between input and output here?

Note that we're doing a double-forwarding here, which may lower throughput.

Parameters

e24	The MIDI event to play.
channel	The channel on which to play the event.

Implements seq64::midibase.

13.61.3.9 api_sysex()

```
virtual void seq64::midibus::api_sysex (
            event * e24 )  [protected], [virtual]
```

Reimplemented from seq64::midibase.

13.61.3.10 api_flush()

```
virtual void seq64::midibus::api_flush ( )  [protected], [virtual]
```

Reimplemented from seq64::midibase.

13.61.3.11 api_continue_from() [1/2]

```
void seq64::midibus::api_continue_from (
            midipulse tick,
            midipulse beats )  [protected], [virtual]
```

This function implements only the RtMidi-specific code.

Note that, unlike in PortMidi, here we do not deal with zeroing the event timestamp.

Parameters

tick	The tick to continue from; unused in the RtMidi API implementation.
beats	The calculated beats. This calculation is made in the midibase::continue_from() function.

Implements seq64::midibase.

13.61.3.12 api_start() [1/2]

```
void seq64::midibus::api_start ( )  [protected], [virtual]
```

This function is called by midibase::start(). No timestamp handling.

Implements seq64::midibase.

13.61.3.13 api_stop() [1/2]

```
void seq64::midibus::api_stop ( )  [protected], [virtual]
```

This function is called by midibase::stop(). No timestamp handling.

Implements seq64::midibase.

13.61.3.14 api_clock() [1/2]

```
void seq64::midibus::api_clock (
            midipulse tick )  [protected], [virtual]
```

This function is called by midibase::clock(). No timestamp handling.

Parameters

tick	The clock tick value, not used in the API implementation of this function for RtMidi.

Implements seq64::midibase.

13.61.3.15 set_virtual_name()

```
bool seq64::midibus::set_virtual_name (
            int portid,
            const std::string & portname )  [private]
```

13.61.3.16 api_connect()

```
bool seq64::midibus::api_connect ( )  [virtual]
```

If the port is an input port, but is not configured (by the user or the "rc" configuration file), then it is not connected, and this is not an error. Output ports are always connected.

Note that the api_connect() function will errprint is own errors. But if we expected to be able to connect, and have a null rt_midi pointer, then this is a reported error.

Returns

Returns true if the connection was made succuessfully, or there was no need to make the connection.

13.61.3.17 api_init_in() [2/2]

```
virtual bool seq64::midibus::api_init_in ( )  [protected], [virtual]
```

Implements seq64::midibase.

13.61.3.18 api_init_in_sub() [2/2]

```
virtual bool seq64::midibus::api_init_in_sub ( )  [protected], [virtual]
```

Reimplemented from seq64::midibase.

13.61.3.19 api_init_out() [2/2]

```
virtual bool seq64::midibus::api_init_out ( )  [protected], [virtual]
```

Implements seq64::midibase.

13.61.3.20 api_init_out_sub() [2/2]

```
virtual bool seq64::midibus::api_init_out_sub ( )  [protected], [virtual]
```

Reimplemented from seq64::midibase.

13.61.3.21 api_deinit_in() [2/2]

```
virtual bool seq64::midibus::api_deinit_in ( )  [protected], [virtual]
```

Reimplemented from seq64::midibase.

13.61.3.22 api_get_midi_event()

```
bool seq64::midibus::api_get_midi_event (
            event * inev )  [protected], [virtual]
```

Parameters

inev	The location to deposit the MIDI event data.

Returns

Returns true if a MIDI event was obtained.

Reimplemented from seq64::midibase.

13.61.3.23 api_poll_for_midi()

```
int seq64::midibus::api_poll_for_midi ( )  [protected], [virtual]
```

This is the API implementation for RtMidi.

This should work only for input busses, so we need to insure this at some point. Currently, this is the domain of the master bus. We also should make this routine just check the input queue size and then read the queue. Note that the ALSA handle checks incoming MIDI events and either passes them to the callback function or pushes them onto the input queue.

Returns

Returns 0 if the polling succeeded, and 1 if it failed. If the buss hasn't been initialized, it has a null m_rt_midi pointer, and will return 0. This can happen normally when a MIDI input port is configured to be disabled.

Reimplemented from seq64::midibase.

13.61.3.24 api_continue_from() [2/2]

```
virtual void seq64::midibus::api_continue_from (
            midipulse tick,
            midipulse beats )  [protected], [virtual]
```

Implements seq64::midibase.

13.61.3.25 api_start() [2/2]

```
virtual void seq64::midibus::api_start ( )  [protected], [virtual]
```

Implements seq64::midibase.

13.61.3.26 api_stop() [2/2]

```
virtual void seq64::midibus::api_stop ( )  [protected], [virtual]
```

Implements seq64::midibase.

13.61.3.27 api_clock() [2/2]

```
virtual void seq64::midibus::api_clock (
            midipulse tick )  [protected], [virtual]
```

Implements seq64::midibase.

13.61.3.28 api_play() [2/2]

```
virtual void seq64::midibus::api_play (
            event * e24,
            midibyte channel )  [protected], [virtual]
```

Implements seq64::midibase.

13.61.4 Friends And Related Function Documentation

13.61.4.1 mastermidibus

```
mastermidibus  [friend]
```

The master MIDI bus sets up the buss, so it gets access to private details.

13.61.5 Field Documentation

13.61.5.1 m_seq

```
snd_seq_t* const seq64::midibus::m_seq  [private]
```

13.61.5.2 m_dest_addr_client

```
const int seq64::midibus::m_dest_addr_client  [private]
```

Could potentially be replaced by midibase::m_bus_id.

13.61.5.3 m_dest_addr_port

```
const int seq64::midibus::m_dest_addr_port  [private]
```

Could potentially be replaced by midibase::m_port_id.

13.61.5.4 m_local_addr_client

```
const int seq64::midibus::m_local_addr_client  [private]
```

13.61.5.5 m_local_addr_port

```
int seq64::midibus::m_local_addr_port  [private]
```

13.61.5.6 m_input_port_name

```
const std::string seq64::midibus::m_input_port_name  [private]
```

It is derived from the (optionally configured) official client name for the application with the word "in" appended.

13.61.5.7 m_rt_midi

```
rtmidi* seq64::midibus::m_rt_midi  [private]
```

13.61.5.8 m_master_info

```
rtmidi_info& seq64::midibus::m_master_info  [private]
```

The rtmidi_info object used for enumerating the ports is a good place to get this handle. It is an extension of the legacy RtMidi interface.

13.62 seq64::midifile Class Reference

This class handles the parsing and writing of MIDI files.

Public Member Functions

- midifile (const std::string &name, int ppqn=SEQ64_USE_DEFAULT_PPQN, bool oldformat=false, bool globalbgs=true)

  Principal constructor.
- ~midifile ()

  A rote destructor.
- bool parse (perform &p, int a_screen_set=0)

  This function opens a binary MIDI file and parses it into sequences and other application objects.
- bool write (perform &p)

  Write the whole MIDI data and Seq24 information out to the file.
- bool write_song (perform &p)
- const std::string & error_message () const

  'Getter' function for member m_error_message
- bool error_is_fatal () const

  'Getter' function for member m_error_is_fatal
- int ppqn () const

  'Getter' function for member m_ppqn Provides a way to get the actual value of PPQN used in processing the sequences when parse() was called.

Private Member Functions

- bool parse_smf_0 (perform &p, int screenset)

  This function parses an SMF 0 binary MIDI file as if it were an SMF 1 file, then, if more than one MIDI channel was encountered in the sequence, splits all of the channels in the sequence out into separate sequences.
- bool parse_smf_1 (perform &p, int screenset, bool is_smf0=false)

  This function parses an SMF 1 binary MIDI file; it is basically the original seq24 midifile::parse() function.
- midilong parse_prop_header (int file_size)

  Parse the proprietary header, figuring out if it is the new format, or the legacy format, for sequencer-specific data.
- bool parse_proprietary_track (perform &a_perf, int file_size)

  After all of the conventional MIDI tracks are read, we're now at the "proprietary" Seq24 data section, which describes the various features that Seq24 supports.
- int pow2 (int logbase2)

  Internal function for simple calculation of a power of 2 without a lot of math.
- bool checklen (midilong len, midibyte type)

  Internal function to check for and report a bad length value.
- void add_trigger (sequence &seq, midishort ppqn)

  Internal function to make the parser easier to read.
- midilong read_long ()

  Reads 4 bytes of data using read_byte().
- midishort read_short ()

  Reads 2 bytes of data using read_byte().
- midibyte read_byte ()

  Reads 1 byte of data directly from the m_data vector, incrementing m_pos after doing so.
- midilong read_varinum ()

  Read a MIDI Variable-Length Value (VLV), which has a variable number of bytes.
- void write_long (midilong value)

  Writes 4 bytes, each extracted from the long value and shifted rightward down to byte size, using the write_byte() function.
- void write_short (midishort value)

Writes 2 bytes, each extracted from the long value and shifted rightward down to byte size, using the write_byte() function.

- void read_byte_array (midibyte *b, int len)

  A helper function to simplify reading midi_control data from the MIDI file.

- void write_byte (midibyte c)

  Writes 1 byte.

- void write_varinum (midilong)

  Writes a MIDI Variable-Length Value (VLV), which has a variable number of bytes.

- void write_track_name (const std::string &trackname)

  Writes out a track name.

- std::string read_track_name ()

  Reads the track name.

- void write_seq_number (midishort seqnum)

  Writes out a sequence number.

- int read_seq_number ()

  Reads the sequence number.

- void write_track_end ()

  Writes out the end-of-track marker.

- bool write_header (int numtracks)

  We want to write:

- void write_prop_header (midilong tag, long len)

  Writes a "proprietary" (SeqSpec) Seq24 footer header in either the new MIDI-compliant format, or the legacy Seq24 format.

- bool write_proprietary_track (perform &a_perf)

  Writes out the final proprietary/SeqSpec section, using the new format if the legacy format is not in force.

- long varinum_size (long len) const

  Calculates the length of a variable length value.

- long prop_item_size (long datalen) const

  Calculates the size of a proprietary item, as written by the write_prop_header() function, plus whatever is called to write the data.

- long track_name_size (const std::string &trackname) const

  Calculates the size of a trackname and the meta event that specifies it.

- void errdump (const std::string &msg)

  Helper function to emit more useful error messages.

- void errdump (const std::string &msg, unsigned long p)

  Helper function to emit more useful error messages for erroneous long values.

- void write_track (const midi_vector &lst)

- long seq_number_size () const

  Returns the size of a sequence-number event, which is always 5 bytes, plus one byte for the delta time that precedes it.

- long track_end_size () const

  Returns the size of a track-end event, which is always 3 bytes.

- bool is_sysex_special_id (midibyte ch)

  Check for special SysEx ID byte.

Private Attributes

- mutex m_mutex

  Provides locking for the sequence.
- int m_file_size

  Holds the size of the MIDI file.
- std::string m_error_message

  Holds the last error message, useful for trouble-shooting without having Sequencer64 running in a console window.
- bool m_error_is_fatal

  Indicates if the error should be considered fatal.
- bool m_disable_reported

  Indicates that file reading has already been disabled (due to serious errors), so don't complain about it anymore.
- int m_pos

  Holds the position in the MIDI file.
- const std::string m_name

  The unchanging name of the MIDI file.
- std::vector< midibyte > m_data

  This vector of characters holds our MIDI data.
- std::list< midibyte > m_char_list

  Provides a list of characters.
- bool m_new_format

  Use the new format for the proprietary footer section of the Seq24 MIDI file.
- bool m_global_bgsequence

  Indicates to store the new key, scale, and background sequence in the global, "proprietary" section of the MIDI song.
- int m_ppqn

  Provides the current value of the PPQN, which used to be constant and is now only the macro DEFAULT_PPQN.
- bool m_use_default_ppqn

  Indicates that the default PPQN is in force.
- midi_splitter m_smf0_splitter

  Provides support for SMF 0.

13.62.1 Detailed Description

In addition to the standard MIDI tracks, it also handles some "private" or "proprietary" tracks specific to Seq24. It does not, however, handle SYSEX events.

13.62.2 Constructor & Destructor Documentation

13.62.2.1 midifile()

```
seq64::midifile::midifile (
            const std::string & name,
            int ppqn = SEQ64_USE_DEFAULT_PPQN,
            bool oldformat = false,
            bool globalbgs = true )
```

Parameters

name	Provides the name of the MIDI file to be read or written.
ppqn	Provides the initial value of the PPQN setting. It is handled differently for parsing (reading) versus writing the MIDI file. • Reading. – If set to SEQ64_USE_DEFAULT_PPQN, the legacy application behavior is used. The m_ppqn member is set to the default PPQN, DEFAULT_PPQN. The value read from the MIDI file, ppqn, is then use to scale the running-time of the sequence relative to DEFAULT_PPQN. – Otherwise, m_ppqn is set to the value read from the MIDI file. No scaling is done. Since the value gets written, specify ppqn as 0, an obviously bogus value, to get this behavior. • Writing. This value is written to the MIDI file in the header chunk of the song. Note that the caller must query for the PPQN set during parsing, and pass it to the constructor when preparing to write the file. See how it is done in the mainwnd class.
oldformat	If true, write out the MIDI file using the old Seq24 format, instead of the new MIDI-compliant sequencer-specific format, for the seq24-specific SeqSpec tags defined in the globals module. This option is false by default. Note that this option is only used in writing; reading can handle either format transparently.
globalbgs	If true, write any non-default values of the key, scale, and background sequence to the global "proprietary" section of the MIDI file, instead of to each sequence. Note that this option is only used in writing; reading can handle either format transparently.

13.62.2.2 ~midifile()

```
seq64::midifile::~midifile ( )
```

13.62.3 Member Function Documentation

13.62.3.1 parse()

```
bool seq64::midifile::parse (
            perform & p,
            int screenset = 0 )
```

In addition to the standard MIDI track data in a normal track, Seq24/Sequencer64 adds four sequencer-specific events just before the end of the track:

```
    c_triggers_new:     SeqSpec FF 7F 1C 24 24 00 08 00 00 ...
    c_midibus:          SeqSpec FF 7F 05 24 24 00 01 00
    c_timesig:          SeqSpec FF 7F 06 24 24 00 06 04 04
    c_midich:           SeqSpec FF 7F 05 24 24 00 02 06
```

```
Note that only Sequencer64 adds "FF 7F len" to the SeqSpec data.

Standard MIDI provides for port and channel specification meta events, but
they are apparently considered obsolete:


    Obsolete meta-event:                Replacement:
    MIDI port (buss):   FF 21 01 po     Device (port) name: FF 09 len text
    MIDI channel:       FF 20 01 ch


What do other applications use for specifying port/channel?

Note the is-modified flag:  We now assume that the perform object is
starting from scratch when parsing.  But we let mainwnd tell the perform
object when to clear everything with perform::clear_all().  The mainwnd
does this for a new file, opening a file, but not for a file import, which
might be done simply to add more MIDI tracks to the current composition.
So, if parsing succeeds, all we want to do is make sure the flag is set.
Parsing a file successfully is not always a modification of the setup.
For instance, the first read of a MIDI file should start clean, not dirty.
```

SysEx notes:

```
 Some files (e.g. Dixie04.mid) do not always encode System Exclusive
 messages properly for a MIDI file.  Instead of a varinum length value,
 they are followed by extended IDs (0x7D, 0x7E, or 0x7F).

 We've covered some of those cases by disabling access to m_data if the
 position passes the size of the file, but we want try to bypass these
 odd cases properly.  So we look ahead for one of these special values.

 Currently, Sequencer64, like Se24, handles SysEx message only to the
 extend of passing them via MIDI Thru.  We hope to improve on that
 capability.
```

Parameters

p	Provides a reference to the perform object into which sequences/tracks are to be added.
screenset	The screen-set offset to be used when loading a sequence (track) from the file. This value ranges from -31 to 0 to +31 (32 is the maximum screen-set available in Seq24). This offset is added to the sequence number read in for the sequence, to place it elsewhere in the imported tune, and locate it in a specific screen-set. If this parameter is non-zero, then we will assume that the perform data is dirty.

Returns

Returns true if the parsing succeeded. Note that the error status is saved in m_error_is_fatal, and a message (to display later) is saved in m_error_message.

13.62.3.2 write()

```
bool seq64::midifile::write (
            perform & p )
```

Also see the write_song() function, for exporting to standard MIDI.

Seq24 reverses the order of some events, due to popping from its container. Not an issue here.

Parameters

p	Provides the object that will contain and manage the entire performance.

Returns

Returns true if the write operations succeeded.

13.62.3.3 write_song()

```
bool seq64::midifile::write_song (
            perform & p )
```

13.62.3.4 error_message()

```
const std::string& seq64::midifile::error_message ( ) const  [inline]
```

13.62.3.5 error_is_fatal()

```
bool seq64::midifile::error_is_fatal ( ) const  [inline]
```

13.62.3.6 ppqn()

```
int seq64::midifile::ppqn ( ) const  [inline]
```

The PPQN will be either the global ppqn (legacy behavior) or the value read from the file, depending on the ppqn parameter passed to the midifile constructor.

13.62.3.7 parse_smf_0()

```
bool seq64::midifile::parse_smf_0 (
            perform & p,
            int screenset )  [private]
```

The original sequence remains in place, in sequence slot 16 (the 17th slot). The user is responsible for deleting it if it is not needed.

Parameters

p	Provides a reference to the perform object into which sequences/tracks are to be added.
screenset	The screen-set offset to be used when loading a sequence (track) from the file.

Returns

Returns true if the parsing succeeded.

13.62.3.8 parse_smf_1()

```
bool seq64::midifile::parse_smf_1 (
            perform & p,
            int screenset,
            bool is_smf0 = false )  [private]
```

It assumes the file-data has already been read into memory. It also assumes that the ID, track-length, and format have already been read.

If the MIDI file contains both proprietary (c_timesig) and MIDI type 0x58 then it came from seq42 or seq32 (Stazed versions). In this case the MIDI type is parsed first (because it is listed first) then it gets overwritten by the proprietary, above.

Parameters

p	Provides a reference to the perform object into which sequences/tracks are to be added.
screenset	The screen-set offset to be used when loading a sequence (track) from the file.
is_smf0	True if we detected that the MIDI file is in SMF 0 format.

Returns

Returns true if the parsing succeeded.

13.62.3.9 parse_prop_header()

```
midilong seq64::midifile::parse_prop_header (
            int file_size )  [private]
```

The new format creates a final track chunk, starting with "MTrk". Then comes the delta-time (here, 0), and the event. An event is a MIDI event, a SysEx event, or a Meta event.

A MIDI Sequencer Specific meta message includes either a delta time or absolute time, and the MIDI Sequencer Specific event encoded as follows:

```
0x00 0xFF 0x7F length data
```

```
For convenience, this function first checks the amount of file data left.
If enough, then it reads a long value.  If the value starts with 0x00 0xFF
0x7F, then that is a SeqSpec event, which signals usage of the new
Sequencer64 "proprietary" format.  Otherwise, it is probably the old
format, and the long value is a control tag (0x242400nn), which can be
returned immedidately.

If it is the new format, we back up to the FF, then get the next byte,
which should be a 7F.  If so, then we read the length (a variable
length value) of the data, and then read the long value, which should
be the control tag, which, again, is returned by this function.
```

Note

Most sequencers seem to be tolerant of both the lack of an "MTrk" marker and of the presence of an unwrapped control tag, and so can handle both the old and new formats of the final proprietary track.

Parameters

file_size	The size of the data file. This value is compared against the member m_pos (the position inside m_data[]), to make sure there is enough data left to process.

Returns

Returns the control-tag value found. These are the values, such as c_midich, found in the globals module, that indicate the type of sequencer-specific data that comes next. If there is not enough data to process, then 0 is returned.

13.62.3.10 parse_proprietary_track()

```
bool seq64::midifile::parse_proprietary_track (
            perform & p,
            int file_size )  [private]
```

It consists of series of tags:

```
        c_midictrl
        c_midiclocks
        c_notes
        c_bpmtag (beats per minute)
        c_mutegroups
        c_musickey (new, added if usr() global_seq_feature() is true)
        c_musicscale (ditto)
        c_backsequence (ditto)
```

```
(There are more tags defined in the globals module, but they are not
used in this function.  This doesn't quite make sense, as there are
also some "triggers" values, and we're pretty sure the application
uses them.  Oh, it turns out that they are set up by actions performed on
each sequence, and are stored as sequencer-specific ("SeqSpec") data with
each track's data as held in the MIDI container for the track.  See the
midi_container module for more information.)

The format is (1) tag ID; (2) length of data; (3) the data.
```

```
First, we separate out this function for a little more clarity.  Then we
added code to handle reading both the legacy Seq24 format and the new,
MIDI-compliant format.  Note that even the new format is not quite
correct, since it doesn't handle a MIDI manufacturer's ID, making it a
single byte that is part of the data.  But it does have the "MTrk" marker
and track name, so that must be processed for the new format.

Now, in our "midicvt" project, we have a test MIDI file,
b4uacuse-non-mtrk.midi that is good, except for having a tag "MUnk"
instead of "MTrk".  We should consider being more permissive, if possible.
Otherwise, though, the only penality is that the "proprietary" chunk is
completely skipped.
```

Extra precision BPM:

Based on a request for two decimals of precision in beats-per-minute, we now save a scaled version of BPM. Our supported range of BPM is SEQ64_MINIMUM_BPM = 1 to SEQ64_MAXIMUM_BPM = 600. If this range is encountered, the value is read as is. If greater than this range (actually, we use 999 as the limit), then we divide the number by 1000 to get the actual BPM, which can thus have more precision than the old integer value allowed. Obviously, when saving, we will multiply by 1000 to encode the BPM.

Parameters

p	The performance object that is being set via the incoming MIDI file.
file_size	The file size as determined in the parse() function.

There are also implicit parameters, with the m_pos and m_new_format member variables.

13.62.3.11 pow2()

```
int seq64::midifile::pow2 (
            int logbase2 )  [private]
```

Use for calculating the denominator of a time signature.

Parameters

logbase2	Provides the power to which 2 is to be raised. This integer is probably only rarely greater than 4 (which represents a denominator of 16).

Returns

Returns 2 raised to the logbase2 power.

13.62.3.12 checklen()

```
bool seq64::midifile::checklen (
            midilong len,
            midibyte type )  [private]
```

A length of zero is now considered legal, but a "warning" message is shown. The largest value allowed within a MIDI file is 0x0FFFFFFF. This limit is set to allow variable-length quantities to be manipulated as 32-bit integers.

Parameters

len	The length value to be checked, and it should be greater than 0. However, we have seen files with zero-length events, such as Lyric events (0x05).
type	The type of meta event. Used for displaying an error.

Returns

Returns true if the length parameter is valid. This now means it is simply less than 0x0FFFFFFF.

13.62.3.13 add_trigger()

```
void seq64::midifile::add_trigger (
            sequence & seq,
            midishort ppqn )  [private]
```

Handles only c_triggers_new values, not the old c_triggers value. If m_ppqn isn't set to the default value, then we must scale these triggers accordingly, just as is done for the MIDI events.

Parameters

seq	Provides the sequence to which the trigger is to be added.
ppqn	Provides the ppqn value to use to scale the tick values if m_use_default_ppqn is true. If 0, the ppqn value is not used.

13.62.3.14 read_long()

```
midilong seq64::midifile::read_long ( )  [private]
```

Warning

This code looks endian-dependent and integer-size dependent.

Returns

Returns the four bytes, shifted appropriately and added together, most-significant byte first, to sum to a long value.

13.62.3.15 read_short()

```
midishort seq64::midifile::read_short ( )  [private]
```

Returns

Returns the two bytes, shifted appropriately and added together, most-significant byte first, to sum to a short value.

13.62.3.16 read_byte()

```
midibyte seq64::midifile::read_byte ( )  [private]
```

Returns

Returns the byte that was read. Returns 0 if there was an error, though there's no way for the caller to determine if this is an error or a good value.

13.62.3.17 read_varinum()

```
midilong seq64::midifile::read_varinum ( )  [private]
```

This function reads the bytes while bit 7 is set in each byte. Bit 7 is a continuation bit. See write_varinum() for more information.

Returns

Returns the accumulated values as a single number.

13.62.3.18 write_long()

```
void seq64::midifile::write_long (
            midilong x )  [private]
```

Warning

This code looks endian-dependent.

Parameters

x	The long value to be written to the MIDI file.

13.62.3.19 write_short()

```
void seq64::midifile::write_short (
            midishort x )  [private]
```

Warning

This code looks endian-dependent.

Parameters

x	The short value to be written to the MIDI file.

13.62.3.20 read_byte_array()

```
void seq64::midifile::read_byte_array (
            midibyte * b,
            int len )  [inline], [private]
```

Parameters

b	The byte array to receive the data.
len	The number of bytes in the array, and to be read.

13.62.3.21 write_byte()

```
void seq64::midifile::write_byte (
            midibyte c )  [inline], [private]
```

The byte is written to the m_char_list member, using a call to push_back().

Parameters

c	The MIDI byte to be "written".

13.62.3.22 write_varinum()

```
void seq64::midifile::write_varinum (
            midilong value )  [private]
```

A MIDI file Variable Length Value is stored in bytes. Each byte has two parts: 7 bits of data and 1 continuation bit. The highest-order bit is set to 1 if there is another byte of the number to follow. The highest-order bit is set to 0 if this byte is the last byte in the VLV.

To recreate a number represented by a VLV, first you remove the continuation bit and then concatenate the leftover bits into a single number.

To generate a VLV from a given number, break the number up into 7 bit units and then apply the correct continuation bit to each byte.

In theory, you could have a very long VLV number which was quite large; however, in the standard MIDI file specification, the maximum length of a VLV value is 5 bytes, and the number it represents can not be larger than 4 bytes.

Here are some common cases:

- Numbers between 0 and 127 (0x7F) are represented by a single byte.
- 0x80 is represented as "0x81 0x00".
- 0x0FFFFFFF (the largest number) is represented as "0xFF 0xFF 0xFF 0x7F".

Also see the varinum_size() function.

Parameters

value	The long value to be encoded as a MIDI varinum, and written to the MIDI file.

13.62.3.23 write_track_name()

```
void seq64::midifile::write_track_name (
            const std::string & trackname )  [private]
```

Note that we have to precede this "event" with a delta time value, set to 0. The format of the output is "0x00 0xFF 0x03 len track-name-bytes".

Parameters

trackname	Provides the name of the track to be written to the MIDI file.

13.62.3.24 read_track_name()

```
std::string seq64::midifile::read_track_name ( )  [private]
```

Meant only for usage in the proprietary/SeqSpec footer track, in the new file format.

Returns

Returns the track name, or an empty string if there was a problem.

13.62.3.25 write_seq_number()

```
void seq64::midifile::write_seq_number (
            midishort seqnum )  [private]
```

The format is "00 FF 00 02 ss ss", where "02" is actually the constant length of the data. We have to precede these values with a 0 delta time, of course.

Now, for sequence 0, an alternate format is "FF 00 00". But that format can only occur in the first track, and the rest of the tracks then don't need a sequence number, since it is assumed to increment. Our application doesn't bother with that shortcut.

Parameters

seqnum	The sequence number to write.

13.62.3.26 read_seq_number()

```
int seq64::midifile::read_seq_number ( )  [private]
```

Meant only for usage in the proprietary/SeqSpec footer track, in the new file format.

Returns

Returns the sequence number found, or -1 if it was not found.

13.62.3.27 write_track_end()

```
void seq64::midifile::write_track_end ( )  [private]
```

13.62.3.28 write_header()

```
bool seq64::midifile::write_header (
            int numtracks )  [private]
```

- 0x4D54726B. The track tag "MTrk". The MIDI spec requires that software can skip over non-standard chunks. "Prop"? Would require a fix to midicvt.
- 0xaabbccdd. The length of the track. This needs to be calculated somehow.
- 0x00. A zero delta time.
- 0x7f7f. Sequence number, a special value, well out of normal range.
- The name of the track:
  - "Seq24-Spec"
  - "Sequencer64-S"

  Then follows the proprietary/SeqSpec data, written in the normal manner. Finally, tack on the track-end meta-event.
  Components of final track size:

```
-# Delta time.  1 byte, always 0x00.
-# Sequence number.  5 bytes.  OPTIONAL.  We won't write it.
-# Track name. 3 + 10 or 3 + 15
-# Series of proprietary/SeqSpec specs:
   -# Prop header:
      -# If legacy format, 4 bytes.
      -# Otherwise, 2 bytes + varinum_size(length) + 4 bytes.
      -# Length of the prop data.
-# Track End. 3 bytes.
```

13.62.3.29 write_prop_header()

```
void seq64::midifile::write_prop_header (
            midilong control_tag,
            long data_length )  [private]
```

This function does not write the data. It replaces calls such as "write_long(c_midich)" in the proprietary secton of write().

The legacy format just writes the control tag (0x242400xx). The new format writes 0x00 0xFF 0x7F len 0x242400xx; the first 0x00 is the delta time.

In the new format, the 0x24 is a kind of "manufacturer ID". At http://www.midi.org/techspecs/manid.↩ php we see that most manufacturer IDs start with 0x00, and are thus three bytes long, or start with codes at 0x40 and above. Similary, this site shows that no manufacturer uses 0x24:

```
http://sequence15.blogspot.com/2008/12/midi-manufacturer-ids.html
```

Warning

Currently, the manufacturer ID is not handled; it is part of the data, which can be misleading in programs that analyze MIDI files.

Parameters

control_tag	Determines the type of sequencer-specific section to be written. It should be one of the value in the globals module, such as c_midibus or c_mutegroups.
data_length	The amount of data that will be written. This parameter does not count the length of the header itself.

13.62.3.30 write_proprietary_track()

```
bool seq64::midifile::write_proprietary_track (
            perform & p )  [private]
```

The first thing to do, for the new format only, is calculate the length of this big section of data. This was quite tricky; we tweaked and adjusted until the midicvt program handled the whole new-format file without emitting any errors.

Here's the basics of what Seq24 did for writing the data in this part of the file:

```
-#  Write the c_midictrl value, then write a 0.  To us, this looks like
    no one wrote any code to write this data.  And yet, the parsing
    code can handles a non-zero value, which is the number of sequences
    as a long value, not a byte.  So shouldn't we write 4 bytes, not
    one?  Yes, indeed, we made a mistake.  However, we should be
    writing out the full data set as well.  But not even Seq24 does
    that!  Perhaps they decided it was best kept in the "rc"
    configuration file.
-#  MORE TO COME.
```

Parameters

p	Provides the object that will contain and manage the entire performance.

Returns

Always returns true. No efficient way to check all of the writes that can happen. Might revisit this issue if some bug crops up.

13.62.3.31 varinum_size()

```
long seq64::midifile::varinum_size (
            long len ) const  [private]
```

This function is needed when calculating the length of a track. Note that it handles only the following situations:

```
https://en.wikipedia.org/wiki/Variable-length_quantity
```

This restriction allows the calculation to be simple and fast.

```
1 byte:  0x00 to 0x7F
2 bytes: 0x80 to 0x3FFF
3 bytes: 0x4000 to 0x001FFFFF
4 bytes: 0x200000 to 0x0FFFFFFF
```

Parameters

len	The long value whose length, when encoded as a MIDI varinum, is to be found.

Returns

Returns values as noted above. Anything beyond that range returns 0.

13.62.3.32 prop_item_size()

```
long seq64::midifile::prop_item_size (
            long data_length ) const  [private]
```

If using the new format, the length includes the sum of sequencer-specific tag (0xFF 0x7F) and the size of the variable-length value. Then, for legacy and new format, 4 bytes are added for the Seq24 MIDI control value, and then the data length is added.

Parameters

data_length	Provides the data length value to be encoded.

Returns

Returns the length of the item size, including the delta time, meta bytes, length byes, the control tag, and the data-length itself.

13.62.3.33 track_name_size()

```
long seq64::midifile::track_name_size (
            const std::string & trackname ) const  [private]
```

Parameters

trackname	Provides the name of the track to be written to the MIDI file.

Returns

Returns the length of the event, which is of the format "0x00 0xFF 0x03 len track-name-bytes".

13.62.3.34 errdump() [1/2]

```
void seq64::midifile::errdump (
            const std::string & msg )  [private]
```

It adds the file offset to the message.

Parameters

msg	The main error message string, without an ending newline character.

Returns

The constructed string is returned as a side-effect, in case we want to pass it along to the externally-accessible error-message buffer.

13.62.3.35 errdump() [2/2]

```
void seq64::midifile::errdump (
            const std::string & msg,
            unsigned long value )  [private]
```

It adds the file offset to the message.

Parameters

msg	The main error message string, without an ending newline character.
value	The long value to show as part of the message.

Returns

The constructed string is returned as a side-effect, in case we want to pass it along to the externally-accessible error-message buffer.

13.62.3.36 write_track()

```
void seq64::midifile::write_track (
            const midi_vector & lst )  [private]
```

13.62.3.37 seq_number_size()

```
long seq64::midifile::seq_number_size ( ) const  [inline], [private]
```

13.62.3.38 track_end_size()

```
long seq64::midifile::track_end_size ( ) const  [inline], [private]
```

13.62.3.39 is_sysex_special_id()

```
bool seq64::midifile::is_sysex_special_id (
            midibyte ch )  [inline], [private]
```

Parameters

ch	Provides the byte to be checked against 0x7D through 0x7F.

Returns

Returns true if the byte is SysEx special ID.

13.62.4 Field Documentation

13.62.4.1 m_mutex

```
mutex seq64::midifile::m_mutex  [mutable], [private]
```

Made mutable for use in certain locked getter functions.

13.62.4.2 m_file_size

```
int seq64::midifile::m_file_size  [private]
```

This variable was added when loading a file that caused an attempt to load data well beyond the file-size of the midicvt test file Dixie04.mid.

13.62.4.3 m_error_message

```
std::string seq64::midifile::m_error_message  [private]
```

If empty, there's no pending error. Currently most useful in the parse() function.

13.62.4.4 m_error_is_fatal

```
bool seq64::midifile::m_error_is_fatal  [private]
```

The caller can query for this value after getting the return value from parse().

13.62.4.5 m_disable_reported

```
bool seq64::midifile::m_disable_reported  [private]
```

Once is enough.

13.62.4.6 m_pos

```
int seq64::midifile::m_pos  [private]
```

This is at least a 31-bit value in the recent architectures running Linux and Windows, so it will handle up to 2 Gb of data. This member is used as the offset into the m_data vector.

13.62.4.7 m_name

```
const std::string seq64::midifile::m_name  [private]
```

13.62.4.8 m_data

```
std::vector<midibyte> seq64::midifile::m_data  [private]
```

We could also use a string of characters, unsigned. This member is resized to the putative size of the MIDI file, in the parse() function. Then the whole file is read into it, as if it were an array. This member is an input buffer.

13.62.4.9 m_char_list

```
std::list<midibyte> seq64::midifile::m_char_list  [private]
```

The class pushes each MIDI byte into this list using the write_byte() function. Also note that the write() function calls sequence::fill_list() to fill a temporary std::list<char> (!) buffer, then writes that data *backwards* to this member. This member is an output buffer.

13.62.4.10 m_new_format

```
bool seq64::midifile::m_new_format  [private]
```

In the new format, each sequencer-specfic value (0x242400xx, as defined in the globals module) is preceded by the sequencer-specific prefix, 0xFF 0x7F len id/date). By default, the new format is used, but the user can specify the –legacy (-l) option, or make a soft link to the sequence24 binary called "seq24", to write the data in the old format. [We will eventually add the –legacy option to the "rc" configuration file.] Note that reading can handle either format transparently.

13.62.4.11 m_global_bgsequence

```
bool seq64::midifile::m_global_bgsequence  [private]
```

13.62.4.12 m_ppqn

```
int seq64::midifile::m_ppqn  [private]
```

13.62.4.13 m_use_default_ppqn

```
bool seq64::midifile::m_use_default_ppqn  [private]
```

13.62.4.14 m_smf0_splitter

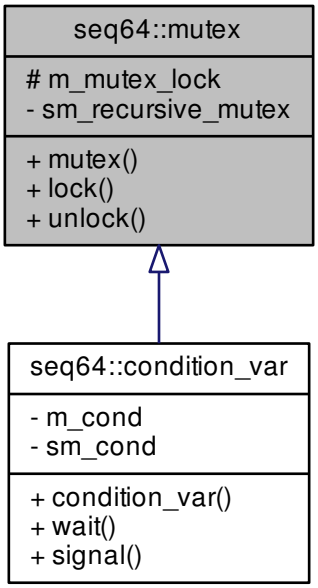
```
midi_splitter seq64::midifile::m_smf0_splitter  [private]
```

This object holds all of the information needed to split a multi-channel sequence.

13.63 seq64::mutex Class Reference

The mutex class provides a simple wrapper for the pthread_mutex_t type used as a recursive mutex.

Inheritance diagram for seq64::mutex:



Public Member Functions

- mutex ()

  The constructor assigns the recursive mutex to the local locking mutex.
- void lock () const

  Lock the mutex.
- void unlock () const

  Unlock the mutex.

Protected Attributes

- pthread_mutex_t m_mutex_lock

  Provides a mutex lock usable by a single module or class.

Static Private Attributes

- static const pthread_mutex_t sm_recursive_mutex

  Provides a recursive mutex that can be used by the whole application, and is, apparently.

13.63.1 Constructor & Destructor Documentation

13.63.1.1 mutex()

```
seq64::mutex::mutex ( )
```

13.63.2 Member Function Documentation

13.63.2.1 lock()

```
void seq64::mutex::lock ( ) const
```

13.63.2.2 unlock()

```
void seq64::mutex::unlock ( ) const
```

13.63.3 Field Documentation

13.63.3.1 sm_recursive_mutex

```
const pthread_mutex_t seq64::mutex::sm_recursive_mutex  [static], [private]
```

Define the static recursive mutex and its condition variable.

13.63.3.2 m_mutex_lock

```
pthread_mutex_t seq64::mutex::m_mutex_lock  [mutable], [protected]
```

However, this mutex ends up being a copy of the static sm_recursive_mutex (and, of course, a different "object").

13.64 seq64::editable_event::name_value_t Struct Reference

Provides a type that contains the pair of values needed for the various lookup maps that are needed to manage editable events.

Data Fields

- unsigned short event_value

  Holds a midibyte value (0x00 to 0xFF) or SEQ64_END_OF_MIDIBYTE_TABLE to indicate the end of an array of name_value_t items.
- std::string event_name

  Holds the human-readable name for an event code or other numeric value in an array of name_value_t items.

13.64.1 Field Documentation

13.64.1.1 event_value

```
unsigned short seq64::editable_event::name_value_t::event_value
```

13.64.1.2 event_name

```
std::string seq64::editable_event::name_value_t::event_name
```

13.65 seq64::options Class Reference

This class supports a full tabbed options dialog.

Inherits Dialog.

Public Member Functions

- options (Gtk::Window &parent, perform &p, bool showjack=false)

Private Types

- enum button {
  e_jack_transport,
  e_jack_master,
  e_jack_master_cond,
  e_jack_midi,
  e_jack_start_mode_live,
  e_jack_start_mode_song,
  e_jack_connect,
  e_jack_disconnect }

  Defines buttons indices or IDs for some controls related to JACK.

Private Member Functions

- perform & perf ()

  'Getter' function for member m_mainperf
- void clock_callback_off (int bus, Gtk::RadioButton *button)
- void clock_callback_on (int bus, Gtk::RadioButton *button)
- void clock_callback_mod (int bus, Gtk::RadioButton *button)
- void clock_mod_callback (Gtk::Adjustment *adj)
- void input_callback (int bus, Gtk::Button *button)
- void filter_callback (Gtk::Button *button)
- void transport_callback (button type, Gtk::Button *button)
- void mouse_seq24_callback (Gtk::RadioButton *)
- void mouse_fruity_callback (Gtk::RadioButton *)
- void mouse_mod4_callback (Gtk::CheckButton *)
- void mouse_snap_split_callback (Gtk::CheckButton *)
- void mouse_click_edit_callback (Gtk::CheckButton *)
- void lash_support_callback (Gtk::CheckButton *)
- void add_midi_clock_page ()
- void add_midi_input_page ()
- void add_keyboard_page ()
- void add_extended_keys_page ()
- void add_mouse_page ()
- void add_jack_sync_page ()

Private Attributes

- Gtk::Tooltips * m_tooltips

  A repository for GTK tooltip support.
- perform & m_mainperf

  The performance object to which some of these options apply.
- Gtk::Button * m_button_ok

  The famous "OK" button's pointer.
- Gtk::CheckButton * m_button_jack_transport

  Main JACK transport selection.
- Gtk::CheckButton * m_button_jack_master

  Main JACK transport master selection.
- Gtk::CheckButton * m_button_jack_master_cond

  Main JACK transport master-conditional selection.
- Gtk::Button * m_button_jack_connect

  JACK Connect button, which we need to enable/disable for clarity and some additional safety.
- Gtk::Button * m_button_jack_disconnect

  JACK Disonnect button, which we need to enable/disable for clarity and some additional safety.
- Gtk::Notebook * m_notebook

  Not sure yet what this notebook is for.

13.65.1 Member Enumeration Documentation

13.65.1.1 button

```
enum seq64::options::button  [private]
```

These values are handled in options::transport_callback(). Some of them set JACK-related values in the rc_settings object, while the others set up or tear down the JACK support of sequencer64.

The JACK Transport settings are a little messy. They should be radio buttons, and control each other's settings. Currently, if the user wants to set up for JACK Master, the JACK Transport button must also be checked.

Enumerator

e_jack_transport	Turns on the "with JACK Transport" option, rc_settings :: with_jack_transport().
e_jack_master	Turns on the "with JACK Master" option, rc_settings :: with_jack_master(). If another application is already JACK Master, this will fail.
e_jack_master_cond	Turns on the "with JACK Master" option rc_settings :: with_jack_master_cond(). This option makes sequencer64 the JACK Master conditionally, that is, if no other application has claimed that role.
e_jack_midi	Turns on the "Native JACK MIDI" option rc_settings :: with_jack_midi(). This is a setting independent of the JACK Transport settings. This is use only in the "rtmidi" implementation os Sequencer64, seq64.
e_jack_start_mode_live	Doesn't directly do anything; the live mode versus song mode is set by the e_jack_start_mode_song value.
e_jack_start_mode_song	Sets the "JACK start mode" value to true, which means that sequencer64 is in song mode. This value is obtained via rc_settings :: song_start_mode(). It will eventually be the start mode that applies to either ALSA or JACK playback.
e_jack_connect	Causes the perform object's JACK initialization function, perform::init_jack(), to be called.
e_jack_disconnect	Causes the perform object's JACK deinitialization function, perform::deinit_jack(), to be called.

13.65.2 Constructor & Destructor Documentation

13.65.2.1 options()

```
seq64::options::options (
            Gtk::Window & parent,
            perform & p,
            bool showjack = false )
```

13.65.3 Member Function Documentation

13.65.3.1 perf()

```
perform& seq64::options::perf ( )  [inline], [private]
```

13.65.3.2 clock_callback_off()

```
void seq64::options::clock_callback_off (
            int bus,
            Gtk::RadioButton * button )  [private]
```

13.65.3.3 clock_callback_on()

```
void seq64::options::clock_callback_on (
            int bus,
            Gtk::RadioButton * button )  [private]
```

13.65.3.4 clock_callback_mod()

```
void seq64::options::clock_callback_mod (
            int bus,
            Gtk::RadioButton * button )  [private]
```

13.65.3.5 clock_mod_callback()

```
void seq64::options::clock_mod_callback (
            Gtk::Adjustment * adj )  [private]
```

13.65.3.6 input_callback()

```
void seq64::options::input_callback (
            int bus,
            Gtk::Button * button )  [private]
```

13.65.3.7 filter_callback()

```
void seq64::options::filter_callback (
            Gtk::Button * button )  [private]
```

13.65.3.8 transport_callback()

```
void seq64::options::transport_callback (
            button type,
            Gtk::Button * button )  [private]
```

13.65.3.9 mouse_seq24_callback()

```
void seq64::options::mouse_seq24_callback (
            Gtk::RadioButton *  )  [private]
```

13.65.3.10 mouse_fruity_callback()

```
void seq64::options::mouse_fruity_callback (
            Gtk::RadioButton *  )  [private]
```

13.65.3.11 mouse_mod4_callback()

```
void seq64::options::mouse_mod4_callback (
            Gtk::CheckButton *  )  [private]
```

13.65.3.12 mouse_snap_split_callback()

```
void seq64::options::mouse_snap_split_callback (
            Gtk::CheckButton *  )  [private]
```

13.65.3.13 mouse_click_edit_callback()

```
void seq64::options::mouse_click_edit_callback (
            Gtk::CheckButton *  )  [private]
```

13.65.3.14 lash_support_callback()

```
void seq64::options::lash_support_callback (
            Gtk::CheckButton *  )  [private]
```

13.65.3.15 add_midi_clock_page()

```
void seq64::options::add_midi_clock_page ( )  [private]
```

13.65.3.16 add_midi_input_page()

```
void seq64::options::add_midi_input_page ( )  [private]
```

13.65.3.17 add_keyboard_page()

```
void seq64::options::add_keyboard_page ( )  [private]
```

13.65.3.18 add_extended_keys_page()

```
void seq64::options::add_extended_keys_page ( )  [private]
```

13.65.3.19 add_mouse_page()

```
void seq64::options::add_mouse_page ( )  [private]
```

13.65.3.20 add_jack_sync_page()

```
void seq64::options::add_jack_sync_page ( )  [private]
```

13.65.4 Field Documentation

13.65.4.1 m_tooltips

```
Gtk::Tooltips* seq64::options::m_tooltips  [private]
```

13.65.4.2 m_mainperf

```
perform& seq64::options::m_mainperf  [private]
```

13.65.4.3 m_button_ok

```
Gtk::Button* seq64::options::m_button_ok  [private]
```

13.65.4.4 m_button_jack_transport

```
Gtk::CheckButton* seq64::options::m_button_jack_transport  [private]
```

13.65.4.5 m_button_jack_master

```
Gtk::CheckButton* seq64::options::m_button_jack_master  [private]
```

13.65.4.6 m_button_jack_master_cond

```
Gtk::CheckButton* seq64::options::m_button_jack_master_cond  [private]
```

13.65.4.7 m_button_jack_connect

```
Gtk::Button* seq64::options::m_button_jack_connect  [private]
```

13.65.4.8 m_button_jack_disconnect

```
Gtk::Button* seq64::options::m_button_jack_disconnect  [private]
```

13.65.4.9 m_notebook

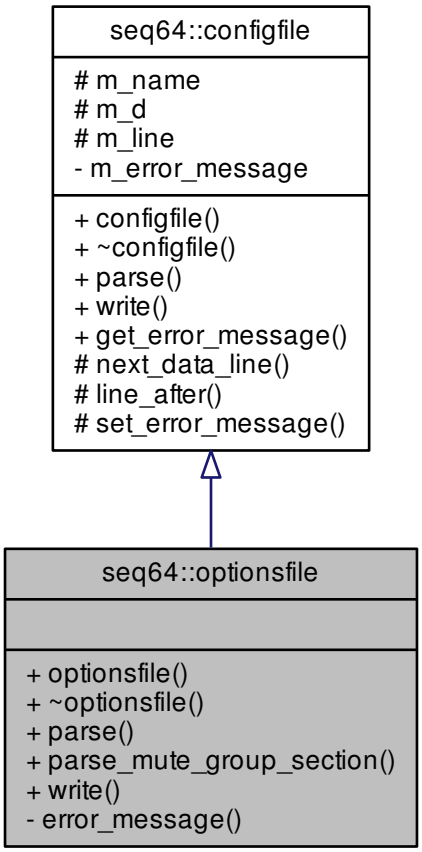
```
Gtk::Notebook* seq64::options::m_notebook  [private]
```

Must be a GTK thang.

13.66 seq64::optionsfile Class Reference

Provides a file for reading and writing the application' main configuration file.

Inheritance diagram for seq64::optionsfile:



Public Member Functions

- optionsfile (const std::string &name)

  Principal constructor.
- ~optionsfile ()

  A rote destructor.
- bool parse (perform &p)

  Parse the ~/.seq24rc or ~/.config/sequencer64/sequencer64.rc file.
- bool parse_mute_group_section (perform &p)

  Parses the [mute-group] section.
- bool write (const perform &p)

  This options-writing function is just about as complex as the options-reading function.

Private Member Functions

- bool error_message (const std::string &sectionname, const std::string &additional="")
  Helper function for error-handling.

Additional Inherited Members

13.66.1 Detailed Description

The settings that are passed around are provided or used by the perform class.

13.66.2 Constructor & Destructor Documentation

13.66.2.1 optionsfile()

```
seq64::optionsfile::optionsfile (
            const std::string & name )
```

Parameters

name	Provides the name of the options file; this is usually a full path file-specification.

13.66.2.2 ~optionsfile()

```
seq64::optionsfile::~optionsfile ( )
```

13.66.3 Member Function Documentation

13.66.3.1 parse()

```
bool seq64::optionsfile::parse (
            perform & p )  [virtual]
```

[midi-control]

Get the number of sequence definitions provided in the [midi-control] section. Ranges from 32 on up. Then read in all of the sequence lines. The first 32 apply to the first screen set. There can also be a comment line "# mute in group" followed by 32 more lines. Then there are addditional comments and single lines for BPM up, BPM down,

Screen Set Up, Screen Set Down, Mod Replace, Mod Snapshot, Mod Queue, Mod Gmute, Mod Glearn, and Screen Set Play. These are all forms of MIDI automation useful to control the playback while not sitting near the computer.

[mute-group]

The mute-group starts with a line that indicates up to 32 mute-groups are defined. A common value is 1024, which means there are 32 groups times 32 keys. But this value is currently thrown away. This value is followed by 32 lines of data, each contained 4 sets of 8 settings. See the seq24-doc project on GitHub for a much more detailed description of this section.

[midi-clock]

The MIDI-clock section defines the clocking value for up to 16 output busses. The first number, 16, indicates how many busses are specified. Generally, these busses are shown to the user with names such as "[1] seq24 1".

[keyboard-control]

The keyboard control defines the keys that will toggle the stage of each of up to 32 patterns in a pattern/sequence box. These keys are displayed in each box as a reminder. The first number specifies the Key number, and the second number specifies the Sequence number.

[keyboard-group]

The keyboard group specifies more automation for the application. The first number specifies the Key number, and the second number specifies the Group number. This section should be better described in the seq24-doc project on GitHub.

[extended-keys]

Additional keys (not yet represented in the Options dialog) to support additional keys for tempo-tapping, Seq32's new transport and connection functionality, and maybe a little more.

[New-keys]

Conditional support for reading Seq32 "rc" files.

[jack-transport]

This section covers various JACK settings, one setting per line. In order, the following numbers are specfied:

```
-   jack_transport - Enable sync with JACK Transport.
-   jack_master - Seq24 will attempt to serve as JACK Master.
-   jack_master_cond - Seq24 will fail to be Master if there is
    already a Master set.
-   song_start_mode:
    -   0 = Playback will be in Live mode.  Use this to allow
        muting and unmuting of loops.
    -   1 = Playback will use the Song Editor's data.
```

[midi-input]

This section covers the MIDI input busses, and has a format similar to "[midi-clock]". Generally, these busses are shown to the user with names such as "[1] seq24 1", and currently there is only one input buss. The first field is the port number, and the second number indicates whether it is disabled (0), or enabled (1).

[midi-clock-mod-ticks]

This section covers.... One common value is 64.

[manual-alsa-ports]

Set to 1 if you want seq24 to create its own ALSA ports and not connect to other clients.

[last-used-dir]

This section simply holds the last path-name that was used to read or write a MIDI file. We still need to add a check for a valid path, and currently the path must start with a "/", so it is not suitable for Windows.

[interaction-method]

This section specified the kind of mouse interaction.

- 0 = 'seq24' (original Seq24 method).
- 1 = 'fruity' (similar to a certain fruity sequencer we like).

The second data line is set to "1" if Mod4 can be used to keep seq24 in note-adding mode even after the right-click is released, and "0" otherwise.

Parameters

p	Provides the performance object to which all of these options apply.

Returns

Returns true if the file was able to be opened for reading. Currently, there is no indication if the parsing actually succeeded.

Implements seq64::configfile.

13.66.3.2 parse_mute_group_section()

```
bool seq64::optionsfile::parse_mute_group_section (
            perform & p )
```

This function is used both in the original reading of the "rc" file, and for reloading the original mute-group data from the "rc".

We used to throw the mute-group count value away, since it was always 1024, but it is useful if no mute groups have been created. So, if it reads 0 (instead of 1024), we will assume there are no mute-group settings. We also have to be sure to go to the next data line even if the strip-empty-mutes option is on.

Parameters

p	Provides a reference to the main perform object. However, we have to cast away the constness, because too many of the perform getter functions are used in non-const contexts.

Returns

Returns true if the file was able to be opened for reading, and the desired data successfully extracted.

13.66.3.3 write()

```
bool seq64::optionsfile::write (
            const perform & p )  [virtual]
```

Parameters

p	Provides a const reference to the main perform object. However, we have to cast away the constness, because too many of the perform getter functions are used in non-const contexts.

Returns

Returns true if the write operations all succeeded.

New boolean to show sequence numbers; ignored in legacy mode.

Implements seq64::configfile.

13.66.3.4 error_message()

```
bool seq64::optionsfile::error_message (
            const std::string & sectionname,
            const std::string & additional = "" )  [private]
```

Parameters

sectionname	Provides the name of the section for reporting the error.
additional	Additional context information to help in finding the error.

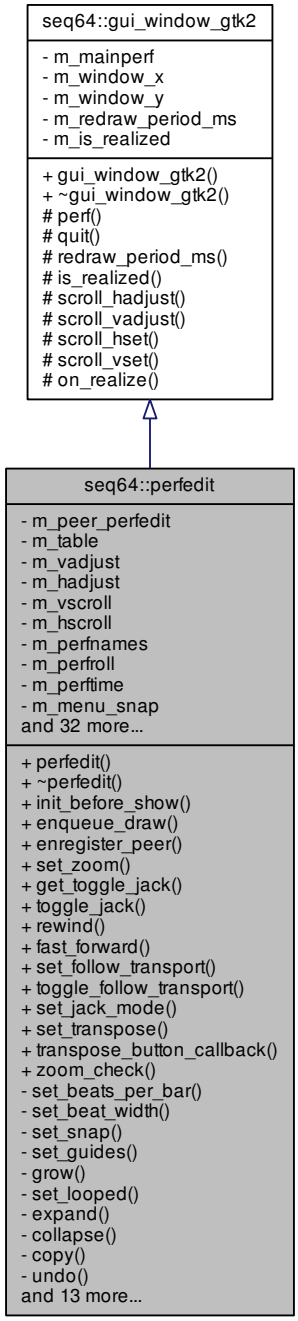
Returns

Always returns false.

13.67 seq64::perfedit Class Reference

This class supports a Performance Editor that is used to arrange the patterns/sequences defined in the patterns panel.

Inheritance diagram for seq64::perfedit:



Public Member Functions

- perfedit (perform &p, bool second_perfedit=false, int ppqn=SEQ64_USE_DEFAULT_PPQN)

  Principal constructor, has a reference to a perform object.
- virtual ~perfedit ()

  This rote destructor does nothing.
- void init_before_show ()

This function forwards its call to the perfroll function of the same name.

- void enqueue_draw (bool forward=true)

  Helper wrapper for calling perfroll::queue_draw() for one or both perfedits.

- void enregister_peer (perfedit *peer)

  Register the peer perfedit object.

- void set_zoom (int z)

  Implements the horizontal zoom feature.

- bool get_toggle_jack ()

  Gets the state fo the JACK toggle button in the Song editor, when compiled with seq32 JACK support.

- void toggle_jack ()

  Sets the state fo the JACK toggle button in the Song editor, when compiled with seq32 JACK support.

- void rewind (bool press)

  Implements the seq32/stazed rewind operation.

- void fast_forward (bool press)

  Implements the seq32/stazed fast-forward operation.

- void set_follow_transport ()

  Sets the transport status when compiled for seq32 JACK support.

- void toggle_follow_transport ()

  Toggles the transport status when compiled for seq32 JACK support.

- void set_jack_mode ()

  Sets the JACK transport status, based on the status of the JACK button in the Song editor, when compiled for seq32 JACK support.

- void set_transpose (int transpose)

  Sets the value of transposition for this window.

- void transpose_button_callback (int transpose)

  The button callback for transposition for this window.

Static Public Member Functions

- static bool zoom_check (int z)

  Checks zoom values for the z/Z keystrokes used in perfroll and perftime.

Private Member Functions

- void set_beats_per_bar (int bpm)

  Sets the beats-per-measure text and value to the given value, and then calls set_guides().

- void set_beat_width (int bw)

  Sets the BW (beat width, or the denominator in the time signature) text and values to the given value, and then calls set_guides().

- void set_snap (int snap)

  Sets the snap text and values to the given value, and then calls set_guides().

- void set_guides ()

  Sets the guides, which are the L and R user-interface elements.

- void grow ()

  Increments the size of the perfroll and perftime objects.

- void set_looped ()

  Set the looping in the perform object.

- void expand ()

  Implement the expand action.

- void collapse ()

Implement the collapse action.

- void copy ()

  Implement the copy (actually, expand-and-copy) action.

- void undo ()

  Implement the undo feature (Ctrl-Z).

- void redo ()

  Implement the redo feature (Ctrl-R).

- void popup_menu (Gtk::Menu *menu)

  Opens the given popup menu.

- void draw_sequences ()

  Forces a redraw of the sequences, though currently just the perfnames part of each sequence in the performance editor.

- bool timeout ()

  Handles a drawing timeout.

- void set_image (bool isrunning)

  Changes the image used for the pause/play button.

- void start_playing ()

  Implement the playing.

- void pause_playing ()

  Pauses the playing of the song, leaving the progress bar where it stopped.

- void stop_playing ()

  Stop the playing.

- void toggle_playing ()

  Reverses the state of playback.

- void on_realize ()

  This callback function calls the base-class on_realize() function, and then connects the perfedit::timeout() function to the Glib signal-timeout, with a redraw timeout of redraw_period_ms().

- bool on_key_press_event (GdkEventKey *ev)

  This function is the callback for a key-press event.

- bool on_key_release_event (GdkEventKey *ev)

  This function is the callback for a key-release event.

- bool on_delete_event (GdkEventAny *)

  All this callback function does is return false.

Private Attributes

- perfedit * m_peer_perfedit

  The partner instance of perfedit.

- Gtk::Table * m_table

  A whole horde of GUI elements.

- Gtk::Adjustment * m_vadjust

  Vertical adjust for piano roll.

- Gtk::Adjustment * m_hadjust

  Horizontal adjust for piano roll.

- Gtk::VScrollbar * m_vscroll

  Vertical scroll for piano roll.

- Gtk::HScrollbar * m_hscroll

  Horizonatl scroll for piano roll.

- perfnames * m_perfnames

  Pattern names in leftmost column.

- perfroll * m_perfroll

  The piano roll in the song editor.
- perftime * m_perftime

  The time/measures bar above roll.
- Gtk::Menu * m_menu_snap

  The menu for grid-snap selection.
- Gtk::Menu * m_menu_xpose

  The menu for transpose selection.
- Gtk::Button * m_button_xpose

  Button to bring up transpose menu.
- Gtk::Entry * m_entry_xpose

  Text edit for the transpose value.
- Gtk::Image * m_image_play

  The image for the play button.
- Gtk::Button * m_button_snap

  Button to bring up the snap menu.
- Gtk::Entry * m_entry_snap

  Text edit for the grid-snap value.
- Gtk::Button * m_button_stop

  The Stop Play button object.
- Gtk::Button * m_button_play

  Implements the yellow two-bar pause button.
- Gtk::ToggleButton * m_button_loop

  Button for Left-to-Right looping.
- Gtk::Button * m_button_expand

  Button for Left/Right expansion.
- Gtk::Button * m_button_collapse

  Button for Left/Right collapse.
- Gtk::Button * m_button_copy

  Expand and copy between L/R.
- Gtk::Button * m_button_grow

  Expand grid (bottom-right button).
- Gtk::Button * m_button_undo

  Button to undo previous action.
- Gtk::Button * m_button_redo

  Button to redo previous action.
- Gtk::ToggleButton * m_button_jack

  Button to toggle JACK connection.
- Gtk::ToggleButton * m_button_follow

  Button to toggle JACK following.
- Gtk::Button * m_button_bpm

  Beats-per-measure menu button.
- Gtk::Entry * m_entry_bpm

  Text-edit for beats-per-measure.
- Gtk::Button * m_button_bw

  Beat-width menu button.
- Gtk::Entry * m_entry_bw

  Text-edit for beat-width.
- Gtk::HBox * m_hbox

  Horizontal box (which?) in table.
- Gtk::HBox * m_hlbox

Horizontal box for buttons at top.

- Gtk::Tooltips * m_tooltips

  Container for tool-tips.

- Gtk::Menu * m_menu_bpm

  Menus for time signature, beats per measure, beat width.

- Gtk::Menu * m_menu_bw

  Drop-down menu for beat-width.

- int m_snap

  Sets the horizontal grid snap-to in units of "pulses" or "ticks".

- int m_bpm

  The current "beats per measure" value.

- int m_bw

  The current "beat width" value.

- int m_ppqn

  The current "parts per quarter note" value.

- bool m_is_running

  Holds the current status of running, for use in display the play versus pause icon.

- int m_standard_bpm

  The standard "beats per measure" of Sequencer64, which here matches the beats-per-measure displayed in the perfroll (piano roll).

Friends

- void update_perfedit_sequences ()

  This global function in the seq64 namespace calls perfedit :: draw_sequences(), if the global perfedit objects exist.

Additional Inherited Members

13.67.1 Detailed Description

It has a seqroll and piano roll? No, it has a perform, a perfnames, a perfroll, and a perftime.

13.67.2 Constructor & Destructor Documentation

13.67.2.1 perfedit()

```
seq64::perfedit::perfedit (
            perform & p,
            bool second_perfedit = false,
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

We've reordered the pointer members and put them in the initializer list to make the constructor a bit cleaner.

Todo Offload most of the work into an initialization function like options does.

Parameters

p	Refers to the main performance object.
second_perfedit	If true, this object is the second perfedit object.
ppqn	The optionally-changed PPQN value to use for the performance editor.

13.67.2.2 ~perfedit()

```
virtual seq64::perfedit::~perfedit ( )  [inline], [virtual]
```

We're going to have to run the application through valgrind to make sure that nothing is left behind.

13.67.3 Member Function Documentation

13.67.3.1 init_before_show()

```
void seq64::perfedit::init_before_show ( )
```

It does not seem to need to also forward to the perftime function of the same name.

13.67.3.2 enqueue_draw()

```
void seq64::perfedit::enqueue_draw (
            bool forward = true )
```

Note that we call the children's queue_draw() functions, not enqueue_draw(), otherwise we'll get stack overflow.

Parameters

forward	If true (the default), pass the call to the peer. When passing this call to the peer, this parameter is set to false to prevent an infinite loop and the resultant stack overflow.

13.67.3.3 zoom_check()

```
static bool seq64::perfedit::zoom_check (
            int z )  [inline], [static]
```

It has to range from greater than 1 (the highest zoom-in causes an unexplained drawing artifact at this time), and not greater than four times the c_perf_scale_x value, at which point we have zoomed out so far that the measure numbers are almost completely obscured.

Parameters

z	The desired zoom value to validate.

13.67.3.4 enregister_peer()

```
void seq64::perfedit::enregister_peer (
            perfedit * peer )  [inline]
```

This function is meant to be called by mainwnd, which creates the perfedits and then makes sure they get along. Only the first call to this function will work; only one peer can be registered.

Parameters

peer	The peer perfedit object to register, if not null.

13.67.3.5 set_zoom()

```
void seq64::perfedit::set_zoom (
            int z )
```

Parameters

z	The zoom value to be set. The child zoom functions called each check that this value is valid.

13.67.3.6 get_toggle_jack()

```
bool seq64::perfedit::get_toggle_jack ( )
```

Returns

Returns the JACK button's get_active() status.

13.67.3.7 toggle_jack()

```
void seq64::perfedit::toggle_jack ( )
```

Note that this will trigger the button signal callback.

13.67.3.8 rewind()

```
void seq64::perfedit::rewind (
            bool press )  [inline]
```

The timeout is in milliseconds, and is currently hard-wired to 120.

Note the use of "&perf()" to get the address of the perform object.

Parameters

press	True if the operation is a key press, false if the operation is a key release.

13.67.3.9 fast_forward()

```
void seq64::perfedit::fast_forward (
            bool press )  [inline]
```

Parameters

press	True if the operation is a key press, false if the operation is a key release.

13.67.3.10 set_follow_transport()

```
void seq64::perfedit::set_follow_transport ( )
```

Note that this will trigger the button signal callback.

13.67.3.11 toggle_follow_transport()

```
void seq64::perfedit::toggle_follow_transport ( )
```

Note that this will trigger the button signal callback.

13.67.3.12 set_jack_mode()

```
void seq64::perfedit::set_jack_mode ( )
```

To avoid a lot of pointer dereferencing, much of the code is offloaded to perform::set_jack_mode(), which now returns a boolean.

13.67.3.13 set_transpose()

```
void seq64::perfedit::set_transpose (
            int transpose )
```

Parameters

transpose	The amount to transpose the transposable sequences. We need to add validation at some point, if the widget does not enforce that.

13.67.3.14 transpose_button_callback()

```
void seq64::perfedit::transpose_button_callback (
            int transpose )
```

Parameters

transpose	The amount to transpose the transposable sequences.

13.67.3.15 set_beats_per_bar()

```
void seq64::perfedit::set_beats_per_bar (
            int bpm )  [private]
```

The usage of is modified was faulty. Offloaded it to the perform object to make it more foolproof. See the perform::modify() function.

Parameters

bpm	Provides the beats/measure or beats/bar value to be set. This value is basically the numerator of the time signature.

13.67.3.16 set_beat_width()

```
void seq64::perfedit::set_beat_width (
            int bw )  [private]
```

The usage of is modified was faulty. Offloaded it to the perform object to make it more foolproof. See the perform::modify() function.

Parameters

bw	Provides the beat width to be set. The beat width is basically the denominator of the time signature.

13.67.3.17 set_snap()

```
void seq64::perfedit::set_snap (
            int snap )  [private]
```

Parameters

snap	Provide the snap value to be set. This value is basically the numerator of the expression "1 / snap".

13.67.3.18 set_guides()

```
void seq64::perfedit::set_guides ( )  [private]
```

See the set_snap() function.

It's a little confusing; I assigned the label "m_standard_bpm" to the value 4 in "measure_pulse = 192 ∗ 4 ∗ m_bpm / m_bw", but I am not sure I understand this equation... why the extra factor of 4? That 4 appears in "c_ppqn ∗ 4" a lot in the original code.

13.67.3.19 grow()

```
void seq64::perfedit::grow ( )  [private]
```

Make sure that setting the modified flag makes sense for this operation. It doesn't seem to modify members.

13.67.3.20 set_looped()

```
void seq64::perfedit::set_looped ( )  [private]
```

13.67.3.21 expand()

```
void seq64::perfedit::expand ( )  [private]
```

This action opens up a space of events between the L and R (left and right) markers. This action is preceded by pushing an Undo operation in the perform object, moving its triggers, and telling the perfroll to redraw.

13.67.3.22 collapse()

```
void seq64::perfedit::collapse ( )  [private]
```

This action removes all events between the L and R (left and right) markers. This action is preceded by pushing an Undo operation in the perform object, not moving its triggers (they go away), and telling the perfroll to redraw.

13.67.3.23 copy()

```
void seq64::perfedit::copy ( )  [private]
```

This action opens up a space of events between the L and R (left and right) markers, and copies the information from the same amount of events that follow the R marker. This action is preceded by pushing an Undo operation in the perform object, copying its triggers, and telling the perfroll to redraw.

13.67.3.24 undo()

```
void seq64::perfedit::undo ( )  [private]
```

We pop an Undo trigger, and then ask the perfroll to queue up a (re)drawing action.

13.67.3.25 redo()

```
void seq64::perfedit::redo ( )  [private]
```

We pop an Redo trigger, and then ask the perfroll to queue up a (re)drawing action.

13.67.3.26 popup_menu()

```
void seq64::perfedit::popup_menu (
            Gtk::Menu * menu )  [private]
```

13.67.3.27 draw_sequences()

```
void seq64::perfedit::draw_sequences ( )  [private]
```

This is meant to be called when the focus of an open seqedit or eventedit window changes.

13.67.3.28 timeout()

```
bool seq64::perfedit::timeout ( )  [private]
```

It redraws "dirty" sequences in the perfroll and the perfnames objects, and shows draw progress on the perfroll. It also changes the pause/play image if the status of running has changed. This function is called frequently and continuously. It will work for both perfedit windows, if both are up.

13.67.3.29 set_image()

```
void seq64::perfedit::set_image (
            bool isrunning )  [private]
```

Parameters

isrunning	If true, the image should be the pause image. Otherwise, it should be the play image.

13.67.3.30 start_playing()

```
void seq64::perfedit::start_playing ( )  [private]
```

JACK will be used if it is present and, in the application, enabled and working. Note the new flag to let perform know that it is a pause/play request from the perfedit window. In other words, a forced Song mode.

13.67.3.31 pause_playing()

```
void seq64::perfedit::pause_playing ( )  [private]
```

Keeps the stop button enabled as a kind of rewind for ALSA. Stop in place!

13.67.3.32 stop_playing()

```
void seq64::perfedit::stop_playing ( )  [private]
```

We need to make the progress line move back to the beginning right away here.

13.67.3.33 toggle_playing()

```
void seq64::perfedit::toggle_playing ( )  [inline], [private]
```

Meant only to be called when the "Play" button is pressed. Currently, the GUI does not change. This function will ultimately act like a Pause/Play button, but currently the pause functionality on works (partially) for JACK transport. Currently not used.

13.67.3.34 on_realize()

```
void seq64::perfedit::on_realize ( )  [private]
```

13.67.3.35 on_key_press_event()

```
bool seq64::perfedit::on_key_press_event (
            GdkEventKey * ev )  [private]
```

By default, the space-bar starts the playing, and the Escape key stops the playing. The start/end key may be the same key (i.e. space-bar), allow toggling when the same key is mapped to both triggers. Note that we now pass false in the call to perform::playback_key_event(), if SEQ64_PAUSE_SUPPORT is compiled in. Song mode doesn't yield the pause effect we want.

Parameters

ev	Provides the key event to implement.

13.67.3.36 on_key_release_event()

```
bool seq64::perfedit::on_key_release_event (
            GdkEventKey * ev )  [private]
```

It is needed to turn off the fast-forward and rewind keys functionality when released.

Parameters

ev	Provides the key event to implement.

13.67.3.37 on_delete_event()

```
bool seq64::perfedit::on_delete_event (
            GdkEventAny *  )  [inline], [private]
```

13.67.4 Friends And Related Function Documentation

13.67.4.1 update_perfedit_sequences

```
void update_perfedit_sequences ( )  [friend]
```

It is used by other objects (seqedit and eventedit) that can modify the currently-edited sequence shown in the perfedit (song window).

13.67.5 Field Documentation

13.67.5.1 m_peer_perfedit

```
perfedit* seq64::perfedit::m_peer_perfedit  [private]
```

13.67.5.2 m_table

```
Gtk::Table* seq64::perfedit::m_table  [private]
```

Layout table for song editor.

13.67.5.3 m_vadjust

```
Gtk::Adjustment* seq64::perfedit::m_vadjust  [private]
```

13.67.5.4 m_hadjust

```
Gtk::Adjustment* seq64::perfedit::m_hadjust  [private]
```

13.67.5.5 m_vscroll

```
Gtk::VScrollbar* seq64::perfedit::m_vscroll  [private]
```

13.67.5.6 m_hscroll

```
Gtk::HScrollbar* seq64::perfedit::m_hscroll  [private]
```

13.67.5.7 m_perfnames

```
perfnames* seq64::perfedit::m_perfnames  [private]
```

13.67.5.8 m_perfroll

```
perfroll* seq64::perfedit::m_perfroll  [private]
```

13.67.5.9 m_perftime

```
perftime* seq64::perfedit::m_perftime  [private]
```

13.67.5.10 m_menu_snap

```
Gtk::Menu* seq64::perfedit::m_menu_snap  [private]
```

13.67.5.11 m_menu_xpose

```
Gtk::Menu* seq64::perfedit::m_menu_xpose  [private]
```

13.67.5.12 m_button_xpose

```
Gtk::Button* seq64::perfedit::m_button_xpose  [private]
```

13.67.5.13 m_entry_xpose

```
Gtk::Entry* seq64::perfedit::m_entry_xpose  [private]
```

13.67.5.14 m_image_play

```
Gtk::Image* seq64::perfedit::m_image_play  [private]
```

13.67.5.15 m_button_snap

```
Gtk::Button* seq64::perfedit::m_button_snap  [private]
```

13.67.5.16 m_entry_snap

```
Gtk::Entry* seq64::perfedit::m_entry_snap  [private]
```

13.67.5.17 m_button_stop

```
Gtk::Button* seq64::perfedit::m_button_stop  [private]
```

13.67.5.18 m_button_play

```
Gtk::Button* seq64::perfedit::m_button_play  [private]
```

The Play button object.

13.67.5.19 m_button_loop

```
Gtk::ToggleButton* seq64::perfedit::m_button_loop  [private]
```

13.67.5.20 m_button_expand

```
Gtk::Button* seq64::perfedit::m_button_expand  [private]
```

13.67.5.21 m_button_collapse

```
Gtk::Button* seq64::perfedit::m_button_collapse  [private]
```

13.67.5.22 m_button_copy

```
Gtk::Button* seq64::perfedit::m_button_copy  [private]
```

13.67.5.23 m_button_grow

```
Gtk::Button* seq64::perfedit::m_button_grow  [private]
```

13.67.5.24 m_button_undo

```
Gtk::Button* seq64::perfedit::m_button_undo  [private]
```

13.67.5.25 m_button_redo

```
Gtk::Button* seq64::perfedit::m_button_redo  [private]
```

13.67.5.26 m_button_jack

```
Gtk::ToggleButton* seq64::perfedit::m_button_jack  [private]
```

13.67.5.27 m_button_follow

```
Gtk::ToggleButton* seq64::perfedit::m_button_follow  [private]
```

13.67.5.28 m_button_bpm

```
Gtk::Button* seq64::perfedit::m_button_bpm  [private]
```

13.67.5.29 m_entry_bpm

```
Gtk::Entry* seq64::perfedit::m_entry_bpm  [private]
```

13.67.5.30 m_button_bw

```
Gtk::Button* seq64::perfedit::m_button_bw  [private]
```

13.67.5.31 m_entry_bw

```
Gtk::Entry* seq64::perfedit::m_entry_bw  [private]
```

13.67.5.32 m_hbox

```
Gtk::HBox* seq64::perfedit::m_hbox  [private]
```

13.67.5.33 m_hlbox

```
Gtk::HBox* seq64::perfedit::m_hlbox  [private]
```

13.67.5.34 m_tooltips

```
Gtk::Tooltips* seq64::perfedit::m_tooltips  [private]
```

13.67.5.35 m_menu_bpm

```
Gtk::Menu* seq64::perfedit::m_menu_bpm  [private]
```

Drop-down menu for beats/minute.

13.67.5.36 m_menu_bw

```
Gtk::Menu* seq64::perfedit::m_menu_bw  [private]
```

13.67.5.37 m_snap

```
int seq64::perfedit::m_snap  [private]
```

13.67.5.38 m_bpm

```
int seq64::perfedit::m_bpm  [private]
```

Do not confuse it with BPM (beats per minute). The numerator of the time signature.

13.67.5.39 m_bw

```
int seq64::perfedit::m_bw  [private]
```

The denominator of the time signature.

13.67.5.40 m_ppqn

```
int seq64::perfedit::m_ppqn  [private]
```

13.67.5.41 m_is_running

```
bool seq64::perfedit::m_is_running  [private]
```

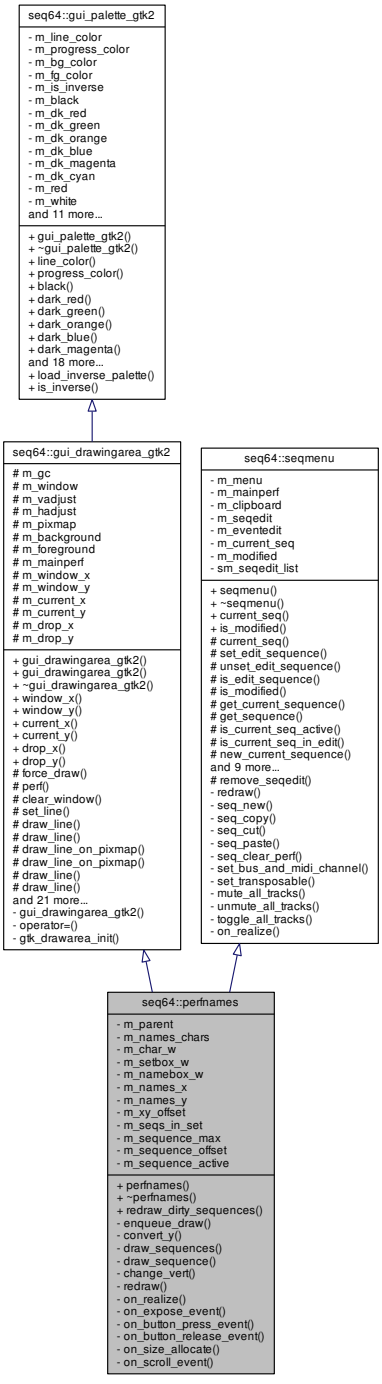
13.67.5.42 m_standard_bpm

```
int seq64::perfedit::m_standard_bpm  [private]
```

13.68 seq64::perfnames Class Reference

This class implements the left-side keyboard in the patterns window.

Inheritance diagram for seq64::perfnames:



Public Member Functions

- perfnames (perform &p, perfedit &parent, Gtk::Adjustment &vadjust)

  Principal constructor for this user-interface object.
- virtual ~perfnames ()

  Let's provide a do-nothing virtual destructor.
- void redraw_dirty_sequences ()

  Redraws sequences that have been modified.

Private Member Functions

- void enqueue_draw ()

  Wraps queue_draw() and forwards the call to the parent perfedit, so that it can forward it to any other perfedit that exists, and to the other sub-elements of the song editor.
- int convert_y (int y)

  Converts a y-value into a sequence number and returns it.
- void draw_sequences ()

  New function to encapsulate forced redrawing of all sequence names in the current viewport.
- void draw_sequence (int sequence)

  Draw the given sequence.
- void change_vert ()

  Change the vertial offset of a sequence/pattern.
- void redraw (int sequence)

  Redraw the given sequence.
- void on_realize ()

  Handles the callback when the window is realized.
- bool on_expose_event (GdkEventExpose *ev)

  Handles an on-expose event.
- bool on_button_press_event (GdkEventButton *ev)

  Provides the callback for a button press, and it handles only a left mouse button [the right mouse button is handled in on_button_release_event()].
- bool on_button_release_event (GdkEventButton *ev)

  Handles a button-release for the right button, bringing up a popup menu that is identical to the right-click popup menu for a slot in the patterns panel (mainwid), and context sensitive.
- void on_size_allocate (Gtk::Allocation &)

  Handles a size-allocation event.
- bool on_scroll_event (GdkEventScroll *ev)

  Handle the vertical scrolling of the window.

Private Attributes

- perfedit & m_parent

  Provides a link to the perfedit that created this object.
- int m_names_chars

  Provides the number of the characters in the name box.
- int m_char_w

  Provides the "real" width of a character.
- int m_setbox_w

  Provides the width of the "set number" box.
- int m_namebox_w

Provides the width of the "name" box.

- int m_names_x

  Provides the width of the names box, which is the width of a character for 24 characters.

- int m_names_y

  Provides the height of the names box, which is hardwired to 24 pixels.

- int m_xy_offset

  Provides the horizontal and vertical offsets of the text relative to the names box.

- const int m_seqs_in_set

  The number of sequences in a set, currently still hardwired to 32.

- const int m_sequence_max

  The maximum number of sequences, current 32 x 32 = 1024.

- int m_sequence_offset

  The offset from the 0th sequence, which is determined by the vertical view of the piano roll, controlled by the vertical scroll-bar.

- bool m_sequence_active [c_max_sequence]

  Indicates if the given sequence is active or not.

Friends

- class perfedit

Additional Inherited Members

13.68.1 Detailed Description

It inherits from gui_drawingarea_gtk2 to support the font, color, and other GUI functionality, and from seqmenu to support the right-click Edit/New/Cut right-click menu.

Obsolete Note the usage of virtual base classes. Since these can add some extra overhead, we should determine if we can do without the virtuality (and indeed it doesn't seem to be needed).

13.68.2 Constructor & Destructor Documentation

13.68.2.1 perfnames()

```
seq64::perfnames::perfnames (
            perform & p,
            perfedit & parent,
            Gtk::Adjustment & vadjust )
```

Weird is that the window (x,y) are set to (c_names_x, 100), when c_names_y is 22 (now 24) in globals.h.

Parameters

p	Provides a reference to the main performance object of the application.
parent	Provides a reference to the object that contains this object, so that this object can tell the parent to queue up a drawing operation.
vadjust	Provides the vertical scrollbar object needed so that perfnames can respond to scrollbar cursor/thumb movement.

13.68.2.2 ~perfnames()

```
virtual seq64::perfnames::~perfnames ( )  [inline], [virtual]
```

13.68.3 Member Function Documentation

13.68.3.1 redraw_dirty_sequences()

```
void seq64::perfnames::redraw_dirty_sequences ( )
```

13.68.3.2 enqueue_draw()

```
void seq64::perfnames::enqueue_draw ( )  [private]
```

The parent perfedit will call perfnames::queue_draw() on behalf of this object, and it will pass a perfnames::enqueue_draw() to the peer perfedit's perfnames, if the peer exists.

13.68.3.3 convert_y()

```
int seq64::perfnames::convert_y (
            int y )  [private]
```

Used in figuring out which sequence to mute/unmute in the performance editor.

Parameters

y	The y value (within the vertical limits of the perfnames column to the left of the performance editor's piano roll.

Returns

Returns the sequence number corresponding to the y value.

13.68.3.4 draw_sequences()

```
void seq64::perfnames::draw_sequences ( )  [private]
```

13.68.3.5 draw_sequence()

```
void seq64::perfnames::draw_sequence (
            int seqnum )  [private]
```

This function has to be prepared to handle an almost endless list of sequences, including unused ones, to draw them all with compatible styles. The sequences are grouped by set-number. The set-number occurs every 32 sequences in the leftmost column of the window.

1. Render the set number, or a blank box, in leftmost column. If the y height of the first draw_rectangle is m_names_y + 1, then we get a black line for the blank tracks, looks ugly.
2. Make sure that the rectangle drawn with the proper background colors for various combinations of muting and highlighting, otherwise just the name is properly colored.
3. Render the column with the name of the sequence. The channel number ranges from 1 to 16, but SMF 0 is indicated on-screen by a channel number of 0. We get the label format from the perform object, for consistency across windows.

Parameters

seqnum	Index to the sequence information to be drawn.

13.68.3.6 change_vert()

```
void seq64::perfnames::change_vert ( )  [private]
```

13.68.3.7 redraw()

```
void seq64::perfnames::redraw (
            int sequence )  [inline], [private], [virtual]
```

This function is a virtual function of seqmenu that must be overridden in this class.

Parameters

sequence	Provides the number of the sequence to be redrawn.

Implements seq64::seqmenu.

13.68.3.8 on_realize()

```
void seq64::perfnames::on_realize ( )  [private]
```

It first calls the base-class version of on_realize(). Then it allocates any additional resources needed.

13.68.3.9 on_expose_event()

```
bool seq64::perfnames::on_expose_event (
            GdkEventExpose * ev )  [private]
```

It draws all of the sequences that will be visible.

We could actually optimize this a tiny bit, to save some additions in the for loop.

Parameters

ev	The expose event, not used.

Returns

Always returns true.

13.68.3.10 on_button_press_event()

```
bool seq64::perfnames::on_button_press_event (
            GdkEventButton * ev )  [private]
```

Two operations are supported by left-clicking on the sequence/track name:

```
-   Normal.  Toggles the mute status of the sequence that is clicked.
-   Shift.  Toggles the mutes status of all other sequences, making
    this operation an easy way to preview a single sequence in the
    performance editor, then bring back the rest of the tracks.
```

Parameters

ev	The mouse button event.

Returns

Always returns true.

13.68.3.11 on_button_release_event()

```
bool seq64::perfnames::on_button_release_event (
            GdkEventButton * p0 )  [private]
```

Parameters

p0	The button event.

Returns

Always returns false.

13.68.3.12 on_size_allocate()

```
void seq64::perfnames::on_size_allocate (
            Gtk::Allocation & a )  [private]
```

It first calls the base-class version of this function.

Parameters

a	The allocation event. It is passed to the base-class on_size_allocate() function, and then m_window_x and m_window_y are set to the width and height, respectively, of the allocation.

13.68.3.13 on_scroll_event()

```
bool seq64::perfnames::on_scroll_event (
            GdkEventScroll * ev )  [private]
```

The vertical value is incremented or decremented by the amount of the step increment, and the page is clamped to the new value.

Parameters

ev	The scrolling event.

Returns

Always returns true.

13.68.4 Friends And Related Function Documentation

13.68.4.1 perfedit

```
friend class perfedit  [friend]
```

13.68.5 Field Documentation

13.68.5.1 m_parent

```
perfedit& seq64::perfnames::m_parent  [private]
```

We want to support two perfedit windows, but the children of perfedit will have to communicate changes requiring a redraw through the parent.

13.68.5.2 m_names_chars

```
int seq64::perfnames::m_names_chars  [private]
```

Pretty much hardwired to 24 at present.

13.68.5.3 m_char_w

```
int seq64::perfnames::m_char_w  [private]
```

This value is obtained from a font-renderer accessor function.

13.68.5.4 m_setbox_w

```
int seq64::perfnames::m_setbox_w  [private]
```

This used to be hardwired to $6 * 2$ (character-width times two).

13.68.5.5 m_namebox_w

```
int seq64::perfnames::m_namebox_w  [private]
```

This used to be a weird calculation based on character width.

13.68.5.6 m_names_x

```
int seq64::perfnames::m_names_x  [private]
```

13.68.5.7 m_names_y

```
int seq64::perfnames::m_names_y  [private]
```

This value was once 22 pixels, but we need a little extra room for our new font. This extra room is compatible enough with the old font, as well.

13.68.5.8 m_xy_offset

```
int seq64::perfnames::m_xy_offset  [private]
```

Currently hardwired.

13.68.5.9 m_seqs_in_set

```
const int seq64::perfnames::m_seqs_in_set  [private]
```

13.68.5.10 m_sequence_max

```
const int seq64::perfnames::m_sequence_max  [private]
```

13.68.5.11 m_sequence_offset

```
int seq64::perfnames::m_sequence_offset  [private]
```

13.68.5.12 m_sequence_active

```
bool seq64::perfnames::m_sequence_active[c_max_sequence]  [private]
```

If this really is the true meaning of this value, we ought to get it directly from the sequence if we can.

13.69 seq64::perform Class Reference

This class supports the performance mode.

Public Types

- enum mute_op_t {
  MUTE_TOGGLE,
  MUTE_OFF,
  MUTE_ON }

  Provides settings for muting.
- enum ff_rw_button_t {
  FF_RW_REWIND,
  FF_RW_NONE,
  FF_RW_FORWARD }

  Provides setting for the fast-forward and rewind functionality.

Public Member Functions

- perform (gui_assistant &mygui, int ppqn=SEQ64_USE_DEFAULT_PPQN)

  This construction initializes a vast number of member variables, some of them public (but we're working on that)!
- ~perform ()

  The destructor sets some running flags to false, signals this condition, then joins the input and output threads if the were launched.
- bool is_modified () const

  'Getter' function for member m_is_modfied
- void modify ()

  'Setter' function for member m_is_modified This setter only sets the modified-flag to true.
- int ppqn () const

  'Getter' function for member m_ppqn
- int sequence_count () const

  'Getter' function for member m_sequence_count It is better to call this getter before bothering to even try to use a sequence.
- int sequence_max () const

  'Getter' function for member m_sequence_max
- bool is_control_status () const

  'Getter' function for member m_control_status
- void set_edit_sequence (int seqnum)

  'Setter' function for member m_edit_sequence
- void unset_edit_sequence (int seqnum)

  'Setter' function for member m_edit_sequence
- bool is_edit_sequence (int seqnum) const

  'Getter' function for member m_edit_sequence
- int get_beats_per_bar () const

  'Getter' function for member m_beats_per_bar
- void set_beats_per_bar (midibpm bpm)

  'Setter' function for member m_beats_per_bar
- int get_beat_width () const

  'Getter' function for member m_beat_width
- void set_beat_width (int bw)

  'Setter' function for member m_beat_width
- void clocks_per_metronome (int cpm)

  'Setter' function for member m_clocks_per_metronome
- int clocks_per_metronome () const

  'Getter' function for member m_clocks_per_metronome
- void set_32nds_per_quarter (int tpq)

  'Setter' function for member m_32nds_per_quarter
- int get_32nds_per_quarter () const

  'Getter' function for member m_32nds_per_quarter
- void us_per_quarter_note (long upqn)

  'Setter' function for member m_us_per_quarter_note
- long us_per_quarter_note () const

  'Getter' function for member m_us_per_quarter_note
- const gui_assistant & gui () const

  'Getter' function for member m_gui_support The const getter.
- gui_assistant & gui ()

  'Getter' function for member m_gui_support The un-const getter.
- const keys_perform & keys () const

'Getter' function for member m_gui_support.keys() The const getter.

- keys_perform & keys ()

  'Getter' function for member m_gui_support.keys() The un-const getter.

- mastermidibus & master_bus ()

  'Getter' function for member m_master_bus Obviously, this is a dangerous function, but we've got ya covered.

- void filter_by_channel (bool flag)

  'Setter' function for member m_master_bus.filter_by_channel()

- bool is_running () const

  'Getter' function for member m_running Could also be called "is_playing()".

- bool is_pattern_playing () const

  'Setter' function for member m_is_pattern_playing

- bool toggle_song_start_mode ()

  'Setter' function for member m_song_start_mode

- void song_start_mode (bool flag)

  'Setter' function for member m_song_start_mode

- bool song_start_mode () const

  'Getter' function for member m_song_start_mode

- bool is_jack_running () const

  'Getter' function for member m_jack_asst.is_running() This function is useful for announcing the status of JACK in user-interface items that only have access to the perform object.

- bool is_jack_master () const

  'Getter' function for member m_jack_asst.is_master() Also now includes is_jack_running(), since one cannot be JACK Master if JACK is not running.

- void enregister (performcallback *pfcb)

  Adds a pointer to an object to be notified by this perform object.

- void toggle_jack_mode ()
- bool set_jack_mode (bool mode)

  Encapsulates behavior needed by perfedit.

- bool get_toggle_jack () const

  'Getter' function for member m_jack_asst.get_jack_mode()

- void set_jack_stop_tick (midipulse tick)

  'Setter' function for member m_jack_asst.set_jack_stop_tick()

- unsigned short combine_bytes (midibyte b0, midibyte b1)

  Combines bytes into an unsigned-short value.

- void FF_rewind ()

  Implements the fast-forward or rewind functionality imported from seq32.

- bool FF_RW_timeout ()

  Convenience function.

- void start_from_perfedit (bool flag)

  'Setter' function for member m_start_from_perfedit

- bool start_from_perfedit () const

  'Getter' function for member m_start_from_perfedit

- void set_follow_transport (bool flag)

  'Getter' function for member m_jack_asst.set_follow_transport()

- bool get_follow_transport () const

  'Getter' function for member m_jack_asst.get_follow_transport()

- void toggle_follow_transport ()

  'Setter' function for member m_jack_asst.toggle_follow_transport()

- void set_reposition (bool postype=true)

  'Getter' function for member m_reposition

- ff_rw_button_t ff_rw_type ()

'Getter' function for member m_FF_RW_button_type

- void ff_rw_type (ff_rw_button_t button_type)

  'Getter' function for member m_FF_RW_button_type
- void rewind (bool press)

  Sets the rewind status.
- void fast_forward (bool press)

  Sets the fast-forward status.
- void reposition (midipulse tick)

  Encapsulates some repositioning code needed to move the position to the mouse pointer location in perfroll.
- bool clear_all ()

  Clears all of the patterns/sequences.
- void launch (int ppqn)

  Calls the MIDI buss and JACK initialization functions and the input/output thread-launching functions.
- void new_sequence (int seq)

  Creates a new pattern/sequence for the given slot, and sets the new pattern's master MIDI bus address.
- void add_sequence (sequence *seq, int perf)

  Adds a pattern/sequence pointer to the list of patterns.
- void delete_sequence (int seq)

  Deletes a pattern/sequence by number.
- bool is_sequence_in_edit (int seq)

  Check if the pattern/sequence, given by number, has an edit in progress.
- void clear_sequence_triggers (int seq)

  Clears the patterns/sequence for the given sequence, if it is active.
- void print_triggers () const

  Shows all the triggers of all the sequences.
- void print_busses () const

  Shows all the triggers of all the sequences.
- void finish ()

  The rough opposite of launch(); it doesn't stop the threads.
- midipulse get_tick () const

  'Getter' function for member m_tick
- void set_tick (midipulse tick)

  'Setter' function for member m_tick
- midipulse get_jack_tick () const

  'Getter' function for member m_jack_tick
- void set_jack_tick (midipulse tick)

  'Setter' function for member m_jack_tick
- void set_left_tick (midipulse tick, bool setstart=true)

  Set the left marker at the given tick.
- midipulse get_left_tick () const

  'Getter' function for member m_left_tick
- void set_start_tick (midipulse tick)

  'Setter' function for member m_starting_tick
- midipulse get_start_tick () const

  'Setter' function for member m_starting_tick
- void set_right_tick (midipulse tick, bool setstart=true)

  Set the right marker at the given tick.
- midipulse get_right_tick () const

  'Getter' function for member m_right_tick
- double left_right_size () const

  Convenience function for JACK support when loop in song mode.

- bool is_active (int seq) const

  Checks the pattern/sequence for activity.
- void apply_song_transpose ()

  Calls the apply_song_transpose() function for all active sequences.
- void set_transpose (int t)

  'Setter' function for member m_transpose For sanity's sake, the values are restricted to +-64.
- int get_transpose () const

  'Getter' function for member m_transpose
- midibpm get_beats_per_minute ()

  'Getter' function for member m_master_bus.get_beats_per_minute Retrieves the BPM setting of the master MIDI buss.
- void clear_mute_groups ()

  Clears all the group-mute items, whether they came from the "rc" file or from the most recently-loaded Sequencer64 MIDI file.
- bool reload_mute_groups (std::string &errmessage)

  Reloads the mute groups from the "rc" file.
- void set_sequence_control_status (int status)

  If the given status is present in the c_status_snapshot, the playing state is saved.
- void unset_sequence_control_status (int status)

  If the given status is present in the c_status_snapshot, the playing state is restored.
- void sequence_playing_toggle (int seq)

  If the given sequence is active, then it is toggled as per the current value of m_control_status.
- void sequence_playing_change (int seq, bool on)

  Turn the playing of a sequence on or off, if it is active.
- void sequence_playing_on (int seq)

  Calls sequence_playing_change() with a value of true.
- void sequence_playing_off (int seq)

  Calls sequence_playing_change() with a value of false.
- void mute_all_tracks (bool flag=true)

  Mutes/unmutes all tracks in the current set of active patterns/sequences.
- void toggle_all_tracks ()

  Toggles the mutes status of all tracks in the current set of active patterns/sequences.
- bool armed_saved () const

  'Getter' function for member m_armed_saved
- void toggle_playing_tracks ()
- void mute_screenset (int ss, bool flag=true)

  Mutes/unmutes all tracks in the desired screen-set.
- void output_func ()

  Performance output function.
- void input_func ()

  This function is called by input_thread_func().
- void set_group_mute_state (int gtrack, bool muted)

  This function sets the mute state of an element in the m_mute_group array.
- bool get_group_mute_state (int gtrack)

  The opposite of set_group_mute_state(), it gets the value of the desired track.
- void set_offset (int offset)

  Calculates the offset into the screen sets.
- int get_offset () const

  'Getter' function for member m_offset
- void save_playing_state ()

  For all active patterns/sequences, this function gets the playing status and saves it in m_sequence_state[i].

- void restore_playing_state ()

  For all active patterns/sequences, this function gets the playing status from m_sequence_state[i] and sets it for the sequence.
- std::string key_name (unsigned int k) const

  Here follows a few forwarding functions for the keys_perform-derived classes.
- keys_perform::SlotMap & get_key_events ()

  Forwarding function for key events.
- keys_perform::SlotMap & get_key_groups ()

  Forwarding function for key groups.
- keys_perform::RevSlotMap & get_key_events_rev ()

  Forwarding function for reverse key events.
- keys_perform::RevSlotMap & get_key_groups_rev ()

  Forwarding function for reverse key groups.
- bool show_ui_sequence_key () const

  'Getter' function for member m_show_ui_sequency_key Provides access to keys().show_ui_sequence_key().
- void show_ui_sequence_key (bool flag)

  'Setter' function for member m_show_ui_sequency_key
- bool show_ui_sequence_number () const

  'Getter' function for member m_show_ui_sequency_number Provides access to keys().show_ui_sequence_number().
- void show_ui_sequence_number (bool flag)

  'Getter' function for member m_show_ui_sequency_number
- unsigned int lookup_keyevent_key (int seqnum)

  Gets the event key for the given sequence.
- long lookup_keyevent_seq (unsigned int keycode)

  Gets the sequence number for the given event key.
- unsigned int lookup_keygroup_key (long groupnum)

  Gets the group key for the given sequence.
- long lookup_keygroup_group (unsigned int keycode)

  Gets the group number for the given group key.
- void start_playing (bool songmode=false)

  Encapsulates a series of calls used in mainwnd.
- void pause_playing (bool songmode=false)

  Pause playback, so that progress bars stay where they are, and playback always resumes where it left off, at least in ALSA mode, which doesn't have to worry about being a "slave".
- void stop_playing ()

  Encapsulates a series of calls used in mainwnd.
- void start_key (bool songmode=false)

  Invoke the start key functionality.
- void pause_key (bool songmode=false)

  Invoke the pause key functionality.
- void stop_key ()

  Invoke the stop key functionality.
- void learn_toggle ()

  Encapsulates some calls used in mainwnd.
- midibpm decrement_beats_per_minute ()

  Encapsulates some calls used in mainwnd.
- midibpm increment_beats_per_minute ()

  Encapsulates some calls used in mainwnd.
- midibpm page_decrement_beats_per_minute ()

  Provides additional coarse control over the BPM value, which comes into force when the Page-Up/Page-Down keys are pressed.

- midibpm page_increment_beats_per_minute ()

  Provides additional coarse control over the BPM value, which comes into force when the Page-Up/Page-Down keys are pressed.
- int decrement_screenset ()

  Encapsulates some calls used in mainwnd.
- int increment_screenset ()

  Encapsulates some calls used in mainwnd.
- bool highlight (const sequence &seq) const

  True if a sequence is empty and should be highlighted.
- bool is_smf_0 (const sequence &seq) const

  True if the sequence is an SMF 0 sequence.
- const sequence * get_sequence (int seq) const

  Retrieves the actual sequence, based on the pattern/sequence number.
- sequence * get_sequence (int seq)

  Retrieves the actual sequence, based on the pattern/sequence number.
- void sequence_key (int seq)

  Handle a sequence key to toggle the playing of an active pattern in the selected screen-set.
- std::string sequence_label (const sequence &seq)

  Provides a way to format the sequence parameters string for display in the mainwid or perfnames modules.
- void set_input_bus (int bus, bool input_active)

  Sets the input bus, and handles the special "key labels on sequence" and "sequence numbers on sequence" functionality.
- void set_clock_bus (int bus, clock_e clocktype)

  Sets the clock value, as specified in the Options / MIDI Clocks tab.
- bool mainwnd_key_event (const keystroke &k)

  Provided for mainwnd :: on_key_press_event() and mainwnd :: on_key_release_event() to call.
- bool perfroll_key_event (const keystroke &k, int drop_sequence)

  Provided for perfroll :: on_key_press_event() and perfroll :: on_key_release_event() to call.
- bool playback_key_event (const keystroke &k, bool songmode=false)

  New function provided to unify the stop/start (space/escape) behavior of the various windows where playback can be started, paused, or stopped.
- void move_triggers (bool direction)

  If the left tick is less than the right tick, then, for each sequence that is active, its triggers are moved by the difference between the right and left in the specified direction.
- void copy_triggers ()

  If the left tick is less than the right tick, then, for each sequence that is active, its triggers are copied, offset by the difference between the right and left.
- void push_trigger_undo (int track=SEQ64_ALL_TRACKS)

  For every active sequence, call that sequence's push_trigger_undo() function.
- void pop_trigger_undo ()

  For every active sequence, call that sequence's pop_trigger_undo() function.
- void pop_trigger_redo ()

  For every active sequence, call that sequence's pop_trigger_redo() function.
- bool is_dirty_main (int seq)

  Checks the pattern/sequence for main-dirtiness.
- bool is_dirty_edit (int seq)

  Checks the pattern/sequence for edit-dirtiness.
- bool is_dirty_perf (int seq)

  Checks the pattern/sequence for perf-dirtiness.
- bool is_dirty_names (int seq)

  Checks the pattern/sequence for names-dirtiness.
- bool is_exportable (int seq) const

Indicates that the desired sequence is active, unmuted, and has a non-zero trigger count.

- void set_screenset (int ss)

  Sets the m_screenset value (the index or ID of the current screen set).
- int get_screenset () const

  'Getter' function for member m_screenset
- int get_playing_screenset () const

  'Getter' function for member m_playing_screen
- bool toggle_other_seqs (int seqnum, bool isshiftkey)

  This code handles the use of the Shift key to toggle the mute state of all other sequences.
- bool toggle_other_names (int seqnum, bool isshiftkey)

  This code handles the use of the Shift key to toggle the mute state of all other sequences.

Private Member Functions

- bool have_undo () const

  'Getter' function for member m_have_undo
- void set_have_undo (bool undo)

  'Setter' function for member m_have_undo Note that, if the undo parameter is true, then we mark the performance as modified.
- bool have_redo () const

  'Getter' function for member m_have_redo
- void set_have_redo (bool redo)

  'Setter' function for member m_have_redo
- void split_trigger (int seqnum, midipulse tick)

  Convenience function for perfroll's split-trigger functionality.
- midipulse get_max_trigger ()

  Locates the largest trigger value among the active sequences.
- void collapse ()

  Convenience function for perfedit's collapse functionality.
- void copy ()

  Convenience function for perfedit's copy functionality.
- void expand ()

  Convenience function for perfedit's expand functionality.
- midi_control & midi_control_toggle (int ctl)

  Retrieves a reference to a value from m_midi_cc_toggle[].
- midi_control & midi_control_on (int ctl)

  Retrieves a reference to a value from m_midi_cc_on[].
- midi_control & midi_control_off (int ctl)

  Retrieves a reference to a value from m_midi_cc_off[].
- void midi_control_event (const event &ev)

  This function encapsulates code in input_func() to make it easier to read and understand.
- void handle_midi_control (int control, bool state)

  Handle the MIDI Control values that provide some automation for the application.
- bool handle_midi_control_ex (int control, midi_control::action a)

  Provides operation of the new MIDI controls.
- const std::string & get_screen_set_notepad (int screen_set) const

  Retrieves the given string from m_screen_set_notepad[].
- const std::string & current_screen_set_notepad () const

  Returns the notepad text for the current screen-set.
- void set_screen_set_notepad (int screenset, const std::string &note)

Copies the given string into m_screen_set_notepad[].

- void set_screen_set_notepad (const std::string &note)

  Sets the notepad text for the current screen-set.
- void set_playing_screenset ()

  Sets the screen set that is active, based on the value of m_screenset.
- bool any_group_unmutes () const

  'Getter' function for member m_mute_group[]
- void print_group_unmutes () const

  This function is a way to dump the mute-group settings in a way independent of the code in the optionsfile module, for debugging.
- void mute_group_tracks ()

  If m_mode_group is true, then this function operates.
- void select_and_mute_group (int g_group)

  Select a mute group and then mutes the track in the group.
- void set_song_mute (mute_op_t op)

  Provides for various settings of the song-mute status of all sequences in the song.
- void set_mode_group_mute ()

  'Setter' function for member m_mode_group
- void unset_mode_group_mute ()

  'Setter' function for member m_mode_group Unsets this member.
- void select_group_mute (int g_mute)

  If we're in group-learn mode, then this function gets the playing statuses of all of the sequences in the current play-screen, and copies them into the desired mute-group.
- void set_mode_group_learn ()

  Sets the group-mute mode, then the group-learn mode, then notifies all of the notification subscribers.
- void unset_mode_group_learn ()

  Notifies all of the notification subscribers that group-learn is being turned off.
- bool is_group_learning ()

  'Getter' function for member m_mode_group_learn
- void set_and_copy_mute_group (int group)

  When in group-learn mode, for active sequences, the mute-group settings are set based on the playing status of each sequence.
- bool activate ()

  Performs a controlled activation of the jack_assistant and other JACK modules.
- void start (bool state)

  If JACK is not running, call inner_start() with the given state.
- void stop ()

  If JACK is not running, call inner_stop().
- void start_jack ()

  If JACK is supported, starts the JACK transport.
- void stop_jack ()

  If JACK is supported, stops the JACK transport.
- void position_jack (bool state, midipulse tick=0)

  If JACK is supported and running, sets the position of the transport.
- void off_sequences ()

  For all active patterns/sequences, set the playing state to false.
- void all_notes_off ()

  For all active patterns/sequences, turn off its playing notes.
- void set_active (int seq, bool active)

  Sets or unsets the active state of the given pattern/sequence number.
- void set_was_active (int seq)

Sets was-active flags: main, edit, perf, and names.

- void reset_sequences (bool pause=false)

  For all active patterns/sequences, get its playing state, turn off the playing notes, set playing to false, zero the markers, and, if not in playback mode, restore the playing state.
- void play (midipulse tick)

  Plays all notes to the current tick.
- void set_orig_ticks (midipulse tick)

  For every pattern/sequence that is active, sets the "original tick" value for the pattern.
- void set_beats_per_minute (midibpm bpm)

  Sets the value of the BPM into the master MIDI buss, after making sure it is squelched to be between 20 and 500.
- void set_looping (bool looping)

  'Setter' function for member m_looping
- int max_active_set () const

  Checks the whole universe of sequences to determine the current last-active set, that is, the highest set that has any active sequences in it.
- void launch_input_thread ()

  Creates the input thread using input_thread_func().
- void launch_output_thread ()

  Creates the output thread using output_thread_func().
- bool init_jack_transport ()

  Initializes JACK support, if SEQ64_JACK_SUPPORT is defined.
- bool deinit_jack_transport ()

  Tears down the JACK infrastructure.
- bool seq_in_playing_screen (int seq)

  A helper function for determining if the mode group is in force, the playing screenset is the same as the current screenset, and the sequence is in the range of the playing screenset.
- void is_modified (bool flag)

  'Setter' function for member m_is_modified
- bool valid_midi_control_seq (int seq) const

  Checks the parameter against c_midi_controls_extended.
- bool is_screenset_valid (int screenset) const

  Checks the screenset against m_max_sets.
- void set_running (bool running)

  'Setter' function for member m_running
- void is_pattern_playing (bool flag)

  'Setter' function for member m_is_pattern_playing
- void set_playback_mode (bool playbackmode)

  'Setter' function for member m_playback_mode
- int mute_group_offset (int track)

  A helper function to calculate the index into the mute-group array, based on the desired track.
- bool is_seq_valid (int seq) const

  Provides common code to check for the bounds of a sequence number.
- bool is_mseq_valid (int seq) const

  Validates the sequence number, which is important since they're currently used as array indices.
- bool install_sequence (sequence *seq, int seqnum)

  A private helper function for add_sequence() and new_sequence().
- void inner_start (bool state)

  Locks on m_condition_var.
- void inner_stop (bool midiclock=false)

  Unconditionally, and without locking, clears the running status, resets the sequences, and sets m_usemidiclock false.
- int clamp_track (int track) const

Provides common code to keep the track value valid.

- void set_key_event (unsigned int keycode, long sequence_slot)

  At construction time, this function sets up one keycode and one event slot.
- void set_key_group (unsigned int keycode, long group_slot)

  At construction time, this function sets up one keycode and one group slot.
- bool create_master_bus ()

  Creates the mastermidibus.
- void add_clock (clock_e clocktype)

  Saves the clock settings read from the "rc" file so that they can be passed to the mastermidibus after it is created.
- void set_clock (int bus, clock_e clocktype)

  Sets a single clock item, if in the currently existing range.
- void add_input (bool flag)

  Saves the input settings read from the "rc" file so that they can be passed to the mastermidibus after it is created.
- void set_input (int bus, bool inputing)

  Sets a single input item, if in the currently existing range.
- bool get_input (int bus)
- bool is_input_system_port (int bus)

Private Attributes

- bool m_song_start_mode

  If true, playback is done in Song mode, not Live mode.
- bool m_start_from_perfedit

  Indicates that, no matter what the current Song/Live setting, the playback was started from the perfedit window.
- bool m_reposition

  It seems that this member, if true, forces a repositioning to the left (L) tick marker.
- float m_excell_FF_RW

  Provides an "acceleration" factor for the fast-forward and rewind functionality.
- ff_rw_button_t m_FF_RW_button_type

  Indicates whether the fast-forward or rewind key is in effect in the perfedit window.
- bool m_mute_group [c_max_sequence]

  Mute group support.
- bool m_armed_saved

  Indicates if the m_saved_armed_statuses[] values are the saved state of the sequences, and can be restored.
- bool m_armed_statuses [c_max_sequence]

  Holds the "global" saved status of the playing tracks, for restoration after saving.
- bool m_tracks_mute_state [c_seqs_in_set]

  Holds the current mute states of each track.
- bool m_mode_group

  If true, indicates that a mode group is selected, and playing statuses will be "memorized".
- bool m_mode_group_learn

  If true, indicates that a group learn is selected, which also "memorizes" a mode group, and notifies subscribers of a group-learn change.
- int m_mute_group_selected

  Selects a group to mute.
- int m_playing_screen

  Playing screen support.
- int m_playscreen_offset

  Playing screen sequence number offset.
- sequence * m_seqs [c_max_sequence]

Provides a "vector" of patterns/sequences.

- bool m_seqs_active [c_max_sequence]

  Each boolean value in this array is set to true if a sequence is active, meaning that it will be used to hold some kind of MIDI data, even if only Meta events.
- bool m_was_active_main [c_max_sequence]

  Each boolean value in this array is set to true if a sequence was active, meaning that it was found to be active at the time we were setting it to inactive.
- bool m_was_active_edit [c_max_sequence]

  Each boolean value in this array is set to true if a sequence was active, meaning that it was found to be active at the time we were setting it to inactive.
- bool m_was_active_perf [c_max_sequence]

  Each boolean value in this array is set to true if a sequence was active, meaning that it was found to be active at the time we were setting it to inactive.
- bool m_was_active_names [c_max_sequence]

  Each boolean value in this array is set to true if a sequence was active, meaning that it was found to be active at the time we were setting it to inactive.
- bool m_sequence_state [c_max_sequence]

  Saves the current playing state of each pattern.
- int m_transpose

  Holds the global MIDI transposition value.
- pthread_t m_out_thread

  Provides information for managing pthreads.
- pthread_t m_in_thread

  Provides a "handle" to the input thread.
- bool m_out_thread_launched

  Indicates that the output thread has been started.
- bool m_in_thread_launched

  Indicates that the input thread has been started.
- bool m_running

  Indicates that playback is running.
- bool m_is_pattern_playing

  Indicates that a pattern is playing.
- bool m_inputing

  Indicates that events are being written to the MIDI input busses in the input thread.
- bool m_outputing

  Indicates that events are being written to the MIDI output busses in the output thread.
- bool m_looping

  Indicates that status of the "loop" button in the performance editor.
- bool m_playback_mode

  Specifies the playback mode.
- int m_ppqn

  Holds the current PPQN for usage in various actions.
- midibpm m_bpm

  Holds the current BPM (beats per minute) for later usage.
- int m_beats_per_bar

  Holds the beats/bar value as obtained from the MIDI file.
- int m_beat_width

  Holds the beat width value as obtained from the MIDI file.
- int m_clocks_per_metronome

  Augments the beats/bar and beat-width with the additional values included in a Time Signature meta event.
- int m_32nds_per_quarter

  Augments the beats/bar and beat-width with the additional values included in a Time Signature meta event.

- long m_us_per_quarter_note

  Augments the beats/bar and beat-width with the additional values included in a Tempo meta event.
- mastermidibus * m_master_bus

  Provides our MIDI buss.
- std::vector< clock_e > m_master_clocks

  Saves the clock settings obtained from the "rc" (options) file so that they can be loaded into the mastermidibus once it is created.
- std::vector< bool > m_master_inputs

  Saves the input settings obtained from the "rc" (options) file so that they can be loaded into the mastermidibus once it is created.
- midipulse m_one_measure

  *Holds the "one measure's worth" of pulses (ticks), which is normally m_ppqn * 4.*
- midipulse m_left_tick

  Holds the position of the left (L) marker, and it is first defined as 0.
- midipulse m_right_tick

  Holds the position of the right (R) marker, and it is first defined as the end of the fourth measure.
- midipulse m_starting_tick

  Holds the starting tick for playing.
- midipulse m_tick

  MIDI Clock support.
- midipulse m_jack_tick

  Let's try to save the last JACK pad structure tick for re-use with resume after pausing.
- bool m_usemidiclock

  More MIDI clock support.
- bool m_midiclockrunning

  More MIDI clock support.
- int m_midiclocktick

  More MIDI clock support.
- int m_midiclockpos

  More MIDI clock support.
- bool m_dont_reset_ticks

  Support for pause, which does not reset the "last tick" when playback stops/starts.
- std::string m_screen_set_notepad [c_max_sets]

  Used in the mainwnd class to set the notepad text for the given set.
- midi_control m_midi_cc_toggle [c_midi_controls_extended]

  Provides the settings of MIDI Toggle, as read from the "rc" file.
- midi_control m_midi_cc_on [c_midi_controls_extended]

  Provides the settings of MIDI On, as read from the "rc" file.
- midi_control m_midi_cc_off [c_midi_controls_extended]

  Provides the settings of MIDI Off, as read from the "rc" file.
- int m_offset

  Holds the current offset into the screen-sets.
- int m_control_status

  Holds the OR'ed control status values.
- int m_screenset

  Indicates the number of the currently-selected screen-set.
- int m_seqs_in_set

  We will eventually replace c_seqs_in_set with this member, which defaults to the value of c_seqs_in_set.
- int m_max_sets

  A replacement for the c_max_sets constant.
- int m_sequence_count

Keeps track of created sequences, whether or not they are active.

- int m_sequence_max

  A replacement for the c_max_sequence constant.
- int m_sequence_high

  Indicates the highest-number sequence.
- int m_edit_sequence

  Hold the number of the currently-in-edit sequence.
- bool m_is_modified

  It may be a good idea to eventually centralize all of the dirtiness of a performance here.
- condition_var m_condition_var

  A condition variable to protect playback.
- jack_assistant m_jack_asst

  A wrapper object for the JACK support of this application.
- bool m_have_undo
- std::vector< int > m_undo_vect

  Holds the "track" numbers or the "all tracks" values for undo operations.
- bool m_have_redo
- std::vector< int > m_redo_vect

  Holds the "track" numbers or the "all tracks" values for redo operations.
- std::vector< performcallback * > m_notify
- gui_assistant & m_gui_support

  Support for a wide range of GUI-related operations.

Static Private Attributes

- static midi_control sm_mc_dummy

  Provides a dummy, inactive midi_control object to handle out-of-range midi_control indicies.

Friends

- class jack_assistant
- class keybindentry
- class mainwnd
- class midifile
- class optionsfile
- class options
- class perfedit
- class perfroll
- void * input_thread_func (void *myperf)

  Set up the performance, and set the process to realtime privileges.
- void * output_thread_func (void *myperf)

  Global functions defined in perform.cpp.
- int jack_sync_callback (jack_transport_state_t state, jack_position_t *pos, void *arg)

  Global functions for JACK support and JACK sessions.
- int jack_transport_callback (jack_nframes_t nframes, void *arg)
- void jack_shutdown (void *arg)
- void jack_timebase_callback (jack_transport_state_t state, jack_nframes_t nframes, jack_position_t *pos, int new_pos, void *arg)

  The JACK timebase function defined here sets the JACK position structure.
- long get_current_jack_position (void *arg)

13.69.1 Detailed Description

It has way too many data members, one of them public. Might be ripe for refactoring. That has its own dangers, of course.

13.69.2 Member Enumeration Documentation

13.69.2.1 mute_op_t

```
enum seq64::perform::mute_op_t
```

Enumerator

MUTE_TOGGLE	
MUTE_OFF	
MUTE_ON	

13.69.2.2 ff_rw_button_t

```
enum seq64::perform::ff_rw_button_t
```

Enumerator

FF_RW_REWIND	
FF_RW_NONE	
FF_RW_FORWARD	

13.69.3 Constructor & Destructor Documentation

13.69.3.1 perform()

```
seq64::perform::perform (
            gui_assistant & mygui,
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

Also note that we have a little issue with the fact that various sequences (patterns) can potentially have different beats/measure and beat-width values.

Currently, when reading the MIDI file, the beats/minute value is obtained from the MIDI file, if present, and this value is passed to perform::set_beats_per_minute(), which forwards it to the master MIDI buss and JACK assistant objects. This Tempo setting comes from both the Tempo meta event in track 0, and from the Seq24's c_bpm SeqSpec section! This setting is now also made for the two Time Signature values.

But note that Sequencer64 now scales the c_bpm value so that two extra digits of precision can be saved with the MIDI file. We went throughout the code, changing BPM from an integer to a double.

Parameters

mygui	Provides access to the GUI assistant that holds many things, including the containers of keys and the "events" they provide. This is a base-class reference; for a real class, see the gui_assistant_gtk2 class in the seq_gtkmm2 GUI-specific library. Note that we access the m_gui_support member using the gui() accessor function.
ppqn	The default, choosable, or actual PPQN value.

13.69.3.2 ~perform()

```
seq64::perform::~perform ( )
```

Finally, any active or inactive (but allocated) patterns/sequences are deleted, and their pointers nullified.

Note that we could use m_sequence_high to replace m_sequence_max in the for-loop, but who cares, we are exiting!

13.69.4 Member Function Documentation

13.69.4.1 is_modified() [1/2]

```
bool seq64::perform::is_modified ( ) const  [inline]
```

13.69.4.2 modify()

```
void seq64::perform::modify ( )  [inline]
```

The setter that will, is_modified(), is private. No one but perform and its friends should falsify this flag.

13.69.4.3 ppqn()

```
int seq64::perform::ppqn ( ) const  [inline]
```

13.69.4.4 sequence_count()

```
int seq64::perform::sequence_count ( ) const  [inline]
```

In many cases at startup, or when loading a file, there are no sequences yet, and still the code calls functions that try to access them.

13.69.4.5 sequence_max()

```
int seq64::perform::sequence_max ( ) const  [inline]
```

13.69.4.6 is_control_status()

```
bool seq64::perform::is_control_status ( ) const  [inline]
```

Returns

Returns true if the m_control_status value is non-zero, which means that there is a queue, replace, or snapshot functionality in progress.

13.69.4.7 set_edit_sequence()

```
void seq64::perform::set_edit_sequence (
            int seqnum )  [inline]
```

Parameters

seqnum	Pass in -1 to disable the edit-sequence number unconditionally. Use unset_edit_sequence() to disable it if it matches the current edit-sequence number.

13.69.4.8 unset_edit_sequence()

```
void seq64::perform::unset_edit_sequence (
            int seqnum )  [inline]
```

Disables the edit-sequence number if it matches the parameter.

Parameters

seqnum	The sequence number of the sequence to unset.

13.69.4.9 is_edit_sequence()

```
bool seq64::perform::is_edit_sequence (
            int seqnum ) const  [inline]
```

Parameters

seqnum	Tests the parameter against m_edit_sequence. Returns true if that member is not -1, and the parameter matches it.

13.69.4.10 get_beats_per_bar()

```
int seq64::perform::get_beats_per_bar ( ) const  [inline]
```

13.69.4.11 set_beats_per_bar()

```
void seq64::perform::set_beats_per_bar (
            midibpm bpm )  [inline]
```

Parameters

bpm	Provides the value for beats/measure. Also used to set the beats/measure in the JACK assistant object.

13.69.4.12 get_beat_width()

```
int seq64::perform::get_beat_width ( ) const  [inline]
```

13.69.4.13 set_beat_width()

```
void seq64::perform::set_beat_width (
            int bw )  [inline]
```

Parameters

bw	Provides the value for beat-width. Also used to set the beat-width in the JACK assistant object.

13.69.4.14 clocks_per_metronome() [1/2]

```
void seq64::perform::clocks_per_metronome (
            int cpm )  [inline]
```

13.69.4.15 clocks_per_metronome() [2/2]

```
int seq64::perform::clocks_per_metronome ( ) const  [inline]
```

13.69.4.16 set_32nds_per_quarter()

```
void seq64::perform::set_32nds_per_quarter (
            int tpq )  [inline]
```

13.69.4.17 get_32nds_per_quarter()

```
int seq64::perform::get_32nds_per_quarter ( ) const  [inline]
```

13.69.4.18 us_per_quarter_note() [1/2]

```
void seq64::perform::us_per_quarter_note (
            long upqn )  [inline]
```

13.69.4.19 us_per_quarter_note() [2/2]

```
long seq64::perform::us_per_quarter_note ( ) const  [inline]
```

13.69.4.20 gui() [1/2]

```
const gui_assistant& seq64::perform::gui ( ) const  [inline]
```

13.69.4.21 gui() [2/2]

```
gui_assistant& seq64::perform::gui ( )  [inline]
```

13.69.4.22 keys() [1/2]

```
const keys_perform& seq64::perform::keys ( ) const  [inline]
```

13.69.4.23 keys() [2/2]

```
keys_perform& seq64::perform::keys ( )  [inline]
```

13.69.4.24 master_bus()

```
mastermidibus& seq64::perform::master_bus ( )  [inline]
```

13.69.4.25 filter_by_channel()

```
void seq64::perform::filter_by_channel (
            bool flag )  [inline]
```

13.69.4.26 is_running()

```
bool seq64::perform::is_running ( ) const  [inline]
```

13.69.4.27 is_pattern_playing() [1/2]

```
bool seq64::perform::is_pattern_playing ( ) const  [inline]
```

13.69.4.28 toggle_song_start_mode()

```
bool seq64::perform::toggle_song_start_mode ( )  [inline]
```

13.69.4.29 song_start_mode() [1/2]

```
void seq64::perform::song_start_mode (
            bool flag )  [inline]
```

13.69.4.30 song_start_mode() [2/2]

```
bool seq64::perform::song_start_mode ( ) const  [inline]
```

13.69.4.31 is_jack_running()

```
bool seq64::perform::is_jack_running ( ) const  [inline]
```

13.69.4.32 is_jack_master()

```
bool seq64::perform::is_jack_master ( ) const  [inline]
```

13.69.4.33 enregister()

```
void seq64::perform::enregister (
            performcallback * pfcb )  [inline]
```

Parameters

pfcb	Provides the pointer to the performance callback.

13.69.4.34 toggle_jack_mode()

```
void seq64::perform::toggle_jack_mode ( )  [inline]
```

13.69.4.35 set_jack_mode()

```
bool seq64::perform::set_jack_mode (
            bool jack_button_active )
```

Note that we moved some of the code from perfedit::set_jack_mode() [the seq32 version] to this function.

Parameters

jack_button_active	Indicates if the perfedit JACK button shows it is active.

Returns

Returns true if JACK is running currently, and false otherwise.

13.69.4.36 get_toggle_jack()

```
bool seq64::perform::get_toggle_jack ( ) const  [inline]
```

13.69.4.37 set_jack_stop_tick()

```
void seq64::perform::set_jack_stop_tick (
            midipulse tick )  [inline]
```

13.69.4.38 combine_bytes()

```
unsigned short seq64::perform::combine_bytes (
            midibyte b0,
            midibyte b1 )
```

http://www.blitter.com/~russtopia/MIDI/~jglatt/tech/midispec/wheel.htm

Two data bytes follow the status. The two bytes should be combined together to form a 14-bit value. The first data byte's bits 0 to 6 are bits 0 to 6 of the 14-bit value. The second data byte's bits 0 to 6 are really bits 7 to 13 of the 14-bit value. In other words, assuming that a C program has the first byte in the variable First and the second data byte in the variable Second, here's how to combine them into a 14-bit value (actually 16-bit since most computer CPUs deal with 16-bit, not 14-bit, integers).

Parameters

b0	The first byte to be combined.
b1	The second byte to be combined.

Returns

Returns the bytes basically OR'd together.

13.69.4.39 FF_rewind()

```
void seq64::perform::FF_rewind ( )
```

It changes m_tick by a quarter of the number of ticks in a standard measure, with m_excell_FF_RW (defaults to one) to factor the difference.

13.69.4.40 FF_RW_timeout()

```
bool seq64::perform::FF_RW_timeout ( )
```

This function is used in the free function version of FF_RW_timeout() as a callback to the gtk_timeout() function. It multiplies m_excell_FF_RW by 1.1 as long as one of the fast-forward or rewind keys is held, and is less than 60.

Returns

Returns true if one of the fast-forward or rewind keys was held, leaving m_excell_FF_RW at the last value it had. Otherwise, it resets the value to 1, and returns false.

13.69.4.41 start_from_perfedit() [1/2]

```
void seq64::perform::start_from_perfedit (
            bool flag )  [inline]
```

13.69.4.42 start_from_perfedit() [2/2]

```
bool seq64::perform::start_from_perfedit ( ) const  [inline]
```

13.69.4.43 set_follow_transport()

```
void seq64::perform::set_follow_transport (
            bool flag )  [inline]
```

13.69.4.44 get_follow_transport()

```
bool seq64::perform::get_follow_transport ( ) const  [inline]
```

13.69.4.45 toggle_follow_transport()

```
void seq64::perform::toggle_follow_transport ( )  [inline]
```

13.69.4.46 set_reposition()

```
void seq64::perform::set_reposition (
            bool postype = true )  [inline]
```

13.69.4.47 ff_rw_type() [1/2]

```
ff_rw_button_t seq64::perform::ff_rw_type ( )  [inline]
```

13.69.4.48 ff_rw_type() [2/2]

```
void seq64::perform::ff_rw_type (
            ff_rw_button_t button_type )  [inline]
```

13.69.4.49 rewind()

```
void seq64::perform::rewind (
            bool press )  [inline]
```

Parameters

press	If true, the status is set to FF_RW_REWIND, otherwise it is set to FF_RW_NONE.

13.69.4.50 fast_forward()

```
void seq64::perform::fast_forward (
```

```
            bool press )  [inline]
```

Parameters

press	If true, the status is set to FF_RW_FORWARD, otherwise it is set to FF_RW_NONE.

13.69.4.51 reposition()

```
void seq64::perform::reposition (
            midipulse tick )
```

Used only in perfroll :: on_key_press_event() to implement the Seq32 pointer-position feature.

Parameters

tick	Provides the position value to be set.

13.69.4.52 clear_all()

```
bool seq64::perform::clear_all ( )
```

The mainwnd module calls this function. Note that perform now handles the "is modified" flag on behalf of all external objects, to centralize and simplify the dirtying of a MIDI tune.

Anything else to clear? What about all the other sequence flags? We can beef up delete_sequence() for them, at some point.

Added stazed code from 1.0.5 to abort clearing if any of the sequences are in editing.

Returns

Returns true if the clear-all operation could be performed. If false, then at least one active sequence was in editing mode.

13.69.4.53 launch()

```
void seq64::perform::launch (
            int ppqn )
```

This function is called in main(). We collected all the calls here as a simplification, and renamed it because it is more than just initialization. This function must be called after the perform constructor and after the configuration file and command-line configuration overrides. The original implementation, where the master buss was an object, was too inflexible to handle a JACK implementation.

Parameters

ppqn	Provides the PPQN value, which is either the default value (192) or is read from the "user" configuration file.

Todo We probably need a bpm parameter for consistency at some point.

13.69.4.54 new_sequence()

```
void seq64::perform::new_sequence (
            int seq )
```

Then it activates the pattern [this is done in the install_sequence() function]. It doesn't deal with thrown exceptions.

This function is called by the seqmenu and mainwid objects to create a new sequence. We now pass this sequence to install_sequence() to better handle potential memory leakage, and to make sure the sequence gets counted. Also, adding a new sequence from the user-interface is a significant modification, so the "is modified" flag gets set.

Change Note ca 2016-05-15 If enabled, wire in the MIDI buss override.

Parameters

seq	The prospective sequence number of the new sequence.

13.69.4.55 add_sequence()

```
void seq64::perform::add_sequence (
            sequence * seq,
            int prefnum )
```

No check is made for a null pointer, but the install_sequence() call will make sure such a pointer is officially logged.

This function checks for the preferred sequence number. This is the number that was specified by the Sequence Number meta-event for the current track. If the preferred sequence number is in the valid range (0 to m_sequence↩ _max) and it is not active, add it and activate it. Otherwise, iterate through all patterns from prefnum to m_↩ sequence_max and add and activate the first one that is not active, and then finish.

Finally, note that this function is used only by midifile, when reading in a MIDI song. Therefore, the "is modified" flag is *not* set by this function; loading a sequence from a file is not a modification that should lead to a prompt for saving the file later.

Todo Shouldn't we wrap around the sequence list if we can't find an empty sequence slot after prefnum?

Todo This function needs some deeper analysis against the original, in my opinion.

Warning

> The logic of the if-statement in this function was such that *prefnum* could be out-of-bounds in the else-clause. We reworked the logic to be airtight. This bug was caught by gcc 4.8.3 on CentOS, but not on gcc 4.9.3 on Debian Sid!

Parameters

seq	The pointer to the pattern/sequence to add.
prefnum	The preferred sequence number of the pattern, as explained above. If this value is out-of-range, then it is basically ignored.

13.69.4.56 delete_sequence()

```
void seq64::perform::delete_sequence (
            int seq )
```

We now also solidify the deletion by setting the pointer to null after deletion, so it will blow up if accidentally accessed. The final act is to raise the "is modified" flag, since deleting an existing sequence is always a significant modification.

Now, this function obviously sets the "active" flag for the sequence to false. But there are a few other flags that are not modified; shouldn't we also falsify them here?

Parameters

seq	The sequence number of the sequence to be deleted. It is validated.

13.69.4.57 is_sequence_in_edit()

```
bool seq64::perform::is_sequence_in_edit (
            int seq )
```

Parameters

seq	Provides the sequence number to be checked.

Returns

Returns truen if the sequence's get_editing() call returns true. Otherwise, false is returned, which can also indicate an illegal sequence number.

13.69.4.58 clear_sequence_triggers()

```
void seq64::perform::clear_sequence_triggers (
            int seq )
```

Parameters

seq	Provides the desired sequence. The is_active() function validates this value.

13.69.4.59 print_triggers()

```
void seq64::perform::print_triggers ( ) const
```

13.69.4.60 print_busses()

```
void seq64::perform::print_busses ( ) const
```

13.69.4.61 finish()

```
void seq64::perform::finish ( )  [inline]
```

A minor simplification for the main() routine, hides the JACK support macro.

13.69.4.62 get_tick()

```
midipulse seq64::perform::get_tick ( ) const  [inline]
```

13.69.4.63 set_tick()

```
void seq64::perform::set_tick (
            midipulse tick )  [inline]
```

13.69.4.64 get_jack_tick()

```
midipulse seq64::perform::get_jack_tick ( ) const  [inline]
```

13.69.4.65 set_jack_tick()

```
void seq64::perform::set_jack_tick (
            midipulse tick )  [inline]
```

Parameters

tick	Provides the current JACK tick (pulse) value to set.

13.69.4.66 set_left_tick()

```
void seq64::perform::set_left_tick (
            midipulse tick,
            bool setstart = true )
```

We let the caller determine if this setting is a modification. If the left tick is later than the right tick, the right tick is move to one measure past the left tick.

Todo The perform::m_one_measure member is currently hardwired to PPQN ∗ 4.

Parameters

tick	The tick (MIDI pulse) at which to place the left tick. If the left tick is greater than or equal to the right tick, then the right ticked is moved forward by one "measure's length" (m_ppqn ∗ 4) past the left tick.
setstart	If true (the default, and long-standing implicit setting), then the starting tick is also set to the left tick.

13.69.4.67 get_left_tick()

```
midipulse seq64::perform::get_left_tick ( ) const  [inline]
```

13.69.4.68 set_start_tick()

```
void seq64::perform::set_start_tick (
            midipulse tick )  [inline]
```

Parameters

tick	Provides the starting JACK tick (pulse) value to set.

13.69.4.69 get_start_tick()

```
midipulse seq64::perform::get_start_tick ( ) const  [inline]
```

13.69.4.70 set_right_tick()

```
void seq64::perform::set_right_tick (
            midipulse tick,
            bool setstart = true )
```

This setting is made only if the tick parameter is at or beyond the first measure. We let the caller determine is this setting is a modification.

Parameters

tick	The tick (MIDI pulse) at which to place the right tick. If less than or equal to the left tick setting, then the left tick is backed up by one "measure's worth" (m_ppqn $*$ 4) worth of ticks from the new right tick.
setstart	If true (the default, and long-standing implicit setting), then the starting tick is also set to the left tick, if that got changed.

13.69.4.71 get_right_tick()

```
midipulse seq64::perform::get_right_tick ( ) const  [inline]
```

13.69.4.72 left_right_size()

```
double seq64::perform::left_right_size ( ) const  [inline]
```

Returns

Returns the difference between the right and left tick, cast to double.

13.69.4.73 is_active()

```
bool seq64::perform::is_active (
            int seq ) const  [inline]
```

Parameters

seq	The pattern number. It is checked for invalidity. This can lead to "too many" (i.e. redundant) checks, but we're trying to centralize such checks in this function.

Returns

Returns the value of the active-flag, or false if the sequence was invalid or null.

13.69.4.74 apply_song_transpose()

```
void seq64::perform::apply_song_transpose ( )
```

13.69.4.75 set_transpose()

```
void seq64::perform::set_transpose (
            int t )  [inline]
```

13.69.4.76 get_transpose()

```
int seq64::perform::get_transpose ( ) const  [inline]
```

13.69.4.77 get_beats_per_minute()

```
midibpm seq64::perform::get_beats_per_minute ( )  [inline]
```

Returns

Returns the value of beats/minute from the master buss.

13.69.4.78 clear_mute_groups()

```
void seq64::perform::clear_mute_groups ( )  [inline]
```

13.69.4.79 reload_mute_groups()

```
bool seq64::perform::reload_mute_groups (
            std::string & errmessage )
```

NOT READY.

Parameters

errmessage	A pass-back parameter for any error message the file-processing might cause.

Returns

Returns true if the reload succeeded.

13.69.4.80 set_sequence_control_status()

```
void seq64::perform::set_sequence_control_status (
            int status )
```

Then the given status is OR'd into the m_control_status.

Parameters

status	The status to be used.

13.69.4.81 unset_sequence_control_status()

```
void seq64::perform::unset_sequence_control_status (
            int status )
```

Then the given status is reversed in m_control_status.

Parameters

status	The status to be used.

13.69.4.82 sequence_playing_toggle()

```
void seq64::perform::sequence_playing_toggle (
            int seq )
```

If m_control_status is c_status_queue, then the sequence's toggle_queued() function is called. This is the "mod queue" implementation.

Otherwise, if it is c_status_replace, then the status is unset, and all sequences are turned off. Then the sequence's toggle-playing() function is called, which should turn it back on. This is the "mod replace" implementation; it is like a Solo. But can it be undone?

This function is called in sequence_key() to implement a toggling of the sequence of the pattern slot in the current screen-set that is represented by the keystroke.

This function is also called in midi_control_event() if the control number represents a sequence number in a screen-set, that is, it ranges from 0 to

1. This value is offset by the current screen-set number, m_offset before passing it to this function.

Parameters

seq	The sequence number of the sequence to be potentially toggled. This value must be a valid and active sequence number.

13.69.4.83 sequence_playing_change()

```
void seq64::perform::sequence_playing_change (
            int seq,
            bool on )
```

Used for the implementation of sequence_playing_on() and sequence_playing_off().

Parameters

seq	The number of the sequence to be turned off.
on	True if the sequence is to be turned on, false if it is to be turned off.

13.69.4.84 sequence_playing_on()

```
void seq64::perform::sequence_playing_on (
            int seq )  [inline]
```

Parameters

seq	The sequence number of the sequence to turn on.

13.69.4.85 sequence_playing_off()

```
void seq64::perform::sequence_playing_off (
            int seq )  [inline]
```

Parameters

seq	The sequence number of the sequence to turn off.

13.69.4.86 mute_all_tracks()

```
void seq64::perform::mute_all_tracks (
```

```
            bool flag = true )
```

Covers tracks from 0 to m_sequence_max.

We have to also set the sequence's playing status, in opposition to the mute status, in order to see the sequence status change on the user-interface. HMMMMMM.

Parameters

flag	If true (the default), the song-mute of the sequence is turned on. Otherwise, it is turned off.

13.69.4.87 toggle_all_tracks()

```
void seq64::perform::toggle_all_tracks ( )
```

Covers tracks from 0 to m_sequence_max.

13.69.4.88 armed_saved()

```
bool seq64::perform::armed_saved ( ) const  [inline]
```

13.69.4.89 toggle_playing_tracks()

```
void seq64::perform::toggle_playing_tracks ( )
```

13.69.4.90 mute_screenset()

```
void seq64::perform::mute_screenset (
            int ss,
            bool flag = true )
```

Parameters

ss	The screen-set to be operated upon.
flag	If true (the default), the song-mute of the sequence is turned on. Otherwise, it is turned off.

13.69.4.91 output_func()

```
void seq64::perform::output_func ( )
```

This function is called by the free function output_thread_func(). Here's how it works:

```
-   It runs while m_outputing is true.
-   MORE TO COME.  Yeah, a lot more to come.  It is a complex
    function.
```

Change Note ca 2016-01-26 Hurray, seq24 is coming back to life! We see that there is a fix for clock tick drift here, which relies on using long and long long values. See the Changelog for seq24 0.9.3.

Warning

Valgrind shows that output_func() is being called before the JACK client pointer is being initialized!!!

1. Get delta time (current - last).
2. Get delta ticks from time.
3. Add to current_ticks.
4. Compute prebuffer ticks.
5. Play from current tick to prebuffer.

Figure out how much time we need to sleep, and do it.

Now we want to trigger every c_thread_trigger_width_us, and it took us delta_us to play(). Also known as the "sleeping_us".

Check MIDI clock adjustment. Note that we replaced "60000000.0f / m_ppqn / bpm" with a call to a function. We also removed the "f" specification from the constants.

13.69.4.92 input_func()

```
void seq64::perform::input_func ( )
```

Stazed:

```
 http://www.blitter.com/~russtopia/MIDI/~jglatt/tech/midispec/ssp.htm

 Example: If a Song Position value of 8 is received, then a sequencer
 (or drum box) should cue playback to the third quarter note of the
 song.  (8 MIDI beats * 6 MIDI clocks per MIDI beat = 48 MIDI Clocks.
 Since there are 24 MIDI Clocks in a quarter note, the first quarter
 occurs on a time of 0 MIDI Clocks, the second quarter note occurs upon
 the 24th MIDI Clock, and the third quarter note occurs on the 48th
 MIDI Clock).

 8 MIDI beats * 6 MIDI clocks per MIDI beat = 48 MIDI Clocks.
```

13.69.4.93 set_group_mute_state()

```
void seq64::perform::set_group_mute_state (
             int gtrack,
             bool muted )  [inline]
```

The index value is the track number offset by the number of the selected mute group (which is equivalent to a set number) times the number of sequences in a set. This function is used in midifile and optionsfile when parsing the file to get the initial mute-groups.

Parameters

gtrack	The number of the track to be muted/unmuted.
muted	This boolean indicates the state to which the track should be set.

13.69.4.94 get_group_mute_state()

```
bool seq64::perform::get_group_mute_state (
            int gtrack )  [inline]
```

Uses the mute_group_offset() function. This function is used in midifile and optionsfile when writing the file to get the initial mute-groups.

Parameters

gtrack	The number of the track for which the state is to be obtained. Like set_group_mute_state(), this value is offset by adding m_mute_group_selected * m_seqs_in_set.

Returns

Returns the desired m_mute_group[] value.

13.69.4.95 set_offset()

```
void seq64::perform::set_offset (
            int offset )  [inline]
```

Sets `m_offset = offset * c_mainwnd_rows * c_mainwnd_cols`.

Parameters

offset	The desired offset.

13.69.4.96 get_offset()

```
int seq64::perform::get_offset ( ) const  [inline]
```

13.69.4.97 save_playing_state()

```
void seq64::perform::save_playing_state ( )
```

Inactive patterns get the value set to false. Used in unsetting the snapshot status (c_status_snapshot).

13.69.4.98 restore_playing_state()

```
void seq64::perform::restore_playing_state ( )
```

Used in unsetting the snapshot status (c_status_snapshot).

13.69.4.99 key_name()

```
std::string seq64::perform::key_name (
            unsigned int k ) const  [inline]
```

Parameters

k	The key number for which to return the string name of the key.

13.69.4.100 get_key_events()

```
keys_perform::SlotMap& seq64::perform::get_key_events ( )  [inline]
```

13.69.4.101 get_key_groups()

```
keys_perform::SlotMap& seq64::perform::get_key_groups ( )  [inline]
```

13.69.4.102 get_key_events_rev()

```
keys_perform::RevSlotMap& seq64::perform::get_key_events_rev ( )  [inline]
```

13.69.4.103 get_key_groups_rev()

```
keys_perform::RevSlotMap& seq64::perform::get_key_groups_rev ( )  [inline]
```

13.69.4.104 show_ui_sequence_key() [1/2]

```
bool seq64::perform::show_ui_sequence_key ( ) const  [inline]
```

Used in mainwid, options, optionsfile, userfile, and perform.

13.69.4.105 show_ui_sequence_key() [2/2]

```
void seq64::perform::show_ui_sequence_key (
            bool flag )  [inline]
```

Parameters

flag	Provides the flag to set into keys().show_ui_sequence_key().

13.69.4.106 show_ui_sequence_number() [1/2]

```
bool seq64::perform::show_ui_sequence_number ( ) const  [inline]
```

Used in mainwid, optionsfile, and perform.

13.69.4.107 show_ui_sequence_number() [2/2]

```
void seq64::perform::show_ui_sequence_number (
            bool flag )  [inline]
```

Parameters

flag	Provides the value to set into keys().show_ui_sequence_number().

13.69.4.108 lookup_keyevent_key()

```
unsigned int seq64::perform::lookup_keyevent_key (
            int seqnum )
```

If we're not in legacy mode, then we adjust for the screenset, so that screensets greater than 0 can also show the correct key name, instead of a question mark.

Legacy seq24 already responds to the toggling of the mute state via the shortcut keys even if screenset $>$ 0, but it shows the question mark.

Parameters

seqnum	The number of the sequence for which to return the event key.

Returns

Returns the desired key. If there is no such value, then the period ('?') character is returned.

13.69.4.109 lookup_keyevent_seq()

```
long seq64::perform::lookup_keyevent_seq (
            unsigned int keycode )  [inline]
```

The inverse of lookup_keyevent_key().

Parameters

keycode	The number of the event key for which to return the configured sequence number.

Returns

Returns the desired sequence. If there is no such value, then a sequence number of 0 is returned.

13.69.4.110 lookup_keygroup_key()

```
unsigned int seq64::perform::lookup_keygroup_key (
            long groupnum )  [inline]
```

Parameters

groupnum	The number of the sequence for which to return the group key.

Returns

Returns the desired key. If there is no such value, then the period ('.') character is returned.

13.69.4.111 lookup_keygroup_group()

```
long seq64::perform::lookup_keygroup_group (
            unsigned int keycode )  [inline]
```

The inverse of lookup_keygroup_key().

Parameters

keycode	The number of the group key for which to return the configured sequence number.

Returns

Returns the desired group number. If there is no such value, then a group number of 0 is returned.

13.69.4.112 start_playing()

```
void seq64::perform::start_playing (
            bool songmode = false )
```

We've reversed the start() and start_jack() calls so that JACK is started first, to match all of the other use-cases for playing that we've found in the code. Note that the complementary function, stop_playing(), is an inline function defined in the header file.

The perform::start() function passes its boolean flag to perform::inner_start(), which sets the playback mode to that flag; if that flag is false, that turns off "song" mode. So that explains why mute/unmute is disabled.

Playback use cases:

```
These use cases are meant to apply to either a Seq32 or a regular build
of Sequencer64, eventually.  Currently, the regular build does not have
a concept of a "global" perform song-mode flag.

-#  mainwnd.
    -#  Play.  If the perform song-mode is "Song", then use that mode.
        Otherwise, use "Live" mode.
    -#  Stop.  This action is modeless here.  In ALSA, it will cause
        a rewind (but currently seqroll doesn't rewind until Play is
        clicked, a minor bug).
    -#  Pause.  Same processing as Play or Stop, depending on current
        status.  When stopping, the progress bars in seqroll and
        perfroll remain at their current point.
-#  perfedit.
    -#  Play.  Override the current perform song-mode to use "Song".
    -#  Stop.  Revert the perfedit setting, in case play is restarted
        or resumed via mainwnd.
    -#  Pause.  Same processing as Play or Stop, depending on current
        status.
 -# ALSA versus JACK.  One issue here is that, if JACK isn't "running"
    at all (i.e. we are in ALSA mode), then we cannot be JACK Master.
```

Helgrind shows a read/write race condition in m_start_from_perfedit bewteen jack_transport_callback() and start↩ _playing() here. Is inline function access of a boolean atomic?

Parameters

songmode	Indicates if the caller wants to start the playback in Song mode (sometimes erroneously referred to as "JACK mode"). In the seq32 code at GitHub, this flag was identical to the "global_jack_start_mode" flag, which is true for Song mode, and false for Live mode. False disables Song mode, and is the default, which matches seq24. Generally, we pass true in this parameter if we're starting playback from the perfedit window. It alters the m_start_from_perfedit member, not the m_song_start_mode member (which replaces the global flag now).

13.69.4.113 pause_playing()

```
void seq64::perform::pause_playing (
            bool songmode = false )
```

Currently almost the same as stop_playing(), but expanded as noted in the comments so that we ultimately have more granular control over what happens. We're researching the whole sequence of stopping and starting, and it can be tricky to make correct changes.

We still need to make restarting pick up at the same place in ALSA mode; in JACK mode, JACK transport takes care of that feature.

Change Note ca 2016-10-11 User layk noted this call, and it makes sense to not do this here, since it is unknown at this point what the actual status is. Note that we STILL need to FOLLOW UP on calls to pause_playing() and stop_playing() in perfedit, mainwnd, etc.

is_pattern_playing(false);

Parameters

songmode	Indicates that, if resuming play, it should play in Song mode (true) or Live mode (false). See the comments for the start_playing() function.

13.69.4.114 stop_playing()

```
void seq64::perform::stop_playing ( )
```

Stops playback, turns off the (new) m_dont_reset_ticks flag, and set the "is-pattern-playing" flag to false. With stop, reset the start-tick to either the left-tick or the 0th tick (to be determined, currently resets to 0).

13.69.4.115 start_key()

```
void seq64::perform::start_key (
            bool songmode = false )
```

Meant to be used by GUIs to unify the treatment of keys versus buttons. Also handy in the extended MIDI controls that people have requested.

Parameters

songmode	The live/play mode parameter to be passed along to the key processor. Defaults to false (live mode).

13.69.4.116 pause_key()

```
void seq64::perform::pause_key (
            bool songmode = false )
```

Meant to be used by GUIs to unify the treatment of keys versus buttons. Also handy in the extended MIDI controls that people have requested.

Parameters

songmode	The live/play mode parameter to be passed along to the key processor, when starting playback. Defaults to false (live mode).

13.69.4.117 stop_key()

```
void seq64::perform::stop_key ( )
```

Meant to be used by GUIs to unify the treatment of keys versus buttons. Also handy in the extended MIDI controls that people have requested.

13.69.4.118 learn_toggle()

```
void seq64::perform::learn_toggle ( )  [inline]
```

13.69.4.119 decrement_beats_per_minute()

```
midibpm seq64::perform::decrement_beats_per_minute ( )
```

Actually does a lot of work in those function calls.

Returns

Returns the resultant BPM, as a convenience.

13.69.4.120 increment_beats_per_minute()

```
midibpm seq64::perform::increment_beats_per_minute ( )
```

Actually does a lot of work in those function calls.

Returns

Returns the resultant BPM, as a convenience.

13.69.4.121 page_decrement_beats_per_minute()

```
midibpm seq64::perform::page_decrement_beats_per_minute ( )
```

Encapsulates some calls used in mainwnd. Actually does a lot of work in those function calls.

Returns

Returns the resultant BPM, as a convenience.

13.69.4.122 page_increment_beats_per_minute()

```
midibpm seq64::perform::page_increment_beats_per_minute ( )
```

Encapsulates some calls used in mainwnd. Actually does a lot of work in those function calls.

Returns

Returns the resultant BPM, as a convenience.

13.69.4.123 decrement_screenset()

```
int seq64::perform::decrement_screenset ( )  [inline]
```

13.69.4.124 increment_screenset()

```
int seq64::perform::increment_screenset ( )  [inline]
```

13.69.4.125 highlight()

```
bool seq64::perform::highlight (
            const sequence & seq ) const  [inline]
```

This setting is currently a build-time option, but could be made a run-time option later.

Parameters

seq	Provides a reference to the desired sequence.

13.69.4.126 is_smf_0()

```
bool seq64::perform::is_smf_0 (
            const sequence & seq ) const  [inline]
```

Parameters

seq	Provides a reference to the desired sequence.

13.69.4.127 get_sequence() [1/2]

```
const sequence* seq64::perform::get_sequence (
            int seq ) const  [inline]
```

This is the const version.

Parameters

seq	The prospective sequence number.

Returns

Returns the value of m_seqs[seq] if seq is valid. Otherwise, a null pointer is returned.

13.69.4.128 get_sequence() [2/2]

```
sequence* seq64::perform::get_sequence (
            int seq )  [inline]
```

Parameters

seq	The prospective sequence number.

Returns

Returns the value of m_seqs[seq] if seq is valid. Otherwise, a null pointer is returned.

13.69.4.129 sequence_key()

```
void seq64::perform::sequence_key (
            int seq )
```

This function is use in mainwnd when toggling the mute/unmute setting using keyboard keys.

Parameters

seq	The sequence's control-key number, which is relative to the current screen-set.

13.69.4.130 sequence_label()

```
std::string seq64::perform::sequence_label (
            const sequence & seq )
```

This string goes on the bottom-left of those user-interface elements.

The format of this string is something like the following example, depending on the "show sequence numbers" option. The values shown are, in this order, sequence number (if allowed), buss number, channel number, beats per bar, and beat width.

```
        No sequence number:     31-16 4/4
        Sequence number:        9  31-16 4/4

The sequence number and buss number are re 0, while the channel number is
displayed re 1, unless it is an SMF 0 null channel (0xFF), in which case
it is 0.
```

Note

Later, we could add the sequence hot-key to this string, though showing that is not much use in perfnames. Also, this function is a stilted mix of direct access and access through sequence number.

Parameters

seq	Provides the reference to the sequence, use for getting the sequence parameters to be written to the label string.

Returns

Returns the filled in label if the sequence is active. Otherwise, an empty string is returned.

13.69.4.131 set_input_bus()

```
void seq64::perform::set_input_bus (
            int bus,
            bool active )
```

This function is called by options::input_callback().

Note that the mastermidibus::set_input() function passes the setting along to the input busarray.

Tricky Code See the bus parameter. We should provide two separate functions for this feature, but it is already combined into one input-callback function with a lot of other functionality in the options module.

Parameters

bus	If this value is greater than SEQ64_DEFAULT_BUSS_MAX (32), then it is treated as a user-interface flag (PERFORM_KEY_LABELS_ON_SEQUENCE or PERFORM_NUM_LABELS_ON_SEQUENCE) that causes all the sequences to be dirtied, and thus get redrawn with the new user-interface setting.
active	Indicates whether the buss or the user-interface feature is active or inactive.

13.69.4.132 set_clock_bus()

```
void seq64::perform::set_clock_bus (
            int bus,
            clock_e clocktype )
```

Note that the call to mastermidibus::set_clock() also sets the clock in the output busarray.

Parameters

bus	The bus index to be set.
clocktype	Indicates whether the buss or the user-interface feature is e_clock_off, e_clock_pos, and e_clock_mod.

13.69.4.133 mainwnd_key_event()

```
bool seq64::perform::mainwnd_key_event (
            const keystroke & k )
```

This function handles the keys for the functions of replace, queue, keep-queue, snapshots, toggling mute groups, group learn, and playing screenset. For further keystroke processing, see mainwnd :: on_key_press_event().

Keys not handled here are handled in mainwnd: bpm up & down; screenset up & down.

Parameters

k	The keystroke object to be handled.

Returns

Returns true if the key was handled.

13.69.4.134 perfroll_key_event()

```
bool seq64::perform::perfroll_key_event (
            const keystroke & k,
            int drop_sequence )
```

It handles the Ctrl keys for cut, copy, paste, and undo.

The "is modified" flag is raised if something is deleted, but we cannot yet handle the case where we undo all the changes. So, for now, we play it safe with the user, even if the user gets annoyed because he knows that he undid all the changes.

Parameters

k	The keystroke object to be handled.
drop_sequence	Provides the index of the sequence whose selected trigger is to be cut, copied, or pasted. Undo and redo are now supported.

Returns

Returns true if the key was handled.

13.69.4.135 playback_key_event()

```
bool seq64::perform::playback_key_event (
            const keystroke & k,
            bool songmode = false )
```

To be used in mainwnd, perfedit, and seqroll.

The start/end key may be the same key (e.g. Space) to allow toggling when the same key is mapped to both triggers.

Checking is_running() may not work completely in JACK.

Change Note layk 2016-10-11 Issue #42 to prevent inadvertent step-edit in sequence :: stream_event(). We did it slightly different to save a little code; also found a spot that was missed.

Parameters

k	Provides the encapsulated keystroke to check.
songmode	Provides the "jack flag" needed by the mainwnd, seqroll, and perfedit windows. Defaults to false, which disables Song mode, and enables Live mode. But using Song mode seems to make the pause key not work in the performance editor.

Returns

Returns true if the keystroke matched the start, stop, or (new) pause keystrokes. Generally, no further keystroke processing is needed in this case.

13.69.4.136 move_triggers()

```
void seq64::perform::move_triggers (
            bool direction )
```

Parameters

direction	Specifies the desired direction; false = left, true = right.

13.69.4.137 copy_triggers()

```
void seq64::perform::copy_triggers ( )
```

This copies the triggers between the L marker and R marker to the R marker.

13.69.4.138 push_trigger_undo()

```
void seq64::perform::push_trigger_undo (
            int track = SEQ64_ALL_TRACKS )
```

Too bad we cannot yet keep track of all the undoes for the sake of properly handling the "is modified" flag.

This function now has a new parameter. Not added to this function is the seemingly redundant undo-push the seq32 code does; is this actually a seq42 thing?

Also, there is still an issue with our undo-handling for a single track. See pop_trigger_undo().

Parameters

track	A new parameter (found in the stazed seq32 code) that allows this function to operate on a single track. A parameter value of SEQ64_ALL_TRACKS (-1, the default) implements the original behavior.

13.69.4.139 pop_trigger_undo()

```
void seq64::perform::pop_trigger_undo ( )
```

Todo Look at seq32/src/perform.cpp and the perform :: push_trigger_undo(track) function, which has a track parameter that has a -1 values the supports all tracks. It requires two new vectors (one for undo, one for redo), two new flags (likewise). We've put this code in place, no longer macroed out, now permanent.

13.69.4.140 pop_trigger_redo()

```
void seq64::perform::pop_trigger_redo ( )
```

13.69.4.141 is_dirty_main()

```
bool seq64::perform::is_dirty_main (
            int seq )
```

See the sequence::is_dirty_main() function.

Parameters

seq	The pattern number. It is checked for validity.

Returns

Returns the was-active-main flag value, before setting it to false. Returns false if the pattern was invalid.

13.69.4.142 is_dirty_edit()

```
bool seq64::perform::is_dirty_edit (
            int seq )
```

Parameters

seq	The pattern number. It is checked for validity.

Returns

Returns the was-active-edit flag value, before setting it to false. Returns false if the pattern was invalid.

13.69.4.143 is_dirty_perf()

```
bool seq64::perform::is_dirty_perf (
            int seq )
```

Parameters

seq	The pattern number. It is checked for validity.

Returns

Returns the was-active-perf flag value, before setting it to false. Returns false if the pattern/sequence number was invalid.

13.69.4.144 is_dirty_names()

```
bool seq64::perform::is_dirty_names (
            int seq )
```

Parameters

seq	The pattern number. It is checked for validity.

Returns

Returns the was-active-names flag value, before setting it to false. Returns false if the pattern/sequence number was invalid.

13.69.4.145 is_exportable()

```
bool seq64::perform::is_exportable (
            int seq ) const
```

Parameters

seq	The index of the desired sequence.

Returns

Returns true if the sequence has the three properties noted above.

13.69.4.146 set_screenset()

```
void seq64::perform::set_screenset (
            int ss )
```

It's not clear that we need to set the "is modified" flag just because we changed the screen set, so we don't.

As a new feature, we would like to queue-mute the previous screenset, and queue-unmute the newly-selected screenset. Still working on getting it right.

Parameters

ss	The index of the desired new screen set. It is forced to range from 0 to m_max_sets - 1. The clamping seems weird, but hews to seq24. What it does is let the user wrap around the screen-sets in the user interface.

13.69.4.147 get_screenset()

```
int seq64::perform::get_screenset ( ) const  [inline]
```

13.69.4.148 get_playing_screenset()

```
int seq64::perform::get_playing_screenset ( ) const  [inline]
```

13.69.4.149 toggle_other_seqs()

```
bool seq64::perform::toggle_other_seqs (
            int seqnum,
            bool isshiftkey )
```

See mainwid::on_button_release_event(). If the Shift key is pressed, toggle the mute state of all other sequences. Inactive sequences are skipped.

Parameters

seqnum	The sequence that is being clicked on. It must be active in order to allow toggling.
isshiftkey	Indicates if the shift-key functionality for toggling all of the other sequences is active.

Returns

Returns true if the full toggling was able to be performed.

13.69.4.150 toggle_other_names()

```
bool seq64::perform::toggle_other_names (
            int seqnum,
            bool isshiftkey )
```

See perfnames::on_button_press_event(). If the Shift key is pressed, toggle the mute state of all other sequences. Inactive sequences are skipped.

Parameters

seqnum	The sequence that is being clicked on. It must be active in order to allow toggling.
isshiftkey	Indicates if the shift-key functionality for toggling all of the other sequences is active.

Returns

Returns true if the toggling was able to be performed.

13.69.4.151 have_undo()

```
bool seq64::perform::have_undo ( ) const  [inline], [private]
```

13.69.4.152 set_have_undo()

```
void seq64::perform::set_have_undo (
            bool undo )  [inline], [private]
```

Once it is set, it remains set, unless cleared by saving the file.

13.69.4.153 have_redo()

```
bool seq64::perform::have_redo ( ) const  [inline], [private]
```

13.69.4.154 set_have_redo()

```
void seq64::perform::set_have_redo (
            bool redo )  [inline], [private]
```

13.69.4.155 split_trigger()

```
void seq64::perform::split_trigger (
            int seqnum,
            midipulse tick )  [private]
```

Parameters

seqnum	Indicates the sequence that needs to have its trigger split.
tick	The MIDI pulse number at which the trigger should be split.

13.69.4.156 get_max_trigger()

```
midipulse seq64::perform::get_max_trigger ( )  [private]
```

Returns

Returns the highest trigger value, or zero. It is not clear why this function doesn't return a "no trigger found" value. Is there always at least one trigger, at 0?

13.69.4.157 collapse()

```
void seq64::perform::collapse ( )  [inline], [private]
```

13.69.4.158 copy()

```
void seq64::perform::copy ( )  [inline], [private]
```

13.69.4.159 expand()

```
void seq64::perform::expand ( )  [inline], [private]
```

13.69.4.160 midi_control_toggle()

```
midi_control & seq64::perform::midi_control_toggle (
            int ctl )  [private]
```

Recall that the midi_control object specifies if a control is active, inversely-active, what status byte initiates it, what data byte initiates it, and the min/max values. Note that the status byte determines what category of event it is (e.g. note on/off versus a continuous controller), and the data byte indicates the note value or the type of continous controller.

Parameters

ctl	Provides the index to pass to valid_midi_control_seq() to obtain a control value (such as c_midi_control_bpm_up) to use to retrieve the desired midi_control object.

Returns

Returns the "toggle" value if the control value is valid, or a reference to sm_mc_dummy otherwise.

13.69.4.161 midi_control_on()

```
midi_control & seq64::perform::midi_control_on (
            int ctl )  [private]
```

Parameters

ctl	Provides the index to pass to valid_midi_control_seq() to obtain a control value (such as c_midi_control_bpm_up) to use to retrieve the desired midi_control object.

Returns

Returns the "on" value if the control value is valid, and a reference to sm_mc_dummy otherwise.

13.69.4.162 midi_control_off()

```
midi_control & seq64::perform::midi_control_off (
            int ctl )  [private]
```

Parameters

ctl	Provides a control value (such as c_midi_control_bpm_up) to use to retrieve the desired midi_control object.

Returns

Returns the "off" value if the control value is valid, and a reference to sm_mc_dummy otherwise.

13.69.4.163 midi_control_event()

```
void seq64::perform::midi_control_event (
             const event & ev )  [private]
```

Here is the processing involved in this function ....

Incorporates pull request #24, arnaud-jacquemin, issue #23 "MIDI controller toggles wrong pattern".

Change Note ca 2016-10-05 Issue #35. Changed "on" to "off".

QUESTIONS/TODO:

```
1. Why go above the sequence numbers, why not
   just go up to c_midi_track_ctrl?

2. What about our new extended controls?
```

13.69.4.164 handle_midi_control()

```
void seq64::perform::handle_midi_control (
             int ctl,
             bool state )  [private]

        c_midi_control_mod_replace
        c_midi_control_mod_snapshot
        c_midi_control_mod_queue
        c_midi_control_mod_gmute
        c_midi_control_mod_glearn

Other values supported:

        c_midi_control_bpm_up
        c_midi_control_bpm_dn
        c_midi_control_ss_up
        c_midi_control_ss_dn
        c_midi_control_play_ss

We have added the following extended values:

        c_midi_control_playback     (for pause/toggle, start, and stop)
        c_midi_control_record
        c_midi_control_solo         (for toggle, on, or off)
        c_midi_control_thru
        c_midi_control_bpm_page_up
        c_midi_control_bpm_page_dn
        c_midi_control_16 to _19    (reserved for expansion)

The extended values will actually be handled by a new function,
handle_midi_control_ex().

c_midi_control_solo probably will need a parameter.

Values from 32 through 2*32 are normalized by subtracting 32 and passed to
the select_and_mute_group() function.  Otherwise, the following apply:

We also reserve a few control values above that for expansion.
```

Parameters

ctl	The MIDI control value to use to perform an operation.
state	The state of the control, used with the following values:

13.69.4.165 handle_midi_control_ex()

```
bool seq64::perform::handle_midi_control_ex (
            int ctl,
            midi_control::action a )  [private]
```

Parameters

ctl	The MIDI control value to use to perform an operation.
a	The action of the control.

Returns

Returns true if the control was an extended control and was acted on.

13.69.4.166 get_screen_set_notepad()

```
const std::string & seq64::perform::get_screen_set_notepad (
            int screenset ) const  [private]
```

Parameters

screenset	The ID number of the screen set, an index into the m_screen_set_notepad[] array. This value is validated.

Returns

Returns a reference to the desired string, or to an empty string if the screen-set number is invalid.

13.69.4.167 current_screen_set_notepad()

```
const std::string& seq64::perform::current_screen_set_notepad ( ) const  [inline], [private]
```

13.69.4.168 set_screen_set_notepad() [1/2]

```
void seq64::perform::set_screen_set_notepad (
            int screenset,
            const std::string & notepad )  [private]
```

Parameters

screenset	The ID number of the screen set, an index into the m_screen_set_notepad[] array.
notepad	Provides the string date to copy into the notepad. Not sure why a pointer is used, instead of nice "const std::string &" parameter. And this pointer isn't checked. Fixed.

13.69.4.169 set_screen_set_notepad() [2/2]

```
void seq64::perform::set_screen_set_notepad (
            const std::string & note )  [inline], [private]
```

Parameters

note	The string value to set into the notepad text.

13.69.4.170 set_playing_screenset()

```
void seq64::perform::set_playing_screenset ( )  [private]
```

This function is called when one of the snapshot keys is pressed.

For each value up to m_seqs_in_set (32), the index of the current sequence in the current screen set (m_playing↩ _screen) is obtained. If the sequence is active and the sequence actually exists, it is processed; null sequences are no longer flagged as an error, they are just ignored.

Modifies m_playing_screen, m_playscreen_offset, stores the current playing-status of each sequence in m_tracks↩ _mute_state[], and then calls mute_group_tracks(), turns on unmuted tracks in the current screen-set.

Basically, this function retrieves and saves the playing status of the sequences in the current play-screen, sets the play-screen to the current screen-set, and then mutes the previous play-screen. It is called via the c_midi_control↩ _play_ss value or via the set-playing-screen-set keystroke.

13.69.4.171 any_group_unmutes()

```
bool seq64::perform::any_group_unmutes ( ) const  [private]
```

Returns

Returns true if there are any unmute statuses in the mute-group array. If they're all zero, we don't need to save them.

13.69.4.172 print_group_unmutes()

```
void seq64::perform::print_group_unmutes ( ) const  [private]
```

13.69.4.173 mute_group_tracks()

```
void seq64::perform::mute_group_tracks ( )  [private]
```

It loops through every screen-set. In each screen-set, it acts on each active sequence. If the active sequence is in the current "in-view" screen-set (m_screenset as opposed to m_playing_screen), and its m_track_mute_state[] is true, then the sequence is turned on, otherwise it is turned off.

Change Note tdeagan 2015-12-22 via git pull. Replaced m_playing_screen with m_screenset.

It seems to us that the for (g) clause should have g range from 0 to m_max_sets, not m_seqs_in_set.

13.69.4.174 select_and_mute_group()

```
void seq64::perform::select_and_mute_group (
            int group )  [private]
```

Called in perform and in mainwnd.

Parameters

group	Provides the group number for the group to be muted.

13.69.4.175 set_song_mute()

```
void seq64::perform::set_song_mute (
            mute_op_t op )  [private]
```

The sequence::set_song_mute() and toggle_song_mute() functions do all the work, including mp-dirtying the sequence.

We've modified this function to call mute_all_tracks() and toggle_all_tracks() in order to consolidate the code and (cough cough) fix a bug in this functionality from the mainwnd menu.

Parameters

op	Provides the "flag" that indicates if this function is to set mute on, off, or to toggle the mute status.

13.69.4.176 set_mode_group_mute()

```
void seq64::perform::set_mode_group_mute ( )  [inline], [private]
```

13.69.4.177 unset_mode_group_mute()

```
void seq64::perform::unset_mode_group_mute ( )  [inline], [private]
```

13.69.4.178 select_group_mute()

```
void seq64::perform::select_group_mute (
            int mutegroup )  [private]
```

Then, no matter what, it makes the desired mute-group the selected mute-group. Compare to set_and_copy_↩ mute_group().

One thing to note is that, once saved, then, if used, it is applied to the current screen-set, even if it is not the screen-set whose playing status were saved.

Parameters

mutegroup	The number of the desired mute group, clamped to be between 0 and m_seqs_in_set-1. Obviously, it is the set whose state is to be stored, if in group-learn mode.

13.69.4.179 set_mode_group_learn()

```
void seq64::perform::set_mode_group_learn ( )  [private]
```

This function is called via a MIDI control c_midi_control_mod_glearn and via the group-learn keystroke.

13.69.4.180 unset_mode_group_learn()

```
void seq64::perform::unset_mode_group_learn ( )  [private]
```

Then unsets the group-learn mode flag. This function is called via a MIDI control c_midi_control_mod_glearn, via the group-learn keystroke, and in mainwnd::on_key_press_event(), to end the group-learn mode.

Shouldn't this function also call this one, to perfectly complement set_mode_group_learn: unset_mode_group_↩ mute(). Too tricky.

13.69.4.181 is_group_learning()

```
bool seq64::perform::is_group_learning ( )  [inline], [private]
```

13.69.4.182 set_and_copy_mute_group()

```
void seq64::perform::set_and_copy_mute_group (
            int mutegroup )  [private]
```

Then the mute-group is stored in m_tracks_mute_state[], which holds states for only the number of sequences in a set.

Compare to select_group_mute(); its main difference is that it will at least copy the states even if not in group-learn mode. And, if in group-learn mode, it will grab the playing states of the sequences before copying them.

This function is used only once, in select_and_mute_group(). It used to be called just select_mute_group(), but that's too easy to confuse with select_group_mute().

Change Note tdeagan 2015-12-22 via git pull: git pull https://github.com/TDeagan/sequencer64.↩ git mute_groups m_screenset replaces m_playscreen_offset.

Parameters

mutegroup	Provides the mute-group to select.

13.69.4.183 activate()

```
bool seq64::perform::activate ( )  [private]
```

Currently does work only for JACK; the activate() calls for other APIs just return true without doing anything.

13.69.4.184 start()

```
void seq64::perform::start (
            bool songmode )  [private]
```

Parameters

songmode	If true, playback is to be in Song mode. Otherwise, it is to be in Live mode.

13.69.4.185 stop()

```
void seq64::perform::stop ( )  [private]
```

The logic seems backward here, in that we call inner_stop() if JACK is not running. Or perhaps we misunderstand the meaning of m_jack_running?

Stazed:

```
This function's sole purpose was to prevent inner_stop() from being
called internally when JACK was running... potentially twice.
inner_stop() was called by output_func() when JACK sent a
JackTransportStopped message. If seq42 initiated the stop, then
stop_jack() was called which then triggered the JackTransportStopped
message to output_func() which then triggered the bool stop_jack to
call inner_stop().  The output_func() call to inner_stop() is only
necessary when some other JACK client sends a jack_transport_stop
message to JACK, not when it is initiated by seq42.  The method of
relying on JACK to call inner_stop() when internally initiated caused
a (very) obscure apparent freeze if you press and hold the start/stop
key if set to toggle. This occurs because of the delay between
JackTransportStarting and JackTransportStopped if both triggered in
rapid succession by holding the toggle key down.  The variable
global_is_running gets set false by a delayed inner_stop() from JACK
after the start (true) is already sent. This means the global is set
to true when JACK is actually off (false). Any subsequent presses to
the toggle key send a stop message because the global is set to true.
Because JACK is not running, output_func() is not running to send the
inner_stop() call which resets the global to false. Thus an apparent
freeze as the toggle key endlessly sends a stop, but inner_stop()
never gets called to reset. Whoo! So, to fix this we just need to
call inner_stop() directly rather than wait for JACK to send a
delayed stop, only when running. This makes the whole purpose of this
stop() function unneeded. The check for m_jack_running is commented
out and this function could be removed. It is being left for future
generations to ponder!!!
```

13.69.4.186 start_jack()

```
void seq64::perform::start_jack ( )  [inline], [private]
```

13.69.4.187 stop_jack()

```
void seq64::perform::stop_jack ( )  [inline], [private]
```

13.69.4.188 position_jack()

```
void seq64::perform::position_jack (
            bool songmode,
            midipulse tick = 0 )  [private]
```

Parameters

songmode	If true, playback is to be in Song mode. Otherwise, it is to be in Live mode.
tick	Provides the pulse position to be set. The default value is 0.

13.69.4.189 off_sequences()

```
void seq64::perform::off_sequences ( )  [private]
```

Replaces "for (int s = 0; s < m_sequence_max; ++s)"

13.69.4.190 all_notes_off()

```
void seq64::perform::all_notes_off ( )  [private]
```

Then flush the master MIDI buss.

13.69.4.191 set_active()

```
void seq64::perform::set_active (
            int seq,
            bool active )  [private]
```

If setting it active, the sequence::number() setter is called. It won't modify the sequence's internal copy of the sequence number if it has already been set.

Parameters

seq	Provides the prospective sequence number.
active	True if the sequence is to be set to the active state.

13.69.4.192 set_was_active()

```
void seq64::perform::set_was_active (
            int seq )  [private]
```

Why do we need this routine?

Parameters

seq	The pattern number. It is checked for validity.

13.69.4.193 reset_sequences()

```
void seq64::perform::reset_sequences (
            bool pause = false )  [private]
```

Note that these calls are folded into one member function of the sequence class. Finally, flush the master MIDI buss.

Parameters

pause	Try to prevent notes from lingering on pause if true. By default, it is false.

13.69.4.194 play()

```
void seq64::perform::play (
            midipulse tick )  [private]
```

Starts the playing of all the patterns/sequences.

This function just runs down the list of sequences and has them dump their events. It skips sequences that have no playable MIDI events.

Note how often the "s" (sequence) pointer was used. It was worth offloading all these calls to a new sequence function. Hence the new sequence::play_queue() function.

Finally, we stop the looping at m_sequence_high rather than m_sequence_max, to save a little time.

Parameters

tick	Provides the tick at which to start playing. This value is also copied to m_tick.

13.69.4.195 set_orig_ticks()

```
void seq64::perform::set_orig_ticks (
            midipulse tick )  [private]
```

This is really the "last tick" value, so we renamed sequence::set_orig_tick() to sequence::set_last_tick().

Parameters

tick	Provides the last-tick value to be set for each sequence that is active.

13.69.4.196 set_beats_per_minute()

```
void seq64::perform::set_beats_per_minute (
            midibpm bpm )  [private]
```

Replaces perform::set_bpm() from seq24.

The value is set only if neither JACK nor this performance object are running.

It's not clear that we need to set the "is modified" flag just because we changed the beats per minute. This setting does get saved to the MIDI file, with the c_bpmtag.

Parameters

bpm	Provides the beats/minute value to be set. It is clamped, if necessary, between the values SEQ64_MINIMUM_BPM to SEQ64_MAXIMUM_BPM. They provide a wide range of speeds, well beyond what normal music needs.

13.69.4.197 set_looping()

```
void seq64::perform::set_looping (
            bool looping )  [inline], [private]
```

Parameters

looping	The boolean value to set for looping, used in the performance editor.

13.69.4.198 max_active_set()

```
int seq64::perform::max_active_set ( ) const  [private]
```

Returns

Returns the value of the highest active set. A value of 0 represents the first set. If no sequences are active, then -1 is returned.

13.69.4.199 launch_input_thread()

```
void seq64::perform::launch_input_thread ( )  [private]
```

This might be a good candidate for a small thread class derived from a small base class.

13.69.4.200 launch_output_thread()

```
void seq64::perform::launch_output_thread ( )  [private]
```

This might be a good candidate for a small thread class derived from a small base class.

13.69.4.201 init_jack_transport()

```
bool seq64::perform::init_jack_transport ( )  [inline], [private]
```

Who calls this routine? The main() routine of the application [via launch()], and the options module, when the Connect button is pressed.

Returns

Returns the result of the init() call; true if JACK sync is now running. If JACK support is not built into the application, then this function returns false, to indicate that JACK is (definitely) not running.

13.69.4.202 deinit_jack_transport()

```
bool seq64::perform::deinit_jack_transport ( )  [inline], [private]
```

Called by launch() and in the options module, when the Disconnect button is pressed.

Returns

Returns the result of the init() call; false if JACK sync is now no longer running. If JACK support is not built into the application, then this function returns true, to indicate that JACK is (definitely) not running.

13.69.4.203 seq_in_playing_screen()

```
bool seq64::perform::seq_in_playing_screen (
            int seq )  [private]
```

Parameters

seq	Provides the index of the desired sequence.

Returns

Returns true if the sequence adheres to the conditions noted above.

13.69.4.204 is_modified() [2/2]

```
void seq64::perform::is_modified (
            bool flag )  [inline], [private]
```

Parameters

flag	The value of the modified flag to be set.

13.69.4.205 valid_midi_control_seq()

```
bool seq64::perform::valid_midi_control_seq (
            int seq ) const  [inline], [private]
```

We were checking against c_midi_track_ctrl as well, but that was a bug. This function is meant to check that the supplied sequence number does not exceed the value of c_midi_controls_extended (32 ∗ 2 + 10 + 10 = 84). The track (sequence or pattern) controls rangoe from 0 to 64. Next come the "c_midi_control" values: bpm_up, bpm_dn, ..., play_ss, plus some extended controls that are relatively new, and, lastly, c_midi_controls_extended itself.

Parameters

seq	The sequence number value that should be inside the c_midi_controls_extended range. This value can specify not only a sequence number, but larger control values as well, so the function and parameter are mildly mis-named.

Returns

Returns true if the sequence number is valid for accessing the MIDI control values. For this function, no error print-out is generated.

13.69.4.206 is_screenset_valid()

```
bool seq64::perform::is_screenset_valid (
            int screenset ) const  [inline], [private]
```

Parameters

screenset	The prospective screenset value.

Returns

Returns true if the parameter is valid. For this function, no error print-out is generated.

13.69.4.207 set_running()

```
void seq64::perform::set_running (
            bool running )  [inline], [private]
```

Parameters

running	The value of the running flag to be set.

13.69.4.208 is_pattern_playing() [2/2]

```
void seq64::perform::is_pattern_playing (
            bool flag )  [inline], [private]
```

13.69.4.209 set_playback_mode()

```
void seq64::perform::set_playback_mode (
            bool playbackmode )  [inline], [private]
```

Parameters

playbackmode	The value of the playback mode flag to be set.

13.69.4.210 mute_group_offset()

```
int seq64::perform::mute_group_offset (
            int track )  [inline], [private]
```

Parameters

track	The number of the desired track.

13.69.4.211 is_seq_valid()

```
bool seq64::perform::is_seq_valid (
            int seq ) const  [private]
```

Also see the function is_mseq_valid(), which also checks the pointer stored in the m_seq[] array.

We considered checking the *seq* param against sequence_count(), but this function is called while creating sequences that add to that count, so we continue checking against the "container" size. Also, it is possible to have holes in the array representing inactive sequences, so that sequencer_count() would be too limiting.

Parameters

seq	The sequencer number, in interval [0, m_sequence_max).

Returns

Returns true if the sequence number is valid.

13.69.4.212 is_mseq_valid()

```
bool seq64::perform::is_mseq_valid (
            int seq ) const  [private]
```

It also evaluates the m_seq[seq] pointer value.

Note

Since we can have holes in the sequence array, where there are inactive sequences, we check if the sequence is even active before emitting a message about a null pointer for the sequence. We only want to see messages that indicate actual problems.

Parameters

seq	Provides the sequence number to be checked. It is checked for validity. We cannot compare the sequence number versus the sequence_count(), because the current implementation can have inactive holes (with null pointers) interspersed with active pointers.

Returns

Returns true if the sequence number is valid as per is_seq_valid(), and the sequence pointer is not null.

13.69.4.213 install_sequence()

```
bool seq64::perform::install_sequence (
            sequence * seq,
            int seqnum )  [private]
```

It is common code and using it prevents inconsistences. It assumes values have already been checked. It does not set the "is modified" flag, since adding a sequence by loading a MIDI file should not set it. Compare new_↩ sequence(), used by mainwid and seqmenu, with add_sequence(), used by midifile.

Parameters

seq	The pointer to the pattern/sequence to add.
seqnum	The sequence number of the pattern to be added. Not validated, to save some time.

Returns

Returns true if a sequence was removed, or the sequence was successfully added. In other words, if a real change in sequence pointers occurred. It is up to the caller to decide if the change warrants setting the "is modified" flag.

13.69.4.214 inner_start()

```
void seq64::perform::inner_start (
            bool songmode )  [private]
```

Then, if not is_running(), the playback mode is set to the given state. If that state is true, call off_sequences(). Set the running status, and signal the condition. Then unlock.

Minor issue:

```
In ALSA mode, restarting the sequence moves the progress bar to the
beginning of the sequence, even if just pausing.  This is fixed by
compiling with SEQ64_PAUSE_SUPPORT, which disables calling
off_sequences() when starting playback from the song editor /
performance window.
```

Parameters

songmode	Sets the playback mode, and, if true, turns off all of the sequences before setting the is-running condition.

13.69.4.215 inner_stop()

```
void seq64::perform::inner_stop (
            bool midiclock = false )  [private]
```

Note that we do need to set the running flag to false here, even when JACK is running. Otherwise, JACK starts ping-ponging back and forth between positions under some circumstances.

However, if JACK is running, we do not want to reset the sequences... this causes the progress bar for each sequence to move to near the end of the sequence.

Parameters

midiclock	If true, indicates that the MIDI clock should be used.

13.69.4.216 clamp_track()

```
int seq64::perform::clamp_track (
            int track ) const  [private]
```

Fixed the bug we found, where we checked for track > m_seqs_in_set, instead of using the >= operator.

Parameters

track	The track value to be checked and rectified as necessary.

Returns

Returns the track parameter, clamped between 0 and m_seqs_in_set-1, inclusive.

13.69.4.217 set_key_event()

```
void seq64::perform::set_key_event (
            unsigned int keycode,
            long sequence_slot )  [inline], [private]
```

It is called 32 times, corresponding to the pattern/sequence slots in the Patterns window. It first removes the given key-code from the regular and reverse slot-maps. Then it removes the sequence-slot from the regular and reverse slot-maps. Finally, it adds the sequence-slot with a key value of key-code, and adds the key-code with a value of sequence-slot.

Parameters

keycode	The keycode for which to set the sequence slot.
sequence_slot	The sequence slot to be set.

13.69.4.218 set_key_group()

```
void seq64::perform::set_key_group (
            unsigned int keycode,
            long group_slot )  [inline], [private]
```

It is called 32 times, corresponding the pattern/sequence slots in the Patterns window. Compare it to the set_key↩ _events() function.

Parameters

keycode	The keycode for which to set the group slot.
group_slot	The group slot to be set.

13.69.4.219 create_master_bus()

```
bool seq64::perform::create_master_bus ( )  [private]
```

We need to delay creation until launch time, so that settings can be obtained before determining just how to set up the application.

Once the master buss is created, we then copy the clocks and input setting that were read from the "rc" file, via the mastermidibus::port_settings() function, to use in determining whether to initialize and connect the input ports at start-up. Seq24 wouldn't connect unconditionally, and Sequencer64 shouldn't, either.

However, the devices actually on the system at start time might be different from what was saved in the "rc" file after the last run of Sequencer64.

Returns

Returns true if the creation succeeded.

13.69.4.220 add_clock()

```
void seq64::perform::add_clock (
            clock_e clocktype )  [inline], [private]
```

Parameters

clocktype	The clock value read from the "rc" file.

13.69.4.221 set_clock()

```
void seq64::perform::set_clock (
            int bus,
            clock_e clocktype )  [inline], [private]
```

Mostly meant for use by the Options / MIDI Input tab.

13.69.4.222 add_input()

```
void seq64::perform::add_input (
            bool flag )  [inline], [private]
```

Parameters

flag	The input flag read from the "rc" file.

13.69.4.223 set_input()

```
void seq64::perform::set_input (
```

```
            int bus,
            bool inputing )  [inline], [private]
```

Mostly meant for use by the Options / MIDI Input tab.

13.69.4.224 get_input()

```
bool seq64::perform::get_input (
            int bus )  [inline], [private]
```

13.69.4.225 is_input_system_port()

```
bool seq64::perform::is_input_system_port (
            int bus )  [inline], [private]
```

13.69.5 Friends And Related Function Documentation

13.69.5.1 jack_assistant

```
friend class jack_assistant  [friend]
```

13.69.5.2 keybindentry

```
friend class keybindentry  [friend]
```

13.69.5.3 mainwnd

```
friend class mainwnd  [friend]
```

13.69.5.4 midifile

```
friend class midifile  [friend]
```

13.69.5.5 optionsfile

```
friend class optionsfile  [friend]
```

13.69.5.6 options

```
friend class options  [friend]
```

13.69.5.7 perfedit

```
friend class perfedit  [friend]
```

13.69.5.8 perfroll

```
friend class perfroll  [friend]
```

13.69.5.9 input_thread_func

```
void* input_thread_func (
            void * myperf )  [friend]
```

Parameters

myperf	Provides the perform object instance that is to be used. Its output_func() is called. Currently, this parameter is not validated, for speed.

Returns

Always returns nullptr.

13.69.5.10 output_thread_func

```
void* output_thread_func (
            void * myperf )  [friend]
```

Set up the performance, set the process to realtime privileges, and then start the output function.

Parameters

myperf	Provides the perform object instance that is to be used. Its output_func() is called. Currently, this parameter is not validated, for speed.

Returns

Always returns nullptr.

13.69.5.11 jack_sync_callback

```
int jack_sync_callback (
            jack_transport_state_t state,
            jack_position_t * pos,
            void * arg )  [friend]
```

This JACK synchronization callback informs the specified perform object of the current state and parameters of JACK.

The transport state will be:

```
-   JackTransportStopped when a new position is requested.
-   JackTransportStarting when the transport is waiting to start.
-   JackTransportRolling when the timeout has expired, and the
    position is now a moving target.
```

This is the slow-sync callback, which the stazed code replaces with jack_transport_callback().

Parameters

state	The JACK Transport state.
pos	The JACK position value.
arg	The pointer to the jack_assistant object. Currently not checked for nullity, nor dynamic-casted.

Returns

Returns 1 if the function works, and 0 if something was wrong.

13.69.5.12 jack_transport_callback

```
int jack_transport_callback (
            jack_nframes_t nframes,
            void * arg )  [friend]
```

13.69.5.13 jack_shutdown

```
void jack_shutdown (
            void * arg )  [friend]
```

13.69.5.14 jack_timebase_callback

```
void jack_timebase_callback (
            jack_transport_state_t state,
            jack_nframes_t nframes,
            jack_position_t * pos,
            int new_pos,
            void * arg )  [friend]
```

The original version of the function worked properly with Hydrogen, but not with Klick. The new code seems to work with both. More testing and clarification is needed. This new code was "discovered" in the source-code for the "SooperLooper" project:

```
    http://essej.net/sooperlooper/
```

The first difference with the new code is that it handles the case where the JACK position is moved (new_pos == true). If this is true, and the JackPositionBBT bit is off in pos->valid, then the new BBT value is set.

The seconds set of differences are in the "else" clause. In the new code, it is very simple: calculate the new tick value, back it off by the number of ticks in a beat, and perhaps go to the first beat of the next bar.

In the old code (complex!), the simple BBT adjustment is always made. This changes (perhaps) the beats_per_bar, beat_type, etc. We need to make these settings use the actual global values for beats set for Sequencer64. Then, if transitioning from JackTransportStarting to JackTransportRolling (instead of checking new_pos!), the BBT values (bar, beat, and tick) are finally adjusted. Here are the steps, with old and new steps noted:

```
-#  Calculate the "delta" ticks based on the current frame, the
    ticks_per_beat, the beats_per_minute, and the frame_rate.  The old
    code saves this in a local, the new code assigns it to pos->tick.
-#  Old code: save this delta as a positive value.
-#  Figure out the settings and modify bar, beat, tick, and
    bar_start_tick.  The old and new code seem to have the same intent,
    but it seems like the new code is faster and also correct.
    -   Old code:  Calculations are made by division and mod
        operations.
    -   New code:  Calculations are made by increments and decrements
        in a while loop.
```

Stazed:

```
The call to jack_timebase_callback() to supply JACK with BBT, etc. would
occasionally fail when the pos information had zero or some garbage in
the pos.frame_rate variable. This would occur when there was a rapid
change of frame position by another client... i.e. qjackctl.  From the
JACK API:

    pos   address of the position structure for the next cycle;
    pos->frame will be its frame number. If new_pos is FALSE, this
    structure contains extended position information from the current
    cycle.  If TRUE, it contains whatever was set by the requester.
    The timebase_callback's task is to update the extended information
    here."

    The "If TRUE" line seems to be the issue. It seems that qjackctl
    does not always set pos.frame_rate so we get garbage and some
    strange BBT calculations that display in qjackctl. So we need to
    set it here and just use m_jack_frame_rate for calculations instead
    of pos.frame_rate.
```

Parameters

state	Indicates the current state of JACK transport.
nframes	The number of JACK frames in the current time period.
pos	Provides the position structure to be filled in, the address of the position structure for the next cycle; pos->frame will be its frame number. If new_pos is FALSE, this structure contains extended position information from the current cycle. If TRUE, it contains whatever was set by the requester. The timebase_callback's task is to update the extended information here.
new_pos	TRUE (non-zero) for a newly requested pos, or for the first cycle after the timebase_callback is defined. This is usually 0 in Sequencer64 at present, and 1 if one, say, presses "rewind" in qjackctl.
arg	Provides the jack_assistant pointer, currently unchecked for nullity.

13.69.5.15 get_current_jack_position

```
long get_current_jack_position (
             void * arg )  [friend]
```

Warning

Currently valgrind flags j->client() as uninitialized.

13.69.6 Field Documentation

13.69.6.1 sm_mc_dummy

```
midi_control seq64::perform::sm_mc_dummy  [static], [private]
```

Instantiate the dummy midi_control object, which is used in lieu of a null pointer.

We're taking code that basically works already, in the sense that it never seems to access a null pointer. So we're not even risking data transfers between this dummy object and the ones we really want to use.

However, it would be nice to be able to detect any errors that occur. How?

13.69.6.2 m_song_start_mode

```
bool seq64::perform::m_song_start_mode  [private]
```

This is a replacement for the global setting, but is essentially a global setting itself, and is saved to and restored from the "rc" configuration file. Sometimes called "JACK start mode", it used to be a JACK setting, but now applies to any playback. Do not confuse this setting with m_playback_mode, which has a similar meaning but is more transitory. Probably, the concept needs some clean-up.

13.69.6.3 m_start_from_perfedit

```
bool seq64::perform::m_start_from_perfedit  [private]
```

13.69.6.4 m_reposition

```
bool seq64::perform::m_reposition  [private]
```

13.69.6.5 m_excell_FF_RW

```
float seq64::perform::m_excell_FF_RW  [private]
```

It starts out at 1.0, and can range up to 60.0, being multiplied by 1.1 by the FF/RW timeout function.

13.69.6.6 m_FF_RW_button_type

```
ff_rw_button_t seq64::perform::m_FF_RW_button_type  [private]
```

It has values of FF_RW_REWIND, FF_RW_NONE, or FF_RW_FORWARD. This was a free (global in a namespace) int in perfedit.

13.69.6.7 m_mute_group

```
bool seq64::perform::m_mute_group[c_max_sequence]  [private]
```

This value determines whether a particular track will be muted or unmuted, and it can handle all tracks available in the application (currently c_max_sets * c_seqs_in_set, i.e. 1024). Note that the current state of playing can be "learned", and stored herein as the desired state for the track.

13.69.6.8 m_armed_saved

```
bool seq64::perform::m_armed_saved  [private]
```

13.69.6.9 m_armed_statuses

```
bool seq64::perform::m_armed_statuses[c_max_sequence]  [private]
```

13.69.6.10 m_tracks_mute_state

```
bool seq64::perform::m_tracks_mute_state[c_seqs_in_set]  [private]
```

Unlike the m_mute_group[] array, this holds the current state, rather than the state desired by activating a mute group, and it applies to only one screen-set.

13.69.6.11 m_mode_group

```
bool seq64::perform::m_mode_group  [private]
```

This value starts out true. It is altered by the c_midi_control_mod_gmute handler or when the keys().group_off() or the keys().group_on() keys are struck.

13.69.6.12 m_mode_group_learn

```
bool seq64::perform::m_mode_group_learn  [private]
```

13.69.6.13 m_mute_group_selected

```
int seq64::perform::m_mute_group_selected  [private]
```

It seems like a "group" is essentially a "set" that is selected for the saving and restoring of the status of all patterns in that set.

13.69.6.14 m_playing_screen

```
int seq64::perform::m_playing_screen  [private]
```

In seq24, this value is altered by set_playing_screenset(), which is called by handle_midi_control(c_midi_control↩ _play_ss, state).

13.69.6.15 m_playscreen_offset

```
int seq64::perform::m_playscreen_offset  [private]
```

Saves some multiplications, should make the code easier to grok, and centralizes the use of c_seqs_in_set, which we want to be able to change at run-time, as a future enhancement.

13.69.6.16 m_seqs

```
sequence* seq64::perform::m_seqs[c_max_sequence]  [private]
```

Todo First, make the sequence array a vector, and second, put allof these flags into a structure and access those members indirectly.

13.69.6.17 m_seqs_active

```
bool seq64::perform::m_seqs_active[c_max_sequence]  [private]
```

This array can have "holes" with inactive sequences, so every sequence needs to be checked before using it.

13.69.6.18 m_was_active_main

```
bool seq64::perform::m_was_active_main[c_max_sequence]  [private]
```

This value seems to be used only in maintaining dirtiness-status; did some process modify the sequence? Was it's mute/unmute status changed?

13.69.6.19 m_was_active_edit

```
bool seq64::perform::m_was_active_edit[c_max_sequence]  [private]
```

This value seems to be used only in maintaining dirtiness-status for editing the mute/unmute status during pattern editing.

13.69.6.20 m_was_active_perf

```
bool seq64::perform::m_was_active_perf[c_max_sequence]  [private]
```

This value seems to be used only in maintaining dirtiness-status for editing the mute/unmute status during performance/song editing.

13.69.6.21 m_was_active_names

```
bool seq64::perform::m_was_active_names[c_max_sequence]  [private]
```

This value seems to be used only in maintaining dirtiness-status for editing the mute/unmute status during performance names editing. Not sure that it serves a real purpose; perhaps created with an eye to editing the pattern name in the song editor?

13.69.6.22 m_sequence_state

```
bool seq64::perform::m_sequence_state[c_max_sequence]  [private]
```

13.69.6.23 m_transpose

```
int seq64::perform::m_transpose  [private]
```

13.69.6.24 m_out_thread

```
pthread_t seq64::perform::m_out_thread  [private]
```

Provides a "handle" to the output thread.

13.69.6.25 m_in_thread

```
pthread_t seq64::perform::m_in_thread  [private]
```

13.69.6.26 m_out_thread_launched

```
bool seq64::perform::m_out_thread_launched  [private]
```

13.69.6.27 m_in_thread_launched

```
bool seq64::perform::m_in_thread_launched  [private]
```

13.69.6.28 m_running

```
bool seq64::perform::m_running  [private]
```

However, this flag is conflated with some JACK support, and we have to supplement it with another flag, m_↩ pattern_playing.

13.69.6.29 m_is_pattern_playing

```
bool seq64::perform::m_is_pattern_playing  [private]
```

It replaces rc_settings :: is_pattern_playing(), which is gone, since the perform object is now visible to all classes that care about it.

13.69.6.30 m_inputing

```
bool seq64::perform::m_inputing  [private]
```

13.69.6.31 m_outputing

```
bool seq64::perform::m_outputing  [private]
```

13.69.6.32 m_looping

```
bool seq64::perform::m_looping  [private]
```

If true, the performance will loop between the L and R markers in the performance editor.

13.69.6.33 m_playback_mode

```
bool seq64::perform::m_playback_mode  [private]
```

There are two, "live" and "song", indicated by the following values:

```
        m_playback_mode == false:       live mode
        m_playback_mode == true:        playback/song mode
```

13.69.6.34 m_ppqn

```
int seq64::perform::m_ppqn  [private]
```

13.69.6.35 m_bpm

```
midibpm seq64::perform::m_bpm  [private]
```

13.69.6.36 m_beats_per_bar

```
int seq64::perform::m_beats_per_bar  [private]
```

The default value is SEQ64_DEFAULT_BEATS_PER_MEASURE (4).

13.69.6.37 m_beat_width

```
int seq64::perform::m_beat_width  [private]
```

The default value is SEQ64_DEFAULT_BEAT_WIDTH (4).

13.69.6.38 m_clocks_per_metronome

```
int seq64::perform::m_clocks_per_metronome  [private]
```

This value provides the number of MIDI clocks between metronome clicks. The default value of this item is 24. It can also be read from some SMF 1 files, such as our hymne.mid example.

13.69.6.39 m_32nds_per_quarter

```
int seq64::perform::m_32nds_per_quarter  [private]
```

Useful in export. A duplicate of the same member in the sequence class.

13.69.6.40 m_us_per_quarter_note

```
long seq64::perform::m_us_per_quarter_note  [private]
```

Useful in export. A duplicate of the same member in the sequence class.

13.69.6.41 m_master_bus

```
mastermidibus* seq64::perform::m_master_bus  [private]
```

We changed this item to a pointer so that we can delay the creation of this object until after all settings have been read.

13.69.6.42 m_master_clocks

```
std::vector<clock_e> seq64::perform::m_master_clocks  [private]
```

13.69.6.43 m_master_inputs

```
std::vector<bool> seq64::perform::m_master_inputs  [private]
```

13.69.6.44 m_one_measure

```
midipulse seq64::perform::m_one_measure  [private]
```

We can save some multiplications, and, more importantly, later define a more flexible definition of "one measure's worth" than simply four quarter notes.

13.69.6.45 m_left_tick

```
midipulse seq64::perform::m_left_tick  [private]
```

Note that "tick" is actually "pulses".

13.69.6.46 m_right_tick

```
midipulse seq64::perform::m_right_tick  [private]
```

Note that "tick" is actually "pulses".

13.69.6.47 m_starting_tick

```
midipulse seq64::perform::m_starting_tick  [private]
```

By default, this value is always reset to the value of the "left tick". We want to eventually be able to leave it at the last playing tick, to support a "pause" functionality. Note that "tick" is actually "pulses".

13.69.6.48 m_tick

```
midipulse seq64::perform::m_tick  [mutable], [private]
```

The m_tick member holds the tick to be used in displaying the progress bars and the maintime pill. It is mutable because sometimes we want to adjust it in a const function for pause functionality.

13.69.6.49 m_jack_tick

```
midipulse seq64::perform::m_jack_tick  [private]
```

13.69.6.50 m_usemidiclock

```
bool seq64::perform::m_usemidiclock  [private]
```

13.69.6.51 m_midiclockrunning

```
bool seq64::perform::m_midiclockrunning  [private]
```

13.69.6.52 m_midiclocktick

```
int seq64::perform::m_midiclocktick  [private]
```

13.69.6.53 m_midiclockpos

```
int seq64::perform::m_midiclockpos  [private]
```

13.69.6.54 m_dont_reset_ticks

```
bool seq64::perform::m_dont_reset_ticks  [private]
```

All this member is used for is keeping the last tick from being reset.

13.69.6.55 m_screen_set_notepad

```
std::string seq64::perform::m_screen_set_notepad[c_max_sets]  [private]
```

13.69.6.56 m_midi_cc_toggle

```
midi_control seq64::perform::m_midi_cc_toggle[c_midi_controls_extended]  [private]
```

13.69.6.57 m_midi_cc_on

```
midi_control seq64::perform::m_midi_cc_on[c_midi_controls_extended]  [private]
```

13.69.6.58 m_midi_cc_off

```
midi_control seq64::perform::m_midi_cc_off[c_midi_controls_extended]  [private]
```

13.69.6.59 m_offset

```
int seq64::perform::m_offset  [private]
```

It is used in the MIDI control of the playback status of the sequences in the current screen-set. It is also used to offset the sequence numbers so that the control (mute/unmute) keys can be shown on any screen-set.

13.69.6.60 m_control_status

```
int seq64::perform::m_control_status  [private]
```

Need to learn more about this one. It is used in the replace, snapshot, and queue functionality.

13.69.6.61 m_screenset

```
int seq64::perform::m_screenset  [private]
```

This is merely the screen-set that is in view. The fix of tdeagan substitutes the "in-view" screen-set for the "playing" screen-set.

13.69.6.62 m_seqs_in_set

```
int seq64::perform::m_seqs_in_set  [private]
```

This change will require some arrays to be dynamically allocated (vectors).

13.69.6.63 m_max_sets

```
int seq64::perform::m_max_sets  [private]
```

Again, currently set to the old value, which is used in hard-wired array sizes. To make it variable will require a move from arrays to vectors.

13.69.6.64 m_sequence_count

```
int seq64::perform::m_sequence_count  [private]
```

Used by the install_sequence() function. Note that this value is not a suitable replacement for c_max_sequence/m↩
_sequence_max, because there can be inactive sequences amidst the active sequences. See the m_sequence↩
_limit member.

13.69.6.65 m_sequence_max

```
int seq64::perform::m_sequence_max  [private]
```

However, this value is already 32 ∗ 32 = 1024, and is probably enough for any usage. Famous last words?

13.69.6.66 m_sequence_high

```
int seq64::perform::m_sequence_high  [private]
```

This value starts as 0, to indicate no sequences loaded, and then contains the highest sequence number hitherto loaded, plus 1 so that it can be used as a for-loop limit similar to m_sequence_max. It's maximum value should be m_sequence_max (c_max_sequence).

Currently meant only for limited context to try to squeeze a little extra speed out of playback. There's no easy way to lower this value when the highest sequence is deleted, though.

13.69.6.67 m_edit_sequence

```
int seq64::perform::m_edit_sequence  [private]
```

Moving this status from seqmenu into perform for better centralized management.

13.69.6.68 m_is_modified

```
bool seq64::perform::m_is_modified  [private]
```

All the GUIs seem to use a perform object.

13.69.6.69 m_condition_var

```
condition_var seq64::perform::m_condition_var  [private]
```

It is signalled if playback has been started. The output thread function waits on this variable until m_running and m_outputing are false. This variable is also signalled in the perform destructor.

13.69.6.70 m_jack_asst

```
jack_assistant seq64::perform::m_jack_asst  [private]
```

It implements most of the JACK stuff.

13.69.6.71 m_have_undo

```
bool seq64::perform::m_have_undo  [private]
```

13.69.6.72 m_undo_vect

```
std::vector<int> seq64::perform::m_undo_vect  [private]
```

See the push_trigger_undo() function.

13.69.6.73 m_have_redo

```
bool seq64::perform::m_have_redo  [private]
```

13.69.6.74 m_redo_vect

```
std::vector<int> seq64::perform::m_redo_vect  [private]
```

See the pop_trigger_undo() function.

13.69.6.75 m_notify

```
std::vector<performcallback *> seq64::perform::m_notify  [private]
```

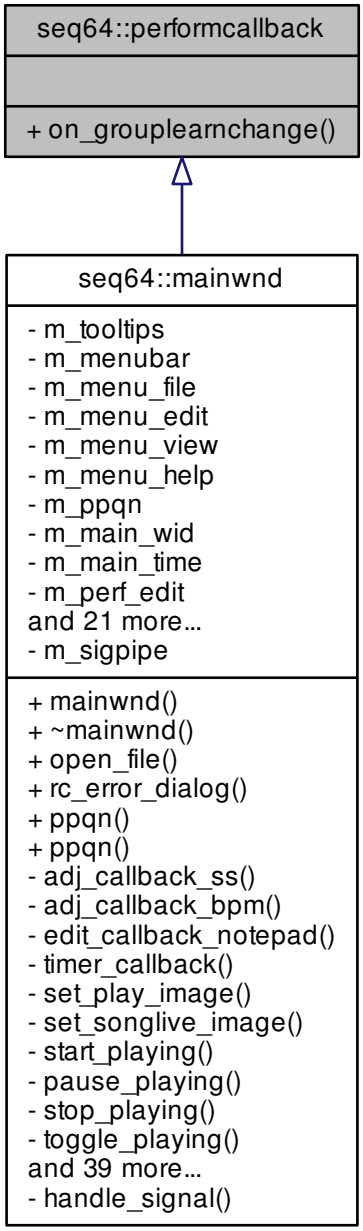
13.69.6.76 m_gui_support

```
gui_assistant& seq64::perform::m_gui_support  [private]
```

13.70 seq64::performcallback Struct Reference

Provides for notification of events.

Inheritance diagram for seq64::performcallback:



Public Member Functions

- virtual void on_grouplearnchange (bool)

  A do-nothing callback.

13.70.1 Detailed Description

Provide a response to a group-learn change event.

13.70.2 Member Function Documentation

13.70.2.1 on_grouplearnchange()

```
virtual void seq64::performcallback::on_grouplearnchange (
            bool  )  [inline], [virtual]
```

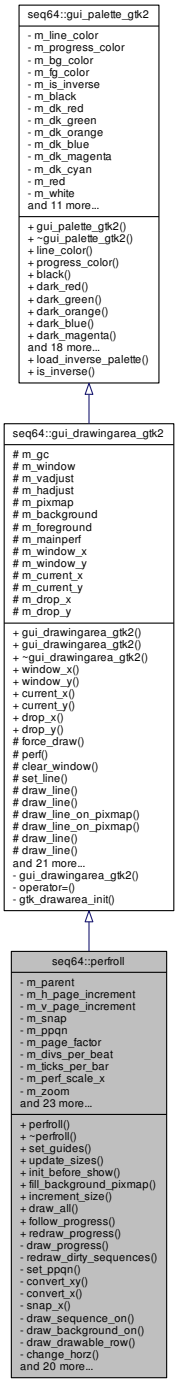
"state" is an Unused parameter.

Reimplemented in seq64::mainwnd.

13.71 seq64::perfroll Class Reference

This class implements the performance roll user interface.

Inheritance diagram for seq64::perfroll:



Public Member Functions

- perfroll (perform &perf, perfedit &parent, Gtk::Adjustment &hadjust, Gtk::Adjustment &vadjust, int ppqn=S↩ EQ64_USE_DEFAULT_PPQN)

  Principal constructor.
- virtual ~perfroll ()

  This destructor deletes the interaction object.

- void set_guides (int snap, int measure, int beat)

  This function sets the m_snap, m_measure_length, and m_beat_length members directly from the function parameters, which are in units of pulses (sometimes misleadingly called "ticks".)
- void update_sizes ()

  Updates the sizes of various items.
- void init_before_show ()

  Sets the roll-lengths ticks member.
- void fill_background_pixmap ()

  This function updates the background of the piano roll.
- void increment_size ()

  Increments the value of m_roll_length_ticks by the PPQN ∗ 512, then calls update_sizes().
- void draw_all ()

  Provides a very common sequence of calls used in perfroll_input.
- void follow_progress ()
- void redraw_progress ()

  Helper function to simplify the client call.

Private Member Functions

- void draw_progress ()

  Draws the progress line that shows where we are in the performance.
- void redraw_dirty_sequences ()

  Redraws patterns/sequences that have been modified.
- void set_ppqn (int ppqn)

  Handles changes to the PPQN value in one place.
- void convert_xy (int x, int y, midipulse &ticks, int &seq)

  Converts (x, y) coordinates on the piano roll to tick (pulse) and sequence numbers.
- void convert_x (int x, midipulse &ticks)

  Converts an x-coordinate to a tick-offset on the x axis.
- void snap_x (int &x)

  This function performs a 'snap' action on x.
- void draw_sequence_on (int seqnum)

  Draws the given pattern/sequence on the given drawable area.
- void draw_background_on (int seqnum)

  Draws the given pattern/sequence background on the given drawable area.
- void draw_drawable_row (long y)

  Not quite sure what this draws yet.
- void change_horz ()

  Changes the 4-bar horizontal offset member and queues up a draw operation.
- void change_vert ()

  Changes the vertical offset member and queues up a draw operation.
- void split_trigger (int sequence, midipulse tick)

  Splits a trigger, whatever that means.
- void enqueue_draw ()

  Wraps queue_draw() and forwards the call to the parent perfedit, so that it can forward it to any other perfedit that exists.
- void set_zoom (int z)

  Implements the horizontal zoom feature.
- void convert_drop_xy ()

  A convenience function.

- void horizontal_adjust (double step)

  This function provides optimization for the on_scroll_event() function.
- void vertical_adjust (double step)

  This function provides optimization for the on_scroll_event() function.
- void horizontal_set (double value)

  Sets the exact position of a horizontal scroll-bar.
- void vertical_set (double value)

  Sets the exact position of a vertical scroll-bar.
- void on_realize ()

  Provides the on-realization callback.
- bool on_expose_event (GdkEventExpose ∗ev)

  Handles the on-expose event.
- bool on_button_press_event (GdkEventButton ∗ev)

  This callback function handles a button press by forwarding it to the interaction object's button-press function.
- bool on_button_release_event (GdkEventButton ∗ev)

  This callback function handles a button release by forwarding it to the interaction object's button-release function.
- bool on_motion_notify_event (GdkEventMotion ∗ev)

  Handles motion notification by forwarding it to the interaction object's motion-notification callback function.
- bool on_scroll_event (GdkEventScroll ∗ev)

  Handles horizontal and vertical scrolling.
- bool on_focus_in_event (GdkEventFocus ∗ev)

  This callback handles an in-focus event by setting the flag to HAS_FOCUS.
- bool on_focus_out_event (GdkEventFocus ∗ev)

  This callback handles an out-of-focus event by resetting the flag HAS_FOCUS.
- void on_size_allocate (Gtk::Allocation &al)

  Upon a size allocation event, this callback calls the base-class version of this function, then sets m_window_x and m_window_y, and calls update_sizes().
- bool on_key_press_event (GdkEventKey ∗ev)

  This callback function handles a key-press event.
- void on_size_request (GtkRequisition ∗)

  This do-nothing callback effectively throws away a size request.

Private Attributes

- perfedit & m_parent

  Provides a link to the perfedit that created this object.
- int m_h_page_increment

  Provides the horizontal page increment for the horizontal scrollbar.
- int m_v_page_increment

  Provides the vertical page increment for the vertical scrollbar.
- int m_snap

  The amount of horizontal snap.
- int m_ppqn

  Parts-per-quarter-note value.
- int m_page_factor

  4096, horizonal page sizing.
- int m_divs_per_beat

  Holds current tick scaling value.
- midipulse m_ticks_per_bar

  Holds current bar scaling value.

- int m_perf_scale_x

  Scaling based on zoom and PPQN.
- int m_zoom

  New value to attempt a rudimentary time-zoom feature.
- int m_names_y

  The maximum height of the perfroll names box, in pixes.
- int m_background_x

  The width of the perfroll background.
- int m_size_box_w

  This is a basically constant value set to s_perfroll_size_box_w = 3.
- int m_measure_length

  The legnth of a measure, in beat units.
- int m_beat_length

  The length of a beat, in parts-per-quarter note.
- midipulse m_old_progress_ticks

  Saves the position of the progress bar, for erasing it in preparation for drawing it at the next tick value.
- bool m_have_button_press

  Used in the fruity and seq24 perfroll input classes to help with trigger push/pop management.
- bool m_transport_follow

  Indicates that the application should follow JACK transport.
- bool m_trans_button_press

  Indicates if the follow-transport button is pressed.
- midipulse m_4bar_offset

  Holds the horizontal offset related to the horizontal scroll-bar position.
- int m_sequence_offset

  This value is the vertical version of m_4bar_offset.
- int m_roll_length_ticks

  Provides the width of the piano roll in ticks.
- midipulse m_drop_tick

  The horizontal location for section movement.
- midipulse m_drop_tick_trigger_offset

  The horizontal trigger location for section movement.
- int m_drop_sequence

  Holds the currently-selected sequence being moved.
- int m_sequence_max

  Currently, just a class-specific version of c_max_sequence, meant for the future.
- bool m_sequence_active [c_max_sequence]

  Used when drawing an active sequence.
- FruityPerfInput m_fruity_interaction

  We need both styles of interaction object present.
- Seq24PerfInput m_seq24_interaction

  Provides support for standard Seq24 mouse handling, plus the keystroke handlers.
- AbstractPerfInput & m_interaction

  Provides a reference to the selected (at startup time) method of mouse interaction.
- bool m_moving

  Used in the Seq24 or Fruity processing when moving a section of triggers.
- bool m_growing

  Used in the Seq24 or Fruity processing when growing a section of triggers.
- bool m_grow_direction

  Used in the Seq24 or Fruity processing when growing a section of triggers.

Friends

- class FruityPerfInput

  These friend implement interaction-specific behavior, although only the Seq24 interactions support full keyboard processing, except for some common functionality provided by perform::perfroll_key_event().
- class Seq24PerfInput
- class perfedit

Additional Inherited Members

13.71.1 Constructor & Destructor Documentation

13.71.1.1 perfroll()

```
seq64::perfroll::perfroll (
            perform & perf,
            perfedit & parent,
            Gtk::Adjustment & hadjust,
            Gtk::Adjustment & vadjust,
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

13.71.1.2 ~perfroll()

```
seq64::perfroll::~perfroll ( )  [virtual]
```

Well, now there are two objects, so no explicit deletion necessary.

13.71.2 Member Function Documentation

13.71.2.1 set_guides()

```
void seq64::perfroll::set_guides (
            int snap,
            int measure,
            int beat )
```

This function then fills in the background, and queues up a draw operation.

Parameters

snap	Provides the number of snap-pulses (pulses per snap interval) as calculated in perfedit::set_guides(). This is actually equal to the measure-pulses divided by the snap value in perfedit; the snap value defaults to 8.
measure	Provides the number of measure-pulses (pulses per measure) as calculated in perfedit::set_guides().
beat	Provides the number of beat-pulses (pulses per beat) as calculated in perfedit::set_guides().

13.71.2.2 update_sizes()

```
void seq64::perfroll::update_sizes ( )
```

Note

Trying to figure out what the 16 is. So take the "bars-visible" calculation, the c_perf_scale_x value, assume that "ticks" is another name for "pulses", and assume that "beats" is a quarter note. Ignoring the numbers, the units come out to:

```
            pixels * ticks / pixel
   bars = --------------------------------
            ticks / beat * beats / bar
```

```
Thus, the 16 is a "beats per bar" or "beats per measure" value.
This doesn't quite make sense, but there are 16 divisions per
beat on the perfroll user-interface.  So for now we'll call it
the latter, and make a variable called "m_divs_per_beat", see its
definition in the class initializer list.
```

13.71.2.3 init_before_show()

```
void seq64::perfroll::init_before_show ( )
```

First, it gets the largest trigger value among the active sequences. Then it truncates this value to the nearest PPQN ∗ 16 ticks. Then it adds PPQN ∗ 4096 ticks.

13.71.2.4 fill_background_pixmap()

```
void seq64::perfroll::fill_background_pixmap ( )
```

The first thing done is to clear the background by painting it with a filled white rectangle.

This function is called whenever something occurs (e.g. zoom) that can affect how the piano roll is drawn.

13.71.2.5 increment_size()

```
void seq64::perfroll::increment_size ( )
```

13.71.2.6 draw_all()

```
void seq64::perfroll::draw_all ( )
```

m_drop_y is adjusted by perfroll::change_vert() for any scroll after it was originally selected. The call below to draw_drawable_row() will have the wrong y location and un-select will not occur if the user scrolls the track up or down to a new y location, if not adjusted.

13.71.2.7 follow_progress()

```
void seq64::perfroll::follow_progress ( )
```

13.71.2.8 redraw_progress()

```
void seq64::perfroll::redraw_progress ( )  [inline]
```

13.71.2.9 draw_progress()

```
void seq64::perfroll::draw_progress ( )  [private]
```

We would like to be able to leave the line there when the progress is paused while running off of JACK transport. How? The perf().get_tick() call always returns 0 when stop is in force.

If we comment out the erasure of the old line, we see that the progress bar is also erased when a pattern boundary is hit (triggers), and when the sequence is stopped by the user.

In order to support true pause in the song editor, we tried to replace perform::get_tick() with perform::get_start_tick() and perform::get_last_tick() [a new experimental function]. But those replacements here always return 0, even as perform::get_tick() increases. Now were are trying a newer function, perform::get_max_tick(), which seems to do the trick for resuming (instead of rewinding) the progress bar. It's still a tiny bit laggy, so we have to find a faster way to get the maximum. (Note that the draw_progress function is called at every timeout, that is, constantly.)

The perform::get_max_tick() call doesn't work with JACK: the progress bar rewinds to the beginning when playback is paused, though it does resume where it left off. It also may cause the progress bar to backtrack through any gap. Let's restore the get_tick() call.

13.71.2.10 redraw_dirty_sequences()

```
void seq64::perfroll::redraw_dirty_sequences ( )  [private]
```

Change Note ca 2016-05-30 Lets try not drawing sequences greater than the maximum, at all.

13.71.2.11 set_ppqn()

```
void seq64::perfroll::set_ppqn (
            int ppqn )  [private]
```

The m_ticks_per_bar member replaces the global ppqn times 16. This construct is parts-per-quarter-note times 4 quarter notes times 4 sixteenth notes in a bar. (We think...)

The m_perf_scale_x member starts out at c_perf_scale_x, which is 32 ticks per pixel at the default tick rate of 192 PPQN. We adjust this now. But note that this calculation still involves the c_perf_scale_x constant.

Todo Resolve the issue of c_perf_scale_x versus m_perf_scale_x in perfroll.

13.71.2.12 convert_xy()

```
void seq64::perfroll::convert_xy (
            int x,
            int y,
            midipulse & d_tick,
            int & d_seq )  [private]
```

The results are returned via the d_tick and d_seq parameters. The sequence number is clipped to a legal value (0 to m_sequence_max).

Parameters

	x	The x coordinate of the mouse pointer.
	y	The y coordinate of the mouse pointer.
out	*d_tick*	Holds the calculated tick value.
out	*d_seq*	Holds the calculated sequence-number value.

13.71.2.13 convert_x()

```
void seq64::perfroll::convert_x (
            int x,
            midipulse & tick )  [private]
```

The result is returned via the tick parameter. Note that m_4bar_offset already includes the m_ticks_per_bar = ppqn $*$ 16 factor, for speed.

Parameters

	x	The input x (pixel) value.
out	*tick*	Holds the result of the calculation.

13.71.2.14 snap_x()

```
void seq64::perfroll::snap_x (
            int & x )  [private]
```

- m_snap = number pulses to snap to
- m_perf_scale_x = number of pulses per pixel

Therefore mod = m_snap/m_perf_scale_x equals the number pixels to snap to.

13.71.2.15 draw_sequence_on()

```
void seq64::perfroll::draw_sequence_on (
            int seqnum )  [private]
```

Statement nesting from hell!

13.71.2.16 draw_background_on()

```
void seq64::perfroll::draw_background_on (
            int seqnum )  [private]
```

13.71.2.17 draw_drawable_row()

```
void seq64::perfroll::draw_drawable_row (
            long y )  [private]
```

It is involved in the drawing of a greyed (selected) row.

What's weird is that we divide y by m_names_y, then multiply it by m_names_y, before passing the result to draw_drawable(). However, if we just use y casted to an int, then the drawing of the row is only partial, vertically.

13.71.2.18 change_horz()

```
void seq64::perfroll::change_horz ( )  [private]
```

Since the m_4bar_offset value is always multiplied by m_ticks_per_bar before usage, let's just do it here and not have to multiply it later.

13.71.2.19 change_vert()

```
void seq64::perfroll::change_vert ( )  [private]
```

Stazed:

```
Must adjust m_drop_y or perfroll_input's unselect_triggers() will not
work if scrolled up or down to a new location.  See the note in
on_button_press_event() in the perfroll_input module.  Also see the
note in the draw_all() function.
```

13.71.2.20 split_trigger()

```
void seq64::perfroll::split_trigger (
            int sequence,
            midipulse tick )  [private]
```

13.71.2.21 enqueue_draw()

```
void seq64::perfroll::enqueue_draw ( )  [private]
```

The parent perfedit will call perfroll::queue_draw() on behalf of this object, and it will pass a perfroll::enqueue_draw() to the peer perfedit's perfroll, if the peer exists.

13.71.2.22 set_zoom()

```
void seq64::perfroll::set_zoom (
            int z )  [private]
```

Change Note ca 2016-04-05 The initial zoom value is c_perf_scale_x (32). We allow it to range from 1 to 128, for now. Smaller values zoom in.

13.71.2.23 convert_drop_xy()

```
void seq64::perfroll::convert_drop_xy ( )  [inline], [private]
```

13.71.2.24 horizontal_adjust()

```
void seq64::perfroll::horizontal_adjust (
            double step )  [inline], [private]
```

A duplicate of the one in seqroll.

Parameters

step	Provides the step value to use for adjusting the horizontal scrollbar. See gui_drawingarea_gtk2::scroll_hadjust() for more information.

13.71.2.25 vertical_adjust()

```
void seq64::perfroll::vertical_adjust (
            double step )  [inline], [private]
```

A near-duplicate of the one in seqroll.

Parameters

step	Provides the step value to use for adjusting the vertical scrollbar. See gui_drawingarea_gtk2::scroll_vadjust() for more information.

13.71.2.26 horizontal_set()

```
void seq64::perfroll::horizontal_set (
            double value )  [inline], [private]
```

Parameters

value	The desired position. Mostly this is either 0.0 or 9999999.0 (an "infinite" value to select the start or end position.

13.71.2.27 vertical_set()

```
void seq64::perfroll::vertical_set (
            double value )  [inline], [private]
```

Parameters

value	The desired position. Mostly this is either 0.0 or 9999999.0 (an "infinite" value to select the start or end position.

13.71.2.28 on_realize()

```
void seq64::perfroll::on_realize ( )  [private]
```

Calls the base-class version first.

Then it allocates the additional resources need, that couldn't be initialized in the constructor, and makes some connections.

Stazed:

```
This creation of m_background needs to be set to the max width for
proper drawing of zoomed measures or they will get truncated with high
beats per measure and low beat width. Since this is a constant size,
it cannot be adjusted later for zoom. The constant
c_perfroll_background_x is set to the max amount by default for use
here. The drawing functions fill_background_pixmap() and
draw_background_on() which use c_perfroll_background_x also, could be
adjusted by zoom with a substituted variable. Not sure if there is any
benefit to doing the adjustment...  Perhaps a small benefit in speed?
Maybe FIXME if really, really bored...
```

13.71.2.29 on_expose_event()

```
bool seq64::perfroll::on_expose_event (
            GdkEventExpose * ev )  [private]
```

Draws a vertical page of the performance editor. The part drawn starts at m_sequence_offset and continues until the last sequence that can be at least partially seen given the height of the window.

If we're at the bottom of the sequences (1024, a non-existent sequence) would be the last sequence shown, we don't bother drawing it. This prevents debug messages about an illegal sequence, and can show a black bottom row that is a clear sign we're at the end of the legal sequences.

Parameters

ev	Provides the expose event.

Returns

Always returns true.

13.71.2.30 on_button_press_event()

```
bool seq64::perfroll::on_button_press_event (
            GdkEventButton * ev )  [private]
```

This gives us Seq24 versus Fruity behavior.

One minor issue: Fruity behavior doesn't yet provide the keystroke behavior we now handle for the Seq24 mode of operation.

13.71.2.31 on_button_release_event()

```
bool seq64::perfroll::on_button_release_event (
            GdkEventButton * ev )  [private]
```

This gives us Seq24 versus Fruity behavior.

13.71.2.32 on_motion_notify_event()

```
bool seq64::perfroll::on_motion_notify_event (
            GdkEventMotion * ev )  [private]
```

13.71.2.33 on_scroll_event()

```
bool seq64::perfroll::on_scroll_event (
            GdkEventScroll * ev )  [private]
```

If the Shift key is held while scrolling, then the scrolling is horizontal, otherwise it is vertical. This matches the convention of the seqedit class.

Note that, unlike the seqedit class, Ctrl-Scroll is not used to modify the zoom value. Rather than mess up legacy behavior, we will rely on keystrokes (z, 0, Z, and Ctrl-Page-Up and Ctrl-Page-Down) to implement this zoom.

Parameters

ev	Provides the scroll event.

Returns

Currently always returns true.

13.71.2.34 on_focus_in_event()

```
bool seq64::perfroll::on_focus_in_event (
            GdkEventFocus * ev )  [private]
```

13.71.2.35 on_focus_out_event()

```
bool seq64::perfroll::on_focus_out_event (
            GdkEventFocus * ev )  [private]
```

13.71.2.36 on_size_allocate()

```
void seq64::perfroll::on_size_allocate (
            Gtk::Allocation & al )  [private]
```

13.71.2.37 on_key_press_event()

```
bool seq64::perfroll::on_key_press_event (
            GdkEventKey * ev )  [private]
```

If we don't check the event type first, then the ev->keyval value is something weird like 65507. Note that we pass the functionality on to the perform::perfroll_key_event() function for the handling of delete, cut, copy, paste, and undo operations. If the keystroke is not handled by that function, then we handle it here.

Note that only the Seq24 input interaction object handles additional keystrokes not handled by the perfroll_key_↩ event() function.

The perfroll_key_event() call handles Del, Ctrl-X, Ctrl-C, Ctrl-V, and Ctrl-Z (which does nothing at present).

We've also added support for moving up and down in the piano roll (Up and Down arrows), paging up and down (Page-Up and Page-Down keys), paging left and right (Shift Page-Up and Page-Down), paging to top and bottom (Home and End), and paging to start and end (Shift Home and End).

The Keypad-End key is an issue on our ASUS "gaming" laptop. Whether it is seen as a "1" or an "End" key depends on an interaction between the Shift and the Num Lock key. Annoying, takes some time to get used to.

Stazed: there are many changes from seq32 that need to be studied before including them here. Note that, even though we filter out the Ctrl key here, it still works for Ctrl-X (cut) and Ctrl-V (paste). For undo, the Undo button can be used, Ctrl-Z never worked in this view anyway.

Warning

We see that 'x' and 'z' are already handled in perfroll_key_event() if the Ctrl key was pressed. Be careful.

13.71.2.38 on_size_request()

```
void seq64::perfroll::on_size_request (
            GtkRequisition *  )  [inline], [private]
```

13.71.3 Friends And Related Function Documentation

13.71.3.1 FruityPerfInput

```
friend class FruityPerfInput  [friend]
```

The perfedit class needs access to the private enqueue_draw() function.

13.71.3.2 Seq24PerfInput

```
friend class Seq24PerfInput  [friend]
```

13.71.3.3 perfedit

```
friend class perfedit  [friend]
```

13.71.4 Field Documentation

13.71.4.1 m_parent

```
perfedit& seq64::perfroll::m_parent  [private]
```

We want to support two perfedit windows, but the children of perfedit will have to communicate changes requiring a redraw through the parent.

13.71.4.2 m_h_page_increment

```
int seq64::perfroll::m_h_page_increment  [private]
```

It was set to 1, the same as the step increment. That is too little. This value will be set to 4, for now. Might be a useful "user" configuration option.

13.71.4.3 m_v_page_increment

```
int seq64::perfroll::m_v_page_increment  [private]
```

It was set to 1, the same as the step increment. That is too little. This value will be set to 8, for now. Might be a useful "user" configuration option.

13.71.4.4 m_snap

```
int seq64::perfroll::m_snap  [private]
```

13.71.4.5 m_ppqn

```
int seq64::perfroll::m_ppqn  [private]
```

13.71.4.6 m_page_factor

```
int seq64::perfroll::m_page_factor  [private]
```

13.71.4.7 m_divs_per_beat

```
int seq64::perfroll::m_divs_per_beat  [private]
```

13.71.4.8 m_ticks_per_bar

```
midipulse seq64::perfroll::m_ticks_per_bar  [private]
```

13.71.4.9 m_perf_scale_x

```
int seq64::perfroll::m_perf_scale_x  [private]
```

13.71.4.10 m_zoom

```
int seq64::perfroll::m_zoom  [private]
```

It seems to work pretty well now.

13.71.4.11 m_names_y

```
int seq64::perfroll::m_names_y  [private]
```

This is currently semantically a constant set to c_names_y = 24.

13.71.4.12 m_background_x

```
int seq64::perfroll::m_background_x  [private]
```

This is based on the m_ppqn value and the value of c_perf_scale_x (or is m_perf_scale_x preferable?)

13.71.4.13 m_size_box_w

```
int seq64::perfroll::m_size_box_w  [private]
```

It is used in drawing the short lines of the small box that sits at the top-left and bottom-right corners of each segment in the pattern editor. These can be used to lengthen and shorten a section in the song editor. We will increase this size, perhaps double it, to make it easier to grab.

13.71.4.14 m_measure_length

```
int seq64::perfroll::m_measure_length  [private]
```

13.71.4.15 m_beat_length

```
int seq64::perfroll::m_beat_length  [private]
```

13.71.4.16 m_old_progress_ticks

```
midipulse seq64::perfroll::m_old_progress_ticks  [private]
```

See the draw_progress() function. This could almost be static inside that function.

13.71.4.17 m_have_button_press

```
bool seq64::perfroll::m_have_button_press  [private]
```

13.71.4.18 m_transport_follow

```
bool seq64::perfroll::m_transport_follow  [private]
```

The alternative is ...?

13.71.4.19 m_trans_button_press

```
bool seq64::perfroll::m_trans_button_press  [private]
```

13.71.4.20 m_4bar_offset

```
midipulse seq64::perfroll::m_4bar_offset  [private]
```

Used in drawing the progress bar and the sequence events. Also used in convert_x() and convert_xy(). This used to be the offset in units of bar ticks, but now we use it as a full-fledged ticks value. See the change_horz() function.

13.71.4.21 m_sequence_offset

```
int seq64::perfroll::m_sequence_offset  [private]
```

It is obtained or changed when the vertical scroll-bar moves. It is used for drawing the correct vertical window in the piano roll.

13.71.4.22 m_roll_length_ticks

```
int seq64::perfroll::m_roll_length_ticks  [private]
```

Calculated in init_before_show() based on the maximum trigger found in the perform object, the ticks/bar, the P↩ PQN, and the page factor. Also can be increased in size in the increment_size() function [tied to the Grow button]. Used in update_sizes().

13.71.4.23 m_drop_tick

```
midipulse seq64::perfroll::m_drop_tick  [private]
```

Used only by the friend modules perfroll_input and fruityperfroll_input.

13.71.4.24 m_drop_tick_trigger_offset

```
midipulse seq64::perfroll::m_drop_tick_trigger_offset  [private]
```

Used only by the friend modules perfroll_input and fruityperfroll_input.

13.71.4.25 m_drop_sequence

```
int seq64::perfroll::m_drop_sequence  [private]
```

Used for redrawing the sequence.

13.71.4.26 m_sequence_max

```
int seq64::perfroll::m_sequence_max  [private]
```

13.71.4.27 m_sequence_active

```
bool seq64::perfroll::m_sequence_active[c_max_sequence]  [private]
```

Not sure yet why we can't just use the sequence's member function to access this status boolean.

13.71.4.28 m_fruity_interaction

```
FruityPerfInput seq64::perfroll::m_fruity_interaction  [private]
```

Even if the user specifies the fruity interaction, the Seq24 interaction is still needed to handle our new keystroke support for the perfroll. We need both objects to exist all the time, similar to the Fruity/Seq24 roles in the seqroll object.

Obsolete AbstractPerfInput * m_interaction

13.71.4.29 m_seq24_interaction

```
Seq24PerfInput seq64::perfroll::m_seq24_interaction  [private]
```

13.71.4.30 m_interaction

```
AbstractPerfInput& seq64::perfroll::m_interaction  [private]
```

13.71.4.31 m_moving

```
bool seq64::perfroll::m_moving  [private]
```

13.71.4.32 m_growing

```
bool seq64::perfroll::m_growing  [private]
```

13.71.4.33 m_grow_direction

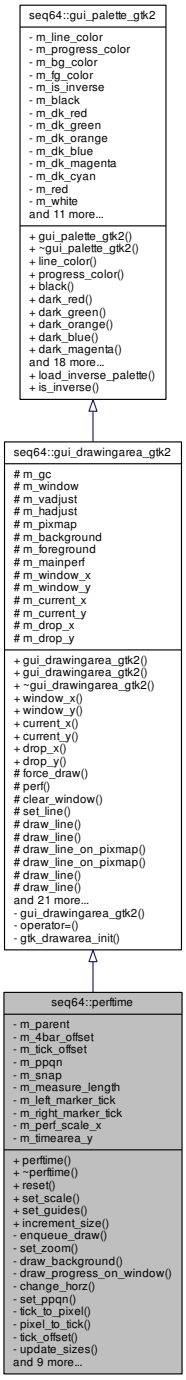
```
bool seq64::perfroll::m_grow_direction  [private]
```

Determines whether the section is growing to the left or to the right.

13.72 seq64::perftime Class Reference

This class implements drawing the piano time at the top of the "performance window" (the "song editor").

Inheritance diagram for seq64::perftime:



Public Member Functions

- perftime (perform &perf, perfedit &parent, Gtk::Adjustment &hadjust, int ppqn=SEQ64_USE_DEFAULT_P↩ PQN)

Principal constructor.

- virtual ~perftime ()

  Let's provide a do-nothing virtual destructor.
- void reset ()
- void set_scale (int scale)
- void set_guides (int snap, int measure)

  Sets the m_snap value and the m_measure_length members directly from the function parameters, which are in units of pulses (sometimes misleadingly called "ticks".)
- void increment_size ()

  This function does nothing.

Private Member Functions

- void enqueue_draw ()

  Wraps queue_draw() and forwards the call to the parent perfedit, so that it can forward it to any other perfedit that exists.
- void set_zoom (int z)

  Implements the horizontal zoom feature.
- void draw_background ()

  Separated out the drawing done in on_expose_event(), so that it can be redone when the zoom changes.
- void draw_progress_on_window ()
- void change_horz ()

  Changes the m_4bar_offset and queues a draw operation.
- void set_ppqn (int ppqn)

  Handles changes to the PPQN value in one place.
- long tick_to_pixel (midipulse tick)

  Common calculation to convert a pulse/tick value to a perftime x value.
- midipulse pixel_to_tick (long pixel)

  The inverse of tick_to_pixel().
- int tick_offset ()

  Centralizes calculation of the tick offset of the time bar.
- void update_sizes ()

  This function does nothing.
- int idle_progress ()

  This function just returns true.
- void update_pixmap ()

  This function does nothing.
- void draw_pixmap_on_window ()

  This function does nothing.
- void on_realize ()

  Implements the on-realization event, then allocates some resources the could not be allocated in the constructor.
- bool on_expose_event (GdkEventExpose *ev)

  Implements the on-expose event.
- bool on_button_press_event (GdkEventButton *ev)

  Implement the button-press event to set the L and R ticks.
- void on_size_allocate (Gtk::Allocation &r)

  Implements a size-allocation event.
- bool on_button_release_event (GdkEventButton *)

  This button-release handler does nothing.
- bool key_press_event (GdkEventKey *ev)

  This callback function handles a key-press event.

Private Attributes

- perfedit & m_parent

  Provides a link to the perfedit that created this object.
- int m_4bar_offset

  Not yet sure exactly what this member represents.
- int m_tick_offset

  This member is m_4bar_offset times 16 times the current PPQN, to save some calculations and centralize this value.
- int m_ppqn

  The current value of PPQN, which we are trying to get to work everywhere, when PPQN is changed from the global ppqn = 192.
- int m_snap

  Snap value, starts out very small, equal to m_ppqn.
- int m_measure_length

  Provides the length of a measure in pulses or ticks.
- int m_left_marker_tick

  Holds the current location of the left (L) marker when arrow movement is in force.
- int m_right_marker_tick

  Holds the current location of the right (R) marker when arrow movement is in force.
- int m_perf_scale_x

  A class version of the global c_perf_scale_x factor.
- int m_timearea_y

  A class version of the global c_timerarea_y factor.

Friends

- class perfedit

Additional Inherited Members

13.72.1 Constructor & Destructor Documentation

13.72.1.1 perftime()

```
seq64::perftime::perftime (
            perform & p,
            perfedit & parent,
            Gtk::Adjustment & hadjust,
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

In the constructor you can only allocate colors; get_window() returns 0 because we have not been realized.

Note

Note that we still have to use a global constant in the base-class constructor; we cannot assign it to the corresponding member beforehand.

Parameters

p	Provides a reference to the main performance object of the application.
parent	Provides a reference to the object that contains this object, so that this object can tell the parent to queue up a drawing operation.
hadjust	Provides the horizontal scrollbar object needed so that perftime can respond to scrollbar cursor/thumb movement.
ppqn	An optional override of the default PPQN value for the application.

13.72.1.2 ~perftime()

```
virtual seq64::perftime::~perftime ( )  [inline], [virtual]
```

13.72.2 Member Function Documentation

13.72.2.1 reset()

```
void seq64::perftime::reset ( )
```

13.72.2.2 set_scale()

```
void seq64::perftime::set_scale (
            int scale )
```

13.72.2.3 set_guides()

```
void seq64::perftime::set_guides (
            int snap,
            int measure )
```

This function then fills in the background, and queues up a draw operation.

Parameters

snap	Provides the number of snap-pulses (pulses per snap interval) as calculated in perfedit::set_guides(). This is actually equal to the measure-pulses divided by the snap value in perfedit; the snap value defaults to 8.
measure	Provides the number of measure-pulses (pulses per measure) as calculated in perfedit::set_guides().

13.72.2.4 increment_size()

```
void seq64::perftime::increment_size ( )  [inline]
```

Compare it to perfroll::increment_size().

13.72.2.5 enqueue_draw()

```
void seq64::perftime::enqueue_draw ( )  [private]
```

The parent perfedit will call perftime::queue_draw() on behalf of this object, and it will pass a perftime::enqueue_↩ draw() to the peer perfedit's perftime, if the peer exists.

13.72.2.6 set_zoom()

```
void seq64::perftime::set_zoom (
            int z )  [private]
```

Redraws the background if the new zoom checked out.

Parameters

z	Provides the zoom value, which is checked, and then copied into m_perf_scale_x.

13.72.2.7 draw_background()

```
void seq64::perftime::draw_background ( )  [private]
```

Note that m_measure_length == 0 will cause integer overflow.

13.72.2.8 draw_progress_on_window()

```
void seq64::perftime::draw_progress_on_window ( )  [private]
```

13.72.2.9 change_horz()

```
void seq64::perftime::change_horz ( )  [private]
```

Again, uses the constant, 16 [now offloaded to the new tick_offset() function.].

13.72.2.10 set_ppqn()

```
void seq64::perftime::set_ppqn (
            int ppqn )  [private]
```

It also modifies m_snap, m_measure_length (but always for four measures!), and m_tick_offset.

Todo We need make the 4 constant variable per the number of beats (quarter-notes) per bar, and also at least make 16 (4x4) a meaningful manifest constant.

Parameters

ppqn	The override value for the PPQN.

13.72.2.11 tick_to_pixel()

```
long seq64::perftime::tick_to_pixel (
            midipulse tick )  [inline], [private]
```

Parameters

tick	The horizontal tick value to convert to an x pixel value, based on tick-offset and the x-scale.

Returns

Returns the x-pixel representing the time location parameter.

13.72.2.12 pixel_to_tick()

```
midipulse seq64::perftime::pixel_to_tick (
            long pixel )  [inline], [private]
```

Parameters

pixel	The pixel value.

Returns

Returns the time value represented b the pixel.

13.72.2.13 tick_offset()

```
int seq64::perftime::tick_offset ( )  [inline], [private]
```

Returns

Returns m_4bar_offset * 16 * m_ppqn.

13.72.2.14 update_sizes()

```
void seq64::perftime::update_sizes ( )  [inline], [private]
```

13.72.2.15 idle_progress()

```
int seq64::perftime::idle_progress ( )  [inline], [private]
```

13.72.2.16 update_pixmap()

```
void seq64::perftime::update_pixmap ( )  [inline], [private]
```

13.72.2.17 draw_pixmap_on_window()

```
void seq64::perftime::draw_pixmap_on_window ( )  [inline], [private]
```

13.72.2.18 on_realize()

```
void seq64::perftime::on_realize ( )  [private]
```

It is important to call the base-class version of this function.

The former work of this function is now done in base-class's on_realize() and in its constructor now.

```
m_window = get_window();
m_gc = Gdk::GC::create(m_window);
m_window->clear();
set_size_request(10, m_timearea_y);
```

13.72.2.19 on_expose_event()

```
bool seq64::perftime::on_expose_event (
            GdkEventExpose * ev )  [private]
```

Redraws the background.

Note

The perfedit object is created early on. When brought on-screen from mainwnd (the main window), first, perftime::on_realize() is called, then this event is called.

Parameters

ev	The expose event, not used.

Returns

Always returns true.

13.72.2.20 on_button_press_event()

```
bool seq64::perftime::on_button_press_event (
            GdkEventButton * p0 )  [private]
```

Added functionality to try to set the start-tick if ctrl-left-click is pressed.

Parameters

p0	The button event.

Returns

Always returns true.

Why is setting the start-tick disabled? We re-enable it and see if it works. To our surprise, it works, but it sticks between stop/pause and the next playback in the performance editor. We added a feature where stop sets the start-tick to the left tick (or the beginning tick).

13.72.2.21 on_size_allocate()

```
void seq64::perftime::on_size_allocate (
            Gtk::Allocation & r )  [private]
```

13.72.2.22 on_button_release_event()

```
bool seq64::perftime::on_button_release_event (
            GdkEventButton *  )  [inline], [private]
```

"ev", The button event parameter, is not used.

Returns

Always returns false

13.72.2.23 key_press_event()

```
bool seq64::perftime::key_press_event (
            GdkEventKey * ev )  [private]
```

Can't get the keystroke events to be seen by perfroll or perftime here using the normal callback function for keystrokes, and not sure why. The perfedit object can call this function, and that call works, so the perfedit class, which does get keystrokes, calls this function to do the work.

This function uses the "l" key to activate the movement of the "L" marker with the arrow keys, by the interval of on snap value for each press. It also uses the "r" key to activate the movement of the "R" marker, and the "x" to deactivate either movement move.

Be aware that there is no visual feedback, as yet, that one is in the movement mode.

Also be aware the changing the name of this function from "key_press_event()" to "on_key_press_event()" will disrupt the process, causing keystrokes to not get here. Too tricky.

13.72.3 Friends And Related Function Documentation

13.72.3.1 perfedit

```
friend class perfedit  [friend]
```

13.72.4 Field Documentation

13.72.4.1 m_parent

```
perfedit& seq64::perftime::m_parent  [private]
```

We want to support two perfedit windows, but the children of perfedit will have to communicate changes requiring a redraw through the parent.

13.72.4.2 m_4bar_offset

```
int seq64::perftime::m_4bar_offset  [private]
```

Also, why always 4/16 in the calculations of this value? Might be able to get rid of this member, though it's a bit tricky.

13.72.4.3 m_tick_offset

```
int seq64::perftime::m_tick_offset  [private]
```

Why 16?

13.72.4.4 m_ppqn

```
int seq64::perftime::m_ppqn  [private]
```

13.72.4.5 m_snap

```
int seq64::perftime::m_snap  [private]
```

13.72.4.6 m_measure_length

```
int seq64::perftime::m_measure_length  [private]
```

This value is m_ppqn ∗ 4, though eventually we want to employ a more flexible representation of measure length. Supports perftime's keystroke processing.

13.72.4.7 m_left_marker_tick

```
int seq64::perftime::m_left_marker_tick  [private]
```

Otherwise it is -1. Supports perftime's keystroke processing.

13.72.4.8 m_right_marker_tick

```
int seq64::perftime::m_right_marker_tick  [private]
```

Otherwise it is -1. Supports perftime's keystroke processing.

13.72.4.9 m_perf_scale_x

```
int seq64::perftime::m_perf_scale_x  [private]
```

13.72.4.10 m_timearea_y

```
int seq64::perftime::m_timearea_y  [private]
```

13.73 seq64::midi_port_info::port_info_t Struct Reference

Hold the information for a single port.

Data Fields

- int m_client_number

  The major buss number of the port.
- std::string m_client_name

  The system's name for the client.
- int m_port_number

  The minor port number of the port.
- std::string m_port_name

  The system's name for the port.
- int m_queue_number

  A number used in some APIs.
- bool m_is_input

  Indicates an input port.
- bool m_is_virtual

  Indicates an manual/virtual port.
- bool m_is_system

  Built-in port, almost always false.

13.73.1 Detailed Description

Except for the virtual-vs-normal status, this information is obtained by scanning the system at the startup time of the application.

13.73.2 Field Documentation

13.73.2.1 m_client_number

```
int seq64::midi_port_info::port_info_t::m_client_number
```

13.73.2.2 m_client_name

```
std::string seq64::midi_port_info::port_info_t::m_client_name
```

13.73.2.3 m_port_number

```
int seq64::midi_port_info::port_info_t::m_port_number
```

13.73.2.4 m_port_name

```
std::string seq64::midi_port_info::port_info_t::m_port_name
```

13.73.2.5 m_queue_number

```
int seq64::midi_port_info::port_info_t::m_queue_number
```

13.73.2.6 m_is_input

```
bool seq64::midi_port_info::port_info_t::m_is_input
```

13.73.2.7 m_is_virtual

```
bool seq64::midi_port_info::port_info_t::m_is_virtual
```

13.73.2.8 m_is_system

```
bool seq64::midi_port_info::port_info_t::m_is_system
```

13.74 seq64::rc_settings Class Reference

This class contains the options formerly named "global_xxxxxx".

Public Member Functions

- rc_settings ()

  Default constructor.
- rc_settings (const rc_settings &rhs)

  Copy constructor.
- rc_settings & operator= (const rc_settings &rhs)

  Principal assignment operator.
- std::string config_filespec () const

  Constructs the full path and file specification for the "rc" file based on whether or not the legacy Seq24 filenames are being used.
- std::string user_filespec () const

  Constructs the full path and file specification for the "user" file based on whether or not the legacy Seq24 filenames are being used.
- void set_defaults ()

  Sets the default values.
- bool auto_option_save () const

  'Getter' function for member m_auto_option_save
- bool legacy_format () const

  'Getter' function for member m_legacy_format
- bool lash_support () const

  'Getter' function for member m_lash_support
- bool allow_mod4_mode () const

  'Getter' function for member m_allow_mod4_mode
- bool allow_snap_split () const

  'Getter' function for member m_allow_snap_split
- bool allow_click_edit () const

  'Getter' function for member m_allow_click_edit
- bool show_midi () const

  'Getter' function for member m_show_midi
- bool priority () const

  'Getter' function for member m_priority
- bool stats () const

  'Getter' function for member m_stats
- bool pass_sysex () const

  'Getter' function for member m_pass_sysex
- bool with_jack_transport () const

  'Getter' function for member m_with_jack_transport
- bool with_jack_master () const

  'Getter' function for member m_with_jack_master
- bool with_jack_master_cond () const

  'Getter' function for member m_with_jack_master_cond
- bool with_jack_midi () const

  'Getter' function for member m_with_jack_midi
- bool with_jack () const

  'Getter' function for member m_with_jack_transport m_with_jack_master, and m_with_jack_master_cond, to save client code some trouble.
- bool filter_by_channel () const

  'Getter' function for member m_filter_by_channel
- bool manual_alsa_ports () const

  'Getter' function for member m_manual_alsa_ports
- bool reveal_alsa_ports () const

'Getter' function for member m_reveal_alsa_ports

- bool print_keys () const

  'Getter' function for member m_print_keys
- bool device_ignore () const

  'Getter' function for member m_device_ignore
- int device_ignore_num () const

  'Getter' function for member m_device_ignore_num
- interaction_method_t interaction_method () const

  'Getter' function for member m_interaction_method
- const std::string & filename () const

  'Getter' function for member m_filename
- void filename (const std::string &value)

  'Setter' function for member m_filename
- const std::string & jack_session_uuid () const

  'Getter' function for member m_jack_session_uuid
- const std::string & last_used_dir () const

  'Getter' function for member m_last_used_dir
- void last_used_dir (const std::string &value)

  'Setter' function for member m_last_used_dir
- const std::string & config_directory () const

  'Getter' function for member m_config_directory
- std::string home_config_directory () const

  Provides the directory for the configuration file, and also creates the directory if necessary.
- const std::string & config_filename () const

  'Getter' function for member m_config_filename
- const std::string & user_filename () const

  'Getter' function for member m_user_filename
- const std::string & config_filename_alt () const

  'Getter' function for member m_config_filename_alt;
- const std::string & user_filename_alt () const

  'Getter' function for member m_user_filename_alt
- const std::string application_name () const

  'Getter' function for member m_application_name
- const std::string & app_client_name () const

  'Getter' function for member m_app_client_name

Protected Member Functions

- void auto_option_save (bool flag)

  'Setter' function for member m_auto_option_save
- void legacy_format (bool flag)

  'Setter' function for member m_legacy_format
- void lash_support (bool flag)

  'Setter' function for member m_lash_support
- void allow_mod4_mode (bool flag)

  'Setter' function for member m_allow_mod4_mode
- void allow_snap_split (bool flag)

  'Setter' function for member m_allow_snap_split
- void allow_click_edit (bool flag)

  'Setter' function for member m_allow_click_edit

- void show_midi (bool flag)

  'Setter' function for member m_show_midi
- void priority (bool flag)

  'Setter' function for member m_priority
- void stats (bool flag)

  'Setter' function for member m_stats
- void pass_sysex (bool flag)

  'Setter' function for member m_pass_sysex
- void with_jack_transport (bool flag)

  'Setter' function for member m_with_jack_transport
- void with_jack_master (bool flag)

  'Setter' function for member m_with_jack_master
- void with_jack_master_cond (bool flag)

  'Setter' function for member m_with_jack_master_cond
- void with_jack_midi (bool flag)

  'Setter' function for member m_with_jack_midi
- void filter_by_channel (bool flag)

  'Setter' function for member m_filter_by_channel
- void manual_alsa_ports (bool flag)

  'Setter' function for member m_manual_alsa_ports
- void reveal_alsa_ports (bool flag)

  'Setter' function for member m_reveal_alsa_ports
- void print_keys (bool flag)

  'Setter' function for member m_print_keys
- void device_ignore (bool flag)

  'Setter' function for member m_device_ignore
- void device_ignore_num (int value)

  'Setter' function for member m_device_ignore_num However, please note that this value, while set in the options processing of the main module, does not appear to be used anywhere in the code in seq24, Sequencer24, and this application.
- void interaction_method (interaction_method_t value)

  'Setter' function for member m_interaction_method
- void jack_session_uuid (const std::string &value)

  'Setter' function for member m_jack_session_uuid
- void config_directory (const std::string &value)

  'Setter' function for member m_config_directory
- void set_config_files (const std::string &value)

  'Setter' function for member m_config_filename and m_user_filename
- void config_filename (const std::string &value)

  'Setter' function for member m_config_filename ("rc")
- void user_filename (const std::string &value)

  'Setter' function for member m_user_filename ("usr")
- void config_filename_alt (const std::string &value)

  'Setter' function for member m_config_filename_alt
- void user_filename_alt (const std::string &value)

  'Setter' function for member m_user_filename_alt

Private Attributes

- bool m_auto_option_save

  [auto-option-save] setting.
- bool m_legacy_format

  Write files in legacy format.
- bool m_lash_support

  Enable LASH, if compiled in.
- bool m_allow_mod4_mode

  Allow Mod4 to hold drawing mode.
- bool m_allow_snap_split

  Allow snap-split of a trigger.
- bool m_allow_click_edit

  Allow double-click edit pattern.
- bool m_show_midi

  Show MIDI events to console.
- bool m_priority

  Run at high priority (Linux only).
- bool m_stats

  Show some output statistics.
- bool m_pass_sysex

  Pass SysEx to outputs, not ready.
- bool m_with_jack_transport

  Enable synchrony with JACK.
- bool m_with_jack_master

  Serve as a JACK transport Master.
- bool m_with_jack_master_cond

  Serve as JACK Master if possible.
- bool m_with_jack_midi

  Use JACK MIDI.
- bool m_filter_by_channel

  Record only sequence channel data.
- bool m_manual_alsa_ports

  [manual-alsa-ports] setting.
- bool m_reveal_alsa_ports

  [reveal-alsa-ports] setting.
- bool m_print_keys

  Show hot-key in main window slot.
- bool m_device_ignore

  From seq24 module, unused!
- int m_device_ignore_num

  From seq24 module, unused!
- interaction_method_t m_interaction_method

  [interaction-method]
- std::string m_filename

  Provides the name of current MIDI file.
- std::string m_jack_session_uuid

  Holds the JACK UUID value that makes this JACK connection unique.
- std::string m_last_used_dir

  Holds the directory from which the last MIDI file was opened (or saved).
- std::string m_config_directory

Holds the current "rc" and "user" configuration directory.

- std::string m_config_filename

  Holds the current "rc" configuration filename.
- std::string m_user_filename

  Holds the current "user" configuration filename.
- std::string m_config_filename_alt

  Holds the legacy "rc" filename, ".seq24rc".
- std::string m_user_filename_alt

  Holds the legacy "user" filename, ".seq24usr".
- const std::string m_application_name

  Holds the application name, e.g.
- std::string m_app_client_name

  Holds the client name for the application.

Friends

- class optionsfile
- class options
- class mainwnd
- class rtmidi_info
- int parse_command_line_options (perform &p, int argc, char ∗argv [ ])

  Parses the command-line options on behalf of the application.
- bool help_check (int argc, char ∗argv [ ])

  Checks to see if the first option is a help or version argument, just so we can skip the "Reading configuration ..." messages.

13.74.1 Detailed Description

It gives us a whole lot more encapsulation and control over how the options of the "rc" file (optionsfile) are set and used. Note that this class does not support the hot-keys options; those are handled in the keys_perform class.

13.74.2 Constructor & Destructor Documentation

13.74.2.1 rc_settings() [1/2]

```
seq64::rc_settings::rc_settings ( )
```

13.74.2.2 rc_settings() [2/2]

```
seq64::rc_settings::rc_settings (
            const rc_settings & rhs )
```

Parameters

rhs	The source of the data for the copy.

13.74.3 Member Function Documentation

13.74.3.1 operator=()

```
rc_settings & seq64::rc_settings::operator= (
            const rc_settings & rhs )
```

Parameters

rhs	The source of the data for the assignment.

Returns

Returns a reference to the destination for use in serial assignments.

13.74.3.2 config_filespec()

```
std::string seq64::rc_settings::config_filespec ( ) const
```

Returns

If home_config_directory() returns a non-empty string, then the legacy or normal "rc" configuration file-name is appended to that result, and returned. Otherwise, an empty string is returned.

13.74.3.3 user_filespec()

```
std::string seq64::rc_settings::user_filespec ( ) const
```

Returns

If home_config_directory() returns a non-empty string, then the legacy or normal "user" configuration file-name is appended to that result, and returned. Otherwise, an empty string is returned.

13.74.3.4 set_defaults()

```
void seq64::rc_settings::set_defaults ( )
```

13.74.3.5 auto_option_save() [1/2]

```
bool seq64::rc_settings::auto_option_save ( ) const  [inline]
```

13.74.3.6 legacy_format() [1/2]

```
bool seq64::rc_settings::legacy_format ( ) const  [inline]
```

13.74.3.7 lash_support() [1/2]

```
bool seq64::rc_settings::lash_support ( ) const  [inline]
```

13.74.3.8 allow_mod4_mode() [1/2]

```
bool seq64::rc_settings::allow_mod4_mode ( ) const  [inline]
```

13.74.3.9 allow_snap_split() [1/2]

```
bool seq64::rc_settings::allow_snap_split ( ) const  [inline]
```

13.74.3.10 allow_click_edit() [1/2]

```
bool seq64::rc_settings::allow_click_edit ( ) const  [inline]
```

13.74.3.11 show_midi() [1/2]

```
bool seq64::rc_settings::show_midi ( ) const  [inline]
```

13.74.3.12 priority() [1/2]

```
bool seq64::rc_settings::priority ( ) const  [inline]
```

13.74.3.13 stats() [1/2]

```
bool seq64::rc_settings::stats ( ) const  [inline]
```

13.74.3.14 pass_sysex() [1/2]

```
bool seq64::rc_settings::pass_sysex ( ) const  [inline]
```

13.74.3.15 with_jack_transport() [1/2]

```
bool seq64::rc_settings::with_jack_transport ( ) const  [inline]
```

13.74.3.16 with_jack_master() [1/2]

```
bool seq64::rc_settings::with_jack_master ( ) const  [inline]
```

13.74.3.17 with_jack_master_cond() [1/2]

```
bool seq64::rc_settings::with_jack_master_cond ( ) const  [inline]
```

13.74.3.18 with_jack_midi() [1/2]

```
bool seq64::rc_settings::with_jack_midi ( ) const  [inline]
```

13.74.3.19 with_jack()

```
bool seq64::rc_settings::with_jack ( ) const  [inline]
```

Do not confuse these original options with the new "no JACK MIDI" option.

13.74.3.20 filter_by_channel() [1/2]

```
bool seq64::rc_settings::filter_by_channel ( ) const  [inline]
```

13.74.3.21 manual_alsa_ports() [1/2]

```
bool seq64::rc_settings::manual_alsa_ports ( ) const  [inline]
```

13.74.3.22 reveal_alsa_ports() [1/2]

```
bool seq64::rc_settings::reveal_alsa_ports ( ) const  [inline]
```

13.74.3.23 print_keys() [1/2]

```
bool seq64::rc_settings::print_keys ( ) const  [inline]
```

13.74.3.24 device_ignore() [1/2]

```
bool seq64::rc_settings::device_ignore ( ) const  [inline]
```

13.74.3.25 device_ignore_num() [1/2]

```
int seq64::rc_settings::device_ignore_num ( ) const  [inline]
```

13.74.3.26 interaction_method() [1/2]

```
interaction_method_t seq64::rc_settings::interaction_method ( ) const  [inline]
```

13.74.3.27 filename() [1/2]

```
const std::string& seq64::rc_settings::filename ( ) const  [inline]
```

13.74.3.28 filename() [2/2]

```
void seq64::rc_settings::filename (
            const std::string & value )
```

Parameters

value	The value to use to make the setting.

13.74.3.29 jack_session_uuid() [1/2]

```
const std::string& seq64::rc_settings::jack_session_uuid ( ) const  [inline]
```

13.74.3.30 last_used_dir() [1/2]

```
const std::string& seq64::rc_settings::last_used_dir ( ) const  [inline]
```

13.74.3.31 last_used_dir() [2/2]

```
void seq64::rc_settings::last_used_dir (
            const std::string & value )
```

Parameters

value	The value to use to make the setting.

13.74.3.32 config_directory() [1/2]

```
const std::string& seq64::rc_settings::config_directory ( ) const  [inline]
```

13.74.3.33 home_config_directory()

```
std::string seq64::rc_settings::home_config_directory ( ) const
```

If the legacy format is in force, then the home directory for the configuration is (in Linux) "/home/username", and the configuration file is ".seq24rc".

If the new format is in force, then the home directory is (in Linux) "/home/username/.config/sequencer64", and the configuration file is "sequencer64.rc".

Returns

Returns the selected home configuration directory. If it does not exist, or could not be created, then an empty string is returned.

13.74.3.34 config_filename() [1/2]

```
const std::string& seq64::rc_settings::config_filename ( ) const  [inline]
```

13.74.3.35 user_filename() [1/2]

```
const std::string& seq64::rc_settings::user_filename ( ) const  [inline]
```

13.74.3.36 config_filename_alt() [1/2]

```
const std::string& seq64::rc_settings::config_filename_alt ( ) const  [inline]
```

13.74.3.37 user_filename_alt() [1/2]

```
const std::string& seq64::rc_settings::user_filename_alt ( ) const  [inline]
```

13.74.3.38 application_name()

```
const std::string seq64::rc_settings::application_name ( ) const  [inline]
```

13.74.3.39 app_client_name()

```
const std::string& seq64::rc_settings::app_client_name ( ) const  [inline]
```

13.74.3.40 auto_option_save() [2/2]

```
void seq64::rc_settings::auto_option_save (
            bool flag )  [inline], [protected]
```

13.74.3.41 legacy_format() [2/2]

```
void seq64::rc_settings::legacy_format (
            bool flag )  [inline], [protected]
```

13.74.3.42 lash_support() [2/2]

```
void seq64::rc_settings::lash_support (
            bool flag )  [inline], [protected]
```

13.74.3.43 allow_mod4_mode() [2/2]

```
void seq64::rc_settings::allow_mod4_mode (
            bool flag )  [inline], [protected]
```

13.74.3.44 allow_snap_split() [2/2]

```
void seq64::rc_settings::allow_snap_split (
            bool flag )  [inline], [protected]
```

13.74.3.45 allow_click_edit() [2/2]

```
void seq64::rc_settings::allow_click_edit (
            bool flag )  [inline], [protected]
```

13.74.3.46 show_midi() [2/2]

```
void seq64::rc_settings::show_midi (
            bool flag )  [inline], [protected]
```

13.74.3.47 priority() [2/2]

```
void seq64::rc_settings::priority (
            bool flag )  [inline], [protected]
```

13.74.3.48 stats() [2/2]

```
void seq64::rc_settings::stats (
            bool flag )  [inline], [protected]
```

13.74.3.49 pass_sysex() [2/2]

```
void seq64::rc_settings::pass_sysex (
            bool flag )  [inline], [protected]
```

13.74.3.50 with_jack_transport() [2/2]

```
void seq64::rc_settings::with_jack_transport (
            bool flag )  [protected]
```

13.74.3.51 with_jack_master() [2/2]

```
void seq64::rc_settings::with_jack_master (
            bool flag )  [protected]
```

13.74.3.52 with_jack_master_cond() [2/2]

```
void seq64::rc_settings::with_jack_master_cond (
            bool flag )  [protected]
```

13.74.3.53 with_jack_midi() [2/2]

```
void seq64::rc_settings::with_jack_midi (
            bool flag )  [inline], [protected]
```

13.74.3.54 filter_by_channel() [2/2]

```
void seq64::rc_settings::filter_by_channel (
            bool flag )  [inline], [protected]
```

13.74.3.55 manual_alsa_ports() [2/2]

```
void seq64::rc_settings::manual_alsa_ports (
            bool flag )  [inline], [protected]
```

13.74.3.56 reveal_alsa_ports() [2/2]

```
void seq64::rc_settings::reveal_alsa_ports (
            bool flag )  [inline], [protected]
```

13.74.3.57 print_keys() [2/2]

```
void seq64::rc_settings::print_keys (
            bool flag )  [inline], [protected]
```

13.74.3.58 device_ignore() [2/2]

```
void seq64::rc_settings::device_ignore (
            bool flag )  [inline], [protected]
```

13.74.3.59 device_ignore_num() [2/2]

```
void seq64::rc_settings::device_ignore_num (
            int value )  [protected]
```

Parameters

value	The value to use to make the setting.

13.74.3.60 interaction_method() [2/2]

```
void seq64::rc_settings::interaction_method (
            interaction_method_t value )  [protected]
```

Parameters

value	The value to use to make the setting.

13.74.3.61 jack_session_uuid() [2/2]

```
void seq64::rc_settings::jack_session_uuid (
            const std::string & value )  [protected]
```

Parameters

value	The value to use to make the setting.

13.74.3.62 config_directory() [2/2]

```
void seq64::rc_settings::config_directory (
            const std::string & value )  [protected]
```

Parameters

value	The value to use to make the setting.

13.74.3.63 set_config_files()

```
void seq64::rc_settings::set_config_files (
            const std::string & value )  [protected]
```

Implements the –config option to change both configuration files ("rc" and "usr") with one option.

Parameters

value	The value to use to make the setting, if the string is not empty. If the value has an extension, it is stripped first.

13.74.3.64 config_filename() [2/2]

```
void seq64::rc_settings::config_filename (
            const std::string & value )  [protected]
```

Parameters

value	The value to use to make the setting, if the string is not empty. If there is no period in the string, then ".rc" is appended to the end of the filename.

13.74.3.65 user_filename() [2/2]

```
void seq64::rc_settings::user_filename (
            const std::string & value )  [protected]
```

Parameters

value	The value to use to make the setting, if the string is not empty. If there is no period in the string, then ".usr" is appended to the end of the filename.

13.74.3.66 config_filename_alt() [2/2]

```
void seq64::rc_settings::config_filename_alt (
            const std::string & value )  [protected]
```

Parameters

value	The value to use to make the setting, if the string is not empty.

13.74.3.67 user_filename_alt() [2/2]

```
void seq64::rc_settings::user_filename_alt (
            const std::string & value )  [protected]
```

Parameters

value	The value to use to make the setting.

13.74.4 Friends And Related Function Documentation

13.74.4.1 optionsfile

```
friend class optionsfile  [friend]
```

13.74.4.2 options

```
friend class options  [friend]
```

13.74.4.3 mainwnd

```
friend class mainwnd  [friend]
```

13.74.4.4 rtmidi_info

```
friend class rtmidi_info  [friend]
```

13.74.4.5 parse_command_line_options

```
int parse_command_line_options (
            perform & p,
            int argc,
            char * argv[] )  [friend]
```

Note that, since we call this function twice (once before the configuration files are parsed, and once after), we have to make sure that the global value optind is reset to 0 before calling this function. Note that the traditional reset value for optind is 1, but 0 is used in GNU code to trigger the internal initialization routine of get_opt().

Parameters

p	The performance object that implements some of the command-line options.
argc	The number of command-line arguments.
argv	The array of command-line argument pointers.

Returns

Returns the value of optind if no help-related options were provided.

13.74.4.6 help_check

```
bool help_check (
            int argc,
            char * argv[] )  [friend]
```

Also check for the –legacy option. Finally, it also checks for the "?" option that people sometimes use as a guess to get help.

Parameters

argc	The number of command-line arguments.
argv	The array of command-line argument pointers.

Returns

Returns true only if -v, -V, –version, -h, –help, or "?" were encountered. If the legacy options occurred, then rc().legacy_format(true) is called, as a side effect, because it will be needed before we parse the options.

13.74.5 Field Documentation

13.74.5.1 m_auto_option_save

```
bool seq64::rc_settings::m_auto_option_save  [private]
```

13.74.5.2 m_legacy_format

```
bool seq64::rc_settings::m_legacy_format  [private]
```

13.74.5.3 m_lash_support

```
bool seq64::rc_settings::m_lash_support  [private]
```

13.74.5.4 m_allow_mod4_mode

```
bool seq64::rc_settings::m_allow_mod4_mode  [private]
```

13.74.5.5 m_allow_snap_split

```
bool seq64::rc_settings::m_allow_snap_split  [private]
```

13.74.5.6 m_allow_click_edit

```
bool seq64::rc_settings::m_allow_click_edit  [private]
```

13.74.5.7 m_show_midi

```
bool seq64::rc_settings::m_show_midi  [private]
```

13.74.5.8 m_priority

```
bool seq64::rc_settings::m_priority  [private]
```

13.74.5.9 m_stats

```
bool seq64::rc_settings::m_stats  [private]
```

13.74.5.10 m_pass_sysex

```
bool seq64::rc_settings::m_pass_sysex  [private]
```

13.74.5.11 m_with_jack_transport

```
bool seq64::rc_settings::m_with_jack_transport  [private]
```

13.74.5.12 m_with_jack_master

```
bool seq64::rc_settings::m_with_jack_master  [private]
```

13.74.5.13 m_with_jack_master_cond

```
bool seq64::rc_settings::m_with_jack_master_cond  [private]
```

13.74.5.14 m_with_jack_midi

```
bool seq64::rc_settings::m_with_jack_midi  [private]
```

13.74.5.15 m_filter_by_channel

```
bool seq64::rc_settings::m_filter_by_channel  [private]
```

13.74.5.16 m_manual_alsa_ports

```
bool seq64::rc_settings::m_manual_alsa_ports  [private]
```

13.74.5.17 m_reveal_alsa_ports

```
bool seq64::rc_settings::m_reveal_alsa_ports  [private]
```

13.74.5.18 m_print_keys

```
bool seq64::rc_settings::m_print_keys  [private]
```

13.74.5.19 m_device_ignore

```
bool seq64::rc_settings::m_device_ignore  [private]
```

13.74.5.20 m_device_ignore_num

```
int seq64::rc_settings::m_device_ignore_num  [private]
```

13.74.5.21 m_interaction_method

```
interaction_method_t seq64::rc_settings::m_interaction_method  [private]
```

13.74.5.22 m_filename

```
std::string seq64::rc_settings::m_filename  [private]
```

13.74.5.23 m_jack_session_uuid

```
std::string seq64::rc_settings::m_jack_session_uuid  [private]
```

13.74.5.24 m_last_used_dir

```
std::string seq64::rc_settings::m_last_used_dir  [private]
```

13.74.5.25 m_config_directory

```
std::string seq64::rc_settings::m_config_directory  [private]
```

This value is "~/.config/sequencer64" by default.

13.74.5.26 m_config_filename

```
std::string seq64::rc_settings::m_config_filename  [private]
```

This value is "sequencer64.rc" by default.

13.74.5.27 m_user_filename

```
std::string seq64::rc_settings::m_user_filename  [private]
```

This value is "sequencer64.usr" by default.

13.74.5.28 m_config_filename_alt

```
std::string seq64::rc_settings::m_config_filename_alt  [private]
```

13.74.5.29 m_user_filename_alt

```
std::string seq64::rc_settings::m_user_filename_alt  [private]
```

13.74.5.30 m_application_name

```
const std::string seq64::rc_settings::m_application_name  [private]
```

"sequencer64", "seq64portmidi", or "seq64". This is a constant, set to SEQ64_APP_NAME. Also see the seq_↩ app_name() function.

13.74.5.31 m_app_client_name

```
std::string seq64::rc_settings::m_app_client_name  [private]
```

This is much like the application name, but in the future will be a configuration option. For now it is just the value of the SEQ64_CLIENT_NAME macro. Also see the seq_client_name() function.

13.75 seq64::rect Class Reference

A small helper class representing a rectangle.

Data Fields

- int x
  The x-coordinate of the origin of the rectangle.
- int y
  The y-coordinate of the origin of the rectangle.
- int height
  The height of the rectangle, in units of pixels.
- int width
  The width of the rectangle, in units of pixels.

13.75.1 Field Documentation

13.75.1.1 x

```
int seq64::rect::x
```

13.75.1.2 y

```
int seq64::rect::y
```

13.75.1.3 height

```
int seq64::rect::height
```

13.75.1.4 width

```
int seq64::rect::width
```

13.76 seq64::gui_drawingarea_gtk2::rect Struct Reference

A small helper structure representing a rectangle.

Data Fields

- int x
- int y
- int height
- int width

13.76.1 Field Documentation

13.76.1.1 x

```
int seq64::gui_drawingarea_gtk2::rect::x
```

13.76.1.2 y

```
int seq64::gui_drawingarea_gtk2::rect::y
```

13.76.1.3 height

```
int seq64::gui_drawingarea_gtk2::rect::height
```

13.76.1.4 width

```
int seq64::gui_drawingarea_gtk2::rect::width
```

13.77 seq64::rterror Class Reference

Exception handling class for rtexmidi.

Inherits exception.

Public Types

- enum Type {
  WARNING,
  DEBUG_WARNING,
  UNSPECIFIED,
  NO_DEVICES_FOUND,
  INVALID_DEVICE,
  MEMORY_ERROR,
  INVALID_PARAMETER,
  INVALID_USE,
  DRIVER_ERROR,
  SYSTEM_ERROR,
  THREAD_ERROR }

Public Member Functions

- rterror (const std::string &message, Type type=rterror::UNSPECIFIED)
- virtual ~rterror ()
- virtual void print_message () const

  Prints thrown error message to stderr.
- virtual const Type & getType () const

  Returns the thrown error message type.
- virtual const std::string & get_message () const

  Returns the thrown error message string.
- virtual const char * what () const noexcept

  Returns the thrown error message as a c-style string.

Private Attributes

- std::string m_message

  Holds the latest message information for the exception.
- Type m_type

  Holds the type or severity of the exception.

13.77.1 Detailed Description

The rterror class is quite simple but it does allow errors to be "caught" by rterror::Type. See the rtexmidi documentation to know which methods can throw an rterror.

Please note that, in this refactoring of rtmidi, we've done away with all the exception specifications, on the advice of Herb Sutter. They may be more relevent to C++11 and beyond, but this library is too small to worry about them, for now.

13.77.2 Member Enumeration Documentation

13.77.2.1 Type

```
enum seq64::rterror::Type
```

Enumerator

WARNING	A non-critical error.
DEBUG_WARNING	Non-critical error useful for debugging.
UNSPECIFIED	The default, unspecified error type.
NO_DEVICES_FOUND	No devices found on system.
INVALID_DEVICE	An invalid device ID was specified.
MEMORY_ERROR	An error occured during memory allocation.
INVALID_PARAMETER	Invalid parameter specified to a function.
INVALID_USE	The function was called incorrectly.
DRIVER_ERROR	A system driver error occured.
SYSTEM_ERROR	A system error occured.
THREAD_ERROR	A thread error occured.

13.77.3 Constructor & Destructor Documentation

13.77.3.1 rterror()

```
seq64::rterror::rterror (
            const std::string & message,
            Type type = rterror::UNSPECIFIED )  [inline]
```

13.77.3.2 ~rterror()

```
virtual seq64::rterror::~rterror ( )  [inline], [virtual]
```

13.77.4 Member Function Documentation

13.77.4.1 print_message()

```
virtual void seq64::rterror::print_message ( ) const  [inline], [virtual]
```

13.77.4.2 getType()

```
virtual const Type& seq64::rterror::getType ( ) const  [inline], [virtual]
```

13.77.4.3 get_message()

```
virtual const std::string& seq64::rterror::get_message ( ) const  [inline], [virtual]
```

13.77.4.4 what()

```
virtual const char* seq64::rterror::what ( ) const  [inline], [virtual], [noexcept]
```

13.77.5 Field Documentation

13.77.5.1 m_message

```
std::string seq64::rterror::m_message  [private]
```

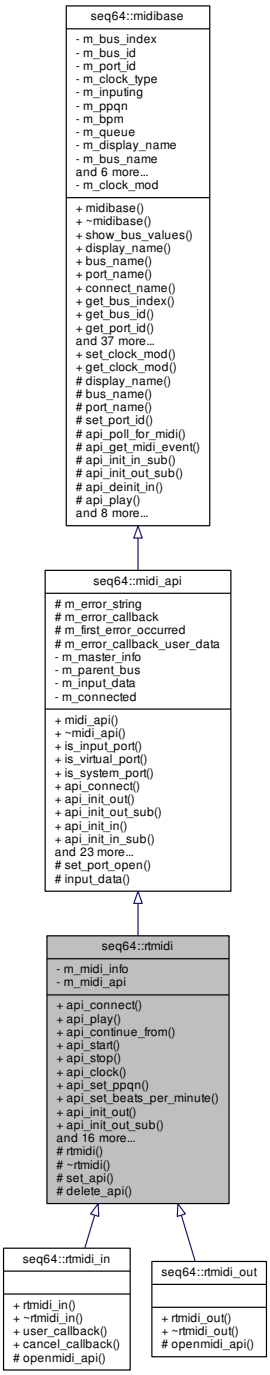
13.77.5.2 m_type

```
Type seq64::rterror::m_type  [private]
```

13.78 seq64::rtmidi Class Reference

The main class of the rtmidi API.

Inheritance diagram for seq64::rtmidi:



Public Member Functions

- virtual bool api_connect ()

- virtual void api_play (event *e24, midibyte channel)
- virtual void api_continue_from (midipulse tick, midipulse beats)
- virtual void api_start ()
- virtual void api_stop ()
- virtual void api_clock (midipulse tick)
- virtual void api_set_ppqn (int ppqn)
- virtual void api_set_beats_per_minute (midibpm bpm)
- virtual bool api_init_out ()
- virtual bool api_init_out_sub ()
- virtual bool api_init_in ()
- virtual bool api_init_in_sub ()
- virtual bool api_deinit_in ()
- virtual bool api_get_midi_event (event *inev)
- virtual int api_poll_for_midi ()
- virtual void api_sysex (event *e24)
- virtual void api_flush ()
- virtual bool is_port_open () const

  Returns true if a port is open and false if not.
- virtual int get_bus_id ()

  Gets the buss/client ID for a MIDI interfaces.
- virtual std::string get_bus_name ()
- virtual int get_port_id ()
- virtual std::string get_port_name ()
- int get_port_count ()
- int full_port_count ()
- const midi_api * get_api () const

  'Getter' function for member m_midi_api const version
- midi_api * get_api ()

  'Getter' function for member m_midi_api non-const version

Protected Member Functions

- rtmidi (midibus &parentbus, rtmidi_info &info)

  Default constructor.
- virtual ~rtmidi ()

  Destructor.
- void set_api (midi_api *ma)

  'Setter' function for member m_midi_api
- void delete_api ()

  'Setter' function for member m_midi_api

Private Attributes

- rtmidi_info & m_midi_info

  Holds a reference to the "global" midi_info wrapper object.
- midi_api * m_midi_api

  Points to the API I/O object (e.g.

Friends

- class midibus

Additional Inherited Members

13.78.1 Detailed Description

We moved the enum Api definition into the new rtmidi_types.hpp module to make refactoring the code easier.

13.78.2 Constructor & Destructor Documentation

13.78.2.1 rtmidi()

```
seq64::rtmidi::rtmidi (
            midibus & parentbus,
            rtmidi_info & info )  [protected]
```

Parameters

parentbus	This is the midibus that the rtmidi object is going to implement, by forwarding calls to the selected MIDI subsystem (e.g. ALSA or JACK).
info	This object provides the system's enumerated busses/ports as found by the selected MIDI subsystem.

13.78.2.2 ~rtmidi()

```
seq64::rtmidi::~rtmidi ( )  [protected], [virtual]
```

13.78.3 Member Function Documentation

13.78.3.1 api_connect()

```
virtual bool seq64::rtmidi::api_connect ( )  [inline], [virtual]
```

Reimplemented from seq64::midi_api.

13.78.3.2 api_play()

```
virtual void seq64::rtmidi::api_play (
            event * e24,
            midibyte channel )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.3 api_continue_from()

```
virtual void seq64::rtmidi::api_continue_from (
            midipulse tick,
            midipulse beats )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.4 api_start()

```
virtual void seq64::rtmidi::api_start ( )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.5 api_stop()

```
virtual void seq64::rtmidi::api_stop ( )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.6 api_clock()

```
virtual void seq64::rtmidi::api_clock (
            midipulse tick )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.7 api_set_ppqn()

```
virtual void seq64::rtmidi::api_set_ppqn (
            int ppqn )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.8 api_set_beats_per_minute()

```
virtual void seq64::rtmidi::api_set_beats_per_minute (
            midibpm bpm )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.9 api_init_out()

```
virtual bool seq64::rtmidi::api_init_out ( )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.10 api_init_out_sub()

```
virtual bool seq64::rtmidi::api_init_out_sub ( )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.11 api_init_in()

```
virtual bool seq64::rtmidi::api_init_in ( )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.12 api_init_in_sub()

```
virtual bool seq64::rtmidi::api_init_in_sub ( )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.13 api_deinit_in()

```
virtual bool seq64::rtmidi::api_deinit_in ( )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.14 api_get_midi_event()

```
virtual bool seq64::rtmidi::api_get_midi_event (
            event * inev )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.15 api_poll_for_midi()

```
virtual int seq64::rtmidi::api_poll_for_midi ( )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.16 api_sysex()

```
virtual void seq64::rtmidi::api_sysex (
            event * e24 )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.17 api_flush()

```
virtual void seq64::rtmidi::api_flush ( )  [inline], [virtual]
```

Implements seq64::midi_api.

13.78.3.18 is_port_open()

```
virtual bool seq64::rtmidi::is_port_open ( ) const  [inline], [virtual]
```

13.78.3.19 get_bus_id()

```
virtual int seq64::rtmidi::get_bus_id ( )  [inline], [virtual]
```

This is the left-hand side of a X:Y pair (such as 128:0).

This function is a new part of the RtMidi interface.

Returns

Returns the buss/client value as provided by the selected API.

13.78.3.20 get_bus_name()

```
virtual std::string seq64::rtmidi::get_bus_name ( )  [inline], [virtual]
```

Returns

Returns the buss name from the selected API subsystem.

13.78.3.21 get_port_id()

```
virtual int seq64::rtmidi::get_port_id ( )  [inline], [virtual]
```

Returns

Returns the port ID number from the selected API subsystem.

13.78.3.22 get_port_name()

```
virtual std::string seq64::rtmidi::get_port_name ( )  [inline], [virtual]
```

Returns

Returns the port name from the selected API subsystem.

13.78.3.23 get_port_count()

```
int seq64::rtmidi::get_port_count ( )  [inline]
```

Returns

This value depends on the MIDI mode setting (input versus output).

13.78.3.24 full_port_count()

```
int seq64::rtmidi::full_port_count ( )  [inline]
```

Returns

This value is the sum of the number of input and output ports.

13.78.3.25 get_api() [1/2]

```
const midi_api* seq64::rtmidi::get_api ( ) const  [inline]
```

13.78.3.26 get_api() [2/2]

```
midi_api* seq64::rtmidi::get_api ( )  [inline]
```

13.78.3.27 set_api()

```
void seq64::rtmidi::set_api (
            midi_api * ma )  [inline], [protected]
```

13.78.3.28 delete_api()

```
void seq64::rtmidi::delete_api ( )  [inline], [protected]
```

13.78.4 Friends And Related Function Documentation

13.78.4.1 midibus

```
friend class midibus  [friend]
```

13.78.5 Field Documentation

13.78.5.1 m_midi_info

```
rtmidi_info& seq64::rtmidi::m_midi_info  [private]
```

Unlike the original RtMidi library, this library separates the port-enumeration code ("info") from the port-usage code ("api").

We might make it a static object at some point.

13.78.5.2 m_midi_api

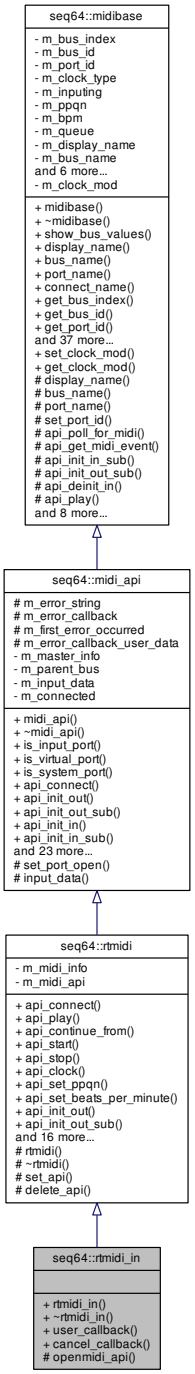
```
midi_api* seq64::rtmidi::m_midi_api  [private]
```

midi_alsa or midi_jack) for which this class is a wrapper.

13.79 seq64::rtmidi_in Class Reference

A realtime MIDI input class.

Inheritance diagram for seq64::rtmidi_in:



Public Member Functions

- rtmidi_in (midibus &parentbus, rtmidi_info &info)

  Constructs the desired MIDI API.
- virtual ~rtmidi_in ()

  A do-nothing virtual destructor.
- void user_callback (rtmidi_callback_t callback, void *userdata=nullptr)

Set a callback function to be invoked for incoming MIDI messages.

- void cancel_callback ()

  Cancel use of the current callback function (if one exists).

Protected Member Functions

- void openmidi_api (rtmidi_api api, rtmidi_info &info)

  Opens the desired MIDI API.

Additional Inherited Members

13.79.1 Detailed Description

This class provides a common, platform-independent API for realtime MIDI input. It allows access to a single MIDI input port. Incoming MIDI messages are either saved to a queue for retrieval using the get_message() function or immediately passed to a user-specified callback function. Create multiple instances of this class to connect to more than one MIDI device at the same time. With the OS-X, Linux ALSA, and JACK MIDI APIs, it is also possible to open a virtual input port to which other MIDI software clients can connect.

13.79.2 Constructor & Destructor Documentation

13.79.2.1 rtmidi_in()

```
seq64::rtmidi_in::rtmidi_in (
            midibus & parentbus,
            rtmidi_info & info )
```

If no compiled support for specified API value is found, we issue a warning and continue as if no API was specified. In this case, we iterate through the compiled APIs and return as soon as we find one with at least one port or we reach the end of the list.

Parameters

parentbus	This is the midibus that the rtmidi object is going to implement, by forwarding calls to the selected MIDI subsystem (e.g. ALSA or JACK).
info	Contains information about the existing ports and the selected MIDI API. Actually, the selected MIDI API is a static value of the rtmidi_info class.

Exceptions

This	function will throw an rterror object if it cannot find a MIDI API to use.

13.79.2.2 ~rtmidi_in()

```
seq64::rtmidi_in::~rtmidi_in ( )  [virtual]
```

13.79.3 Member Function Documentation

13.79.3.1 user_callback()

```
void seq64::rtmidi_in::user_callback (
            rtmidi_callback_t callback,
            void * userdata = nullptr )  [inline]
```

The callback function will be called whenever an incoming MIDI message is received. While not absolutely necessary, it is best to set the callback function before opening a MIDI port to avoid leaving some messages in the queue.

Parameters

callback	A callback function must be given.
userdata	Optionally, a pointer to additional data can be passed to the callback function whenever it is called.

13.79.3.2 cancel_callback()

```
void seq64::rtmidi_in::cancel_callback ( )  [inline]
```

Subsequent incoming MIDI messages will be written to the queue and can be retrieved with the *get_message* function.

13.79.3.3 openmidi_api()

```
void seq64::rtmidi_in::openmidi_api (
            rtmidi_api api,
            rtmidi_info & info )  [protected]
```

Parameters

api	The enum value for the desired MIDI API. If not specified, first JACK is tried, then ALSA.
info	Holds information about the API's setup (e.g. a list of the ALSA ports found on the system, the main ALSA "handle" pointer, plus the PPQN, BPM, and other information).

13.80 seq64::rtmidi_in_data Class Reference

The rtmidi_in_data structure is used to pass private class data to the MIDI input handling function or thread.

Public Member Functions

- rtmidi_in_data ()
- const midi_queue & queue () const

  'Getter' function for member m_queue const
- midi_queue & queue ()

  'Getter' function for member m_queue non-const
- const midi_message & message () const
- midi_message & message ()
- midibyte ignore_flags () const
- bool test_ignore_flags (midibyte testbits)
- void ignore_flags (midibyte setbits)
- bool do_input () const
- void do_input (bool flag)
- bool first_message () const
- void first_message (bool flag)
- bool continue_sysex () const
- void continue_sysex (bool flag)
- bool using_callback () const
- void using_callback (bool flag)
- const void * api_data () const

  'Getter' function for member m_api_data const
- void * api_data ()

  'Getter' function for member m_api_data non-const
- void api_data (void *dataptr)
- const void * user_data () const

  'Getter' function for member m_user_data const
- void * user_data ()

  'Getter' function for member m_user_data const
- void user_data (void *dataptr)

  'Setter' function for member m_user_data
- rtmidi_callback_t user_callback () const

  'Getter' function for member m_user_callback
- void user_callback (rtmidi_callback_t cbptr)

  'Setter' function for member m_user_callback This should be done immediately after opening the port to avoid having incoming messages written to the queue instead of sent to the callback function.

Private Attributes

- midi_queue m_queue
- midi_message m_message
- midibyte m_ignore_flags
- bool m_do_input
- bool m_first_message
- void * m_api_data
- bool m_using_callback
- rtmidi_callback_t m_user_callback
- void * m_user_data
- bool m_continue_sysex

13.80.1 Detailed Description

Used to be nested in the rtmidi_in class.

13.80.2 Constructor & Destructor Documentation

13.80.2.1 rtmidi_in_data()

```
seq64::rtmidi_in_data::rtmidi_in_data ( )
```

13.80.3 Member Function Documentation

13.80.3.1 queue() [1/2]

```
const midi_queue& seq64::rtmidi_in_data::queue ( ) const  [inline]
```

13.80.3.2 queue() [2/2]

```
midi_queue& seq64::rtmidi_in_data::queue ( )  [inline]
```

13.80.3.3 message() [1/2]

```
const midi_message& seq64::rtmidi_in_data::message ( ) const  [inline]
```

13.80.3.4 message() [2/2]

```
midi_message& seq64::rtmidi_in_data::message ( )  [inline]
```

13.80.3.5 ignore_flags() [1/2]

```
midibyte seq64::rtmidi_in_data::ignore_flags ( ) const  [inline]
```

13.80.3.6 test_ignore_flags()

```
bool seq64::rtmidi_in_data::test_ignore_flags (
            midibyte testbits )  [inline]
```

13.80.3.7 ignore_flags() [2/2]

```
void seq64::rtmidi_in_data::ignore_flags (
            midibyte setbits )  [inline]
```

13.80.3.8 do_input() [1/2]

```
bool seq64::rtmidi_in_data::do_input ( ) const  [inline]
```

13.80.3.9 do_input() [2/2]

```
void seq64::rtmidi_in_data::do_input (
            bool flag )  [inline]
```

13.80.3.10 first_message() [1/2]

```
bool seq64::rtmidi_in_data::first_message ( ) const  [inline]
```

13.80.3.11 first_message() [2/2]

```
void seq64::rtmidi_in_data::first_message (
            bool flag )  [inline]
```

13.80.3.12 continue_sysex() [1/2]

```
bool seq64::rtmidi_in_data::continue_sysex ( ) const  [inline]
```

13.80.3.13 continue_sysex() [2/2]

```
void seq64::rtmidi_in_data::continue_sysex (
            bool flag )  [inline]
```

13.80.3.14 using_callback() [1/2]

```
bool seq64::rtmidi_in_data::using_callback ( ) const  [inline]
```

13.80.3.15 using_callback() [2/2]

```
void seq64::rtmidi_in_data::using_callback (
            bool flag )  [inline]
```

13.80.3.16 api_data() [1/3]

```
const void* seq64::rtmidi_in_data::api_data ( ) const  [inline]
```

13.80.3.17 api_data() [2/3]

```
void* seq64::rtmidi_in_data::api_data ( )  [inline]
```

13.80.3.18 api_data() [3/3]

```
void seq64::rtmidi_in_data::api_data (
            void * dataptr )  [inline]
```

13.80.3.19 user_data() [1/3]

```
const void* seq64::rtmidi_in_data::user_data ( ) const  [inline]
```

13.80.3.20 user_data() [2/3]

```
void* seq64::rtmidi_in_data::user_data ( )  [inline]
```

13.80.3.21 user_data() [3/3]

```
void seq64::rtmidi_in_data::user_data (
            void * dataptr )  [inline]
```

13.80.3.22 user_callback() [1/2]

```
rtmidi_callback_t seq64::rtmidi_in_data::user_callback ( ) const  [inline]
```

13.80.3.23 user_callback() [2/2]

```
void seq64::rtmidi_in_data::user_callback (
            rtmidi_callback_t cbptr )  [inline]
```

13.80.4 Field Documentation

13.80.4.1 m_queue

```
midi_queue seq64::rtmidi_in_data::m_queue  [private]
```

13.80.4.2 m_message

```
midi_message seq64::rtmidi_in_data::m_message  [private]
```

13.80.4.3 m_ignore_flags

```
midibyte seq64::rtmidi_in_data::m_ignore_flags  [private]
```

13.80.4.4 m_do_input

```
bool seq64::rtmidi_in_data::m_do_input  [private]
```

13.80.4.5 m_first_message

```
bool seq64::rtmidi_in_data::m_first_message  [private]
```

13.80.4.6 m_api_data

```
void* seq64::rtmidi_in_data::m_api_data  [private]
```

13.80.4.7 m_using_callback

```
bool seq64::rtmidi_in_data::m_using_callback  [private]
```

13.80.4.8 m_user_callback

```
rtmidi_callback_t seq64::rtmidi_in_data::m_user_callback  [private]
```

13.80.4.9 m_user_data

```
void* seq64::rtmidi_in_data::m_user_data  [private]
```

13.80.4.10 m_continue_sysex

```
bool seq64::rtmidi_in_data::m_continue_sysex  [private]
```

13.81 seq64::rtmidi_info Class Reference

A class for enumerating MIDI clients and ports.

Public Member Functions

- rtmidi_info (rtmidi_api api=RTMIDI_API_UNSPECIFIED, const std::string &appname="rtmidiapp", int ppqn=SEQ64_DEFAULT_PPQN, midibpm bpm=SEQ64_DEFAULT_BPM)

  Default constructor.
- virtual ~rtmidi_info ()

  Destructor.
- bool midi_mode () const

  Sets the input or output mode for getting data.
- void midi_mode (bool flag)

  Sets the input or output mode for getting data.
- void clear ()

  Clear the MIDI port container.
- void add_input (const midibus *m)

  Add midibus information to the input ports.
- void add_output (const midibus *m)

  Add midibus information to the output ports.
- void add_bus (const midibus *m)

  Adds the bus to a list of busses to be connected by the API at the right time (currently applies only to JACK).
- int get_bus_id (int index) const

  Gets the buss/client ID for a MIDI interfaces.
- std::string get_bus_name (int index) const
- int get_port_count () const
- int full_port_count () const
- int get_port_id (int index) const
- std::string get_port_name (int index) const
- bool get_input (int index) const
- bool get_virtual (int index) const
- bool get_system (int index) const
- int get_all_port_info ()
- int queue_number (int index) const
- const std::string & app_name () const
- int global_queue () const
- int ppqn () const
- void api_set_ppqn (int p)
- midibpm bpm () const
- void api_set_beats_per_minute (midibpm b)
- void api_port_start (mastermidibus &masterbus, int bus, int port)
- bool api_get_midi_event (event *inev)
- void api_flush ()
- int api_poll_for_midi ()
- std::string port_list () const

  Returns a list of all the ports as an ASCII string.
- const midi_info * get_api_info () const

  'Getter' function for member m_info_api const version
- midi_info * get_api_info ()

  'Getter' function for member m_info_api non-const version

Static Public Member Functions

- static std::string get_version ()

  'Getter' function for member SEQ64_RTMIDI_VERSION This is a static function to replace the midi_api version.
- static void get_compiled_api (std::vector< rtmidi_api > &apis)

  Gets the list of APIs compiled into the application.
- static rtmidi_api & selected_api ()

  'Getter' function for member sm_selected_api

Protected Member Functions

- bool api_connect ()
- bool set_api_info (midi_info *ma)

  'Setter' function for member m_info_api This function also checks the pointer and returns false if it is not valid.
- void delete_api ()

  'Setter' function for member m_info_api
- bool openmidi_api (rtmidi_api api, const std::string &appname, int ppqn, midibpm bpm)

  Opens the desired MIDI API.

Static Protected Member Functions

- static void selected_api (const rtmidi_api &api)

  'Setter' function for member sm_selected_api

Private Attributes

- midi_info * m_info_api

  Provides access to the selected API (currently only JACK or ALSA).

Static Private Attributes

- static rtmidi_api sm_selected_api

  To save repeated queries, we save this value.

Friends

- class mastermidibus
- class midibus
- class rtmidi_in
- class rtmidi_out

13.81.1 Detailed Description

New, but ripe for refactoring nonetheless.

13.81.2 Constructor & Destructor Documentation

13.81.2.1 rtmidi_info()

```
seq64::rtmidi_info::rtmidi_info (
            rtmidi_api api = RTMIDI_API_UNSPECIFIED,
            const std::string & appname = "rtmidiapp",
            int ppqn = SEQ64_DEFAULT_PPQN,
            midibpm bpm = SEQ64_DEFAULT_BPM )
```

Code basically cut-and-paste from rtmidi_in or rtmidi_out. Common code!

13.81.2.2 ~rtmidi_info()

```
seq64::rtmidi_info::~rtmidi_info ( )  [virtual]
```

13.81.3 Member Function Documentation

13.81.3.1 get_version()

```
std::string seq64::rtmidi_info::get_version ( )  [static]
```

13.81.3.2 get_compiled_api()

```
void seq64::rtmidi_info::get_compiled_api (
            std::vector< rtmidi_api > & apis )  [static]
```

Note that we make ALSA versus JACK a runtime option as it is in the legacy Sequencer64 application.

This is a static function to replace the midi_api version.

Parameters

apis	The API structure.

13.81.3.3 midi_mode() [1/2]

```
bool seq64::rtmidi_info::midi_mode ( ) const  [inline]
```

13.81.3.4 midi_mode() [2/2]

```
void seq64::rtmidi_info::midi_mode (
            bool flag )  [inline]
```

13.81.3.5 clear()

```
void seq64::rtmidi_info::clear ( )  [inline]
```

13.81.3.6 add_input()

```
void seq64::rtmidi_info::add_input (
            const midibus * m )  [inline]
```

Also adds the midibus to a lit of busses to connect in mastermidibus. This function is meant for virtual ports.

13.81.3.7 add_output()

```
void seq64::rtmidi_info::add_output (
            const midibus * m )  [inline]
```

Also adds the midibus to a lit of busses to connect in mastermidibus. This function is meant for virtual ports.

13.81.3.8 add_bus()

```
void seq64::rtmidi_info::add_bus (
            const midibus * m )  [inline]
```

See the calls to this function in mastermidibus.

13.81.3.9 get_bus_id()

```
int seq64::rtmidi_info::get_bus_id (
            int index ) const  [inline]
```

This is the left-hand side of a X:Y pair (such as 128:0).

This function is a new part of the RtMidi interface.

Parameters

index	The ordinal index of the desired interface to look up.

Returns

Returns the buss/client value as provided by the selected API.

13.81.3.10 get_bus_name()

```
std::string seq64::rtmidi_info::get_bus_name (
            int index ) const  [inline]
```

13.81.3.11 get_port_count()

```
int seq64::rtmidi_info::get_port_count ( ) const  [inline]
```

13.81.3.12 full_port_count()

```
int seq64::rtmidi_info::full_port_count ( ) const  [inline]
```

13.81.3.13 get_port_id()

```
int seq64::rtmidi_info::get_port_id (
            int index ) const  [inline]
```

13.81.3.14 get_port_name()

```
std::string seq64::rtmidi_info::get_port_name (
            int index ) const  [inline]
```

13.81.3.15 get_input()

```
bool seq64::rtmidi_info::get_input (
            int index ) const  [inline]
```

13.81.3.16 get_virtual()

```
bool seq64::rtmidi_info::get_virtual (
            int index ) const  [inline]
```

13.81.3.17 get_system()

```
bool seq64::rtmidi_info::get_system (
            int index ) const  [inline]
```

13.81.3.18 get_all_port_info()

```
int seq64::rtmidi_info::get_all_port_info ( )  [inline]
```

13.81.3.19 queue_number()

```
int seq64::rtmidi_info::queue_number (
            int index ) const  [inline]
```

13.81.3.20 app_name()

```
const std::string& seq64::rtmidi_info::app_name ( ) const  [inline]
```

13.81.3.21 global_queue()

```
int seq64::rtmidi_info::global_queue ( ) const  [inline]
```

13.81.3.22 ppqn()

```
int seq64::rtmidi_info::ppqn ( ) const  [inline]
```

13.81.3.23 api_set_ppqn()

```
void seq64::rtmidi_info::api_set_ppqn (
            int p )  [inline]
```

13.81.3.24 bpm()

```
midibpm seq64::rtmidi_info::bpm ( ) const  [inline]
```

13.81.3.25 api_set_beats_per_minute()

```
void seq64::rtmidi_info::api_set_beats_per_minute (
            midibpm b )  [inline]
```

13.81.3.26 api_port_start()

```
void seq64::rtmidi_info::api_port_start (
            mastermidibus & masterbus,
            int bus,
            int port )  [inline]
```

13.81.3.27 api_get_midi_event()

```
bool seq64::rtmidi_info::api_get_midi_event (
            event * inev )  [inline]
```

13.81.3.28 api_flush()

```
void seq64::rtmidi_info::api_flush ( )  [inline]
```

13.81.3.29 api_poll_for_midi()

```
int seq64::rtmidi_info::api_poll_for_midi ( )  [inline]
```

13.81.3.30 port_list()

```
std::string seq64::rtmidi_info::port_list ( ) const  [inline]
```

13.81.3.31 selected_api() [1/2]

```
static rtmidi_api& seq64::rtmidi_info::selected_api ( )  [inline], [static]
```

13.81.3.32 get_api_info() [1/2]

```
const midi_info* seq64::rtmidi_info::get_api_info ( ) const  [inline]
```

13.81.3.33 get_api_info() [2/2]

```
midi_info* seq64::rtmidi_info::get_api_info ( )  [inline]
```

13.81.3.34 api_connect()

```
bool seq64::rtmidi_info::api_connect ( )  [inline], [protected]
```

13.81.3.35 selected_api() [2/2]

```
static void seq64::rtmidi_info::selected_api (
            const rtmidi_api & api )  [inline], [static], [protected]
```

13.81.3.36 set_api_info()

```
bool seq64::rtmidi_info::set_api_info (
            midi_info * ma )  [inline], [protected]
```

This feature is important to allow a missing API (e.g. the JACK server is not running) to be detected.

13.81.3.37 delete_api()

```
void seq64::rtmidi_info::delete_api ( )  [inline], [protected]
```

13.81.3.38 openmidi_api()

```
bool seq64::rtmidi_info::openmidi_api (
            rtmidi_api api,
            const std::string & appname,
            int ppqn,
            midibpm bpm )  [protected]
```

If the JACK API is tried, and found missing, we turn off all of the other JACK flags found in the "rc" configuration file. Also, the loop in the constructor will come back here to try the other compiled-in APIs (currently just ALSA).

Parameters

api	The desired MIDI API.
appname	The name of the application, to be passed to the midi_info-derived constructor.
ppqn	The PPQN value to pass along to the midi_info_derived constructor.
bpm	The BPM (beats per minute) value to pass along to the midi_info_derived constructor.

Returns

Returns true if a valid API is found. A valid API is on that is both compiled into the application and is found existing on the host computer (system).

13.81.4 Friends And Related Function Documentation

13.81.4.1 mastermidibus

```
friend class mastermidibus  [friend]
```

13.81.4.2 midibus

```
friend class midibus  [friend]
```

13.81.4.3 rtmidi_in

```
friend class rtmidi_in  [friend]
```

13.81.4.4 rtmidi_out

```
friend class rtmidi_out  [friend]
```

13.81.5 Field Documentation

13.81.5.1 m_info_api

```
midi_info* seq64::rtmidi_info::m_info_api  [private]
```

13.81.5.2 sm_selected_api

```
rtmidi_api seq64::rtmidi_info::sm_selected_api  [static], [private]
```

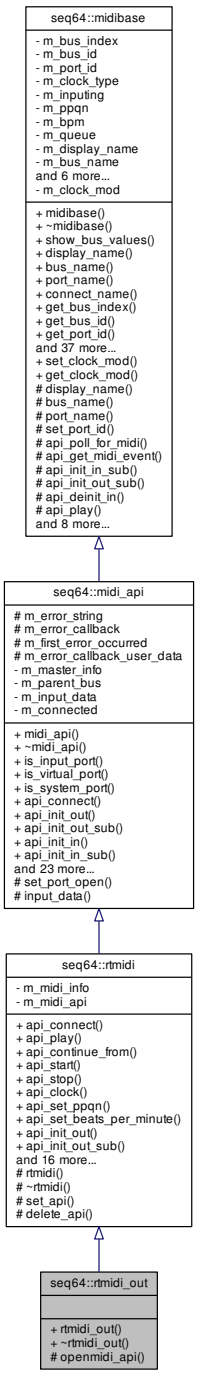
Holds the selected API code.

Its default value is RTMIDI_API_UNSPECIFIED.

13.82 seq64::rtmidi_out Class Reference

A realtime MIDI output class.

Inheritance diagram for seq64::rtmidi_out:



Public Member Functions

- rtmidi_out (midibus &parentbus, rtmidi_info &info)

Principal constructor.

- virtual ~rtmidi_out ()

  The destructor closes any open MIDI connections.

Protected Member Functions

- void openmidi_api (rtmidi_api api, rtmidi_info &info)

Additional Inherited Members

13.82.1 Detailed Description

This class provides a common, platform-independent API for MIDI output. It allows one to probe available MIDI output ports, to connect to one such port, and to send MIDI bytes immediately over the connection. Create multiple instances of this class to connect to more than one MIDI device at the same time. With the OS-X, Linux ALSA and JACK MIDI APIs, it is also possible to open a virtual port to which other MIDI software clients can connect.

13.82.2 Constructor & Destructor Documentation

13.82.2.1 rtmidi_out()

```
seq64::rtmidi_out::rtmidi_out (
            midibus & parentbus,
            rtmidi_info & info )
```

Attempt to open the specified API. If there is no compiled support for specified API value, then issue a warning and continue as if no API was specified. In that case, we Iterate through the compiled APIs and return as soon as we find one with at least one port or we reach the end of the list.

Parameters

parentbus	This is the midibus that the rtmidi object is going to implement, by forwarding calls to the selected MIDI subsystem (e.g. ALSA or JACK).
info	Contains information about the existing ports and the selected MIDI API. Actually, the selected MIDI API is a static value of the rtmidi_info class.

Exceptions

This	function will throw an rterror object if it cannot find a MIDI API to use.

13.82.2.2 ~rtmidi_out()

```
seq64::rtmidi_out::~rtmidi_out ( )  [virtual]
```

A do-nothing virtual destructor.

13.82.3 Member Function Documentation

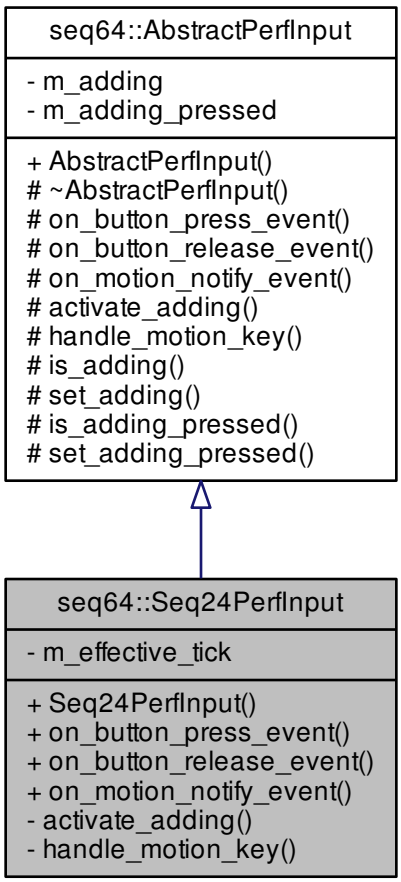
13.82.3.1 openmidi_api()

```
void seq64::rtmidi_out::openmidi_api (
            rtmidi_api api,
            rtmidi_info & info )  [protected]
```

13.83 seq64::Seq24PerfInput Class Reference

Implements the default (Seq24) performance input characteristics of this application.

Inheritance diagram for seq64::Seq24PerfInput:



Public Member Functions

- Seq24PerfInput ()
- bool on_button_press_event (GdkEventButton *a_ev, perfroll &roll)

  Handles the normal variety of button-press event.
- bool on_button_release_event (GdkEventButton *a_ev, perfroll &roll)

  Handles various button-release events.
- bool on_motion_notify_event (GdkEventMotion *a_ev, perfroll &roll)

  Handles the normal motion-notify event.

Private Member Functions

- virtual void activate_adding (bool a_adding, perfroll &roll)

  A popup menu (which one?) calls this.
- bool handle_motion_key (bool is_left, perfroll &roll)

  Handles the keystroke motion-notify event for moving a pattern back and forth in the performance.

Private Attributes

- midipulse m_effective_tick

  The current tick for the current segment?

Friends

- class perfroll

Additional Inherited Members

13.83.1 Constructor & Destructor Documentation

13.83.1.1 Seq24PerfInput()

```
seq64::Seq24PerfInput::Seq24PerfInput ( )  [inline]
```

13.83.2 Member Function Documentation

13.83.2.1 on_button_press_event()

```
bool seq64::Seq24PerfInput::on_button_press_event (
            GdkEventButton * ev,
            perfroll & roll )  [virtual]
```

Is there any easy way to use ctrl-left-click as the middle button here?

Stazed:

```
roll.m_drop_y will be adjusted by perfroll::change_vert() for any scroll
after it was originally selected. The call here to draw_drawable_row()
[now folded into draw_all()] will have the wrong y location and
un-select will not occur (or the wrong sequence will be unselected) if
the user scrolls the track up or down to a new y location, if not
adjusted.
```

Returns

Returns true if a modification occurred.

Implements seq64::AbstractPerfInput.

13.83.2.2 on_button_release_event()

```
bool seq64::Seq24PerfInput::on_button_release_event (
            GdkEventButton * ev,
            perfroll & roll )  [virtual]
```

Any use for the middle-button or ctrl-left-click we can add?

Returns

Returns true if any modification occurred.

Implements seq64::AbstractPerfInput.

13.83.2.3 on_motion_notify_event()

```
bool seq64::Seq24PerfInput::on_motion_notify_event (
            GdkEventMotion * ev,
            perfroll & roll )  [virtual]
```

Returns

Returns true if a modification occurs. This function used to always return true.

Implements seq64::AbstractPerfInput.

13.83.2.4 activate_adding()

```
void seq64::Seq24PerfInput::activate_adding (
            bool adding,
            perfroll & roll )  [private], [virtual]
```

What does it mean?

Implements seq64::AbstractPerfInput.

13.83.2.5 handle_motion_key()

```
bool seq64::Seq24PerfInput::handle_motion_key (
            bool is_left,
            perfroll & roll )  [private], [virtual]
```

What happens when the mouse is used to drag the pattern is that, first, roll.m_drop_tick is set by left-clicking into the pattern to select it. As the pattern is dragged, the drop-tick value does not change, but the tick (converted from the moving x value) does.

Then the button-handler sets roll.m_moving = true, and calculates roll.m_drop_tick_trigger_offset = roll.m_drop_tick - p.get_sequence(dropseq)->selected_trigger_start();

The motion handler sees that roll.m_moving is true, gets the new tick value from the new x value, offsets it, and calls p.get_sequence(dropseq)->move_selected_triggers_to(tick, true).

When the user releases the left button, then roll.m_growing is turned of and the roll draw_all()'s.

Parameters

is_left	False denotes the right arrow key, and true denotes the left arrow key.
roll	Provides a reference to the parent roll, which keeps track of most of the information about the status of the window.

Returns

Returns true if there was some action able to happen that would necessitate a window update. We've updated triggers::move_selected() [called indirectly near the end of this routine] to return false if no more movement could be made. This prevents this routine from moving way ahead after movement of the selected (in the user-interface) trigger stops.

Implements seq64::AbstractPerfInput.

13.83.3 Friends And Related Function Documentation

13.83.3.1 perfroll

```
friend class perfroll  [friend]
```

13.83.4 Field Documentation

13.83.4.1 m_effective_tick

```
midipulse seq64::Seq24PerfInput::m_effective_tick  [private]
```

13.84 seq64::Seq24SeqEventInput Struct Reference

This structure implement the normal interaction methods for Seq24.

Public Member Functions

- Seq24SeqEventInput ()
  Default constructor.
- void set_adding (bool adding, seqevent &ths)
  Changes the mouse cursor to a pencil or a left pointer in the given seqevent object, depending on the first parameter.
- bool on_button_press_event (GdkEventButton *ev, seqevent &ths)
  Implements the on-button-press event callback.
- bool on_button_release_event (GdkEventButton *ev, seqevent &ths)
  Implements the on-button-release callback.
- bool on_motion_notify_event (GdkEventMotion *ev, seqevent &ths)
  Implements the on-motion-notify event.

Data Fields

- bool m_adding
  True if we're adding events via the mouse.

13.84.1 Constructor & Destructor Documentation

13.84.1.1 Seq24SeqEventInput()

```
seq64::Seq24SeqEventInput::Seq24SeqEventInput ( )  [inline]
```

13.84.2 Member Function Documentation

13.84.2.1 set_adding()

```
void seq64::Seq24SeqEventInput::set_adding (
            bool adding,
            seqevent & seqev )
```

Modifies m_adding as well.

Parameters

adding	The value to set m_adding to, and if true, sets the mouse cursor to a pencil icon, otherwise sets it to a standard mouse-pointer icon.
seqev	The seqevent whose window will be set to "adding" mode.

13.84.2.2 on_button_press_event()

```
bool seq64::Seq24SeqEventInput::on_button_press_event (
            GdkEventButton * ev,
            seqevent & seqev )
```

Set values for dragging, then reset the box that holds dirty redraw spot. Then do the rest.

Parameters

ev	The button event for the press of a mouse button.
seqev	Provides the seqevent strip to be affected by this button event.

Returns

Returns true if a likely modification was made. This function used to return true all the time.

Needs update. seqev.m_seq.unselect(); ???????

13.84.2.3 on_button_release_event()

```
bool seq64::Seq24SeqEventInput::on_button_release_event (
            GdkEventButton * ev,
            seqevent & seqev )
```

Parameters

ev	The button event for the release of a mouse button.
seqev	Provides the seqevent strip to be affected by this button event.

Returns

Returns true if a likely modification was made. This function used to return true all the time.

13.84.2.4 on_motion_notify_event()

```
bool seq64::Seq24SeqEventInput::on_motion_notify_event (
            GdkEventMotion * ev,
            seqevent & seqev )
```

Parameters

ev	The button event for the motion of the mouse cursor.
seqev	Provides the seqevent strip to be affected by this button event.

Returns

Returns true if a likely modification was made. This function used to return true all the time.

13.84.3 Field Documentation

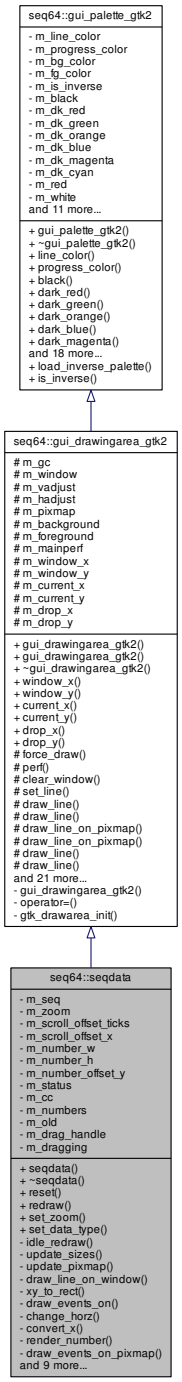
13.84.3.1 m_adding

```
bool seq64::Seq24SeqEventInput::m_adding
```

13.85 seq64::seqdata Class Reference

This class supports drawing piano-roll eventis on a window.

Inheritance diagram for seq64::seqdata:



Public Member Functions

- seqdata (sequence &seq, perform &p, int zoom, Gtk::Adjustment &hadjust)

  Principal constructor.
- virtual ~seqdata ()

  Let's provide a do-nothing virtual destructor.
- void reset ()

This function calls update_size().

- void redraw ()

  Calls change_horz() to update the pixmap and queue up a redraw operation.
- void set_zoom (int a_zoom)

  Sets the zoom to the given value and resets the view via the reset function.
- void set_data_type (midibyte status, midibyte control)

  Sets the status to the given value, and the control to the optional given value, which defaults to 0, then calls redraw().

Private Member Functions

- int idle_redraw ()

  Draws events on this object's built-in window and pixmap.
- void update_sizes ()

  Updates the sizes in the pixmap if the view is realized, and queues up a draw operation.
- void update_pixmap ()

  Simply calls draw_events_on_pixmap().
- void draw_line_on_window ()

  Draws on vertical line on the data window.
- void xy_to_rect (int x1, int y1, int x2, int y2, int &rx, int &ry, int &rw, int &rh)

  This function takes two points, and returns an XWin rectangle, returned via the last four parameters.
- void draw_events_on (Glib::RefPtr< Gdk::Drawable > drawable)

  Draws events on the given drawable object.
- void change_horz ()

  Change the scrolling offset on the x-axis, and redraw.
- void convert_x (int x, midipulse &tick)

  This function takes screen coordinates, and gives the horizontaol tick value based on the current zoom, returned via the second parameter.
- void render_number (Glib::RefPtr< Gdk::Pixmap > &pixmap, int x, int y, const char *const num)

  Convenience function for rendering numbers.
- void draw_events_on_pixmap ()

  Simply calls draw_events_on() for this object's built-in pixmap.
- void draw_pixmap_on_window ()

  Simply queues up a draw operation.
- void on_realize ()

  Implements the on-realization event, by calling the base-class version and then allocating the resources that could not be allocated in the constructor.
- bool on_expose_event (GdkEventExpose *ev)

  Implements the on-expose event by calling draw_drawable() on the event.
- bool on_button_press_event (GdkEventButton *ev)

  Implements a mouse button-press event.
- bool on_button_release_event (GdkEventButton *ev)

  Implement a button-release event.
- bool on_motion_notify_event (GdkEventMotion *ev)

  Handles a motion-notify event.
- bool on_leave_notify_event (GdkEventCrossing *ev)

  Handles an on-leave notification event.
- bool on_scroll_event (GdkEventScroll *ev)

  Implements the on-scroll event.
- void on_size_allocate (Gtk::Allocation &)

  Handles a size-allocation event by updating m_window_x and m_window_y, and then updating all of the sizes of the data pane in update_sizes().

Private Attributes

- sequence & m_seq

  Points to the sequence whose data is being affected by this class.
- int m_zoom

  Sets the zoom value for this part of the sequence editor, one pixel == m_zoom ticks, i.e.
- int m_scroll_offset_ticks

  The value of the leftmost tick in the data pane.
- int m_scroll_offset_x

  The value of the leftmost pixel in the data pane.
- int m_number_w

  The adjusted width of a digit in a data number.
- int m_number_h

  The adjusted height of all digits in a data number.
- int m_number_offset_y

  A new value to make it easier to adapt the vertical number drawing of a data item's numeric value to a different font.
- midibyte m_status

  Holds the status byte of the next event in the sequence, and indicates What the data window is currently editing or drawing.
- midibyte m_cc

  Holds the MIDI CC byte of the next event in the sequence, and indicates What the data window is currently editing or drawing.
- Glib::RefPtr< Gdk::Pixmap > m_numbers [c_dataarea_y]

  Holds the pixmaps for each number (0 to 127) that can be drawn for a data value in the data pane.
- GdkRectangle m_old

  This rectangle is used in blanking out a data line in draw_line_on_window().
- bool m_drag_handle
- bool m_dragging

  This value is true if the mouse is being dragged in the data pane, which is done in order to change the height and value of each data line.

Friends

- class lfownd
- class seqevent
- class seqroll

Additional Inherited Members

13.85.1 Constructor & Destructor Documentation

13.85.1.1 seqdata()

```
seq64::seqdata::seqdata (
            sequence & seq,
            perform & p,
            int zoom,
            Gtk::Adjustment & hadjust )
```

In the constructor one can only allocate colors, get_window() returns 0 because this pane has not yet been realized.

Parameters

seq	The sequence that is being displayed and edited by this data pane.
p	The performance object that oversees all of the sequences. This object is needed here only to access the perform::modify() function.
zoom	The starting zoom of this pane.
hadjust	The horizontal adjustment object provided by the parent class, seqedit, that created this pane.

13.85.1.2 ~seqdata()

```
virtual seq64::seqdata::~seqdata ( )  [inline], [virtual]
```

13.85.2 Member Function Documentation

13.85.2.1 reset()

```
void seq64::seqdata::reset ( )
```

Then, regardless of whether the view is realized, updates the pixmap and queues up a draw operation.

Note

If it weren't for the is_realized() condition, we could just call update_sizes(), which does all this anyway.

13.85.2.2 redraw()

```
void seq64::seqdata::redraw ( )  [inline]
```

13.85.2.3 set_zoom()

```
void seq64::seqdata::set_zoom (
            int z )
```

Called by seqedit::set_zoom(), which validates the zoom value.

Parameters

z	The desired zoom value, assumed to be validated already. See the seqedit::set_zoom() function.

13.85.2.4 set_data_type()

```
void seq64::seqdata::set_data_type (
            midibyte status,
            midibyte control )
```

Perhaps we should check that at least one of the parameters causes a change.

Parameters

status	The MIDI event byte (status byte) to set.
control	The MIDI CC value to set.

13.85.2.5 idle_redraw()

```
int seq64::seqdata::idle_redraw ( )  [private]
```

This drawing is done only if there is no dragging in progress, to guarantee no flicker.

13.85.2.6 update_sizes()

```
void seq64::seqdata::update_sizes ( )  [private]
```

It creates a pixmap with window dimensions given by m_window_x and m_window_y.

We thought there was a potential memory leak, since m_pixmap is created every time the window is resized, but valgrind says otherwise... maybe. An awful lot of Gtk leaks!

13.85.2.7 update_pixmap()

```
void seq64::seqdata::update_pixmap ( )  [private]
```

13.85.2.8 draw_line_on_window()

```
void seq64::seqdata::draw_line_on_window ( )  [private]
```

13.85.2.9 xy_to_rect()

```
void seq64::seqdata::xy_to_rect (
            int x1,
            int y1,
            int x2,
            int y2,
            int & rx,
            int & ry,
            int & rw,
            int & rh )  [private]
```

It checks the mins/maxes, then fills in x, y, and width, height.

Parameters

	x1	The input x value for the first data point.
	y1	The input y value for the first data point.
	x2	The input x value for the second data point.
	y2	The input y value for the second data point.
out	*rx*	The output for the x value of the XWin rectangle.
out	*ry*	The output for the y value of the XWin rectangle.
out	*rw*	The output for the width value of the XWin rectangle.
out	*rh*	The output for the height of the XWin rectangle.

13.85.2.10 draw_events_on()

```
void seq64::seqdata::draw_events_on (
            Glib::RefPtr< Gdk::Drawable > drawable )  [private]
```

Very similar to seqevent :: draw_events_on(). And yet it doesn't handle zooming as well, must fix!

Stazed:

```
For Note On there can be multiple events on the same vertical in which
the selected item can be covered.  For Note On the selected item
needs to be drawn last so it can be seen.  So, for other events the
variable num_selected_events will be -1 for ALL_EVENTS. For Note On
only, the variable will be the number of selected events. If 0 then
only one pass is needed. If > 0 then two passes are needed, one for
unselected (first), and one for selected (last).  For the first pass,
if any events are selected, the selection type is EVENTS_UNSELECTED.
For the second pass, it will be set to num_selected_events.
```

We now draw the data line for selected event in dark orange, instead of black. We're not likely to adopt the Stazed convention of drawing in blue. Also, there seem to be some bugs in how the data selection works. Needs more evaluation.

Also, if we decide to draw handle on each vertical data line, it would look nicer if a circle.

Parameters

drawable	The given drawable object.

13.85.2.11 change_horz()

```
void seq64::seqdata::change_horz ( )  [private]
```

Basically identical to seqevent::change_horz().

13.85.2.12 convert_x()

```
void seq64::seqdata::convert_x (
            int x,
            midipulse & tick )  [inline], [private]
```

13.85.2.13 render_number()

```
void seq64::seqdata::render_number (
            Glib::RefPtr< Gdk::Pixmap > & pixmap,
            int x,
            int y,
            const char *const num )  [inline], [private]
```

Parameters

pixmap	The reference pointer to the GDK pixmap onto which this number will be drawing.
x	The x-coordinate of the position of the text.
y	The y-coordinate of the position of the text.
num	The number to be rendered. This should be a string reference, but oh well.

13.85.2.14 draw_events_on_pixmap()

```
void seq64::seqdata::draw_events_on_pixmap ( )  [inline], [private]
```

13.85.2.15 draw_pixmap_on_window()

```
void seq64::seqdata::draw_pixmap_on_window ( )  [inline], [private]
```

13.85.2.16 on_realize()

```
void seq64::seqdata::on_realize ( )  [private]
```

It also connects up the change_horz() function.

Note that this function creates a small pixmap for every possible y-value, where y ranges from 0 to MIDI_COUNT↩ _MAX-1 = 127. It then fills each pixmap with a numeric representation of that y value, up to three digits (left-padded with spaces).

13.85.2.17 on_expose_event()

```
bool seq64::seqdata::on_expose_event (
            GdkEventExpose * ev )  [private]
```

Parameters

ev	Provides the expose-event.

Returns

Always returns true.

13.85.2.18 on_button_press_event()

```
bool seq64::seqdata::on_button_press_event (
            GdkEventButton * ev )  [private]
```

This function pushes the undo information for the sequence, sets the drop-point, resets the box that holds dirty redraw spot, and sets m_dragging to true.

Parameters

ev	Provides the button-press event.

Returns

Always returns true.

13.85.2.19 on_button_release_event()

```
bool seq64::seqdata::on_button_release_event (
            GdkEventButton * ev )  [private]
```

Sets the current point. If m_dragging is true, then the sequence data is changed, the performance modification flag is set, and m_dragging is reset.

Parameters

ev	Provides the button-release event.

Returns

Returns true if a modification occurred, and in that case also sets the perform modification flag.

13.85.2.20 on_motion_notify_event()

```
bool seq64::seqdata::on_motion_notify_event (
            GdkEventMotion * ev )  [private]
```

It converts the x,y of the mouse to ticks, then sets the events in the event-data-range, updates the pixmap, draws events in the window, and draws a line on the window.

Parameters

ev	The motion event.

Returns

Returns true if a change in event data occurred. If true, then the perform modification flag is set.

13.85.2.21 on_leave_notify_event()

```
bool seq64::seqdata::on_leave_notify_event (
            GdkEventCrossing * ev )  [private]
```

Parameter "p0", the crossing point for the event, is unused.

13.85.2.22 on_scroll_event()

```
bool seq64::seqdata::on_scroll_event (
            GdkEventScroll * ev )  [private]
```

This scroll event only handles basic scrolling, without any modifier keys such as the Ctrl of Shift masks. If there is a note (seqroll pane) or event (seqevent pane) selected, and mouse hovers over the data area (seqdata pane), then this scrolling action will increase or decrease the value of the data item, which lengthens of shortens the line drawn.

Todo DOCUMENT the seqdata scrolling behavior in the documentation projects.

Parameters

ev	Provides the scroll-event.

Returns

Always returns true.

13.85.2.23 on_size_allocate()

```
void seq64::seqdata::on_size_allocate (
            Gtk::Allocation & r )  [private]
```

Parameters

r	Provides the allocation event.

13.85.3 Friends And Related Function Documentation

13.85.3.1 lfownd

```
friend class lfownd  [friend]
```

13.85.3.2 seqevent

```
friend class seqevent  [friend]
```

13.85.3.3 seqroll

```
friend class seqroll  [friend]
```

13.85.4 Field Documentation

13.85.4.1 m_seq

```
sequence& seq64::seqdata::m_seq  [private]
```

13.85.4.2 m_zoom

```
int seq64::seqdata::m_zoom  [private]
```

the unit is ticks/pixel.

13.85.4.3 m_scroll_offset_ticks

```
int seq64::seqdata::m_scroll_offset_ticks  [private]
```

Adjusted in the change_horz() function.

13.85.4.4 m_scroll_offset_x

```
int seq64::seqdata::m_scroll_offset_x  [private]
```

Adjusted in the change_horz() function. It is the offset ticks divided by the zoom value, i.e. the unit is pixels..

13.85.4.5 m_number_w

```
int seq64::seqdata::m_number_w  [private]
```

By "adjusted", well this is just a minor tweak for appearances.

13.85.4.6 m_number_h

```
int seq64::seqdata::m_number_h  [private]
```

Basically, the character height times 3. By "adjusted", well this is just a minor tweak for appearances.

13.85.4.7 m_number_offset_y

```
int seq64::seqdata::m_number_offset_y  [private]
```

This value was hardwired as 8, for a character height of 10.

13.85.4.8 m_status

```
midibyte seq64::seqdata::m_status  [private]
```

13.85.4.9 m_cc

```
midibyte seq64::seqdata::m_cc  [private]
```

13.85.4.10 m_numbers

```
Glib::RefPtr<Gdk::Pixmap> seq64::seqdata::m_numbers[c_dataarea_y]  [private]
```

This array is filled only once, in the on_realize() function.

13.85.4.11 m_old

```
GdkRectangle seq64::seqdata::m_old  [private]
```

13.85.4.12 m_drag_handle

```
bool seq64::seqdata::m_drag_handle  [private]
```

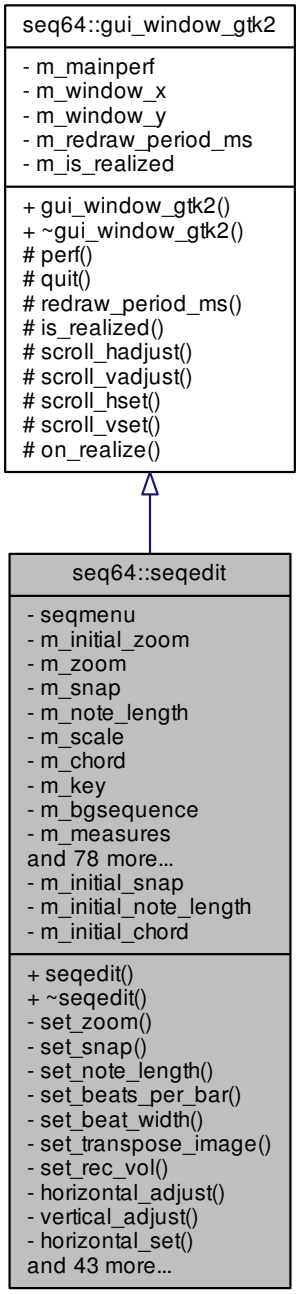
13.85.4.13 m_dragging

```
bool seq64::seqdata::m_dragging  [private]
```

13.86 seq64::seqedit Class Reference

Implements the Pattern Editor, which has references to:

Inheritance diagram for seq64::seqedit:



Public Member Functions

- seqedit (perform &perf, sequence &seq, int pos, int ppqn=SEQ64_USE_DEFAULT_PPQN)

  Principal constructor.
- virtual ~seqedit ()

  A rote destructor.

Private Member Functions

- void set_zoom (int zoom)

  Selects the given zoom value.
- void set_snap (int snap)

  Selects the given snap value, which is the number of ticks in a snap-sized interval.
- void set_note_length (int note_length)

  Selects the given note-length value.
- void set_beats_per_bar (int bpm)

  Set the bpm (beats per measure) value, using the given parameter, and some internal values passed to apply_length().
- void set_beat_width (int bw)

  Set the bw (beat width) value, using the given parameter, and some internal values passed to apply_length().
- void set_transpose_image (bool istransposable)

  Changes the image used for the transpose button.
- void set_rec_vol (int recvol)

  Passes the given parameter to sequence::set_rec_vol().
- void horizontal_adjust (double step)

  This function provides optimization for the on_scroll_event() function.
- void vertical_adjust (double step)

  This function provides optimization for the on_scroll_event() function.
- void horizontal_set (double value)

  Sets the exact position of a horizontal scroll-bar.
- void vertical_set (double value)

  Sets the exact position of a vertical scroll-bar.
- void set_measures (int lim)

  Set the measures value, using the given parameter, and some internal values passed to apply_length().
- void apply_length (midibpm bpm, int bw, int measures)

  Sets the sequence length based on the three given parameters.
- long get_measures ()

  Calculates the measures value based on the bpm (beats per measure), ppqn (parts per quarter note), and bw (beat width) values, and returns the resultant measures value.
- void set_midi_channel (int midichannel, bool user_change=false)

  Selects the given MIDI channel parameter in the main sequence object, so that it will use that channel.
- void set_midi_bus (int midibus, bool user_change=false)

  Selects the given MIDI buss parameter in the main sequence object, so that it will use that buss.
- void set_scale (int scale)

  Selects the given scale value.
- void set_chord (int chord)
- void set_key (int note)

  Selects the given key (signature) value.
- void set_background_sequence (int seq)

  Draws the given background sequence on the Pattern editor so that the musician has something to see that can be played against.
- void transpose_change_callback ()

  Passes the transpose status to the sequence object.
- void name_change_callback ()

  Set the name for the main sequence to this object's entry name.
- void play_change_callback ()

  Passes the play status to the sequence object.
- void record_change_callback ()

  Passes the recording status to the sequence object.

- void q_rec_change_callback ()

  Passes the quantized-recording status to the sequence object.
- void thru_change_callback ()

  Passes the MIDI Thru status to the sequence object.
- void undo_callback ()

  Pops an undo operation from the sequence object, and then tells the segroll, seqtime, seqdata, and seqevent objects to redraw.
- void redo_callback ()

  Pops a redo operation from the sequence object, and then tell the segroll, seqtime, seqdata, and seqevent objects to redraw.
- void set_data_type (midibyte status, midibyte control=0)

  Sets the data type based on the given parameters.
- void update_all_windows ()
- void fill_top_bar ()

  This function inserts the user-interface items into the top bar or panel of the pattern editor; this bar has two rows of user interface elements.
- void create_menus ()

  Creates the various menus by pushing menu elements into the menus.
- void popup_menu (Gtk::Menu *menu)

  Pops up the given pop-up menu.
- void popup_event_menu ()

  Populates the event-selection menu that drops from the "Event" button in the bottom row of the Pattern editor.
- void popup_midibus_menu ()

  Populates the MIDI Output buss pop-up menu.
- void popup_sequence_menu ()

  Populates the "set background sequence" menu (drops from the button that has some note-bars on it at the right of the second row of the top bar).
- void popup_tool_menu ()

  Sets up the pop-up menus that are brought up by pressing the Tools button, which shows a hammer image.
- void popup_midich_menu ()

  Populates the MIDI Channel pop-up menu.
- Gtk::Image * create_menu_image (bool state=false)

  Sets the menu pixmap depending on the given state, where true is a full menu (black backgroun), and empty menu (gray background).
- bool timeout ()

  Update the window after a time out, based on dirtiness and on playback progress.
- void do_action (int action, int var)

  Implements the actions brought forth from the Tools (hammer) button.
- void mouse_action (mouse_action_e action)
- void start_playing ()
- void stop_playing ()
- void change_focus (bool set_it=true)

  Changes what perform and mainwid see as the "current sequence".
- void handle_close ()

  Handles closing the sequence editor.
- void on_realize ()

  On realization, calls the base-class version, and connects the redraw timeout signal, timed at redraw_period_ms().
- void on_set_focus (Widget *focus)

  On receiving focus, attempt to tell mainwid that this sequence is now the current sequence.
- bool on_focus_in_event (GdkEventFocus *)

  Implements the on-focus event handling.
- bool on_focus_out_event (GdkEventFocus *)

Implements the on-unfocus event handling.

- bool on_delete_event (GdkEventAny *event)

  Handles an on-delete event.

- bool on_scroll_event (GdkEventScroll *ev)

  Handles an on-scroll event.

- bool on_key_press_event (GdkEventKey *ev)

  Handles a key-press event.

Private Attributes

- friend seqmenu
- const int m_initial_zoom

  Provides the initial zoom, used for restoring the original zoom using the 0 key.

- int m_zoom

  Provides the zoom values: 1 2 3 4, and 1, 2, 4, 8, 16.

- int m_snap

  Used in setting the snap-to value in pulses, off = 1.

- int m_note_length

  The default length of a note to be inserted by a right-left-click operation.

- int m_scale

  Setting for the music scale, can now be saved with the sequence.

- int m_chord

  Setting for the current chord generation; not now saved with the sequence.

- int m_key

  Setting for the music key, can now be saved with the sequence.

- int m_bgsequence

  Setting for the background sequence, can now be saved with the sequence.

- long m_measures

  Provides the length of the sequence in measures.

- int m_ppqn

  Holds a copy of the current PPQN for the sequence (and the entire MIDI file).

- int m_pp_whole
- int m_pp_eighth
- int m_pp_sixteenth
- sequence & m_seq

  Holds a reference to the sequence that this window represents.

- Gtk::MenuBar * m_menubar

  A number of user-interface objects for common.

- Gtk::Menu * m_menu_tools

  The "hammer" tool button menu.

- Gtk::Menu * m_menu_zoom

  Magnifying glass zoom menu.

- Gtk::Menu * m_menu_snap

  Two-arrows grid-snap menu.

- Gtk::Menu * m_menu_note_length

  Notes menu for note length.

- Gtk::Menu * m_menu_length

  Pattern-length "bars" menu.

- Gtk::ToggleButton * m_toggle_transpose

  Transpose toggle button.

- Gtk::Image * m_image_transpose

  Image for transpose button.
- Gtk::Menu * m_menu_midich

  MIDI channel DIN menu button.
- Gtk::Menu * m_menu_midibus

  MIDI output buss menu button.
- Gtk::Menu * m_menu_data

  "Event" button to select data.
- Gtk::Menu * m_menu_key

  "Music key" menu button.
- Gtk::Menu * m_menu_scale

  "Music scale" menu button.
- Gtk::Menu * m_menu_chords

  "Chords" menu button.
- Gtk::Menu * m_menu_sequences

  "Background sequence" button.
- Gtk::Menu * m_menu_bpm

  Beats/measure numerator menu.
- Gtk::Menu * m_menu_bw

  Beat-width denominator menu.
- Gtk::Menu * m_menu_rec_vol

  Recording level "Vol" button.
- Gtk::Adjustment * m_vadjust

  Scrollbar and adjustment objects for horizontal and vertical panning.
- Gtk::Adjustment * m_hadjust

  Horizontal motion scratchpad.
- Gtk::VScrollbar * m_vscroll_new

  Main vertical scroll-bar.
- Gtk::HScrollbar * m_hscroll_new

  Main horizontal scroll-bar.
- seqkeys * m_seqkeys_wid

  Handles the piano-keys part of the pattern-editor user-interface.
- seqtime * m_seqtime_wid

  Handles the time-line (bar or measures) part of the pattern-editor user-interface.
- seqdata * m_seqdata_wid

  Handles the event-data part of the pattern-editor user-interface.
- seqevent * m_seqevent_wid

  Handles the small event part of the pattern-editor user-interface, where events can be moved and added.
- seqroll * m_seqroll_wid

  Handles the piano-roll part of the pattern-editor user-interface.
- Gtk::Button * m_button_lfo

  The LFO button in the pattern editor.
- lfownd * m_lfo_wnd

  The LFO window object used by the pattern editor.
- Gtk::Table * m_table

  More user-interface elements.
- Gtk::VBox * m_vbox

  Layout box for 3 h-boxes.
- Gtk::HBox * m_hbox

  Topmost menu/text dialog row.
- Gtk::HBox * m_hbox2

Second row of buttons.

- Gtk::Button * m_button_undo

  Undo-edit button.
- Gtk::Button * m_button_redo

  Redo-edit button.
- Gtk::Button * m_button_quantize

  Quantize-pattern button.
- Gtk::Button * m_button_tools

  Button for the Tools menu.
- Gtk::Button * m_button_sequence

  Button for Background pattern.
- Gtk::Entry * m_entry_sequence

  Text for background pattern.
- Gtk::Button * m_button_bus

  Button for MIDI Buss menu.
- Gtk::Entry * m_entry_bus

  Text showing MIDI Buss name.
- Gtk::Button * m_button_channel

  Button for the MIDI Channel.
- Gtk::Entry * m_entry_channel

  Text for the MIDI Channel.
- Gtk::Button * m_button_snap

  Button for the Grid-snap menu.
- Gtk::Entry * m_entry_snap

  Text for selected Grid-snap.
- Gtk::Button * m_button_note_length

  Button for Note-length menu.
- Gtk::Entry * m_entry_note_length

  Text showing the Note-length.
- Gtk::Button * m_button_zoom

  Button for the Zoom menu.
- Gtk::Entry * m_entry_zoom

  Text for the selected Zoom.
- Gtk::Button * m_button_length

  Button for pattern-length.
- Gtk::Entry * m_entry_length

  Text for the pattern-length.
- Gtk::Button * m_button_key

  Button for the Music Key.
- Gtk::Entry * m_entry_key

  Text for selected Music Key.
- Gtk::Button * m_button_scale

  Button for the Music Scale.
- Gtk::Entry * m_entry_scale

  Text for the Music Scale.
- Gtk::Button * m_button_chord

  Button for the current Chord.
- Gtk::Entry * m_entry_chord

  Text for the current Chord.
- Gtk::Tooltips * m_tooltips

  Tooltip collector for dialog.

- Gtk::Button * m_button_data
  Button for Event (data) menu.
- Gtk::Entry * m_entry_data
  Text for the selected Event.
- Gtk::Button * m_button_bpm
  Button for Beats/Measure menu.
- Gtk::Entry * m_entry_bpm
  Text for chosen Beats/Measure.
- Gtk::Button * m_button_bw
  Button for Beat-Width menu.
- Gtk::Entry * m_entry_bw
  Text for chosen Beat-Width.
- Gtk::Button * m_button_rec_vol
  Button for recording volume.
- Gtk::ToggleButton * m_toggle_play
  Pattern-to-MIDI record button.
- Gtk::ToggleButton * m_toggle_record
  MIDI-port-to-pattern button.
- Gtk::ToggleButton * m_toggle_q_rec
  Quantized-record MIDI button.
- Gtk::ToggleButton * m_toggle_thru
  MIDI-to-pattern-MIDI button.
- Gtk::Entry * m_entry_name
  Name of the sequence.
- midibyte m_editing_status
  Indicates what MIDI event/status the data window currently editing.
- midibyte m_editing_cc
  Indicates what MIDI CC value the data window currently editing.
- bool m_have_focus
  Indicates that the focus has already been changed to this sequence.

Static Private Attributes

- static int m_initial_snap
  Static data members.
- static int m_initial_note_length
- static int m_initial_chord

Additional Inherited Members

13.86.1 Detailed Description

- perform
- seqroll
- seqkeys
- seqdata
- seqtime
- seqevent
- sequence

This class has a metric ton of user-interface objects and other members.

13.86.2 Constructor & Destructor Documentation

13.86.2.1 seqedit()

```
seq64::seqedit::seqedit (
            perform & p,
            sequence & seq,
            int pos,
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

If provided, override the scale, key, and background-sequence with the values stored in the file with the sequence, if they are set to non-default values. This is a new feature.

Todo Offload most of the work into an initialization function like options does.

Horizontal Gtk::Adjustment constructor: The initial value was 0 on a range from 0 to 1, with step and page increments of 1, and a page_size of 1. We can fix these values here, or create an h_adjustment() function similar to eventedit↩ ::v_adjustment(), which first gets called in on_realize().

Parameters

p	The performance object of which the sequence is a part.
seq	The seqeuence object this window object represents.
pos	The sequence number (pattern slot number) for this sequence and window.
ppqn	The optional PPQN parameter for this sequence. Warning: not really used by the caller, need to square that!

13.86.2.2 ~seqedit()

```
seq64::seqedit::~seqedit ( )  [virtual]
```

13.86.3 Member Function Documentation

13.86.3.1 set_zoom()

```
void seq64::seqedit::set_zoom (
            int z )  [private]
```

It is passed to the seqroll, seqtime, seqdata, and seqevent objects, as well. This function doesn't check if the zoom will change, because this function might be used to initialize the zoom of the children.

The notation for zoom in the user-interface is in pixels:ticks, but I would prefer to use pulses/pixel (pulses per pixel). Oh well. Note that this value of zoom is saved to the "user" configuration file when Sequencer64 exit.

Parameters

z	The prospective zoom value to set. It is applied only if between the minimum and maximum allowed zoom values, inclusive. See the usr().min_zoom() and usr().max_zoom() function.

13.86.3.2 set_snap()

```
void seq64::seqedit::set_snap (
            int s )  [private]
```

It is passed to the seqroll, seqevent, and sequence objects, as well.

The default initial snap is the default PPQN divided by 4, or the equivalent of a 16th note (48 ticks). The snap divisor is 192 ∗ 4 / 48 or 16.

Parameters

s	The prospective snap value to set. It is checked only to make sure it is greater than 0, to avoid a numeric exception.

13.86.3.3 set_note_length()

```
void seq64::seqedit::set_note_length (
            int notelength )  [private]
```

It is passed to the seqroll object, as well.

Warning

Currently, we don't handle changes in the global PPQN after the creation of the menu. The creation of the menu hard-wires the values of note-length. To adjust for a new global PQN, we will need to store the original PPQN (m_original_ppqn = m_ppqn), and then adjust the notelength based on the new PPQN. For example if the new PPQN is twice as high as 192, then the notelength should double, though the text displayed in the "Note length" field should remain the same. However, we do adjust for a non-default PPQN at startup time.

Parameters

notelength	Provides the note length in units of MIDI pulses.

13.86.3.4 set_beats_per_bar()

```
void seq64::seqedit::set_beats_per_bar (
            int bpm )  [private]
```

Todo Check if verification is needed at this point.

Parameters

bpm	Provides the BPM (beats per measure) value to set.

13.86.3.5 set_beat_width()

```
void seq64::seqedit::set_beat_width (
            int bw )  [private]
```

Todo Check if verification is needed at this point.

Parameters

bw	Provides the beat-width value to set.

13.86.3.6 set_transpose_image()

```
void seq64::seqedit::set_transpose_image (
            bool istransposable )  [private]
```

Parameters

istransposable	If true, set the image to the "Transpose" icon. Otherwise, set it to the "Drum" (not transposable) icon.

13.86.3.7 set_rec_vol()

```
void seq64::seqedit::set_rec_vol (
            int recvol )  [private]
```

This function also changes the button's text to match the selection, and also changes the global velocity-override setting in user_settings. Note that the setting will not be saved to the "usr" configuration file unless Sequencer64 was run with the "--user-save" option.

Parameters

recvol	The setting to be made, obtained from the recording-volume ("Vol") menu.

13.86.3.8 horizontal_adjust()

```
void seq64::seqedit::horizontal_adjust (
            double step )  [inline], [private]
```

A duplicate of the one in seqroll.

Parameters

step	Provides the step value to use for adjusting the horizontal scrollbar. See gui_drawingarea_gtk2::scroll_hadjust() for more information.

13.86.3.9 vertical_adjust()

```
void seq64::seqedit::vertical_adjust (
            double step )  [inline], [private]
```

A near-duplicate of the one in seqroll.

Parameters

step	Provides the step value to use for adjusting the vertical scrollbar. See gui_drawingarea_gtk2::scroll_vadjust() for more information.

13.86.3.10 horizontal_set()

```
void seq64::seqedit::horizontal_set (
            double value )  [inline], [private]
```

Parameters

value	The desired position. Mostly this is either 0.0 or 9999999.0 (an "infinite" value to select the start or end position.

13.86.3.11 vertical_set()

```
void seq64::seqedit::vertical_set (
            double value )  [inline], [private]
```

Parameters

value	The desired position. Mostly this is either 0.0 or 9999999.0 (an "infinite" value to select the start or end position.

13.86.3.12 set_measures()

```
void seq64::seqedit::set_measures (
            int lim )  [private]
```

Todo Check if verification is needed at this point.

Parameters

lim	Provides the sequence length, in measures.

13.86.3.13 apply_length()

```
void seq64::seqedit::apply_length (
            midibpm bpm,
            int bw,
            int measures )  [private]
```

There's an implicit "adjust-triggers = true" parameter used in sequence::set_length().

Then the seqroll, seqtime, seqdata, and seqevent objects are reset().

13.86.3.14 get_measures()

```
long seq64::seqedit::get_measures ( )  [private]
```

Todo Create a sequence::set_units() function or a sequence::get_measures() function to forward to.

13.86.3.15 set_midi_channel()

```
void seq64::seqedit::set_midi_channel (
            int midichannel,
            bool user_change = false )  [private]
```

Should this change set the is-modified flag? Where should validation occur?

Parameters

midichannel	The MIDI channel value to set.
user_change	True if the user made this change, and thus has potentially modified the song.

13.86.3.16 set_midi_bus()

```
void seq64::seqedit::set_midi_bus (
            int bus,
            bool user_change = false )  [private]
```

Should this change set the is-modified flag? Where should validation against the ALSA or JACK buss limits occur?

Also, it would be nice to be able to update this display of the MIDI bus in the field if we set it from the seqmenu.

Parameters

bus	The buss value to set.
user_change	True if the user made this change, and thus has potentially modified the song.

13.86.3.17 set_scale()

```
void seq64::seqedit::set_scale (
            int scale )  [private]
```

It is passed to the seqroll and seqkeys objects, as well. As a new feature, it is also passed to the sequence, so that it can be saved as part of the sequence data.

Note that the "initial value" for this parameter is a static variable that gets set to the new value, so that opening up another sequence causes the sequence to take on the new "initial value" as well. A feature, but should it be optional? Now it is, based on the setting of usr().global_seq_feature().

13.86.3.18 set_chord()

```
void seq64::seqedit::set_chord (
            int chord )  [private]
```

13.86.3.19 set_key()

```
void seq64::seqedit::set_key (
            int key )  [private]
```

It is passed to the seqroll and seqkeys objects, as well. As a new feature, it is also passed to the sequence, so that it can be saved as part of the sequence data.

Note that the "initial value" for this parameter is a static variable that gets set to the new value, so that opening up another sequence causes the sequence to take on the new "initial value" as well. A feature, but should it be optional? Now it is, based on the setting of usr().global_seq_feature().

13.86.3.20 set_background_sequence()

```
void seq64::seqedit::set_background_sequence (
            int seqnum )  [private]
```

As a new feature, it is also passed to the sequence, so that it can be saved as part of the sequence data, but only if less or equal to the maximum single-byte MIDI value, 127.

Note that the "initial value" for this parameter is a static variable that gets set to the new value, so that opening up another sequence causes the sequence to take on the new "initial value" as well. A feature, but should it be optional? Now it is, based on the setting of usr().global_seq_feature().

13.86.3.21 transpose_change_callback()

```
void seq64::seqedit::transpose_change_callback ( )  [private]
```

13.86.3.22 name_change_callback()

```
void seq64::seqedit::name_change_callback ( )  [private]
```

That name is the name the user has given to the sequence being edited.

13.86.3.23 play_change_callback()

```
void seq64::seqedit::play_change_callback ( )  [private]
```

13.86.3.24 record_change_callback()

```
void seq64::seqedit::record_change_callback ( )  [private]
```

Stazed:

```
 Both record_change_callback() and thru_change_callback() will call
 set_sequence_input() for the same sequence. We only need to call it if
 it is not already set, if setting. And, we should not unset it if the
 m_toggle_thru->get_active() is true.
```

13.86.3.25 q_rec_change_callback()

```
void seq64::seqedit::q_rec_change_callback ( )  [private]
```

13.86.3.26 thru_change_callback()

```
void seq64::seqedit::thru_change_callback ( )  [private]
```

Stazed:

```
Both record_change_callback() and thru_change_callback() will call
set_sequence_input() for the same sequence. We only need to call it if
it is not already set, if setting. And, we should not unset it if the
m_toggle_thru->get_active() is true.
```

13.86.3.27 undo_callback()

```
void seq64::seqedit::undo_callback ( )  [private]
```

13.86.3.28 redo_callback()

```
void seq64::seqedit::redo_callback ( )  [private]
```

13.86.3.29 set_data_type()

```
void seq64::seqedit::set_data_type (
            midibyte status,
            midibyte control = 0 )  [private]
```

This function uses the hardwired array c_controller_names.

Parameters

status	The current editing status.
control	The control value. However, we really need to validate it!

13.86.3.30 update_all_windows()

```
void seq64::seqedit::update_all_windows ( )  [private]
```

13.86.3.31 fill_top_bar()

```
void seq64::seqedit::fill_top_bar ( )  [private]
```

Note that, if a non-default title for the sequence is in force, then we immediately force the focus to the seqroll "widget", so that the space bar can be used to control playback, instead of immediately erasing the name of the sequence. The following commented radio-buttons were a visual way to select the modes of note editing (select, draw, and grow). These can easily be done with the left mouse button, keystrokes, or some other tricks, though.

13.86.3.32 create_menus()

```
void seq64::seqedit::create_menus ( )  [private]
```

The first menu is the Zoom menu, represented in the pattern/sequence editor by a button with a magnifying glass. The values are "pixels to ticks", where "ticks" are actually the "pulses" of "pulses per quarter note". We would prefer the notation "n" instead of "1:n", as in "n pulses per pixel".

Note that many of the setups here could be loops through data structures. The Snap menu is actually the Grid Snap button, which shows two arrows pointing to a central bar. This menu somewhat duplicates the same menu in perfedit.

To reduce the amount of written code, we now use a static array to initialize some of the seqedit menu entries. 0 denotes the separator. This same setup is used to set up both the snap and note menu, since they are exactly the same. Saves a *lot* of code.

This menu lets one set the key of the sequence, and is brought up by the button with the "golden key" image on it.

This button shows a down around for the bottom half of the time signature. It's tooltip is "Time signature. Length of beat." But it is called bw, or beat width, in the code.

This menu is shown when pressing the button at the bottom of the window that has "Vol" as its label. Let's show the numbers as well to help the user. And we'll have to document this change.

This menu sets the scale to show on the panel, and the button shows a "staircase" image. See the c_music_scales enumeration defined in the globals module.

This section sets up two different menus. The first is m_menu_length. This menu lets one set the sequence length in bars. The second menu is the m_menu_bpm, or BPM, which here means "beats per measure" (not "beats per minute").

13.86.3.33 popup_menu()

```
void seq64::seqedit::popup_menu (
            Gtk::Menu * menu )  [private]
```

13.86.3.34 popup_event_menu()

```
void seq64::seqedit::popup_event_menu ( )  [private]
```

This menu has a large number of items. I think they are filled in in code, but can also be loaded from ~/.seq24usr. To be determined. Create the 8 sub-menus for the various ranges of controller changes, shown 16 per sub-menu.

13.86.3.35 popup_midibus_menu()

```
void seq64::seqedit::popup_midibus_menu ( )  [private]
```

The MIDI busses are obtained by getting the mastermidibus object, and iterating through the busses that it contains.

However, JACK counts the playback ports, such as "yoshimi:midi in", as "input" ports... the application outputs to the input ports. So we have to deal with that somehow.

13.86.3.36 popup_sequence_menu()

```
void seq64::seqedit::popup_sequence_menu ( )  [private]
```

It is populated with an "Off" menu entry, and a second "[0]" menu entry that pulls up a drop-down menu of all of the patterns/sequences that are present in the MIDI file for screen-set 0. If more screensets have active sequences, then their screen-set number appears in the screen-set section of the menu.

Now, at present, we can only save background sequence numbers that are less than 128, which means the sequences from 0 to 127, or the first four screen sets. Higher sequences can be selected, but, right now, they cannot be saved. We'll probably fix that at some point, low priority.

13.86.3.37 popup_tool_menu()

```
void seq64::seqedit::popup_tool_menu ( )  [private]
```

This button shows three sub-menus that need to be filled in by this function. All the functions accessed here seem to be implemented by the do_action() function.

13.86.3.38 popup_midich_menu()

```
void seq64::seqedit::popup_midich_menu ( )  [private]
```

13.86.3.39 create_menu_image()

```
Gtk::Image * seq64::seqedit::create_menu_image (
             bool state = false )  [private]
```

13.86.3.40 timeout()

```
bool seq64::seqedit::timeout ( )  [private]
```

Note the new call to seqroll::follow_progress(). This allows the seqroll to pop to the next frame of events to continue to show the moving progress bar. Does this need to be an option? It only affects patterns longer than a measure or two, whatever the width of the seqroll window is. This is a new feature that is not in seq24.

What about seqtime? That doesn't change.

13.86.3.41 do_action()

```
void seq64::seqedit::do_action (
            int action,
            int var )  [private]
```

Note that the push_undo() calls push all of the current events (in sequence::m_events) onto the stack (as a single entry).

13.86.3.42 mouse_action()

```
void seq64::seqedit::mouse_action (
            mouse_action_e action )  [private]
```

13.86.3.43 start_playing()

```
void seq64::seqedit::start_playing ( )  [private]
```

13.86.3.44 stop_playing()

```
void seq64::seqedit::stop_playing ( )  [private]
```

13.86.3.45 change_focus()

```
void seq64::seqedit::change_focus (
            bool set_it = true )  [private]
```

Similar to the same function in eventedit.

Parameters

set_it	If true (the default value), indicates we want focus, otherwise we want to give up focus.

13.86.3.46 handle_close()

```
void seq64::seqedit::handle_close ( )  [private]
```

13.86.3.47 on_realize()

```
void seq64::seqedit::on_realize ( )  [private]
```

13.86.3.48 on_set_focus()

```
void seq64::seqedit::on_set_focus (
            Widget * focus )  [private]
```

Only works in certain circumstances.

13.86.3.49 on_focus_in_event()

```
bool seq64::seqedit::on_focus_in_event (
            GdkEventFocus *  )  [private]
```

13.86.3.50 on_focus_out_event()

```
bool seq64::seqedit::on_focus_out_event (
            GdkEventFocus *  )  [private]
```

13.86.3.51 on_delete_event()

```
bool seq64::seqedit::on_delete_event (
            GdkEventAny * event )  [private]
```

It tells the sequence to stop recording, tells the perform object's mastermidibus to stop processing input, and sets the sequence object's editing flag to false.

Warning

This function also calls "delete this"!

Returns

Always returns false.

13.86.3.52 on_scroll_event()

```
bool seq64::seqedit::on_scroll_event (
            GdkEventScroll * ev )  [private]
```

This handles moving the scroll wheel on a mouse or do a two-fingered scrolling action on a touchpad. If no modifier key is pressed, this moves the view up or down on the "notes" coordinate, showing different piano keys. This behavior is implemented in seqkeys::on_scroll_event(), and is called into play by returning false here.

If the Ctrl key is pressed, then the scrolling action causes the view to zoom in or out. This behavior is implemented here.

If the Shift key is pressed, then the scrolling action moves the view horizontally on the time-line (measures-line) of the piano roll. This behavior is implemented here.

13.86.3.53 on_key_press_event()

```
bool seq64::seqedit::on_key_press_event (
            GdkEventKey * ev )  [private]
```

A number of new keystrokes are processed, so that we can lessen the reliance on the mouse and work a little faster.

```
-   Ctrl-W keypress.  This keypress closes the sequence/pattern editor
    window by way of calling on_delete_event().  We could apply this
    convention to all the other windows.
-   z 0 Z zoom keys.  "z" zooms out, "Z" (Shift-z) zooms in, and "0"
    resets the zoom to the default.
-   Page-Up and Page-Down.  Moves up and down in the piano roll.
-   Home and End.  Page to the top or the bottom of the piano roll.
-   Shift-Page-Up and Shift-Page-Down.  Move left and right in the
    piano roll.
-   Shift-Home and Shift-End.  Page to the start or the end of the
    piano roll.
-   Ctrl-Page-Up and Ctrl-Page-Down.  Mirrors the zoom-in and zoom-out
    capabilities of scrolling up and down with the mouse while the
    Ctrl key is pressed.
```

The Keypad-End key is an issue on our ASUS "gaming" laptop. Whether it is seen as a "1" or an "End" key depends on an interaction between the Shift and the Num Lock key. Annoying, takes some time to get used to.

Change Note layk 2016-10-17 Issue #46. Undoing (ctrl-z) removes two instances of history. To reproduce this bug, if one makes three notes one at a time and presses ctrl-z once only the first one remains. Same goes for moving notes. This is due to this else-if statement where we call seqroll::on_key_press_event() making first removal. This if statement is never true and seqroll::on_key_press_event() is called again as Gtk::Window::on_key_press_event(), making another m_seq.pop_undo() in seqroll. Note that the code here was an (ill-advised) attempt to avoid the pattern title field from grabbing the initial keystrokes; better to just get used to clicking the piano roll first. Finally, fixing the undo bug also let's ctrl-page-up/page-down change the zoom. Lastly, we've removed the undo here... seqroll already handles both undo and redo keystrokes.

Change Note ca 2016-10-18 Issue #46. In addition to layk's fixes, we have to properly determine if we're inside the "Sequence Name" ("GtkEntry") field, as opposed to the "GtkDrawingArea" field, to avoid grabbing and using keystrokes intended for the text-entry field. We may have to rethink the whole seqroll vs. seqedit key-press process at some point, as this is a bit too tricky. Please note that the name "gtkmm__GtkEntry" likely applies only to GNU's C++ compiler, g++. This will be an issue in any port to Microsoft's C++ compiler.

Parameters

ev	Provides the keystroke event to be handled.

Returns

Returns true if we handled the keystroke here. Otherwise, returns the value of Gtk::Window::on_key_press↩
_event(ev).

13.86.4 Field Documentation

13.86.4.1 seqmenu

```
friend seq64::seqedit::seqmenu  [private]
```

13.86.4.2 m_initial_snap

```
int seq64::seqedit::m_initial_snap  [static], [private]
```

These items apply to all of the instances of seqedit, and are passed on to the following constructors:

- seqdata
- seqevent
- seqroll
- seqtime

The snap and note-length defaults would be good to write to the "user" configuration file. The scale and key would be nice to write to the proprietary section of the MIDI song. Or, even more flexibly, to each sequence, if that makes sense to do, since all tracks would generally be in the same key. Right, Charles Ives?

Note that, currently, that some of these "initial values" are modified, so that they are "contagious". That is, the next sequence to be opened in the sequence editor will adopt these values. This is a long-standing feature of Seq24, but strikes us as a bit surprising.

Change Note ca 2016-04-10 If we just double the PPQN, then the snap divisor becomes 32, and the snap interval is a 32nd note. We would like to keep it at a 16th note. We correct the snap ticks to the actual PPQN ratio.

13.86.4.3 m_initial_note_length

```
int seq64::seqedit::m_initial_note_length  [static], [private]
```

13.86.4.4 m_initial_chord

```
int seq64::seqedit::m_initial_chord  [static], [private]
```

13.86.4.5 m_initial_zoom

```
const int seq64::seqedit::m_initial_zoom  [private]
```

13.86.4.6 m_zoom

```
int seq64::seqedit::m_zoom  [private]
```

The value of zoom is the same as the number of pixels per tick on the piano roll.

13.86.4.7 m_snap

```
int seq64::seqedit::m_snap  [private]
```

13.86.4.8 m_note_length

```
int seq64::seqedit::m_note_length  [private]
```

13.86.4.9 m_scale

```
int seq64::seqedit::m_scale  [private]
```

13.86.4.10 m_chord

```
int seq64::seqedit::m_chord  [private]
```

13.86.4.11 m_key

```
int seq64::seqedit::m_key  [private]
```

13.86.4.12 m_bgsequence

```
int seq64::seqedit::m_bgsequence  [private]
```

13.86.4.13 m_measures

```
long seq64::seqedit::m_measures  [private]
```

13.86.4.14 m_ppqn

```
int seq64::seqedit::m_ppqn  [private]
```

13.86.4.15 m_pp_whole

```
int seq64::seqedit::m_pp_whole  [private]
```

13.86.4.16 m_pp_eighth

```
int seq64::seqedit::m_pp_eighth  [private]
```

13.86.4.17 m_pp_sixteenth

```
int seq64::seqedit::m_pp_sixteenth  [private]
```

13.86.4.18 m_seq

```
sequence& seq64::seqedit::m_seq  [private]
```

13.86.4.19 m_menubar

```
Gtk::MenuBar* seq64::seqedit::m_menubar  [private]
```

Many of these are menu items, and are associated with buttons that, when pressed, bring up the menu for display and selection of its entries.The top bar with menu buttons.

13.86.4.20 m_menu_tools

```
Gtk::Menu* seq64::seqedit::m_menu_tools  [private]
```

13.86.4.21 m_menu_zoom

```
Gtk::Menu* seq64::seqedit::m_menu_zoom  [private]
```

13.86.4.22 m_menu_snap

```
Gtk::Menu* seq64::seqedit::m_menu_snap  [private]
```

13.86.4.23 m_menu_note_length

```
Gtk::Menu* seq64::seqedit::m_menu_note_length  [private]
```

13.86.4.24 m_menu_length

```
Gtk::Menu* seq64::seqedit::m_menu_length  [private]
```

13.86.4.25 m_toggle_transpose

```
Gtk::ToggleButton* seq64::seqedit::m_toggle_transpose  [private]
```

13.86.4.26 m_image_transpose

```
Gtk::Image* seq64::seqedit::m_image_transpose  [private]
```

13.86.4.27 m_menu_midich

```
Gtk::Menu* seq64::seqedit::m_menu_midich  [private]
```

13.86.4.28 m_menu_midibus

```
Gtk::Menu* seq64::seqedit::m_menu_midibus  [private]
```

13.86.4.29 m_menu_data

```
Gtk::Menu* seq64::seqedit::m_menu_data  [private]
```

13.86.4.30 m_menu_key

```
Gtk::Menu* seq64::seqedit::m_menu_key  [private]
```

13.86.4.31 m_menu_scale

```
Gtk::Menu* seq64::seqedit::m_menu_scale  [private]
```

13.86.4.32 m_menu_chords

```
Gtk::Menu* seq64::seqedit::m_menu_chords  [private]
```

13.86.4.33 m_menu_sequences

```
Gtk::Menu* seq64::seqedit::m_menu_sequences  [private]
```

13.86.4.34 m_menu_bpm

```
Gtk::Menu* seq64::seqedit::m_menu_bpm  [private]
```

13.86.4.35 m_menu_bw

```
Gtk::Menu* seq64::seqedit::m_menu_bw  [private]
```

13.86.4.36 m_menu_rec_vol

```
Gtk::Menu* seq64::seqedit::m_menu_rec_vol  [private]
```

13.86.4.37 m_vadjust

```
Gtk::Adjustment* seq64::seqedit::m_vadjust  [private]
```

Vertical position descriptor.

13.86.4.38 m_hadjust

```
Gtk::Adjustment* seq64::seqedit::m_hadjust  [private]
```

13.86.4.39 m_vscroll_new

```
Gtk::VScrollbar* seq64::seqedit::m_vscroll_new  [private]
```

13.86.4.40 m_hscroll_new

```
Gtk::HScrollbar* seq64::seqedit::m_hscroll_new  [private]
```

13.86.4.41 m_seqkeys_wid

```
seqkeys* seq64::seqedit::m_seqkeys_wid  [private]
```

This item draws the piano-keys at the left of the seqedit window.

13.86.4.42 m_seqtime_wid

```
seqtime* seq64::seqedit::m_seqtime_wid  [private]
```

This is the location where the measure numbers and the END marker are shown.

13.86.4.43 m_seqdata_wid

```
seqdata* seq64::seqedit::m_seqdata_wid  [private]
```

This is the area at the bottom of the window that shows value lines for the selected kinds of events.

13.86.4.44 m_seqevent_wid

```
seqevent* seq64::seqedit::m_seqevent_wid  [private]
```

13.86.4.45 m_seqroll_wid

```
seqroll* seq64::seqedit::m_seqroll_wid  [private]
```

13.86.4.46 m_button_lfo

```
Gtk::Button* seq64::seqedit::m_button_lfo  [private]
```

This item will always be an optional part of the build, enabled by defining SEQ64_STAZED_LFO_SUPPORT.

13.86.4.47 m_lfo_wnd

```
lfownd* seq64::seqedit::m_lfo_wnd  [private]
```

This item get the seqdata window hooked into it, and so must follow that item in the C++ initializer list.

13.86.4.48 m_table

```
Gtk::Table* seq64::seqedit::m_table  [private]
```

These items provide a number of buttons and text-entry fields, as well as their layout.The layout table for editor.

13.86.4.49 m_vbox

```
Gtk::VBox* seq64::seqedit::m_vbox  [private]
```

13.86.4.50 m_hbox

```
Gtk::HBox* seq64::seqedit::m_hbox  [private]
```

13.86.4.51 m_hbox2

```
Gtk::HBox* seq64::seqedit::m_hbox2  [private]
```

13.86.4.52 m_button_undo

```
Gtk::Button* seq64::seqedit::m_button_undo  [private]
```

13.86.4.53 m_button_redo

```
Gtk::Button* seq64::seqedit::m_button_redo  [private]
```

13.86.4.54 m_button_quantize

```
Gtk::Button* seq64::seqedit::m_button_quantize  [private]
```

13.86.4.55 m_button_tools

```
Gtk::Button* seq64::seqedit::m_button_tools  [private]
```

13.86.4.56 m_button_sequence

```
Gtk::Button* seq64::seqedit::m_button_sequence  [private]
```

13.86.4.57 m_entry_sequence

```
Gtk::Entry* seq64::seqedit::m_entry_sequence  [private]
```

13.86.4.58 m_button_bus

```
Gtk::Button* seq64::seqedit::m_button_bus  [private]
```

13.86.4.59 m_entry_bus

```
Gtk::Entry* seq64::seqedit::m_entry_bus  [private]
```

13.86.4.60 m_button_channel

```
Gtk::Button* seq64::seqedit::m_button_channel  [private]
```

13.86.4.61 m_entry_channel

```
Gtk::Entry* seq64::seqedit::m_entry_channel  [private]
```

13.86.4.62 m_button_snap

```
Gtk::Button* seq64::seqedit::m_button_snap  [private]
```

13.86.4.63 m_entry_snap

```
Gtk::Entry* seq64::seqedit::m_entry_snap  [private]
```

13.86.4.64 m_button_note_length

```
Gtk::Button* seq64::seqedit::m_button_note_length  [private]
```

13.86.4.65 m_entry_note_length

```
Gtk::Entry* seq64::seqedit::m_entry_note_length  [private]
```

13.86.4.66 m_button_zoom

```
Gtk::Button* seq64::seqedit::m_button_zoom  [private]
```

13.86.4.67 m_entry_zoom

```
Gtk::Entry* seq64::seqedit::m_entry_zoom  [private]
```

13.86.4.68 m_button_length

```
Gtk::Button* seq64::seqedit::m_button_length  [private]
```

13.86.4.69 m_entry_length

```
Gtk::Entry* seq64::seqedit::m_entry_length  [private]
```

13.86.4.70 m_button_key

```
Gtk::Button* seq64::seqedit::m_button_key  [private]
```

13.86.4.71 m_entry_key

```
Gtk::Entry* seq64::seqedit::m_entry_key  [private]
```

13.86.4.72 m_button_scale

```
Gtk::Button* seq64::seqedit::m_button_scale  [private]
```

13.86.4.73 m_entry_scale

```
Gtk::Entry* seq64::seqedit::m_entry_scale  [private]
```

13.86.4.74 m_button_chord

```
Gtk::Button* seq64::seqedit::m_button_chord  [private]
```

13.86.4.75 m_entry_chord

```
Gtk::Entry* seq64::seqedit::m_entry_chord  [private]
```

13.86.4.76 m_tooltips

```
Gtk::Tooltips* seq64::seqedit::m_tooltips  [private]
```

13.86.4.77 m_button_data

```
Gtk::Button* seq64::seqedit::m_button_data  [private]
```

13.86.4.78 m_entry_data

```
Gtk::Entry* seq64::seqedit::m_entry_data  [private]
```

13.86.4.79 m_button_bpm

```
Gtk::Button* seq64::seqedit::m_button_bpm  [private]
```

13.86.4.80 m_entry_bpm

```
Gtk::Entry* seq64::seqedit::m_entry_bpm  [private]
```

13.86.4.81 m_button_bw

```
Gtk::Button* seq64::seqedit::m_button_bw  [private]
```

13.86.4.82 m_entry_bw

```
Gtk::Entry* seq64::seqedit::m_entry_bw  [private]
```

13.86.4.83 m_button_rec_vol

```
Gtk::Button* seq64::seqedit::m_button_rec_vol  [private]
```

13.86.4.84 m_toggle_play

```
Gtk::ToggleButton* seq64::seqedit::m_toggle_play  [private]
```

13.86.4.85 m_toggle_record

```
Gtk::ToggleButton* seq64::seqedit::m_toggle_record  [private]
```

13.86.4.86 m_toggle_q_rec

```
Gtk::ToggleButton* seq64::seqedit::m_toggle_q_rec  [private]
```

13.86.4.87 m_toggle_thru

```
Gtk::ToggleButton* seq64::seqedit::m_toggle_thru  [private]
```

13.86.4.88 m_entry_name

```
Gtk::Entry* seq64::seqedit::m_entry_name  [private]
```

13.86.4.89 m_editing_status

```
midibyte seq64::seqedit::m_editing_status  [private]
```

13.86.4.90 m_editing_cc

```
midibyte seq64::seqedit::m_editing_cc  [private]
```

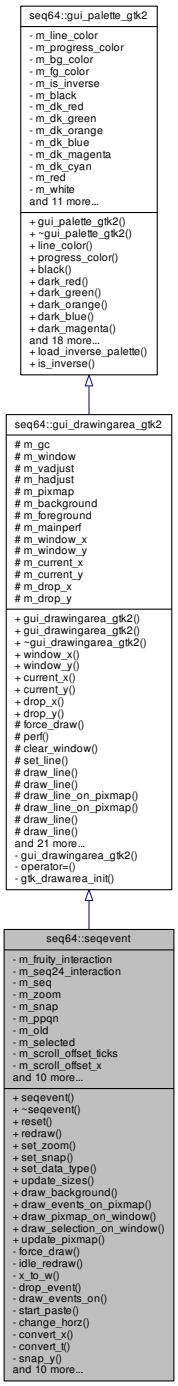
13.86.4.91 m_have_focus

```
bool seq64::seqedit::m_have_focus  [private]
```

13.87 seq64::seqevent Class Reference

Implements the piano event drawing area.

Inheritance diagram for seq64::seqevent:



Public Member Functions

- seqevent (perform &p, sequence &seq, int zoom, int snap, seqdata &seqdata_wid, Gtk::Adjustment &hadjust, int ppqn=SEQ64_USE_DEFAULT_PPQN)

Principal constructor.

- virtual ~seqevent ()

  Let's provide a do-nothing virtual destructor.

- void reset ()

  This function basically resets the whole widget as if it was realized again.

- void redraw ()

  Adjusts the scrolling offset for ticks, updates the pixmap, and draws it on the window.

- void set_zoom (int zoom)

  Sets zoom to the given value, and resets if the value ended up being changed.

- void set_snap (int snap)

  'Setter' function for member m_snap Simply sets the snap member.

- void set_data_type (midibyte status, midibyte control)

  Sets the status to the given parameter, and the CC value to the given optional control parameter, which defaults to 0.

- void update_sizes ()

  If the window is realized, this function creates a pixmap with window dimensions, the updates the pixmap, and queues up a redraw.

- void draw_background ()

  This function updates the background.

- void draw_events_on_pixmap ()

  This function fills the main pixmap with events.

- void draw_pixmap_on_window ()

  This function currently just queues up a draw operation for the pixmap.

- void draw_selection_on_window ()

  Draw the selected events on the window.

- void update_pixmap ()

  Redraws the background pixmap on the main pixmap, then puts the events on.

Private Member Functions

- virtual void force_draw ()

  Forces a draw on the current drawable area of the window.

- int idle_redraw ()

  Implements redraw while idling.

- void x_to_w (int x1, int x2, int &x, int &w)

  This function checks the mins / maxes.

- void drop_event (midipulse tick)

  Drops (adds) an event at the given tick.

- void draw_events_on (Glib::RefPtr< Gdk::Drawable > draw)

  Draws events on the given drawable object.

- void start_paste ()

  Starts a paste operation.

- void change_horz ()

  Changes the horizontal scrolling offset for ticks, then updates the pixmap and forces a redraw.

- void convert_x (int x, midipulse &tick)

  Takes the screen x coordinate, multiplies it by the current zoom, and returns the tick value in the given parameter.

- void convert_t (midipulse tick, int &x)

  Converts the given tick value to an x corrdinate, based on the zoom, and returns it via the second parameter.

- void snap_y (int &y)

  This function performs a 'snap' on y.

- void snap_x (int &x)

This function performs a 'snap' on x.

- void on_realize ()

  Implements the on-realize callback.
- bool on_expose_event (GdkEventExpose *ev)

  Implements the on-expose event callback.
- bool on_button_press_event (GdkEventButton *ev)

  Implements the on-button-press event callback.
- bool on_button_release_event (GdkEventButton *ev)

  Implements the on-button-release event callback.
- bool on_motion_notify_event (GdkEventMotion *ev)

  Implements the on-motion-notify event callback.
- bool on_focus_in_event (GdkEventFocus *)

  Responds to a focus event by setting the HAS_FOCUS flag.
- bool on_focus_out_event (GdkEventFocus *)

  Responds to a unfocus event by resetting the HAS_FOCUS flag.
- bool on_key_press_event (GdkEventKey *p0)

  Implements the key-press event callback function.
- void on_size_allocate (Gtk::Allocation &)

  Implements the on-size-allocate event callback.

Private Attributes

- FruitySeqEventInput m_fruity_interaction

  Provides the mouse-handling paradigm for the fruity interaction.
- Seq24SeqEventInput m_seq24_interaction

  Provides the normal mouse-handling for Sequencer64.
- sequence & m_seq

  Provides a reference to the sequence whose data is represented in this seqevent object.
- int m_zoom

  Zoom setting, means that one pixel == m_zoom ticks.
- int m_snap

  The grid-snap setting for the event bar grid.
- int m_ppqn

  The value to use for the PPQN for this sequence.
- GdkRectangle m_old

  Used in drawing the event selection in the thing event row.
- GdkRectangle m_selected

  Used in moving and pasting the selected events in the thin event row.
- int m_scroll_offset_ticks

  Provides the offset of the ticks in the event view based on where the scroll-bar has moved the view "window".
- int m_scroll_offset_x

  Provides the offset of the pixels in the event view based on where the scroll-bar has moved the view "window".
- seqdata & m_seqdata_wid

  The data view that parallels this event view.
- bool m_selecting

  Used when highlighting a bunch of events.
- bool m_moving_init

  Used externally by the fruityseq and seq24seq modules, to initialize the act of moving events.
- bool m_moving

  Indicates that this pane is in the act of moving a selection.

- bool m_growing

  Used externally by the fruityseq and seq24seq modules, when growing the event duration.
- bool m_painting

  Used externally by the fruityseq and seq24seq modules, in painting the selected events.
- bool m_paste

  Indicates that we've selected some events and are in paste mode.
- int m_move_snap_offset_x

  Used externally by the fruityseq and seq24seq modules, in snapping.
- midibyte m_status

  Indicates what is the data window currently editing.
- midibyte m_cc

  Indicates what is the data window currently editing.

Friends

- struct FruitySeqEventInput
- struct Seq24SeqEventInput

Additional Inherited Members

13.87.1 Constructor & Destructor Documentation

13.87.1.1 seqevent()

```
seq64::seqevent::seqevent (
            perform & p,
            sequence & seq,
            int zoom,
            int snap,
            seqdata & seqdata_wid,
            Gtk::Adjustment & hadjust,
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

Parameters

p	The "parent" perform object controlling all of the sequences.
seq	The current sequence operated on by this object.
zoom	The initial zoom value.
snap	The initial snap value.
seqdata_wid	The data pane that this event pane is associated with.
hadjust	The horizontal scroll-bar.
ppqn	The initial PPQN value.

13.87.1.2 ~seqevent()

```
virtual seq64::seqevent::~seqevent ( )  [inline], [virtual]
```

13.87.2 Member Function Documentation

13.87.2.1 reset()

```
void seq64::seqevent::reset ( )
```

Basically identical to seqtime::reset().

13.87.2.2 redraw()

```
void seq64::seqevent::redraw ( )
```

Somewhat similar to seqroll::redraw().

13.87.2.3 set_zoom()

```
void seq64::seqevent::set_zoom (
            int z )
```

Parameters

z	The desired zoom value, assumed to be validated already. See the seqedit::set_zoom() function.

13.87.2.4 set_snap()

```
void seq64::seqevent::set_snap (
            int snap )  [inline]
```

The parameter is not validated.

13.87.2.5 set_data_type()

```
void seq64::seqevent::set_data_type (
            midibyte status,
            midibyte control )
```

Then redraws.

Parameters

status	The status/event byte to set. For example, EVENT_NOTE_ON and EVENT_NOTE off. This byte should have the channel nybble cleared.
control	The MIDI CC byte to set.

13.87.2.6 update_sizes()

```
void seq64::seqevent::update_sizes ( )
```

This ends up filling the background with dotted lines, etc.

13.87.2.7 draw_background()

```
void seq64::seqevent::draw_background ( )
```

It sets the foreground to white, draws the rectangle, in order to clear the pixmap. The build-time option SEQ64↩ _SOLID_PIANOROLL_GRID causes solid lines to be drawn, in gray, instead of dotted black lines, for a smoother look.

Also, as a trial option, if the current data type is EVENT_NOTE_ON, EVENT_NOTE_OFF, and EVENT_AFTER↩ TOUCH, we draw the background in light grey to remind the user that there are issues in copying or moving these events around (unlinked) by themselves.

13.87.2.8 draw_events_on_pixmap()

```
void seq64::seqevent::draw_events_on_pixmap ( )
```

13.87.2.9 draw_pixmap_on_window()

```
void seq64::seqevent::draw_pixmap_on_window ( )
```

Old comments:

```
It then tells event to do the same.  We changed something on this
window, and chances are we need to update the event widget as well and
update our velocity window.
```

13.87.2.10 draw_selection_on_window()

```
void seq64::seqevent::draw_selection_on_window ( )
```

13.87.2.11 update_pixmap()

```
void seq64::seqevent::update_pixmap ( )
```

13.87.2.12 force_draw()

```
void seq64::seqevent::force_draw ( )  [private], [virtual]
```

Reimplemented from seq64::gui_drawingarea_gtk2.

13.87.2.13 idle_redraw()

```
int seq64::seqevent::idle_redraw ( )  [private]
```

Who calls this routine? Probably the default timer routine, but not sure.

Returns

Always returns true.

13.87.2.14 x_to_w()

```
void seq64::seqevent::x_to_w (
            int x1,
            int x2,
            int & x,
            int & w )  [private]
```

Then it fills in x and the width.

Parameters

	x1	The "left" x value.
	x2	The "right" x value.
out	*x*	The destination for the converted x value.
out	*w*	The destination for the converted width value.

13.87.2.15 drop_event()

```
void seq64::seqevent::drop_event (
            midipulse tick )  [private]
```

It sets the first byte properly for after-touch, program-change, channel-pressure, and pitch-wheel. The type of event is determined by m_status.

Parameters

tick	The destination time (division, pulse, tick) for the event to be dropped at.

13.87.2.16 draw_events_on()

```
void seq64::seqevent::draw_events_on (
            Glib::RefPtr< Gdk::Drawable > drawable )  [private]
```

Very similar to seqdata::draw_events_on().

Parameters

drawable	The given drawable object.

13.87.2.17 start_paste()

```
void seq64::seqevent::start_paste ( )  [private]
```

It gets the clipboard box that selected elements are in, makes a coordinate conversion, and then, sets the m_↩ selected rectangle to hold the (x,y,w,h) of the selected events.

13.87.2.18 change_horz()

```
void seq64::seqevent::change_horz ( )  [private]
```

Very similar to seqroll::change_horz(). Basically identical to seqdata::change_horz().

13.87.2.19 convert_x()

```
void seq64::seqevent::convert_x (
            int x,
            midipulse & tick )  [inline], [private]
```

Why not just return it normally?

Parameters

	x	The x (pixel) value to convert.
out	*tick*	The destination for the converted x value.

13.87.2.20 convert_t()

```
void seq64::seqevent::convert_t (
            midipulse tick,
            int & x )  [inline], [private]
```

Why not just return it normally?

Parameters

	tick	The tick (pulse) value to convert.
out	*x*	The destination for the converted tick value.

13.87.2.21 snap_y()

```
void seq64::seqevent::snap_y (
            int & y )  [inline], [private]
```

Parameters

out	*y*	The return parameter for the conversion. Why not just return the value?

13.87.2.22 snap_x()

```
void seq64::seqevent::snap_x (
            int & x )  [private]
```

- snap = number pulses to snap to
- m_zoom = number of pulses per pixel
- Therefore snap / m_zoom = number of pixels to snap to.

Parameters

out	*x*	The output destination for the snapped x value.

13.87.2.23 on_realize()

```
void seq64::seqevent::on_realize ( )  [private]
```

It calls the base-class version, and then allocates additional resource not allocated in the constructor. Finally, it connects up the change_horz function.

13.87.2.24 on_expose_event()

```
bool seq64::seqevent::on_expose_event (
            GdkEventExpose * ev )  [private]
```

Parameters

ev	The expose event.

13.87.2.25 on_button_press_event()

```
bool seq64::seqevent::on_button_press_event (
            GdkEventButton * ev )  [private]
```

It distinguishes between the Seq24 and Fruity varieties of mouse interaction.

Odd. In the legacy code, each case fell through to the next case to the "default" case! We will assume for now that this is incorrect.

Note that returning "true" from a Gtkmm event-handler stops the propagation of the event to higher-level widgets. The Fruity and Seq24 event handlers return true, always. In the legacy code, though, the fall-through code caused false to be returned, always. Not sure what effect this had. Added some fixes, but then commented them out until better testing can be done.

Parameters

ev	The button event.

Returns

Returns true if the button-press was handled.

13.87.2.26 on_button_release_event()

```
bool seq64::seqevent::on_button_release_event (
            GdkEventButton * ev )  [private]
```

It distinguishes between the Seq24 and Fruity varieties of mouse interaction.

Odd. The fruity case fell through to the Seq24 case. We will assume for now that this is correct. Added some fixes, but then commented them out until better testing can be done.

Parameters

ev	The button event.

Returns

Returns true if the button-press was handled.

13.87.2.27 on_motion_notify_event()

```
bool seq64::seqevent::on_motion_notify_event (
            GdkEventMotion * ev )  [private]
```

It distinguishes between the Seq24 and Fruity varieties of mouse interaction.

Odd. The fruity case fell through to the Seq24 case. We will assume for now that this is correct. Added some fixes, but then commented them out until better testing can be done.

Parameters

ev	The motion event.

Returns

Returns true if the motion-event was handled.

13.87.2.28 on_focus_in_event()

```
bool seq64::seqevent::on_focus_in_event (
            GdkEventFocus *  )  [private]
```

Parameter "ev" is the focus event, unused.

Returns

Always returns false.

13.87.2.29 on_focus_out_event()

```
bool seq64::seqevent::on_focus_out_event (
            GdkEventFocus *  )  [private]
```

Parameter "ev" is the focus event, unused.

Returns

Always returns false.

13.87.2.30 on_key_press_event()

```
bool seq64::seqevent::on_key_press_event (
            GdkEventKey * ev )  [private]
```

It handles deleted a selection via the Backspace or Delete keys, cut via Ctrl-X, copy via Ctrl-C, paste via Ctrl-V, and undo via Ctrl-Z.

Would be nice to provide redo functionality via Ctrl-Y. :-)

Parameters

ev	The key-press event.

Returns

Returns true if an event was handled. Only some of the handled events also cause the perform modification flag to be set as a side-effect.

13.87.2.31 on_size_allocate()

```
void seq64::seqevent::on_size_allocate (
            Gtk::Allocation & a )  [private]
```

The m_window_x and m_window_y values are set to the allocation width and height, respectively.

Parameters

a	The allocation to be processed.

13.87.3 Friends And Related Function Documentation

13.87.3.1 FruitySeqEventInput

```
friend struct FruitySeqEventInput  [friend]
```

13.87.3.2 Seq24SeqEventInput

```
friend struct Seq24SeqEventInput  [friend]
```

13.87.4 Field Documentation

13.87.4.1 m_fruity_interaction

```
FruitySeqEventInput seq64::seqevent::m_fruity_interaction  [private]
```

Why should we need both at the same time? Just load the one that is specified in the configuration.

13.87.4.2 m_seq24_interaction

```
Seq24SeqEventInput seq64::seqevent::m_seq24_interaction  [private]
```

13.87.4.3 m_seq

```
sequence& seq64::seqevent::m_seq  [private]
```

13.87.4.4 m_zoom

```
int seq64::seqevent::m_zoom  [private]
```

13.87.4.5 m_snap

```
int seq64::seqevent::m_snap  [private]
```

Same meaning as for the piano roll. This value is the denominator of the note size used for the snap.

13.87.4.6 m_ppqn

```
int seq64::seqevent::m_ppqn  [private]
```

Used in snap and zoom scaling.

13.87.4.7 m_old

```
GdkRectangle seq64::seqevent::m_old  [private]
```

13.87.4.8 m_selected

```
GdkRectangle seq64::seqevent::m_selected  [private]
```

13.87.4.9 m_scroll_offset_ticks

```
int seq64::seqevent::m_scroll_offset_ticks  [private]
```

13.87.4.10 m_scroll_offset_x

```
int seq64::seqevent::m_scroll_offset_x  [private]
```

Set to m_scroll_offset_ticks divided by m_zoom.

13.87.4.11 m_seqdata_wid

```
seqdata& seq64::seqevent::m_seqdata_wid  [private]
```

13.87.4.12 m_selecting

```
bool seq64::seqevent::m_selecting  [private]
```

13.87.4.13 m_moving_init

```
bool seq64::seqevent::m_moving_init  [private]
```

13.87.4.14 m_moving

```
bool seq64::seqevent::m_moving  [private]
```

WARNING: This operation seems to have a bug. It makes the events very very long. This bug exists in Seq24.

13.87.4.15 m_growing

```
bool seq64::seqevent::m_growing  [private]
```

Does growing work in this view? Need to do some better testing.

13.87.4.16 m_painting

```
bool seq64::seqevent::m_painting  [private]
```

13.87.4.17 m_paste

```
bool seq64::seqevent::m_paste  [private]
```

13.87.4.18 m_move_snap_offset_x

```
int seq64::seqevent::m_move_snap_offset_x  [private]
```

13.87.4.19 m_status

```
midibyte seq64::seqevent::m_status  [private]
```

The current status/event byte.

13.87.4.20 m_cc

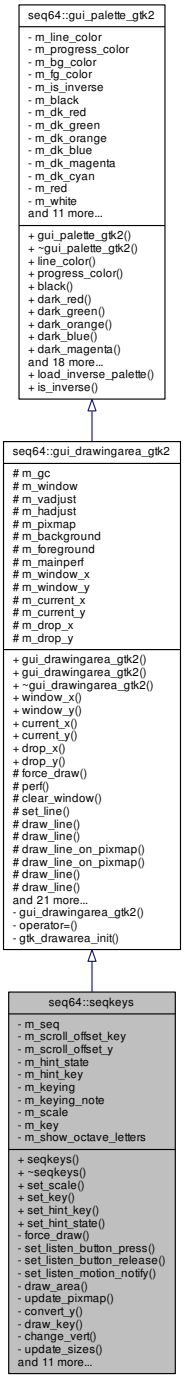
```
midibyte seq64::seqevent::m_cc  [private]
```

The current MIDI CC value.

13.88 seq64::seqkeys Class Reference

This class implements the left side piano of the pattern/sequence editor.

Inheritance diagram for seq64::seqkeys:



Public Member Functions

- seqkeys (sequence &seq, perform &p, Gtk::Adjustment &vadjust)

  Principal constructor.
- virtual ~seqkeys ()

  Let's provide a do-nothing virtual destructor.
- void set_scale (int scale)

Sets the musical scale, then resets.

- void set_key (int key)

  Sets the musical key, then resets.
- void set_hint_key (int key)

  Sets a key to grey so that it can serve as a scale hint.
- void set_hint_state (bool state)

  Sets the hint state to the given value.

Private Member Functions

- virtual void force_draw ()

  Forces a draw operation on the whole window.
- void set_listen_button_press (GdkEventButton ∗ev)

  Sneaky accessors for the seqroll friend.
- void set_listen_button_release (GdkEventButton ∗ev)
- void set_listen_motion_notify (GdkEventMotion ∗ev)
- void draw_area ()

  Draws the updated pixmap on the drawable area of the window where the keys' location is hardwired.
- void update_pixmap ()

  Updates the pixmaps to prepare it for the next draw operation.
- void convert_y (int y, int &note)

  Takes the screen y coordinate, and returns the note value in the second parameter.
- void draw_key (int key, bool state)

  Draws the given key according to the given state.
- void change_vert ()

  Changes the y offset of the scrolling, and the forces a draw.
- void update_sizes ()
- void reset ()

  Resetting the keys view updates the pixmap and queues up a draw operation.
- bool is_black_key (int key) const

  Detects a black key.
- void on_realize ()

  Implements the on-realize event.
- bool on_expose_event (GdkEventExpose ∗ev)

  Implements the on-expose event, by drawing on the window.
- bool on_button_press_event (GdkEventButton ∗ev)

  Implements the on-button-press event callback.
- bool on_button_release_event (GdkEventButton ∗ev)

  Implements the on-button-release event callback.
- bool on_motion_notify_event (GdkEventMotion ∗p0)

  Implements the on-motion-notify event handler.
- bool on_enter_notify_event (GdkEventCrossing ∗p0)

  Implements the on-enter notification event handler.
- bool on_leave_notify_event (GdkEventCrossing ∗p0)

  Implements the on-leave notification event handler.
- bool on_scroll_event (GdkEventScroll ∗ev)

  Implements the on-scroll-event notification event handler.
- void on_size_allocate (Gtk::Allocation &)

  Implements the on-size-allocation notification event handler.

Private Attributes

- sequence & m_seq

  The sequence object that the keys pane will be using.
- int m_scroll_offset_key

  Provides the value of the current top key in the keys pane.
- int m_scroll_offset_y

  Provides the value of the current top key in the keys pane in units of relative pixels.
- bool m_hint_state

  Indicates if a piano key is set to indicate where on the pitch scale the mouse cursor is sitting.
- int m_hint_key

  Indicates the current y-value of the mouse pointer in units of key value.
- bool m_keying

  Set to true while the left mouse button is being pressed.
- int m_keying_note

  The note to be played when selected in the seqkeys pane.
- int m_scale

  This member holds the scale value for the musical scale for the current edit of the sequence.
- int m_key

  This member holds the key value for the musical key for the current edit of the sequence.
- bool m_show_octave_letters

  The default value is to show the octave letters on the vertical virtual keyboard.

Friends

- class seqroll
- class FruitySeqRollInput

Additional Inherited Members

13.88.1 Detailed Description

Note the friends of this class, seqroll and FruitySeqRollInput. Where is Seq24SeqRollInput? Gone. It has been folded back into seqroll.

13.88.2 Constructor & Destructor Documentation

13.88.2.1 seqkeys()

```
seq64::seqkeys::seqkeys (
            sequence & seq,
            perform & p,
            Gtk::Adjustment & vadjust )
```

Parameters

seq	Provides the sequence object to which this seqkeys pane is associated.
p	Provides the performance object to which this seqkeys pane (and all sequences) are associated.
vadjust	The range object for the vertical scrollbar linked to the position in the seqkeys pane.

13.88.2.2 ~seqkeys()

```
virtual seq64::seqkeys::~seqkeys ( )  [inline], [virtual]
```

13.88.3 Member Function Documentation

13.88.3.1 set_scale()

```
void seq64::seqkeys::set_scale (
            int scale )
```

This function is called by the seqedit class.

Parameters

scale	The musical scale value to be set.

13.88.3.2 set_key()

```
void seq64::seqkeys::set_key (
            int key )
```

Parameters

key	The musical key value to be set.

13.88.3.3 set_hint_key()

```
void seq64::seqkeys::set_hint_key (
            int key )
```

If m_hint_state is true, the key is drawn (again).

Parameters

key	The key value to set the hint-key to.

13.88.3.4 set_hint_state()

```
void seq64::seqkeys::set_hint_state (
            bool state )
```

Parameters

state	Provides the value for hinting, where true == on, false == off.

13.88.3.5 force_draw()

```
void seq64::seqkeys::force_draw ( )  [private], [virtual]
```

Unlike most other overridden versions of force_draw(), this one does not call the base-class version.

Reimplemented from seq64::gui_drawingarea_gtk2.

13.88.3.6 set_listen_button_press()

```
void seq64::seqkeys::set_listen_button_press (
            GdkEventButton * ev )  [inline], [private]
```

From the stazed code.

Parameters

ev	The event to be forwarded from the seqroll.

13.88.3.7 set_listen_button_release()

```
void seq64::seqkeys::set_listen_button_release (
            GdkEventButton * ev )  [inline], [private]
```

13.88.3.8 set_listen_motion_notify()

```
void seq64::seqkeys::set_listen_motion_notify (
            GdkEventMotion * ev )  [inline], [private]
```

13.88.3.9 draw_area()

```
void seq64::seqkeys::draw_area ( )  [private]
```

13.88.3.10 update_pixmap()

```
void seq64::seqkeys::update_pixmap ( )  [private]
```

This function draws the keys, which range from 0 to 127 (SEQ64_MIDI_COUNT_MAX - 1 = c_num_keys - 1). Every octave, a key letter and number (e.g. "C4") is shown. The letter is adjusted to match the current scale (e.g. "C#4").

We want to support an option to show the key number rather than the note letter/number combination, and perhaps to toggle between them. The current difficulty is that the fonts used are just a little to high to fit within the vertical limits of each key. We really don't want to change the vertical size at this time, so we just print every other note value.

Also note that this algorithm draws from the top down, so we have to account for that.

13.88.3.11 convert_y()

```
void seq64::seqkeys::convert_y (
            int y,
            int & note )  [private]
```

Parameters

	y	The y (vertical) screen coordinate to convert.
out	*note*	The destination for the note calculation. This would be better as a return value.

13.88.3.12 draw_key()

```
void seq64::seqkeys::draw_key (
            int key,
            bool state )  [private]
```

It accounts for the black keys and the white keys, and for the highlighting of the active key.

Parameters

key	The key to be drawn.
state	How the key is to be drawn, where false == normal, true == grayed. A key is greyed when the mouse cursor is at the same vertical location on the piano as the key.

13.88.3.13 change_vert()

```
void seq64::seqkeys::change_vert ( )  [private]
```

Weird, in seq24 and here, the following was used, completely by accident! We fixed it, but must beware!

```
    m_scroll_offset_y = m_scroll_offset_key * c_key_y,  // comma operator!!!
    force_draw();
```

13.88.3.14 update_sizes()

```
void seq64::seqkeys::update_sizes ( )  [private]
```

13.88.3.15 reset()

```
void seq64::seqkeys::reset ( )  [private]
```

13.88.3.16 is_black_key()

```
bool seq64::seqkeys::is_black_key (
            int key ) const  [inline], [private]
```

Parameters

key	The key to analyze.

Returns

Returns true if the key is black (value 1, 3, 6, 8, or 10).

13.88.3.17 on_realize()

```
void seq64::seqkeys::on_realize ( )  [private]
```

Call the base-class version and then allocates resources that could not be allocated in the constructor. It connects the change_vert() function and then calls it.

13.88.3.18 on_expose_event()

```
bool seq64::seqkeys::on_expose_event (
            GdkEventExpose * ev )  [private]
```

Parameters

ev	The expose-event object.

13.88.3.19 on_button_press_event()

```
bool seq64::seqkeys::on_button_press_event (
            GdkEventButton * ev )  [private]
```

It handles the left and right buttons. The left button, pressed on the piano keyboard, causes m_keying to be set to true, and the given note to play. The right button toggles the note display between letter/number and MIDI note number.

Parameters

ev	The mouse-button event to use.

Returns

Always returns true.

13.88.3.20 on_button_release_event()

```
bool seq64::seqkeys::on_button_release_event (
            GdkEventButton * ev )  [private]
```

It currently handles only the left button, and only if m_keying is true.

This function is used after pressing on one of the keys on the left-side piano keyboard, to make it play, and turns off the playing of the note.

Parameters

ev	The button-event.

Returns

Always returns true.

13.88.3.21 on_motion_notify_event()

```
bool seq64::seqkeys::on_motion_notify_event (
            GdkEventMotion * p0 )  [private]
```

This allows rolling down the keyboard, playing the notes one-by-one.

Parameters

p0	The motion event.

Returns

Always returns false.

13.88.3.22 on_enter_notify_event()

```
bool seq64::seqkeys::on_enter_notify_event (
            GdkEventCrossing * p0 )  [private]
```

This greys the current key.

13.88.3.23 on_leave_notify_event()

```
bool seq64::seqkeys::on_leave_notify_event (
            GdkEventCrossing * p0 )  [private]
```

This un-greys the current key and stops playing the note.

13.88.3.24 on_scroll_event()

```
bool seq64::seqkeys::on_scroll_event (
            GdkEventScroll * ev )  [private]
```

Note that there is no usage of the modifier keys (e.g. Shift or Ctrl). Compare this function to seqedit::on_scroll_↩ event().

Parameters

ev	Provides the direction of the scroll event.

Returns

Always returns true.

13.88.3.25 on_size_allocate()

```
void seq64::seqkeys::on_size_allocate (
            Gtk::Allocation & all )  [private]
```

Parameters

all	Provies the allocation and its width and height.

13.88.4 Friends And Related Function Documentation

13.88.4.1 seqroll

```
friend class seqroll  [friend]
```

13.88.4.2 FruitySeqRollInput

```
friend class FruitySeqRollInput  [friend]
```

13.88.5 Field Documentation

13.88.5.1 m_seq

```
sequence& seq64::seqkeys::m_seq  [private]
```

13.88.5.2 m_scroll_offset_key

```
int seq64::seqkeys::m_scroll_offset_key  [private]
```

Modified in change_vert().

13.88.5.3 m_scroll_offset_y

```
int seq64::seqkeys::m_scroll_offset_y  [private]
```

Modified in change_vert().

13.88.5.4 m_hint_state

```
bool seq64::seqkeys::m_hint_state  [private]
```

13.88.5.5 m_hint_key

```
int seq64::seqkeys::m_hint_key  [private]
```

13.88.5.6 m_keying

```
bool seq64::seqkeys::m_keying  [private]
```

Used in playing the sound for each note as it is clicked in the seqkeys pane.

13.88.5.7 m_keying_note

```
int seq64::seqkeys::m_keying_note  [private]
```

13.88.5.8 m_scale

```
int seq64::seqkeys::m_scale  [private]
```

13.88.5.9 m_key

```
int seq64::seqkeys::m_key  [private]
```

13.88.5.10 m_show_octave_letters

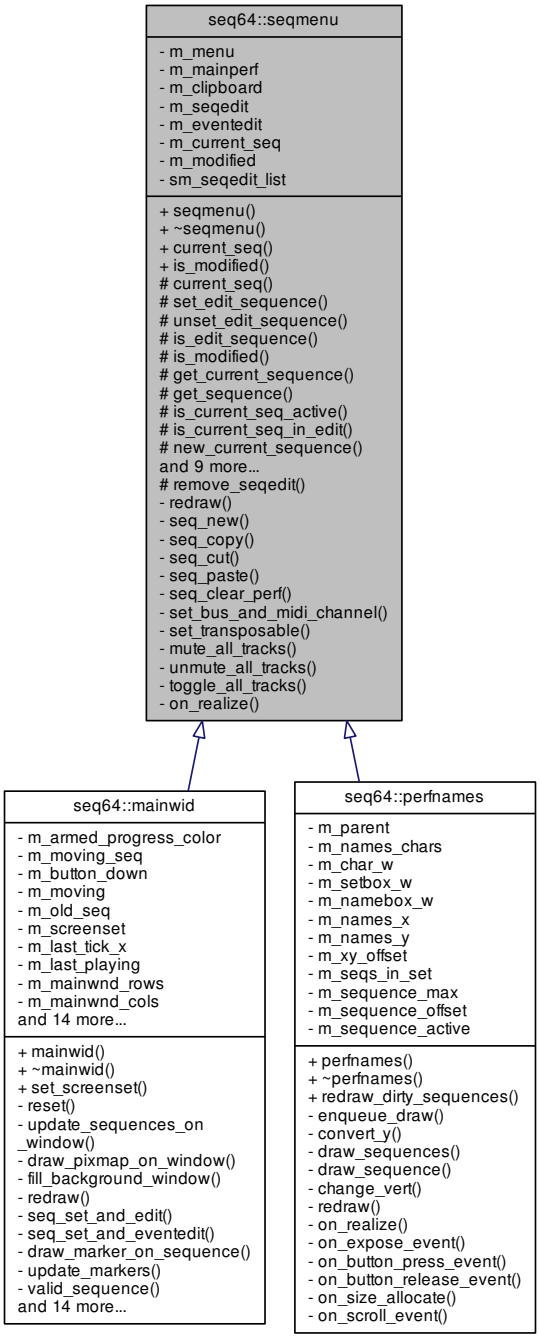
```
bool seq64::seqkeys::m_show_octave_letters  [private]
```

If false, then the MIDI key numbers are shown instead. This is a new feature of Sequencer64.

13.89 seq64::seqmenu Class Reference

This class handles the right-click menu of the sequence slots in the pattern window.

Inheritance diagram for seq64::seqmenu:



Public Member Functions

- seqmenu (perform &a_p)

  Principal constructor.
- virtual ~seqmenu ()

  Provides a rote base-class destructor.
- int current_seq () const

'Getter' function for member m_current_seq We're changing the name, so that "seq" indicates an integer by (an imperfect) convention.

- bool is_modified () const

  'Getter' function for member m_modified

Protected Member Functions

- void current_seq (int seq)

  'Setter' function for member m_current_seq
- void set_edit_sequence (int seqnum)

  'Setter' function for member m_edit_sequence Pass in -1 to disable the edit-sequence number.
- void unset_edit_sequence (int seqnum)

  'Setter' function for member m_edit_sequence Disable the edit-sequence number if it matches the parameter.
- bool is_edit_sequence (int seqnum) const

  'Getter' function for member m_edit_sequence Tests the parameter against m_edit_sequence.
- void is_modified (bool flag)

  'Setter' function for member m_modified
- sequence * get_current_sequence () const

  'Getter' function for member m_mainperf.get_sequence(current_seq()) This call is used many, many times, and well worth wrapping.
- sequence * get_sequence (int seqnum) const

  Forwards the get-sequence call to the perform object.
- bool is_current_seq_active () const

  Forwards the is-sequence-active check to the perform object.
- bool is_current_seq_in_edit () const

  Forwards the is-sequence-in-edit check to the perform object.
- void new_current_sequence ()

  Forwards the new-current-sequence call to the perform object.
- void new_sequence (int seqnum)

  Forwards the new-sequence call to the perform object.
- void delete_current_sequence ()

  Forwards the delete-sequence call to the perform object.
- void toggle_current_sequence ()

  Forwards the sequence-playing-toggle call to the perform object.
- void popup_menu ()

  This function sets up the pattern menu entries.
- void seq_edit ()

  This menu callback launches the sequence-editor (pattern editor) window.
- void seq_event_edit ()

  This menu callback launches the new event editor window.
- seqedit * create_seqedit (sequence &s)

  A wrapper function so that we can not only create a new seqedit object, but have some management over it.
- virtual void seq_set_and_edit (int seqnum)

  Sets the current sequence and then acts as if the user had clicked on its slot.
- virtual void seq_set_and_eventedit (int seqnum)

  Sets the current sequence and then acts as if the user had right-clicked on its slot and selected "Event Edit".

Static Protected Member Functions

- static void remove_seqedit (sequence &s)

  A wrapper function to make sure the seqedit object is removed from the list when it goes away.

Private Types

- typedef std::map< int, seqedit * > SeqeditMap

  An easy type definition for a map of seqedit pointers keyed by the sequence number.
- typedef std::pair< int, seqedit * > SeqeditPair

  A pair to make an entry to add to the seqedit map.
- typedef std::map< int, seqedit * >::iterator iterator

  An iterator for the seqedit map.
- typedef std::map< int, seqedit * >::const_iterator const_iterator

  A const iterator for the seqedit map.

Private Member Functions

- virtual void redraw (int a_sequence)=0
- void seq_new ()

  This function sets the new sequence into the perform object, a bit prematurely, though.
- void seq_copy ()

  Copies the selected (current) sequence to the clipboard sequence.
- void seq_cut ()

  Deletes the selected (current) sequence and copies it to the clipboard sequence, if it is not in edit mode.
- void seq_paste ()

  Pastes the sequence clipboard into the current sequence, if the current sequence slot is not active.
- void seq_clear_perf ()

  If the current sequence is active, this function pushes a trigger undo in the main perform object, clears its sequence triggers for the current sequence, and sets the dirty flag of the sequence.
- void set_bus_and_midi_channel (int a_bus, int a_ch)

  Sets up the bus, MIDI channel, and dirtiness flag of the current sequence in the main perform object, as per the give parameters.
- void set_transposable (bool flag)

  Sets the "is-transposable" flag of the current sequence.
- void mute_all_tracks ()

  Mutes all tracks in the main perform object.
- void unmute_all_tracks ()

  Unmutes all tracks in the main perform object.
- void toggle_all_tracks ()

  Toggles the mute-status of all tracks in the main perform object.
- void on_realize ()

Private Attributes

- Gtk::Menu * m_menu

  The menu to pop up when the right-click action is used either on a mainwid pattern slot or on a perfedit pattern name.
- perform & m_mainperf

  Provides a reference to the central (non-UI) object involved in managing a song and performance.
- sequence m_clipboard

  Holds a copy of data concerning a sequence, which can then be pasted into another pattern slot.
- seqedit * m_seqedit

  Points to the latest seqedit object, if created.
- eventedit * m_eventedit

  Points to the latest eventedit object, if created.
- int m_current_seq

  References the current sequence by sequence number.
- bool m_modified

  Indicates if a sequence has been created.

Static Private Attributes

- static SeqeditMap sm_seqedit_list

  Holds a list of the currently open seqedit objects, stored as pointers keyed by the sequence number.

Friends

- class mainwnd
- class seqedit

13.89.1 Detailed Description

It is an abstract base class.

13.89.2 Member Typedef Documentation

13.89.2.1 SeqeditMap

```
typedef std::map<int, seqedit *> seq64::seqmenu::SeqeditMap  [private]
```

13.89.2.2 SeqeditPair

```
typedef std::pair<int, seqedit *> seq64::seqmenu::SeqeditPair  [private]
```

13.89.2.3 iterator

```
typedef std::map<int, seqedit *>::iterator seq64::seqmenu::iterator  [private]
```

13.89.2.4 const_iterator

```
typedef std::map<int, seqedit *>::const_iterator seq64::seqmenu::const_iterator  [private]
```

13.89.3 Constructor & Destructor Documentation

13.89.3.1 seqmenu()

```
seq64::seqmenu::seqmenu (
            perform & p )
```

Apart from filling in some of the members, this function initializes the clipboard, so that we don't get a crash on a paste with no previous copy.

Parameters

p	The main performance object representing the whole MIDI song.

13.89.3.2 ~seqmenu()

```
seq64::seqmenu::~seqmenu ( )  [virtual]
```

A rote destructor.

This is necessary in an abstraction base class.

If we determine that we need to delete the m_seqedit pointer, we can do it here. But that is not likely, because we can have many new seqedit objects in play, because we can edit many at once.

13.89.4 Member Function Documentation

13.89.4.1 current_seq() [1/2]

```
int seq64::seqmenu::current_seq ( ) const  [inline]
```

13.89.4.2 is_modified() [1/2]

```
bool seq64::seqmenu::is_modified ( ) const  [inline]
```

13.89.4.3 current_seq() [2/2]

```
void seq64::seqmenu::current_seq (
            int seq )  [inline], [protected]
```

13.89.4.4 set_edit_sequence()

```
void seq64::seqmenu::set_edit_sequence (
            int seqnum )  [inline], [protected]
```

Now a pass-along to the perform object.

13.89.4.5 unset_edit_sequence()

```
void seq64::seqmenu::unset_edit_sequence (
            int seqnum )  [inline], [protected]
```

13.89.4.6 is_edit_sequence()

```
bool seq64::seqmenu::is_edit_sequence (
            int seqnum ) const  [inline], [protected]
```

Returns true if that member is not -1, and the parameter matches it. Now a pass-along to the perform object.

13.89.4.7 is_modified() [2/2]

```
void seq64::seqmenu::is_modified (
            bool flag )  [inline], [protected]
```

13.89.4.8 get_current_sequence()

```
sequence* seq64::seqmenu::get_current_sequence ( ) const  [inline], [protected]
```

13.89.4.9 get_sequence()

```
sequence* seq64::seqmenu::get_sequence (
            int seqnum ) const  [inline], [protected]
```

13.89.4.10 is_current_seq_active()

```
bool seq64::seqmenu::is_current_seq_active ( ) const  [inline], [protected]
```

13.89.4.11 is_current_seq_in_edit()

```
bool seq64::seqmenu::is_current_seq_in_edit ( ) const  [inline], [protected]
```

13.89.4.12 new_current_sequence()

```
void seq64::seqmenu::new_current_sequence ( )  [inline], [protected]
```

13.89.4.13 new_sequence()

```
void seq64::seqmenu::new_sequence (
            int seqnum )  [inline], [protected]
```

13.89.4.14 delete_current_sequence()

```
void seq64::seqmenu::delete_current_sequence ( )  [inline], [protected]
```

13.89.4.15 toggle_current_sequence()

```
void seq64::seqmenu::toggle_current_sequence ( )  [inline], [protected]
```

13.89.4.16 popup_menu()

```
void seq64::seqmenu::popup_menu ( )  [protected]
```

It also sets up the pattern popup menu entries that are used in mainwid. Note that, for the selected sequence, the "Edit" and "Event Edit" menu entries are not included if a pattern editor or event editor is already running. The new event editor seems to create far-reaching problems that we do not yet understand, so it is now possible to disable it at build time. We have mitigated most of those problems by not allowing both a seq_edit() and a seq_event_edit() at the same time.

13.89.4.17 seq_edit()

```
void seq64::seqmenu::seq_edit ( )  [protected]
```

If it is already open for that sequence, this function just raises it.

Note that the m_seqedit member to which we save the new pointer is currently there just to avoid a compiler warning.

Also, if a new sequences is created, we set the m_modified flag to true, even though the sequence might later be deleted. Too much modification to keep track of!

An oddity is that calling show_all() here does not work unless the seqedit() constructor makes its show_all() call.

13.89.4.18 seq_event_edit()

```
void seq64::seqmenu::seq_event_edit ( )  [protected]
```

If it is already open for that sequence, this function just raises it.

Note that the m_eventedit member to which we save the new pointer is currently there just to avoid a compiler warning.

This menu entry is available only if the selected sequence is active. That is, if the sequence has already been created.

An oddity is that we need the show_all() call here in order to see the dialog. A situation different from that for seqedit! However, now it doesn't seem to be needed, and we have put it back into the eventedit constructor.

13.89.4.19 create_seqedit()

```
seqedit * seq64::seqmenu::create_seqedit (
            sequence & s )  [protected]
```

We don't bother checking here if the insert succeeded. If it doesn't, all bets are off.

Parameters

s	Provides the sequence for which the seqedit will be created. The perform object and the current_seq() value are implicit parameters. This object can obviously be modified by the sequence editor, so cannot be constant.

Returns

Returns the pointer to the new seqedit object.

13.89.4.20 remove_seqedit()

```
void seq64::seqmenu::remove_seqedit (
            sequence & s )  [static], [protected]
```

Called by seqedit::on_delete_event().

13.89.4.21 seq_set_and_edit()

```
void seq64::seqmenu::seq_set_and_edit (
            int seqnum )  [protected], [virtual]
```

How do we account for the current screenset? It might not matter if the mute/unmute keystrokes were designed to work only with the current screenset.

Change Note ca 2016-11-01 We would like to be able to right-click on a given pattern slot in mainwid, and figure out if it has a seqedit window open, so that we can update that window. So we need to add that seqedit window to a map of seqedits, keyed by the slot number. Then we can look up that slot and see if it has a seqedit window open. If the seqedit window closes, that window needs to remove itself from the map. This won't be needed for the event editor, which has no functionality from seqmenu.

Parameters

seqnum	The number of the sequence to edit.

Reimplemented in seq64::mainwid.

13.89.4.22 seq_set_and_eventedit()

```
void seq64::seqmenu::seq_set_and_eventedit (
            int seqnum )  [protected], [virtual]
```

Parameters

seqnum	The number of the sequence to event-edit.

Reimplemented in seq64::mainwid.

13.89.4.23 redraw()

```
virtual void seq64::seqmenu::redraw (
            int a_sequence )  [private], [pure virtual]
```

Implemented in seq64::mainwid, and seq64::perfnames.

13.89.4.24 seq_new()

```
void seq64::seqmenu::seq_new ( )  [private]
```

For one thing, if current_seq() is either a -1 or is greater than the maximum allowed sequence number, perform::is_active() will return false, and we have no idea whether the sequence is not active or the sequence number is just invalid. So we need to check the pointer we got before trying to use it.

13.89.4.25 seq_copy()

```
void seq64::seqmenu::seq_copy ( )  [private]
```

We use a more appropriate function than operator =() here: sequence::partial_assign().

Todo Can be offloaded to a perform member function that accepts a sequence clipboard non-const reference parameter.

13.89.4.26 seq_cut()

```
void seq64::seqmenu::seq_cut ( )  [private]
```

Todo A lot of seq_cut() can be offloaded to a (new) perform member function that takes a sequence clipboard non-const reference parameter.

13.89.4.27 seq_paste()

```
void seq64::seqmenu::seq_paste ( )  [private]
```

Then it sets the dirty flag for the destination sequence.

Todo All of seq_paste() can be offloaded to a (new) perform member function with a const clipboard reference parameter.

13.89.4.28 seq_clear_perf()

```
void seq64::seqmenu::seq_clear_perf ( )  [private]
```

13.89.4.29 set_bus_and_midi_channel()

```
void seq64::seqmenu::set_bus_and_midi_channel (
            int bus,
            int ch )  [private]
```

Parameters

bus	The MIDI buss number to set (bus vs buss? You decide.)
ch	The MIDI channel number to set.

13.89.4.30 set_transposable()

```
void seq64::seqmenu::set_transposable (
            bool flag )  [private]
```

Parameters

flag	The value to use to set the flag.

13.89.4.31 mute_all_tracks()

```
void seq64::seqmenu::mute_all_tracks ( )  [inline], [private]
```

13.89.4.32 unmute_all_tracks()

```
void seq64::seqmenu::unmute_all_tracks ( )  [inline], [private]
```

13.89.4.33 toggle_all_tracks()

```
void seq64::seqmenu::toggle_all_tracks ( )  [inline], [private]
```

13.89.4.34 on_realize()

```
void seq64::seqmenu::on_realize ( )  [private]
```

13.89.5 Friends And Related Function Documentation

13.89.5.1 mainwnd

```
friend class mainwnd  [friend]
```

13.89.5.2 seqedit

```
friend class seqedit  [friend]
```

13.89.6 Field Documentation

13.89.6.1 sm_seqedit_list

```
seqmenu::SeqeditMap seq64::seqmenu::sm_seqedit_list  [static], [private]
```

The single map of seqedit objects, for seqedit updates and management.

We can use this map to look up patterns that we want to change from the right-click seqmenu, and modify the seqedit affected if it is found in the list.

Currently selectable by the USE_SEQEDIT_MACRO until we can make it foolproof.

13.89.6.2 m_menu

```
Gtk::Menu* seq64::seqmenu::m_menu  [private]
```

13.89.6.3 m_mainperf

```
perform& seq64::seqmenu::m_mainperf  [private]
```

13.89.6.4 m_clipboard

```
sequence seq64::seqmenu::m_clipboard  [private]
```

13.89.6.5 m_seqedit

```
seqedit* seq64::seqmenu::m_seqedit  [private]
```

Change Note Added by Chris on 2015-08-02 based on compiler warnings and a comment warning in the seq_edit() function. We'll save the result of that function here, and will let valgrind tell us later if Gtkmm takes care of it.

13.89.6.6 m_eventedit

```
eventedit* seq64::seqmenu::m_eventedit  [private]
```

13.89.6.7 m_current_seq

```
int seq64::seqmenu::m_current_seq  [private]
```

13.89.6.8 m_modified

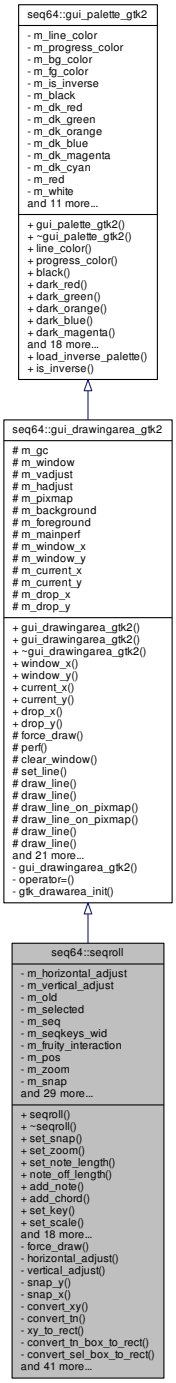
```
bool seq64::seqmenu::m_modified  [private]
```

Todo We need to make sure that the perform object is in control of the modification flag.

13.90 seq64::seqroll Class Reference

Implements the piano roll section of the pattern editor.

Inheritance diagram for seq64::seqroll:



Public Member Functions

- seqroll (perform &perf, sequence &seq, int zoom, int snap, seqkeys &seqkeys_wid, int pos, Gtk::Adjustment &hadjust, Gtk::Adjustment &vadjust, int ppqn=SEQ64_USE_DEFAULT_PPQN)

  Principal constructor.

- virtual ~seqroll ()

  Provides a destructor to delete allocated objects.

- void set_snap (int snap)

  Sets the snap to the given value, and then resets the view.
- void set_zoom (int zoom)

  Sets the zoom to the given value, and then resets the view.
- void set_note_length (int note_length)

  'Setter' function for member m_note_length
- int note_off_length () const

  'Getter' function for member m_note_length, adjusted for the note_off_margin.
- bool add_note (midipulse tick, int note, bool paint=true)

  Convenience wrapper for sequence::add_note().
- void add_chord (midipulse tick, int note)

  Convenience wrapper for sequence::add_chord().
- void set_key (int key)

  Sets the music key to the given value, and then resets the view.
- void set_scale (int scale)

  Sets the music scale to the given value, and then resets the view.
- void set_chord (int chord)

  Sets the current chord to the given value.
- void set_data_type (midibyte status, midibyte control)

  Sets the status to the given parameter, and the CC value to the given optional control parameter, which defaults to 0.
- void set_background_sequence (bool state, int seq)

  This function sets the given sequence onto the piano roll of the pattern editor, so that the musician can have another pattern to play against.
- void update_pixmap ()

  This function draws the background pixmap on the main pixmap, and then draws the events on it.
- void update_sizes ()

  Update the sizes of items based on zoom, PPQN, BPM, BW (beat width) and more.
- void update_background ()

  Updates the background of this window.
- void draw_background_on_pixmap ()

  Draws the main pixmap.
- void draw_events_on_pixmap ()

  Fills the main pixmap with events.
- void draw_selection_on_window ()

  Draws the current selecton on the main window.
- void draw_progress_on_window ()

  Draw a progress line on the window.
- void reset ()

  This function basically resets the whole widget as if it were realized again.
- void update_and_draw (int force=false)

  Wraps up some common code.
- void redraw ()

  Redraws unless m_ignore_redraw is true.
- void redraw_events ()

  Redraws events unless m_ignore_redraw is true.
- void start_paste ()

  Starts a paste operation.
- void complete_paste ()
- void complete_paste (int x, int y)

  Completes a paste operation.
- void follow_progress ()

Private Member Functions

- virtual void force_draw ()

  Set the pixmap into the window and then draws the selection on it.
- void horizontal_adjust (double step)

  This function provides optimization for the on_scroll_event() function.
- void vertical_adjust (double step)

  This function provides optimization for the on_scroll_event() function.
- void snap_y (int &y)

  Snaps the y value to the piano-key "height".
- void snap_x (int &x)

  Performs a 'snap' operation on the x coordinate.
- void convert_xy (int x, int y, midipulse &ticks, int &note)
- void convert_tn (midipulse ticks, int note, int &x, int &y)

  This function takes the given note and tick, and returns the screen coordinates via the pointer parameters.
- void xy_to_rect (int x1, int y1, int x2, int y2, int &x, int &y, int &w, int &h)

  Converts rectangle corner coordinates to a starting coordinate, plus a width and height.
- void convert_tn_box_to_rect (midipulse tick_s, midipulse tick_f, int note_h, int note_l, int &x, int &y, int &w, int &h)

  Converts a tick/note box to an x/y rectangle.
- void convert_sel_box_to_rect (midipulse tick_s, midipulse tick_f, int note_h, int note_l)

  A convenience function wrapping a common call to convert_tn_box_to_rect().
- void get_selected_box (midipulse &tick_s, int &note_h, midipulse &tick_f, int &note_l)

  A convenience function wrapping a common call to m_seq.get_selected_box() and convert_tn_box_to_rect().
- void draw_events_on (Glib::RefPtr< Gdk::Drawable > draw)

  Draws events on the given drawable area.
- int idle_redraw ()

  Draw the events on the main window and on the pixmap.
- int idle_progress ()
- void change_horz ()

  Change the horizontal scrolling offset and redraw.
- void change_vert ()

  Change the vertical scrolling offset and redraw.
- void move_selection_box (int dx, int dy)

  Function to allow motion of the selection box via the arrow keys.
- void move_selected_notes (int dx, int dy)

  Proposed new function to encapsulate the movement of selections even more fully.
- void grow_selected_notes (int dx)

  Proposed new function to encapsulate the movement of selections even more fully.
- void set_adding (bool adding)

  Changes the mouse cursor pixmap according to whether a note is being added or not.
- void update_mouse_pointer (bool adding=false)

  Updates the mouse pointer, implementing a context-sensitive mouse.
- bool button_press_initial (GdkEventButton *ev, int &norm_x, int &snapped_x, int &snapped_y)
- void align_selection (midipulse &tick_s, int &note_h, midipulse &tick_f, int &note_l, int snapped_x)

  Get the box that selected elements are in.
- bool button_press (GdkEventButton *ev)

  Implements the on-button-press event handling for the Seq24 style of mouse interaction.
- bool button_release (GdkEventButton *ev)

  Implements the on-button-release event handling for the Seq24 style of mouse interaction.
- bool motion_notify (GdkEventMotion *ev)

Seq24-style on-motion mouse interaction.

- void clear_selected ()

  'Setter' function for member m_old
- void clear_old ()

  'Setter' function for member m_old
- void clear_flags ()

  Clears all the mouse-action flags.
- int scroll_offset_x (int x) const

  Useful x calculation.
- int scroll_offset_y (int y) const

  Useful y calculation.
- void set_current_offset_x_y (int x, int y)

  Useful x calculation.
- bool adding () const

  'Getter' function for member m_adding
- bool selecting () const

  'Getter' function for member m_selecting
- bool growing () const

  'Getter' function for member m_growing
- bool normal_action () const

  Indicates if we're drag-pasting, selecting, moving, growing, or pasting.
- bool select_action () const

  Indicates if we're selecting, moving, growing, or pasting.
- bool drop_action () const

  Indicates if we're moving or pasting.
- bool moving () const

  'Getter' function for member m_moving
- void on_realize ()

  Implements the on-realize event handling.
- bool on_expose_event (GdkEventExpose *ev)

  Implements the on-expose event handling.
- bool on_button_press_event (GdkEventButton *ev)

  Implements the on-button-press event handling.
- bool on_button_release_event (GdkEventButton *ev)

  Implements the on-button-release event handling.
- bool on_motion_notify_event (GdkEventMotion *ev)

  Implements the on-motion-notify event handling.
- bool on_focus_in_event (GdkEventFocus *)

  Implements the on-focus event handling.
- bool on_focus_out_event (GdkEventFocus *)

  Implements the on-unfocus event handling.
- bool on_key_press_event (GdkEventKey *ev)

  Implements the on-key-press event handling.
- bool on_scroll_event (GdkEventScroll *a_ev)

  Implements the on-scroll event handling.
- void on_size_allocate (Gtk::Allocation &)

  Implements the on-size-allocate event handling.
- bool on_leave_notify_event (GdkEventCrossing *p0)

  Implements the on-leave-notify event handling.
- bool on_enter_notify_event (GdkEventCrossing *p0)

  Implements the on-enter-notify event handling.

Private Attributes

- Gtk::Adjustment & m_horizontal_adjust

  For accessing on_key_press_event().
- Gtk::Adjustment & m_vertical_adjust

  We need direct access to the vertical scrollbar if we want to be able to make it follow PageUp and PageDown.
- rect m_old

  The previous selection rectangle, used for undrawing it.
- rect m_selected

  Used in moving and pasting notes.
- sequence & m_seq

  Provides a reference to the seqeunce represented by piano roll.
- seqkeys & m_seqkeys_wid

  Holds a reference to the seqkeys pane that is associated with the seqroll piano roll.
- FruitySeqRollInput m_fruity_interaction

  Provides a fruity input object, whether it is needed or not.
- int m_pos

  A position value.
- int m_zoom

  Zoom setting, means that one pixel == m_zoom ticks.
- int m_snap

  The grid-snap setting for the piano roll grid.
- int m_ppqn

  The value of PPQN for the current MIDI song.
- int m_note_length

  Holds the note length in force for this sequence.
- int m_scale

  Indicates the musical scale in force for this sequence.
- int m_chord

  Indicates the current chord in force for this sequence for inserting notes.
- int m_key

  Indicates the musical key in force for this sequence.
- bool m_adding

  Set when in note-adding mode.
- bool m_selecting

  Set when highlighting a bunch of events.
- bool m_moving

  Set when moving a bunch of events.
- bool m_moving_init

  Indicates the beginning of moving some events.
- bool m_growing

  Indicates that the notes are to be extended or reduced in length.
- bool m_painting

  Indicates the painting of events.
- bool m_paste

  Indicates that we are in the process of painting notes.
- bool m_is_drag_pasting

  Indicates the drag-pasting of events.
- bool m_is_drag_pasting_start

  Indicates the drag-pasting of events.
- bool m_justselected_one

Indicates the selection of one event.

- int m_move_delta_x

  Tells where the dragging started, the x value.
- int m_move_delta_y

  Tells where the dragging started, the y value.
- int m_move_snap_offset_x

  This item is used in the fruityseqroll module.
- int m_progress_x

  Provides the location of the progress bar.
- int m_scroll_offset_ticks

  The horizontal value of the scroll window in units of ticks/pulses/divisions.
- int m_scroll_offset_key

  The vertical offset of the scroll window in units of MIDI notes/keys.
- int m_scroll_offset_x

  The horizontal value of the scroll window in units of pixels.
- int m_scroll_offset_y

  The vertical value of the scroll window in units of pixels.
- bool m_transport_follow

  TBD.
- bool m_trans_button_press

  TBD.
- int m_background_sequence

  Holds the value of the musical background sequence that is shown in cyan (formerly grey) on the background of the piano roll.
- bool m_drawing_background_seq

  Set to true if the drawing of the background sequence is to be done.
- midibyte m_status

  Set to true to avoid the call to update_and_draw().
- midibyte m_cc

  The current MIDI control value selected in the seqedit.

Friends

- class FruitySeqRollInput

  This friend implements fruity interaction-specific behavior.

Additional Inherited Members

13.90.1 Constructor & Destructor Documentation

13.90.1.1 seqroll()

```
seq64::seqroll::seqroll (
            perform & p,
            sequence & seq,
            int zoom,
            int snap,
            seqkeys & seqkeys_wid,
            int pos,
            Gtk::Adjustment & hadjust,
            Gtk::Adjustment & vadjust,
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

Parameters

p	The performance object that helps control this piano roll. Note that we can get the perform object from the sequence, and save a parameter. Low priority change.
seq	The sequence object represented by this piano roll.
zoom	The initial zoom of this piano roll.
snap	The initial grid snap of this piano roll.
seqkeys_wid	A reference to the piano keys window that is shown to the left of this piano roll.
pos	A position parameter. See the description of seqroll::m_pos. This is actually the sequence number, and is currently unused. However, we're sure we can find a use for it sometime.
hadjust	Represents the horizontal scrollbar of this window. It is actually created by the "parent" seqedit object.
vadjust	Represents the vertical scrollbar of this window. It is actually created by the "parent" seqedit object.
ppqn	The initial value of the PPQN for this sequence. Useful in scale calculations.

13.90.1.2 ~seqroll()

```
seq64::seqroll::~seqroll ( )  [virtual]
```

The only thing to delete here is the clipboard. Except it is never used, so is commented out.

13.90.2 Member Function Documentation

13.90.2.1 set_snap()

```
void seq64::seqroll::set_snap (
            int snap )  [inline]
```

Parameters

snap	Provides the sname value to set.

13.90.2.2 set_zoom()

```
void seq64::seqroll::set_zoom (
            int zoom )
```

Parameters

zoom	The desired zoom value, assumed to be validated already. See the seqedit::set_zoom() function.

13.90.2.3 set_note_length()

```
void seq64::seqroll::set_note_length (
            int note_length )  [inline]
```

13.90.2.4 note_off_length()

```
int seq64::seqroll::note_off_length ( ) const  [inline]
```

13.90.2.5 add_note()

```
bool seq64::seqroll::add_note (
            midipulse tick,
            int note,
            bool paint = true )
```

The length parameters is obtained from the note_off_length() function. This sets the note length at a little less than the snap value.

Parameters

tick	The time destination of the new note, in pulses.
note	The pitch destination of the new note.
paint	If true, repaint to be left with just the inserted event. The default is true. The value of false is useful in inserting a number of events and saving the repainting until last. It is a bit tricky, as the default paint value for sequence::add_note() is false.

13.90.2.6 add_chord()

```
void seq64::seqroll::add_chord (
            midipulse tick,
            int note )  [inline]
```

Implicit parameters are the m_chord and note_off_length() members. The latter deducts just a little from the snap value.

Parameters

tick	The tick at which to add the chord.
note	The base (bottom) note of the chord.

13.90.2.7 set_key()

```
void seq64::seqroll::set_key (
            int key )
```

Parameters

key	The desired key value.

13.90.2.8 set_scale()

```
void seq64::seqroll::set_scale (
            int scale )
```

Parameters

scale	The desired scale value.

13.90.2.9 set_chord()

```
void seq64::seqroll::set_chord (
            int chord )
```

Parameters

chord	The desired chord value.

13.90.2.10 set_data_type()

```
void seq64::seqroll::set_data_type (
            midibyte status,
            midibyte control )  [inline]
```

Unlike the same function in seqevent, this version does not redraw. Used by seqedit.

13.90.2.11 set_background_sequence()

```
void seq64::seqroll::set_background_sequence (
            bool state,
            int seq )
```

The state parameter sets the boolean m_drawing_background_seq.

Parameters

state	If true, the background sequence will be drawn.
seq	Provides the sequence number, which is checked against the SEQ64_IS_LEGAL_SEQUENCE() macro before being used. This macro allows the value SEQ64_SEQUENCE_LIMIT, which disables the background sequence.

13.90.2.12 update_pixmap()

```
void seq64::seqroll::update_pixmap ( )
```

13.90.2.13 update_sizes()

```
void seq64::seqroll::update_sizes ( )
```

It brings the scrollbar back to the beginning, resets the upper limit to the number of ticks in the sequence, sets the page-size based on the window size and the zoom factor.

The horizontal step increment is 1 semiquaver (1/16) note per zoom level. The horizontal page increment is currently always one bar. We may want to make that larger for scrolling after the progress bar.

Tha maximum value set for the scrollbar brings it to the last "page" of the piano roll.

The vertical size are also adjusted. More on the story later.

13.90.2.14 update_background()

```
void seq64::seqroll::update_background ( )
```

The first thing done is to clear the background, painting it white.

13.90.2.15 draw_background_on_pixmap()

```
void seq64::seqroll::draw_background_on_pixmap ( )
```

13.90.2.16 draw_events_on_pixmap()

```
void seq64::seqroll::draw_events_on_pixmap ( )
```

Just calls draw_events_on().

13.90.2.17 draw_selection_on_window()

```
void seq64::seqroll::draw_selection_on_window ( )
```

Note the parameters of draw_drawable(), which we need to be sure of to draw thicker boxes.

```
-   x and y position of rectangle to draw
-   x and y position in drawable where rectangle should be drawn
-   width and height of rectangle to draw
```

A final parameter of false draws an unfilled rectangle. Orange makes it a little more clear that we're pasting, I think. We also want to try to thicken the lines somehow.

13.90.2.18 draw_progress_on_window()

```
void seq64::seqroll::draw_progress_on_window ( )
```

This is done by first blanking out the line with the background, which contains white space and grey lines, using the the draw_drawable function. Remember that we wrap the draw_drawable() function so it's parameters are xsrc, ysrc, xdest, ydest, width, and height.

Note that the progress-bar position is based on the sequence::get_last_tick() value, the current zoom, and the current scroll-offset x value.

Finally, we had an issue with the selection box flickering, which seems to be solved satisfactorily by not drawing it if a select action is in force. Hopefully no one needs to select notes on the fly and see the progress bar moving at the same time! Another tactic is to draw progress only when the performance is running. This has the benefit/drawback that the progress bar is left where it stops. Consider an enumeration of options: normal, when-not-selecting, and when-running.

13.90.2.19 reset()

```
void seq64::seqroll::reset ( )
```

It's almost identical to the change_horz() function, just calling update_sizes() before update_and_draw().

13.90.2.20 update_and_draw()

```
void seq64::seqroll::update_and_draw (
            int force = false )
```

Parameters

force	If true, force an immediate draw, otherwise just queue up a draw. This value defaults to false.

13.90.2.21 redraw()

```
void seq64::seqroll::redraw ( )
```

Somewhat similar to seqevent::redraw(). Actually, we don't seem to need to ignore redraw when making settings in the seqedit constructor, so this member no longer exists.

13.90.2.22 redraw_events()

```
void seq64::seqroll::redraw_events ( )
```

Actually, that member is not needed and no longer exists.

13.90.2.23 start_paste()

```
void seq64::seqroll::start_paste ( )
```

13.90.2.24 complete_paste() [1/2]

```
void seq64::seqroll::complete_paste ( )  [inline]
```

13.90.2.25 complete_paste() [2/2]

```
void seq64::seqroll::complete_paste (
            int x,
            int y )
```

13.90.2.26 follow_progress()

```
void seq64::seqroll::follow_progress ( )
```

13.90.2.27 force_draw()

```
void seq64::seqroll::force_draw ( )  [private], [virtual]
```

Reimplemented from seq64::gui_drawingarea_gtk2.

13.90.2.28 horizontal_adjust()

```
void seq64::seqroll::horizontal_adjust (
            double step )  [inline], [private]
```

A duplicate of the one in seqedit.

Parameters

step	Provides the step value to use for adjusting the horizontal scrollbar. See gui_drawingarea_gtk2::scroll_hadjust() for more information.

13.90.2.29 vertical_adjust()

```
void seq64::seqroll::vertical_adjust (
            double step )  [inline], [private]
```

A duplicate of the one in seqedit.

Parameters

step	Provides the step value to use for adjusting the vertical scrollbar. See gui_drawingarea_gtk2::scroll_vadjust() for more information.

13.90.2.30 snap_y()

```
void seq64::seqroll::snap_y (
            int & y )  [inline], [private]
```

Parameters

out	*y*	The y-value to be snapped.

13.90.2.31 snap_x()

```
void seq64::seqroll::snap_x (
            int & x )  [private]
```

This function is similar to snap_y(), but it calculates a modulo value from the snap and zoom settings.

```
-   m_snap = number pulses to snap to
-   m_zoom = number of pulses per pixel
```

Therefore, m_snap / m_zoom = number pixels to snap to.

Parameters

out	*x*	Provides the x-value to be snapped and returned. A return value would be better.

13.90.2.32 convert_xy()

```
void seq64::seqroll::convert_xy (
            int x,
            int y,
            midipulse & ticks,
            int & note )  [private]
```

13.90.2.33 convert_tn()

```
void seq64::seqroll::convert_tn (
            midipulse tick,
            int note,
            int & x,
            int & y )  [private]
```

This function is the "inverse" of convert_xy().

Parameters

	tick	Provides the horizontal value in MIDI pulses.
	note	Provides the vertical value, a note value.
out	*x*	Provides the destination x value of the coordinate.
out	*y*	Provides the destination y value of the coordinate.

13.90.2.34 xy_to_rect()

```
void seq64::seqroll::xy_to_rect (
            int x1,
            int y1,
            int x2,
            int y2,
            int & x,
            int & y,
            int & w,
            int & h )  [private]
```

This function checks the mins / maxes, and then fills in the x, y, width, and height values.

We should refactor this function to use the utility class seqroll::rect as the destination for the conversion.

Parameters

	x1	The x value of the first corner.
	y1	The y value of the first corner.

Parameters

	x2	The x value of the second corner.
	y2	The y value of the second corner.
out	*x*	The destination for the x value in pixels.
out	*y*	The destination for the y value in pixels.
out	*w*	The destination for the rectangle width in pixels.
out	*h*	The destination for the rectangle height value in pixels.

13.90.2.35 convert_tn_box_to_rect()

```
void seq64::seqroll::convert_tn_box_to_rect (
            midipulse tick_s,
            midipulse tick_f,
            int note_h,
            int note_l,
            int & x,
            int & y,
            int & w,
            int & h )  [private]
```

We should refactor this function to use the utility class seqroll::rect as the destination for the conversion.

Parameters

	tick_s	The starting tick of the rectangle.
	tick_f	The finishing tick of the rectangle.
	note_h	The high note of the rectangle.
	note_l	The low note of the rectangle.
out	*x*	The destination for the x value in pixels.
out	*y*	The destination for the y value in pixels.
out	*w*	The destination for the rectangle width in pixels.
out	*h*	The destination for the rectangle height value in pixels.

13.90.2.36 convert_sel_box_to_rect()

```
void seq64::seqroll::convert_sel_box_to_rect (
            midipulse tick_s,
            midipulse tick_f,
            int note_h,
            int note_l )  [private]
```

Parameters

tick_s	The starting tick of the rectangle.
tick_f	The finishing tick of the rectangle.
note_h	The high note of the rectangle.
note_l	The low note of the rectangle.

13.90.2.37 get_selected_box()

```
void seq64::seqroll::get_selected_box (
            midipulse & tick_s,
            int & note_h,
            midipulse & tick_f,
            int & note_l )  [private]
```

Parameters

out	*tick_s*	The starting tick of the rectangle.
out	*tick_f*	The finishing tick of the rectangle.
out	*note_h*	The high note of the rectangle.
out	*note_l*	The low note of the rectangle.

13.90.2.38 draw_events_on()

```
void seq64::seqroll::draw_events_on (
            Glib::RefPtr< Gdk::Drawable > draw )  [private]
```

"Method 0" draws the background sequence, if active. "Method 1" draws the sequence itself.

Parameters

draw	The "drawable" area to draw on.

13.90.2.39 idle_redraw()

```
int seq64::seqroll::idle_redraw ( )  [private]
```

13.90.2.40 idle_progress()

```
int seq64::seqroll::idle_progress ( )  [private]
```

13.90.2.41 change_horz()

```
void seq64::seqroll::change_horz ( )  [private]
```

Roughly similar to seqevent::change_horz().

13.90.2.42 change_vert()

```
void seq64::seqroll::change_vert ( )  [private]
```

13.90.2.43 move_selection_box()

```
void seq64::seqroll::move_selection_box (
            int dx,
            int dy )  [private]
```

We now let the Enter key to finish pasting and deselect the moved notes. With the mouse, selecting all notes, copying them, and moving the selection box, pasting can be completed with either a left-click or the Enter key.

We have a weird problem on our main system where the selection box is very flickery. But it works fine on another system. A Gtk-2 issue? Now it seems to work fine, after an update. No, it seems to work well in sequences that have non-note events amongst the note events.

Parameters

dx	The amount to move the selection box. Values are -1, 0, or 1. -1 is left one snap, 0 is no movement horizontally, and 1 is right one snap.
dy	The amount to move the selection box. Values are -1, 0, or 1. -1 is up one snap, 0 is no movement vertically, and 1 is down one snap.

13.90.2.44 move_selected_notes()

```
void seq64::seqroll::move_selected_notes (
            int dx,
            int dy )  [private]
```

Works with the four arrow keys.

Note that the movement vertically is different for the selection box versus the notes. While the movement values are -1, 0, or 1, the differences are as follows:

```
-   Selection box vertical movement:
    -   -1 is up one note snap.
    -   0 is no vertical movement.
    -   +1 is down one note snap.
-   Note vertical movement:
    -   -1 is down one note.
    -   0 is no note vertical movement.
    -   +1 is up one note.
```

Parameters

dx	The amount to move the selection box or the selection horizontally. Values are -1 (left one time snap), 0 (no movement), and +1 (right one snap). Obviously values other than +-1 can be used for larger movement, but the GUI doesn't yet support that ... we could implement movement by "pages" some day.
dy	The amount to move the selection box or the selection vertically. See the notes above.

13.90.2.45 grow_selected_notes()

```
void seq64::seqroll::grow_selected_notes (
            int dx )  [private]
```

Parameters

dx	The amount to grow the selection horizontally. Values are -1 (left one time snap), 0 (no stretching), and +1 (right one snap). Obviously values other than +-1 can be used for larger stretching, but the GUI doesn't yet support that.

13.90.2.46 set_adding()

```
void seq64::seqroll::set_adding (
            bool adding )  [private]
```

What calls this? It is actually a right click. Not present in the "fruity" implementation. Now moved to the normal seqroll class.

Parameters

adding	True if adding a note.

13.90.2.47 update_mouse_pointer()

```
void seq64::seqroll::update_mouse_pointer (
            bool adding = false )  [private]
```

Moved here from the "fruity" seqroll class.

13.90.2.48 button_press_initial()

```
bool seq64::seqroll::button_press_initial (
            GdkEventButton * ev,
            int & norm_x,
            int & snapped_x,
            int & snapped_y )  [private]
```

13.90.2.49 align_selection()

```
void seq64::seqroll::align_selection (
            midipulse & tick_s,
            int & note_h,
            midipulse & tick_f,
            int & note_l,
            int snapped_x )  [private]
```

Save offset that we get from the snap above. Align selection for drawing. Could be used in XRollInput::on_button↩
_press_event().

13.90.2.50 button_press()

```
bool seq64::seqroll::button_press (
            GdkEventButton * ev )  [private]
```

This function now uses the needs_update flag to determine if the perform object should modify().

Parameters

ev	Provides the button-press event to process.

Returns

Returns the value of needs_update. It used to return only true.

13.90.2.51 button_release()

```
bool seq64::seqroll::button_release (
            GdkEventButton * ev )  [private]
```

This function now uses the needs_update flag to determine if the perform object should modify().

Parameters

ev	Provides the button-release event to process.

Returns

Returns the value of needs_update. It used to return only true.

If in moving mode, adjust for snap and convert deltas into screen coordinates. Since delta_note was from delta_y, it will be flipped (delta_y[0] = note[127], etc.), so we have to adjust.

A left/middle click converts deltas into screen coordinates, then pushs the undo state. Shift causes a "stretch selected" which currently acts like a "move selected" operation. BUG? Otherwise, Ctrl indirectly allows a "grow selected" operation.

Minor new feature. If the Super (Mod4, Windows) key is pressed when release, keep the adding state in force. One can then use the unadorned left-click key to add notes. Right click to reset the adding mode. This feature is enabled only if allowed by the settings (but is true by default). See the same code in perfrollinput.cpp.

13.90.2.52 motion_notify()

```
bool seq64::seqroll::motion_notify (
            GdkEventMotion * ev )  [private]
```

We could allow move painting for chords, but that would take some tricky code to move all of the notes of the chord. And allowing painting here currently affects only one note after the chord itself is created.

Parameters

ev	Provides the button-release event to process.

Returns

Returns true if the event was processed.

13.90.2.53 clear_selected()

```
void seq64::seqroll::clear_selected ( )  [inline], [private]
```

13.90.2.54 clear_old()

```
void seq64::seqroll::clear_old ( )  [inline], [private]
```

13.90.2.55 clear_flags()

```
void seq64::seqroll::clear_flags ( )  [inline], [private]
```

13.90.2.56 scroll_offset_x()

```
int seq64::seqroll::scroll_offset_x (
            int x ) const  [inline], [private]
```

Offsets the x value by the x origin of the current page.

Parameters

x	The x value to offset.

13.90.2.57 scroll_offset_y()

```
int seq64::seqroll::scroll_offset_y (
            int y ) const  [inline], [private]
```

Offsets the y value by the y origin of the current page.

Parameters

y	The y value to offset.

13.90.2.58 set_current_offset_x_y()

```
void seq64::seqroll::set_current_offset_x_y (
            int x,
            int y )  [inline], [private]
```

Offsets the current x value by the x origin of the current page.

Parameters

x	The x value to offset.

void set_current_offset_x (int x) { m_current_x = x + m_scroll_offset_x; } Useful y calculation. Offsets the current y value by the y origin of the current page.

Parameters

y	The y value to offset.

void set_current_offset_y (int y) { m_current_y = y + m_scroll_offset_y; } Useful x and y calculation. Offsets the current x and y values by the x and y origin of the current page.

Parameters

x	The y value to offset.
y	The y value to offset.

13.90.2.59 adding()

```
bool seq64::seqroll::adding ( ) const  [inline], [private]
```

13.90.2.60 selecting()

```
bool seq64::seqroll::selecting ( ) const  [inline], [private]
```

13.90.2.61 growing()

```
bool seq64::seqroll::growing ( ) const  [inline], [private]
```

13.90.2.62 normal_action()

```
bool seq64::seqroll::normal_action ( ) const  [inline], [private]
```

Returns

Returns true if one of those five flags are set.

13.90.2.63 select_action()

```
bool seq64::seqroll::select_action ( ) const  [inline], [private]
```

Returns

Returns true if one of those four flags are set.

13.90.2.64 drop_action()

```
bool seq64::seqroll::drop_action ( ) const  [inline], [private]
```

Returns

Returns true if one of those two flags are set.

13.90.2.65 moving()

```
bool seq64::seqroll::moving ( ) const  [inline], [private]
```

13.90.2.66 on_realize()

```
void seq64::seqroll::on_realize ( )  [private]
```

13.90.2.67 on_expose_event()

```
bool seq64::seqroll::on_expose_event (
            GdkEventExpose * ev )  [private]
```

Parameters

ev	The expose event to process.

Returns

Always returns true.

13.90.2.68 on_button_press_event()

```
bool seq64::seqroll::on_button_press_event (
            GdkEventButton * ev )  [private]
```

Parameters

ev	The expose event to process.

Returns

Returns the result of the Seq24 interaction or the Fruity interaction, that is, the return value of Seq24SeqRollInput::on_button_press_event() or FruitySeqRollInput::on_button_press_event().

13.90.2.69 on_button_release_event()

```
bool seq64::seqroll::on_button_release_event (
            GdkEventButton * ev )  [private]
```

This function checks the "rc" interaction-method option, and calls the forwarding function for the seq24 or the fruity interaction method. Might be a good case to prefer inheritance and not try to support changing the interaction method without a restart of Sequencer64.

Parameters

ev	The button release event to process.

Returns

Returns the return value of Seq24SeqRollInput::on_button_release_event() or FruitySeqRollInput::on_↩ button_release_event().

13.90.2.70 on_motion_notify_event()

```
bool seq64::seqroll::on_motion_notify_event (
            GdkEventMotion * ev )  [private]
```

Parameters

ev	The motion-notification event to process.

Returns

Returns the return value of Seq24SeqRollInput::on_motion_notify_event() or FruitySeqRollInput::on_motion↩ _notify_event().

13.90.2.71 on_focus_in_event()

```
bool seq64::seqroll::on_focus_in_event (
            GdkEventFocus *  )  [private]
```

Sets the GDK HAS_FOCUS flag. Parameter "ev" is the event-focus event, not used.

Returns

Always returns false.

13.90.2.72 on_focus_out_event()

```
bool seq64::seqroll::on_focus_out_event (
            GdkEventFocus *  )  [private]
```

Resets the GDK HAS_FOCUS flag. Parameter "ev" is the event-focus event, not used.

Returns

Always returns false.

13.90.2.73 on_key_press_event()

```
bool seq64::seqroll::on_key_press_event (
            GdkEventKey * ev )  [private]
```

The start/end key may be the same key (i.e. SPACEBAR). Allow toggling when the same key is mapped to both triggers (i.e. SPACEBAR).

Concerning the usage of the arrow keys in this function: This code is reached, but has no visible effect. Why? I think they were meant to move the point for playback. We may have a bug with our new handling of triggers (unlikely), or maybe these depend upon the proper playback mode. In any case, the old functionality is preserved. However, if there are notes selected, then these keys support selection movement.

Since the Up and Down arrow keys are used for movement, we'd have to check selection status before trying to use them to move up and down in the piano roll, in smaller steps than the new Page-Up and Page-Down key support.

Parameters

ev	The key-press event to process.

Returns

Returns true if the key-press was handled.

I think we should be able to move and remove notes while playing, which is already supported using the mouse.

if (! perf().is_playing)

13.90.2.74 on_scroll_event()

```
bool seq64::seqroll::on_scroll_event (
            GdkEventScroll * ev )  [private]
```

This scroll event only handles basic scrolling without any modifier keys such as the Ctrl or Shift masks. The seqedit class handles that fun stuff.

Note that this function seems to duplicate the functionality of seqkeys::on_scroll_event(). Do we really need both? Which one do we need?

Parameters

ev	The scroll event to process.

Returns

Returns true if the scroll event was handled.

13.90.2.75 on_size_allocate()

```
void seq64::seqroll::on_size_allocate (
            Gtk::Allocation & a )  [private]
```

Calls the base-class version of this function and sets m_window_x and m_window_y to the width and height of the allocation parameter. Then calls update_sizes().

Parameters

a	The GDK allocation event object.

13.90.2.76 on_leave_notify_event()

```
bool seq64::seqroll::on_leave_notify_event (
            GdkEventCrossing * p0 )  [private]
```

Calls m_seqkeys_wid.set_hint_state(false). Parameter "ev" is the event-crossing event, not used.

Returns

Always returns false.

13.90.2.77 on_enter_notify_event()

```
bool seq64::seqroll::on_enter_notify_event (
            GdkEventCrossing * p0 )  [private]
```

Calls m_seqkeys_wid.set_hint_state(true). Parameter "ev" is the event-crossing event, not used.

Returns

Always returns false.

13.90.3 Friends And Related Function Documentation

13.90.3.1 FruitySeqRollInput

```
friend class FruitySeqRollInput  [friend]
```

We've absorbed the Seq24SeqRollInput class functionality back into seqroll, to save code.

13.90.4 Field Documentation

13.90.4.1 m_horizontal_adjust

```
Gtk::Adjustment& seq64::seqroll::m_horizontal_adjust  [private]
```

It would be good to be able to avoid this access!

Change Note layk 2016-10-17 Issue #46. No need for this declaration now, due to the fix in seqedit.

friend class seqedit; We need direct access to the horizontal scrollbar if we want to be able to make it follow the progress bar.

13.90.4.2 m_vertical_adjust

```
Gtk::Adjustment& seq64::seqroll::m_vertical_adjust  [private]
```

13.90.4.3 m_old

```
rect seq64::seqroll::m_old  [private]
```

13.90.4.4 m_selected

```
rect seq64::seqroll::m_selected  [private]
```

13.90.4.5 m_seq

```
sequence& seq64::seqroll::m_seq  [private]
```

13.90.4.6 m_seqkeys_wid

```
seqkeys& seq64::seqroll::m_seqkeys_wid  [private]
```

13.90.4.7 m_fruity_interaction

```
FruitySeqRollInput seq64::seqroll::m_fruity_interaction  [private]
```

13.90.4.8 m_pos

```
int seq64::seqroll::m_pos  [private]
```

Need to clarify what exactly this member is used for.

13.90.4.9 m_zoom

```
int seq64::seqroll::m_zoom  [private]
```

13.90.4.10 m_snap

```
int seq64::seqroll::m_snap  [private]
```

Same meaning as for the event-bar grid. This value is the denominator of the note size used for the snap.

13.90.4.11 m_ppqn

```
int seq64::seqroll::m_ppqn  [private]
```

Supports values other than the default of 192.

13.90.4.12 m_note_length

```
int seq64::seqroll::m_note_length  [private]
```

Used in the seq24seqroll module only.

13.90.4.13 m_scale

```
int seq64::seqroll::m_scale  [private]
```

13.90.4.14 m_chord

```
int seq64::seqroll::m_chord  [private]
```

13.90.4.15 m_key

```
int seq64::seqroll::m_key  [private]
```

13.90.4.16 m_adding

```
bool seq64::seqroll::m_adding  [private]
```

This flag was moved from both the fruity and the seq24 seqroll classes.

13.90.4.17 m_selecting

```
bool seq64::seqroll::m_selecting  [private]
```

13.90.4.18 m_moving

```
bool seq64::seqroll::m_moving  [private]
```

13.90.4.19 m_moving_init

```
bool seq64::seqroll::m_moving_init  [private]
```

Used in the fruity and seq24 mouse-handling modules.

13.90.4.20 m_growing

```
bool seq64::seqroll::m_growing  [private]
```

13.90.4.21 m_painting

```
bool seq64::seqroll::m_painting  [private]
```

Used in the fruity and seq24 mouse-handling modules.

13.90.4.22 m_paste

```
bool seq64::seqroll::m_paste  [private]
```

13.90.4.23 m_is_drag_pasting

```
bool seq64::seqroll::m_is_drag_pasting  [private]
```

Used in the fruity mouse-handling module.

13.90.4.24 m_is_drag_pasting_start

```
bool seq64::seqroll::m_is_drag_pasting_start  [private]
```

Used in the fruity mouse-handling module.

13.90.4.25 m_justselected_one

```
bool seq64::seqroll::m_justselected_one  [private]
```

Used in the fruity mouse-handling module.

13.90.4.26 m_move_delta_x

```
int seq64::seqroll::m_move_delta_x  [private]
```

13.90.4.27 m_move_delta_y

```
int seq64::seqroll::m_move_delta_y  [private]
```

13.90.4.28 m_move_snap_offset_x

```
int seq64::seqroll::m_move_snap_offset_x  [private]
```

13.90.4.29 m_progress_x

```
int seq64::seqroll::m_progress_x  [private]
```

13.90.4.30 m_scroll_offset_ticks

```
int seq64::seqroll::m_scroll_offset_ticks  [private]
```

13.90.4.31 m_scroll_offset_key

```
int seq64::seqroll::m_scroll_offset_key  [private]
```

13.90.4.32 m_scroll_offset_x

```
int seq64::seqroll::m_scroll_offset_x  [private]
```

13.90.4.33 m_scroll_offset_y

```
int seq64::seqroll::m_scroll_offset_y  [private]
```

13.90.4.34 m_transport_follow

```
bool seq64::seqroll::m_transport_follow  [private]
```

13.90.4.35 m_trans_button_press

```
bool seq64::seqroll::m_trans_button_press  [private]
```

13.90.4.36 m_background_sequence

```
int seq64::seqroll::m_background_sequence  [private]
```

13.90.4.37 m_drawing_background_seq

```
bool seq64::seqroll::m_drawing_background_seq  [private]
```

13.90.4.38 m_status

```
midibyte seq64::seqroll::m_status  [private]
```

Used in set_background_sequence(), change_horz(), change_vert(), reset().... Never set to true, except in seq24, let's just comment it out for now. It hasn't been used in sequencer64 for awhile now.

bool m_ignore_redraw; The current status/event selected in the seqedit. Not used in seqroll at present.

13.90.4.39 m_cc

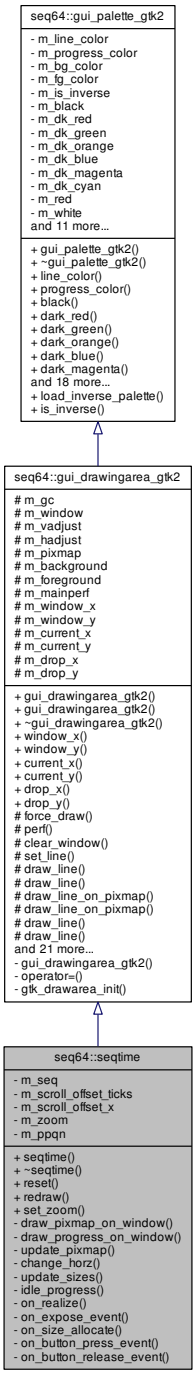
```
midibyte seq64::seqroll::m_cc  [private]
```

Not used in seqroll at present.

13.91 seq64::seqtime Class Reference

This class implements the piano time, whatever that is.

Inheritance diagram for seq64::seqtime:



Public Member Functions

- seqtime (sequence &seq, perform &p, int zoom, Gtk::Adjustment &hadjust, int ppqn=SEQ64_USE_DEFA↩ ULT_PPQN)

  Principal constructor.
- virtual ~seqtime ()

  Let's provide a do-nothing virtual destructor.

- void reset ()

  Sets the scroll offset tick and x values, updates the sizes and the pixmap, and resets the window.
- void redraw ()

  Very similar to the reset() function, except it doesn't update the sizes.
- void set_zoom (int zoom)

  Sets the zoom to the given value and resets the window.

Private Member Functions

- void draw_pixmap_on_window ()

  Draws the pixmap on the window.
- void draw_progress_on_window ()
- void update_pixmap ()

  Updates the pixmap.
- void change_horz ()

  Changes the scrolling horizontal offset, updates the pixmap, and forces a redraw.
- void update_sizes ()

  Updates the pixmap to a new size and queues up a draw operation.
- bool idle_progress ()

  Simply returns true.
- void on_realize ()

  Called when the window is drawn.
- bool on_expose_event (GdkEventExpose *a_ev)

  Implements the on-expose event handler.
- void on_size_allocate (Gtk::Allocation &)

  Implements the on-size-allocate event handler.
- bool on_button_press_event (GdkEventButton *)

  Implements the on-button-press event handler.
- bool on_button_release_event (GdkEventButton *)

  Implements the on-button-release event handler.

Private Attributes

- sequence & m_seq
- int m_scroll_offset_ticks
- int m_scroll_offset_x
- int m_zoom

  one pixel == m_zoom ticks
- int m_ppqn

Additional Inherited Members

13.91.1 Constructor & Destructor Documentation

13.91.1.1 seqtime()

```
seq64::seqtime::seqtime (
            sequence & seq,
            perform & p,
            int zoom,
            Gtk::Adjustment & hadjust,
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

In the constructor you can only allocate colors; get_window() returns 0 because the window is not yet realized>

13.91.1.2 ~seqtime()

```
virtual seq64::seqtime::~seqtime ( )  [inline], [virtual]
```

13.91.2 Member Function Documentation

13.91.2.1 reset()

```
void seq64::seqtime::reset ( )
```

Basically identical to seqevent::reset().

13.91.2.2 redraw()

```
void seq64::seqtime::redraw ( )
```

13.91.2.3 set_zoom()

```
void seq64::seqtime::set_zoom (
            int zoom )
```

Parameters

zoom	The desired zoom value, assumed to be validated already. See the seqedit::set_zoom() function.

13.91.2.4 draw_pixmap_on_window()

```
void seq64::seqtime::draw_pixmap_on_window ( )  [private]
```

13.91.2.5 draw_progress_on_window()

```
void seq64::seqtime::draw_progress_on_window ( )  [private]
```

13.91.2.6 update_pixmap()

```
void seq64::seqtime::update_pixmap ( )  [private]
```

When the zoom is at 32 ticks per pixel, there is a thick bar for every measure, and a measure number and major time division every 4 measures.at the default PPQN of 192.

A major line is a line that has a measure number in the timeline. The number of measures in a major line is 1 for zooms from 1:1 to 1:8; 2 for zoom 1:16; 4 for zoom 1:32; 8 for zoom 1:64 (new); and 16 for zoom 1:128. Zooms 1:64 and above look good only for high PPQN values.

We calculate the measure length in 32nd notes. This value is, of course, 32, when the time signature is 4/4. Then calculate measures/line. "measures_per_major" is more like "measures per major line". With a higher zoom than 32, this calculation yields a floating-point exception if m_zoom

32, so we rearrange the calculation and hope that it still works out the

same for smaller values.

Stazed:

At 32, a bar every measure.

```
zoom    32          16          8         4         1
ml
1       128
2       64
4       32        16          8
8       16m       8           4           2       1
16      8m        4           2           1       1
32      4m        2           1           1       1
64      2m        1           1           1       1
128     1m        1           1           1       1
```

Todo Sizing needs to be controlled by font parameters. Instead of 19 or 20, estimate the width of 3 letters. Instead of 9 pixels down, use the height of the seqtime and the height of a character.

13.91.2.7 change_horz()

```
void seq64::seqtime::change_horz ( )  [private]
```

13.91.2.8 update_sizes()

```
void seq64::seqtime::update_sizes ( )  [private]
```

13.91.2.9 idle_progress()

```
bool seq64::seqtime::idle_progress ( )  [inline], [private]
```

13.91.2.10 on_realize()

```
void seq64::seqtime::on_realize ( )  [private]
```

Call the base-class version of this function first. Then addition resources are allocated.

13.91.2.11 on_expose_event()

```
bool seq64::seqtime::on_expose_event (
            GdkEventExpose * a_ev )  [private]
```

13.91.2.12 on_size_allocate()

```
void seq64::seqtime::on_size_allocate (
            Gtk::Allocation & a )  [private]
```

13.91.2.13 on_button_press_event()

```
bool seq64::seqtime::on_button_press_event (
            GdkEventButton *  )  [inline], [private]
```

Simply returns false.

13.91.2.14 on_button_release_event()

```
bool seq64::seqtime::on_button_release_event (
            GdkEventButton *  )  [inline], [private]
```

Simply returns false.

13.91.3 Field Documentation

13.91.3.1 m_seq

```
sequence& seq64::seqtime::m_seq  [private]
```

13.91.3.2 m_scroll_offset_ticks

```
int seq64::seqtime::m_scroll_offset_ticks  [private]
```

13.91.3.3 m_scroll_offset_x

```
int seq64::seqtime::m_scroll_offset_x  [private]
```

13.91.3.4 m_zoom

```
int seq64::seqtime::m_zoom  [private]
```

13.91.3.5 m_ppqn

```
int seq64::seqtime::m_ppqn  [private]
```

13.92 seq64::sequence Class Reference

The sequence class is firstly a receptable for a single track of MIDI data read from a MIDI file or edited into a pattern.

Public Types

- enum select_action_e {
  e_select,
  e_select_one,
  e_is_selected,
  e_would_select,
  e_deselect,
  e_toggle_selection,
  e_remove_one }

  This enumeration is used in selecting events and note.

Public Member Functions

- sequence (int ppqn=SEQ64_USE_DEFAULT_PPQN)

  Principal constructor.
- ~sequence ()

  A rote destructor.
- void partial_assign (const sequence &rhs)

  A cut-down version of principal assignment operator.
- event_list & events ()

  'Getter' function for member m_events Non-const version.
- const event_list & events () const

  'Getter' function for member m_events Const version.
- bool any_selected_notes () const

  'Getter' function for member m_events.any_selected_notes()
- const triggers::List & triggerlist () const

  'Getter' function for member m_triggers This is the const version.
- triggers::List & triggerlist ()

  'Getter' function for member m_triggers
- int get_trigger_count () const

  Gets the trigger count, useful for exporting a sequence.
- void set_trigger_paste_tick (midipulse tick)
- midipulse get_trigger_paste_tick () const
- int number () const

  'Getter' function for member m_seq_number
- void number (int seqnum)

  'Setter' function for member m_seq_number This setter will set the sequence number only if it has not already been set.
- void modify ()

  A convenience function that we have to put here so that the m_parent pointer can be used without an additional include-file in the sequence.hpp module.
- int event_count () const

  Returns the number of events stored in m_events.
- void set_hold_undo (bool hold)

  Modifies the undo-hold container.
- int get_hold_undo () const

  'Getter' function for member m_events_undo_hold.count()
- void set_have_undo ()

  'Setter' function for member m_have_undo
- bool have_undo () const

  'Getter' function for member m_have_undo
- void set_have_redo ()

  'Setter' function for member m_have_redo No reliable way to "unmodify" the performance here.
- bool have_redo () const

  'Getter' function for member m_have_redo
- void push_undo (bool hold=false)

  Pushes the event-list into the undo-list or the upcoming undo-hold-list.
- void pop_undo ()

  If there are items on the undo list, this function pushes the event-list into the redo-list, puts the top of the undo-list into the event-list, pops from the undo-list, calls verify_and_link(), and then calls unselect.
- void pop_redo ()

  If there are items on the redo list, this function pushes the event-list into the undo-list, puts the top of the redo-list into the event-list, pops from the redo-list, calls verify_and_link(), and then calls unselect.

- void push_trigger_undo ()

  Calls triggers::push_undo() with locking.
- void pop_trigger_undo ()

  Calls triggers::pop_undo() with locking.
- void pop_trigger_redo ()

  Calls triggers::pop_redo() with locking.
- void set_name (const std::string &name)

  Sets the sequence name member, m_name.
- void set_name (char *name)

  Sets the sequence name member, m_name.
- void set_measures (int lengthmeasures)
- int get_measures ()
- int get_ppqn () const

  'Getter' function for member m_ppqn Provided as a convenience for the editable_events class.
- void set_beats_per_bar (int beatspermeasure)

  'Setter' function for member m_time_beats_per_measure
- int get_beats_per_bar () const

  'Getter' function for member m_time_beats_per_measure
- void set_beat_width (int beatwidth)

  'Setter' function for member m_time_beat_width
- int get_beat_width () const

  'Getter' function for member m_time_beat_width
- midipulse measures_to_ticks (int measures=1) const

  A convenience function for calculating the number of ticks in the given number of measures.
- void clocks_per_metronome (int cpm)

  'Setter' function for member m_clocks_per_metronome
- int clocks_per_metronome () const

  'Getter' function for member m_clocks_per_metronome
- void set_32nds_per_quarter (int tpq)

  'Setter' function for member m_32nds_per_quarter
- int get_32nds_per_quarter () const

  'Getter' function for member m_32nds_per_quarter
- void us_per_quarter_note (long upqn)

  'Setter' function for member m_us_per_quarter_note
- long us_per_quarter_note () const

  'Getter' function for member m_us_per_quarter_note
- void set_rec_vol (int rec_vol)

  'Setter' function for member m_rec_vol If this velocity is greater than zero, then m_note_on_velocity will be set as well.
- void set_song_mute (bool mute)

  'Setter' function for member m_song_mute This function also calls set_dirty_mp() to make sure that the perfnames panel is updated to show the new mute status of the sequence.
- void toggle_song_mute ()

  'Setter' function for member m_song_mute This function toogles the song muting status.
- bool get_song_mute () const

  'Getter' function for member m_song_mute
- void apply_song_transpose ()

  Applies the transpose value held by the master MIDI buss object, if non-zero, and if the sequence is set to be transposable.
- void set_transposable (bool flag)

  'Setter' function for member m_transposable Changing this flag modifies the sequence and performance.

- bool get_transposable () const

  'Getter' function for member m_transposable
- const char * get_name () const

  'Getter' function for member m_name pointer
- const std::string & name () const

  'Getter' function for member m_name
- void set_editing (bool edit)

  'Setter' function for member m_editing
- bool get_editing () const

  'Getter' function for member m_editing
- void set_raise (bool edit)

  'Setter' function for member m_raise
- bool get_raise (void) const

  'Getter' function for member m_raise
- void set_length (midipulse len=0, bool adjust_triggers=true, bool verify=true)

  Sets the length (m_length) and adjusts triggers for it, if desired.
- midipulse get_length () const

  'Getter' function for member m_length
- midipulse get_last_tick ()

  Returns the last tick played, and is used by the editor's idle function.
- void set_last_tick (midipulse tick)

  'Setter' function for member m_last_tick This function used to be called "set_orig_tick()", now renamed to match up with get_last_tick().
- midipulse mod_last_tick ()

  Some MIDI file errors and other things can lead to an m_length of 0, which causes arithmetic errors when m_last_tick is modded against it.
- void set_playing (bool)

  Sets the playing state of this sequence.
- bool get_playing () const

  'Getter' function for member m_playing
- void toggle_playing ()

  Toggles the playing status of this sequence.
- void toggle_queued ()

  'Setter' function for member m_queued and m_queued_tick Toggles the queued flag and sets the dirty-mp flag.
- void off_queued ()

  'Setter' function for member m_queued Turns off (resets) the queued flag and sets the dirty-mp flag.
- void on_queued ()

  'Setter' function for member m_queued Turns on (sets) the queued flag and sets the dirty-mp flag.
- bool get_queued () const

  'Getter' function for member m_queued
- midipulse get_queued_tick () const

  'Getter' function for member m_queued_tick
- bool check_queued_tick (midipulse tick) const

  Helper function for perform.
- void set_recording (bool)

  'Setter' function for member m_recording and m_notes_on
- bool get_recording () const

  'Getter' function for member m_recording
- void set_snap_tick (int st)

  'Setter' function for member m_snap_tick
- void set_quantized_rec (bool qr)

'Setter' function for member m_quantized_rec

- bool get_quantized_rec () const

  'Getter' function for member m_quantized_rec

- void set_thru (bool)

  'Setter' function for member m_thru

- bool get_thru () const

  'Getter' function for member m_thru

- bool is_dirty_main ()

  Returns the value of the dirty main flag, and sets that flag to false (i.e.

- bool is_dirty_edit ()

  Returns the value of the dirty edit flag, and sets that flag to false.

- bool is_dirty_perf ()

  Returns the value of the dirty performance flag, and sets that flag to false.

- bool is_dirty_names ()

  Returns the value of the dirty names (heh heh) flag, and sets that flag to false.

- void set_dirty_mp ()

  Sets the dirty flags for names, main, and performance.

- void set_dirty ()

  Call set_dirty_mp() and then sets the dirty flag for editing.

- midibyte get_midi_channel () const

  'Getter' function for member m_midi_channel

- bool is_smf_0 () const

  Returns true if this sequence is an SMF 0 sequence.

- void set_midi_channel (midibyte ch, bool user_change=false)

  Sets the m_midi_channel number>

- void print () const

  Prints a list of the currently-held events.

- void print_triggers () const

  Prints a list of the currently-held triggers.

- void play (midipulse tick, bool playback_mode)

  The play() function dumps notes starting from the given tick, and it pre-buffers ahead.

- void play_queue (midipulse tick, bool playbackmode)

  Provides encapsulation for a series of called used in perform::play().

- void add_note (midipulse tick, midipulse len, int note, bool paint=false, int velocity=SEQ64_PRESERVE_V↩ ELOCITY)

  Adds a note of a given length and note value, at a given tick location.

- bool add_event (const event &er)

  Adds an event to the internal event list in a sorted manner.

- void add_chord (int chord, midipulse tick, midipulse len, int note)

  Adds a chord of a given length and note value, at a given tick location.

- void add_event (midipulse tick, midibyte status, midibyte d0, midibyte d1, bool paint=false)

  Adds a event of a given status value and data values, at a given tick location.

- bool append_event (const event &er)

  An alternative to add_event() that does not sort the events, even if the event list is implemented by an std::list.

- void sort_events ()

  Calls event_list::sort().

- void add_trigger (midipulse tick, midipulse len, midipulse offset=0, bool adjust_offset=true)

  Adds a trigger.

- void split_trigger (midipulse tick)

  Splits a trigger.

- void grow_trigger (midipulse tick_from, midipulse tick_to, midipulse len)

Grows a trigger.

- void del_trigger (midipulse tick)

  Deletes a trigger, that brackets the given tick, from the trigger-list.
- bool get_trigger_state (midipulse tick)

  Checks the list of triggers against the given tick.
- bool select_trigger (midipulse tick)

  Checks the list of triggers against the given tick.
- triggers::List get_triggers () const

  Returns a copy of the triggers for this sequence.
- bool unselect_triggers ()

  Unselects all triggers.
- bool intersect_triggers (midipulse position, midipulse &start, midipulse &ender)

  This function examines each trigger in the trigger list.
- bool intersect_notes (midipulse position, midipulse position_note, midipulse &start, midipulse &ender, int &note)

  This function examines each note in the event list.
- bool intersect_events (midipulse posstart, midipulse posend, midibyte status, midipulse &start)

  This function examines each non-note event in the event list.
- void del_selected_trigger ()

  Deletes the first selected trigger that is found.
- void cut_selected_trigger ()

  Copies and deletes the first selected trigger that is found.
- void copy_selected_trigger ()

  First, this function clears any unpasted middle-click tick setting.
- void paste_trigger (midipulse paste_tick=SEQ64_NO_PASTE_TRIGGER)

  If there is a copied trigger, then this function grabs it from the trigger clipboard and adds it.
- bool move_selected_triggers_to (midipulse tick, bool adjust_offset, triggers::grow_edit_t which=triggers::GROW_MOVE)

  Moves selected triggers as per the given parameters.
- midipulse selected_trigger_start ()

  Gets the last-selected trigger's start tick.
- midipulse selected_trigger_end ()

  Gets the selected trigger's end tick.
- midipulse get_max_trigger ()

  Get the ending value of the last trigger in the trigger-list.
- void move_triggers (midipulse start_tick, midipulse distance, bool direction)

  Moves triggers in the trigger-list.
- void copy_triggers (midipulse start_tick, midipulse distance)

  Copies triggers to another location.
- void clear_triggers ()

  Clears the whole list of triggers.
- midipulse get_trigger_offset () const

  'Getter' function for member m_trigger_offset
- void set_midi_bus (char mb, bool user_change=false)

  Sets the MIDI buss/port number to dump MIDI data to.
- char get_midi_bus () const

  'Getter' function for member m_bus
- void set_master_midi_bus (mastermidibus *mmb)

  'Setter' function for member m_masterbus Do we need to call set_dirty_mp() here? It doesn't affect any user-interface elements.
- int select_note_events (midipulse tick_s, int note_h, midipulse tick_f, int note_l, select_action_e action)

Selects events in range provided: tick start, note high, tick end, and note low.

- int select_events (midipulse tick_s, midipulse tick_f, midibyte status, midibyte cc, select_action_e action)

  Select all events in the given range, and returns the number selected.
- int select_events (midibyte status, midibyte cc, bool inverse=false)

  Select all events with the given status, and returns the number selected.
- int select_events (midipulse tick_s, midipulse tick_f, midibyte status)
- int select_event_handle (midipulse tick_s, midipulse tick_f, midibyte status, midibyte cc, int data_s)

  Use selected note ons if any.
- int select_linked (long tick_s, long tick_f, midibyte status)

  Used with seqevent when selecting Note On or Note Off, this function will select the opposite linked event.
- int select_even_or_odd_notes (int note_len, bool even)

  Selects every other note.
- void select_all_notes (bool inverse=false)

  New convenience function.
- int get_num_selected_notes () const

  Counts the selected notes in the event list.
- int get_num_selected_events (midibyte status, midibyte cc) const

  Counts the selected events, with the given status, in the event list.
- void select_all ()

  Selects all events, unconditionally.
- void copy_selected ()

  Copies the selected events.
- void cut_selected (bool copyevents=true)

  Cuts the selected events.
- void paste_selected (midipulse tick, int note)

  Pastes the selected notes (and only note events) at the given tick and the given note value.
- void get_selected_box (midipulse &tick_s, int &note_h, midipulse &tick_f, int &note_l)

  Returns the 'box' of the selected items.
- void get_clipboard_box (midipulse &tick_s, int &note_h, midipulse &tick_f, int &note_l)

  Returns the 'box' of the clipboard items.
- midipulse adjust_timestamp (midipulse t, bool isnoteoff)

  A new function to consolidate the adjustment of timestamps in a pattern.
- midipulse trim_timestamp (midipulse t)

  A new function to consolidate the adjustment of timestamps in a pattern.
- midipulse clip_timestamp (midipulse ontime, midipulse offtime)

  A new function to consolidate the growth/shrinkage of timestamps in a pattern.
- void move_selected_notes (midipulse deltatick, int deltanote)

  Removes and adds selected notes in position.
- bool stream_event (event &ev)

  Streams the given event.
- bool change_event_data_range (midipulse tick_s, midipulse tick_f, midibyte status, midibyte cc, int d_s, int d_f)

  Changes the event data range.
- void change_event_data_lfo (double value, double range, double speed, double phase, wave_type_t wave, midibyte status, midibyte cc)

  Modifies data events according to the parameters active in the LFO window (lfownd).
- void increment_selected (midibyte status, midibyte)

  Increments events the match the given status and control values.
- void decrement_selected (midibyte status, midibyte)

  Decrements events the match the given status and control values.
- void grow_selected (midipulse deltatick)

The original description was "Moves note off event." But this also gets called when simply selecting a second note via a ctrl-left-click, even in seq24.

- void stretch_selected (midipulse deltatick)

  Performs a stretch operation on the selected events.
- bool remove_marked ()

  Removes marked events.
- bool mark_selected ()

  Marks the selected events.
- void remove_selected ()

  Removes selected events.
- void unpaint_all ()

  Unpaints all events in the event-list.
- void unselect ()

  Deselects all events, unconditionally.
- void verify_and_link ()

  This function verifies state: all note-ons have a note-off, and it links note-offs with their note-ons.
- void link_new ()

  Links a new event.
- void zero_markers ()

  Resets everything to zero.
- void play_note_on (int note)

  Plays a note from the piano roll on the main bus on the master MIDI buss.
- void play_note_off (int note)

  Turns off a note from the piano roll on the main bus on the master MIDI buss.
- void off_playing_notes ()

  Sends a note-off event for all active notes.
- void stop (bool song_mode=false)

  Provides a helper function simplify and speed up perform :: reset_sequences().
- void pause (bool song_mode=false)

  A pause version of stop().
- void reset_draw_marker ()

  This refreshes the play marker to the last tick.
- void reset_draw_trigger_marker ()

  Sets the draw-trigger iterator to the beginning of the trigger list.
- draw_type_t get_next_note_event (midipulse *tick_s, midipulse *tick_f, int *note, bool *selected, int *velocity)

  Each call to seqdata() fills the passed references with a events elements, and returns true.
- bool get_minmax_note_events (int &lowest, int &highest)

  A new function provided so that we can find the minimum and maximum notes with only one (not two) traversal of the event list.
- bool get_next_event (midibyte status, midibyte cc, midipulse *tick, midibyte *d0, midibyte *d1, bool *selected, int evtype=EVENTS_ALL)

  Get the next event in the event list that matches the given status and control character.
- bool get_next_event (midibyte *status, midibyte *cc)

  Get the next event in the event list.
- bool get_next_trigger (midipulse *tick_on, midipulse *tick_off, bool *selected, midipulse *tick_offset)

  Get the next trigger in the trigger list, and set the parameters based on that trigger.
- void quantize_events (midibyte status, midibyte cc, midipulse snap_tick, int divide, bool linked=false)

  Grabs the specified events, puts them into a list, quantizes them against the snap ticks, and merges them in to the event container.
- void push_quantize (midibyte status, midibyte cc, midipulse snap_tick, int divide, bool linked=false)

A new convenience function.

- void transpose_notes (int steps, int scale)

  Transposes notes by the given steps, in accordance with the given scale.
- void shift_notes (midipulse ticks)
- void multiply_pattern (double multiplier)
- midibyte musical_key () const

  'Getter' function for member m_musical_key
- void musical_key (int key)

  'Setter' function for member m_musical_key
- midibyte musical_scale () const

  'Getter' function for member m_musical_scale
- void musical_scale (int scale)

  'Setter' function for member m_musical_scale
- int background_sequence () const

  'Getter' function for member m_background_sequence
- void background_sequence (int bs)

  'Setter' function for member m_background_sequence Only partial validation at present, we do not want the upper limit to be hard-wired at this time.
- void show_events () const

  A member function to dump a summary of events stored in the event-list of a sequence.
- void copy_events (const event_list &newevents)

  Copies an external container of events into the current container, effectively replacing all of its events.
- midipulse note_off_margin () const

  'Getter' function for member m_note_length

Private Types

- typedef std::stack< event_list > EventStack

  Provides a stack of event-lists for use with the undo and redo facility.

Private Member Functions

- sequence & operator= (const sequence &rhs)
- bool event_in_range (const event &e, midibyte status, midipulse tick_s, midipulse tick_f) const

  A convenience function used a couple of times.
- void set_parent (perform *p)

  'Setter' function for member m_parent Sets the "parent" of this sequence, so that it can get some extra information about the performance.
- void put_event_on_bus (event &ev)

  Takes an event that this sequence is holding, and places it on the MIDI buss.
- void set_trigger_offset (midipulse trigger_offset)

  Sets m_trigger_offset and wraps it to m_length.
- void adjust_trigger_offsets_to_length (midipulse newlen)

  Adjusts trigger offsets to the length specified for all triggers, and undo triggers.
- midipulse adjust_offset (midipulse offset)
- void remove (event_list::iterator i)

  A helper function, which does not lock/unlock, so it is unsafe to call without supplying an iterator from the event-list.
- void remove (event &e)

  A helper function, which does not lock/unlock, so it is unsafe to call without supplying an iterator from the event-list.
- void remove_all ()

  Clears all events from the event container.
- bool channel_match (const event &e) const

  Checks to see if the event's channel matches the sequence's nominal channel.

Private Attributes

- perform * m_parent

  For pause support, we need a way for the sequence to find out if JACK transport is active.
- event_list m_events

  This list holds the current pattern/sequence events.
- triggers m_triggers

  The triggers associated with the sequence, used in the performance/song editor.
- event_list m_events_undo_hold

  Provides a list of event actions to undo for the Stazed LFO and seqdata support.
- bool m_have_undo

  A stazed flag indicating that we have some undo information.
- bool m_have_redo

  A stazed flag indicating that we have some redo information.
- EventStack m_events_undo

  Provides a list of event actions to undo.
- EventStack m_events_redo

  Provides a list of event actions to redo.
- event_list::iterator m_iterator_draw

  An iterator for drawing events.
- bool m_channel_match

  A new feature for recording, based on a "stazed" feature.
- midibyte m_midi_channel

  Contains the proper MIDI channel for this sequence.
- midibyte m_bus

  Contains the proper MIDI bus number for this sequence.
- bool m_song_mute

  Provides a flag for the song playback mode muting.
- bool m_transposable

  Indicate if the sequence is transposable or not.
- int m_notes_on

  Provides a member to hold the polyphonic step-edit note counter.
- mastermidibus * m_masterbus

  Provides the master MIDI buss which handles the output of the sequence to the proper buss and MIDI channel.
- int m_playing_notes [SEQ64_MIDI_NOTES_MAX]

  Provides a "map" for Note On events.
- bool m_was_playing

  Indicates if the sequence was playing.
- bool m_playing

  True if sequence playback currently is in progress for this sequence.
- bool m_recording

  True if sequence recording currently is in progress for this sequence.
- bool m_quantized_rec

  True if recording in quantized mode.
- bool m_thru

  True if recording in MIDI-through mode.
- bool m_queued

  True if the events are queued.
- bool m_dirty_main

  These flags indicate that the content of the sequence has changed due to recording, editing, performance management, or even (?) a name change.

- bool m_dirty_edit

  Provides the main is-edited flag.
- bool m_dirty_perf

  Provides performance dirty flagflag.
- bool m_dirty_names

  Provides the names dirtiness flag.
- bool m_editing

  Indicates that the sequence is currently being edited.
- bool m_raise

  Used in seqmenu and seqedit.
- std::string m_name

  Provides the name/title for the sequence.
- midipulse m_last_tick

  These members manage where we are in the playing of this sequence, including triggering.
- midipulse m_queued_tick

  Provides the next tick to play?
- midipulse m_trigger_offset

  Provides the trigger offset.
- const int m_maxbeats

  This constant provides the scaling used to calculate the time position in ticks (pulses), based also on the PPQN value.
- int m_ppqn

  Holds the PPQN value for this sequence, so that we don't have to rely on a global constant value.
- int m_seq_number

  A new member so that the sequence number is carried along with the sequence.
- midipulse m_length

  Holds the length of the sequence in pulses (ticks).
- midipulse m_snap_tick

  The size of snap in units of pulses (ticks).
- int m_time_beats_per_measure

  Provides the number of beats per bar used in this sequence.
- int m_time_beat_width

  Provides with width of a beat.
- int m_clocks_per_metronome

  Augments the beats/bar and beat-width with the additional values included in a Time Signature meta event.
- int m_32nds_per_quarter

  Augments the beats/bar and beat-width with the additional values included in a Time Signature meta event.
- long m_us_per_quarter_note

  Augments the beats/bar and beat-width with the additional values included in a Tempo meta event.
- int m_rec_vol

  The volume to be used when recording.
- int m_note_on_velocity

  The Note On velocity used.
- int m_note_off_velocity

  The Note Off velocity used.
- midibyte m_musical_key

  Holds a copy of the musical key for this sequence, which we now support writing to this sequence.
- midibyte m_musical_scale

  Holds a copy of the musical scale for this sequence, which we now support writing to this sequence.
- int m_background_sequence

  Holds a copy of the background sequence number for this sequence, which we now support writing to this sequence.
- mutex m_mutex

  Provides locking for the sequence.
- const midipulse m_note_off_margin

  Provides the number of ticks to shave off of the end of painted notes.

Static Private Attributes

- static event_list m_events_clipboard

  A static clipboard for holding pattern/sequence events.

Friends

- class perform
- class triggers

13.92.1 Detailed Description

More members than you can shake a stick at.

13.92.2 Member Typedef Documentation

13.92.2.1 EventStack

```
typedef std::stack<event_list> seq64::sequence::EventStack  [private]
```

13.92.3 Member Enumeration Documentation

13.92.3.1 select_action_e

```
enum seq64::sequence::select_action_e
```

Se the select_note_events() and select_events() functions.

Enumerator

e_select	Selection in progress.
e_select_one	To select a single event.
e_is_selected	The events are selected.
e_would_select	The events would be selected.
e_deselect	To deselect event under the cursor.
e_toggle_selection	Toggle selection under cursor.
e_remove_one	To remove one note under the cursor.

13.92.4 Constructor & Destructor Documentation

13.92.4.1 sequence()

```
seq64::sequence::sequence (
            int ppqn = SEQ64_USE_DEFAULT_PPQN )
```

Parameters

ppqn	Provides the PPQN parameter to perhaps alter the default PPQN value of this sequence.

13.92.4.2 ~sequence()

```
seq64::sequence::~sequence ( )
```

13.92.5 Member Function Documentation

13.92.5.1 operator=()

```
sequence& seq64::sequence::operator= (
            const sequence & rhs )  [private]
```

13.92.5.2 partial_assign()

```
void seq64::sequence::partial_assign (
            const sequence & rhs )
```

We're replacing that incomplete function (many members are not assigned) with the more accurately-named partial_assign() function.

It did not assign them all, so we created this partial_assign() function to do this work, and replaced operator =() with this function in client code.

Threadsafe

Parameters

rhs	Provides the source of the new member values.

13.92.5.3 events() [1/2]

```
event_list& seq64::sequence::events ( )  [inline]
```

13.92.5.4 events() [2/2]

```
const event_list& seq64::sequence::events ( ) const  [inline]
```

13.92.5.5 any_selected_notes()

```
bool seq64::sequence::any_selected_notes ( ) const  [inline]
```

13.92.5.6 triggerlist() [1/2]

```
const triggers::List& seq64::sequence::triggerlist ( ) const  [inline]
```

13.92.5.7 triggerlist() [2/2]

```
triggers::List& seq64::sequence::triggerlist ( )  [inline]
```

13.92.5.8 get_trigger_count()

```
int seq64::sequence::get_trigger_count ( ) const  [inline]
```

13.92.5.9 set_trigger_paste_tick()

```
void seq64::sequence::set_trigger_paste_tick (
            midipulse tick )  [inline]
```

13.92.5.10 get_trigger_paste_tick()

```
midipulse seq64::sequence::get_trigger_paste_tick ( ) const  [inline]
```

13.92.5.11 number() [1/2]

```
int seq64::sequence::number ( ) const  [inline]
```

13.92.5.12 number() [2/2]

```
void seq64::sequence::number (
            int seqnum )  [inline]
```

13.92.5.13 modify()

```
void seq64::sequence::modify ( )
```

One minor issue is how can we unmodify the performance? We'd need to keep a count/stack of modifications over all sequences in the performance. Probably not practical, in general. We will probably keep track of the modification of the buss (port) and channel numbers, as per GitHub Issue #47..

13.92.5.14 event_count()

```
int seq64::sequence::event_count ( ) const
```

Note that only playable events are counted in a sequence. If a sequence class function provides a mutex, call m_events.count() instead.

Threadsafe

Returns

Returns m_events.count().

13.92.5.15 set_hold_undo()

```
void seq64::sequence::set_hold_undo (
            bool hold )
```

Parameters

hold	If true, then the events in the m_events container are added to the m_events_undo_hold container. Otherwise, that container is cleared.

13.92.5.16 get_hold_undo()

```
int seq64::sequence::get_hold_undo ( ) const  [inline]
```

13.92.5.17 set_have_undo()

```
void seq64::sequence::set_have_undo ( )  [inline]
```

13.92.5.18 have_undo()

```
bool seq64::sequence::have_undo ( ) const  [inline]
```

13.92.5.19 set_have_redo()

```
void seq64::sequence::set_have_redo ( )  [inline]
```

13.92.5.20 have_redo()

```
bool seq64::sequence::have_redo ( ) const  [inline]
```

13.92.5.21 push_undo()

```
void seq64::sequence::push_undo (
            bool hold = false )
```

Threadsafe

Parameters

hold	A new parameter for the stazed undo/redo support, not yet used. If true, then the events go into the undo-hold-list.

13.92.5.22 pop_undo()

```
void seq64::sequence::pop_undo ( )
```

We would like to be able to set perform's modify flag to false here, but other sequences might still be in a modified state. We could add a modify flag to sequence, and falsify that flag here. Something to think about.

Threadsafe

13.92.5.23 pop_redo()

```
void seq64::sequence::pop_redo ( )
```

Threadsafe

13.92.5.24 push_trigger_undo()

```
void seq64::sequence::push_trigger_undo ( )
```

Threadsafe

13.92.5.25 pop_trigger_undo()

```
void seq64::sequence::pop_trigger_undo ( )
```

Threadsafe

13.92.5.26 pop_trigger_redo()

```
void seq64::sequence::pop_trigger_redo ( )
```

Threadsafe

13.92.5.27 set_name() [1/2]

```
void seq64::sequence::set_name (
            const std::string & name )
```

13.92.5.28 set_name() [2/2]

```
void seq64::sequence::set_name (
            char * name )
```

13.92.5.29 set_measures()

```
void seq64::sequence::set_measures (
            int lengthmeasures )
```

13.92.5.30 get_measures()

```
int seq64::sequence::get_measures ( )
```

13.92.5.31 get_ppqn()

```
int seq64::sequence::get_ppqn ( ) const  [inline]
```

13.92.5.32 set_beats_per_bar()

```
void seq64::sequence::set_beats_per_bar (
            int beatspermeasure )
```

Threadsafe

Parameters

beatspermeasure	The new setting of the beats-per-bar value.

13.92.5.33 get_beats_per_bar()

```
int seq64::sequence::get_beats_per_bar ( ) const  [inline]
```

13.92.5.34 set_beat_width()

```
void seq64::sequence::set_beat_width (
            int beatwidth )
```

Threadsafe

Parameters

beatwidth	The new setting of the beat width value.

13.92.5.35 get_beat_width()

```
int seq64::sequence::get_beat_width ( ) const  [inline]
```

Threadsafe

13.92.5.36 measures_to_ticks()

```
midipulse seq64::sequence::measures_to_ticks (
            int measures = 1 ) const  [inline]
```

13.92.5.37 clocks_per_metronome() [1/2]

```
void seq64::sequence::clocks_per_metronome (
            int cpm )  [inline]
```

13.92.5.38 clocks_per_metronome() [2/2]

```
int seq64::sequence::clocks_per_metronome ( ) const  [inline]
```

13.92.5.39 set_32nds_per_quarter()

```
void seq64::sequence::set_32nds_per_quarter (
            int tpq )  [inline]
```

13.92.5.40 get_32nds_per_quarter()

```
int seq64::sequence::get_32nds_per_quarter ( ) const  [inline]
```

13.92.5.41 us_per_quarter_note() [1/2]

```
void seq64::sequence::us_per_quarter_note (
            long upqn )  [inline]
```

13.92.5.42 us_per_quarter_note() [2/2]

```
long seq64::sequence::us_per_quarter_note ( ) const  [inline]
```

13.92.5.43 set_rec_vol()

```
void seq64::sequence::set_rec_vol (
            int recvol )
```

Threadsafe

Parameters

recvol	The new setting of the recording volume setting. It is used only if it ranges from 0 to SEQ64_MAX_NOTE_ON_VELOCITY, or is set to SEQ64_PRESERVE_VELOCITY.

13.92.5.44 set_song_mute()

```
void seq64::sequence::set_song_mute (
            bool mute )  [inline]
```

13.92.5.45 toggle_song_mute()

```
void seq64::sequence::toggle_song_mute ( )  [inline]
```

13.92.5.46 get_song_mute()

```
bool seq64::sequence::get_song_mute ( ) const  [inline]
```

13.92.5.47 apply_song_transpose()

```
void seq64::sequence::apply_song_transpose ( )
```

13.92.5.48 set_transposable()

```
void seq64::sequence::set_transposable (
            bool flag )
```

Note that when a sequence is being read from a MIDI file, it will not yet have a parent, so we have to check for that before setting the perform modify flag.

13.92.5.49 get_transposable()

```
bool seq64::sequence::get_transposable ( ) const  [inline]
```

13.92.5.50 get_name()

```
const char* seq64::sequence::get_name ( ) const  [inline]
```

Deprecated

13.92.5.51 name()

```
const std::string& seq64::sequence::name ( ) const  [inline]
```

13.92.5.52 set_editing()

```
void seq64::sequence::set_editing (
            bool edit )  [inline]
```

13.92.5.53 get_editing()

```
bool seq64::sequence::get_editing ( ) const  [inline]
```

13.92.5.54 set_raise()

```
void seq64::sequence::set_raise (
            bool edit )  [inline]
```

13.92.5.55 get_raise()

```
bool seq64::sequence::get_raise (
            void  ) const  [inline]
```

13.92.5.56 set_length()

```
void seq64::sequence::set_length (
            midipulse len = 0,
            bool adjust_triggers = true,
            bool verify = true )
```

This function is called in seqedit::apply_length(), when the user selects a sequence length in measures. This function is also called when reading a MIDI file.

There's an issue, though. If the application is compiled to use the original std::list container for MIDI events, that implementation sorts the container after every event insertion. If the application is compiled to used the std::map container (to speed up the reading of large MIDI files *greatly*), sorting happens automatically. But, if we use the original std::list implementation, but leave the sorting until later (to speed up the reading of large MIDI files *greatly*), then the verify_and_link() call that happens with every new event happens before the events are sorted, and the result is elongated notes showing up in the pattern slot in the main window. Therefore, we need a way to skip the verification when reading a MIDI file, and do the verification only after all events are read.

That function calculates the length in ticks:

```
    L = M x B x 4 x P / W
        L == length (ticks or pulses)
        M == number of measures
        B == beats per measure
        P == pulses per quarter-note
        W == beat width in beats per measure


For our "b4uacuse" MIDI file, M can be about 100 measures, B is 4,
P can be 192 (but we want to support higher values), and W is 4.
So L = 100 * 4 * 4 * 192 / 4 = 76800 ticks.  Seems small.
```

Threadsafe

Parameters

len	The length value to be set. If it is smaller than ppqn/4, then it is set to that value, unless it is zero, in which case m_length is used and does not change. It also sets the length value for the sequence's triggers.
adjust_triggers	If true, m_triggers.adjust_offsets_to_length() is called. The value defaults to true.
verify	This new parameter defaults to true. If true, verify_and_link() is called. Otherwise, it is not, and the caller should call this function with the default value after reading all the events.

13.92.5.57 get_length()

```
midipulse seq64::sequence::get_length ( ) const  [inline]
```

13.92.5.58 get_last_tick()

```
midipulse seq64::sequence::get_last_tick ( )
```

If m_length is 0, this function returns m_last_tick - m_trigger_offset, to avoid an arithmetic exception. Should we return 0 instead?

Note that seqroll calls this function to help get the location of the progress bar. What does perfedit do?

13.92.5.59 set_last_tick()

```
void seq64::sequence::set_last_tick (
            midipulse tick )
```

Threadsafe

13.92.5.60 mod_last_tick()

```
midipulse seq64::sequence::mod_last_tick ( )  [inline]
```

This function replaces the "m_last_tick % m_length", returning m_last_tick if m_length is 0 or 1.

13.92.5.61 set_playing()

```
void seq64::sequence::set_playing (
            bool p )
```

When playing, and the sequencer is running, notes get dumped to the ALSA buffers.

Parameters

p	Provides the playing status to set. True means to turn on the playing, false means to turn it off, and turn off any notes still playing.

13.92.5.62 get_playing()

```
bool seq64::sequence::get_playing ( ) const  [inline]
```

13.92.5.63 toggle_playing()

```
void seq64::sequence::toggle_playing ( )  [inline]
```

How exactly does this differ from toggling the mute status?

13.92.5.64 toggle_queued()

```
void seq64::sequence::toggle_queued ( )
```

Also calculates the queued tick based on m_last_tick.

Threadsafe

13.92.5.65 off_queued()

```
void seq64::sequence::off_queued ( )
```

Do we need to set m_queued_tick as in toggle_queued()? Currently not used.

Threadsafe

13.92.5.66 on_queued()

```
void seq64::sequence::on_queued ( )
```

Do we need to set m_queued_tick as in toggle_queued()? Currently not used.

Threadsafe

13.92.5.67 get_queued()

```
bool seq64::sequence::get_queued ( ) const  [inline]
```

13.92.5.68 get_queued_tick()

```
midipulse seq64::sequence::get_queued_tick ( ) const  [inline]
```

13.92.5.69 check_queued_tick()

```
bool seq64::sequence::check_queued_tick (
            midipulse tick ) const  [inline]
```

13.92.5.70 set_recording()

```
void seq64::sequence::set_recording (
            bool r )
```

Threadsafe

13.92.5.71 get_recording()

```
bool seq64::sequence::get_recording ( ) const  [inline]
```

13.92.5.72 set_snap_tick()

```
void seq64::sequence::set_snap_tick (
            int st )
```

Threadsafe

13.92.5.73 set_quantized_rec()

```
void seq64::sequence::set_quantized_rec (
            bool qr )
```

Threadsafe

13.92.5.74 get_quantized_rec()

```
bool seq64::sequence::get_quantized_rec ( ) const  [inline]
```

13.92.5.75 set_thru()

```
void seq64::sequence::set_thru (
            bool r )
```

Threadsafe

13.92.5.76 get_thru()

```
bool seq64::sequence::get_thru ( ) const  [inline]
```

13.92.5.77 is_dirty_main()

```
bool seq64::sequence::is_dirty_main ( )
```

resets it). This flag signals that a redraw is needed from recording.

Threadsafe

Returns

Returns the dirty status.

13.92.5.78 is_dirty_edit()

```
bool seq64::sequence::is_dirty_edit ( )
```

The m_dirty_edit flag is set by the function set_dirty().

Threadsafe

Returns

Returns the dirty status.

13.92.5.79 is_dirty_perf()

```
bool seq64::sequence::is_dirty_perf ( )
```

Threadsafe

Returns

Returns the dirty status.

13.92.5.80 is_dirty_names()

```
bool seq64::sequence::is_dirty_names ( )
```

Not sure that we need to lock a boolean on modern processors.

Threadsafe

Returns

Returns the dirty status.

13.92.5.81 set_dirty_mp()

```
void seq64::sequence::set_dirty_mp ( )
```

These flags are meant for causing user-interface refreshes, not for performance modification.

m_dirty_names is set to false in is_dirty_names(); m_dirty_names is set to false in is_dirty_main(); m_dirty_names is set to false in is_dirty_perf().

Not threadsafe

13.92.5.82 set_dirty()

```
void seq64::sequence::set_dirty ( )
```

Threadsafe

13.92.5.83 get_midi_channel()

```
midibyte seq64::sequence::get_midi_channel ( ) const  [inline]
```

13.92.5.84 is_smf_0()

```
bool seq64::sequence::is_smf_0 ( ) const  [inline]
```

13.92.5.85 set_midi_channel()

```
void seq64::sequence::set_midi_channel (
            midibyte ch,
            bool user_change = false )
```

Threadsafe

Parameters

ch	The MIDI channel to set as the channel number for this sequence.
user_change	If true (the default value is false), the user has decided to change this value, and we might need to modify the perform's dirty flag, so that the user gets prompted for a change, This is a response to GitHub issue #47, where channel changes do not cause a prompt to save the sequence.

13.92.5.86 print()

```
void seq64::sequence::print ( ) const
```

Not threadsafe

13.92.5.87 print_triggers()

```
void seq64::sequence::print_triggers ( ) const
```

Not threadsafe

13.92.5.88 play()

```
void seq64::sequence::play (
            midipulse end_tick,
            bool playback_mode )
```

This function is called by the sequencer thread, performance. The tick comes in as global tick. It turns the sequence off after we play in this frame.

Note

With pause support, the progress bar for the pattern/sequence editor does what we want: pause with the pause button, and rewind with the stop button. Works with JACK, with issues, but we'd like to have the stop button do a rewind in JACK, too.

The trigger calculations have been offloaded to the triggers::play() function. It's return value and side-effects tell if there's a change in playing based on triggers and tells the ticks that bracket it.

Parameters

end_tick	Provides the current end-tick value. The tick comes in as a global tick.
playback_mode	Provides how playback is managed. True indicates that it is performance/song-editor playback, controlled by the set of patterns and triggers set up in that editor, and saved with the song in seq24 format. False indicates that the playback is controlled by the main window, in live mode.

Threadsafe

13.92.5.89 play_queue()

```
void seq64::sequence::play_queue (
            midipulse tick,
            bool playbackmode )
```

Starts the playing of a pattern/sequence. This function just has the sequence dump its events. It ignores the sequence if it has no playable MIDI events.

Change Note ca 2016-10-12 Issue #39. Removed the check for a non-zero event count. This lets the seqroll show the progress bar in motion.

Parameters

tick	Provides the tick/pulse from which to start playing.
playbackmode	Indicates if the playback is in live mode (false) or song mode (true).

13.92.5.90 add_note()

```
void seq64::sequence::add_note (
            midipulse tick,
            midipulse len,
            int note,
            bool paint = false,
            int velocity = SEQ64_PRESERVE_VELOCITY )
```

It adds a single note-on / note-off pair.

The paint parameter indicates if we care about the painted event, so then the function runs though the events and deletes the painted ones that overlap the ones we want to add.

Also note that push_undo() is not incorporated into this function, for the sake of speed.

Here, we could ignore events not on the sequence's channel, as an option. We have to be careful because this function can be used in painting notes.

Stazed:

```
http://www.blitter.com/~russtopia/MIDI/~jglatt/tech/midispec.htm

Note Off: The first data is the note number. There are 128 possible
notes on a MIDI device, numbered 0 to 127 (where Middle C is note
number 60). This indicates which note should be released.  The second
data byte is the velocity, a value from 0 to 127. This indicates how
quickly the note should be released (where 127 is the fastest). It's
up to a MIDI device how it uses velocity information. Often velocity
will be used to tailor the VCA release time.  MIDI devices that can
generate Note Off messages, but don't implement velocity features,
will transmit Note Off messages with a preset velocity of 64.
```

Also, we now see that seq24 never used the recording-velocity member (m_rec_vol). We use it to modify the new m_note_on_velocity member if the user changes it in the seqedit window.

Threadsafe

Parameters

tick	The time destination of the new note, in pulses.
len	The duration of the new note, in pulses.
note	The pitch destination of the new note.
paint	If true, repaint the whole set of events, in order to be left with a clean view of the inserted event. The default is false.
velocity	If not set to SEQ64_PRESERVE_VELOCITY, the velocity of the note is set to this value. Otherwise, it is hard-wired to the stored note-on velocity. The name of this macro is counter-intuitive here. Currently, the note-off velocity is HARD-WIRED!

13.92.5.91 add_event() [1/2]

```
bool seq64::sequence::add_event (
            const event & er )
```

Then it reset the draw-marker and sets the dirty flag.

Currently, when reading a MIDI file [see the midifile::parse() function], only the main events (notes, after-touch, pitch, program changes, etc.) are added with this function. So, we can rely on reading only playable events into a sequence. Well, actually, certain meta-events are also read, to obtain channel, buss, and more settings. Also read for a sequence, if the global-sequence flag is not set, are the new key, scale, and background sequence parameters.

This module (sequencer) adds all of those events as well, but it can surely add other events. We should assume that any events added by sequencer are playable/usable.

Here, we could ignore events not on the sequence's channel, as an option. We have to be careful because this function can be used in painting events.

Threadsafe

Warning

This pushing (and, in writing the MIDI file, the popping), causes events with identical timestamps to be written in reverse order. Doesn't affect functionality, but it's puzzling until one understands what is happening. Actually, this is true only in Seq24, we've fixed that behavior for Sequencer64.

Parameters

er	Provide a reference to the event to be added; the event is copied into the events container.

Returns

Returns true if the event was added.

13.92.5.92 add_chord()

```
void seq64::sequence::add_chord (
            int chord,
            midipulse tick,
            midipulse len,
            int note )
```

If SEQ64_STAZED_CHORD_GENERATOR is not defined, it devolves to add_note().

Todo Add the ability to preserve the incoming velocity.

Threadsafe

Parameters

chord	If greater than 0 (and less than c_chord_number), a chord (multiple notes) will be generated using this chord in the c_chord_table[] array. Otherwise, only a single note will be added.
tick	The time destination of the new note, in pulses.
len	The duration of the new note, in pulses.
note	The pitch destination of the new note.

13.92.5.93 add_event() [2/2]

```
void seq64::sequence::add_event (
            midipulse tick,
            midibyte status,
            midibyte d0,
            midibyte d1,
            bool paint = false )
```

The paint parameter indicates if we care about the painted event, so then the function runs though the events and deletes the painted ones that overlap the ones we want to add.

Threadsafe

Parameters

tick	The time destination of the event.
status	The type of event to add.
d0	The first data byte for the event.
d1	The second data byte for the event (if needed).
paint	If true, the inserted event is marked for painting.

13.92.5.94 append_event()

```
bool seq64::sequence::append_event (
            const event & er )
```

This function is meant mainly for reading the MIDI file, to save a lot of time.

Parameters

er	Provide a reference to the event to be added; the event is copied into the events container.

Returns

Returns true if the event was added.

13.92.5.95 sort_events()

```
void seq64::sequence::sort_events ( )  [inline]
```

13.92.5.96 add_trigger()

```
void seq64::sequence::add_trigger (
            midipulse tick,
            midipulse len,
            midipulse offset = 0,
            bool fixoffset = true )
```

A pass-through function that calls triggers::add(). See that function for more details.

Threadsafe

Parameters

tick	The time destination of the trigger.
len	The duration of the trigger.
offset	The performance offset of the trigger.
fixoffset	If true, adjust the offset.

13.92.5.97 split_trigger()

```
void seq64::sequence::split_trigger (
            midipulse splittick )
```

This is the public overload of split_trigger.

Threadsafe

Parameters

splittick	The time location of the split.

13.92.5.98 grow_trigger()

```
void seq64::sequence::grow_trigger (
            midipulse tickfrom,
            midipulse tickto,
            midipulse len )
```

See triggers::grow() for more information.

Parameters

tickfrom	The desired from-value back which to expand the trigger, if necessary.
tickto	The desired to-value towards which to expand the trigger, if necessary.
len	The additional length to append to tickto for the check.

Threadsafe

13.92.5.99 del_trigger()

```
void seq64::sequence::del_trigger (
            midipulse tick )
```

See triggers::remove().

Threadsafe

Parameters

tick	Provides the tick to be used for finding the trigger to be erased.

13.92.5.100 get_trigger_state()

```
bool seq64::sequence::get_trigger_state (
            midipulse tick )
```

If any trigger is found to bracket that tick, then true is returned.

Parameters

tick	Provides the tick of interest.

Returns

Returns true if a trigger is found that brackets the given tick.

13.92.5.101 select_trigger()

```
bool seq64::sequence::select_trigger (
            midipulse tick )
```

If any trigger is found to bracket that tick, then true is returned, and the trigger is marked as selected.

Parameters

tick	Provides the tick of interest.

Returns

Returns true if a trigger is found that brackets the given tick; this is the return value of m_triggers.select().

13.92.5.102 get_triggers()

```
triggers::List seq64::sequence::get_triggers ( ) const
```

This function is basically a threadsafe version of sequence::triggerlist().

Returns

Returns of copy of m_triggers.triggerlist().

13.92.5.103 unselect_triggers()

```
bool seq64::sequence::unselect_triggers ( )
```

Returns

Returns the m_triggers.unselect() return value.

13.92.5.104 intersect_triggers()

```
bool seq64::sequence::intersect_triggers (
            midipulse position,
            midipulse & start,
            midipulse & ender )
```

If the given position is between the current trigger's tick-start and tick-end values, the these values are copied to the start and end parameters, respectively, and then we exit. See triggers::intersect().

Threadsafe

Parameters

position	The position to examine.
start	The destination for the starting tick of the matching trigger.
ender	The destination for the ending tick of the matching trigger.

Returns

Returns true if a trigger was found whose start/end ticks contained the position. Otherwise, false is returned, and the start and end return parameters should not be used.

13.92.5.105 intersect_notes()

```
bool seq64::sequence::intersect_notes (
            midipulse position,
            midipulse position_note,
            midipulse & start,
            midipulse & ender,
            int & note )
```

If the given position is between the current notes on and off time values, values, the these values are copied to the start and end parameters, respectively, the note value is copied to the note parameter, and then we exit.

Threadsafe

Parameters

	position	The position to examine.
	position_note	I think this is the note value we might be looking for ???
out	*start*	The destination for the starting timestamp of the matching note.
out	*ender*	The destination for the ending timestamp of the matching note.
out	*note*	The destination for the note of the matching event. Why is this an int value???

Returns

Returns true if a event was found whose start/end ticks contained the position. Otherwise, false is returned, and the start and end return parameters should not be used.

13.92.5.106 intersect_events()

```
bool seq64::sequence::intersect_events (
            midipulse posstart,
            midipulse posend,
            midibyte status,
            midipulse & start )
```

If the given position is between the current notes's timestamp-start and timestamp-end values, the these values are copied to the posstart and posend parameters, respectively, and then we exit.

Threadsafe

Parameters

posstart	The starting position to examine.
posend	The ending position to examine.
status	The desired status value.
start	The destination for the starting timestamp of the matching trigger.

Returns

Returns true if a event was found whose start/end timestamps contained the position. Otherwise, false is returned, and the start and end return parameters should not be used.

13.92.5.107 del_selected_trigger()

```
void seq64::sequence::del_selected_trigger ( )
```

13.92.5.108 cut_selected_trigger()

```
void seq64::sequence::cut_selected_trigger ( )
```

13.92.5.109 copy_selected_trigger()

```
void seq64::sequence::copy_selected_trigger ( )
```

Then it copies the first selected trigger that is found.

13.92.5.110 paste_trigger()

```
void seq64::sequence::paste_trigger (
            midipulse paste_tick = SEQ64_NO_PASTE_TRIGGER )
```

Why isn't this protected by a mutex? We will enable this if anything bad happens, such as a deadlock, or corruption, that we can prove happens here.

Parameters

paste_tick	A new parameter that provides the tick for pasting, or SEQ64_NO_PASTE_TRIGGER (-1) if there is none.

13.92.5.111 move_selected_triggers_to()

```
bool seq64::sequence::move_selected_triggers_to (
             midipulse tick,
             bool adjustoffset,
             triggers::grow_edit_t which = triggers::GROW_MOVE )


          min_tick][0                1][max_tick
                          2

The \a which parameter has three possible values:

-#  If we are moving the 0, use first as offset.
-#  If we are moving the 1, use the last as the offset.
-#  If we are moving both (2), use first as offset.
```

Threadsafe

Parameters

tick	The tick at which the trigger starts.
adjustoffset	Set to true if the offset is to be adjusted.
which	Selects which movement will be done, as discussed above.

Returns

Returns the value of triggers::move_selected(), which indicate that the movement could be made. Used in Seq24PerfInput::handle_motion_key().

13.92.5.112 selected_trigger_start()

```
midipulse seq64::sequence::selected_trigger_start ( )
```

Threadsafe

Returns

Returns the tick_start() value of the last-selected trigger. If no triggers are selected, then -1 is returned.

13.92.5.113 selected_trigger_end()

```
midipulse seq64::sequence::selected_trigger_end ( )
```

Threadsafe

Returns

Returns the tick_end() value of the last-selected trigger. If no triggers are selected, then -1 is returned.

13.92.5.114 get_max_trigger()

```
midipulse seq64::sequence::get_max_trigger ( )
```

Threadsafe

Returns

Returns the maximum trigger value.

13.92.5.115 move_triggers()

```
void seq64::sequence::move_triggers (
            midipulse starttick,
            midipulse distance,
            bool direction )
```

Note the dependence on the m_length member being kept in sync with the parent's value of m_length.

Threadsafe

Parameters

starttick	The current location of the triggers.
distance	The distance away from the current location to which to move the triggers.
direction	If true, the triggers are moved forward. If false, the triggers are moved backward.

13.92.5.116 copy_triggers()

```
void seq64::sequence::copy_triggers (
            midipulse starttick,
            midipulse distance )
```

Threadsafe

Parameters

starttick	The current location of the triggers.
distance	The distance away from the current location to which to copy the triggers.

13.92.5.117 clear_triggers()

```
void seq64::sequence::clear_triggers ( )
```

Threadsafe

13.92.5.118 get_trigger_offset()

```
midipulse seq64::sequence::get_trigger_offset ( ) const  [inline]
```

13.92.5.119 set_midi_bus()

```
void seq64::sequence::set_midi_bus (
            char mb,
            bool user_change = false )
```

Threadsafe

Parameters

mb	The MIDI buss to set as the buss number for this sequence. Also called the "MIDI port" number.
user_change	If true (the default value is false), the user has decided to change this value, and we might need to modify the perform's dirty flag, so that the user gets prompted for a change, This is a response to GitHub issue #47, where buss changes do not cause a prompt to save the sequence.

13.92.5.120 get_midi_bus()

```
char seq64::sequence::get_midi_bus ( ) const  [inline]
```

13.92.5.121 set_master_midi_bus()

```
void seq64::sequence::set_master_midi_bus (
            mastermidibus * mmb )
```

Threadsafe

Parameters

mmb	Provides a pointer to the master MIDI buss for this sequence. This should be a reference, but isn't, nor is it checked.

13.92.5.122 select_note_events()

```
int seq64::sequence::select_note_events (
            midipulse tick_s,
            int note_h,
            midipulse tick_f,
            int note_l,
            select_action_e action )
```

Be aware the the event::is_note() function is used, and that it includes Aftertouch events, which generally need to stick with their Note On counterparts.

If a "note" event is detected, then we skip it. This is necessary since channel pressure and control change use d0 for seqdata, and d0 is returned by get_note(). This causes note selection to occasionally select them when their seqdata values are within range of the tick selection. So therefore we want only Note Ons and Note Offs.

Note

The continuation below ("continue") is necessary since channel pressure and control change use d0 for seqdata [which is returned by get_note()]. This causes seqroll note selection to occasionally select them when their seqdata values are within the range of tick selection. So only, note ons and offs. What about Aftertouch? We have the event::is_note() function for that.

Parameters

tick_s	The starting tick.
note_h	The highest note selected.
tick_f	The ending, or finishing, tick.
note_l	The lowest note selected.
action	The action to perform on the selection.

Returns

Returns the number of notes selected.

13.92.5.123 select_events() [1/3]

```
int seq64::sequence::select_events (
            midipulse tick_s,
```

```
            midipulse tick_f,
            midibyte status,
            midibyte cc,
            select_action_e action )
```

Note that there is also an overloaded version of this function.

Threadsafe

Parameters

tick_s	The start time of the selection.
tick_f	The finish time of the selection.
status	The desired event in the selection.
cc	The desired control-change in the selection, if the event is a control-change.
action	The desired selection action.

Returns

Returns the number of events selected.

13.92.5.124 select_events() [2/3]

```
int seq64::sequence::select_events (
            midibyte status,
            midibyte cc,
            bool inverse = false )
```

Note that there is also an overloaded version of this function.

Threadsafe

Warning

This used to be a void function, so it just returns 0 for now.

Parameters

status	Provides the status value to be selected.
cc	If the status is EVENT_CONTROL_CHANGE, then data byte 0 must match this value.
inverse	If true, invert the selection.

Returns

Always returns 0.

13.92.5.125 select_events() [3/3]

```
int seq64::sequence::select_events (
            midipulse tick_s,
            midipulse tick_f,
            midibyte status )
```

13.92.5.126 select_event_handle()

```
int seq64::sequence::select_event_handle (
            midipulse tick_s,
            midipulse tick_f,
            midibyte status,
            midibyte cc,
            int dats )
```

Parameters

tick_s	Provides the starting tick.
tick_f	Provides the ending (finishing) tick.
status	Provides the desired MIDI event to be selected.
cc	Provides the desired MIDI control value to be selected.
dats	Provides the center of a small data value range of plus or minus 2.

Returns

Returns the number of events selected.

13.92.5.127 select_linked()

```
int seq64::sequence::select_linked (
            long tick_s,
            long tick_f,
            midibyte status )
```

Parameters

tick_s	Provides the starting tick.
tick_f	Provides the ending (finishing) tick.
status	Provides the desired MIDI event to be selected.

Returns

Returns the number of notes selected.

13.92.5.128 select_even_or_odd_notes()

```
int seq64::sequence::select_even_or_odd_notes (
            int note_len,
            bool even )
```

Enabled only if USE_STAZED_ODD_EVEN_SELECTION is defined.

Parameters

note_len	The desired note lengths for the selection.
even	True if we want the even notes.

Returns

Returns the number of notes selected.

13.92.5.129 select_all_notes()

```
void seq64::sequence::select_all_notes (
            bool inverse = false )  [inline]
```

What about Aftertouch events? I think we need to select them as well in seqedit, so let's add that selection here as well.

Parameters

inverse	If set to true (the default is false), then this causes the selection to be inverted.

13.92.5.130 get_num_selected_notes()

```
int seq64::sequence::get_num_selected_notes ( ) const
```

Threadsafe

Returns

Returns m_events.count_selected_notes().

13.92.5.131 get_num_selected_events()

```
int seq64::sequence::get_num_selected_events (
            midibyte status,
            midibyte cc ) const
```

If the event is a control change (CC), then it must also match the given CC value.

Threadsafe

Parameters

status	The desired kind of event to count.
cc	The desired control-change to count, if the event is a control-change.

Returns

Returns m_events.count_selected_events().

13.92.5.132 select_all()

```
void seq64::sequence::select_all ( )
```

Threadsafe

13.92.5.133 copy_selected()

```
void seq64::sequence::copy_selected ( )
```

This function also has the danger, discovered by user 0rel, of events being modified after being added to the clipboard. So we add his reconstruction fix here as well. To summarize the steps:

```
-#  Clear the m_events_clipboard.  NO!  If we have no events to
    copy to the clipboard, we do not want to clear it.  This kills
    cut-and-paste functionality.
-#  Add all selected events in this clipboard to the sequence.
-#  Normalize the timestamps of the events in the clip relative to the
    timestamp of the first selected event.  (Is this really needed?)
-#  Reconstruct/reconstitute the m_events_clipboard.
```

This process is a bit easier to manage than erase/insert on events because std::multimap has no erase() function that returns the next valid iterator. Also, we use a local clipboard first, to save on copying. We've enhanced the error-checking, too.

Finally, note that m_events_clipboard is a static member of sequence, so:

```
-#  Copying can be done between sequences.
-#  Access to it needs to be protected by a mutex.
```

Threadsafe

13.92.5.134 cut_selected()

```
void seq64::sequence::cut_selected (
            bool copyevents = true )
```

Pushes onto the undo stack, may copy the events, marks the selected events, and removes them. Now also sets the dirty flag so that the caller doesn't have to. Also raises the modify flag on the parent perform object.

Threadsafe

Parameters

copyevents	If true, copy the selected events before marking and removing them.

13.92.5.135 paste_selected()

```
void seq64::sequence::paste_selected (
             midipulse tick,
             int note )
```

Also, we've moved external calls to push_undo() into this function. The caller shouldn't have to do that.

The event_keys used to access/sort the multimap event_list is not updated after changing timestamp/rank of the stored events. Regenerating all key/value pairs before merging them solves this issue, so that the order of events in the sequence will be preserved. This action is not needed for moving or growing events. Nor is it needed if the old std::list implementation of the event container is compiled in. However, it is needed in any operation that modifies the timestamp of an event inside the container:

```
-   copy_selected()
-   paste_selected()
-   quantize_events() TODO TODO TODO!
```

The alternative to reconstructing the map is to erase-and-insert the events modified in the code above, rather than just tweaking their values, which have an effect on sorting for the event-map implementation. However, multimap does not provide an erase() function that returns the next valid iterator, which would complicate this method of operation. So we're inclined to stick with this solution.

There was an issue with copy/pasting a whole sequence. The pasted events did not go to their destination, but overlayed the original events. This bugs also occurred in Seq24 0.9.2. It occurs with the allofarow.mid file when doing Ctrl-A Ctrl-C Ctrl-V Move-Mouse Left-Click. It turns out the original code was checking only the first event to see if it was a Note event. For sequences that started with a Control Change or Program Change (or other non-Note events), the highest note was never modified, and none of the note events were adjusted.

Finally, we only want to transpose note events (i.e. alter m_data[0]), and not other kinds of events. We still need to figure out what to do with aftertouch, though. Currently likely to be covered by the processing of the note that it accompanies.

Threadsafe

Parameters

tick	The time destination for the paste. This represents the "x" coordinate of the upper left corner of the paste-box. It will be converted to an offset, for example pasting every event 48 ticks forward from the original copy.
note	The note/pitch destination for the paste. This represents the "y" coordinate of the upper left corner of the paste-box. It will be converted to an offset, for example pasting every event 7 notes higher than the original copy.

13.92.5.136 get_selected_box()

```
void seq64::sequence::get_selected_box (
            midipulse & tick_s,
            int & note_h,
            midipulse & tick_f,
            int & note_l )
```

Note the common-code betweem this function and get_clipboard_box(). Also note we could return a boolean indicating if the return values were filled in.

Threadsafe

Parameters

out	*tick_s*	Side-effect return reference for the start time.
out	*note_h*	Side-effect return reference for the high note.
out	*tick_f*	Side-effect return reference for the finish time.
out	*note_l*	Side-effect return reference for the low note.

13.92.5.137 get_clipboard_box()

```
void seq64::sequence::get_clipboard_box (
            midipulse & tick_s,
            int & note_h,
            midipulse & tick_f,
            int & note_l )
```

Note the common-code betweem this function and get_selected_box(). Also note we could return a boolean indicating if the return values were filled in.

Threadsafe

Parameters

out	*tick_s*	Side-effect return reference for the start time.
out	*note_h*	Side-effect return reference for the high note.
out	*tick_f*	Side-effect return reference for the finish time.
out	*note_l*	Side-effect return reference for the low note.

13.92.5.138 adjust_timestamp()

```
midipulse seq64::sequence::adjust_timestamp (
```

```
            midipulse t,
            bool isnoteoff )
```

- If the timestamp plus the delta is greater that m_length, we do round robin magic.
- If the timestamp is greater than m_length, then it is wrapped around to the beginning.
- If the timestamp equals m_length, then it is set to 0, and later, trimmed.
- If the timestamp is less than 0, then it is set to the end.

Taken from similar code in move_selected_notes() and grow_selected(). Be careful using this function.

Parameters

t	Provides the timestamp to be adjusted based on m_length.
isnoteoff	Used for "expanding" the timestamp from 0 to just less than m_length, if necessary. Should be set to true only for Note Off events; it defaults to false, which means to wrap the events around the end of the sequence if necessary, and is used only in movement, not in growth.

Returns

Returns the adjusted timestamp.

13.92.5.139 trim_timestamp()

```
midipulse seq64::sequence::trim_timestamp (
            midipulse t )
```

Similar to adjust_timestamp, but it doesn't have an *isnoteoff* parameter.

Parameters

t	Provides the timestamp to be adjusted based on m_length.

Returns

Returns the adjusted timestamp.

13.92.5.140 clip_timestamp()

```
midipulse seq64::sequence::clip_timestamp (
            midipulse ontime,
            midipulse offtime )
```

If the new (off) timestamp is less than the on-time, it is clipped to the snap value. If it is greater than the length of the sequence, then it is clipped to the sequence length. No wrap-around.

Parameters

ontime	Provides the original time, which limits the amount of negative adjustment that can be done.
offtime	Provides the timestamp to be adjusted and clipped.

Returns

Returns the adjusted timestamp.

13.92.5.141 move_selected_notes()

```
void seq64::sequence::move_selected_notes (
            midipulse delta_tick,
            int delta_note )
```

Also currently moves any other events in the range of the selection.

Also, we've moved external calls to push_undo() into this function. The caller shouldn't have to do that.

Another thing this function does is wrap-around when movement occurs. Any events (except Note Off) that will start just after the END of the pattern will be wrapped around to the beginning of the pattern.

Fixed:

Select all notes in a short pattern that starts at time 0 and has non-note events starting at time 0 (see contrib/midi/allofarow.mid); move them with the right arrow, and move them back with the left arrow; then view in the event editor, and see that the non-Note events have not moved back, and in fact move way too far to the right, actually to near the END marker. We've fixed that in the new adjust_timestamp() function.

This function checks for any marked events in seq24, but now we make sure the event is a Note On or Note Off event before dealing with it. We now handle properly events like Program Change, Control Change, and Pitch Wheel. Remember that Aftertouch is treated like a note, as it has velocity. For non-Notes, event::get_note() returns m_data[0], and we don't want to adjust that.

Note

We leave a small gap where mark_selected() locks and unlocks, then we lock again. This should only be an issue if moving notes while the sequence is playing.

Parameters

delta_tick	Provides the amount of time to move the selected notes. Note that it also applies to events. Note-Off events are expanded to m_length if their timestamp would be 0. All other events will wrap around to 0.
delta_note	Provides the amount of pitch to move the selected notes. This value is applied only to Note (On and Off) events. Also, if this value would bring a note outside the range of 0 to 127, that note is not changed and the event is not moved.

13.92.5.142 stream_event()

```
bool seq64::sequence::stream_event (
            event & ev )
```

The event's timestamp is adjusted, if needed. If recording:

```
-   If the pattern is playing, the event is added.
-   If the pattern is playing and quantized record is in force, the
    note's timestamp is altered.
-   If not playing, but the event is a Note On or Note Off, we add it
    and keep track of it.
```

If MIDI Thru is enabled, the event is put on the buss.

We are adding a feature where events are rejected if their channel doesn't match that of the sequence. This has been a complaint of some people. Could modify the add_event() and add_note() functions, but better to do it here for comprehensive event support. Also have to make sure the event-channel is preserved before this function is called, and also need to make sure that the channel is appended on both playback and in saving of the MIDI file.

We are also adding the usage, at last, of the m_rec_vol member, including the "Free" menu entry in seqedit, which sets the velocity to SEQ64_PRESERVE_VELOCITY (-1).

Todo When we feel like debugging, we will replace the global is-playing call with the parent perform's is-running call.

Threadsafe

Parameters

ev	Provides the event to stream.

Returns

Returns true if the event's channel matched that of this sequence, and the channel-matching feature was set to true. Also returns true if we're not using channel-matching. A return value of true means the event should be saved.

13.92.5.143 change_event_data_range()

```
bool seq64::sequence::change_event_data_range (
            midipulse tick_s,
            midipulse tick_f,
            midibyte status,
            midibyte cc,
            int data_s,
            int data_f )
```

Changes only selected events, if any.

Threadsafe

Let t == the current tick value; ts == tick start value; tf == tick finish value; ds = data start value; df == data finish value; d = the new data value. Then

```
            df (t - ts) + ds (tf - t)
        d = -------------------------
                      tf  -   ts
```

```
If this were an interpolation formula it would be:
```

```
                             t -  ts
        d = ds + (df - ds) ---------
                             tf - ts
```

```
Something is not quite right; to be investigated.
```

Parameters

tick_s	Provides the starting tick value.
tick_f	Provides the ending tick value.
status	Provides the event status that is to be changed.
cc	Provides the event control value.
data_s	Provides the starting data value.
data_f	Provides the finishing data value.

Returns

Returns true if the data was changed.

13.92.5.144 change_event_data_lfo()

```
void seq64::sequence::change_event_data_lfo (
            double value,
            double range,
            double speed,
            double phase,
            wave_type_t wave,
            midibyte status,
            midibyte cc )
```

Parameters

value	Provides the base value for the event data value. Ranges from 0 to 127 in increments of 0.1. This amount is added to the result of the wave_func() calculation.
range	Provides the range for the event data value. Ranges from 0 to 127 in increments of 0.1.
speed	Provides the inverse periodicity (?) for the modifications. Ranges from 0 to 16 in increments of 0.01. Not sure what units this value is in.
phase	The phase of the event modification. Ranges from 0 to 1 (what units?) in increments of 0.01.
wave	The wave type to apply. Ranges from 1 to 5.
status	The status value for the events to modify.
cc	Provides the control-change value for Control Change events that are to be modified.

13.92.5.145 increment_selected()

```
void seq64::sequence::increment_selected (
            midibyte astat,
            midibyte  )
```

The supported statuses are:

- EVENT_NOTE_ON
- EVENT_NOTE_OFF
- EVENT_AFTERTOUCH
- EVENT_CONTROL_CHANGE
- EVENT_PITCH_WHEEL
- EVENT_PROGRAM_CHANGE
- EVENT_CHANNEL_PRESSURE

Threadsafe

Parameters

astat	The desired event.

Parameter "acontrol", the desired control-change, is unused. This might be a bug, or at least a missing feature.

13.92.5.146 decrement_selected()

```
void seq64::sequence::decrement_selected (
            midibyte astat,
            midibyte  )
```

The supported statuses are:

- One-byte messages
  - EVENT_PROGRAM_CHANGE
  - EVENT_CHANNEL_PRESSURE
- Two-byte messages
  - EVENT_NOTE_ON
  - EVENT_NOTE_OFF
  - EVENT_AFTERTOUCH
  - EVENT_CONTROL_CHANGE
  - EVENT_PITCH_WHEEL

Threadsafe

Parameters

astat	The desired event.

Parameter "acontrol", the desired control-change, is unused. This might be a bug, or at least a missing feature.

13.92.5.147 grow_selected()

```
void seq64::sequence::grow_selected (
            midipulse delta )
```

And, though it doesn't move Note Off events, it does reconstruct them.

This function is called when doing a ctrl-left mouse move on the selected notes or when using ctrl-left-arrow or ctrl-right-arrow to shrink or stretch the selected notes. Using the mouse allows pretty much any amount of growth or shrinkage, but use the arrow keys limits the changes to the current snap value.

This function grows/shrinks only Note On events that are marked and linked. If an event is not linked, this function now ignores the event's timestamp, rather than risk a segfault on a null pointer. Compare this function to the stretch_selected() and move_selected_notes() functions.

This function would strip out non-Notes, but now it at least preserves them and moves them, to try to preserve their relative position re the notes.

In any case, we want to mark the original off-event for deletion, otherwise we get duplicate off events, for example in the "Begin/End" pattern in the test.midi file.

This function now tries to prevent pathological growth, such as trying to shrink the notes to zero length or less, or stretch them beyond the length of the sequence. Otherwise we get weird and unexpected results. Also, we've moved external calls to push_undo() into this function. The caller shouldn't have to do that.

A comment on terminology: The user "selects" notes, while the sequencer "marks" notes. The first thing this function does is mark all the selected notes.

Threadsafe

Parameters

delta	An offset for each linked event's timestamp.

13.92.5.148 stretch_selected()

```
void seq64::sequence::stretch_selected (
            midipulse delta_tick )
```

This should move a note off event, according to old comments, but it doesn't seem to do that. See the grow_↩ selected() function. Rather, it moves any event in the selection.

Also, we've moved external calls to push_undo() into this function. The caller shouldn't have to do that.

Threadsafe

Parameters

delta_tick	Provides the amount of time to stretch the selected notes.

13.92.5.149 remove_marked()

```
bool seq64::sequence::remove_marked ( )
```

Note how this function forwards the call to m_event.remove_marked().

Threadsafe

Returns

Returns true if at least one event was removed.

13.92.5.150 mark_selected()

```
bool seq64::sequence::mark_selected ( )
```

Threadsafe

Returns

Returns true if there were any events that got marked.

13.92.5.151 remove_selected()

```
void seq64::sequence::remove_selected ( )
```

This is a new convenience function to fold in the push_undo() and mark_selected() calls. It makes the process slightly faster, as well.

Threadsafe Also makes the whole process threadsafe.

13.92.5.152 unpaint_all()

```
void seq64::sequence::unpaint_all ( )
```

Threadsafe

13.92.5.153 unselect()

```
void seq64::sequence::unselect ( )
```

Threadsafe

13.92.5.154 verify_and_link()

```
void seq64::sequence::verify_and_link ( )
```

Threadsafe

13.92.5.155 link_new()

```
void seq64::sequence::link_new ( )
```

Threadsafe

13.92.5.156 zero_markers()

```
void seq64::sequence::zero_markers ( )  [inline]
```

This function is used when the sequencer stops. This function currently sets m_last_tick = 0, but we would like to avoid that if doing a pause, rather than a stop, of playback.

13.92.5.157 play_note_on()

```
void seq64::sequence::play_note_on (
            int note )
```

It flushes a note to the midibus to preview its sound, used by the virtual piano.

Threadsafe

Parameters

note	The note to play. It is not checked for range validity, for the sake of speed.

13.92.5.158 play_note_off()

```
void seq64::sequence::play_note_off (
            int note )
```

Threadsafe

Parameters

note	The note to turn off. It is not checked for range validity, for the sake of speed.

13.92.5.159 off_playing_notes()

```
void seq64::sequence::off_playing_notes ( )
```

This function does not bother checking if m_masterbus is a null pointer.

Threadsafe

13.92.5.160 stop()

```
void seq64::sequence::stop (
            bool song_mode = false )
```

In Live mode, the user controls playback, while in Song mode, JACK or the performance/song editor controls playback. This function used to be called "reset()".

Parameters

song_mode	True if song mode is on. This can mean that JACK transport is not in control of playback.

13.92.5.161 pause()

```
void seq64::sequence::pause (
            bool song_mode = false )
```

It still includes the note-shutoff capability to prevent notes from lingering. Note that we do not call set_playing(false)... it disarms the sequence, which we do not want upon pausing.

13.92.5.162 reset_draw_marker()

```
void seq64::sequence::reset_draw_marker ( )
```

It resets the draw marker so that calls to get_next_note_event() will start from the first event.

Threadsafe

13.92.5.163 reset_draw_trigger_marker()

```
void seq64::sequence::reset_draw_trigger_marker ( )
```

Threadsafe

13.92.5.164 get_next_note_event()

```
draw_type_t seq64::sequence::get_next_note_event (
            midipulse * tick_s,
            midipulse * tick_f,
            int * note,
            bool * selected,
            int * velocity )
```

When it has no more events, returns a false.

Note that, before the first call to draw a sequence, the reset_draw_marker() function must be called, to reset m_↩ iterator_draw.

Parameters

out	*tick_s*	Provides a pointer destination for the start time.
out	*tick_f*	Provides a pointer destination for the finish time.
out	*note*	Provides a pointer destination for the note pitch value Probably should be a midibyte value.
out	*selected*	Provides a pointer destination for the selection status of the note.
out	*velocity*	Provides a pointer destination for the note velocity. Probably should be a midibyte value.

13.92.5.165 get_minmax_note_events()

```
bool seq64::sequence::get_minmax_note_events (
            int & lowest,
            int & highest )
```

Todo For efficency, we should calculate this only when the event set changes, and save the results and return them if good.

Threadsafe

Parameters

lowest	A reference parameter to return the note with the lowest value. if there are no notes, then it is set to SEQ64_MIDI_COUNT_MAX-1.
highest	A reference parameter to return the note with the highest value. if there are no notes, then it is set to -1.

Returns

If there are no notes in the list, then false is returned, and the results should be disregarded.

13.92.5.166 get_next_event() [1/2]

```
bool seq64::sequence::get_next_event (
            midibyte status,
            midibyte cc,
            midipulse * tick,
            midibyte * d0,
            midibyte * d1,
            bool * selected,
            int evtype = EVENTS_ALL )
```

Then set the rest of the parameters parameters using that event. If the status is the new value EVENT_ANY, then any event will be obtained.

Note the usage of event::is_desired_cc_or_not_cc(status, cc, ∗d0); Either we have a control change with the right CC or it's a different type of event.

Parameters

status	The type of event to be obtained. The special value EVENT_ANY can be provided so that no event statuses are filtered.
cc	The continuous controller value that might be desired.
tick	A pointer return value for the tick value of the next event found.
d0	A pointer return value for the first data value of the event.
d1	A pointer return value for the second data value of the event.
selected	A pointer return value for the is-selected status of the event.
evtype	A stazed parameter for picking either all event or unselected events.

13.92.5.167 get_next_event() [2/2]

```
bool seq64::sequence::get_next_event (
            midibyte * status,
            midibyte * cc )
```

Then set the status and control character parameters using that event.

Parameters

status	Provides a pointer to the MIDI status byte to be set, as a way to retrieve the event.
cc	The return pointer for the control value.

13.92.5.168 get_next_trigger()

```
bool seq64::sequence::get_next_trigger (
            midipulse * tick_on,
            midipulse * tick_off,
            bool * selected,
            midipulse * tick_offset )
```

13.92.5.169 quantize_events()

```
void seq64::sequence::quantize_events (
            midibyte status,
            midibyte cc,
            midipulse snap_tick,
            int divide,
            bool linked = false )
```

One confusing things is why the original versions of the events don't seem to be deleted.

Parameters

status	Indicates the type of event to be quantized.
cc	The desired control-change to count, if the event is a control-change.
snap_tick	Provides the maximum amount to move the events. Actually, events are moved to the previous or next snap_tick value depend on whether they are halfway to the next one or not.
divide	A rough indicator of the amount of quantization. The only values used in the application are either 1 ("quantize") or 2 ("tighten"). The latter value reduces the amount of change slightly.
linked	False by default, this parameter indicates if marked events are to be relinked, as far as we can tell.

13.92.5.170 push_quantize()

```
void seq64::sequence::push_quantize (
             midibyte status,
             midibyte cc,
             midipulse snap_tick,
             int divide,
             bool linked = false )
```

See the sequence::quantize_events() function for more information. This function just does locking and a push-undo before calling that function.

Parameters

status	The kind of event to quantize, such as Note On, or the event type selected in the pattern editor's data pane.
cc	The control-change value to quantize, again as selected in the pattern editor's data pane. For Note Ons, this value should be set to 0.
snap_tick	The number of ticks to use for quantizing the events. Usually, this is the snap value selected in the pattern editor.
divide	Provides a division value, usually either 1 ("quantize") or 2 ("tighten").
linked	Set this value to true for tightening notes. The default value of this parameter is false.

13.92.5.171 transpose_notes()

```
void seq64::sequence::transpose_notes (
             int steps,
             int scale )
```

If the scale value is 0, this is "no scale", which is the chromatic scale, where all 12 notes, including sharps and flats, are part of the scale.

Also, we've moved external calls to push_undo() into this function. The caller shouldn't have to do that.

Note

> We noticed (ca 2016-06-10) that MIDI aftertouch events need to be transposed, but are not being transposed here. Assuming they are selectable (another question!), the test for note-on and note-off is not sufficient, and so has been replaced by a call to event::is_note_msg().

Parameters

steps	The number of steps to transpose the notes.
scale	The scale to make the notes adhere to while transposing.

13.92.5.172 shift_notes()

```
void seq64::sequence::shift_notes (
            midipulse ticks )
```

13.92.5.173 multiply_pattern()

```
void seq64::sequence::multiply_pattern (
            double multiplier )
```

13.92.5.174 musical_key() [1/2]

```
midibyte seq64::sequence::musical_key ( ) const  [inline]
```

13.92.5.175 musical_key() [2/2]

```
void seq64::sequence::musical_key (
            int key )  [inline]
```

13.92.5.176 musical_scale() [1/2]

```
midibyte seq64::sequence::musical_scale ( ) const  [inline]
```

13.92.5.177 musical_scale() [2/2]

```
void seq64::sequence::musical_scale (
            int scale )  [inline]
```

13.92.5.178 background_sequence() [1/2]

```
int seq64::sequence::background_sequence ( ) const  [inline]
```

13.92.5.179 background_sequence() [2/2]

```
void seq64::sequence::background_sequence (
            int bs )  [inline]
```

Disabling the sequence number (setting it to SEQ64_SEQUENCE_LIMIT) is valid.

13.92.5.180 show_events()

```
void seq64::sequence::show_events ( ) const
```

13.92.5.181 copy_events()

```
void seq64::sequence::copy_events (
            const event_list & newevents )
```

Compare this function to the remove_all() function. Copying the container is a lot of work, but fairly fast, even with an std::multimap as the container.

Threadsafe Note that we had to consolidate the replacement of all the events in the container in order to prevent the "Save to Sequence" button in the eventedit object from causing the application to segfault. It would segfault when the mainwnd timer callback would fire, causing updates to the sequence's slot pixmap, which would then try to access deleted events. Part of the issue was that note links were dropped when copying the events, so now we call verify_and_link() to hopefully reconstitute the links.

Parameters

newevents	Provides the container of MIDI events that will completely replace the current container. Normally this container is supplied by the event editor, via the eventslots class.

13.92.5.182 note_off_margin()

```
midipulse seq64::sequence::note_off_margin ( ) const  [inline]
```

13.92.5.183 event_in_range()

```
bool seq64::sequence::event_in_range (
            const event & e,
            midibyte status,
            midipulse tick_s,
            midipulse tick_f ) const  [inline], [private]
```

Makes if-clauses easier to read.

Parameters

e	Provides the event to be checked.
status	Provides the event type that must be matched.
tick_s	The lower end of the range of timestamps that the event must fall within.
tick_f	The upper end of the range of timestamps that the event must fall within.

Returns

Returns true if the event matchs all of the restrictions noted.

13.92.5.184 set_parent()

```
void seq64::sequence::set_parent (
            perform * p )  [private]
```

Remember that m_parent is not at all owned by the sequence. We just don't want to do all the work necessary to make it a reference, at this time.

Parameters

p	A pointer to the parent, assigned only if not already assigned.

13.92.5.185 put_event_on_bus()

```
void seq64::sequence::put_event_on_bus (
            event & ev )  [private]
```

This function does not bother checking if m_masterbus is a null pointer.

Parameters

ev	The event to put on the buss.

Threadsafe

13.92.5.186 set_trigger_offset()

```
void seq64::sequence::set_trigger_offset (
            midipulse trigger_offset )  [private]
```

If m_length is 0, then m_trigger_offset is simply set to the parameter.

Threadsafe

Parameters

trigger_offset	The full trigger offset to set.

13.92.5.187 adjust_trigger_offsets_to_length()

```
void seq64::sequence::adjust_trigger_offsets_to_length (
            midipulse newlength )  [private]
```

Threadsafe

Might can get rid of this function?

Parameters

newlength	The new length of the adjusted trigger.

13.92.5.188 adjust_offset()

```
midipulse seq64::sequence::adjust_offset (
            midipulse offset )  [private]
```

13.92.5.189 remove() [1/2]

```
void seq64::sequence::remove (
            event_list::iterator i )  [private]
```

We no longer bother checking the pointer. If it is bad, all hope is lost. If the event is a note off, and that note is currently playing, then send a note off.

Not threadsafe

Parameters

i	Provides the iterator to the event to remove from the event list.

13.92.5.190 remove() [2/2]

```
void seq64::sequence::remove (
            event & e )  [private]
```

Finds the given event in m_events, and removes the first iterator matching that. If there are events that would match after that, they remain in the container. This matches seq24 behavior.

Not threadsafe

Parameters

e	Provides a reference to the event to be removed.

13.92.5.191 remove_all()

```
void seq64::sequence::remove_all ( )  [private]
```

Unsets the modified flag. (Why?) Also see the new copy_events() function.

13.92.5.192 channel_match()

```
bool seq64::sequence::channel_match (
            const event & e ) const  [inline], [private]
```

Parameters

e	The event whose channel nybble is to be checked.

Returns

Returns true if the channel-matching feature is enable and the channels match, or true if the channel-matching feature is turned off.

13.92.6 Friends And Related Function Documentation

13.92.6.1 perform

```
friend class perform  [friend]
```

13.92.6.2 triggers

```
friend class triggers  [friend]
```

13.92.7 Field Documentation

13.92.7.1 m_events_clipboard

```
event_list seq64::sequence::m_events_clipboard  [static], [private]
```

Being static allows for copy/paste between patterns.

13.92.7.2 m_parent

```
perform* seq64::sequence::m_parent  [private]
```

We can use the rc_settings flag(s), but JACK could be disconnected. We could use a reference here, but, to avoid modifying the midifile class as well, we use a pointer. It is set in perform::add_sequence(). This member would also be using for passing modification status to the parent, so that the GUI code doesn't have to do it.

13.92.7.3 m_events

```
event_list seq64::sequence::m_events  [private]
```

It used to be called m_list_events, but a map implementation is now available, and is the default.

13.92.7.4 m_triggers

```
triggers seq64::sequence::m_triggers  [private]
```

13.92.7.5 m_events_undo_hold

```
event_list seq64::sequence::m_events_undo_hold  [private]
```

Changed, of course, from std::list<event> to the sequence::Events typedef.

```
Events m_events_undo_hold;
```

13.92.7.6 m_have_undo

```
bool seq64::sequence::m_have_undo  [private]
```

13.92.7.7 m_have_redo

```
bool seq64::sequence::m_have_redo  [private]
```

Previously, unlike the perfedit, the seqedit did not provide a redo facility.

13.92.7.8 m_events_undo

```
EventStack seq64::sequence::m_events_undo  [private]
```

13.92.7.9 m_events_redo

```
EventStack seq64::sequence::m_events_redo  [private]
```

13.92.7.10 m_iterator_draw

```
event_list::iterator seq64::sequence::m_iterator_draw  [private]
```

13.92.7.11 m_channel_match

```
bool seq64::sequence::m_channel_match  [private]
```

If true (not yet the default), then the seqedit window will record only MIDI events that match its channel. The old behavior is preserved if this variable is set to false.

13.92.7.12 m_midi_channel

```
midibyte seq64::sequence::m_midi_channel  [private]
```

However, if this value is EVENT_NULL_CHANNEL (0xFF), then this sequence is an SMF 0 track, and has no single channel.

13.92.7.13 m_bus

```
midibyte seq64::sequence::m_bus  [private]
```

13.92.7.14 m_song_mute

```
bool seq64::sequence::m_song_mute  [private]
```

13.92.7.15 m_transposable

```
bool seq64::sequence::m_transposable  [private]
```

A potential feature from stazed's seq32 project. Now it is an actual, configurable feature.

13.92.7.16 m_notes_on

```
int seq64::sequence::m_notes_on  [private]
```

13.92.7.17 m_masterbus

```
mastermidibus* seq64::sequence::m_masterbus  [private]
```

13.92.7.18 m_playing_notes

```
int seq64::sequence::m_playing_notes[SEQ64_MIDI_NOTES_MAX]  [private]
```

It is used when muting, to shut off the notes that are playing.

13.92.7.19 m_was_playing

```
bool seq64::sequence::m_was_playing  [private]
```

13.92.7.20 m_playing

```
bool seq64::sequence::m_playing  [private]
```

13.92.7.21 m_recording

```
bool seq64::sequence::m_recording  [private]
```

13.92.7.22 m_quantized_rec

```
bool seq64::sequence::m_quantized_rec  [private]
```

13.92.7.23 m_thru

```
bool seq64::sequence::m_thru  [private]
```

13.92.7.24 m_queued

```
bool seq64::sequence::m_queued  [private]
```

13.92.7.25 m_dirty_main

```
bool seq64::sequence::m_dirty_main  [private]
```

Provides the main dirtiness flag.

13.92.7.26 m_dirty_edit

```
bool seq64::sequence::m_dirty_edit  [private]
```

13.92.7.27 m_dirty_perf

```
bool seq64::sequence::m_dirty_perf  [private]
```

13.92.7.28 m_dirty_names

```
bool seq64::sequence::m_dirty_names  [private]
```

13.92.7.29 m_editing

```
bool seq64::sequence::m_editing  [private]
```

13.92.7.30 m_raise

```
bool seq64::sequence::m_raise  [private]
```

It allows a sequence editor window to pop up if not already raised, in seqedit::timeout().

13.92.7.31 m_name

```
std::string seq64::sequence::m_name  [private]
```

13.92.7.32 m_last_tick

```
midipulse seq64::sequence::m_last_tick  [private]
```

Provides the last tick played.

13.92.7.33 m_queued_tick

```
midipulse seq64::sequence::m_queued_tick  [private]
```

13.92.7.34 m_trigger_offset

```
midipulse seq64::sequence::m_trigger_offset  [private]
```

13.92.7.35 m_maxbeats

```
const int seq64::sequence::m_maxbeats  [private]
```

Hardwired to c_maxbeats at present.

13.92.7.36 m_ppqn

```
int seq64::sequence::m_ppqn  [private]
```

13.92.7.37 m_seq_number

```
int seq64::sequence::m_seq_number  [private]
```

This number is set in the perform::install_sequence() function.

13.92.7.38 m_length

```
midipulse seq64::sequence::m_length  [private]
```

This value should be a power of two when used as a bar unit.

13.92.7.39 m_snap_tick

```
midipulse seq64::sequence::m_snap_tick  [private]
```

It starts out as the value m_ppqn / 4.

13.92.7.40 m_time_beats_per_measure

```
int seq64::sequence::m_time_beats_per_measure  [private]
```

Defaults to 4. Used by the sequence editor to mark things in correct time on the user-interface.

13.92.7.41 m_time_beat_width

```
int seq64::sequence::m_time_beat_width  [private]
```

Defaults to 4, which means the beat is a quarter note. A value of 8 would mean it is an eighth note. Used by the sequence editor to mark things in correct time on the user-interface.

13.92.7.42 m_clocks_per_metronome

```
int seq64::sequence::m_clocks_per_metronome  [private]
```

This value provides the number of MIDI clocks between metronome clicks. The default value of this item is 24. It can also be read from some SMF 1 files, such as our hymne.mid example.

13.92.7.43 m_32nds_per_quarter

```
int seq64::sequence::m_32nds_per_quarter  [private]
```

This value provides the number of notated 32nd notes in a MIDI quarter note (24 MIDI clocks). The usual (and default) value of this parameter is 8; some sequencers allow this to be changed.

13.92.7.44 m_us_per_quarter_note

```
long seq64::sequence::m_us_per_quarter_note  [private]
```

This value can be extracted from the beats-per-minute value (mastermidibus::m_beats_per_minute), but here we set it to 0 by default, indicating that we don't want to write it. Otherwise, it can be read from a MIDI file, and saved here to be restored later.

13.92.7.45 m_rec_vol

```
int seq64::sequence::m_rec_vol  [private]
```

13.92.7.46 m_note_on_velocity

```
int seq64::sequence::m_note_on_velocity  [private]
```

Currently set to SEQ64_DEFAULT_NOTE_ON_VELOCITY. If the recording velocity (m_rec_vol) is non-zero, this value will be set to the desired recording velocity. A "stazed" feature.

13.92.7.47 m_note_off_velocity

```
int seq64::sequence::m_note_off_velocity  [private]
```

Currently set to SEQ64_DEFAULT_NOTE_OFF_VELOCITY, and currently unmodifiable. A "stazed" feature.

13.92.7.48 m_musical_key

```
midibyte seq64::sequence::m_musical_key  [private]
```

If the value is SEQ64_KEY_OF_C, then there is no musical key to be set.

13.92.7.49 m_musical_scale

```
midibyte seq64::sequence::m_musical_scale  [private]
```

If the value is the enumeration value c_scale_off, then there is no musical scale to be set.

13.92.7.50 m_background_sequence

```
int seq64::sequence::m_background_sequence  [private]
```

If the value is greater than max_sequence(), then there is no background sequence to be set.

13.92.7.51 m_mutex

```
mutex seq64::sequence::m_mutex  [mutable], [private]
```

Made mutable for use in certain locked getter functions.

13.92.7.52 m_note_off_margin

```
const midipulse seq64::sequence::m_note_off_margin  [private]
```

Also used when the user attempts to shrink a note to zero (or less than zero) length.

13.93 seq64::trigger Class Reference

This class hold a single trigger for a sequence object.

Public Member Functions

- trigger ()
  Initializes the trigger structure.
- bool operator< (const trigger &rhs)
  This operator compares only the m_tick_start members.
- midipulse length () const
  'Getter' function for member m_tick_end and m_tick_start.
- midipulse tick_start () const
  'Getter' function for member m_tick_start
- void tick_start (midipulse s)
  'Setter' function for member m_tick_start
- void increment_tick_start (midipulse s)
  'Setter' function for member m_tick_start
- void decrement_tick_start (midipulse s)
  'Setter' function for member m_tick_start
- midipulse tick_end () const
  'Getter' function for member m_tick_end
- void tick_end (midipulse e)
  'Setter' function for member m_tick_end
- void increment_tick_end (midipulse s)
  'Setter' function for member m_tick_end
- void decrement_tick_end (midipulse s)
  'Setter' function for member m_tick_end
- midipulse offset () const
  'Getter' function for member m_offset
- void offset (midipulse o)
  'Setter' function for member m_offset
- void increment_offset (midipulse s)
  'Setter' function for member m_offset
- void decrement_offset (midipulse s)
  'Setter' function for member m_offset
- bool selected () const
  'Getter' function for member m_selected
- void selected (bool s)
  'Setter' function for member m_selected

Private Attributes

- midipulse m_tick_start

  Provides the starting tick for this trigger.
- midipulse m_tick_end

  Provides the ending tick for this trigger.
- midipulse m_offset

  Provides the offset for this trigger.
- bool m_selected

  Indicates that the trigger is part of a selection.

13.93.1 Detailed Description

This class is used in playback, and is contained in the triggers class.

13.93.2 Constructor & Destructor Documentation

13.93.2.1 trigger()

```
seq64::trigger::trigger ( )  [inline]
```

13.93.3 Member Function Documentation

13.93.3.1 operator<()

```
bool seq64::trigger::operator< (
            const trigger & rhs )  [inline]
```

Parameters

rhs	The "right-hand side" of the less-than operation.

Returns

Returns true if m_tick_start is less than rhs's.

13.93.3.2 length()

```
midipulse seq64::trigger::length ( ) const  [inline]
```

We've seen that some of the calculations of trigger length are wrong, being 1 tick less than the true length of the trigger in pulses. This function calculates trigger length the correct way.

13.93.3.3 tick_start() [1/2]

```
midipulse seq64::trigger::tick_start ( ) const  [inline]
```

13.93.3.4 tick_start() [2/2]

```
void seq64::trigger::tick_start (
            midipulse s )  [inline]
```

13.93.3.5 increment_tick_start()

```
void seq64::trigger::increment_tick_start (
            midipulse s )  [inline]
```

13.93.3.6 decrement_tick_start()

```
void seq64::trigger::decrement_tick_start (
            midipulse s )  [inline]
```

13.93.3.7 tick_end() [1/2]

```
midipulse seq64::trigger::tick_end ( ) const  [inline]
```

13.93.3.8 tick_end() [2/2]

```
void seq64::trigger::tick_end (
            midipulse e )  [inline]
```

13.93.3.9 increment_tick_end()

```
void seq64::trigger::increment_tick_end (
            midipulse s )  [inline]
```

13.93.3.10 decrement_tick_end()

```
void seq64::trigger::decrement_tick_end (
            midipulse s )  [inline]
```

13.93.3.11 offset() [1/2]

```
midipulse seq64::trigger::offset ( ) const  [inline]
```

13.93.3.12 offset() [2/2]

```
void seq64::trigger::offset (
            midipulse o )  [inline]
```

13.93.3.13 increment_offset()

```
void seq64::trigger::increment_offset (
            midipulse s )  [inline]
```

13.93.3.14 decrement_offset()

```
void seq64::trigger::decrement_offset (
            midipulse s )  [inline]
```

13.93.3.15 selected() [1/2]

```
bool seq64::trigger::selected ( ) const  [inline]
```

13.93.3.16 selected() [2/2]

```
void seq64::trigger::selected (
            bool s )  [inline]
```

13.93.4 Field Documentation

13.93.4.1 m_tick_start

```
midipulse seq64::trigger::m_tick_start  [private]
```

13.93.4.2 m_tick_end

```
midipulse seq64::trigger::m_tick_end  [private]
```

13.93.4.3 m_offset

```
midipulse seq64::trigger::m_offset  [private]
```

13.93.4.4 m_selected

```
bool seq64::trigger::m_selected  [private]
```

13.94 seq64::triggers Class Reference

The triggers class is a receptable the triggers that can be used with a sequence object.

Public Member Functions

- triggers (sequence &parent)

  Principal constructor.
- ~triggers ()

  A rote destructor.
- triggers & operator= (const triggers &rhs)

  Principal assignment operator.
- void set_ppqn (int ppqn)

  'Setter' function for member m_ppqn We have to set this value after construction for best safety.
- void set_length (int len)

  'Setter' function for member m_length We have to set this value after construction for best safety.
- const List & triggerlist () const

  'Getter' function for member m_triggers This is the const version
- List & triggerlist ()

  'Getter' function for member m_triggers
- void push_undo ()

  Pushes the list-trigger into the trigger undo-list, then flags each item in the undo-list as unselected.
- void pop_undo ()

  If the trigger undo-list has any items, the list-trigger is pushed into the redo list, the top of the undo-list is coped into the list-trigger, and then pops from the undo-list.
- void pop_redo ()

  If the trigger redo-list has any items, the list-trigger is pushed into the undo list, the top of the redo-list is coped into the list-trigger, and then pops from the redo-list.
- void print (const std::string &seqname) const

  Prints a list of the currently-held triggers.
- bool play (midipulse &starttick, midipulse &endtick)

  If playback-mode (song mode) is in force, that is, if using in-triggers and on/off triggers, this function handles that kind of playback.
- void add (midipulse tick, midipulse len, midipulse offset=0, bool adjustoffset=true)

  Adds a trigger.
- void adjust_offsets_to_length (midipulse newlen)

  Adjusts trigger offsets to the length specified for all triggers, and undo triggers.
- void split (midipulse tick)

  Splits the first trigger that brackets the splittick parameter.
- void grow (midipulse tickfrom, midipulse tickto, midipulse length)

  Grows a trigger.
- void remove (midipulse tick)

  Deletes the first trigger that brackets the given tick from the trigger-list.
- bool get_state (midipulse tick)

  Checks the list of triggers against the given tick.
- bool select (midipulse tick)

  Checks the list of triggers against the given tick.
- bool unselect ()

  Unselects all triggers.
- bool intersect (midipulse position, midipulse &start, midipulse &end)

  This function examines each trigger in the trigger list.
- void remove_selected ()

  Deletes the first selected trigger that is found.
- void copy_selected ()

  Copies the first selected trigger that is found.
- void paste (midipulse paste_tick=SEQ64_NO_PASTE_TRIGGER)

If there is a copied trigger, then this function grabs it from the trigger clipboard and adds it.

- bool move_selected (midipulse tick, bool adjustoffset, grow_edit_t which=GROW_MOVE)

  Moves selected triggers as per the given parameters.

- midipulse get_selected_start ()

  Gets the selected trigger's start tick.

- midipulse get_selected_end ()

  Gets the selected trigger's end tick.

- midipulse get_maximum ()

  Get the ending value of the last trigger in the trigger-list.

- void move (midipulse starttick, midipulse distance, bool direction)

  Moves triggers in the trigger-list.

- void copy (midipulse starttick, midipulse distance)

  Not sure what these diagrams are for yet.

- void clear ()

  Clears the whole list of triggers.

- bool next (midipulse *tick_on, midipulse *tick_off, bool *selected, midipulse *tick_offset)

  Get the next trigger in the trigger list, and set the parameters based on that trigger.

- trigger next_trigger ()

  Get the next trigger in the trigger list.

- void reset_draw_trigger_marker ()

  Sets the draw-trigger iterator to the beginning of the trigger list.

- void set_trigger_paste_tick (midipulse tick)
- midipulse get_trigger_paste_tick () const

Private Types

- enum grow_edit_t {
  GROW_START,
  GROW_END,
  GROW_MOVE }

  Provides a typedef introduced by Stazed to make the trigger grow/move code easier to understand.

- typedef std::list< trigger > List

  Exposes the triggers type, currently needed for midi_container only.

- typedef std::stack< List > Stack

  Provides a stack for use with the undo/redo features of the trigger support.

Private Member Functions

- midipulse adjust_offset (midipulse offset)

  Adjusts the given offset by mod'ing it with m_length and adding m_length if needed, and returning the result.

- void split (trigger &trig, midipulse splittick)

  Splits the trigger given by the parameter into two triggers.

Private Attributes

- sequence & m_parent
  Holds a reference to the parent sequence object that owns this trigger object.
- List m_triggers
  This list holds the current pattern/triggers events.
- trigger m_clipboard
  This item holds a single copied trigger, to be pasted later.
- Stack m_undo_stack
  Handles the undo list for a series of operations on triggers.
- Stack m_redo_stack
  Handles the redo list for a series of operations on triggers.
- List::iterator m_iterator_play_trigger
  An iterator for cycling through the triggers during playback.
- List::iterator m_iterator_draw_trigger
  An iterator for cycling through the triggers during drawing.
- bool m_trigger_copied
  Set to true if there is an active trigger in the trigger clipboard.
- midipulse m_paste_tick
  The tick point for pasting.
- int m_ppqn
  Holds the value of the PPQN from the parent sequence, for easy access.
- int m_length
  Holds the value of the length from the parent sequence, for easy access.

Friends

- class midi_container
- class midifile
- class sequence
- class Seq24PerfInput
- class FruityPerfInput

13.94.1 Member Typedef Documentation

13.94.1.1 List

```
typedef std::list<trigger> seq64::triggers::List  [private]
```

13.94.1.2 Stack

```
typedef std::stack<List> seq64::triggers::Stack  [private]
```

13.94.2 Member Enumeration Documentation

13.94.2.1 grow_edit_t

```
enum seq64::triggers::grow_edit_t  [private]
```

Enumerator

GROW_START	Grow the start of the trigger.
GROW_END	Grow the end of the trigger.
GROW_MOVE	Move the entire trigger block.

13.94.3 Constructor & Destructor Documentation

13.94.3.1 triggers()

```
seq64::triggers::triggers (
            sequence & parent )
```

Parameters

parent	The triggers object often needs to tell its parent sequence object what to do (such as stop playing).

13.94.3.2 ~triggers()

```
seq64::triggers::~triggers ( )
```

13.94.4 Member Function Documentation

13.94.4.1 operator=()

```
triggers & seq64::triggers::operator= (
            const triggers & rhs )
```

Follows the stock rules for such an operator, but does a little more then just assign member values.

FIXED, BEWARE: Currently, it does not assign them all, so we should create a partial_copy() function to do this work, and use it where it is needed.

Parameters

rhs	Provides the "right-hand side" of the assignment operation.

Returns

Returns a reference to self, for use in concatenated assignment operations.

13.94.4.2 set_ppqn()

```
void seq64::triggers::set_ppqn (
             int ppqn )  [inline]
```

13.94.4.3 set_length()

```
void seq64::triggers::set_length (
             int len )  [inline]
```

Also, there a chance that the length of the parent might change from time to time. Currently, only the sequence constructor and midifile call this function.

13.94.4.4 triggerlist() [1/2]

```
const List& seq64::triggers::triggerlist ( ) const  [inline]
```

13.94.4.5 triggerlist() [2/2]

```
List& seq64::triggers::triggerlist ( )  [inline]
```

13.94.4.6 push_undo()

```
void seq64::triggers::push_undo ( )
```

13.94.4.7 pop_undo()

```
void seq64::triggers::pop_undo ( )
```

13.94.4.8 pop_redo()

```
void seq64::triggers::pop_redo ( )
```

13.94.4.9 print()

```
void seq64::triggers::print (
             const std::string & seqname ) const
```

Parameters

seqname	A tag name to accompany the print-out, for the human to read.

13.94.4.10 play()

```
bool seq64::triggers::play (
            midipulse & start_tick,
            midipulse & end_tick )
```

This is a new function for sequence::play() to call.

The for-loop goes through all the triggers, determining if there is are trigger start/end values before the *end_tick*. If so, then the trigger state is set to true (start only within the tick range) or false (end is within the tick range), and the trigger tick is set to start or end. The first start or end trigger that is past the end tick cause the search to end.

If the trigger state has changed, then the start/end ticks are passed back to the sequence, and the trigger offset is adjusted.

Parameters

start_tick	Provides the starting tick value, and returns the modified value as a side-effect.
end_tick	Provides the ending tick value, and returns the modified value as a side-effect.

Returns

Returns true if we're through playing the frame (trigger turning off), and the caller should stop the playback.

13.94.4.11 add()

```
void seq64::triggers::add (
            midipulse tick,
            midipulse len,
            midipulse offset = 0,
            bool fixoffset = true )
```

What is this?

```
   is    ie
   <      ><        ><        >
   es             ee
   <               >
   XX
   es ee
   <   >
   <>
   es    ee
   <      >
   <    >
   es     ee
   <       >
   <    >
```

Parameters

tick	Provides the tick (pulse) time at which the trigger goes on.
len	Provides the length of the trigger. This value is actually calculated from the "on" value minus the "off" value read from the MIDI file.
offset	This value specifies the offset of the trigger. It is a feature of the c_triggers_new that c_triggers doesn't have. It is the third value in the trigger specification of the Sequencer64 MIDI file.
fixoffset	If true, the offset parameter is modified by adjust_offset() first. We think that basically makes sure it is positive.

13.94.4.12 adjust_offsets_to_length()

```
void seq64::triggers::adjust_offsets_to_length (
            midipulse newlength )
```

Parameters

newlength	Provides the length to which to adjust the offsets.

COMMON CODE?

13.94.4.13 split() [1/2]

```
void seq64::triggers::split (
            midipulse splittick )
```

This is the first trigger where splittick is greater than L and less than R.

Parameters

splittick	Provides the tick that must be bracketed for the split to be made.

13.94.4.14 grow()

```
void seq64::triggers::grow (
            midipulse tickfrom,
            midipulse tickto,
            midipulse len )
```

This function looks for the first trigger where the tickfrom parameter is between the trigger's tick-start and tick-end values. If found then the trigger's start is moved back to tickto, if necessary, or the trigger's end is moved to tickto plus the length parameter, if necessary.

Then this new trigger is added, and the function breaks from the search loop.

Parameters

tickfrom	The desired from-value back which to expand the trigger, if necessary.
tickto	The desired to-value towards which to expand the trigger, if necessary.
len	The additional length to append to tickto for the check.

13.94.4.15 remove()

```
void seq64::triggers::remove (
            midipulse tick )
```

Parameters

tick	Provides the tick to be examined.

13.94.4.16 get_state()

```
bool seq64::triggers::get_state (
            midipulse tick )
```

If any trigger is found to bracket that tick, then true is returned.

Parameters

tick	Provides the tick of interest.

Returns

Returns true if a trigger is found that brackets the given tick.

13.94.4.17 select()

```
bool seq64::triggers::select (
            midipulse tick )
```

If any trigger is found to bracket that tick, then true is returned, and the trigger is marked as selected.

Parameters

tick	Provides the tick of interest.

Returns

Returns true if a trigger is found that brackets the given tick.

13.94.4.18 unselect()

```
bool seq64::triggers::unselect ( )
```

Returns

Always returns false.

13.94.4.19 intersect()

```
bool seq64::triggers::intersect (
            midipulse position,
            midipulse & start,
            midipulse & ender )
```

If the given position is between the current trigger's tick-start and tick-end values, the these values are copied to the start and end parameters, respectively, and then we exit.

Parameters

position	The position to examine.
start	The destination for the starting tick (m_tick_start) of the matching trigger.
ender	The destination for the ending tick (m_tick_end) of the matching trigger.

Returns

Returns true if a trigger was found whose start/end ticks contained the position. Otherwise, false is returned, and the start and end return parameters should not be used.

13.94.4.20 remove_selected()

```
void seq64::triggers::remove_selected ( )
```

13.94.4.21 copy_selected()

```
void seq64::triggers::copy_selected ( )
```

13.94.4.22 paste()

```
void seq64::triggers::paste (
            midipulse paste_tick = SEQ64_NO_PASTE_TRIGGER )
```

It pastes at the copy end. or at the paste-tick, if supplied.

Parameters

paste_tick	Provides the optional tick at which to paste the trigger. If not set to SEQ64_NO_PASTE_TRIGGER, this value is used to adjust the paste offset.

13.94.4.23 move_selected()

```
bool seq64::triggers::move_selected (
            midipulse tick,
            bool fixoffset,
            grow_edit_t which = GROW_MOVE )


          mintick][0                1][maxtick
                          2

The \a which parameter has three possible values:

-#  If we are moving the 0, use first as offset.
-#  If we are moving the 1, use the last as the offset.
-#  If we are moving both (2), use first as offset.
```

Parameters

tick	The tick at which the trigger starts.
fixoffset	Set to true if the offset is to be adjusted.
which	Selects which movement will be done, as discussed above. See the values of the trigger::grow_edit_t type.

Returns

Returns true if there was room to move. Otherwise, false is returned. We need this feature to support keystoke movement of a selected trigger in the perfroll window, and keep it from continually incrementing when there can be no more movement. This causes moving the other direction to be delayed while the accumulating movement counter is used up. However, right now we can't rely on this result, and ignore it. There may be no way around this minor issue.

13.94.4.24 get_selected_start()

```
midipulse seq64::triggers::get_selected_start ( )
```

We guess this ends up selecting only one trigger, otherwise only the last selected one would effectively set the result.

Returns

Returns the tick_start() value of the last-selected trigger. If no triggers are selected, then midipulse(-1) is returned.

13.94.4.25 get_selected_end()

```
midipulse seq64::triggers::get_selected_end ( )
```

Returns

Returns the tick_end() value of the last-selected trigger. If no triggers are selected, then midipulse(-1) is returned.

13.94.4.26 get_maximum()

```
midipulse seq64::triggers::get_maximum ( )
```

Returns

Returns the tick-end for the last trigger, if available. Otherwise, 0 is returned.

13.94.4.27 move()

```
void seq64::triggers::move (
            midipulse starttick,
            midipulse distance,
            bool direction )
```

There's no way to optimize this by saving tick values, as they are potentially modified at each step.

Parameters

starttick	The current location of the triggers.
distance	The distance away from the current location to which to move the triggers.
direction	If true, the triggers are moved forward. If false, the triggers are moved backward.

13.94.4.28 copy()

```
void seq64::triggers::copy (
```

```
            midipulse starttick,
            midipulse distance )


... a
[      ][      ]
...
... a
...

5   7    play
3        offset
8   10   play

X...X...X...X...X...X...X...X...X...X...
L       R
[        ] [     ]  []  orig
[                   ]

        <<
        [     ]    [  ][ ]  [] split on the R marker, shift first
        [     ]        [     ]
        delete middle
        [     ][ ]  []         move ticks
        [     ][     ]

        L       R
        [     ][ ] [     ]  [] split on L
        [     ][             ]

        [     ]        [ ] [     ]  [] increase all after L
        [     ]        [             ]


|...|...|...|...|...|...|...

0123456789abcdef0123456789abcdef
[      ][      ][      ][      ][      ][

[  ][      ][  ][][][][][      ]  [  ][  ]
0   4       4   0 7 4 2 0         6   2
0   4       4   0 1 4 6 0         2   6 inverse offset

[              ][              ][              ]
[  ][      ][  ][][][][][      ]  [  ][  ]
0   c       4   0 f c a 8         e   a
0   4       c   0 1 4 6 8         2   6  inverse offset

[                              ][
[  ][      ][  ][][][][][      ]  [  ][  ]
k   g f c a 8
0   4       c   g h k m n       inverse offset

0123456789abcdefghijklmonpq
ponmlkjihgfedcba9876543210
0fedcba9876543210fedcba9876543210fedcba9876543210fedcba9876543210
```

Copies triggers to a point distant from a given tick.

Parameters

starttick	The current location of the triggers.
distance	The distance away from the current location to which to copy the triggers.

13.94.4.29 clear()

```
void seq64::triggers::clear ( )  [inline]
```

13.94.4.30 next()

```
bool seq64::triggers::next (
            midipulse * tick_on,
            midipulse * tick_off,
            bool * selected,
            midipulse * offset )
```

Todo It would be a bit simpler to simply return a trigger object, wouldn't it?

Parameters

tick_on	Return value for the retrieval of the starting tick for the trigger.
tick_off	Return value for the retrieval of the ending tick for the trigger.
selected	Return value for the retrieval of the is-selected flag for the trigger.
offset	Return value for the retrieval of the offset for the trigger.

Returns

Returns true if a trigger was found. If false, the caller cannot rely on the values returned through the return parameters.

Side-effect(s) The value of the m_iterator_draw_trigger member will be altered by this call, unless pointing to the end of the triggerlist, or if there are no triggers.

13.94.4.31 next_trigger()

```
trigger seq64::triggers::next_trigger ( )
```

Returns

Returns the next trigger. If there is none, a default trigger object is returned.

13.94.4.32 reset_draw_trigger_marker()

```
void seq64::triggers::reset_draw_trigger_marker ( )  [inline]
```

13.94.4.33 set_trigger_paste_tick()

```
void seq64::triggers::set_trigger_paste_tick (
            midipulse tick )  [inline]
```

13.94.4.34 get_trigger_paste_tick()

```
midipulse seq64::triggers::get_trigger_paste_tick ( ) const  [inline]
```

13.94.4.35 adjust_offset()

```
midipulse seq64::triggers::adjust_offset (
            midipulse offset )  [private]
```

Parameters

offset	Provides the offset, mod'ed against m_length, used to adjust the offset.

Returns

Returns the new offset. However, if m_length is 0, no change is made, and the original offset is returned.

13.94.4.36 split() [2/2]

```
void seq64::triggers::split (
            trigger & trig,
            midipulse splittick )  [private]
```

The original trigger ends 1 tick before the splittick parameter, and the new trigger starts at splittick and ends where the original trigger ended.

Parameters

trig	Provides the original trigger, and also holds the changes made to that trigger as it is shortened, as a side-effect.
splittick	The position just after where the original trigger will be truncated, and the new trigger begins.

13.94.5 Friends And Related Function Documentation

13.94.5.1 midi_container

```
friend class midi_container  [friend]
```

13.94.5.2 midifile

```
friend class midifile  [friend]
```

13.94.5.3 sequence

```
friend class sequence  [friend]
```

13.94.5.4 Seq24PerfInput

```
friend class Seq24PerfInput  [friend]
```

13.94.5.5 FruityPerfInput

```
friend class FruityPerfInput  [friend]
```

13.94.6 Field Documentation

13.94.6.1 m_parent

```
sequence& seq64::triggers::m_parent  [private]
```

13.94.6.2 m_triggers

```
List seq64::triggers::m_triggers  [private]
```

13.94.6.3 m_clipboard

```
trigger seq64::triggers::m_clipboard  [private]
```

13.94.6.4 m_undo_stack

```
Stack seq64::triggers::m_undo_stack  [private]
```

13.94.6.5 m_redo_stack

```
Stack seq64::triggers::m_redo_stack  [private]
```

13.94.6.6 m_iterator_play_trigger

```
List::iterator seq64::triggers::m_iterator_play_trigger  [private]
```

13.94.6.7 m_iterator_draw_trigger

```
List::iterator seq64::triggers::m_iterator_draw_trigger  [private]
```

13.94.6.8 m_trigger_copied

```
bool seq64::triggers::m_trigger_copied  [private]
```

13.94.6.9 m_paste_tick

```
midipulse seq64::triggers::m_paste_tick  [private]
```

Set to -1 if not in force. This is a new feature from stazed's Seq32 project.

13.94.6.10 m_ppqn

```
int seq64::triggers::m_ppqn  [private]
```

This should not change, but we have to set it after construction, and so we provide a setter for it, set_ppqn(), called by the sequence constructor.

13.94.6.11 m_length

```
int seq64::triggers::m_length  [private]
```

This might change, we're not yet sure.

13.95 seq64::user_instrument Class Reference

Provides data about the MIDI instruments, readable from the "user" configuration file.

Public Member Functions

- user_instrument (const std::string &name="")

  Default constructor.
- user_instrument (const user_instrument &rhs)

  Copy constructor.
- user_instrument & operator= (const user_instrument &rhs)

  Principal assignment operator.
- bool is_valid () const

  'Getter' function for member m_is_valid
- void set_defaults ()

  Sets the default values.
- const std::string & name () const

  'Getter' function for member m_instrument_def.instrument (name of instrument)
- int controller_count () const

  'Getter' function for member m_controller_count This function returns the number of active controllers.
- int controller_max () const

  'Getter' function for member MIDI_CONTROLLER_MAX This function returns the maximum number of controllers, active or inactive.
- const std::string & controller_name (int c) const

  'Getter' function for member m_instrument_def.controllers[c]
- bool controller_active (int c) const

  'Getter' function for member m_instrument_def.controllers_active[c]
- void set_controller (int c, const std::string &cname, bool isactive)

  'Setter' function for member m_instrument_def.controllers[c] and .controllers_active[c] Only sets the controller values if the object is already valid.

Private Member Functions

- void set_name (const std::string &instname)

  'Setter' function for member m_instrument_def.instrument If the name parameter is not empty, the validity flag is set to true, otherwise it is set to false.
- void copy_definitions (const user_instrument &rhs)

  Copies the array members from one instance of user_instrument to this one.

Private Attributes

- bool m_is_valid

  Provides a validity flag, useful in returning a reference to a bogus object for internal error-check.
- int m_controller_count

  Provides the actual number of non-default controllers actually set.
- user_instrument_t m_instrument_def

  The instance of the structure that this class wraps.

13.95.1 Detailed Description

Will later make the size adjustable, if it makes sense to do so.

13.95.2 Constructor & Destructor Documentation

13.95.2.1 user_instrument() [1/2]

```
seq64::user_instrument::user_instrument (
            const std::string & name = "" )
```

Fills in the defaults for the instrument definition, sets its name, and provides some light validation.

Parameters

name	The name of the instrument, valid only if it is not empty.

13.95.2.2 user_instrument() [2/2]

```
seq64::user_instrument::user_instrument (
            const user_instrument & rhs )
```

Parameters

rhs	The sources of the data for the copy.

13.95.3 Member Function Documentation

13.95.3.1 operator=()

```
user_instrument & seq64::user_instrument::operator= (
            const user_instrument & rhs )
```

Parameters

rhs	The sources of the data for the assignment.

Returns

Returns a reference to this object.

13.95.3.2 is_valid()

```
bool seq64::user_instrument::is_valid ( ) const  [inline]
```

13.95.3.3 set_defaults()

```
void seq64::user_instrument::set_defaults ( )
```

Also invalidates the object.

13.95.3.4 name()

```
const std::string& seq64::user_instrument::name ( ) const  [inline]
```

13.95.3.5 controller_count()

```
int seq64::user_instrument::controller_count ( ) const  [inline]
```

13.95.3.6 controller_max()

```
int seq64::user_instrument::controller_max ( ) const  [inline]
```

Remember that the controller numbers for each MIDI instrument range from 0 to 127 (MIDI_CONTROLLER_MAX-1).

13.95.3.7 controller_name()

```
const std::string & seq64::user_instrument::controller_name (
            int c ) const
```

Parameters

c	The index of the desired controller.

Returns

The name of the desired controller has is returned. If the index c is out of range, or the object is not valid, then a reference to an internal, empty string is returned.

13.95.3.8 controller_active()

```
bool seq64::user_instrument::controller_active (
            int c ) const
```

Parameters

c	The index of the desired controller.

Returns

The status of the desired controller has is returned. If the index c is out of range, or the object is not valid, then false is returned.

13.95.3.9 set_controller()

```
void seq64::user_instrument::set_controller (
            int c,
            const std::string & cname,
            bool isactive )
```

Parameters

c	The index of the desired controller.
cname	The name of the controller to be set as the controller name.
isactive	A flag that indicates if the desired controller is active.

13.95.3.10 set_name()

```
void seq64::user_instrument::set_name (
            const std::string & instname )  [private]
```

Too tricky?

Parameters

instname	The name of the instrument, valid only if it is not empty.

13.95.3.11 copy_definitions()

```
void seq64::user_instrument::copy_definitions (
            const user_instrument & rhs )  [private]
```

Does not include the validity flag.

Parameters

rhs	The sources of the data for the partial copy.

13.95.4 Field Documentation

13.95.4.1 m_is_valid

```
bool seq64::user_instrument::m_is_valid  [private]
```

Callers should check this flag via the is_valid() accessor before using this object. This flag is set to true when any valid member assignment occurs via a public setter call. However, setting an empty name for the instrument member will render the object invalid.

13.95.4.2 m_controller_count

```
int seq64::user_instrument::m_controller_count  [private]
```

Often, the "user" configuration file has only a few out of the 128 assigned explicitly.

13.95.4.3 m_instrument_def

```
user_instrument_t seq64::user_instrument::m_instrument_def  [private]
```

13.96 seq64::user_instrument_t Struct Reference

This structure corresponds to `[user-instrument-N]` definitions in the `~/.seq24usr` or `~/.config/sequencer64/s`
`usr` file.

Data Fields

- std::string instrument

  Provides the name of the "instrument" being supported.
- std::string controllers [SEQ64_MIDI_CONTROLLER_MAX]

  Provides a list of up to 128 controllers (e.g.
- bool controllers_active [SEQ64_MIDI_CONTROLLER_MAX]

  Provides a flag that indicates if each of up to 128 controller is active and supported.

13.96.1 Field Documentation

13.96.1.1 instrument

```
std::string seq64::user_instrument_t::instrument
```

Do not confuse "instrument" with "program" here. An "instrument" is most likely a hardware MIDI sound-box (though it could be a software synthesizer as well.

13.96.1.2 controllers

```
std::string seq64::user_instrument_t::controllers[SEQ64_MIDI_CONTROLLER_MAX]
```

"Modulation"). If a controller isn't present, or if General MIDI is in force, this name might be empty.

13.96.1.3 controllers_active

```
bool seq64::user_instrument_t::controllers_active[SEQ64_MIDI_CONTROLLER_MAX]
```

If false, it might be an unsupported controller or a General MIDI device.

13.97 seq64::user_midi_bus Class Reference

Provides data about the MIDI busses, readable from the "user" configuration file.

Public Member Functions

- user_midi_bus (const std::string &name="")
  Default constructor.
- user_midi_bus (const user_midi_bus &rhs)
  Copy constructor.
- user_midi_bus & operator= (const user_midi_bus &rhs)
  Principal assignment operator.
- bool is_valid () const
  'Getter' function for member m_is_valid
- void set_defaults ()
  Sets the default values.
- const std::string & name () const
  'Getter' function for member m_midi_bus_def.alias (name of alias)
- int channel_count () const
  'Getter' function for member m_channel_count
- int channel_max () const
  'Getter' function for member SEQ64_MIDI_BUS_CHANNEL_MAX
- int instrument (int channel) const
  'Getter' function for member m_midi_bus_def.instrument[channel]
- void set_instrument (int channel, int instrum)
  'Getter' function for member m_midi_bus_def.instrument[channel]

Private Member Functions

- void set_name (const std::string &name)
  'Setter' function for member m_midi_bus_def.alias (name of alias) Also sets the validity flag according to the emptiness of the name parameter.
- void copy_definitions (const user_midi_bus &rhs)
  Copies the member fields from one instance of user_midi_bus to this one.

Private Attributes

- bool m_is_valid
  Provides a validity flag, useful in returning a reference to a bogus object for internal error-check.
- int m_channel_count
  Provides the actual number of non-default buss channels actually set.
- user_midi_bus_t m_midi_bus_def
  The instance of the structure that this class wraps.

13.97.1 Detailed Description

Will later make the size adjustable, if it makes sense to do so.

13.97.2 Constructor & Destructor Documentation

13.97.2.1 user_midi_bus() [1/2]

```
seq64::user_midi_bus::user_midi_bus (
            const std::string & name = "" )
```

Parameters

name	The name of the buss, valid only if it is not empty.

13.97.2.2 user_midi_bus() [2/2]

```
seq64::user_midi_bus::user_midi_bus (
            const user_midi_bus & rhs )
```

Parameters

rhs	The sources of the data for the copy.

13.97.3 Member Function Documentation

13.97.3.1 operator=()

```
user_midi_bus & seq64::user_midi_bus::operator= (
            const user_midi_bus & rhs )
```

Parameters

rhs	The sources of the data for the assignment.

Returns

Returns a reference to this object.

13.97.3.2 is_valid()

```
bool seq64::user_midi_bus::is_valid ( ) const  [inline]
```

13.97.3.3 set_defaults()

```
void seq64::user_midi_bus::set_defaults ( )
```

Also invalidates the object. All 16 of the channels are set to SEQ64_GM_INSTRUMENT_FLAG (-1).

13.97.3.4 name()

```
const std::string& seq64::user_midi_bus::name ( ) const  [inline]
```

13.97.3.5 channel_count()

```
int seq64::user_midi_bus::channel_count ( ) const  [inline]
```

Returns

This function returns the number of channels. Basically this value is always the same as that returned by channel_max(), but this pair of functions is consistent with the count functions in the user_instrument class.

13.97.3.6 channel_max()

```
int seq64::user_midi_bus::channel_max ( ) const  [inline]
```

Returns

Returns the maximum number of MIDI buss channels. Remember that the instrument channels for each MIDI buss range from 0 to 15 (MIDI_BUS_CHANNEL_MAX-1).

13.97.3.7 instrument()

```
int seq64::user_midi_bus::instrument (
            int channel ) const
```

Parameters

channel	Provides the desired buss channel number.

Returns

The instrument number of the desired buss channel is returned. If the channel number is out of range, or the object is not valid, then SEQ64_GM_INSTRUMENT_FLAG (-1) is returned.

13.97.3.8 set_instrument()

```
void seq64::user_midi_bus::set_instrument (
            int channel,
            int instrum )
```

Does not alter the validity flag, just checks it.

Parameters

channel	Provides the desired buss channel number.
instrum	Provides the instrument number to set that channel to.

13.97.3.9 set_name()

```
void seq64::user_midi_bus::set_name (
            const std::string & name )  [inline], [private]
```

13.97.3.10 copy_definitions()

```
void seq64::user_midi_bus::copy_definitions (
            const user_midi_bus & rhs )  [private]
```

Does not include the validity flag.

13.97.4 Field Documentation

13.97.4.1 m_is_valid

```
bool seq64::user_midi_bus::m_is_valid  [private]
```

Callers should check this flag via the is_valid() accessor before using this object. This flag is set to true when any valid member assignment occurs via a public setter call.

13.97.4.2 m_channel_count

```
int seq64::user_midi_bus::m_channel_count  [private]
```

Often, the "user" configuration file has only a few out of the 16 assigned explicitly.

13.97.4.3 m_midi_bus_def

```
user_midi_bus_t seq64::user_midi_bus::m_midi_bus_def  [private]
```

13.98 seq64::user_midi_bus_t Struct Reference

This structure corresponds to `[user-midi-bus-0]` definitions in the `~/.seq24usr` ("user") file (`~/.config/sequencer64/sequencer64.usr` in the latest version of the application).

Data Fields

- std::string alias

  Provides the user's desired name for the MIDI bus.
- int instrument [SEQ64_MIDI_BUS_CHANNEL_MAX]

  Provides an implicit list of MIDI channels from 0 to 15 (1 to 16) and the "instrument" number assigned to each channel.

13.98.1 Field Documentation

13.98.1.1 alias

```
std::string seq64::user_midi_bus_t::alias
```

For example, "2x2 A" for some kind of MIDI card or USB MIDI cable. If manual-alsa-ports is enabled, this could be something like "[0] seq24 0", and that is what should be shown in that case.

13.98.1.2 instrument

```
int seq64::user_midi_bus_t::instrument[SEQ64_MIDI_BUS_CHANNEL_MAX]
```

Note that the "instrument" is not a MIDI program number. Instead, it is the number associated with a "user-instrument" section in the "user" configuration file.

13.99 seq64::user_settings Class Reference

Holds the current values of sequence settings and settings that can modify the number of sequences and the configuration of the user-interface.

Public Member Functions

- user_settings ()

  Default constructor.
- user_settings (const user_settings &rhs)

  Copy constructor.
- user_settings & operator= (const user_settings &rhs)

  Principal assignment operator.
- void set_defaults ()

  Sets the default values.
- void normalize ()

  Calculate the derived values from the already-set values.
- bool add_bus (const std::string &alias)

  Adds a user buss to the container, but only does so if the name parameter is not empty.
- bool add_instrument (const std::string &instname)

  Adds a user instrument to the container, but only does so if the name parameter is not empty.
- const user_midi_bus & bus (int index)

  'Getter' function for member Unlike the non-const version this function is public.
- const user_instrument & instrument (int index)

  'Getter' function for member Unlike the non-const version this function is public.
- int bus_count () const

  'Getter' function for member m_midi_buses.size()
- void set_bus_instrument (int index, int channel, int instrum)

  'Getter' function for member m_midi_buses[index].instrument[channel] Currently this function is used, in the userfile::parse() function.
- int bus_instrument (int buss, int channel)

  'Getter' function for member m_midi_buses[buss].instrument[channel]
- const std::string & bus_name (int buss)

  'Getter' function for member m_midi_buses[buss].name
- int instrument_count () const

  'Getter' function for member m_instruments.size()
- void set_instrument_controllers (int index, int cc, const std::string &ccname, bool isactive)

  'Setter' function for member m_midi_instrument_defs[index].controllers, controllers_active
- const std::string & instrument_name (int instrum)

  'Getter' function for member m_instruments[instrument].instrument (name of instrument)
- const std::string & instrument_name (int buss, int channel)

  Gets the correct instrument number from the buss and channel, and then looks up the name of the instrument.
- bool instrument_controller_active (int instrum, int cc)

  'Getter' function for member m_instruments[instrument].controllers_active[controller]
- bool controller_active (int buss, int channel, int cc)

  A convenience function so that the caller doesn't have to get the instrument number from the bus_instrument() member function.
- const std::string & instrument_controller_name (int instrum, int cc)

  'Getter' function for member m_instruments[instrument].controllers_active[controller]
- const std::string & controller_name (int buss, int channel, int cc)

  'Getter' function for member m_instruments[instrument].controllers_active[controller] A convenience function so that the caller doesn't have to get the instrument number from the bus_instrument() member function.
- int grid_style () const

  'Getter' function for member m_grid_style Checks for normal style.
- bool grid_is_normal () const

  'Getter' function for member m_grid_style Checks for normal style.
- bool grid_is_white () const

'Getter' function for member m_grid_style Checks for the white style.

- bool grid_is_black () const

  'Getter' function for member m_grid_style Checks for the black style.

- int grid_brackets () const

  'Getter' function for member m_grid_brackets

- int mainwnd_rows () const

  'Getter' function for member m_mainwnd_rows

- int mainwnd_cols () const

  'Getter' function for member m_mainwnd_cols

- int seqs_in_set () const

  'Getter' function for member m_seqs_in_set, dependent member

- int gmute_tracks () const

  'Getter' function for member m_gmute_tracks, dependent member

- int max_sets () const

  'Getter' function for member m_max_sets

- int max_sequence () const

  'Getter' function for member m_max_sequence, dependent member

- int text_x () const

  'Getter' function for member m_text_x, not user modifiable, not saved

- int text_y () const

  'Getter' function for member m_text_y, not user modifiable, not saved

- int seqchars_x () const

  'Getter' function for member m_seqchars_x, not user modifiable, not saved

- int seqchars_y () const

  'Getter' function for member m_seqchars_y, not user modifiable, not saved

- int seqarea_x () const

  'Getter' function for member m_seqarea_x, not user modifiable, not saved

- int seqarea_y () const

  'Getter' function for member m_seqarea_y, not user modifiable, not saved

- int seqarea_seq_x () const

  'Getter' function for member m_seqarea_seq_x, not user modifiable, not saved

- int seqarea_seq_y () const

  'Getter' function for member m_seqarea_seq_y, not user modifiable, not saved

- int mainwid_border () const

  'Getter' function for member m_mainwid_border

- int mainwid_spacing () const

  'Getter' function for member m_mainwid_spacing

- int mainwid_x () const

  'Getter' function for member m_mainwid_x, dependent member

- int mainwid_y () const

  'Getter' function for member m_mainwid_y, dependent member

- int control_height () const

  'Getter' function for member m_control_height

- int zoom () const

  'Getter' function for member m_current_zoom

- void zoom (int value)

  'Setter' function for member m_current_zoom This value is not modified unless the value parameter is between 1 and 512, inclusive.

- bool global_seq_feature () const

  'Getter' function for member m_global_seq_feature_save

- void global_seq_feature (bool flag)

'Setter' function for member m_global_seq_feature_save

- int seqedit_scale () const

  'Getter' function for member m_seqedit_scale

- void seqedit_scale (int scale)

  'Setter' function for member m_seqedit_scale

- int seqedit_key () const

  'Getter' function for member m_seqedit_key

- void seqedit_key (int key)

  'Setter' function for member m_seqedit_key

- int seqedit_bgsequence () const

  'Getter' function for member m_seqedit_bgsequence

- void seqedit_bgsequence (int seqnum)

  'Setter' function for member m_seqedit_bgsequence Note that SEQ64_IS_LEGAL_SEQUENCE() allows the SE↩ Q64_SEQUENCE_LIMIT (0x800 = 2048) value, to turn off the use of a background sequence.

- bool use_new_font () const

  'Getter' function for member m_use_new_font

- bool allow_two_perfedits () const

  'Getter' function for member m_allow_two_perfedits

- int perf_h_page_increment () const

  'Getter' function for member m_h_perf_page_increment

- int perf_v_page_increment () const

  'Getter' function for member m_v_perf_page_increment

- int progress_bar_colored () const

  'Getter' function for member m_progress_bar_colored

- bool progress_bar_thick () const

  'Getter' function for member m_progress_bar_thick

- bool inverse_colors () const

  ***Accessor** m_inverse_colors*

- int window_redraw_rate () const

  'Getter' function for member m_window_redraw_rate_ms

- bool use_more_icons () const

  'Getter' function for member m_use_more_icons

- bool save_user_config () const

  'Getter' function for member m_save_user_config

- void save_user_config (bool flag)

  'Setter' function for member m_save_user_config

- int midi_ppqn () const

  'Getter' function for member m_midi_ppqn

- int midi_beats_per_bar () const

  'Getter' function for member m_midi_beats_per_measure

- midibpm midi_beats_per_minute () const

  'Getter' function for member m_midi_beats_per_minute

- int midi_beat_width () const

  'Getter' function for member m_midi_beat_width

- char midi_buss_override () const

  'Getter' function for member m_midi_buss_override

- int velocity_override () const

  'Getter' function for member m_velocity_override

- int bpm_precision () const

  'Getter' function for member m_bpm_precision

- midibpm bpm_step_increment () const

'Getter' function for member m_bpm_step_increment

- midibpm bpm_page_increment () const

  'Getter' function for member m_bpm_page_increment

- int min_zoom () const

  'Getter' function for member mc_min_zoom

- int max_zoom () const

  'Getter' function for member mc_max_zoom

- int baseline_ppqn () const

  'Getter' function for member mc_baseline_ppqn

- bool option_daemonize () const

  'Getter' function for member m_user_option_daemonize

- std::string option_logfile () const

  'Getter' function for member m_user_option_logfile

- void use_new_font (bool flag)

  'Setter' function for member m_use_new_font

- void allow_two_perfedits (bool flag)

  Sets the value of allowing two perfedits to be created and shown to the user.

- void perf_h_page_increment (int inc)

  Sets the horizontal page increment size for the horizontal scrollbar of a perfedit window.

- void perf_v_page_increment (int inc)

  Sets the vertical page increment size for the vertical scrollbar of a perfedit window.

- void progress_bar_colored (int palcode)

  'Setter' function for member m_progress_bar_colored

- void progress_bar_thick (bool flag)

  'Setter' function for member m_progress_bar_thick

- void inverse_colors (bool flag)

  'Setter' function for member m_inverse_colors

- void window_redraw_rate (int ms)

  'Setter' function for member m_window_redraw_rate_ms

- void use_more_icons (bool flag)

  'Setter' function for member m_use_more_icons

- void option_daemonize (bool flag)

  'Setter' function for member m_user_option_daemonize

- void option_logfile (const std::string &logfile)

  'Setter' function for member m_user_option_logfile

- void midi_ppqn (int ppqn)

  'Setter' function for member m_midi_ppqn This value can be set from 96 to 19200 (this upper limit will be determined by what Sequencer64 can actually handle).

- void midi_buss_override (char buss)

  'Setter' function for member m_midi_buss_override This value can be set from 0 to 31.

- void velocity_override (int vel)

  'Setter' function for member m_velocity_override

- void bpm_precision (int precision)

  'Setter' function for member m_bpm_precision

- void bpm_step_increment (midibpm increment)

  'Setter' function for member m_bpm_step_increment

- void bpm_page_increment (midibpm increment)

  'Setter' function for member m_bpm_page_increment

Protected Member Functions

- void grid_brackets (int thickness)

  'Getter' function for member m_grid_brackets
- void grid_style (int gridstyle)

  'Setter' function for member m_grid_style
- void mainwnd_rows (int value)

  'Setter' function for member m_mainwnd_rows This value is not modified unless the value parameter is between 4 and 8, inclusive.
- void mainwnd_cols (int value)

  'Setter' function for member m_mainwnd_cols This value is not modified unless the value parameter is between 8 and 10, inclusive.
- void max_sets (int value)

  'Setter' function for member m_max_sets This value is not modified unless the value parameter is between 32 and 64, inclusive.
- void text_x (int value)

  'Setter' function for member m_text_x This value is not modified unless the value parameter is between 6 and 6, inclusive.
- void text_y (int value)

  'Setter' function for member m_text_y This value is not modified unless the value parameter is between 12 and 12, inclusive.
- void seqchars_x (int value)

  'Setter' function for member m_seqchars_x This affects the size or crampiness of a pattern slot, and for now we will hardwire it to 15.
- void seqchars_y (int value)

  'Setter' function for member m_seqchars_y This affects the size or crampiness of a pattern slot, and for now we will hardwire it to 5.
- void seqarea_x (int value)

  'Setter' function for member m_seqarea_x
- void seqarea_y (int value)

  'Setter' function for member m_seqarea_y
- void seqarea_seq_x (int value)

  'Setter' function for member m_seqarea_seq_x
- void seqarea_seq_y (int value)

  'Setter' function for member m_seqarea_seq_y
- void mainwid_border (int value)

  'Setter' function for member m_mainwid_border This value is not modified unless the value parameter is between 0 and 3, inclusive.
- void mainwid_spacing (int value)

  'Setter' function for member m_mainwid_spacing This value is not modified unless the value parameter is between 2 and 6, inclusive.
- void control_height (int value)

  'Setter' function for member m_control_height This value is not modified unless the value parameter is between 0 and 4, inclusive.
- void dump_summary ()

  Provides a debug dump of basic information to help debug a surprisingly intractable problem with all busses having the name and values of the last buss in the configuration.
- void midi_beats_per_bar (int beatsperbar)

  'Setter' function for member m_midi_beats_per_measure This value can be set from 1 to 16.
- void midi_beats_per_minute (midibpm beatsperminute)

  'Setter' function for member m_midi_beats_minute This value can be set from 20 to 500.
- void midi_beat_width (int beatwidth)

  'Setter' function for member m_midi_beatwidth This value can be set to any power of 2 in the range from 1 to 16.

Private Types

- enum mainwid_grid_style_t {
  grid_style_normal,
  grid_style_white,
  grid_style_black,
  grid_style_max }
- typedef std::vector< user_midi_bus > Busses

  [user-midi-bus-definitions]
- typedef std::vector< user_midi_bus >::iterator BussIterator
- typedef std::vector< user_midi_bus >::const_iterator BussConstIterator
- typedef std::vector< user_instrument > Instruments

  [user-instrument-definitions]
- typedef std::vector< user_instrument >::iterator InstrumentIterator
- typedef std::vector< user_instrument >::const_iterator InstrumentConstIterator

Private Member Functions

- user_midi_bus & private_bus (int buss)

  'Getter' function for member m_midi_buses[index] (internal function) If the index is out of range, then an invalid object is returned.
- user_instrument & private_instrument (int instrum)

  'Getter' function for member m_instruments[index] If the index is out of range, then a invalid object is returned.

Private Attributes

- Busses m_midi_buses

  Provides data about the MIDI busses, readable from the "user" configuration file.
- Instruments m_instruments

  Provides data about the MIDI instruments, readable from the "user" configuration file.
- mainwid_grid_style_t m_grid_style

  [user-interface-settings]
- int m_grid_brackets

  Specify drawing brackets (like the old Seq24) or a solid box.
- int m_mainwnd_rows

  Number of rows in the Patterns Panel.
- int m_mainwnd_cols

  Number of columns in the Patterns Panel.
- int m_max_sets

  Maximum number of screen sets that can be supported.
- int m_mainwid_border

  These control sizes.
- int m_mainwid_spacing
- int m_control_height

  This constants seems to be created for a future purpose, perhaps to reserve space for a new bar on the mainwid pane.
- int m_current_zoom

  Provides the initial zoom value, in units of ticks per pixel.
- bool m_global_seq_feature_save

  If true, this value provide a bit of backward-compatibility with the global key/scale/background-sequence persistence feature.

- int m_seqedit_scale

  Replaces seqedit::m_initial_scale as the repository for the scale to apply when a sequence is loaded into the sequence editor.
- int m_seqedit_key

  Replaces seqedit::m_initial_key as the repository for the key to apply when a sequence is loaded into the sequence editor.
- int m_seqedit_bgsequence

  Replaces seqedit::m_initial_sequence as the repository for the background sequence to apply when a sequence is loaded into the sequence editor.
- bool m_use_new_font

  Sets the usage of the font.
- bool m_allow_two_perfedits

  Enables the usage of two perfedit windows, for added convenience in editing multi-set songs.
- int m_h_perf_page_increment

  Allows a changed to the page size for the horizontal scroll bar.
- int m_v_perf_page_increment

  Allows a changed to the page size for the vertical scroll bar.
- int m_progress_bar_colored

  If set, makes progress bars have the "progress_color()", instead of black.
- bool m_progress_bar_thick

  If set, makes progress bars thicker than 1 pixel...
- bool m_inverse_colors

  If set, use an alternate, neo-inverse color palette.
- int m_window_redraw_rate_ms

  Provides the global setting for redraw rate of windows.
- bool m_use_more_icons

  Another [user-interface-settings] item.
- int m_text_x

  Constants for the mainwid class.
- int m_text_y
- int m_seqchars_x

  Constants for the mainwid class.
- int m_seqchars_y
- int m_midi_ppqn

  Provides the universal PPQN setting for the duration of this setting.
- int m_midi_beats_per_measure

  Provides the universal and unambiguous MIDI value for beats per measure, also called "beats per bar" (BPB).
- int m_midi_beats_per_minute

  Provides the universal and unambiguous MIDI value for beats per minute (BPM).
- int m_midi_beat_width

  Provides the universal MIDI value for beats width (BW).
- char m_midi_buss_override

  Provides a universal override of the buss number for all sequences, for the purpose of convenience of of testing.
- int m_velocity_override

  Sets the default velocity for note adding.
- int m_bpm_precision

  Sets the precision of the BPM (beats-per-minute) setting.
- midibpm m_bpm_step_increment

  The step increment value for BPM, regardless of the decimal precision.
- midibpm m_bpm_page_increment

  This is the larger increment for paging the BPM.

- int m_total_seqs

  The maximum number of patterns supported is given by the number of patterns supported in the panel (32) times the maximum number of sets (32), or 1024 patterns.
- int m_seqs_in_set

  Number of patterns/sequences in the Patterns Panel, also known as a "set" or "screen set".
- int m_gmute_tracks

  Number of group-mute tracks that can be supported, which is m_seqs_in_set squared, or 1024.
- int m_max_sequence

  The maximum number of patterns supported is given by the number of patterns supported in the panel (32) times the maximum number of sets (32), or 1024 patterns.
- int m_seqarea_x

  The m_seqarea_x and m_seqarea_y constants are derived from the width and heights of the default character set, and the number of characters in width, and the number of lines, in a pattern/sequence box.
- int m_seqarea_y
- int m_seqarea_seq_x

  Area of what? Doesn't look at all like it is based on the size of characters.
- int m_seqarea_seq_y
- int m_mainwid_x

  The width of the main pattern/sequence grid, in pixels.
- int m_mainwid_y
- bool m_save_user_config

  Provides a temporary variable that can be set from the command line to cause the "user" state to be saved into the "user" configuration file.
- const int mc_min_zoom

  Provides the minimum zoom value, currently a constant.
- const int mc_max_zoom

  Provides the maximum zoom value, currently a constant.
- const int mc_baseline_ppqn

  Permanent storage for the baseline, default PPQN used by Seq24.
- bool m_user_option_daemonize

  Indicates if the application should be daemonized.
- std::string m_user_option_logfile

  If not empty, this file will be set up as the destination for all logging done by the errprint(), infoprint(), warnprint(), and printf() functions.

Friends

- class userfile

13.99.1 Detailed Description

These settings will eventually be made part of the "user" settings file.

13.99.2 Member Typedef Documentation

13.99.2.1 Busses

```
typedef std::vector<user_midi_bus> seq64::user_settings::Busses  [private]
```

Internal type for the container of user_midi_bus objects. Sorry about the "confusion" about "bus" versus "buss". See Google for arguments about it.

13.99.2.2 BussIterator

```
typedef std::vector<user_midi_bus>::iterator seq64::user_settings::BussIterator  [private]
```

13.99.2.3 BussConstIterator

```
typedef std::vector<user_midi_bus>::const_iterator seq64::user_settings::BussConstIterator
[private]
```

13.99.2.4 Instruments

```
typedef std::vector<user_instrument> seq64::user_settings::Instruments  [private]
```

Internal type for the container of user_instrument objects.

13.99.2.5 InstrumentIterator

```
typedef std::vector<user_instrument>::iterator seq64::user_settings::InstrumentIterator  [private]
```

13.99.2.6 InstrumentConstIterator

```
typedef std::vector<user_instrument>::const_iterator seq64::user_settings::InstrumentConst↩
Iterator  [private]
```

13.99.3 Member Enumeration Documentation

13.99.3.1 mainwid_grid_style_t

```
enum seq64::user_settings::mainwid_grid_style_t  [private]
```

Enumerator

grid_style_normal The grid background color is white. This style better fits displaying the white-on-black sequence numbers. The box is drawn with brackets on either side.	
grid_style_black	The grid background color is black.
grid_style_max	Marks the end of the list, and is an illegal

13.99.4 Constructor & Destructor Documentation

13.99.4.1 user_settings() [1/2]

```
seq64::user_settings::user_settings ( )
```

13.99.4.2 user_settings() [2/2]

```
seq64::user_settings::user_settings (
            const user_settings & rhs )
```

13.99.5 Member Function Documentation

13.99.5.1 operator=()

```
user_settings & seq64::user_settings::operator= (
            const user_settings & rhs )
```

13.99.5.2 set_defaults()

```
void seq64::user_settings::set_defaults ( )
```

For the m_midi_buses and m_instruments members, this function can only iterate over the current size of the vectors. But the default size is zero!

13.99.5.3 normalize()

```
void seq64::user_settings::normalize ( )
```

Should we normalize the BPM increment values here, in case they are irregular?

13.99.5.4 add_bus()

```
bool seq64::user_settings::add_bus (
            const std::string & alias )
```

13.99.5.5 add_instrument()

```
bool seq64::user_settings::add_instrument (
            const std::string & instname )
```

13.99.5.6 bus()

```
const user_midi_bus& seq64::user_settings::bus (
            int index )  [inline]
```

Cannot append the const specifier.

13.99.5.7 instrument()

```
const user_instrument& seq64::user_settings::instrument (
            int index )  [inline]
```

Cannot append the const specifier.

13.99.5.8 bus_count()

```
int seq64::user_settings::bus_count ( ) const  [inline]
```

13.99.5.9 set_bus_instrument()

```
void seq64::user_settings::set_bus_instrument (
            int index,
            int channel,
            int instrum )
```

13.99.5.10 bus_instrument()

```
int seq64::user_settings::bus_instrument (
            int buss,
            int channel )  [inline]
```

13.99.5.11 bus_name()

```
const std::string& seq64::user_settings::bus_name (
            int buss )  [inline]
```

13.99.5.12 instrument_count()

```
int seq64::user_settings::instrument_count ( ) const  [inline]
```

13.99.5.13 set_instrument_controllers()

```
void seq64::user_settings::set_instrument_controllers (
            int index,
            int cc,
            const std::string & ccname,
            bool isactive )
```

13.99.5.14 instrument_name() [1/2]

```
const std::string& seq64::user_settings::instrument_name (
            int instrum )  [inline]
```

13.99.5.15 instrument_name() [2/2]

```
const std::string& seq64::user_settings::instrument_name (
            int buss,
            int channel )  [inline]
```

13.99.5.16 instrument_controller_active()

```
bool seq64::user_settings::instrument_controller_active (
            int instrum,
            int cc )  [inline]
```

13.99.5.17 controller_active()

```
bool seq64::user_settings::controller_active (
            int buss,
            int channel,
            int cc )  [inline]
```

It also has a shorter name.

13.99.5.18 instrument_controller_name()

```
const std::string& seq64::user_settings::instrument_controller_name (
            int instrum,
            int cc )  [inline]
```

13.99.5.19 controller_name()

```
const std::string& seq64::user_settings::controller_name (
            int buss,
            int channel,
            int cc )  [inline]
```

It also has a shorter name.

13.99.5.20 grid_style() [1/2]

```
int seq64::user_settings::grid_style ( ) const  [inline]
```

13.99.5.21 grid_is_normal()

```
bool seq64::user_settings::grid_is_normal ( ) const  [inline]
```

13.99.5.22 grid_is_white()

```
bool seq64::user_settings::grid_is_white ( ) const  [inline]
```

13.99.5.23 grid_is_black()

```
bool seq64::user_settings::grid_is_black ( ) const  [inline]
```

13.99.5.24 grid_brackets() [1/2]

```
int seq64::user_settings::grid_brackets ( ) const  [inline]
```

13.99.5.25 mainwnd_rows() [1/2]

```
int seq64::user_settings::mainwnd_rows ( ) const  [inline]
```

13.99.5.26 mainwnd_cols() [1/2]

```
int seq64::user_settings::mainwnd_cols ( ) const  [inline]
```

13.99.5.27 seqs_in_set()

```
int seq64::user_settings::seqs_in_set ( ) const  [inline]
```

13.99.5.28 gmute_tracks()

```
int seq64::user_settings::gmute_tracks ( ) const  [inline]
```

13.99.5.29 max_sets() [1/2]

```
int seq64::user_settings::max_sets ( ) const  [inline]
```

13.99.5.30 max_sequence()

```
int seq64::user_settings::max_sequence ( ) const  [inline]
```

13.99.5.31 text_x() [1/2]

```
int seq64::user_settings::text_x ( ) const  [inline]
```

13.99.5.32 text_y() [1/2]

```
int seq64::user_settings::text_y ( ) const  [inline]
```

13.99.5.33 seqchars_x() [1/2]

```
int seq64::user_settings::seqchars_x ( ) const  [inline]
```

13.99.5.34 seqchars_y() [1/2]

```
int seq64::user_settings::seqchars_y ( ) const  [inline]
```

13.99.5.35 seqarea_x() [1/2]

```
int seq64::user_settings::seqarea_x ( ) const  [inline]
```

13.99.5.36 seqarea_y() [1/2]

```
int seq64::user_settings::seqarea_y ( ) const  [inline]
```

13.99.5.37 seqarea_seq_x() [1/2]

```
int seq64::user_settings::seqarea_seq_x ( ) const  [inline]
```

13.99.5.38 seqarea_seq_y() [1/2]

```
int seq64::user_settings::seqarea_seq_y ( ) const  [inline]
```

13.99.5.39 mainwid_border() [1/2]

```
int seq64::user_settings::mainwid_border ( ) const  [inline]
```

13.99.5.40 mainwid_spacing() [1/2]

```
int seq64::user_settings::mainwid_spacing ( ) const  [inline]
```

13.99.5.41 mainwid_x()

```
int seq64::user_settings::mainwid_x ( ) const  [inline]
```

13.99.5.42 mainwid_y()

```
int seq64::user_settings::mainwid_y ( ) const  [inline]
```

13.99.5.43 control_height() [1/2]

```
int seq64::user_settings::control_height ( ) const  [inline]
```

13.99.5.44 zoom() [1/2]

```
int seq64::user_settings::zoom ( ) const  [inline]
```

13.99.5.45 zoom() [2/2]

```
void seq64::user_settings::zoom (
            int value )
```

The default value is 2. Note that 0 is allowed as a special case, which allows the default zoom to be adjusted when the PPQN value is different from the default.

13.99.5.46 global_seq_feature() [1/2]

```
bool seq64::user_settings::global_seq_feature ( ) const  [inline]
```

13.99.5.47 global_seq_feature() [2/2]

```
void seq64::user_settings::global_seq_feature (
            bool flag )  [inline]
```

13.99.5.48 seqedit_scale() [1/2]

```
int seq64::user_settings::seqedit_scale ( ) const  [inline]
```

13.99.5.49 seqedit_scale() [2/2]

```
void seq64::user_settings::seqedit_scale (
            int scale )  [inline]
```

13.99.5.50 seqedit_key() [1/2]

```
int seq64::user_settings::seqedit_key ( ) const  [inline]
```

13.99.5.51 seqedit_key() [2/2]

```
void seq64::user_settings::seqedit_key (
            int key )  [inline]
```

13.99.5.52 seqedit_bgsequence() [1/2]

```
int seq64::user_settings::seqedit_bgsequence ( ) const  [inline]
```

13.99.5.53 seqedit_bgsequence() [2/2]

```
void seq64::user_settings::seqedit_bgsequence (
            int seqnum )  [inline]
```

13.99.5.54 use_new_font() [1/2]

```
bool seq64::user_settings::use_new_font ( ) const  [inline]
```

13.99.5.55 allow_two_perfedits() [1/2]

```
bool seq64::user_settings::allow_two_perfedits ( ) const  [inline]
```

13.99.5.56 perf_h_page_increment() [1/2]

```
int seq64::user_settings::perf_h_page_increment ( ) const  [inline]
```

13.99.5.57 perf_v_page_increment() [1/2]

```
int seq64::user_settings::perf_v_page_increment ( ) const  [inline]
```

13.99.5.58 progress_bar_colored() [1/2]

```
int seq64::user_settings::progress_bar_colored ( ) const  [inline]
```

13.99.5.59 progress_bar_thick() [1/2]

```
bool seq64::user_settings::progress_bar_thick ( ) const  [inline]
```

13.99.5.60 inverse_colors() [1/2]

```
bool seq64::user_settings::inverse_colors ( ) const  [inline]
```

13.99.5.61 window_redraw_rate() [1/2]

```
int seq64::user_settings::window_redraw_rate ( ) const  [inline]
```

13.99.5.62 use_more_icons() [1/2]

```
bool seq64::user_settings::use_more_icons ( ) const  [inline]
```

13.99.5.63 save_user_config() [1/2]

```
bool seq64::user_settings::save_user_config ( ) const  [inline]
```

13.99.5.64 save_user_config() [2/2]

```
void seq64::user_settings::save_user_config (
            bool flag )  [inline]
```

13.99.5.65 grid_brackets() [2/2]

```
void seq64::user_settings::grid_brackets (
            int thickness )  [inline], [protected]
```

13.99.5.66 grid_style() [2/2]

```
void seq64::user_settings::grid_style (
            int gridstyle )  [protected]
```

13.99.5.67 mainwnd_rows() [2/2]

```
void seq64::user_settings::mainwnd_rows (
            int value )  [protected]
```

The default value is 4. Dependent values are recalculated after the assignment.

13.99.5.68 mainwnd_cols() [2/2]

```
void seq64::user_settings::mainwnd_cols (
            int value )  [protected]
```

The default value is 8. Dependent values are recalculated after the assignment.

13.99.5.69 max_sets() [2/2]

```
void seq64::user_settings::max_sets (
            int value )  [protected]
```

The default value is 32. Dependent values are recalculated after the assignment.

13.99.5.70 text_x() [2/2]

```
void seq64::user_settings::text_x (
            int value )  [protected]
```

The default value is 6. Dependent values are recalculated after the assignment. This value is currently restricted, until we can code up a bigger font.

13.99.5.71 text_y() [2/2]

```
void seq64::user_settings::text_y (
            int value )  [protected]
```

The default value is 12. Dependent values are recalculated after the assignment. This value is currently restricted, until we can code up a bigger font.

13.99.5.72 seqchars_x() [2/2]

```
void seq64::user_settings::seqchars_x (
            int value )  [protected]
```

13.99.5.73 seqchars_y() [2/2]

```
void seq64::user_settings::seqchars_y (
            int value )  [protected]
```

13.99.5.74 seqarea_x() [2/2]

```
void seq64::user_settings::seqarea_x (
            int value )  [protected]
```

13.99.5.75 seqarea_y() [2/2]

```
void seq64::user_settings::seqarea_y (
            int value )  [protected]
```

13.99.5.76 seqarea_seq_x() [2/2]

```
void seq64::user_settings::seqarea_seq_x (
            int value )  [protected]
```

13.99.5.77 seqarea_seq_y() [2/2]

```
void seq64::user_settings::seqarea_seq_y (
            int value )  [protected]
```

13.99.5.78 mainwid_border() [2/2]

```
void seq64::user_settings::mainwid_border (
            int value )  [protected]
```

The default value is 0. Dependent values are recalculated after the assignment.

13.99.5.79 mainwid_spacing() [2/2]

```
void seq64::user_settings::mainwid_spacing (
            int value )  [protected]
```

The default value is 2. Dependent values are recalculated after the assignment.

13.99.5.80 control_height() [2/2]

```
void seq64::user_settings::control_height (
            int value )  [protected]
```

The default value is 0. Dependent values are recalculated after the assignment.

13.99.5.81 dump_summary()

```
void seq64::user_settings::dump_summary ( )  [protected]
```

Does its work only if PLATFORM_DEBUG and SEQ64_USE_DEBUG_OUTPUT are defined. Only enabled in emergencies :-D.

13.99.5.82 midi_ppqn() [1/2]

```
int seq64::user_settings::midi_ppqn ( ) const  [inline]
```

13.99.5.83 midi_beats_per_bar() [1/2]

```
int seq64::user_settings::midi_beats_per_bar ( ) const  [inline]
```

13.99.5.84 midi_beats_per_minute() [1/2]

```
midibpm seq64::user_settings::midi_beats_per_minute ( ) const  [inline]
```

13.99.5.85 midi_beat_width() [1/2]

```
int seq64::user_settings::midi_beat_width ( ) const  [inline]
```

13.99.5.86 midi_buss_override() [1/2]

```
char seq64::user_settings::midi_buss_override ( ) const  [inline]
```

13.99.5.87 velocity_override() [1/2]

```
int seq64::user_settings::velocity_override ( ) const  [inline]
```

13.99.5.88 bpm_precision() [1/2]

```
int seq64::user_settings::bpm_precision ( ) const  [inline]
```

13.99.5.89 bpm_step_increment() [1/2]

```
midibpm seq64::user_settings::bpm_step_increment ( ) const  [inline]
```

13.99.5.90 bpm_page_increment() [1/2]

```
midibpm seq64::user_settings::bpm_page_increment ( ) const  [inline]
```

13.99.5.91 min_zoom()

```
int seq64::user_settings::min_zoom ( ) const  [inline]
```

13.99.5.92 max_zoom()

```
int seq64::user_settings::max_zoom ( ) const  [inline]
```

13.99.5.93 baseline_ppqn()

```
int seq64::user_settings::baseline_ppqn ( ) const  [inline]
```

13.99.5.94 option_daemonize() [1/2]

```
bool seq64::user_settings::option_daemonize ( ) const  [inline]
```

13.99.5.95 option_logfile() [1/2]

```
std::string seq64::user_settings::option_logfile ( ) const
```

Returns

This function returns rc().config_directory() + m_user_option_logfile if the latter does not contain a path marker ("/"). Otherwise, it returns m_user_option_logfile, which must be a full path specification to the desired log-file.

13.99.5.96 use_new_font() [2/2]

```
void seq64::user_settings::use_new_font (
            bool flag )  [inline]
```

13.99.5.97 allow_two_perfedits() [2/2]

```
void seq64::user_settings::allow_two_perfedits (
            bool flag )  [inline]
```

13.99.5.98 perf_h_page_increment() [2/2]

```
void seq64::user_settings::perf_h_page_increment (
            int inc )
```

This value ranges from 1 (the original value, really too small for a "page" operation) to 6 (which is 24 measures, the same as the typical width of the perfroll)

13.99.5.99 perf_v_page_increment() [2/2]

```
void seq64::user_settings::perf_v_page_increment (
            int inc )
```

This value ranges from 1 (the original value, really too small for a "page" operation) to 18 (which is 18 tracks, slightly more than the typical height of the perfroll)

13.99.5.100 progress_bar_colored() [2/2]

```
void seq64::user_settings::progress_bar_colored (
            int palcode )  [inline]
```

13.99.5.101 progress_bar_thick() [2/2]

```
void seq64::user_settings::progress_bar_thick (
            bool flag )  [inline]
```

13.99.5.102 inverse_colors() [2/2]

```
void seq64::user_settings::inverse_colors (
            bool flag )  [inline]
```

13.99.5.103 window_redraw_rate() [2/2]

```
void seq64::user_settings::window_redraw_rate (
            int ms )  [inline]
```

13.99.5.104 use_more_icons() [2/2]

```
void seq64::user_settings::use_more_icons (
            bool flag )  [inline]
```

13.99.5.105 option_daemonize() [2/2]

```
void seq64::user_settings::option_daemonize (
            bool flag )  [inline]
```

13.99.5.106 option_logfile() [2/2]

```
void seq64::user_settings::option_logfile (
            const std::string & logfile )  [inline]
```

13.99.5.107 midi_ppqn() [2/2]

```
void seq64::user_settings::midi_ppqn (
            int value )
```

The default value is 192.

13.99.5.108 midi_buss_override() [2/2]

```
void seq64::user_settings::midi_buss_override (
            char buss )
```

The default value is -1, which means that there is no buss override. It provides a way to override the buss number for smallish MIDI files. It replaces the buss-number read from the file. This option is turned on by the –bus option, and is merely a convenience feature for the quick previewing of a tune. (It's called "developer laziness".)

13.99.5.109 velocity_override() [2/2]

```
void seq64::user_settings::velocity_override (
            int vel )
```

13.99.5.110 bpm_precision() [2/2]

```
void seq64::user_settings::bpm_precision (
            int precision )
```

13.99.5.111 bpm_step_increment() [2/2]

```
void seq64::user_settings::bpm_step_increment (
            midibpm increment )
```

13.99.5.112 bpm_page_increment() [2/2]

```
void seq64::user_settings::bpm_page_increment (
            midibpm increment )
```

13.99.5.113 midi_beats_per_bar() [2/2]

```
void seq64::user_settings::midi_beats_per_bar (
            int value )  [protected]
```

The default value is 4.

13.99.5.114 midi_beats_per_minute() [2/2]

```
void seq64::user_settings::midi_beats_per_minute (
            midibpm value )  [protected]
```

The default value is 120.

13.99.5.115 midi_beat_width() [2/2]

```
void seq64::user_settings::midi_beat_width (
            int bw )  [protected]
```

The default value is 4.

13.99.5.116 private_bus()

```
user_midi_bus & seq64::user_settings::private_bus (
            int index )  [private]
```

This invalid object has an empty alias, and all the instrument numbers are -1.

13.99.5.117 private_instrument()

```
user_instrument & seq64::user_settings::private_instrument (
            int index )  [private]
```

This invalid object has an empty(), instrument name, false for all controllers_active[] values, and empty controllers[] string values.

13.99.6 Friends And Related Function Documentation

13.99.6.1 userfile

```
friend class userfile  [friend]
```

13.99.7 Field Documentation

13.99.7.1 m_midi_buses

```
Busses seq64::user_settings::m_midi_buses  [private]
```

Since this object is a vector, its size is adjustable.

13.99.7.2 m_instruments

```
Instruments seq64::user_settings::m_instruments  [private]
```

The size is adjustable, and grows as objects are added.

13.99.7.3 m_grid_style

```
mainwid_grid_style_t seq64::user_settings::m_grid_style  [private]
```

These are not labelled, but are present in the "user" configuration file in the following order:

```
-#  grid-style
-#  grid-brackets
-#  mainwnd-rows
-#  mainwnd-cols
-#  max-set
-#  mainwid-border
-#  control-height
-#  zoom
-#  global-seq-feature
-#  use-new-font
-#  allow-two-perfedits
-#  perf-h-page-increment
-#  perf-v-page-increment
-#  progress-bar-colored (new)
-#  progress-bar-thick (new)
-#  window-redraw-rate-ms (new)
```

Specifies the current grid style.

13.99.7.4 m_grid_brackets

```
int seq64::user_settings::m_grid_brackets  [private]
```

0 = no brackets, 1 and above is the thickness of the brakcets. 1 is the normal thickness of the brackets, 2 is a two-pixel thickness, and so on.

13.99.7.5 m_mainwnd_rows

```
int seq64::user_settings::m_mainwnd_rows  [private]
```

The current value is 4, and if changed, many other values depend on it. Together with m_mainwnd_cols, this value fixes the patterns grid into a 4 x 8 set of patterns known as a "screen set". We would like to be able to change this value from 4 to 8, and maybe allow the values of 5, 6, and 7 as well. But if we could just get 8 working, then well would Sequencer64 deserve the 64 in its name.

13.99.7.6 m_mainwnd_cols

```
int seq64::user_settings::m_mainwnd_cols  [private]
```

The current value is 4, and probably won't change, since other values depend on it. Together with m_mainwnd_rows, this value fixes the patterns grid into a 4 x 8 set of patterns known as a "screen set".

13.99.7.7 m_max_sets

```
int seq64::user_settings::m_max_sets  [private]
```

Basically, that the number of times the Patterns Panel can be filled. 32 sets can be created. Although this value is part of the "user" configuration file, it is likely that it will never change. Rather, the number of sequences per set would change. We'll see.

13.99.7.8 m_mainwid_border

```
int seq64::user_settings::m_mainwid_border  [private]
```

We'll try changing them and see what happens. Increasing these value spreads out the pattern grids a little bit and makes the Patterns panel slightly bigger. Seems like it would be useful to make these values user-configurable.

13.99.7.9 m_mainwid_spacing

```
int seq64::user_settings::m_mainwid_spacing  [private]
```

13.99.7.10 m_control_height

```
int seq64::user_settings::m_control_height  [private]
```

But it is used only in this header file, to define m_mainwid_y, but doesn't add anything to that value.

13.99.7.11 m_current_zoom

```
int seq64::user_settings::m_current_zoom  [private]
```

The original default value was 32 ticks per pixel, but larger PPQN values need higher values, and we will have to adapt the default zoom to the PPQN value. Also, the zoom can never be zero, as it can appear as the divisor in scaling equations.

13.99.7.12 m_global_seq_feature_save

```
bool seq64::user_settings::m_global_seq_feature_save  [private]
```

In this feature, applying one of these three changes to a sequence causes them to also be applied to sequences that are subsequently opened for editing. However, we improve on this feature by allowing the changes to be saved in the global, proprietary part of the saved MIDI file.

If false, the user can still save the key/scale/background-sequence values with each individual sequence, so they can be different.

This value will be true by default, unless changed in the "user" configuration file.

13.99.7.13 m_seqedit_scale

```
int seq64::user_settings::m_seqedit_scale  [private]
```

Its default value is c_scale_off. Although this value is now stored in the user_settings class, it always comes from the currently loaded MIDI file, if present. If m_global_seq_feature_save is true, this variable is stored in the "proprietary" track at the end of the file, under the control tag c_musicscale, and will be applied to any sequence that is edited. If m_global_seq_feature_save is false, this variable is stored, if used, in the meta-data for the sequence to which it applies, and, again, is tagged with the control tag c_musicscale.

13.99.7.14 m_seqedit_key

```
int seq64::user_settings::m_seqedit_key  [private]
```

Its default value is SEQ64_KEY_OF_C. Although this value is now stored in the user_settings class, it always comes from the currently loaded MIDI file, if present. If m_global_seq_feature_save is true, this variable is stored in the "proprietary" track at the end of the file, under the control tag c_musickey, and will be applied to any sequence that is edited. If m_global_seq_feature_save is false, this variable is stored, if used, in the meta-data for the sequence to which it applies, and, again, is tagged with the control tag c_musickey.

13.99.7.15 m_seqedit_bgsequence

```
int seq64::user_settings::m_seqedit_bgsequence  [private]
```

Its default value is SEQ64_SEQUENCE_LIMIT. Although this value is now stored in the user_settings class, it always comes from the currently loaded MIDI file, if present. If m_global_seq_feature_save is true, this variable is stored, if it has a valid (but not "legal") value, in the "proprietary" track at the end of the file, under the control tag c_backsequence, and will be applied to any sequence that is edited. If m_global_seq_feature_save is false, this variable is stored, if used, in the meta-data for the sequence to which it applies, and, again, is tagged with the control tag c_backsequence.

13.99.7.16 m_use_new_font

```
bool seq64::user_settings::m_use_new_font  [private]
```

By default, in normal mode, the new font is used. In legacy mode, the old font is used.

13.99.7.17 m_allow_two_perfedits

```
bool seq64::user_settings::m_allow_two_perfedits  [private]
```

Defaults to true.

13.99.7.18 m_h_perf_page_increment

```
int seq64::user_settings::m_h_perf_page_increment  [private]
```

The value used to be hardwired to 1 (in four-measure units), now it defaults to 4 (16 measures at a time). The value of 1 is already covered by the scrollbar arrows.

13.99.7.19 m_v_perf_page_increment

```
int seq64::user_settings::m_v_perf_page_increment  [private]
```

The value used to be hardwired to 1 (in single-track units), now it defaults to 8. The value of 1 is already covered by the scrollbar arrows.

13.99.7.20 m_progress_bar_colored

```
int seq64::user_settings::m_progress_bar_colored  [private]
```

This value is no longer hardwired in the gui_palette_gtk2 module to be red. Now we want to let the color select from a slightly large palette. We chande this from a boolean to an integer to allow the selection of more colors.

13.99.7.21 m_progress_bar_thick

```
bool seq64::user_settings::m_progress_bar_thick  [private]
```

2 pixels. It isn't useful to support anything thicker.

13.99.7.22 m_inverse_colors

```
bool seq64::user_settings::m_inverse_colors  [private]
```

Not all colors are reversed, though.

13.99.7.23 m_window_redraw_rate_ms

```
int seq64::user_settings::m_window_redraw_rate_ms  [private]
```

Not all windows use this yet. The default is 40 ms (c_redraw_ms, which is 20 ms in Windows builds)), but some windows originally used 25 ms, so beware of side-effects.

13.99.7.24 m_use_more_icons

```
bool seq64::user_settings::m_use_more_icons  [private]
```

If set to 1, icons will be used for more buttons. This setting affects only a few buttons so far, such as the buttons at the top of the main window.

13.99.7.25 m_text_x

```
int seq64::user_settings::m_text_x  [private]
```

The m_text_x and m_text_y constants help define the "seqarea" size. It looks like these two values are the character width (x) and height (y) in pixels. Thus, these values would be dependent on the font chosen. But that, currently, is hard-wired. See the m_font_6_12[] array for the default font specification.

However, please not that font files are not used. Instead, the fonts are provided by two pixmaps in the `src/pixmap` directory: `font_b.xpm` (black lettering on a white background) and `font_w.xpm` (white lettering on a black background).

We have added black-on-yellow and yellow-on-black versions of the fonts, to support the highlighting of pattern boxes if they are empty of actual MIDI events.

We have also added a set of four new font files that are roughly the same size, and are treated as the same size, but look smooth and less like a DOS-era font.

The font module does not use these values directly, but does define some similar variables that differ slightly between the two styles of font. There are a lot of tricks and hard-wired places to fix before further work can be done with fonts in Sequencer64.

13.99.7.26 m_text_y

```
int seq64::user_settings::m_text_y  [private]
```

13.99.7.27 m_seqchars_x

```
int seq64::user_settings::m_seqchars_x  [private]
```

The m_seqchars_x and m_seqchars_y constants help define the "seqarea" size. These look like the number of characters per line and the number of lines of characters, in a pattern/sequence box.

13.99.7.28 m_seqchars_y

```
int seq64::user_settings::m_seqchars_y  [private]
```

13.99.7.29 m_midi_ppqn

```
int seq64::user_settings::m_midi_ppqn  [private]
```

This variable replaces the global ppqn. The default value of this setting is 192 parts-per-quarter-note (PPQN). There is still a lot of work to get a different PPQN to work properly in speed of playback, scaling of the user interface, and other issues. Note that this value can be changed by the still-experimental –ppqn option. There is one remaining trace of the global, though: DEFAULT_PPQN.

13.99.7.30 m_midi_beats_per_measure

```
int seq64::user_settings::m_midi_beats_per_measure  [private]
```

This variable will replace the global beats per measure. The default value of this variable is SEQ64_DEFAULT_↩ BEATS_PER_MEASURE (4). For external access, we will call this value "beats per bar", abbreviate it "BPB", and use "bpb" in any accessor function names. Now, although it applies to the whole session, we should be able to continue seq24's tradition of allowing each sequence to have its own time signature. Also, there are a number of places where the number 4 appears and looks like it might be a hardwired BPB value, either for MIDI purposes or for drawing the piano-roll grids. So we might need a couple different versions of this variable.

13.99.7.31 m_midi_beats_per_minute

```
int seq64::user_settings::m_midi_beats_per_minute  [private]
```

This variable will replace the global beats per minute. The default value of this variable is DEFAULT_BPM (120). This variable should apply to the whole session; there's probably no way to support a diffent tempo for each sequence. But we shall see. For external access, we will call this value "beats per minute", abbreviate it "BPM", and use "bpm" in any accessor function names.

13.99.7.32 m_midi_beat_width

```
int seq64::user_settings::m_midi_beat_width  [private]
```

This variable will replace the global beat_width. The default value of this variable is DEFAULT_BEAT_WIDTH (4). Now, although it applies to the whole session, we should be able to continue seq24's tradition of allowing each sequence to have its own time signature. Also, there are a number of places where the number 4 appears and looks like it might be a hardwired BW value, either for MIDI purposes or for drawing the user-interface. So we might need a couple different versions of this variable. For external access, we will call this value "beat width", abbreviate it "BW", and use "bw" in any accessor function names.

13.99.7.33 m_midi_buss_override

```
char seq64::user_settings::m_midi_buss_override  [private]
```

This variable replaces the global buss-override variable, and is set via the command-line option –bus.

13.99.7.34 m_velocity_override

```
int seq64::user_settings::m_velocity_override  [private]
```

The value SEQ64_PRESERVE_VELOCITY (-1) preserves the velocity of incoming notes, so that nuances in live playing can be preserved. The popup-menu for the "Vol" button in the seqedit window shows this value as the "Free" menu entry. The rest of the values in the menu show a few select velocities, but any velocity from 0 to 127 can be entered here. Of course, 0 is not recommended.

13.99.7.35 m_bpm_precision

```
int seq64::user_settings::m_bpm_precision  [private]
```

The original value was effectively 0, but we need to be able to support the following values:

```
-   0.  The legacy default.
-   1.  One decimal place in the BPM spinner.
-   2.  Two decimal places in the BPM spinner.
```

13.99.7.36 m_bpm_step_increment

```
midibpm seq64::user_settings::m_bpm_step_increment  [private]
```

The default value is the legacy value, 1, for a BPM precision value of 0. The default value is 0.1 if one decimal place of precision is in force, and 0.01 if two decimal places of precision is in force. This is the increment that is performed in the BPM field of the main window when the arrow-buttons are clicked, the up/down arrow keys are pressed, or the BPM MIDI controls are processed.

13.99.7.37 m_bpm_page_increment

```
midibpm seq64::user_settings::m_bpm_page_increment  [private]
```

Currently, the only way to use this increment is to click in the BPM field of the main window and then use the Page-Up and Page-Down keys.

13.99.7.38 m_total_seqs

```
int seq64::user_settings::m_total_seqs  [private]
```

It is basically the same value as m_max_sequence by default. It is a derived value, and not stored in the "user" file. We might make it equal to the maximum number of sequences the currently-loaded MIDI file.

```
m_total_seqs = m_seqs_in_set * m_max_sets;
```

13.99.7.39 m_seqs_in_set

```
int seq64::user_settings::m_seqs_in_set  [private]
```

This value is 4 x 8 = 32 by default.

Warning

Currently implicit/explicit in a number of the "rc" file and rc_settings. Would probably want the left 32 or the first 32 items in the main window only to be subject to keystroke control. This value is calculated by the normalize() function, and is *not* part of the "user" configuration file.

13.99.7.40 m_gmute_tracks

```
int seq64::user_settings::m_gmute_tracks  [private]
```

This value is *not* part of the "user" configuration file; it is calculated by the normalize() function.

13.99.7.41 m_max_sequence

```
int seq64::user_settings::m_max_sequence  [private]
```

It is a derived value, and not stored in the "user" file.

```
m_max_sequence = m_seqs_in_set * m_max_sets;
```

13.99.7.42 m_seqarea_x

```
int seq64::user_settings::m_seqarea_x  [private]
```

Compare these two constants to m_seqarea_seq_x(y), which was in mainwid.h, but is now in this file.

13.99.7.43 m_seqarea_y

```
int seq64::user_settings::m_seqarea_y  [private]
```

13.99.7.44 m_seqarea_seq_x

```
int seq64::user_settings::m_seqarea_seq_x  [private]
```

These are used only in the mainwid module.

13.99.7.45 m_seqarea_seq_y

```
int seq64::user_settings::m_seqarea_seq_y  [private]
```

13.99.7.46 m_mainwid_x

```
int seq64::user_settings::m_mainwid_x  [private]
```

Affected by the m_mainwid_border and m_mainwid_spacing values.

```
 c_mainwid_x =
 (
     (c_seqarea_x + c_mainwid_spacing) * c_mainwnd_cols -
         c_mainwid_spacing + c_mainwid_border * 2
 );
```

13.99.7.47 m_mainwid_y

```
int seq64::user_settings::m_mainwid_y  [private]
```

13.99.7.48 m_save_user_config

```
bool seq64::user_settings::m_save_user_config  [private]
```

Normally, this state is not saved. It is not saved because there is currently no user-interface for editing it, and because it can pick up some command-line options, and it is not right to have them written to the "user" configuration file.

(The "rc" configuration file is a different case, having historically always been saved, and having a number of command-line options, such as JACK settings that should generally be permanent on a given system.)

Anyway, this flag can be set by the –user-save option. This setting is never saved. But note that, if no "user" configuration file is found, it is then saved anyway.

13.99.7.49 mc_min_zoom

```
const int seq64::user_settings::mc_min_zoom  [private]
```

It's value is 1.

13.99.7.50 mc_max_zoom

```
const int seq64::user_settings::mc_max_zoom  [private]
```

It's value was 32, but is now 512, to allow for better presentation of high PPQN valued sequences.

13.99.7.51 mc_baseline_ppqn

```
const int seq64::user_settings::mc_baseline_ppqn  [private]
```

This value is necessary in order to keep user-interface elements stable when different PPQNs are used. It is set to DEFAULT_PPQN.

13.99.7.52 m_user_option_daemonize

```
bool seq64::user_settings::m_user_option_daemonize  [private]
```

All options that begin with "option_" are options specific to a particular version of Sequencer64. We don't anticipate having a lot of such options, so there's no need for a separate class to handle them. These options are flagged on the command-line by the strings "-o" or "--option".

13.99.7.53 m_user_option_logfile

```
std::string seq64::user_settings::m_user_option_logfile  [private]
```

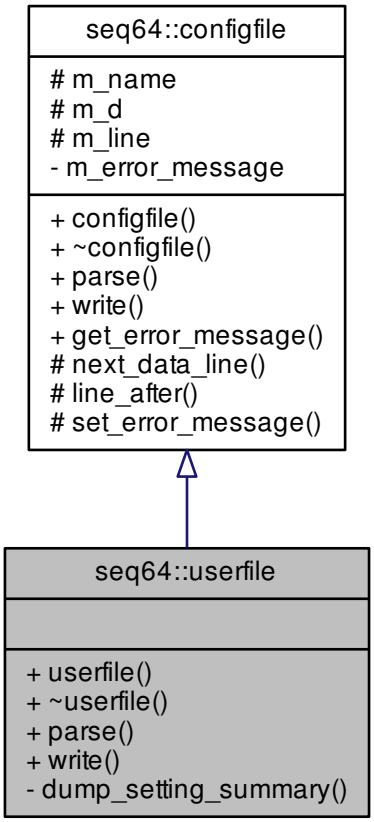
In other words, stdout and stderr will go to a log file instead. Unless a full path is provided, this filename will be a base filename, with the path given by rc().config_directory() prepended to it. That path is normally ~/.config/sequencer64, but can be modified on the command line via the -H (–home) option.

This file can also be specified by the "-o log=filename" option.

13.100 seq64::userfile Class Reference

Supports the user's ~/.config/sequencer64/sequencer64.usr and ~/.seq24usr configuration file.

Inheritance diagram for seq64::userfile:



Public Member Functions

- userfile (const std::string &a_name)

  Principal constructor.
- ~userfile ()

  A rote destructor needed for a derived class.
- bool parse (perform &a_perf)

  Parses a "usr" file, filling in the given perform object.
- bool write (const perform &a_perf)

  This function just returns false, as there is no "perform" information in the user-file yet.

Private Member Functions

- void dump_setting_summary ()

  Provides a debug dump of basic information to help debug a surprisingly intractable problem with all busses having the name and values of the last buss in the configuration.

Additional Inherited Members

13.100.1 Constructor & Destructor Documentation

13.100.1.1 userfile()

```
seq64::userfile::userfile (
            const std::string & name )
```

Parameters

name	Provides the full file path specification to the configuration file.

13.100.1.2 ~userfile()

```
seq64::userfile::~userfile ( )
```

13.100.2 Member Function Documentation

13.100.2.1 parse()

```
bool seq64::userfile::parse (
            perform & a_perf )  [virtual]
```

This function opens the file as a text file (line-oriented).

Parameters

a_perf	The performance object, currently unused.

Returns

Returns true if the parsing succeeded.

Implements seq64::configfile.

13.100.2.2 write()

```
bool seq64::userfile::write (
            const perform & a_perf )  [virtual]
```

Parameters

a_perf	The performance object, currently unused.

Returns

Returns true if the writing succeeded.

Implements seq64::configfile.

13.100.2.3 dump_setting_summary()

```
void seq64::userfile::dump_setting_summary ( )  [private]
```

Does work only if PLATFORM_DEBUG is defined; see the user_settings class.

Index

~AbstractPerfInput
    seq64::AbstractPerfInput, 136
~automutex
    seq64::automutex, 140
~busarray
    seq64::busarray, 142
~businfo
    seq64::businfo, 152
~configfile
    seq64::configfile, 164
~editable_event
    seq64::editable_event, 173
~editable_events
    seq64::editable_events, 184
~event
    seq64::event, 195
~event_list
    seq64::event_list, 216
~eventedit
    seq64::eventedit, 230
~eventslots
    seq64::eventslots, 246
~gui_assistant
    seq64::gui_assistant, 278
~gui_assistant_gtk2
    seq64::gui_assistant_gtk2, 281
~gui_drawingarea_gtk2
    seq64::gui_drawingarea_gtk2, 286
~gui_palette_gtk2
    seq64::gui_palette_gtk2, 304
~gui_window_gtk2
    seq64::gui_window_gtk2, 314
~jack_assistant
    seq64::jack_assistant, 320
~keys_perform
    seq64::keys_perform, 354
~keys_perform_gtk2
    seq64::keys_perform_gtk2, 378
~lfownd
    seq64::lfownd, 394
~maintime
    seq64::maintime, 399
~mainwid
    seq64::mainwid, 406
~mainwnd
    seq64::mainwnd, 423
~mastermidibase
    seq64::mastermidibase, 444
~mastermidibus
    seq64::mastermidibus, 462
~midi_alsa
    seq64::midi_alsa, 472
~midi_alsa_info
    seq64::midi_alsa_info, 481
~midi_api
    seq64::midi_api, 487
~midi_container
    seq64::midi_container, 497
~midi_in_jack
    seq64::midi_in_jack, 513
~midi_info
    seq64::midi_info, 518
~midi_jack
    seq64::midi_jack, 529
~midi_jack_data
    seq64::midi_jack_data, 540
~midi_jack_info
    seq64::midi_jack_info, 544
~midi_list
    seq64::midi_list, 552
~midi_out_jack
    seq64::midi_out_jack, 563
~midi_queue
    seq64::midi_queue, 569
~midi_splitter
    seq64::midi_splitter, 574
~midi_vector
    seq64::midi_vector, 583
~midibase
    seq64::midibase, 591
~midibus
    seq64::midibus, 611
~midifile
    seq64::midifile, 623
~optionsfile
    seq64::optionsfile, 650
~perfedit
    seq64::perfedit, 659
~perfnames
    seq64::perfnames, 675
~perform
    seq64::perform, 695
~perfroll
    seq64::perfroll, 773
~perftime
    seq64::perftime, 791
~rterror
    seq64::rterror, 824

~rtmidi
seq64::rtmidi, 828
~rtmidi_in
seq64::rtmidi_in, 836
~rtmidi_info
seq64::rtmidi_info, 846
~rtmidi_out
seq64::rtmidi_out, 855
~seqdata
seq64::seqdata, 866
~seqedit
seq64::seqedit, 883
~seqevent
seq64::seqevent, 911
~seqkeys
seq64::seqkeys, 926
~seqmenu
seq64::seqmenu, 939
~seqroll
seq64::seqroll, 954
~seqtime
seq64::seqtime, 983
~sequence
seq64::sequence, 998
~triggers
seq64::triggers, 1065
~userfile
seq64::userfile, 1126

about_dialog
seq64::mainwnd, 429
AbstractPerfInput
seq64::AbstractPerfInput, 136
action
seq64::midi_control, 505
activate
seq64::businfo, 154
seq64::jack_assistant, 324
seq64::mastermidibase, 454
seq64::mastermidibus, 466
seq64::perform, 739
activate_adding
seq64::AbstractPerfInput, 137
seq64::FruityPerfInput, 270
seq64::Seq24PerfInput, 858
active
seq64::businfo, 152
seq64::midi_control, 506
add
seq64::busarray, 142, 143
seq64::editable_events, 187
seq64::event_list, 217
seq64::midi_jack_info, 548
seq64::midi_port_info, 565
seq64::midi_queue, 569
seq64::triggers, 1067
add_bus
seq64::midi_info, 523
seq64::rtmidi_info, 847
seq64::user_settings, 1098
add_chord
seq64::seqroll, 955
seq64::sequence, 1015
add_clock
seq64::perform, 750
add_event
seq64::midi_container, 500
seq64::sequence, 1015, 1016
add_extended_keys_page
seq64::options, 647
add_input
seq64::perform, 750
seq64::rtmidi_info, 847
add_instrument
seq64::user_settings, 1099
add_jack_sync_page
seq64::options, 647
add_keyboard_page
seq64::options, 647
add_long
seq64::midi_container, 500
add_midi_clock_page
seq64::options, 646
add_midi_input_page
seq64::options, 647
add_mouse_page
seq64::options, 647
add_note
seq64::seqroll, 955
seq64::sequence, 1014
add_output
seq64::rtmidi_info, 847
add_sequence
seq64::perform, 705
add_short
seq64::midi_container, 500
add_trigger
seq64::midifile, 629
seq64::sequence, 1017
add_variable
seq64::midi_container, 499
adding
seq64::seqroll, 969
adj_callback_bpm
seq64::mainwnd, 424
adj_callback_ss
seq64::mainwnd, 424
adjust_offset
seq64::sequence, 1048
seq64::triggers, 1075
adjust_offsets_to_length
seq64::triggers, 1068
adjust_timestamp
seq64::sequence, 1031
adjust_trigger_offsets_to_length
seq64::sequence, 1048
adjustment_dummy

seq64, 104
alias
seq64::user_midi_bus_t, 1088
align_selection
seq64::seqroll, 966
all_notes_off
seq64::perform, 741
allocate
seq64::midi_queue, 570
allow_click_edit
seq64::rc_settings, 806, 811
allow_mod4_mode
seq64::rc_settings, 806, 811
allow_snap_split
seq64::rc_settings, 806, 811
allow_two_perfedits
seq64::user_settings, 1106, 1111
analyze
seq64::editable_event, 178
any_group_unmutes
seq64::perform, 736
any_selected_notes
seq64::event_list, 222
seq64::sequence, 999
api_clock
seq64::mastermidibase, 456
seq64::midi_alsa, 476
seq64::midi_api, 491
seq64::midi_jack, 537
seq64::midibase, 604
seq64::midibus, 615, 617
seq64::rtmidi, 829
api_connect
seq64::midi_api, 488
seq64::midi_info, 520
seq64::midi_jack, 533
seq64::midi_jack_info, 545
seq64::midibus, 615
seq64::rtmidi, 828
seq64::rtmidi_info, 851
api_continue_from
seq64::mastermidibase, 455
seq64::mastermidibus, 466
seq64::midi_alsa, 476
seq64::midi_api, 490
seq64::midi_jack, 536
seq64::midibase, 603
seq64::midibus, 614, 617
seq64::rtmidi, 829
api_data
seq64::rtmidi_in_data, 841
api_deinit_in
seq64::midi_alsa, 474
seq64::midi_api, 489
seq64::midi_jack, 534
seq64::midibase, 602
seq64::midibus, 613, 616
seq64::rtmidi, 830
api_flush
seq64::mastermidibase, 455
seq64::mastermidibus, 465, 467
seq64::midi_alsa, 476
seq64::midi_alsa_info, 483
seq64::midi_api, 490
seq64::midi_info, 520
seq64::midi_jack, 536
seq64::midi_jack_info, 546
seq64::midibase, 603
seq64::midibus, 614
seq64::rtmidi, 831
seq64::rtmidi_info, 850
api_get_bus_name
seq64::midi_api, 491
api_get_midi_event
seq64::mastermidibase, 456
seq64::mastermidibus, 463, 466
seq64::midi_alsa, 474
seq64::midi_alsa_info, 481
seq64::midi_api, 489
seq64::midi_in_jack, 514
seq64::midi_info, 520
seq64::midi_jack, 535
seq64::midi_jack_info, 545
seq64::midibase, 602
seq64::midibus, 616
seq64::rtmidi, 830
seq64::rtmidi_info, 850
api_get_port_name
seq64::midi_api, 491
seq64::midi_jack, 537
api_init
seq64::mastermidibase, 454
seq64::mastermidibus, 463, 467
api_init_clock
seq64::mastermidibase, 455
api_init_in
seq64::midi_alsa, 473
seq64::midi_api, 488
seq64::midi_jack, 533
seq64::midibase, 603
seq64::midibus, 612, 615
seq64::rtmidi, 830
api_init_in_sub
seq64::midi_alsa, 474
seq64::midi_api, 489
seq64::midi_jack, 534
seq64::midibase, 602
seq64::midibus, 613, 616
seq64::rtmidi, 830
api_init_out
seq64::midi_alsa, 473
seq64::midi_api, 488
seq64::midi_jack, 533
seq64::midibase, 603
seq64::midibus, 612, 616
seq64::rtmidi, 830

api_init_out_sub
seq64::midi_alsa, 473
seq64::midi_api, 488
seq64::midi_jack, 534
seq64::midibase, 602
seq64::midibus, 612, 616
seq64::rtmidi, 830
api_is_more_input
seq64::mastermidibase, 456
seq64::mastermidibus, 463, 466
api_play
seq64::midi_alsa, 475
seq64::midi_api, 489
seq64::midi_jack, 535
seq64::midibase, 602
seq64::midibus, 613, 618
seq64::rtmidi, 828
api_poll_for_midi
seq64::mastermidibase, 456
seq64::mastermidibus, 463, 466
seq64::midi_alsa, 474
seq64::midi_alsa_info, 482
seq64::midi_api, 489
seq64::midi_in_jack, 513
seq64::midi_info, 520
seq64::midi_jack, 535
seq64::midi_jack_info, 545
seq64::midibase, 601
seq64::midibus, 617
seq64::rtmidi, 831
seq64::rtmidi_info, 850
api_port_start
seq64::mastermidibase, 456
seq64::mastermidibus, 466, 467
seq64::midi_alsa_info, 482
seq64::midi_info, 520
seq64::midi_jack_info, 546
seq64::rtmidi_info, 850
api_set_beats_per_minute
seq64::mastermidibase, 455
seq64::mastermidibus, 465, 467
seq64::midi_alsa, 477
seq64::midi_alsa_info, 482
seq64::midi_api, 491
seq64::midi_info, 519
seq64::midi_jack, 537
seq64::midi_jack_info, 546
seq64::rtmidi, 829
seq64::rtmidi_info, 850
api_set_ppqn
seq64::mastermidibase, 455
seq64::mastermidibus, 465, 467
seq64::midi_alsa, 477
seq64::midi_alsa_info, 482
seq64::midi_api, 491
seq64::midi_info, 519
seq64::midi_jack, 537
seq64::midi_jack_info, 545
seq64::rtmidi, 829
seq64::rtmidi_info, 850
api_start
seq64::mastermidibase, 454
seq64::mastermidibus, 465
seq64::midi_alsa, 476
seq64::midi_api, 490
seq64::midi_jack, 536
seq64::midibase, 604
seq64::midibus, 614, 617
seq64::rtmidi, 829
api_stop
seq64::mastermidibase, 455
seq64::mastermidibus, 465
seq64::midi_alsa, 476
seq64::midi_api, 490
seq64::midi_jack, 536
seq64::midibase, 604
seq64::midibus, 615, 617
seq64::rtmidi, 829
api_sysex
seq64::midi_alsa, 475
seq64::midi_api, 490
seq64::midi_jack, 535
seq64::midibase, 603
seq64::midibus, 614
seq64::rtmidi, 831
app_client_name
seq64::rc_settings, 810
app_name
seq64::midi_info, 519
seq64::rtmidi_info, 849
append
seq64::event_list, 218
append_event
seq64::sequence, 1016
append_sysex
seq64::event, 204
application_name
seq64::rc_settings, 810
apply_length
seq64::seqedit, 887
apply_song_transpose
seq64::mainwnd, 427
seq64::perform, 709
seq64::sequence, 1006
armed_saved
seq64::perform, 713
array
seq64::midi_message, 558
at
seq64::midi_message, 557
at_bpm_dn
seq64::keys_perform, 367
at_bpm_up
seq64::keys_perform, 367
at_event_edit
seq64::keys_perform, 370

at_fast_forward
seq64::keys_perform, 370
at_follow_transport
seq64::keys_perform, 370
at_group_learn
seq64::keys_perform, 369
at_group_off
seq64::keys_perform, 369
at_group_on
seq64::keys_perform, 369
at_keep_queue
seq64::keys_perform, 368
at_menu_mode
seq64::keys_perform, 369
at_pattern_edit
seq64::keys_perform, 370
at_pause
seq64::keys_perform, 369
at_pointer_position
seq64::keys_perform, 370
at_queue
seq64::keys_perform, 368
at_replace
seq64::keys_perform, 368
at_rewind
seq64::keys_perform, 370
at_screenset_dn
seq64::keys_perform, 368
at_screenset_up
seq64::keys_perform, 368
at_set_playing_screenset
seq64::keys_perform, 368
at_show_ui_sequence_key
seq64::keys_perform, 371
at_show_ui_sequence_number
seq64::keys_perform, 371
at_snapshot_1
seq64::keys_perform, 368
at_snapshot_2
seq64::keys_perform, 368
at_song_mode
seq64::keys_perform, 369
at_start
seq64::keys_perform, 369
at_stop
seq64::keys_perform, 371
at_tap_bpm
seq64::keys_perform, 370
at_toggle_jack
seq64::keys_perform, 369
at_toggle_mutes
seq64::keys_perform, 370
auto_option_save
seq64::rc_settings, 806, 810
automutex
seq64::automutex, 139

background_sequence
seq64::sequence, 1045, 1046
baseline_ppqn
seq64::user_settings, 1111
beat_width
seq64::midi_timing, 579
beats
seq64::midi_measures, 555
beats_per_measure
seq64::midi_timing, 579
beats_per_minute
seq64::midi_timing, 578, 579
begin
seq64::editable_events, 186
seq64::event_list, 217
bg_color
seq64::gui_palette_gtk2, 307, 308
black
seq64::gui_palette_gtk2, 305
black_key
seq64::gui_palette_gtk2, 307
black_paint
seq64::gui_palette_gtk2, 307
blue
seq64::gui_palette_gtk2, 307
bpm
seq64::midi_info, 519
seq64::midibase, 593
seq64::rtmidi_info, 850
bpm_dn
seq64::keys_perform, 355
bpm_from_tempo_us
seq64, 79
bpm_page_increment
seq64::user_settings, 1110, 1113
bpm_precision
seq64::user_settings, 1110, 1113
bpm_step_increment
seq64::user_settings, 1110, 1113
bpm_up
seq64::keys_perform, 354
build_details
seq64, 88
build_info_dialog
seq64::mainwnd, 429
bus
seq64::busarray, 143
seq64::businfo, 152, 154
seq64::user_settings, 1099
bus_container
seq64::midi_info, 523
bus_count
seq64::user_settings, 1099
bus_instrument
seq64::user_settings, 1099
bus_name
seq64::midibase, 592, 601
seq64::user_settings, 1099
busarray
seq64::busarray, 142

seq64::businfo, 155
businfo
seq64::businfo, 151, 152
BussConstIterator
seq64::user_settings, 1097
BussIterator
seq64::user_settings, 1097
bussbyte
seq64, 64
Busses
seq64::user_settings, 1096
button
seq64::click, 160
seq64::options, 643
button_press
seq64::seqroll, 966
button_press_initial
seq64::seqroll, 965
button_release
seq64::seqroll, 966

c_backsequence
seq64, 119
c_bpmtag
seq64, 118
c_chord_number
seq64, 125
c_chord_size
seq64, 125
c_chord_table
seq64, 125
c_chord_table_text
seq64, 125
c_chord_text
seq64, 125
c_controller_names
seq64, 111
c_interval_text
seq64, 125
c_key_text
seq64, 125
c_mainwid_x
seq64, 132
c_mainwid_y
seq64, 132
c_max_busses
seq64, 126
c_max_instruments
seq64, 126
c_midi_control_16
seq64, 122
c_midi_control_17
seq64, 122
c_midi_control_18
seq64, 122
c_midi_control_19
seq64, 122
c_midi_control_bpm_dn
seq64, 120
c_midi_control_bpm_page_dn
seq64, 122
c_midi_control_bpm_page_up
seq64, 122
c_midi_control_bpm_up
seq64, 120
c_midi_control_mod_glearn
seq64, 121
c_midi_control_mod_gmute
seq64, 121
c_midi_control_mod_queue
seq64, 121
c_midi_control_mod_replace
seq64, 120
c_midi_control_mod_snapshot
seq64, 120
c_midi_control_play_ss
seq64, 121
c_midi_control_playback
seq64, 121
c_midi_control_record
seq64, 121
c_midi_control_solo
seq64, 121
c_midi_control_ss_dn
seq64, 120
c_midi_control_ss_up
seq64, 120
c_midi_control_thru
seq64, 122
c_midi_controls
seq64, 121
c_midi_controls_extended
seq64, 122
c_midi_track_ctrl
seq64, 119
c_midibus
seq64, 117
c_midibus_input_size
seq64, 116
c_midibus_output_size
seq64, 116
c_midibus_sysex_chunk
seq64, 116
c_midich
seq64, 117
c_midiclocks
seq64, 118
c_midictrl
seq64, 118
c_music_scales
seq64, 68
c_musickey
seq64, 119
c_musicscale
seq64, 119
c_mutegroups
seq64, 118

c_notes
seq64, 118
c_perf_bp_mes
seq64, 119
c_perf_bw
seq64, 119
c_scales_policy
seq64, 123
c_scales_text
seq64, 124
c_scales_transpose_dn
seq64, 124
c_scales_transpose_up
seq64, 123
c_status_queue
seq64, 131
c_status_replace
seq64, 131
c_status_snapshot
seq64, 131
c_timesig
seq64, 118
c_transpose
seq64, 119
c_triggers
seq64, 118
c_triggers_new
seq64, 118
calculate_base_sizes
seq64::mainwid, 411
cancel_callback
seq64::midi_api, 493
seq64::rtmidi_in, 837
category
seq64::editable_event, 175
category_string
seq64::editable_event, 175
category_t
seq64::editable_event, 171
cc_match
seq64::event, 202
change_event_data_lfo
seq64::sequence, 1035
change_event_data_range
seq64::sequence, 1034
change_focus
seq64::eventedit, 234
seq64::seqedit, 893
change_horz
seq64::perfroll, 777
seq64::perftime, 792
seq64::seqdata, 869
seq64::seqevent, 915
seq64::seqroll, 964
seq64::seqtime, 984
change_vert
seq64::eventslots, 252
seq64::perfnames, 676
seq64::perfroll, 777
seq64::seqkeys, 929
seq64::seqroll, 964
channel_count
seq64::user_midi_bus, 1086
channel_match
seq64::sequence, 1049
channel_max
seq64::user_midi_bus, 1086
channel_string
seq64::editable_event, 178
char_height
seq64::font, 263
char_width
seq64::font, 263
CharList
seq64::midi_list, 551
CharVector
seq64::midi_vector, 583
check_channel
seq64::event, 197
check_queued_tick
seq64::sequence, 1010
checklen
seq64::midifile, 628
choose_file
seq64::mainwnd, 431
choose_ppqn
seq64, 100
clamp
seq64, 108
clamp_track
seq64::perform, 748
clear
seq64::editable_events, 188
seq64::event_list, 219
seq64::midi_container, 499
seq64::midi_info, 519
seq64::midi_list, 552
seq64::midi_port_info, 566
seq64::midi_vector, 585
seq64::rtmidi_info, 847
seq64::triggers, 1073
clear_all
seq64::perform, 704
clear_flags
seq64::seqroll, 967
clear_link
seq64::event, 205
clear_links
seq64::event_list, 221
clear_mute_groups
seq64::mainwnd, 427
seq64::perform, 710
clear_old
seq64::seqroll, 967
clear_selected
seq64::seqroll, 967

clear_sequence_triggers
seq64::perform, 706
clear_triggers
seq64::sequence, 1024
clear_window
seq64::gui_drawingarea_gtk2, 287
click
seq64::click, 158
client
seq64::jack_assistant, 329
client_handle
seq64::midi_jack, 529, 530
seq64::midi_jack_info, 544, 547
client_name
seq64::jack_assistant, 329
client_open
seq64::jack_assistant, 329
client_uuid
seq64::jack_assistant, 329
clip_timestamp
seq64::sequence, 1032
clock
seq64::busarray, 144
seq64::businfo, 155
seq64::mastermidibase, 454
seq64::midibase, 600
clock_callback_mod
seq64::options, 645
clock_callback_off
seq64::options, 644
clock_callback_on
seq64::options, 645
clock_e
seq64, 68
clock_mod_callback
seq64::options, 645
clock_tick_duration_bogus
seq64, 81
clock_ticks_from_ppqn
seq64, 82
clocks_per_metronome
seq64::perform, 698
seq64::sequence, 1004
close_client
seq64::midi_jack, 531
close_out
seq64::eventedit, 234
close_port
seq64::midi_jack, 531
collapse
seq64::perfedit, 663
seq64::perform, 732
Color
seq64::font, 261
seq64::gui_palette_gtk2, 303
combine_bytes
seq64::perform, 701
complete_paste
seq64::seqroll, 959
condition_var
seq64::condition_var, 162
config_directory
seq64::rc_settings, 809, 814
config_filename
seq64::rc_settings, 809, 814
config_filename_alt
seq64::rc_settings, 810, 815
config_filespec
seq64::rc_settings, 805
configfile
seq64::configfile, 164
connect
seq64::midi_jack_info, 548
connect_name
seq64::midi_info, 522
seq64::midi_port_info, 567
seq64::midibase, 592
connect_port
seq64::midi_jack, 531
const_iterator
seq64::editable_events, 183
seq64::event_list, 216
seq64::seqmenu, 938
container
seq64::midi_message, 557
continue_from
seq64::busarray, 144
seq64::businfo, 155
seq64::mastermidibase, 447
seq64::midibase, 600
continue_sysex
seq64::rtmidi_in_data, 840
control_height
seq64::user_settings, 1104, 1109
controller_active
seq64::user_instrument, 1081
seq64::user_settings, 1100
controller_count
seq64::user_instrument, 1080
controller_max
seq64::user_instrument, 1080
controller_name
seq64::user_instrument, 1080
seq64::user_settings, 1101
controllers
seq64::user_instrument_t, 1083
controllers_active
seq64::user_instrument_t, 1083
convert_drop_xy
seq64::perfroll, 778
convert_sel_box_to_rect
seq64::seqroll, 962
convert_t
seq64::seqevent, 916
convert_tn
seq64::seqroll, 961

convert_tn_box_to_rect
seq64::seqroll, 962
convert_x
seq64::perfroll, 776
seq64::seqdata, 869
seq64::seqevent, 915
convert_xy
seq64::perfroll, 776
seq64::seqroll, 961
convert_y
seq64::eventslots, 251
seq64::perfnames, 675
seq64::seqkeys, 928
copy
seq64::perfedit, 663
seq64::perform, 732
seq64::triggers, 1072
copy_definitions
seq64::user_instrument, 1082
seq64::user_midi_bus, 1087
copy_events
seq64::sequence, 1046
copy_selected
seq64::sequence, 1029
seq64::triggers, 1070
copy_selected_trigger
seq64::sequence, 1021
copy_triggers
seq64::perform, 727
seq64::sequence, 1023
count
seq64::busarray, 143
seq64::editable_events, 187
seq64::event_list, 217
seq64::midi_message, 558
seq64::midi_queue, 569
seq64::midi_splitter, 575
count_selected_events
seq64::event_list, 223
count_selected_notes
seq64::event_list, 222
create_jack_client
seq64, 95
create_lash_driver
seq64, 98
create_master_bus
seq64::perform, 749
create_menu_image
seq64::seqedit, 892
create_menus
seq64::seqedit, 891
create_ringbuffer
seq64::midi_jack, 531
create_seqedit
seq64::seqmenu, 942
current_event
seq64::editable_events, 188
current_index
seq64::eventslots, 246
current_screen_set_notepad
seq64::perform, 735
current_seq
seq64::seqmenu, 939
current_x
seq64::gui_drawingarea_gtk2, 286
current_y
seq64::gui_drawingarea_gtk2, 286
cut_selected
seq64::sequence, 1029
cut_selected_trigger
seq64::sequence, 1021

dark_blue
seq64::gui_palette_gtk2, 305
dark_cyan
seq64::gui_palette_gtk2, 306
dark_green
seq64::gui_palette_gtk2, 305
dark_grey
seq64::gui_palette_gtk2, 306
dark_magenta
seq64::gui_palette_gtk2, 306
dark_orange
seq64::gui_palette_gtk2, 305
dark_red
seq64::gui_palette_gtk2, 305
data
seq64::event, 207
seq64::midi_control, 506
data_string
seq64::editable_event, 178
deactivate
seq64::businfo, 154
deallocate
seq64::midi_queue, 570
decrement_beats_per_minute
seq64::perform, 722
decrement_bottom
seq64::eventslots, 254
decrement_current
seq64::eventslots, 254
decrement_data1
seq64::event, 203
decrement_data2
seq64::event, 203
decrement_offset
seq64::trigger, 1060
decrement_screenset
seq64::perform, 722
decrement_selected
seq64::sequence, 1036
decrement_tick_end
seq64::trigger, 1060
decrement_tick_start
seq64::trigger, 1059
decrement_top
seq64::eventslots, 253

deinit
seq64::jack_assistant, 323
deinit_in
seq64::midibase, 598
deinit_jack_transport
seq64::perform, 744
del_selected_trigger
seq64::sequence, 1021
del_trigger
seq64::sequence, 1018
delete_api
seq64::rtmidi, 833
seq64::rtmidi_info, 852
delete_current_event
seq64::eventslots, 249
delete_current_sequence
seq64::seqmenu, 941
delete_lash_driver
seq64, 99
delete_sequence
seq64::perform, 706
delta_time_us_to_ticks
seq64, 80
device_ignore
seq64::rc_settings, 808, 813
device_ignore_num
seq64::rc_settings, 808, 813
disconnect
seq64::midi_jack_info, 548
display_name
seq64::midibase, 592, 601
divisions
seq64::midi_measures, 555
do_action
seq64::seqedit, 892
do_input
seq64::rtmidi_in_data, 840
done
seq64::midi_container, 498
seq64::midi_list, 552
seq64::midi_vector, 584
double_ticks_from_ppqn
seq64, 82
draw_all
seq64::perfroll, 775
draw_area
seq64::seqkeys, 928
draw_background
seq64::perftime, 792
seq64::seqevent, 913
draw_background_on
seq64::perfroll, 777
draw_background_on_pixmap
seq64::seqroll, 957
draw_drawable
seq64::gui_drawingarea_gtk2, 296
draw_drawable_row
seq64::perfroll, 777
draw_event
seq64::eventslots, 251
draw_events
seq64::eventslots, 252
draw_events_on
seq64::seqdata, 869
seq64::seqevent, 915
seq64::seqroll, 963
draw_events_on_pixmap
seq64::seqdata, 870
seq64::seqevent, 913
seq64::seqroll, 957
draw_key
seq64::seqkeys, 928
draw_line
seq64::gui_drawingarea_gtk2, 288–290
draw_line_on_pixmap
seq64::gui_drawingarea_gtk2, 288, 289
draw_line_on_window
seq64::seqdata, 867
draw_marker_on_sequence
seq64::mainwid, 408
draw_normal_rectangle_on_pixmap
seq64::gui_drawingarea_gtk2, 295
draw_pixmap_on_window
seq64::mainwid, 407
seq64::perftime, 794
seq64::seqdata, 870
seq64::seqevent, 913
seq64::seqtime, 983
draw_progress
seq64::perfroll, 775
draw_progress_on_window
seq64::perftime, 792
seq64::seqroll, 958
seq64::seqtime, 983
draw_rectangle
seq64::gui_drawingarea_gtk2, 292–294
draw_rectangle_on_pixmap
seq64::gui_drawingarea_gtk2, 294, 295
draw_selection_on_window
seq64::seqevent, 913
seq64::seqroll, 958
draw_sequence
seq64::perfnames, 675
draw_sequence_on
seq64::perfroll, 777
draw_sequence_on_pixmap
seq64::mainwid, 409
draw_sequence_pixmap_on_window
seq64::mainwid, 410
draw_sequences
seq64::perfedit, 664
seq64::perfnames, 675
draw_sequences_on_pixmap
seq64::mainwid, 410
draw_type_t
seq64, 69

dref
seq64::editable_events, 186, 187
seq64::event_list, 220
drop_action
seq64::seqroll, 970
drop_event
seq64::seqevent, 914
drop_x
seq64::gui_drawingarea_gtk2, 287
drop_y
seq64::gui_drawingarea_gtk2, 287
dump_midi_input
seq64::mastermidibase, 449
dump_setting_summary
seq64::userfile, 1127
dump_summary
seq64::user_settings, 1109

EVENT_AFTERTOUCH
seq64, 112
EVENT_ANY
seq64, 112
EVENT_CHANNEL_PRESSURE
seq64, 113
EVENT_CLEAR_CHAN_MASK
seq64, 116
EVENT_CONTROL_CHANGE
seq64, 112
EVENT_GET_CHAN_MASK
seq64, 116
EVENT_MIDI_ACTIVE_SENS
seq64, 115
EVENT_MIDI_CLOCK
seq64, 114
EVENT_MIDI_CONTINUE
seq64, 115
EVENT_MIDI_META
seq64, 115
EVENT_MIDI_QUARTER_FRAME
seq64, 113
EVENT_MIDI_RESET
seq64, 115
EVENT_MIDI_SONG_F4
seq64, 114
EVENT_MIDI_SONG_F5
seq64, 114
EVENT_MIDI_SONG_F9
seq64, 114
EVENT_MIDI_SONG_FD
seq64, 115
EVENT_MIDI_SONG_POS
seq64, 113
EVENT_MIDI_SONG_SELECT
seq64, 113
EVENT_MIDI_START
seq64, 114
EVENT_MIDI_STOP
seq64, 115
EVENT_MIDI_SYSEX_CONTINUE
seq64, 114
EVENT_MIDI_SYSEX_END
seq64, 114
EVENT_MIDI_SYSEX
seq64, 113
EVENT_MIDI_TUNE_SELECT
seq64, 114
EVENT_NOTE_OFF
seq64, 112
EVENT_NOTE_ON
seq64, 112
EVENT_NULL_CHANNEL
seq64, 115
EVENT_PITCH_WHEEL
seq64, 113
EVENT_PROGRAM_CHANGE
seq64, 112
EVENT_STATUS_BIT
seq64, 112
EVENTS_ALL
seq64, 116
EVENTS_UNSELECTED
seq64, 116
edit_action_t
seq64, 70
edit_callback_notepad
seq64::mainwnd, 424
edit_field_has_focus
seq64::mainwnd, 431
editable_event
seq64::editable_event, 172, 173
editable_events
seq64::editable_events, 184
seq64::event_list, 224
emit_clock
seq64::mastermidibase, 448
empty
seq64::event_list, 217
seq64::midi_message, 558
seq64::midi_queue, 569
end
seq64::editable_events, 186
seq64::event_list, 217
enqueue_draw
seq64::eventedit, 231
seq64::eventslots, 251
seq64::perfedit, 659
seq64::perfnames, 675
seq64::perfroll, 778
seq64::perftime, 792
enregister
seq64::perform, 700
enregister_peer
seq64::perfedit, 660
enregister_perfedits
seq64::mainwnd, 427
errdump
seq64::midifile, 636

error
seq64::midi_api, 492
seq64::midi_info, 522
error_is_fatal
seq64::midifile, 625
error_message
seq64, 89
seq64::jack_assistant, 332
seq64::midifile, 625
seq64::optionsfile, 653
event
seq64::event, 194
event_count
seq64::eventslots, 246
seq64::sequence, 1000
event_edit
seq64::keys_perform, 360
event_in_range
seq64::sequence, 1046
event_key
seq64::event_list::event_key, 212
event_list
seq64::event_list, 216
event_name
seq64::editable_event::name_value_t, 642
event_value
seq64::editable_event::name_value_t, 642
EventStack
seq64::sequence, 997
eventedit
seq64::eventedit, 229
seq64::eventslots, 257
Events
seq64::editable_events, 183
seq64::event_list, 215
events
seq64::editable_events, 186
seq64::event_list, 223
seq64::sequence, 999
EventsPair
seq64::editable_events, 183
seq64::event_list, 215
eventslots
seq64::editable_events, 189
seq64::eventedit, 237
seq64::eventslots, 245
expand
seq64::perfedit, 663
seq64::perform, 732
extract_bus_name
seq64, 84
extract_names
seq64::midi_jack_info, 548
extract_port_name
seq64, 85
extract_port_names
seq64, 84
extract_timing_numbers
seq64, 71

FF_RW_timeout
seq64, 107
seq64::perform, 702
FF_rewind
seq64::perform, 702
fast_forward
seq64::keys_perform, 362
seq64::perfedit, 661
seq64::perform, 703
ff_rw_button_t
seq64::perform, 694
ff_rw_type
seq64::perform, 703
fg_color
seq64::gui_palette_gtk2, 308
file_access
seq64, 90
file_accessible
seq64, 91
file_executable
seq64, 91
file_exists
seq64, 90
file_exit
seq64::mainwnd, 430
file_import_dialog
seq64::mainwnd, 428
file_is_directory
seq64, 92
file_new
seq64::mainwnd, 428
file_open
seq64::mainwnd, 428
file_readable
seq64, 90
file_save
seq64::mainwnd, 428
file_save_as
seq64::mainwnd, 429
file_writable
seq64, 91
filename
seq64::rc_settings, 808
fill
seq64::midi_container, 497
fill_background_pixmap
seq64::perfroll, 774
fill_background_window
seq64::mainwid, 407
fill_meta_track_end
seq64::midi_container, 501
fill_proprietary
seq64::midi_container, 501
fill_seq_name
seq64::midi_container, 501
fill_seq_number
seq64::midi_container, 500

fill_time_sig_and_tempo
seq64::midi_container, 501
fill_top_bar
seq64::seqedit, 890
filter_by_channel
seq64::mastermidibase, 444, 445
seq64::perform, 699
seq64::rc_settings, 807, 812
filter_callback
seq64::options, 645
finish
seq64::perform, 707
first_message
seq64::rtmidi_in_data, 840
flush
seq64::mastermidibase, 448
seq64::midibase, 599
follow_progress
seq64::perfroll, 775
seq64::seqroll, 959
follow_transport
seq64::keys_perform, 362
font
seq64::font, 261
font_render
seq64, 104
force_draw
seq64::gui_drawingarea_gtk2, 287
seq64::seqevent, 914
seq64::seqkeys, 927
seq64::seqroll, 959
format_timestamp
seq64::editable_event, 177
front
seq64::midi_queue, 570
FruityPerfInput
seq64::FruityPerfInput, 267
seq64::perfroll, 782
seq64::triggers, 1076
FruitySeqEventInput
seq64::FruitySeqEventInput, 271
seq64::seqevent, 919
FruitySeqRollInput
seq64::FruitySeqRollInput, 274
seq64::seqkeys, 932
seq64::seqroll, 975
full
seq64::midi_queue, 569
full_port_count
seq64::midi_info, 519
seq64::rtmidi, 832
seq64::rtmidi_info, 848

g_midi_control_limit
seq64, 123
g_rc_settings
seq64, 132
g_user_settings
seq64, 132

get
seq64::midi_container, 499
seq64::midi_list, 552
seq64::midi_vector, 584
get_32nds_per_quarter
seq64::perform, 698
seq64::sequence, 1004
get_all_port_info
seq64::midi_alsa_info, 483
seq64::midi_info, 523
seq64::midi_jack_info, 547
seq64::rtmidi_info, 849
get_api
seq64::rtmidi, 832, 833
get_api_info
seq64::rtmidi_info, 851
get_beat_width
seq64::jack_assistant, 321
seq64::perform, 697
seq64::sequence, 1004
get_beats_per_bar
seq64::perform, 697
seq64::sequence, 1003
get_beats_per_measure
seq64::jack_assistant, 322
get_beats_per_minute
seq64::jack_assistant, 322
seq64::mastermidibase, 445
seq64::perform, 710
get_bpm
seq64::mastermidibase, 445
get_bus_id
seq64::midi_info, 521
seq64::midi_port_info, 566
seq64::midibase, 592
seq64::rtmidi, 831
seq64::rtmidi_info, 847
get_bus_index
seq64::midibase, 592
get_bus_name
seq64::midi_info, 521
seq64::midi_port_info, 566
seq64::rtmidi, 831
seq64::rtmidi_info, 848
get_channel
seq64::event, 197
get_client
seq64::midi_alsa, 472
seq64::midibus, 612
get_clipboard_box
seq64::sequence, 1031
get_clock
seq64::busarray, 146
seq64::mastermidibase, 453
seq64::midibase, 594
get_clock_mod
seq64::midibase, 597
get_compiled_api

seq64::rtmidi_info, 846
get_compound_option
seq64, 101
get_current_jack_position
seq64, 97
seq64::jack_assistant, 336
seq64::perform, 755
get_current_sequence
seq64::seqmenu, 940
get_data
seq64::event, 203
get_editing
seq64::sequence, 1006
get_error_message
seq64::configfile, 166
get_follow_transport
seq64::jack_assistant, 328
seq64::perform, 702
get_group_mute_state
seq64::perform, 715
get_hold_undo
seq64::sequence, 1001
get_input
seq64::busarray, 148
seq64::mastermidibase, 452
seq64::midi_info, 521
seq64::midi_port_info, 566
seq64::midibase, 595
seq64::perform, 751
seq64::rtmidi_info, 848
get_jack_client_info
seq64::jack_assistant, 330
get_jack_mode
seq64::jack_assistant, 327
get_jack_pos
seq64::jack_assistant, 327
get_jack_stop_tick
seq64::jack_assistant, 327
get_jack_tick
seq64::jack_assistant, 327
seq64::perform, 707
get_key_events
seq64::keys_perform, 364
seq64::perform, 716
get_key_events_rev
seq64::keys_perform, 365
seq64::perform, 716
get_key_groups
seq64::keys_perform, 364
seq64::perform, 716
get_key_groups_rev
seq64::keys_perform, 365
seq64::perform, 716
get_keys
seq64::keys_perform, 354
get_last_tick
seq64::sequence, 1008
get_left_tick
seq64::perform, 708
get_length
seq64::sequence, 1008
get_linked
seq64::event, 205
get_max_trigger
seq64::perform, 732
seq64::sequence, 1023
get_maximum
seq64::triggers, 1072
get_measures
seq64::seqedit, 887
seq64::sequence, 1003
get_message
seq64::rterror, 825
get_midi_bus
seq64::sequence, 1024
get_midi_bus_name
seq64::busarray, 146
get_midi_channel
seq64::sequence, 1012
get_midi_event
seq64::busarray, 149
seq64::mastermidibase, 451
seq64::midibase, 597
get_midi_in_bus_name
seq64::mastermidibase, 450
get_midi_out_bus_name
seq64::mastermidibase, 449
get_minmax_note_events
seq64::sequence, 1042
get_name
seq64::sequence, 1006
get_next_event
seq64::sequence, 1042, 1043
get_next_note_event
seq64::sequence, 1040
get_next_trigger
seq64::sequence, 1043
get_note
seq64::event, 207
get_note_velocity
seq64::event, 208
get_num_in_buses
seq64::mastermidibase, 444
get_num_out_buses
seq64::mastermidibase, 444
get_num_selected_events
seq64::sequence, 1028
get_num_selected_notes
seq64::sequence, 1028
get_offset
seq64::perform, 715
get_playing
seq64::sequence, 1009
get_playing_screenset
seq64::perform, 730
get_port

seq64::midi_alsa, 473
seq64::midibus, 612
get_port_count
seq64::midi_info, 520
seq64::midi_port_info, 566
seq64::rtmidi, 832
seq64::rtmidi_info, 848
get_port_id
seq64::midi_info, 521
seq64::midi_port_info, 566
seq64::midibase, 593
seq64::rtmidi, 832
seq64::rtmidi_info, 848
get_port_name
seq64::midi_info, 521
seq64::midi_port_info, 566
seq64::rtmidi, 832
seq64::rtmidi_info, 848
get_ppqn
seq64::jack_assistant, 321
seq64::mastermidibase, 445
seq64::sequence, 1003
get_quantized_rec
seq64::sequence, 1010
get_queue_number
seq64::midi_port_info, 567
get_queued
seq64::sequence, 1009
get_queued_tick
seq64::sequence, 1009
get_raise
seq64::sequence, 1007
get_rank
seq64::event, 209
get_recording
seq64::sequence, 1010
get_right_tick
seq64::perform, 709
get_screen_set_notepad
seq64::perform, 735
get_screenset
seq64::perform, 730
get_selected_box
seq64::seqroll, 963
seq64::sequence, 1030
get_selected_end
seq64::triggers, 1072
get_selected_start
seq64::triggers, 1071
get_sequence
seq64::mastermidibase, 445
seq64::perform, 723, 724
seq64::seqmenu, 940
get_song_mute
seq64::sequence, 1005
get_start_tick
seq64::perform, 708
get_state
seq64::triggers, 1069
get_status
seq64::event, 202
get_sysex
seq64::event, 204
get_sysex_size
seq64::event, 205
get_system
seq64::midi_info, 521
seq64::midi_port_info, 567
seq64::rtmidi_info, 849
get_thru
seq64::sequence, 1011
get_tick
seq64::perform, 707
get_timestamp
seq64::event, 197
get_toggle_jack
seq64::perfedit, 660
seq64::perform, 701
get_transposable
seq64::sequence, 1006
get_transpose
seq64::perform, 710
get_trigger_count
seq64::sequence, 999
get_trigger_offset
seq64::sequence, 1024
get_trigger_paste_tick
seq64::sequence, 999
seq64::triggers, 1075
get_trigger_state
seq64::sequence, 1018
get_triggers
seq64::sequence, 1019
get_version
seq64::rtmidi_info, 846
get_virtual
seq64::midi_info, 521
seq64::midi_port_info, 567
seq64::rtmidi_info, 849
getType
seq64::rterror, 825
global_queue
seq64::midi_info, 522, 523
seq64::rtmidi_info, 849
global_seq_feature
seq64::user_settings, 1104
gmute_tracks
seq64::user_settings, 1102
green
seq64::gui_palette_gtk2, 307
grey
seq64::gui_palette_gtk2, 306
grid_brackets
seq64::user_settings, 1101, 1107
grid_is_black
seq64::user_settings, 1101

grid_is_normal
seq64::user_settings, 1101
grid_is_white
seq64::user_settings, 1101
grid_style
seq64::user_settings, 1101, 1107
group_learn
seq64::keys_perform, 359
group_off
seq64::keys_perform, 358, 359
group_on
seq64::keys_perform, 358
grow
seq64::perfedit, 663
seq64::triggers, 1068
grow_edit_t
seq64::triggers, 1064
grow_selected
seq64::sequence, 1037
grow_selected_notes
seq64::seqroll, 965
grow_trigger
seq64::sequence, 1018
growing
seq64::seqroll, 970
gs_mainwid_pointer
seq64, 132
gs_perfedit_pointer_0
seq64, 133
gs_perfedit_pointer_1
seq64, 133
Gtk, 49
gtk_drawarea_init
seq64::gui_drawingarea_gtk2, 297
gui
seq64::perform, 698
gui_assistant
seq64::gui_assistant, 278
gui_assistant_gtk2
seq64::gui_assistant_gtk2, 280
gui_drawingarea_gtk2
seq64::gui_drawingarea_gtk2, 285
gui_palette_gtk2
seq64::gui_palette_gtk2, 304
gui_window_gtk2
seq64::gui_window_gtk2, 313

handle_cancel
seq64::eventedit, 235
handle_close
seq64::eventedit, 234
seq64::seqedit, 893
handle_config
seq64::lash, 390
handle_delete
seq64::eventedit, 234
handle_event
seq64::lash, 390
handle_insert
seq64::eventedit, 234
handle_midi_control
seq64::perform, 734
handle_midi_control_ex
seq64::perform, 735
handle_modify
seq64::eventedit, 235
handle_motion_key
seq64::AbstractPerfInput, 137
seq64::FruityPerfInput, 270
seq64::Seq24PerfInput, 859
handle_save
seq64::eventedit, 235
handle_signal
seq64::mainwnd, 424
have_redo
seq64::perform, 731
seq64::sequence, 1001
have_undo
seq64::perform, 731
seq64::sequence, 1001
height
seq64::gui_drawingarea_gtk2::rect, 822
seq64::rect, 821
help_check
seq64, 85
seq64::rc_settings, 816
highlight
seq64::perform, 723
home_config_directory
seq64::rc_settings, 809
horizontal_adjust
seq64::perfroll, 778
seq64::seqedit, 886
seq64::seqroll, 959
horizontal_set
seq64::perfroll, 779
seq64::seqedit, 886

idle_progress
seq64::maintime, 399
seq64::perftime, 794
seq64::seqroll, 963
seq64::seqtime, 985
idle_redraw
seq64::seqdata, 867
seq64::seqevent, 914
seq64::seqroll, 963
ignore_flags
seq64::rtmidi_in_data, 839, 840
in_range
seq64::midi_control, 508
increment
seq64::midi_splitter, 574
increment_beats_per_minute
seq64::perform, 722
increment_bottom
seq64::eventslots, 255
increment_current

seq64::eventslots, 254
increment_data1
seq64::event, 203
increment_data2
seq64::event, 203
increment_offset
seq64::trigger, 1060
increment_screenset
seq64::perform, 723
increment_selected
seq64::sequence, 1036
increment_size
seq64::perfroll, 774
seq64::perftime, 792
increment_tick_end
seq64::trigger, 1059
increment_tick_start
seq64::trigger, 1059
increment_top
seq64::eventslots, 254
info_message
seq64, 89
seq64::jack_assistant, 332
init
seq64::font, 262
seq64::jack_assistant, 323
seq64::lash, 390
seq64::mastermidibase, 444
init_before_show
seq64::perfedit, 659
seq64::perfroll, 774
init_clock
seq64::busarray, 144
seq64::businfo, 153–155
seq64::mastermidibase, 447
seq64::midibase, 600
init_in
seq64::midibase, 598
init_in_sub
seq64::midibase, 598
init_input
seq64::businfo, 153, 154
init_jack_transport
seq64::perform, 743
init_out
seq64::midibase, 598
init_out_sub
seq64::midibase, 598
initialize
seq64::busarray, 143
seq64::businfo, 153
seq64::midi_splitter, 574
initialize_buses
seq64::mastermidibase, 449
initialized
seq64::businfo, 153
inner_start
seq64::perform, 748
inner_stop
seq64::perform, 748
input
seq64::mastermidibase, 454
input_callback
seq64::options, 645
input_data
seq64::midi_api, 493
input_func
seq64::perform, 714
input_ports
seq64::midi_info, 518
input_thread_func
seq64, 100
seq64::perform, 752
insert_event
seq64::eventslots, 247, 248
install_sequence
seq64::perform, 747
install_signal_handlers
seq64::mainwnd, 431
instrument
seq64::user_instrument_t, 1083
seq64::user_midi_bus, 1086
seq64::user_midi_bus_t, 1088
seq64::user_settings, 1099
instrument_controller_active
seq64::user_settings, 1100
instrument_controller_name
seq64::user_settings, 1101
instrument_count
seq64::user_settings, 1100
instrument_name
seq64::user_settings, 1100
InstrumentConstIterator
seq64::user_settings, 1097
InstrumentIterator
seq64::user_settings, 1097
Instruments
seq64::user_settings, 1097
interaction_method
seq64::rc_settings, 808, 813
interaction_method_t
seq64, 68
intersect
seq64::triggers, 1070
intersect_events
seq64::sequence, 1021
intersect_notes
seq64::sequence, 1020
intersect_triggers
seq64::sequence, 1019
invalid_key
seq64, 97
inverse_active
seq64::midi_control, 506
inverse_colors
seq64::user_settings, 1106, 1112

is
    seq64::keystroke, 386
is_active
    seq64::perform, 709
is_adding
    seq64::AbstractPerfInput, 137
is_adding_pressed
    seq64::AbstractPerfInput, 138
is_black_key
    seq64::seqkeys, 929
is_channel_msg
    seq64::event, 197
is_control_status
    seq64::perform, 696
is_ctrl_key
    seq64, 105, 106
is_ctrl_shift_key
    seq64, 106
is_current_seq_active
    seq64::seqmenu, 940
is_current_seq_in_edit
    seq64::seqmenu, 940
is_delete
    seq64::keystroke, 386
is_desired_cc_or_not_cc
    seq64::event, 199
is_dirty_edit
    seq64::perform, 728
    seq64::sequence, 1011
is_dirty_main
    seq64::perform, 728
    seq64::sequence, 1011
is_dirty_names
    seq64::perform, 729
    seq64::sequence, 1011
is_dirty_perf
    seq64::perform, 729
    seq64::sequence, 1011
is_dumping
    seq64::mastermidibase, 445
is_edit_sequence
    seq64::perform, 697
    seq64::seqmenu, 940
is_exportable
    seq64::perform, 729
is_group_learning
    seq64::perform, 738
is_input_port
    seq64::midi_api, 488
    seq64::midibase, 593, 594
is_input_system_port
    seq64::mastermidibase, 452
    seq64::perform, 751
is_inverse
    seq64::gui_palette_gtk2, 305
is_jack_master
    seq64::perform, 700
is_jack_running
    seq64::perform, 700
is_left
    seq64::click, 159
is_letter
    seq64::keystroke, 386
is_linked
    seq64::event, 205
is_marked
    seq64::event, 206
is_master
    seq64::jack_assistant, 321
is_middle
    seq64::click, 159
is_modified
    seq64::event_list, 218
    seq64::perform, 695, 744
    seq64::seqmenu, 939, 940
is_more_input
    seq64::mastermidibase, 451
is_mseq_valid
    seq64::perform, 747
is_no_modifier
    seq64, 105
is_note
    seq64::event, 208
is_note_msg
    seq64::event, 198
is_note_off
    seq64::event, 208
is_note_off_recorded
    seq64::event, 209
is_note_off_velocity
    seq64, 89
is_note_on
    seq64::event, 208
is_null_midipulse
    seq64, 99
is_one_byte_msg
    seq64::event, 198
is_output_port
    seq64::midibase, 594
is_painted
    seq64::event, 206
is_pattern_playing
    seq64::perform, 699, 746
is_port_open
    seq64::midi_api, 491
    seq64::rtmidi, 831
is_press
    seq64::click, 159
    seq64::keystroke, 386
is_realized
    seq64::gui_window_gtk2, 314
is_right
    seq64::click, 159
is_running
    seq64::jack_assistant, 321
    seq64::perform, 699

is_save
seq64::mainwnd, 431
is_screenset_valid
seq64::perform, 745
is_selected
seq64::event, 206
is_seq_valid
seq64::perform, 746
is_sequence_in_edit
seq64::perform, 706
is_shift_key
seq64, 105, 106
is_smf_0
seq64::perform, 723
seq64::sequence, 1012
is_strict_note_msg
seq64::event, 199
is_super_key
seq64, 107
is_sysex_special_id
seq64::midifile, 637
is_system_port
seq64::busarray, 148
seq64::midi_api, 488
seq64::midibase, 594
is_two_byte_msg
seq64::event, 198
is_valid
seq64::user_instrument, 1080
seq64::user_midi_bus, 1085
is_virtual_port
seq64::midi_api, 488
seq64::midibase, 593
iterator
seq64::editable_events, 183
seq64::event_list, 216
seq64::seqmenu, 938

jack_assistant
seq64::jack_assistant, 320
seq64::perform, 751
jack_data
seq64::midi_jack, 529
jack_dialog
seq64::mainwnd, 429
jack_dummy_callback
seq64, 103
jack_frame_rate
seq64::jack_assistant, 328
jack_idle_connect
seq64::gui_assistant, 278
seq64::gui_assistant_gtk2, 281
jack_message_bit_bucket
seq64, 111
jack_process_io
seq64, 111
seq64::midi_jack_info, 548
jack_process_rtmidi_input
seq64, 109
jack_process_rtmidi_output
seq64, 110
jack_session_callback
seq64, 97
seq64::jack_assistant, 336
jack_session_uuid
seq64::rc_settings, 809, 814
jack_shutdown
seq64::perform, 753
jack_shutdown_callback
seq64, 93
seq64::jack_assistant, 334
jack_sync_callback
seq64, 93
seq64::jack_assistant, 334
seq64::perform, 753
jack_timebase_callback
seq64, 94
seq64::jack_assistant, 335
seq64::perform, 754
jack_transport_callback
seq64, 95
seq64::jack_assistant, 334
seq64::perform, 753
jf_bit
seq64::jack_status_pair_t, 342
jf_meaning
seq64::jack_status_pair_t, 343
js_clock_tick
seq64::jack_scratchpad, 341
js_current_tick
seq64::jack_scratchpad, 341
js_delta_tick_frac
seq64::jack_scratchpad, 342
js_dumping
seq64::jack_scratchpad, 341
js_init_clock
seq64::jack_scratchpad, 341
js_jack_stopped
seq64::jack_scratchpad, 341
js_looping
seq64::jack_scratchpad, 341
js_playback_mode
seq64::jack_scratchpad, 341
js_ticks_converted
seq64::jack_scratchpad, 342
js_ticks_converted_last
seq64::jack_scratchpad, 342
js_ticks_delta
seq64::jack_scratchpad, 342
js_total_tick
seq64::jack_scratchpad, 341

keep_queue
seq64::keys_perform, 356
Key
seq64::editable_events, 183
key
seq64::keystroke, 386

key_name
seq64::keys_perform, 366
seq64::keys_perform_gtk2, 378
seq64::perform, 716
key_press_event
seq64::perftime, 795
keybindentry
seq64::keybindentry, 344
seq64::perform, 751
keys
seq64::gui_assistant, 279
seq64::perform, 699
keys_perform
seq64::keys_perform, 353
keys_perform_gtk2
seq64::keys_perform_gtk2, 378
keystroke
seq64::keystroke, 384, 385
keyval_name
seq64, 98
keyval_normalize
seq64, 98
kpt_bpm_dn
seq64::keys_perform_transfer, 380
kpt_bpm_up
seq64::keys_perform_transfer, 380
kpt_event_edit
seq64::keys_perform_transfer, 382
kpt_fast_forward
seq64::keys_perform_transfer, 383
kpt_follow_transport
seq64::keys_perform_transfer, 383
kpt_group_learn
seq64::keys_perform_transfer, 380
kpt_group_off
seq64::keys_perform_transfer, 380
kpt_group_on
seq64::keys_perform_transfer, 380
kpt_keep_queue
seq64::keys_perform_transfer, 381
kpt_menu_mode
seq64::keys_perform_transfer, 382
kpt_pattern_edit
seq64::keys_perform_transfer, 382
kpt_pause
seq64::keys_perform_transfer, 382
kpt_pointer_position
seq64::keys_perform_transfer, 383
kpt_queue
seq64::keys_perform_transfer, 381
kpt_replace
seq64::keys_perform_transfer, 381
kpt_rewind
seq64::keys_perform_transfer, 383
kpt_screenset_dn
seq64::keys_perform_transfer, 380
kpt_screenset_up
seq64::keys_perform_transfer, 380
kpt_set_playing_screenset
seq64::keys_perform_transfer, 380
kpt_show_ui_sequence_key
seq64::keys_perform_transfer, 381
kpt_show_ui_sequence_number
seq64::keys_perform_transfer, 382
kpt_snapshot_1
seq64::keys_perform_transfer, 381
kpt_snapshot_2
seq64::keys_perform_transfer, 381
kpt_song_mode
seq64::keys_perform_transfer, 382
kpt_start
seq64::keys_perform_transfer, 381
kpt_stop
seq64::keys_perform_transfer, 381
kpt_tap_bpm
seq64::keys_perform_transfer, 382
kpt_toggle_jack
seq64::keys_perform_transfer, 382
kpt_toggle_mutes
seq64::keys_perform_transfer, 383

lash
seq64::lash, 389
lash_driver
seq64, 99
lash_support
seq64::rc_settings, 806, 811
lash_support_callback
seq64::options, 646
lash_timeout_connect
seq64::gui_assistant, 278
seq64::gui_assistant_gtk2, 281
last_used_dir
seq64::rc_settings, 809
launch
seq64::perform, 704
launch_input_thread
seq64::perform, 743
launch_output_thread
seq64::perform, 743
learn_toggle
seq64::mainwnd, 426
seq64::perform, 721
left_right_size
seq64::perform, 709
legacy_format
seq64::rc_settings, 806, 810
length
seq64::trigger, 1058
lfownd
seq64::lfownd, 394
seq64::seqdata, 873
light_grey
seq64::gui_palette_gtk2, 306
line_after
seq64::configfile, 165
line_color

seq64::gui_palette_gtk2, 305
line_count
seq64::eventslots, 246
line_increment
seq64::eventslots, 246
line_maximum
seq64::eventslots, 246
link
seq64::event, 205
link_new
seq64::event_list, 220
seq64::sequence, 1039
List
seq64::triggers, 1064
load_events
seq64::editable_events, 185
seq64::eventslots, 247
load_inverse_palette
seq64::gui_palette_gtk2, 304
lock
seq64::mutex, 641
log2_time_sig_value
seq64, 78
log_main_sequence
seq64::midi_splitter, 574
long_options
seq64, 126
lookup_keyevent_key
seq64::keys_perform, 365
seq64::perform, 717
lookup_keyevent_seq
seq64::keys_perform, 365
seq64::perform, 717
lookup_keygroup_group
seq64::keys_perform, 366
seq64::perform, 719
lookup_keygroup_key
seq64::keys_perform, 365
seq64::perform, 719

m_32nds_per_quarter
seq64::perform, 761
seq64::sequence, 1055
m_4bar_offset
seq64::perfroll, 785
seq64::perftime, 796
m_FF_RW_button_type
seq64::perform, 756
m_active
seq64::businfo, 156
seq64::midi_control, 508
m_adding
seq64::AbstractPerfInput, 138
seq64::Seq24SeqEventInput, 862
seq64::seqroll, 977
m_adding_pressed
seq64::AbstractPerfInput, 138
m_adjust_bpm
seq64::mainwnd, 436
m_adjust_load_offset
seq64::mainwnd, 436
m_adjust_ss
seq64::mainwnd, 436
m_allow_click_edit
seq64::rc_settings, 817
m_allow_mod4_mode
seq64::rc_settings, 817
m_allow_snap_split
seq64::rc_settings, 817
m_allow_two_perfedits
seq64::user_settings, 1117
m_alsa_seq
seq64::mastermidibus, 468
seq64::midi_alsa_info, 484
m_api_data
seq64::rtmidi_in_data, 843
m_app_client_name
seq64::rc_settings, 821
m_app_name
seq64::midi_info, 525
m_application_name
seq64::rc_settings, 820
m_armed_progress_color
seq64::mainwid, 414
m_armed_saved
seq64::perform, 756
m_armed_statuses
seq64::perform, 756
m_auto_option_save
seq64::rc_settings, 817
m_b_on_c_pixmap
seq64::font, 265
m_b_on_y_pixmap
seq64::font, 264
m_back
seq64::midi_queue, 571
m_background
seq64::gui_drawingarea_gtk2, 298
m_background_sequence
seq64::seqroll, 979
seq64::sequence, 1056
m_background_x
seq64::perfroll, 784
m_bar_width
seq64::maintime, 400
m_beat_length
seq64::perfroll, 785
m_beat_width
seq64::jack_assistant, 339
seq64::maintime, 400
seq64::midi_timing, 580
seq64::perform, 760
m_beats
seq64::midi_measures, 556
m_beats_per_bar
seq64::perform, 760
m_beats_per_measure

seq64::jack_assistant, 339
seq64::midi_timing, 580
m_beats_per_minute
seq64::jack_assistant, 340
seq64::mastermidibase, 459
seq64::midi_timing, 580
m_bg_color
seq64::gui_palette_gtk2, 311
m_bgsequence
seq64::seqedit, 897
m_black
seq64::gui_palette_gtk2, 308
m_black_pixmap
seq64::font, 264
m_blk_key
seq64::gui_palette_gtk2, 310
m_blk_paint
seq64::gui_palette_gtk2, 310
m_blue
seq64::gui_palette_gtk2, 310
m_bottbox
seq64::eventedit, 238
m_bottom_iterator
seq64::eventslots, 259
m_box_height
seq64::maintime, 401
m_box_less_pill
seq64::maintime, 401
m_box_width
seq64::maintime, 401
m_bpm
seq64::midi_info, 525
seq64::midibase, 605
seq64::perfedit, 671
seq64::perform, 760
m_bpm_page_increment
seq64::user_settings, 1121
m_bpm_precision
seq64::user_settings, 1121
m_bpm_step_increment
seq64::user_settings, 1121
m_bus
seq64::businfo, 156
seq64::sequence, 1051
m_bus_announce
seq64::mastermidibase, 458
m_bus_container
seq64::midi_info, 524
m_bus_id
seq64::midibase, 605
m_bus_index
seq64::midibase, 605
m_bus_name
seq64::midibase, 606
m_button
seq64::click, 161
m_button_bpm
seq64::perfedit, 670
seq64::seqedit, 906
m_button_bus
seq64::seqedit, 903
m_button_bw
seq64::perfedit, 670
seq64::seqedit, 906
m_button_cancel
seq64::eventedit, 239
m_button_channel
seq64::seqedit, 903
m_button_chord
seq64::seqedit, 905
m_button_collapse
seq64::perfedit, 669
m_button_copy
seq64::perfedit, 669
m_button_data
seq64::seqedit, 906
m_button_del
seq64::eventedit, 238
m_button_down
seq64::mainwid, 414
m_button_expand
seq64::perfedit, 669
m_button_follow
seq64::perfedit, 670
m_button_grow
seq64::perfedit, 669
m_button_ins
seq64::eventedit, 238
m_button_jack
seq64::mainwnd, 436
seq64::perfedit, 669
m_button_jack_connect
seq64::options, 648
m_button_jack_disconnect
seq64::options, 648
m_button_jack_master
seq64::options, 648
m_button_jack_master_cond
seq64::options, 648
m_button_jack_transport
seq64::options, 648
m_button_key
seq64::seqedit, 905
m_button_learn
seq64::mainwnd, 435
m_button_length
seq64::seqedit, 904
m_button_lfo
seq64::seqedit, 902
m_button_loop
seq64::perfedit, 669
m_button_modify
seq64::eventedit, 238
m_button_note_length
seq64::seqedit, 904
m_button_ok

seq64::options, 648
m_button_perfedit
seq64::mainwnd, 436
m_button_play
seq64::mainwnd, 436
seq64::perfedit, 668
m_button_quantize
seq64::seqedit, 903
m_button_rec_vol
seq64::seqedit, 906
m_button_redo
seq64::perfedit, 669
seq64::seqedit, 903
m_button_save
seq64::eventedit, 239
m_button_scale
seq64::seqedit, 905
m_button_sequence
seq64::seqedit, 903
m_button_snap
seq64::perfedit, 668
seq64::seqedit, 904
m_button_stop
seq64::mainwnd, 435
seq64::perfedit, 668
m_button_tools
seq64::seqedit, 903
m_button_undo
seq64::perfedit, 669
seq64::seqedit, 902
m_button_xpose
seq64::perfedit, 668
m_button_zoom
seq64::seqedit, 904
m_bw
seq64::perfedit, 671
m_bytes
seq64::midi_message, 558
m_c_on_b_pixmap
seq64::font, 265
m_call_seq_edit
seq64::mainwnd, 437
m_call_seq_eventedit
seq64::mainwnd, 437
m_category
seq64::editable_event, 180
m_cc
seq64::seqdata, 874
seq64::seqevent, 922
seq64::seqroll, 980
m_cell_h
seq64::font, 263
m_cell_w
seq64::font, 263
m_channel
seq64::event, 210
m_channel_count
seq64::user_midi_bus, 1087
m_channel_match
seq64::sequence, 1051
m_char_list
seq64::midi_list, 553
seq64::midifile, 639
m_char_vector
seq64::midi_vector, 585
m_char_w
seq64::eventslots, 258
seq64::perfnames, 679
m_chord
seq64::seqedit, 897
seq64::seqroll, 977
m_client
seq64::lash, 391
m_client_name
seq64::midi_in_jack, 514
seq64::midi_port_info::port_info_t, 798
m_client_number
seq64::midi_port_info::port_info_t, 798
m_clip_mask
seq64::font, 265
m_clipboard
seq64::seqmenu, 946
seq64::triggers, 1076
m_clock_mod
seq64::midibase, 604
m_clock_type
seq64::midibase, 605
m_clocks_per_metronome
seq64::perform, 760
seq64::sequence, 1055
m_cond
seq64::condition_var, 163
m_condition_var
seq64::perform, 765
m_config_directory
seq64::rc_settings, 820
m_config_filename
seq64::rc_settings, 820
m_config_filename_alt
seq64::rc_settings, 820
m_connected
seq64::midi_api, 494
m_container
seq64::busarray, 150
m_continue_sysex
seq64::rtmidi_in_data, 843
m_control_height
seq64::user_settings, 1116
m_control_status
seq64::perform, 763
m_controller_count
seq64::user_instrument, 1082
m_current_event
seq64::editable_events, 189
m_current_index
seq64::eventslots, 259

m_current_iterator
seq64::eventslots, 259
m_current_seq
seq64::seqmenu, 946
m_current_x
seq64::FruityPerfInput, 270
seq64::gui_drawingarea_gtk2, 299
m_current_y
seq64::FruityPerfInput, 270
seq64::gui_drawingarea_gtk2, 299
m_current_zoom
seq64::user_settings, 1116
m_d
seq64::configfile, 167
m_data
seq64::event, 210
seq64::midi_control, 508
seq64::midifile, 638
m_dest_addr_client
seq64::midi_alsa, 478
seq64::midibus, 618
m_dest_addr_port
seq64::midi_alsa, 478
seq64::midibus, 618
m_device_ignore
seq64::rc_settings, 819
m_device_ignore_num
seq64::rc_settings, 819
m_dirty_edit
seq64::sequence, 1053
m_dirty_main
seq64::sequence, 1053
m_dirty_names
seq64::sequence, 1053
m_dirty_perf
seq64::sequence, 1053
m_disable_reported
seq64::midifile, 638
m_display_name
seq64::midibase, 606
m_divisions
seq64::midi_measures, 556
m_divs_per_beat
seq64::perfroll, 784
m_dk_blue
seq64::gui_palette_gtk2, 309
m_dk_cyan
seq64::gui_palette_gtk2, 309
m_dk_green
seq64::gui_palette_gtk2, 308
m_dk_grey
seq64::gui_palette_gtk2, 310
m_dk_magenta
seq64::gui_palette_gtk2, 309
m_dk_orange
seq64::gui_palette_gtk2, 309
m_dk_red
seq64::gui_palette_gtk2, 308
m_do_input
seq64::rtmidi_in_data, 842
m_dont_reset_ticks
seq64::perform, 763
m_drag_handle
seq64::seqdata, 875
m_drag_paste_start_pos
seq64::FruitySeqRollInput, 276
m_dragging
seq64::seqdata, 875
m_drawing_background_seq
seq64::seqroll, 979
m_drop_sequence
seq64::perfroll, 786
m_drop_tick
seq64::perfroll, 786
m_drop_tick_trigger_offset
seq64::perfroll, 786
m_drop_x
seq64::gui_drawingarea_gtk2, 299
m_drop_y
seq64::gui_drawingarea_gtk2, 300
m_dumping_input
seq64::mastermidibase, 459
m_edit_sequence
seq64::perform, 764
m_editbox
seq64::eventedit, 238
m_editing
seq64::sequence, 1053
m_editing_cc
seq64::seqedit, 907
m_editing_status
seq64::seqedit, 907
m_effective_tick
seq64::Seq24PerfInput, 860
m_entry_bpm
seq64::perfedit, 670
seq64::seqedit, 906
m_entry_bus
seq64::seqedit, 903
m_entry_bw
seq64::perfedit, 670
seq64::seqedit, 906
m_entry_channel
seq64::seqedit, 904
m_entry_chord
seq64::seqedit, 905
m_entry_data
seq64::seqedit, 906
m_entry_ev_data_0
seq64::eventedit, 240
m_entry_ev_data_1
seq64::eventedit, 240
m_entry_ev_name
seq64::eventedit, 240
m_entry_ev_timestamp
seq64::eventedit, 240

m_entry_key
seq64::seqedit, 905
m_entry_length
seq64::seqedit, 905
m_entry_name
seq64::seqedit, 907
m_entry_note_length
seq64::seqedit, 904
m_entry_notes
seq64::mainwnd, 437
m_entry_scale
seq64::seqedit, 905
m_entry_sequence
seq64::seqedit, 903
m_entry_snap
seq64::perfedit, 668
seq64::seqedit, 904
m_entry_xpose
seq64::perfedit, 668
m_entry_zoom
seq64::seqedit, 904
m_erase_painting
seq64::FruitySeqRollInput, 276
m_error_callback
seq64::midi_api, 494
m_error_callback_user_data
seq64::midi_api, 494
m_error_is_fatal
seq64::midifile, 638
m_error_message
seq64::configfile, 166
seq64::midifile, 638
m_error_string
seq64::midi_api, 494
seq64::midi_info, 525
m_event_container
seq64::eventslots, 257
m_event_count
seq64::eventslots, 258
m_eventedit
seq64::seqmenu, 946
m_events
seq64::editable_events, 189
seq64::event_list, 224
seq64::sequence, 1050
m_events_clipboard
seq64::sequence, 1050
m_events_redo
seq64::sequence, 1051
m_events_undo
seq64::sequence, 1051
m_events_undo_hold
seq64::sequence, 1050
m_eventslots
seq64::eventedit, 237
m_excell_FF_RW
seq64::perform, 756
m_fg_color
seq64::gui_palette_gtk2, 311
m_file_size
seq64::midifile, 638
m_filename
seq64::rc_settings, 819
m_filter_by_channel
seq64::mastermidibase, 459
seq64::rc_settings, 819
m_first_error_occurred
seq64::midi_api, 494
m_first_message
seq64::rtmidi_in_data, 843
m_flash_height
seq64::maintime, 401
m_flash_width
seq64::maintime, 401
m_flash_x
seq64::maintime, 401
m_follow_transport
seq64::jack_assistant, 339
m_font_h
seq64::font, 263
m_font_w
seq64::font, 263
m_foreground
seq64::gui_drawingarea_gtk2, 299
m_format_timestamp
seq64::editable_event, 180
m_front
seq64::midi_queue, 571
m_fruity_interaction
seq64::perfroll, 787
seq64::seqevent, 920
seq64::seqroll, 976
m_gc
seq64::gui_drawingarea_gtk2, 298
m_global_bgsequence
seq64::midifile, 639
m_global_queue
seq64::midi_info, 525
m_global_seq_feature_save
seq64::user_settings, 1116
m_gmute_tracks
seq64::user_settings, 1122
m_green
seq64::gui_palette_gtk2, 310
m_grey
seq64::gui_palette_gtk2, 310
m_grid_brackets
seq64::user_settings, 1115
m_grid_style
seq64::user_settings, 1115
m_grow_direction
seq64::perfroll, 787
m_growing
seq64::perfroll, 787
seq64::seqevent, 921
seq64::seqroll, 977

m_gui_support
seq64::perform, 766
m_h_page_increment
seq64::perfroll, 783
m_h_perf_page_increment
seq64::user_settings, 1118
m_hadjust
seq64::gui_drawingarea_gtk2, 298
seq64::perfedit, 667
seq64::seqedit, 901
m_has_link
seq64::event, 210
m_have_button_press
seq64::perfroll, 785
m_have_focus
seq64::eventedit, 241
seq64::seqedit, 907
m_have_redo
seq64::perform, 765
seq64::sequence, 1051
m_have_undo
seq64::perform, 765
seq64::sequence, 1050
m_hbox
seq64::lfownd, 395
seq64::perfedit, 670
seq64::seqedit, 902
m_hbox2
seq64::seqedit, 902
m_hint_key
seq64::seqkeys, 933
m_hint_state
seq64::seqkeys, 933
m_hlbox
seq64::perfedit, 670
m_horizontal_adjust
seq64::seqroll, 975
m_hscroll
seq64::perfedit, 667
m_hscroll_new
seq64::seqedit, 901
m_htopbox
seq64::eventedit, 237
m_ignore_flags
seq64::rtmidi_in_data, 842
m_image_play
seq64::mainwnd, 435
seq64::perfedit, 668
m_image_transpose
seq64::seqedit, 899
m_in_thread
seq64::perform, 759
m_in_thread_launched
seq64::perform, 759
m_inbus_array
seq64::mastermidibase, 458
m_info_api
seq64::rtmidi_info, 853
m_init_clock
seq64::businfo, 156
m_init_input
seq64::businfo, 156
m_initial_chord
seq64::seqedit, 896
m_initial_note_length
seq64::seqedit, 896
m_initial_snap
seq64::seqedit, 896
m_initial_zoom
seq64::seqedit, 896
m_initialized
seq64::businfo, 156
m_input
seq64::midi_info, 524
m_input_data
seq64::midi_api, 494
m_input_port_name
seq64::midi_alsa, 478
seq64::midibus, 619
m_inputing
seq64::midibase, 605
seq64::perform, 759
m_instrument_def
seq64::user_instrument, 1082
m_instruments
seq64::user_settings, 1115
m_interaction
seq64::perfroll, 787
m_interaction_method
seq64::rc_settings, 819
m_inverse_active
seq64::midi_control, 508
m_inverse_colors
seq64::user_settings, 1118
m_is_drag_pasting
seq64::FruitySeqEventInput, 273
seq64::seqroll, 978
m_is_drag_pasting_start
seq64::FruitySeqEventInput, 273
seq64::seqroll, 978
m_is_input
seq64::midi_port_info::port_info_t, 799
m_is_input_port
seq64::midibase, 606
m_is_inverse
seq64::gui_palette_gtk2, 308
m_is_lash_supported
seq64::lash, 391
m_is_modified
seq64::event_list, 224
seq64::perform, 765
m_is_pattern_playing
seq64::perform, 759
m_is_press
seq64::click, 160
seq64::keystroke, 388

m_is_realized
seq64::gui_window_gtk2, 316
m_is_running
seq64::mainwnd, 437
seq64::perfedit, 671
m_is_system
seq64::midi_port_info::port_info_t, 799
m_is_system_port
seq64::midibase, 606
m_is_valid
seq64::user_instrument, 1082
seq64::user_midi_bus, 1087
m_is_virtual
seq64::midi_port_info::port_info_t, 799
m_is_virtual_port
seq64::midibase, 606
m_iterator_draw
seq64::sequence, 1051
m_iterator_draw_trigger
seq64::triggers, 1077
m_iterator_play_trigger
seq64::triggers, 1077
m_jack_asst
seq64::perform, 765
m_jack_buffmessage
seq64::midi_jack_data, 541
m_jack_buffsize
seq64::midi_jack_data, 541
m_jack_client
seq64::jack_assistant, 337
seq64::midi_jack_data, 541
seq64::midi_jack_info, 549
m_jack_client_name
seq64::jack_assistant, 337
m_jack_client_uuid
seq64::jack_assistant, 337
m_jack_data
seq64::midi_jack, 539
m_jack_frame_current
seq64::jack_assistant, 337
m_jack_frame_last
seq64::jack_assistant, 337
m_jack_frame_rate
seq64::jack_assistant, 339
m_jack_info
seq64::midi_jack, 539
m_jack_lasttime
seq64::midi_jack_data, 541
m_jack_master
seq64::jack_assistant, 338
m_jack_parent
seq64::jack_assistant, 337
m_jack_port
seq64::midi_jack_data, 541
m_jack_ports
seq64::midi_jack_info, 549
m_jack_pos
seq64::jack_assistant, 338
m_jack_rtmidiin
seq64::midi_jack_data, 541
m_jack_running
seq64::jack_assistant, 338
m_jack_session_uuid
seq64::rc_settings, 820
m_jack_stop_tick
seq64::jack_assistant, 339
m_jack_tick
seq64::jack_assistant, 338
seq64::perform, 762
m_jack_transport_state
seq64::jack_assistant, 338
m_jack_transport_state_last
seq64::jack_assistant, 338
m_jsession_ev
seq64::jack_assistant, 338
m_justselected_one
seq64::FruitySeqEventInput, 273
seq64::seqroll, 978
m_key
seq64::keybindentry, 345
seq64::keystroke, 388
seq64::seqedit, 897
seq64::seqkeys, 933
seq64::seqroll, 977
m_key_bpm_dn
seq64::keys_perform, 372
m_key_bpm_up
seq64::keys_perform, 372
m_key_event_edit
seq64::keys_perform, 375
m_key_events
seq64::keys_perform, 372
m_key_events_rev
seq64::keys_perform, 372
m_key_fast_forward
seq64::keys_perform, 375
m_key_follow_transport
seq64::keys_perform, 375
m_key_group_learn
seq64::keys_perform, 374
m_key_group_off
seq64::keys_perform, 374
m_key_group_on
seq64::keys_perform, 374
m_key_groups
seq64::keys_perform, 372
m_key_groups_rev
seq64::keys_perform, 372
m_key_keep_queue
seq64::keys_perform, 373
m_key_menu_mode
seq64::keys_perform, 374
m_key_pattern_edit
seq64::keys_perform, 375
m_key_pause
seq64::keys_perform, 374

m_key_pointer_position
seq64::keys_perform, 375
m_key_queue
seq64::keys_perform, 373
m_key_replace
seq64::keys_perform, 373
m_key_rewind
seq64::keys_perform, 375
m_key_screenset_dn
seq64::keys_perform, 373
m_key_screenset_up
seq64::keys_perform, 373
m_key_set_playing_screenset
seq64::keys_perform, 373
m_key_show_ui_sequence_key
seq64::keys_perform, 372
m_key_show_ui_sequence_number
seq64::keys_perform, 372
m_key_snapshot_1
seq64::keys_perform, 373
m_key_snapshot_2
seq64::keys_perform, 373
m_key_song_mode
seq64::keys_perform, 374
m_key_start
seq64::keys_perform, 374
m_key_stop
seq64::keys_perform, 376
m_key_tap_bpm
seq64::keys_perform, 375
m_key_toggle_jack
seq64::keys_perform, 374
m_key_toggle_mutes
seq64::keys_perform, 375
m_keying
seq64::seqkeys, 933
m_keying_note
seq64::seqkeys, 933
m_keys_perform
seq64::gui_assistant, 279
m_label_category
seq64::eventedit, 240
m_label_channel
seq64::eventedit, 239
m_label_ev_count
seq64::eventedit, 239
m_label_modified
seq64::eventedit, 240
m_label_ppqn
seq64::eventedit, 239
m_label_right
seq64::eventedit, 240
m_label_seq_name
seq64::eventedit, 239
m_label_spacer
seq64::eventedit, 239
m_label_time_fmt
seq64::eventedit, 240
m_label_time_sig
seq64::eventedit, 239
m_lash_args
seq64::lash, 391
m_lash_support
seq64::rc_settings, 817
m_last_playing
seq64::mainwid, 415
m_last_tick
seq64::sequence, 1054
m_last_tick_x
seq64::mainwid, 415
m_last_used_dir
seq64::rc_settings, 820
m_lasttick
seq64::midibase, 606
m_left_marker_tick
seq64::perftime, 797
m_left_tick
seq64::perform, 761
m_legacy_format
seq64::rc_settings, 817
m_length
seq64::sequence, 1055
seq64::triggers, 1077
m_lfo_wnd
seq64::seqedit, 902
m_line
seq64::configfile, 167
m_line_color
seq64::gui_palette_gtk2, 311
m_line_count
seq64::eventslots, 258
m_line_maximum
seq64::eventslots, 258
m_line_overlap
seq64::eventslots, 259
m_linked
seq64::event, 210
m_local_addr_client
seq64::midi_alsa, 478
seq64::midibus, 619
m_local_addr_port
seq64::midi_alsa, 478
seq64::midibus, 619
m_looping
seq64::perform, 760
m_lt_grey
seq64::gui_palette_gtk2, 310
m_main_cursor
seq64::mainwnd, 435
m_main_time
seq64::mainwnd, 434
m_main_wid
seq64::mainwnd, 434
m_mainperf
seq64::gui_drawingarea_gtk2, 299
seq64::gui_window_gtk2, 316

seq64::options, 647
seq64::seqmenu, 946
m_mainwid_border
seq64::mainwid, 416
seq64::user_settings, 1116
m_mainwid_spacing
seq64::mainwid, 416
seq64::user_settings, 1116
m_mainwid_x
seq64::mainwid, 416
seq64::user_settings, 1123
m_mainwid_y
seq64::mainwid, 416
seq64::user_settings, 1123
m_mainwnd_cols
seq64::mainwid, 415
seq64::user_settings, 1116
m_mainwnd_rows
seq64::mainwid, 415
seq64::user_settings, 1115
m_manual_alsa_ports
seq64::rc_settings, 819
m_marked
seq64::event, 211
m_master_bus
seq64::perform, 761
m_master_clocks
seq64::mastermidibase, 458
seq64::perform, 761
m_master_info
seq64::midi_api, 493
seq64::midibus, 619
m_master_inputs
seq64::mastermidibase, 458
seq64::perform, 761
m_masterbus
seq64::sequence, 1052
m_max_busses
seq64::mastermidibase, 458
m_max_sequence
seq64::user_settings, 1122
m_max_sets
seq64::mainwid, 416
seq64::perform, 764
seq64::user_settings, 1116
m_max_value
seq64::midi_control, 509
m_maxbeats
seq64::sequence, 1054
m_measure_length
seq64::perfroll, 785
seq64::perftime, 797
m_measures
seq64::midi_measures, 555
seq64::seqedit, 897
m_menu
seq64::seqmenu, 946
m_menu_bpm
seq64::perfedit, 671
seq64::seqedit, 900
m_menu_bw
seq64::perfedit, 671
seq64::seqedit, 900
m_menu_chords
seq64::seqedit, 900
m_menu_data
seq64::seqedit, 900
m_menu_edit
seq64::mainwnd, 434
m_menu_file
seq64::mainwnd, 434
m_menu_help
seq64::mainwnd, 434
m_menu_key
seq64::seqedit, 900
m_menu_length
seq64::seqedit, 899
m_menu_midibus
seq64::seqedit, 899
m_menu_midich
seq64::seqedit, 899
m_menu_mode
seq64::mainwnd, 437
m_menu_note_length
seq64::seqedit, 899
m_menu_rec_vol
seq64::seqedit, 900
m_menu_scale
seq64::seqedit, 900
m_menu_sequences
seq64::seqedit, 900
m_menu_snap
seq64::perfedit, 667
seq64::seqedit, 899
m_menu_tools
seq64::seqedit, 898
m_menu_view
seq64::mainwnd, 434
m_menu_xpose
seq64::perfedit, 668
m_menu_zoom
seq64::seqedit, 899
m_menubar
seq64::mainwnd, 433
seq64::seqedit, 898
m_message
seq64::rterror, 825
seq64::rtmidi_in_data, 842
m_midi_api
seq64::rtmidi, 833
m_midi_beat_width
seq64::user_settings, 1120
m_midi_beats_per_measure
seq64::user_settings, 1120
m_midi_beats_per_minute
seq64::user_settings, 1120

m_midi_bus_def
seq64::user_midi_bus, 1087
m_midi_buses
seq64::user_settings, 1115
m_midi_buss_override
seq64::user_settings, 1120
m_midi_cc_off
seq64::perform, 763
m_midi_cc_on
seq64::perform, 763
m_midi_cc_toggle
seq64::perform, 763
m_midi_channel
seq64::sequence, 1051
m_midi_handle
seq64::midi_info, 525
m_midi_info
seq64::rtmidi, 833
m_midi_master
seq64::mastermidibus, 468
m_midi_mode_input
seq64::midi_info, 524
m_midi_parameters
seq64::editable_events, 189
m_midi_ppqn
seq64::user_settings, 1119
m_midiclockpos
seq64::perform, 763
m_midiclockrunning
seq64::perform, 762
m_midiclocktick
seq64::perform, 762
m_min_value
seq64::midi_control, 508
m_mode_group
seq64::perform, 757
m_mode_group_learn
seq64::perform, 757
m_modified
seq64::seqmenu, 947
m_modifier
seq64::click, 161
seq64::keystroke, 388
m_move_delta_x
seq64::seqroll, 978
m_move_delta_y
seq64::seqroll, 978
m_move_snap_offset_x
seq64::seqevent, 922
seq64::seqroll, 978
m_moving
seq64::mainwid, 414
seq64::perfroll, 787
seq64::seqevent, 921
seq64::seqroll, 977
m_moving_init
seq64::seqevent, 921
seq64::seqroll, 977
m_moving_seq
seq64::mainwid, 414
m_multi_client
seq64::midi_jack, 539
seq64::midi_jack_info, 549
m_musical_key
seq64::sequence, 1056
m_musical_scale
seq64::sequence, 1056
m_mute_group
seq64::perform, 756
m_mute_group_selected
seq64::perform, 757
m_mutex
seq64::mastermidibase, 459
seq64::midibase, 607
seq64::midifile, 638
seq64::sequence, 1056
m_mutex_lock
seq64::mutex, 641
m_name
seq64::configfile, 166
seq64::midifile, 638
seq64::sequence, 1054
m_name_category
seq64::editable_event, 180
m_name_channel
seq64::editable_event, 181
m_name_data
seq64::editable_event, 181
m_name_meta
seq64::editable_event, 180
m_name_seqspec
seq64::editable_event, 181
m_name_status
seq64::editable_event, 180
m_name_timestamp
seq64::editable_event, 180
m_namebox_w
seq64::perfnames, 679
m_names_chars
seq64::perfnames, 679
m_names_x
seq64::perfnames, 679
m_names_y
seq64::perfnames, 679
seq64::perfroll, 784
m_new_format
seq64::midifile, 639
m_note_length
seq64::seqedit, 897
seq64::seqroll, 976
m_note_off_margin
seq64::sequence, 1057
m_note_off_velocity
seq64::sequence, 1056
m_note_on_velocity
seq64::sequence, 1056

m_notebook
seq64::options, 648
m_notes_on
seq64::sequence, 1052
m_notify
seq64::perform, 766
m_num_poll_descriptors
seq64::mastermidibus, 468
seq64::midi_alsa_info, 484
m_number_h
seq64::seqdata, 874
m_number_offset_y
seq64::seqdata, 874
m_number_w
seq64::seqdata, 874
m_numbers
seq64::seqdata, 874
m_offset
seq64::font, 264
seq64::perform, 763
seq64::trigger, 1061
m_old
seq64::seqdata, 874
seq64::seqevent, 920
seq64::seqroll, 975
m_old_progress_ticks
seq64::perfroll, 785
m_old_seq
seq64::mainwid, 414
m_one_measure
seq64::perform, 761
m_options
seq64::mainwnd, 435
m_optsbox
seq64::eventedit, 238
m_orange
seq64::gui_palette_gtk2, 309
m_out_thread
seq64::perform, 758
m_out_thread_launched
seq64::perform, 759
m_outbus_array
seq64::mastermidibase, 458
m_output
seq64::midi_info, 524
m_outputing
seq64::perform, 759
m_padded_h
seq64::font, 264
m_page_factor
seq64::perfroll, 783
m_pager_index
seq64::eventslots, 259
m_painted
seq64::event, 211
m_painting
seq64::seqevent, 921
seq64::seqroll, 977
m_parent
seq64::editable_event, 180
seq64::eventslots, 257
seq64::perfnames, 678
seq64::perfroll, 783
seq64::perftime, 796
seq64::sequence, 1050
seq64::triggers, 1076
m_parent_bus
seq64::midi_api, 493
m_pass_sysex
seq64::rc_settings, 818
m_paste
seq64::seqevent, 922
seq64::seqroll, 978
m_paste_tick
seq64::triggers, 1077
m_peer_perfedit
seq64::perfedit, 666
m_perf
seq64::keybindentry, 346
m_perf_edit
seq64::mainwnd, 435
m_perf_edit_2
seq64::mainwnd, 435
m_perf_scale_x
seq64::perfroll, 784
seq64::perftime, 797
m_perfnames
seq64::perfedit, 667
m_perform
seq64::lash, 391
m_perfroll
seq64::perfedit, 667
m_perftime
seq64::perfedit, 667
m_phase
seq64::lfownd, 396
m_pill_width
seq64::maintime, 401
m_pixmap
seq64::font, 264
seq64::gui_drawingarea_gtk2, 298
m_playback_mode
seq64::perform, 760
m_playing
seq64::sequence, 1052
m_playing_notes
seq64::sequence, 1052
m_playing_screen
seq64::perform, 757
m_playscreen_offset
seq64::perform, 757
m_poll_descriptors
seq64::mastermidibus, 468
seq64::midi_alsa_info, 484
m_port_container
seq64::midi_port_info, 567

m_port_count
seq64::midi_port_info, 567
m_port_id
seq64::midibase, 605
m_port_name
seq64::midi_port_info::port_info_t, 798
seq64::midibase, 606
m_port_number
seq64::midi_port_info::port_info_t, 798
m_pos
seq64::midifile, 638
seq64::seqroll, 976
m_position_for_get
seq64::midi_container, 504
m_pp_eighth
seq64::seqedit, 898
m_pp_sixteenth
seq64::seqedit, 898
m_pp_whole
seq64::seqedit, 898
m_ppqn
seq64::jack_assistant, 339
seq64::maintime, 402
seq64::mainwnd, 434
seq64::mastermidibase, 458
seq64::midi_info, 525
seq64::midi_splitter, 576
seq64::midi_timing, 580
seq64::midibase, 605
seq64::midifile, 639
seq64::perfedit, 671
seq64::perform, 760
seq64::perfroll, 783
seq64::perftime, 796
seq64::seqedit, 898
seq64::seqevent, 920
seq64::seqroll, 976
seq64::seqtime, 986
seq64::sequence, 1054
seq64::triggers, 1077
m_print_keys
seq64::rc_settings, 819
m_priority
seq64::rc_settings, 818
m_progress_bar_colored
seq64::user_settings, 1118
m_progress_bar_thick
seq64::user_settings, 1118
m_progress_color
seq64::gui_palette_gtk2, 311
m_progress_height
seq64::mainwid, 417
m_progress_x
seq64::seqroll, 978
m_quantized_rec
seq64::sequence, 1053
m_queue
seq64::mastermidibase, 458
seq64::midibase, 605
seq64::rtmidi_in_data, 842
m_queue_number
seq64::midi_port_info::port_info_t, 799
m_queued
seq64::sequence, 1053
m_queued_tick
seq64::sequence, 1054
m_raise
seq64::sequence, 1054
m_range
seq64::lfownd, 396
m_rank
seq64::event_list::event_key, 213
m_rec_vol
seq64::sequence, 1056
m_recording
seq64::sequence, 1052
m_red
seq64::gui_palette_gtk2, 309
m_redo_stack
seq64::triggers, 1077
m_redo_vect
seq64::perform, 765
m_redraw_period_ms
seq64::gui_window_gtk2, 316
m_remote_port_name
seq64::midi_jack, 539
m_reposition
seq64::perform, 756
m_reveal_alsa_ports
seq64::rc_settings, 819
m_right_marker_tick
seq64::perftime, 797
m_right_tick
seq64::perform, 762
m_rightbox
seq64::eventedit, 238
m_ring
seq64::midi_queue, 571
m_ring_size
seq64::midi_queue, 571
m_roll_length_ticks
seq64::perfroll, 786
m_rt_midi
seq64::midibus, 619
m_running
seq64::perform, 759
m_safety_mutex
seq64::automutex, 140
m_save_user_config
seq64::user_settings, 1123
m_scale
seq64::seqedit, 897
seq64::seqkeys, 933
seq64::seqroll, 976
m_scale_phase
seq64::lfownd, 395

m_scale_range
seq64::lfownd, 395
m_scale_speed
seq64::lfownd, 395
m_scale_value
seq64::lfownd, 395
m_scale_wave
seq64::lfownd, 395
m_screen_set_notepad
seq64::perform, 763
m_screenset
seq64::mainwid, 415
seq64::perform, 764
m_screenset_offset
seq64::mainwid, 417
m_screenset_slots
seq64::mainwid, 417
m_scroll_offset_key
seq64::seqkeys, 932
seq64::seqroll, 979
m_scroll_offset_ticks
seq64::seqdata, 873
seq64::seqevent, 921
seq64::seqroll, 979
seq64::seqtime, 986
m_scroll_offset_x
seq64::seqdata, 874
seq64::seqevent, 921
seq64::seqroll, 979
seq64::seqtime, 986
m_scroll_offset_y
seq64::seqkeys, 933
seq64::seqroll, 979
m_selected
seq64::event, 211
seq64::seqevent, 920
seq64::seqroll, 975
seq64::trigger, 1061
m_selecting
seq64::seqevent, 921
seq64::seqroll, 977
m_seq
seq64::eventedit, 241
seq64::eventslots, 257
seq64::lfownd, 395
seq64::mastermidibase, 459
seq64::midi_alsa, 478
seq64::midibus, 618
seq64::seqdata, 873
seq64::seqedit, 898
seq64::seqevent, 920
seq64::seqkeys, 932
seq64::seqroll, 975
seq64::seqtime, 986
m_seq24_interaction
seq64::perfroll, 787
seq64::seqevent, 920
m_seq_number
seq64::sequence, 1054
m_seqarea_seq_x
seq64::mainwid, 415
seq64::user_settings, 1122
m_seqarea_seq_y
seq64::mainwid, 416
seq64::user_settings, 1122
m_seqarea_x
seq64::mainwid, 415
seq64::user_settings, 1122
m_seqarea_y
seq64::mainwid, 415
seq64::user_settings, 1122
m_seqchars_x
seq64::user_settings, 1119
m_seqchars_y
seq64::user_settings, 1119
m_seqdata
seq64::lfownd, 395
m_seqdata_wid
seq64::seqedit, 901
seq64::seqevent, 921
m_seqedit
seq64::seqmenu, 946
m_seqedit_bgsequence
seq64::user_settings, 1117
m_seqedit_key
seq64::user_settings, 1117
m_seqedit_scale
seq64::user_settings, 1117
m_seqevent_wid
seq64::seqedit, 901
m_seqkeys_wid
seq64::seqedit, 901
seq64::seqroll, 976
m_seqroll_wid
seq64::seqedit, 902
m_seqs
seq64::perform, 757
m_seqs_active
seq64::perform, 757
m_seqs_in_set
seq64::perfnames, 680
seq64::perform, 764
seq64::user_settings, 1121
m_seqtime_wid
seq64::seqedit, 901
m_sequence
seq64::editable_events, 189
seq64::midi_container, 504
m_sequence_active
seq64::perfnames, 680
seq64::perfroll, 786
m_sequence_count
seq64::perform, 764
m_sequence_high
seq64::perform, 764
m_sequence_max

seq64::perfnames, 680
seq64::perform, 764
seq64::perfroll, 786
m_sequence_offset
seq64::perfnames, 680
seq64::perfroll, 786
m_sequence_state
seq64::perform, 758
m_setbox_w
seq64::eventslots, 258
seq64::perfnames, 679
m_show_midi
seq64::rc_settings, 818
m_show_octave_letters
seq64::seqkeys, 933
m_showbox
seq64::eventedit, 238
m_sigpipe
seq64::mainwnd, 433
m_size
seq64::midi_queue, 571
m_size_box_w
seq64::perfroll, 784
m_slot
seq64::keybindentry, 346
m_slots_chars
seq64::eventslots, 257
m_slots_x
seq64::eventslots, 258
m_slots_y
seq64::eventslots, 258
m_smf0_channels
seq64::midi_splitter, 577
m_smf0_channels_count
seq64::midi_splitter, 576
m_smf0_main_sequence
seq64::midi_splitter, 577
m_smf0_seq_number
seq64::midi_splitter, 577
m_smf0_splitter
seq64::midifile, 639
m_snap
seq64::perfedit, 671
seq64::perfroll, 783
seq64::perftime, 797
seq64::seqedit, 897
seq64::seqevent, 920
seq64::seqroll, 976
m_snap_tick
seq64::sequence, 1055
m_song_mute
seq64::sequence, 1052
m_song_start_mode
seq64::perform, 755
m_speed
seq64::lfownd, 396
m_spinbutton_bpm
seq64::mainwnd, 436
m_spinbutton_load_offset
seq64::mainwnd, 437
m_spinbutton_ss
seq64::mainwnd, 436
m_standard_bpm
seq64::perfedit, 671
m_start_from_perfedit
seq64::perform, 755
m_starting_tick
seq64::perform, 762
m_stats
seq64::rc_settings, 818
m_status
seq64::event, 210
seq64::midi_control, 508
seq64::seqdata, 874
seq64::seqevent, 922
seq64::seqroll, 980
m_sysex
seq64::event, 210
m_sysex_size
seq64::event, 210
m_table
seq64::eventedit, 237
seq64::perfedit, 666
seq64::seqedit, 902
m_text_size_x
seq64::mainwid, 416
m_text_size_y
seq64::mainwid, 416
m_text_x
seq64::user_settings, 1119
m_text_y
seq64::user_settings, 1119
m_thru
seq64::sequence, 1053
m_tick
seq64::maintime, 402
seq64::perform, 762
m_tick_end
seq64::trigger, 1061
m_tick_offset
seq64::perftime, 796
m_tick_start
seq64::trigger, 1061
m_ticks_per_bar
seq64::perfroll, 784
m_time_beat_width
seq64::sequence, 1055
m_time_beats_per_measure
seq64::sequence, 1055
m_timearea_y
seq64::perftime, 797
m_timeout_connect
seq64::mainwnd, 437
m_timestamp
seq64::event, 210
seq64::event_list::event_key, 213

seq64::midi_message, 559
m_toggle_jack
seq64::jack_assistant, 339
m_toggle_play
seq64::seqedit, 906
m_toggle_q_rec
seq64::seqedit, 907
m_toggle_record
seq64::seqedit, 907
m_toggle_thru
seq64::seqedit, 907
m_toggle_transpose
seq64::seqedit, 899
m_tooltips
seq64::mainwnd, 433
seq64::options, 647
seq64::perfedit, 670
seq64::seqedit, 905
m_top_index
seq64::eventslots, 259
m_top_iterator
seq64::eventslots, 259
m_total_seqs
seq64::user_settings, 1121
m_tracks_mute_state
seq64::perform, 756
m_trans_button_press
seq64::perfroll, 785
seq64::seqroll, 979
m_transport_follow
seq64::perfroll, 785
seq64::seqroll, 979
m_transposable
seq64::sequence, 1052
m_transpose
seq64::perform, 758
m_trigger_copied
seq64::triggers, 1077
m_trigger_offset
seq64::sequence, 1054
m_triggers
seq64::sequence, 1050
seq64::triggers, 1076
m_type
seq64::keybindentry, 345
seq64::rterror, 825
m_undo_stack
seq64::triggers, 1077
m_undo_vect
seq64::perform, 765
m_us_per_quarter_note
seq64::perform, 761
seq64::sequence, 1055
m_use_default_ppqn
seq64::midi_splitter, 576
seq64::midifile, 639
m_use_jack_polling
seq64::mastermidibus, 469
m_use_more_icons
seq64::user_settings, 1118
m_use_new_font
seq64::font, 263
seq64::user_settings, 1117
m_usemidiclock
seq64::perform, 762
m_user_callback
seq64::rtmidi_in_data, 843
m_user_data
seq64::rtmidi_in_data, 843
m_user_filename
seq64::rc_settings, 820
m_user_filename_alt
seq64::rc_settings, 820
m_user_option_daemonize
seq64::user_settings, 1124
m_user_option_logfile
seq64::user_settings, 1124
m_using_callback
seq64::rtmidi_in_data, 843
m_v_page_increment
seq64::perfroll, 783
m_v_perf_page_increment
seq64::user_settings, 1118
m_vadjust
seq64::eventedit, 237
seq64::gui_drawingarea_gtk2, 298
seq64::perfedit, 667
seq64::seqedit, 901
m_value
seq64::lfownd, 396
m_vbox
seq64::seqedit, 902
m_vector_sequence
seq64::mastermidibase, 459
m_velocity_override
seq64::user_settings, 1120
m_vertical_adjust
seq64::seqroll, 975
m_vscroll
seq64::eventedit, 237
seq64::perfedit, 667
m_vscroll_new
seq64::seqedit, 901
m_was_active_edit
seq64::perform, 758
m_was_active_main
seq64::perform, 758
m_was_active_names
seq64::perform, 758
m_was_active_perf
seq64::perform, 758
m_was_playing
seq64::sequence, 1052
m_wave
seq64::lfownd, 396
m_wave_name

seq64::lfownd, 396
m_white
seq64::gui_palette_gtk2, 309
m_white_pixmap
seq64::font, 264
m_wht_key
seq64::gui_palette_gtk2, 311
m_wht_paint
seq64::gui_palette_gtk2, 310
m_window
seq64::gui_drawingarea_gtk2, 298
m_window_redraw_rate_ms
seq64::user_settings, 1118
m_window_x
seq64::gui_drawingarea_gtk2, 299
seq64::gui_window_gtk2, 316
m_window_y
seq64::gui_drawingarea_gtk2, 299
seq64::gui_window_gtk2, 316
m_with_jack_master
seq64::rc_settings, 818
m_with_jack_master_cond
seq64::rc_settings, 818
m_with_jack_midi
seq64::rc_settings, 818
m_with_jack_transport
seq64::rc_settings, 818
m_x
seq64::click, 160
m_xy_offset
seq64::perfnames, 679
m_y
seq64::click, 161
m_y_on_b_pixmap
seq64::font, 264
m_yellow
seq64::gui_palette_gtk2, 309
m_zoom
seq64::perfroll, 784
seq64::seqdata, 873
seq64::seqedit, 897
seq64::seqevent, 920
seq64::seqroll, 976
seq64::seqtime, 986
maintime
seq64::maintime, 399
mainwid
seq64::mainwid, 406
mainwid_border
seq64::user_settings, 1103, 1109
mainwid_grid_style_t
seq64::user_settings, 1097
mainwid_spacing
seq64::user_settings, 1103, 1109
mainwid_x
seq64::user_settings, 1104
mainwid_y
seq64::user_settings, 1104
mainwnd
seq64::maintime, 400
seq64::mainwid, 414
seq64::mainwnd, 422
seq64::perform, 751
seq64::rc_settings, 816
seq64::seqmenu, 945
mainwnd_cols
seq64::user_settings, 1102, 1107
mainwnd_key_event
seq64::perform, 726
mainwnd_rows
seq64::user_settings, 1102, 1107
make_clock
seq64::event, 207
make_directory
seq64, 92
make_section_name
seq64, 104
manual_alsa_ports
seq64::rc_settings, 808, 812
mark
seq64::event, 206
mark_all
seq64::event_list, 222
mark_out_of_range
seq64::event_list, 221
mark_selected
seq64::event_list, 221
seq64::sequence, 1038
master_bus
seq64::perform, 699
master_info
seq64::midi_api, 492
master_midi_mode
seq64::midi_api, 492
mastermidibase
seq64::mastermidibase, 442
mastermidibus
seq64::mastermidibus, 462
seq64::midibase, 604
seq64::midibus, 618
seq64::rtmidi_info, 852
match
seq64::midi_control, 507
seq64::midibase, 593
max_active_set
seq64::perform, 743
max_sequence
seq64::user_settings, 1102
max_sets
seq64::user_settings, 1102, 1107
max_value
seq64::midi_control, 507
max_zoom
seq64::user_settings, 1111
mc_baseline_ppqn
seq64::user_settings, 1123

mc_max_zoom
seq64::user_settings, 1123
mc_min_zoom
seq64::user_settings, 1123
measures
seq64::midi_measures, 554
measures_to_ticks
seq64, 83
seq64::sequence, 1004
measurestring_to_pulses
seq64, 74
menu_mode
seq64::keys_perform, 361
merge
seq64::event_list, 219
message
seq64::rtmidi_in_data, 839
message_concatenate
seq64, 88
meta_string
seq64::editable_event, 178
midi_alsa
seq64::midi_alsa, 472
midi_alsa_info
seq64::mastermidibase, 457
seq64::mastermidibus, 468
seq64::midi_alsa_info, 480
midi_api
seq64::midi_api, 487
midi_api_name
seq64, 108
midi_beat_width
seq64::user_settings, 1110, 1114
midi_beats_per_bar
seq64::user_settings, 1109, 1114
midi_beats_per_minute
seq64::user_settings, 1110, 1114
midi_buss_override
seq64::user_settings, 1110, 1113
midi_container
seq64::event_list, 224
seq64::midi_container, 497
seq64::triggers, 1075
midi_control
seq64::midi_control, 506
midi_control_event
seq64::perform, 734
midi_control_off
seq64::perform, 733
midi_control_on
seq64::perform, 733
midi_control_toggle
seq64::perform, 732
midi_handle
seq64::midi_info, 518, 523
midi_in_alsa
seq64::midi_in_alsa, 511
midi_in_jack
seq64::midi_in_jack, 513
midi_info
seq64::midi_info, 518
midi_input_callback
seq64, 111
midi_input_test
seq64, 109
midi_jack
seq64::midi_jack, 528
seq64::midi_jack_info, 548
midi_jack_data
seq64::midi_jack_data, 540
midi_jack_info
seq64::mastermidibus, 468
seq64::midi_jack, 538
seq64::midi_jack_info, 544
midi_list
seq64::midi_list, 551
midi_measures
seq64::midi_measures, 554
midi_measures_to_pulses
seq64, 74
midi_message
seq64::midi_message, 557
midi_mode
seq64::midi_info, 518
seq64::rtmidi_info, 846, 847
midi_out_alsa
seq64::midi_out_alsa, 561
midi_out_jack
seq64::midi_out_jack, 563
midi_port_info
seq64::midi_port_info, 565
midi_ppqn
seq64::user_settings, 1109, 1113
midi_probe
seq64, 109
midi_queue
seq64::midi_queue, 569
midi_splitter
seq64::event_list, 224
seq64::midi_splitter, 573
midi_timing
seq64::midi_timing, 578
midi_vector
seq64::midi_vector, 583
midibase
seq64::midibase, 590
midibpm
seq64, 65
midibus
seq64::midibus, 610, 611
seq64::rtmidi, 833
seq64::rtmidi_info, 852
midibyte
seq64, 64
midifile
seq64::event_list, 224

seq64::midi_container, 503
seq64::midifile, 622
seq64::perform, 751
seq64::triggers, 1076
midilong
seq64, 65
midipulse
seq64, 65
midishort
seq64, 65
millisleep
seq64, 99
min
seq64, 109
min_value
seq64::midi_control, 507
min_zoom
seq64::user_settings, 1110
mod_control
seq64::click, 160
seq64::keystroke, 387
mod_control_shift
seq64::click, 160
seq64::keystroke, 387
mod_last_tick
seq64::sequence, 1008
mod_super
seq64::click, 160
seq64::keystroke, 387
mod_timestamp
seq64::event, 200
modifier
seq64::click, 160
seq64::keystroke, 387
modify
seq64::perform, 695
seq64::sequence, 1000
modify_current_event
seq64::eventslots, 249
motion_notify
seq64::seqroll, 967
mouse_action
seq64::seqedit, 893
mouse_action_e
seq64, 69
mouse_click_edit_callback
seq64::options, 646
mouse_fruity_callback
seq64::options, 646
mouse_mod4_callback
seq64::options, 646
mouse_seq24_callback
seq64::options, 646
mouse_snap_split_callback
seq64::options, 646
move
seq64::triggers, 1072
move_selected
seq64::triggers, 1071
move_selected_notes
seq64::seqroll, 964
seq64::sequence, 1033
move_selected_triggers_to
seq64::sequence, 1022
move_selection_box
seq64::seqroll, 964
move_triggers
seq64::perform, 727
seq64::sequence, 1023
moving
seq64::seqroll, 970
multi_client
seq64::midi_jack, 529
seq64::midi_jack_info, 544
multiply_pattern
seq64::sequence, 1045
musical_key
seq64::sequence, 1045
musical_scale
seq64::sequence, 1045
mute_all_tracks
seq64::perform, 712
seq64::seqmenu, 945
mute_group_offset
seq64::perform, 746
mute_group_tracks
seq64::perform, 737
mute_op_t
seq64::perform, 694
mute_screenset
seq64::perform, 713
mutex
seq64::mutex, 641

name
seq64::sequence, 1006
seq64::user_instrument, 1080
seq64::user_midi_bus, 1085
name_change_callback
seq64::seqedit, 889
name_to_value
seq64::editable_event, 174
nc_midi_port_info
seq64::midi_info, 523
new_current_sequence
seq64::seqmenu, 940
new_file
seq64::mainwnd, 430
new_open_error_dialog
seq64::mainwnd, 429
new_sequence
seq64::perform, 705
seq64::seqmenu, 941
next
seq64::triggers, 1074
next_data_line
seq64::configfile, 165

next_trigger
seq64::triggers, 1074
non_cc_match
seq64::event, 202
normal_action
seq64::seqroll, 970
normalize
seq64::user_settings, 1098
note_off_length
seq64::seqroll, 955
note_off_margin
seq64::sequence, 1046
number
seq64::sequence, 1000

off_playing_notes
seq64::sequence, 1039
off_queued
seq64::sequence, 1009
off_sequences
seq64::perform, 741
offset
seq64::trigger, 1060
on_button_press_event
seq64::AbstractPerfInput, 137
seq64::FruityPerfInput, 267
seq64::FruitySeqEventInput, 272
seq64::FruitySeqRollInput, 275
seq64::Seq24PerfInput, 857
seq64::Seq24SeqEventInput, 861
seq64::eventslots, 255
seq64::mainwid, 412
seq64::perfnames, 677
seq64::perfroll, 780
seq64::perftime, 795
seq64::seqdata, 871
seq64::seqevent, 917
seq64::seqkeys, 930
seq64::seqroll, 971
seq64::seqtime, 985
on_button_release_event
seq64::AbstractPerfInput, 137
seq64::FruityPerfInput, 268
seq64::FruitySeqEventInput, 272
seq64::FruitySeqRollInput, 275
seq64::Seq24PerfInput, 858
seq64::Seq24SeqEventInput, 861
seq64::eventslots, 255
seq64::mainwid, 412
seq64::perfnames, 677
seq64::perfroll, 780
seq64::perftime, 795
seq64::seqdata, 871
seq64::seqevent, 917
seq64::seqkeys, 930
seq64::seqroll, 971
seq64::seqtime, 985
on_delete_event
seq64::eventedit, 236
seq64::mainwnd, 432
seq64::perfedit, 666
seq64::seqedit, 894
on_enter_notify_event
seq64::seqkeys, 931
seq64::seqroll, 974
on_expose_event
seq64::eventslots, 255
seq64::maintime, 400
seq64::mainwid, 411
seq64::perfnames, 676
seq64::perfroll, 780
seq64::perftime, 794
seq64::seqdata, 870
seq64::seqevent, 917
seq64::seqkeys, 930
seq64::seqroll, 971
seq64::seqtime, 985
on_focus_in_event
seq64::eventedit, 236
seq64::eventslots, 255
seq64::mainwid, 413
seq64::perfroll, 781
seq64::seqedit, 894
seq64::seqevent, 918
seq64::seqroll, 972
on_focus_out_event
seq64::eventedit, 236
seq64::eventslots, 256
seq64::lfownd, 394
seq64::mainwid, 413
seq64::perfroll, 781
seq64::seqedit, 894
seq64::seqevent, 918
seq64::seqroll, 972
on_frame_down
seq64::eventslots, 256
on_frame_end
seq64::eventslots, 257
on_frame_home
seq64::eventslots, 257
on_frame_up
seq64::eventslots, 256
on_grouplearnchange
seq64::mainwnd, 433
seq64::performcallback, 768
on_key_press_event
seq64::eventedit, 236
seq64::keybindentry, 345
seq64::mainwnd, 432
seq64::perfedit, 665
seq64::perfroll, 782
seq64::seqedit, 895
seq64::seqevent, 918
seq64::seqroll, 973
on_key_release_event
seq64::mainwnd, 432
seq64::perfedit, 666

on_leave_notify_event
seq64::seqdata, 872
seq64::seqkeys, 931
seq64::seqroll, 974
on_left_button_pressed
seq64::FruityPerfInput, 269
on_motion_notify_event
seq64::AbstractPerfInput, 137
seq64::FruityPerfInput, 268
seq64::FruitySeqEventInput, 273
seq64::FruitySeqRollInput, 275
seq64::Seq24PerfInput, 858
seq64::Seq24SeqEventInput, 861
seq64::mainwid, 413
seq64::perfroll, 781
seq64::seqdata, 871
seq64::seqevent, 918
seq64::seqkeys, 931
seq64::seqroll, 972
on_move_down
seq64::eventslots, 256
on_move_up
seq64::eventslots, 256
on_queued
seq64::sequence, 1009
on_realize
seq64::eventedit, 235
seq64::eventslots, 255
seq64::gui_drawingarea_gtk2, 298
seq64::gui_window_gtk2, 315
seq64::maintime, 400
seq64::mainwid, 411
seq64::mainwnd, 433
seq64::perfedit, 665
seq64::perfnames, 676
seq64::perfroll, 779
seq64::perftime, 794
seq64::seqdata, 870
seq64::seqedit, 893
seq64::seqevent, 916
seq64::seqkeys, 929
seq64::seqmenu, 945
seq64::seqroll, 971
seq64::seqtime, 985
on_right_button_pressed
seq64::FruityPerfInput, 269
on_scroll_event
seq64::eventslots, 256
seq64::perfnames, 678
seq64::perfroll, 781
seq64::seqdata, 872
seq64::seqedit, 894
seq64::seqkeys, 931
seq64::seqroll, 973
on_set_focus
seq64::eventedit, 235
seq64::seqedit, 894
on_size_allocate
seq64::eventslots, 256
seq64::perfnames, 678
seq64::perfroll, 781
seq64::perftime, 795
seq64::seqdata, 872
seq64::seqevent, 919
seq64::seqkeys, 932
seq64::seqroll, 974
seq64::seqtime, 985
on_size_request
seq64::perfroll, 782
open_client
seq64::midi_in_jack, 514
seq64::midi_jack, 533
seq64::midi_out_jack, 564
open_client_impl
seq64::midi_jack, 530
open_file
seq64::mainwnd, 423
open_performance_edit
seq64::mainwnd, 426
open_performance_edit_2
seq64::mainwnd, 426
openmidi_api
seq64::rtmidi_in, 837
seq64::rtmidi_info, 852
seq64::rtmidi_out, 856
operator<
seq64::event, 196
seq64::event_list::event_key, 212
seq64::trigger, 1058
operator=
seq64::automutex, 140
seq64::click, 158
seq64::editable_event, 174
seq64::editable_events, 185
seq64::event, 195
seq64::event_list, 216
seq64::gui_drawingarea_gtk2, 286
seq64::keystroke, 385
seq64::maintime, 399
seq64::rc_settings, 805
seq64::sequence, 998
seq64::triggers, 1065
seq64::user_instrument, 1079
seq64::user_midi_bus, 1085
seq64::user_settings, 1098
operator[]
seq64::midi_message, 557
option_daemonize
seq64::user_settings, 1111, 1112
option_logfile
seq64::user_settings, 1111, 1113
options
seq64::keybindentry, 345
seq64::keys_perform, 371
seq64::options, 644
seq64::perform, 752

seq64::rc_settings, 815
options_dialog
seq64::mainwnd, 428
optionsfile
seq64::keys_perform, 371
seq64::optionsfile, 650
seq64::perform, 751
seq64::rc_settings, 815
orange
seq64::gui_palette_gtk2, 306
output
seq64::jack_assistant, 326
output_func
seq64::perform, 713
output_ports
seq64::midi_info, 518
output_thread_func
seq64, 99
seq64::perform, 752

padded_height
seq64::font, 263
page_decrement_beats_per_minute
seq64::perform, 722
page_increment_beats_per_minute
seq64::perform, 722
page_movement
seq64::eventslots, 253
page_topper
seq64::eventslots, 253
pager_index
seq64::eventslots, 247
paint
seq64::event, 205
parent
seq64::editable_event, 174
seq64::jack_assistant, 321
parent_bus
seq64::midi_api, 492
parse
seq64::configfile, 166
seq64::midifile, 623
seq64::optionsfile, 650
seq64::userfile, 1126
parse_command_line_options
seq64, 87
seq64::rc_settings, 816
parse_mute_group_section
seq64::optionsfile, 652
parse_mute_groups
seq64, 87
parse_options_files
seq64, 86
parse_prop_header
seq64::midifile, 626
parse_proprietary_track
seq64::midifile, 627
parse_smf_0
seq64::midifile, 625
parse_smf_1
seq64::midifile, 626
partial_assign
seq64::sequence, 998
pass_sysex
seq64::rc_settings, 807, 812
paste
seq64::triggers, 1070
paste_selected
seq64::sequence, 1030
paste_trigger
seq64::sequence, 1021
pattern_edit
seq64::keys_perform, 360
pause
seq64::keys_perform, 360
seq64::sequence, 1040
pause_key
seq64::perform, 721
pause_playing
seq64::mainwnd, 426
seq64::perfedit, 665
seq64::perform, 720
perf
seq64::gui_drawingarea_gtk2, 287
seq64::gui_window_gtk2, 314
seq64::options, 644
perf_h_page_increment
seq64::user_settings, 1106, 1111
perf_modify
seq64::eventedit, 233
perf_v_page_increment
seq64::user_settings, 1106, 1112
perfedit
seq64::perfedit, 658
seq64::perfnames, 678
seq64::perform, 752
seq64::perfroll, 783
seq64::perftime, 796
perfnames
seq64::perfnames, 674
perform
seq64::keys_perform, 371
seq64::mastermidibase, 457
seq64::perform, 694
seq64::sequence, 1049
perfroll
seq64::AbstractPerfInput, 138
seq64::FruityPerfInput, 270
seq64::Seq24PerfInput, 859
seq64::perform, 752
seq64::perfroll, 773
perfroll_key_event
seq64::perform, 726
perftime
seq64::perftime, 790
pixel_to_tick
seq64::perftime, 793

play
seq64::busarray, 145
seq64::mastermidibase, 447
seq64::midibase, 599
seq64::perform, 742
seq64::sequence, 1013
seq64::triggers, 1067
play_change_callback
seq64::seqedit, 889
play_note_off
seq64::sequence, 1039
play_note_on
seq64::sequence, 1039
play_queue
seq64::sequence, 1013
playback_key_event
seq64::perform, 726
pointer_position
seq64::keys_perform, 362, 363
poll_for_midi
seq64::busarray, 148
seq64::mastermidibase, 450
seq64::midibase, 597
pop
seq64::midi_queue, 569
pop_front
seq64::midi_queue, 570
pop_redo
seq64::sequence, 1002
seq64::triggers, 1066
pop_trigger_redo
seq64::perform, 728
seq64::sequence, 1002
pop_trigger_undo
seq64::perform, 728
seq64::sequence, 1002
pop_undo
seq64::sequence, 1002
seq64::triggers, 1066
populate_menu_edit
seq64::mainwnd, 432
populate_menu_file
seq64::mainwnd, 431
populate_menu_help
seq64::mainwnd, 432
populate_menu_view
seq64::mainwnd, 432
popup_event_menu
seq64::seqedit, 891
popup_menu
seq64::perfedit, 664
seq64::seqedit, 891
seq64::seqmenu, 941
popup_midibus_menu
seq64::seqedit, 891
popup_midich_menu
seq64::seqedit, 892
popup_sequence_menu
seq64::seqedit, 892
popup_tool_menu
seq64::seqedit, 892
port_exit
seq64::busarray, 147
seq64::mastermidibase, 446
port_handle
seq64::midi_jack, 530
port_list
seq64::mastermidibus, 467
seq64::midi_info, 522
seq64::rtmidi_info, 851
port_name
seq64::midibase, 592, 601
port_settings
seq64::mastermidibase, 454
port_start
seq64::mastermidibase, 446
position
seq64::jack_assistant, 325
seq64::midi_container, 499
position_increment
seq64::midi_container, 499
position_jack
seq64::perform, 740
position_reset
seq64::midi_container, 499
pow2
seq64::midifile, 628
ppqn
seq64::mainwnd, 424
seq64::midi_info, 519
seq64::midi_splitter, 575
seq64::midi_timing, 580
seq64::midibase, 593
seq64::midifile, 625
seq64::perform, 695
seq64::rtmidi_info, 849
ppqn_is_valid
seq64, 92
print
seq64::busarray, 146
seq64::businfo, 155
seq64::event, 209
seq64::event_list, 223
seq64::mastermidibase, 448
seq64::midibase, 600
seq64::sequence, 1013
seq64::triggers, 1066
print_busses
seq64::perform, 707
print_group_unmutes
seq64::perform, 736
print_keys
seq64::rc_settings, 808, 813
print_message
seq64::rterror, 825
print_triggers

seq64::perform, 707
seq64::sequence, 1013
priority
seq64::rc_settings, 806, 811
private_bus
seq64::user_settings, 1114
private_instrument
seq64::user_settings, 1114
process_events
seq64::lash, 390
process_o_options
seq64, 87
progress_bar_colored
seq64::user_settings, 1106, 1112
progress_bar_thick
seq64::user_settings, 1106, 1112
progress_color
seq64::gui_palette_gtk2, 305
prop_item_size
seq64::midifile, 635
pulse_length_us
seq64, 79
pulses_per_measure
seq64, 82
pulses_to_measurestring
seq64, 72
pulses_to_midi_measures
seq64, 73
pulses_to_string
seq64, 72
pulses_to_timestring
seq64, 73, 74
push
seq64::midi_message, 558
push_back
seq64::event_list, 218
push_quantize
seq64::sequence, 1044
push_trigger_undo
seq64::perform, 727
seq64::sequence, 1002
push_undo
seq64::sequence, 1001
seq64::triggers, 1066
put
seq64::midi_container, 498
seq64::midi_list, 552
seq64::midi_vector, 584
put_event_on_bus
seq64::sequence, 1047

q_rec_change_callback
seq64::seqedit, 889
quantize_events
seq64::sequence, 1043
query_save_changes
seq64::mainwnd, 429
queue
seq64::keys_perform, 355, 356
seq64::rtmidi_in_data, 839
queue_number
seq64::midi_info, 522
seq64::midibase, 595
seq64::rtmidi_info, 849
quit
seq64::gui_assistant, 278
seq64::gui_assistant_gtk2, 281
seq64::gui_window_gtk2, 314

rc
seq64, 100
rc_error_dialog
seq64::mainwnd, 423
rc_settings
seq64::rc_settings, 804
read_byte
seq64::midifile, 629
read_byte_array
seq64::midifile, 631
read_long
seq64::midifile, 629
read_seq_number
seq64::midifile, 633
read_short
seq64::midifile, 629
read_track_name
seq64::midifile, 632
read_varinum
seq64::midifile, 630
record_change_callback
seq64::seqedit, 889
red
seq64::gui_palette_gtk2, 306
redo
seq64::perfedit, 664
redo_callback
seq64::seqedit, 890
redraw
seq64::mainwid, 408
seq64::perfnames, 676
seq64::seqdata, 866
seq64::seqevent, 912
seq64::seqmenu, 943
seq64::seqroll, 959
seq64::seqtime, 983
redraw_dirty_sequences
seq64::perfnames, 675
seq64::perfroll, 775
redraw_events
seq64::seqroll, 959
redraw_period_ms
seq64::gui_window_gtk2, 314
redraw_progress
seq64::perfroll, 775
ref_midi_port_info
seq64::midi_info, 524
register_port
seq64::midi_jack, 532

reload_mute_groups
seq64::mainwnd, 427
seq64::perform, 710
remote_port_name
seq64::midi_jack, 529, 530
remove
seq64::businfo, 152
seq64::editable_events, 188
seq64::event_list, 219
seq64::sequence, 1048, 1049
seq64::triggers, 1069
remove_all
seq64::sequence, 1049
remove_marked
seq64::event_list, 222
seq64::sequence, 1038
remove_selected
seq64::sequence, 1038
seq64::triggers, 1070
remove_seqedit
seq64::seqmenu, 942
render_number
seq64::seqdata, 870
render_string
seq64::gui_drawingarea_gtk2, 291
render_string_on_drawable
seq64::font, 262
render_string_on_pixmap
seq64::gui_drawingarea_gtk2, 291
replace
seq64::editable_events, 188
seq64::keys_perform, 355
replacement_port
seq64::busarray, 149
reposition
seq64::perform, 704
reset
seq64::mainwid, 407
seq64::perftime, 791
seq64::seqdata, 866
seq64::seqevent, 912
seq64::seqkeys, 929
seq64::seqroll, 958
seq64::seqtime, 983
reset_draw_marker
seq64::sequence, 1040
reset_draw_trigger_marker
seq64::sequence, 1040
seq64::triggers, 1074
reset_sequences
seq64::perform, 741
restart_sysex
seq64::event, 204
restore_playing_state
seq64::perform, 715
RevSlotMap
seq64::keys_perform, 353
reveal_alsa_ports
seq64::rc_settings, 808, 813
rewind
seq64::keys_perform, 362
seq64::perfedit, 660
seq64::perform, 703
rterror
seq64::rterror, 824
rterror_callback
seq64, 65
rtmidi
seq64::rtmidi, 828
rtmidi_api
seq64, 70
rtmidi_callback_t
seq64, 65
rtmidi_in
seq64::rtmidi_in, 836
seq64::rtmidi_info, 853
rtmidi_in_data
seq64::rtmidi_in_data, 839
rtmidi_info
seq64::midi_info, 524
seq64::rc_settings, 816
seq64::rtmidi_info, 846
rtmidi_out
seq64::rtmidi_info, 853
seq64::rtmidi_out, 855

s_arg_list
seq64, 126
s_build_alsamidi_support
seq64, 127
s_build_chord_generator
seq64, 128
s_build_edit_highlight
seq64, 128
s_build_follow_progress
seq64, 129
s_build_highlight_empty
seq64, 127
s_build_jack_session
seq64, 128
s_build_jack_support
seq64, 128
s_build_lash_support
seq64, 128
s_build_midi_vector
seq64, 129
s_build_pause_support
seq64, 128
s_build_portmidi_support
seq64, 127
s_build_rtmidi_support
seq64, 127
s_build_solid_grid
seq64, 129
s_build_timesig_tempo
seq64, 129
s_build_use_event_map

seq64, 128
s_character_mapping
seq64, 130
s_debug_mode
seq64, 130
s_event_editor
seq64, 128
s_global_lash_driver
seq64, 130
s_handlesize
seq64, 132, 133
s_help_1a
seq64, 126
s_help_1b
seq64, 127
s_help_2
seq64, 127
s_help_3
seq64, 127
s_help_4
seq64, 127
s_jitter_amount
seq64, 132
s_seq32_jack_support
seq64, 129
s_seq32_lfo_support
seq64, 130
s_seq32_menu_buttons
seq64, 130
s_seq32_transport
seq64, 129
s_seq32_transpose
seq64, 130
s_statistics_support
seq64, 129
s_status_pairs
seq64, 130
s_strip_empty_mutes
seq64, 129
save_clock
seq64::mastermidibase, 456
save_events
seq64::editable_events, 185
seq64::eventslots, 250
save_file
seq64::mainwnd, 430
save_input
seq64::mastermidibase, 457
save_playing_state
seq64::perform, 715
save_user_config
seq64::user_settings, 1107
scale_lfo_change
seq64::lfownd, 394
screenset_dn
seq64::keys_perform, 357
screenset_up
seq64::keys_perform, 357
scroll_hadjust
seq64::gui_drawingarea_gtk2, 296
seq64::gui_window_gtk2, 314
scroll_hset
seq64::gui_drawingarea_gtk2, 297
seq64::gui_window_gtk2, 315
scroll_offset_x
seq64::seqroll, 967
scroll_offset_y
seq64::seqroll, 969
scroll_vadjust
seq64::gui_drawingarea_gtk2, 296
seq64::gui_window_gtk2, 315
scroll_vset
seq64::gui_drawingarea_gtk2, 297
seq64::gui_window_gtk2, 315
select
seq64::event, 206
seq64::triggers, 1069
select_action
seq64::seqroll, 970
select_action_e
seq64::sequence, 997
select_all
seq64::event_list, 223
seq64::sequence, 1029
select_all_notes
seq64::sequence, 1028
select_and_mute_group
seq64::perform, 737
select_even_or_odd_notes
seq64::sequence, 1028
select_event
seq64::eventslots, 250
select_event_handle
seq64::sequence, 1027
select_events
seq64::sequence, 1025, 1026
select_fg_bg_colors
seq64::mainwid, 411
select_group_mute
seq64::perform, 738
select_linked
seq64::sequence, 1027
select_note_events
seq64::sequence, 1025
select_trigger
seq64::sequence, 1019
selected
seq64::trigger, 1060
selected_api
seq64::rtmidi_info, 851
selected_trigger_end
seq64::sequence, 1022
selected_trigger_start
seq64::sequence, 1022
selecting
seq64::seqroll, 970

send_byte
seq64::midi_jack, 537
send_message
seq64::midi_out_jack, 563
seq
seq64::midi_alsa_info, 481
Seq24PerfInput
seq64::Seq24PerfInput, 857
seq64::perfroll, 782
seq64::triggers, 1076
Seq24SeqEventInput
seq64::Seq24SeqEventInput, 860
seq64::seqevent, 919
seq64, 49
adjustment_dummy, 104
bpm_from_tempo_us, 79
build_details, 88
bussbyte, 64
c_backsequence, 119
c_bpmtag, 118
c_chord_number, 125
c_chord_size, 125
c_chord_table, 125
c_chord_table_text, 125
c_chord_text, 125
c_controller_names, 111
c_interval_text, 125
c_key_text, 125
c_mainwid_x, 132
c_mainwid_y, 132
c_max_busses, 126
c_max_instruments, 126
c_midi_control_16, 122
c_midi_control_17, 122
c_midi_control_18, 122
c_midi_control_19, 122
c_midi_control_bpm_dn, 120
c_midi_control_bpm_page_dn, 122
c_midi_control_bpm_page_up, 122
c_midi_control_bpm_up, 120
c_midi_control_mod_glearn, 121
c_midi_control_mod_gmute, 121
c_midi_control_mod_queue, 121
c_midi_control_mod_replace, 120
c_midi_control_mod_snapshot, 120
c_midi_control_play_ss, 121
c_midi_control_playback, 121
c_midi_control_record, 121
c_midi_control_solo, 121
c_midi_control_ss_dn, 120
c_midi_control_ss_up, 120
c_midi_control_thru, 122
c_midi_controls, 121
c_midi_controls_extended, 122
c_midi_track_ctrl, 119
c_midibus, 117
c_midibus_input_size, 116
c_midibus_output_size, 116
c_midibus_sysex_chunk, 116
c_midich, 117
c_midiclocks, 118
c_midictrl, 118
c_music_scales, 68
c_musickey, 119
c_musicscale, 119
c_mutegroups, 118
c_notes, 118
c_perf_bp_mes, 119
c_perf_bw, 119
c_scales_policy, 123
c_scales_text, 124
c_scales_transpose_dn, 124
c_scales_transpose_up, 123
c_status_queue, 131
c_status_replace, 131
c_status_snapshot, 131
c_timesig, 118
c_transpose, 119
c_triggers, 118
c_triggers_new, 118
choose_ppqn, 100
clamp, 108
clock_e, 68
clock_tick_duration_bogus, 81
clock_ticks_from_ppqn, 82
create_jack_client, 95
create_lash_driver, 98
delete_lash_driver, 99
delta_time_us_to_ticks, 80
double_ticks_from_ppqn, 82
draw_type_t, 69
EVENT_AFTERTOUCH, 112
EVENT_ANY, 112
EVENT_CHANNEL_PRESSURE, 113
EVENT_CLEAR_CHAN_MASK, 116
EVENT_CONTROL_CHANGE, 112
EVENT_GET_CHAN_MASK, 116
EVENT_MIDI_ACTIVE_SENS, 115
EVENT_MIDI_CLOCK, 114
EVENT_MIDI_CONTINUE, 115
EVENT_MIDI_META, 115
EVENT_MIDI_QUARTER_FRAME, 113
EVENT_MIDI_RESET, 115
EVENT_MIDI_SONG_F4, 114
EVENT_MIDI_SONG_F5, 114
EVENT_MIDI_SONG_F9, 114
EVENT_MIDI_SONG_FD, 115
EVENT_MIDI_SONG_POS, 113
EVENT_MIDI_SONG_SELECT, 113
EVENT_MIDI_START, 114
EVENT_MIDI_STOP, 115
EVENT_MIDI_SYSEX_CONTINUE, 114
EVENT_MIDI_SYSEX_END, 114
EVENT_MIDI_SYSEX, 113
EVENT_MIDI_TUNE_SELECT, 114
EVENT_NOTE_OFF, 112

EVENT_NOTE_ON, 112
EVENT_NULL_CHANNEL, 115
EVENT_PITCH_WHEEL, 113
EVENT_PROGRAM_CHANGE, 112
EVENT_STATUS_BIT, 112
EVENTS_ALL, 116
EVENTS_UNSELECTED, 116
edit_action_t, 70
error_message, 89
extract_bus_name, 84
extract_port_name, 85
extract_port_names, 84
extract_timing_numbers, 71
FF_RW_timeout, 107
file_access, 90
file_accessible, 91
file_executable, 91
file_exists, 90
file_is_directory, 92
file_readable, 90
file_writable, 91
font_render, 104
g_midi_control_limit, 123
g_rc_settings, 132
g_user_settings, 132
get_compound_option, 101
get_current_jack_position, 97
gs_mainwid_pointer, 132
gs_perfedit_pointer_0, 133
gs_perfedit_pointer_1, 133
help_check, 85
info_message, 89
input_thread_func, 100
interaction_method_t, 68
invalid_key, 97
is_ctrl_key, 105, 106
is_ctrl_shift_key, 106
is_no_modifier, 105
is_note_off_velocity, 89
is_null_midipulse, 99
is_shift_key, 105, 106
is_super_key, 107
jack_dummy_callback, 103
jack_message_bit_bucket, 111
jack_process_io, 111
jack_process_rtmidi_input, 109
jack_process_rtmidi_output, 110
jack_session_callback, 97
jack_shutdown_callback, 93
jack_sync_callback, 93
jack_timebase_callback, 94
jack_transport_callback, 95
keyval_name, 98
keyval_normalize, 98
lash_driver, 99
log2_time_sig_value, 78
long_options, 126
make_directory, 92
make_section_name, 104
measures_to_ticks, 83
measurestring_to_pulses, 74
message_concatenate, 88
midi_api_name, 108
midi_input_callback, 111
midi_input_test, 109
midi_measures_to_pulses, 74
midi_probe, 109
midibpm, 65
midibyte, 64
midilong, 65
midipulse, 65
midishort, 65
millisleep, 99
min, 109
mouse_action_e, 69
output_thread_func, 99
parse_command_line_options, 87
parse_mute_groups, 87
parse_options_files, 86
ppqn_is_valid, 92
process_o_options, 87
pulse_length_us, 79
pulses_per_measure, 82
pulses_to_measurestring, 72
pulses_to_midi_measures, 73
pulses_to_string, 72
pulses_to_timestring, 73, 74
rc, 100
rterror_callback, 65
rtmidi_api, 70
rtmidi_callback_t, 65
s_arg_list, 126
s_build_alsamidi_support, 127
s_build_chord_generator, 128
s_build_edit_highlight, 128
s_build_follow_progress, 129
s_build_highlight_empty, 127
s_build_jack_session, 128
s_build_jack_support, 128
s_build_lash_support, 128
s_build_midi_vector, 129
s_build_pause_support, 128
s_build_portmidi_support, 127
s_build_rtmidi_support, 127
s_build_solid_grid, 129
s_build_timesig_tempo, 129
s_build_use_event_map, 128
s_character_mapping, 130
s_debug_mode, 130
s_event_editor, 128
s_global_lash_driver, 130
s_handlesize, 132, 133
s_help_1a, 126
s_help_1b, 127
s_help_2, 127
s_help_3, 127

s_help_4, 127
s_jitter_amount, 132
s_seq32_jack_support, 129
s_seq32_lfo_support, 130
s_seq32_menu_buttons, 130
s_seq32_transport, 129
s_seq32_transpose, 130
s_statistics_support, 129
s_status_pairs, 130
s_strip_empty_mutes, 129
seq_app_name, 103
seq_client_name, 103
seq_event_type_t, 67
seq_modifier_t, 66
seq_scroll_direction_t, 67
seq_version, 103
shorten_file_spec, 76
show_jack_statuses, 96
silence_jack_errors, 108
silence_jack_info, 108
string_is_void, 77
string_not_void, 76
string_to_midibyte, 76
string_to_pulses, 75
strings_match, 77
swap, 70
tempo_us_from_bpm, 79
tempo_us_to_bytes, 78
test_widget_click, 107
ticks_to_delta_time_us, 81
timestring_to_pulses, 75, 101
to_string, 90
update_mainwid_sequences, 107
update_perfedit_sequences, 107
usr, 100
versiontext, 126
wave_func, 83
wave_type_name, 71
wave_type_t, 66
write_options_files, 88
zoom_power_of_2, 78
seq64::AbstractPerfInput, 135
~AbstractPerfInput, 136
AbstractPerfInput, 136
activate_adding, 137
handle_motion_key, 137
is_adding, 137
is_adding_pressed, 138
m_adding, 138
m_adding_pressed, 138
on_button_press_event, 137
on_button_release_event, 137
on_motion_notify_event, 137
perfroll, 138
set_adding, 138
set_adding_pressed, 138
seq64::FruityPerfInput, 265
activate_adding, 270
FruityPerfInput, 267
handle_motion_key, 270
m_current_x, 270
m_current_y, 270
on_button_press_event, 267
on_button_release_event, 268
on_left_button_pressed, 269
on_motion_notify_event, 268
on_right_button_pressed, 269
perfroll, 270
update_mouse_pointer, 268
seq64::FruitySeqEventInput, 271
FruitySeqEventInput, 271
m_is_drag_pasting, 273
m_is_drag_pasting_start, 273
m_justselected_one, 273
on_button_press_event, 272
on_button_release_event, 272
on_motion_notify_event, 273
update_mouse_pointer, 271
seq64::FruitySeqRollInput, 274
FruitySeqRollInput, 274
m_drag_paste_start_pos, 276
m_erase_painting, 276
on_button_press_event, 275
on_button_release_event, 275
on_motion_notify_event, 275
update_mouse_pointer, 274
seq64::Seq24PerfInput, 856
activate_adding, 858
handle_motion_key, 859
m_effective_tick, 860
on_button_press_event, 857
on_button_release_event, 858
on_motion_notify_event, 858
perfroll, 859
Seq24PerfInput, 857
seq64::Seq24SeqEventInput, 860
m_adding, 862
on_button_press_event, 861
on_button_release_event, 861
on_motion_notify_event, 861
Seq24SeqEventInput, 860
set_adding, 860
seq64::automutex, 139
~automutex, 140
automutex, 139
m_safety_mutex, 140
operator=, 140
seq64::busarray, 140
~busarray, 142
add, 142, 143
bus, 143
busarray, 142
clock, 144
continue_from, 144
count, 143
get_clock, 146

get_input, 148
get_midi_bus_name, 146
get_midi_event, 149
init_clock, 144
initialize, 143
is_system_port, 148
m_container, 150
play, 145
poll_for_midi, 148
port_exit, 147
print, 146
replacement_port, 149
set_all_clocks, 145
set_all_inputs, 148
set_clock, 145
set_input, 147
start, 144
stop, 144
sysex, 145
seq64::businfo, 150
~businfo, 152
activate, 154
active, 152
bus, 152, 154
busarray, 155
businfo, 151, 152
clock, 155
continue_from, 155
deactivate, 154
init_clock, 153–155
init_input, 153, 154
initialize, 153
initialized, 153
m_active, 156
m_bus, 156
m_init_clock, 156
m_init_input, 156
m_initialized, 156
print, 155
remove, 152
start, 154
stop, 154
sysex, 155
seq64::click, 156
button, 160
click, 158
is_left, 159
is_middle, 159
is_press, 159
is_right, 159
m_button, 161
m_is_press, 160
m_modifier, 161
m_x, 160
m_y, 161
mod_control, 160
mod_control_shift, 160
mod_super, 160
modifier, 160
operator=, 158
x, 159
y, 159
seq64::condition_var, 161
condition_var, 162
m_cond, 163
signal, 162
sm_cond, 163
wait, 162
seq64::configfile, 163
~configfile, 164
configfile, 164
get_error_message, 166
line_after, 165
m_d, 167
m_error_message, 166
m_line, 167
m_name, 166
next_data_line, 165
parse, 166
set_error_message, 166
write, 166
seq64::editable_event, 167
~editable_event, 173
analyze, 178
category, 175
category_string, 175
category_t, 171
channel_string, 178
data_string, 178
editable_event, 172, 173
format_timestamp, 177
m_category, 180
m_format_timestamp, 180
m_name_category, 180
m_name_channel, 181
m_name_data, 181
m_name_meta, 180
m_name_seqspec, 181
m_name_status, 180
m_name_timestamp, 180
m_parent, 180
meta_string, 178
name_to_value, 174
operator=, 174
parent, 174
seqspec_string, 178
set_status_from_string, 177
sm_category_arrays, 179
sm_category_names, 179
sm_channel_event_names, 179
sm_meta_event_names, 179
sm_prop_event_names, 179
sm_system_event_names, 179
status_string, 177
stock_event_string, 177
time_as_measures, 176

time_as_minutes, 176
time_as_pulses, 176
timestamp, 176
timestamp_format_t, 172
timestamp_string, 175
value_to_name, 174
seq64::editable_event::name_value_t, 641
event_name, 642
event_value, 642
seq64::editable_events, 181
~editable_events, 184
add, 187
begin, 186
clear, 188
const_iterator, 183
count, 187
current_event, 188
dref, 186, 187
editable_events, 184
end, 186
Events, 183
events, 186
EventsPair, 183
eventslots, 189
iterator, 183
Key, 183
load_events, 185
m_current_event, 189
m_events, 189
m_midi_parameters, 189
m_sequence, 189
operator=, 185
remove, 188
replace, 188
save_events, 185
string_to_pulses, 185
timing, 185
seq64::event, 190
~event, 195
append_sysex, 204
cc_match, 202
check_channel, 197
clear_link, 205
data, 207
decrement_data1, 203
decrement_data2, 203
event, 194
get_channel, 197
get_data, 203
get_linked, 205
get_note, 207
get_note_velocity, 208
get_rank, 209
get_status, 202
get_sysex, 204
get_sysex_size, 205
get_timestamp, 197
increment_data1, 203
increment_data2, 203
is_channel_msg, 197
is_desired_cc_or_not_cc, 199
is_linked, 205
is_marked, 206
is_note, 208
is_note_msg, 198
is_note_off, 208
is_note_off_recorded, 209
is_note_on, 208
is_one_byte_msg, 198
is_painted, 206
is_selected, 206
is_strict_note_msg, 199
is_two_byte_msg, 198
link, 205
m_channel, 210
m_data, 210
m_has_link, 210
m_linked, 210
m_marked, 211
m_painted, 211
m_selected, 211
m_status, 210
m_sysex, 210
m_sysex_size, 210
m_timestamp, 210
make_clock, 207
mark, 206
mod_timestamp, 200
non_cc_match, 202
operator<, 196
operator=, 195
paint, 205
print, 209
restart_sysex, 204
select, 206
set_channel, 201
set_data, 202
set_note, 207
set_note_velocity, 208
set_status, 200, 201
set_status_keep_channel, 201
set_sysex_size, 205
set_timestamp, 196
SysexContainer, 194
transpose_note, 207
unmark, 206
unpaint, 206
unselect, 206
seq64::event_list, 213
~event_list, 216
add, 217
any_selected_notes, 222
append, 218
begin, 217
clear, 219
clear_links, 221

const_iterator, 216
count, 217
count_selected_events, 223
count_selected_notes, 222
dref, 220
editable_events, 224
empty, 217
end, 217
event_list, 216
Events, 215
events, 223
EventsPair, 215
is_modified, 218
iterator, 216
link_new, 220
m_events, 224
m_is_modified, 224
mark_all, 222
mark_out_of_range, 221
mark_selected, 221
merge, 219
midi_container, 224
midi_splitter, 224
midifile, 224
operator=, 216
print, 223
push_back, 218
remove, 219
remove_marked, 222
select_all, 223
sequence, 224
sort, 220
unmark_all, 222
unmodify, 219
unpaint_all, 222
unselect_all, 223
verify_and_link, 221
seq64::event_list::event_key, 211
event_key, 212
m_rank, 213
m_timestamp, 213
operator<, 212
seq64::eventedit, 225
~eventedit, 230
change_focus, 234
close_out, 234
enqueue_draw, 231
eventedit, 229
eventslots, 237
handle_cancel, 235
handle_close, 234
handle_delete, 234
handle_insert, 234
handle_modify, 235
handle_save, 235
m_bottbox, 238
m_button_cancel, 239
m_button_del, 238
m_button_ins, 238
m_button_modify, 238
m_button_save, 239
m_editbox, 238
m_entry_ev_data_0, 240
m_entry_ev_data_1, 240
m_entry_ev_name, 240
m_entry_ev_timestamp, 240
m_eventslots, 237
m_have_focus, 241
m_htopbox, 237
m_label_category, 240
m_label_channel, 239
m_label_ev_count, 239
m_label_modified, 240
m_label_ppqn, 239
m_label_right, 240
m_label_seq_name, 239
m_label_spacer, 239
m_label_time_fmt, 240
m_label_time_sig, 239
m_optsbox, 238
m_rightbox, 238
m_seq, 241
m_showbox, 238
m_table, 237
m_vadjust, 237
m_vscroll, 237
on_delete_event, 236
on_focus_in_event, 236
on_focus_out_event, 236
on_key_press_event, 236
on_realize, 235
on_set_focus, 235
perf_modify, 233
set_dirty, 233
set_event_category, 232
set_event_data_0, 232
set_event_data_1, 232
set_event_name, 232
set_event_timestamp, 232
set_seq_count, 231
set_seq_ppqn, 231
set_seq_time_sig, 231
set_seq_title, 231
v_adjustment, 233
seq64::eventslots, 241
~eventslots, 246
change_vert, 252
convert_y, 251
current_index, 246
decrement_bottom, 254
decrement_current, 254
decrement_top, 253
delete_current_event, 249
draw_event, 251
draw_events, 252
enqueue_draw, 251

event_count, 246
eventedit, 257
eventslots, 245
increment_bottom, 255
increment_current, 254
increment_top, 254
insert_event, 247, 248
line_count, 246
line_increment, 246
line_maximum, 246
load_events, 247
m_bottom_iterator, 259
m_char_w, 258
m_current_index, 259
m_current_iterator, 259
m_event_container, 257
m_event_count, 258
m_line_count, 258
m_line_maximum, 258
m_line_overlap, 259
m_pager_index, 259
m_parent, 257
m_seq, 257
m_setbox_w, 258
m_slots_chars, 257
m_slots_x, 258
m_slots_y, 258
m_top_index, 259
m_top_iterator, 259
modify_current_event, 249
on_button_press_event, 255
on_button_release_event, 255
on_expose_event, 255
on_focus_in_event, 255
on_focus_out_event, 256
on_frame_down, 256
on_frame_end, 257
on_frame_home, 257
on_frame_up, 256
on_move_down, 256
on_move_up, 256
on_realize, 255
on_scroll_event, 256
on_size_allocate, 256
page_movement, 253
page_topper, 253
pager_index, 247
save_events, 250
select_event, 250
set_current_event, 247
set_text, 251
top_index, 246
seq64::font, 260
char_height, 263
char_width, 263
Color, 261
font, 261
init, 262
m_b_on_c_pixmap, 265
m_b_on_y_pixmap, 264
m_black_pixmap, 264
m_c_on_b_pixmap, 265
m_cell_h, 263
m_cell_w, 263
m_clip_mask, 265
m_font_h, 263
m_font_w, 263
m_offset, 264
m_padded_h, 264
m_pixmap, 264
m_use_new_font, 263
m_white_pixmap, 264
m_y_on_b_pixmap, 264
padded_height, 263
render_string_on_drawable, 262
seq64::gui_assistant, 276
~gui_assistant, 278
gui_assistant, 278
jack_idle_connect, 278
keys, 279
lash_timeout_connect, 278
m_keys_perform, 279
quit, 278
seq64::gui_assistant_gtk2, 279
~gui_assistant_gtk2, 281
gui_assistant_gtk2, 280
jack_idle_connect, 281
lash_timeout_connect, 281
quit, 281
sm_internal_keys, 281
seq64::gui_drawingarea_gtk2, 282
~gui_drawingarea_gtk2, 286
clear_window, 287
current_x, 286
current_y, 286
draw_drawable, 296
draw_line, 288–290
draw_line_on_pixmap, 288, 289
draw_normal_rectangle_on_pixmap, 295
draw_rectangle, 292–294
draw_rectangle_on_pixmap, 294, 295
drop_x, 287
drop_y, 287
force_draw, 287
gtk_drawarea_init, 297
gui_drawingarea_gtk2, 285
m_background, 298
m_current_x, 299
m_current_y, 299
m_drop_x, 299
m_drop_y, 300
m_foreground, 299
m_gc, 298
m_hadjust, 298
m_mainperf, 299
m_pixmap, 298

m_vadjust, 298
m_window, 298
m_window_x, 299
m_window_y, 299
on_realize, 298
operator=, 286
perf, 287
render_string, 291
render_string_on_pixmap, 291
scroll_hadjust, 296
scroll_hset, 297
scroll_vadjust, 296
scroll_vset, 297
set_current_drop_x, 297
set_current_drop_y, 297
set_line, 287
window_x, 286
window_y, 286
seq64::gui_drawingarea_gtk2::rect, 822
height, 822
width, 822
x, 822
y, 822
seq64::gui_palette_gtk2, 300
~gui_palette_gtk2, 304
bg_color, 307, 308
black, 305
black_key, 307
black_paint, 307
blue, 307
Color, 303
dark_blue, 305
dark_cyan, 306
dark_green, 305
dark_grey, 306
dark_magenta, 306
dark_orange, 305
dark_red, 305
fg_color, 308
green, 307
grey, 306
gui_palette_gtk2, 304
is_inverse, 305
light_grey, 306
line_color, 305
load_inverse_palette, 304
m_bg_color, 311
m_black, 308
m_blk_key, 310
m_blk_paint, 310
m_blue, 310
m_dk_blue, 309
m_dk_cyan, 309
m_dk_green, 308
m_dk_grey, 310
m_dk_magenta, 309
m_dk_orange, 309
m_dk_red, 308
m_fg_color, 311
m_green, 310
m_grey, 310
m_is_inverse, 308
m_line_color, 311
m_lt_grey, 310
m_orange, 309
m_progress_color, 311
m_red, 309
m_white, 309
m_wht_key, 311
m_wht_paint, 310
m_yellow, 309
orange, 306
progress_color, 305
red, 306
white, 306
white_key, 307
white_paint, 307
yellow, 307
seq64::gui_window_gtk2, 312
~gui_window_gtk2, 314
gui_window_gtk2, 313
is_realized, 314
m_is_realized, 316
m_mainperf, 316
m_redraw_period_ms, 316
m_window_x, 316
m_window_y, 316
on_realize, 315
perf, 314
quit, 314
redraw_period_ms, 314
scroll_hadjust, 314
scroll_hset, 315
scroll_vadjust, 315
scroll_vset, 315
seq64::jack_assistant, 316
~jack_assistant, 320
activate, 324
client, 329
client_name, 329
client_open, 329
client_uuid, 329
deinit, 323
error_message, 332
get_beat_width, 321
get_beats_per_measure, 322
get_beats_per_minute, 322
get_current_jack_position, 336
get_follow_transport, 328
get_jack_client_info, 330
get_jack_mode, 327
get_jack_pos, 327
get_jack_stop_tick, 327
get_jack_tick, 327
get_ppqn, 321
info_message, 332

init, 323
is_master, 321
is_running, 321
jack_assistant, 320
jack_frame_rate, 328
jack_session_callback, 336
jack_shutdown_callback, 334
jack_sync_callback, 334
jack_timebase_callback, 335
jack_transport_callback, 334
m_beat_width, 339
m_beats_per_measure, 339
m_beats_per_minute, 340
m_follow_transport, 339
m_jack_client, 337
m_jack_client_name, 337
m_jack_client_uuid, 337
m_jack_frame_current, 337
m_jack_frame_last, 337
m_jack_frame_rate, 339
m_jack_master, 338
m_jack_parent, 337
m_jack_pos, 338
m_jack_running, 338
m_jack_stop_tick, 339
m_jack_tick, 338
m_jack_transport_state, 338
m_jack_transport_state_last, 338
m_jsession_ev, 338
m_ppqn, 339
m_toggle_jack, 339
output, 326
parent, 321
position, 325
session_event, 324
set_beat_width, 321
set_beats_per_measure, 322
set_beats_per_minute, 322
set_follow_transport, 328
set_jack_mode, 327
set_jack_running, 329
set_jack_stop_tick, 327
set_position, 332
set_ppqn, 326
set_start_from_perfedit, 328
show_position, 330
sm_status_pairs, 337
song_start_mode, 328
start, 324
stop, 324
sync, 331
tick_multiplier, 329
toggle_follow_transport, 328
toggle_jack_mode, 327
toggle_song_start_mode, 328
transport_not_starting, 322
transport_state, 322
seq64::jack_scratchpad, 340
js_clock_tick, 341
js_current_tick, 341
js_delta_tick_frac, 342
js_dumping, 341
js_init_clock, 341
js_jack_stopped, 341
js_looping, 341
js_playback_mode, 341
js_ticks_converted, 342
js_ticks_converted_last, 342
js_ticks_delta, 342
js_total_tick, 341
seq64::jack_status_pair_t, 342
jf_bit, 342
jf_meaning, 343
seq64::keybindentry, 343
keybindentry, 344
m_key, 345
m_perf, 346
m_slot, 346
m_type, 345
on_key_press_event, 345
options, 345
set, 345
type, 344
seq64::keys_perform, 346
~keys_perform, 354
at_bpm_dn, 367
at_bpm_up, 367
at_event_edit, 370
at_fast_forward, 370
at_follow_transport, 370
at_group_learn, 369
at_group_off, 369
at_group_on, 369
at_keep_queue, 368
at_menu_mode, 369
at_pattern_edit, 370
at_pause, 369
at_pointer_position, 370
at_queue, 368
at_replace, 368
at_rewind, 370
at_screenset_dn, 368
at_screenset_up, 368
at_set_playing_screenset, 368
at_show_ui_sequence_key, 371
at_show_ui_sequence_number, 371
at_snapshot_1, 368
at_snapshot_2, 368
at_song_mode, 369
at_start, 369
at_stop, 371
at_tap_bpm, 370
at_toggle_jack, 369
at_toggle_mutes, 370
bpm_dn, 355
bpm_up, 354

event_edit, 360
fast_forward, 362
follow_transport, 362
get_key_events, 364
get_key_events_rev, 365
get_key_groups, 364
get_key_groups_rev, 365
get_keys, 354
group_learn, 359
group_off, 358, 359
group_on, 358
keep_queue, 356
key_name, 366
keys_perform, 353
lookup_keyevent_key, 365
lookup_keyevent_seq, 365
lookup_keygroup_group, 366
lookup_keygroup_key, 365
m_key_bpm_dn, 372
m_key_bpm_up, 372
m_key_event_edit, 375
m_key_events, 372
m_key_events_rev, 372
m_key_fast_forward, 375
m_key_follow_transport, 375
m_key_group_learn, 374
m_key_group_off, 374
m_key_group_on, 374
m_key_groups, 372
m_key_groups_rev, 372
m_key_keep_queue, 373
m_key_menu_mode, 374
m_key_pattern_edit, 375
m_key_pause, 374
m_key_pointer_position, 375
m_key_queue, 373
m_key_replace, 373
m_key_rewind, 375
m_key_screenset_dn, 373
m_key_screenset_up, 373
m_key_set_playing_screenset, 373
m_key_show_ui_sequence_key, 372
m_key_show_ui_sequence_number, 372
m_key_snapshot_1, 373
m_key_snapshot_2, 373
m_key_song_mode, 374
m_key_start, 374
m_key_stop, 376
m_key_tap_bpm, 375
m_key_toggle_jack, 374
m_key_toggle_mutes, 375
menu_mode, 361
options, 371
optionsfile, 371
pattern_edit, 360
pause, 360
perform, 371
pointer_position, 362, 363
queue, 355, 356
replace, 355
RevSlotMap, 353
rewind, 362
screenset_dn, 357
screenset_up, 357
set_all_key_events, 366
set_all_key_groups, 366
set_key_event, 367
set_key_group, 367
set_keys, 354
set_playing_screenset, 358
show_ui_sequence_key, 364
show_ui_sequence_number, 364
SlotMap, 353
snapshot_1, 356
snapshot_2, 357
song_mode, 361
start, 359
stop, 361
tap_bpm, 363
toggle_jack, 363
toggle_mutes, 363
seq64::keys_perform_gtk2, 376
~keys_perform_gtk2, 378
key_name, 378
keys_perform_gtk2, 378
set_all_key_events, 378
set_all_key_groups, 379
seq64::keys_perform_transfer, 379
kpt_bpm_dn, 380
kpt_bpm_up, 380
kpt_event_edit, 382
kpt_fast_forward, 383
kpt_follow_transport, 383
kpt_group_learn, 380
kpt_group_off, 380
kpt_group_on, 380
kpt_keep_queue, 381
kpt_menu_mode, 382
kpt_pattern_edit, 382
kpt_pause, 382
kpt_pointer_position, 383
kpt_queue, 381
kpt_replace, 381
kpt_rewind, 383
kpt_screenset_dn, 380
kpt_screenset_up, 380
kpt_set_playing_screenset, 380
kpt_show_ui_sequence_key, 381
kpt_show_ui_sequence_number, 382
kpt_snapshot_1, 381
kpt_snapshot_2, 381
kpt_song_mode, 382
kpt_start, 381
kpt_stop, 381
kpt_tap_bpm, 382
kpt_toggle_jack, 382

kpt_toggle_mutes, 383
seq64::keystroke, 383
is, 386
is_delete, 386
is_letter, 386
is_press, 386
key, 386
keystroke, 384, 385
m_is_press, 388
m_key, 388
m_modifier, 388
mod_control, 387
mod_control_shift, 387
mod_super, 387
modifier, 387
operator=, 385
shift_lock, 387
seq64::lash, 388
handle_config, 390
handle_event, 390
init, 390
lash, 389
m_client, 391
m_is_lash_supported, 391
m_lash_args, 391
m_perform, 391
process_events, 390
set_alsa_client_id, 389
start, 389
seq64::lfownd, 392
∼lfownd, 394
lfownd, 394
m_hbox, 395
m_phase, 396
m_range, 396
m_scale_phase, 395
m_scale_range, 395
m_scale_speed, 395
m_scale_value, 395
m_scale_wave, 395
m_seq, 395
m_seqdata, 395
m_speed, 396
m_value, 396
m_wave, 396
m_wave_name, 396
on_focus_out_event, 394
scale_lfo_change, 394
toggle_visible, 394
seq64::maintime, 397
∼maintime, 399
idle_progress, 399
m_bar_width, 400
m_beat_width, 400
m_box_height, 401
m_box_less_pill, 401
m_box_width, 401
m_flash_height, 401
m_flash_width, 401
m_flash_x, 401
m_pill_width, 401
m_ppqn, 402
m_tick, 402
maintime, 399
mainwnd, 400
on_expose_event, 400
on_realize, 400
operator=, 399
seq64::mainwid, 402
∼mainwid, 406
calculate_base_sizes, 411
draw_marker_on_sequence, 408
draw_pixmap_on_window, 407
draw_sequence_on_pixmap, 409
draw_sequence_pixmap_on_window, 410
draw_sequences_on_pixmap, 410
fill_background_window, 407
m_armed_progress_color, 414
m_button_down, 414
m_last_playing, 415
m_last_tick_x, 415
m_mainwid_border, 416
m_mainwid_spacing, 416
m_mainwid_x, 416
m_mainwid_y, 416
m_mainwnd_cols, 415
m_mainwnd_rows, 415
m_max_sets, 416
m_moving, 414
m_moving_seq, 414
m_old_seq, 414
m_progress_height, 417
m_screenset, 415
m_screenset_offset, 417
m_screenset_slots, 417
m_seqarea_seq_x, 415
m_seqarea_seq_y, 416
m_seqarea_x, 415
m_seqarea_y, 415
m_text_size_x, 416
m_text_size_y, 416
mainwid, 406
mainwnd, 414
on_button_press_event, 412
on_button_release_event, 412
on_expose_event, 411
on_focus_in_event, 413
on_focus_out_event, 413
on_motion_notify_event, 413
on_realize, 411
redraw, 408
reset, 407
select_fg_bg_colors, 411
seq_from_xy, 410
seq_set_and_edit, 408
seq_set_and_eventedit, 408

set_screenset, 407
timeout, 410
update_mainwid_sequences, 414
update_markers, 409
update_sequences_on_window, 407
valid_sequence, 409
seq64::mainwnd, 417
~mainwnd, 423
about_dialog, 429
adj_callback_bpm, 424
adj_callback_ss, 424
apply_song_transpose, 427
build_info_dialog, 429
choose_file, 431
clear_mute_groups, 427
edit_callback_notepad, 424
edit_field_has_focus, 431
enregister_perfedits, 427
file_exit, 430
file_import_dialog, 428
file_new, 428
file_open, 428
file_save, 428
file_save_as, 429
handle_signal, 424
install_signal_handlers, 431
is_save, 431
jack_dialog, 429
learn_toggle, 426
m_adjust_bpm, 436
m_adjust_load_offset, 436
m_adjust_ss, 436
m_button_jack, 436
m_button_learn, 435
m_button_perfedit, 436
m_button_play, 436
m_button_stop, 435
m_call_seq_edit, 437
m_call_seq_eventedit, 437
m_entry_notes, 437
m_image_play, 435
m_is_running, 437
m_main_cursor, 435
m_main_time, 434
m_main_wid, 434
m_menu_edit, 434
m_menu_file, 434
m_menu_help, 434
m_menu_mode, 437
m_menu_view, 434
m_menubar, 433
m_options, 435
m_perf_edit, 435
m_perf_edit_2, 435
m_ppqn, 434
m_sigpipe, 433
m_spinbutton_bpm, 436
m_spinbutton_load_offset, 437
m_spinbutton_ss, 436
m_timeout_connect, 437
m_tooltips, 433
mainwnd, 422
new_file, 430
new_open_error_dialog, 429
on_delete_event, 432
on_grouplearnchange, 433
on_key_press_event, 432
on_key_release_event, 432
on_realize, 433
open_file, 423
open_performance_edit, 426
open_performance_edit_2, 426
options_dialog, 428
pause_playing, 426
populate_menu_edit, 432
populate_menu_file, 431
populate_menu_help, 432
populate_menu_view, 432
ppqn, 424
query_save_changes, 429
rc_error_dialog, 423
reload_mute_groups, 427
save_file, 430
sequence_key, 427
set_play_image, 425
set_song_mute, 428
set_songlive_image, 425
signal_action, 431
start_playing, 425
stop_playing, 426
timer_callback, 425
toLower, 427
toggle_playing, 426
update_window_title, 427
seq64::mastermidibase, 438
~mastermidibase, 444
activate, 454
api_clock, 456
api_continue_from, 455
api_flush, 455
api_get_midi_event, 456
api_init, 454
api_init_clock, 455
api_is_more_input, 456
api_poll_for_midi, 456
api_port_start, 456
api_set_beats_per_minute, 455
api_set_ppqn, 455
api_start, 454
api_stop, 455
clock, 454
continue_from, 447
dump_midi_input, 449
emit_clock, 448
filter_by_channel, 444, 445
flush, 448

get_beats_per_minute, 445
get_bpm, 445
get_clock, 453
get_input, 452
get_midi_event, 451
get_midi_in_bus_name, 450
get_midi_out_bus_name, 449
get_num_in_buses, 444
get_num_out_buses, 444
get_ppqn, 445
get_sequence, 445
init, 444
init_clock, 447
initialize_buses, 449
input, 454
is_dumping, 445
is_input_system_port, 452
is_more_input, 451
m_beats_per_minute, 459
m_bus_announce, 458
m_dumping_input, 459
m_filter_by_channel, 459
m_inbus_array, 458
m_master_clocks, 458
m_master_inputs, 458
m_max_busses, 458
m_mutex, 459
m_outbus_array, 458
m_ppqn, 458
m_queue, 458
m_seq, 459
m_vector_sequence, 459
mastermidibase, 442
midi_alsa_info, 457
perform, 457
play, 447
poll_for_midi, 450
port_exit, 446
port_settings, 454
port_start, 446
print, 448
save_clock, 456
save_input, 457
set_beats_per_minute, 453
set_clock, 451
set_input, 452
set_ppqn, 453
set_sequence_input, 449
start, 445
stop, 446
sysex, 448
seq64::mastermidibus, 460
~mastermidibus, 462
activate, 466
api_continue_from, 466
api_flush, 465, 467
api_get_midi_event, 463, 466
api_init, 463, 467
api_is_more_input, 463, 466
api_poll_for_midi, 463, 466
api_port_start, 466, 467
api_set_beats_per_minute, 465, 467
api_set_ppqn, 465, 467
api_start, 465
api_stop, 465
m_alsa_seq, 468
m_midi_master, 468
m_num_poll_descriptors, 468
m_poll_descriptors, 468
m_use_jack_polling, 469
mastermidibus, 462
midi_alsa_info, 468
midi_jack_info, 468
port_list, 467
seq64::midi_alsa, 469
~midi_alsa, 472
api_clock, 476
api_continue_from, 476
api_deinit_in, 474
api_flush, 476
api_get_midi_event, 474
api_init_in, 473
api_init_in_sub, 474
api_init_out, 473
api_init_out_sub, 473
api_play, 475
api_poll_for_midi, 474
api_set_beats_per_minute, 477
api_set_ppqn, 477
api_start, 476
api_stop, 476
api_sysex, 475
get_client, 472
get_port, 473
m_dest_addr_client, 478
m_dest_addr_port, 478
m_input_port_name, 478
m_local_addr_client, 478
m_local_addr_port, 478
m_seq, 478
midi_alsa, 472
set_virtual_name, 477
seq64::midi_alsa_info, 479
~midi_alsa_info, 481
api_flush, 483
api_get_midi_event, 481
api_poll_for_midi, 482
api_port_start, 482
api_set_beats_per_minute, 482
api_set_ppqn, 482
get_all_port_info, 483
m_alsa_seq, 484
m_num_poll_descriptors, 484
m_poll_descriptors, 484
midi_alsa_info, 480
seq, 481

sm_input_caps, 484
sm_output_caps, 484
seq64::midi_api, 485
~midi_api, 487
api_clock, 491
api_connect, 488
api_continue_from, 490
api_deinit_in, 489
api_flush, 490
api_get_bus_name, 491
api_get_midi_event, 489
api_get_port_name, 491
api_init_in, 488
api_init_in_sub, 489
api_init_out, 488
api_init_out_sub, 488
api_play, 489
api_poll_for_midi, 489
api_set_beats_per_minute, 491
api_set_ppqn, 491
api_start, 490
api_stop, 490
api_sysex, 490
cancel_callback, 493
error, 492
input_data, 493
is_input_port, 488
is_port_open, 491
is_system_port, 488
is_virtual_port, 488
m_connected, 494
m_error_callback, 494
m_error_callback_user_data, 494
m_error_string, 494
m_first_error_occurred, 494
m_input_data, 494
m_master_info, 493
m_parent_bus, 493
master_info, 492
master_midi_mode, 492
midi_api, 487
parent_bus, 492
set_port_open, 493
user_callback, 493
seq64::midi_container, 495
~midi_container, 497
add_event, 500
add_long, 500
add_short, 500
add_variable, 499
clear, 499
done, 498
fill, 497
fill_meta_track_end, 501
fill_proprietary, 501
fill_seq_name, 501
fill_seq_number, 500
fill_time_sig_and_tempo, 501
get, 499
m_position_for_get, 504
m_sequence, 504
midi_container, 497
midifile, 503
position, 499
position_increment, 499
position_reset, 499
put, 498
size, 498
song_fill_seq_event, 503
song_fill_seq_trigger, 503
seq64::midi_control, 504
action, 505
active, 506
data, 506
in_range, 508
inverse_active, 506
m_active, 508
m_data, 508
m_inverse_active, 508
m_max_value, 509
m_min_value, 508
m_status, 508
match, 507
max_value, 507
midi_control, 506
min_value, 507
set, 507
status, 506
seq64::midi_in_alsa, 509
midi_in_alsa, 511
seq64::midi_in_jack, 511
~midi_in_jack, 513
api_get_midi_event, 514
api_poll_for_midi, 513
m_client_name, 514
midi_in_jack, 513
open_client, 514
seq64::midi_info, 515
~midi_info, 518
add_bus, 523
api_connect, 520
api_flush, 520
api_get_midi_event, 520
api_poll_for_midi, 520
api_port_start, 520
api_set_beats_per_minute, 519
api_set_ppqn, 519
app_name, 519
bpm, 519
bus_container, 523
clear, 519
connect_name, 522
error, 522
full_port_count, 519
get_all_port_info, 523
get_bus_id, 521

get_bus_name, 521
get_input, 521
get_port_count, 520
get_port_id, 521
get_port_name, 521
get_system, 521
get_virtual, 521
global_queue, 522, 523
input_ports, 518
m_app_name, 525
m_bpm, 525
m_bus_container, 524
m_error_string, 525
m_global_queue, 525
m_input, 524
m_midi_handle, 525
m_midi_mode_input, 524
m_output, 524
m_ppqn, 525
midi_handle, 518, 523
midi_info, 518
midi_mode, 518
nc_midi_port_info, 523
output_ports, 518
port_list, 522
ppqn, 519
queue_number, 522
ref_midi_port_info, 524
rtmidi_info, 524
seq64::midi_jack, 526
~midi_jack, 529
api_clock, 537
api_connect, 533
api_continue_from, 536
api_deinit_in, 534
api_flush, 536
api_get_midi_event, 535
api_get_port_name, 537
api_init_in, 533
api_init_in_sub, 534
api_init_out, 533
api_init_out_sub, 534
api_play, 535
api_poll_for_midi, 535
api_set_beats_per_minute, 537
api_set_ppqn, 537
api_start, 536
api_stop, 536
api_sysex, 535
client_handle, 529, 530
close_client, 531
close_port, 531
connect_port, 531
create_ringbuffer, 531
jack_data, 529
m_jack_data, 539
m_jack_info, 539
m_multi_client, 539
m_remote_port_name, 539
midi_jack, 528
midi_jack_info, 538
multi_client, 529
open_client, 533
open_client_impl, 530
port_handle, 530
register_port, 532
remote_port_name, 529, 530
send_byte, 537
set_virtual_name, 538
seq64::midi_jack_data, 539
~midi_jack_data, 540
m_jack_buffmessage, 541
m_jack_buffsize, 541
m_jack_client, 541
m_jack_lasttime, 541
m_jack_port, 541
m_jack_rtmidiin, 541
midi_jack_data, 540
valid_buffer, 540
seq64::midi_jack_info, 542
~midi_jack_info, 544
add, 548
api_connect, 545
api_flush, 546
api_get_midi_event, 545
api_poll_for_midi, 545
api_port_start, 546
api_set_beats_per_minute, 546
api_set_ppqn, 545
client_handle, 544, 547
connect, 548
disconnect, 548
extract_names, 548
get_all_port_info, 547
jack_process_io, 548
m_jack_client, 549
m_jack_ports, 549
m_multi_client, 549
midi_jack, 548
midi_jack_info, 544
multi_client, 544
seq64::midi_list, 549
~midi_list, 552
CharList, 551
clear, 552
done, 552
get, 552
m_char_list, 553
midi_list, 551
put, 552
size, 552
seq64::midi_measures, 553
beats, 555
divisions, 555
m_beats, 556
m_divisions, 556

m_measures, 555
measures, 554
midi_measures, 554
seq64::midi_message, 556
array, 558
at, 557
container, 557
count, 558
empty, 558
m_bytes, 558
m_timestamp, 559
midi_message, 557
operator[], 557
push, 558
timestamp, 558
seq64::midi_out_alsa, 559
midi_out_alsa, 561
seq64::midi_out_jack, 561
∼midi_out_jack, 563
midi_out_jack, 563
open_client, 564
send_message, 563
seq64::midi_port_info, 564
add, 565
clear, 566
connect_name, 567
get_bus_id, 566
get_bus_name, 566
get_input, 566
get_port_count, 566
get_port_id, 566
get_port_name, 566
get_queue_number, 567
get_system, 567
get_virtual, 567
m_port_container, 567
m_port_count, 567
midi_port_info, 565
seq64::midi_port_info::port_info_t, 797
m_client_name, 798
m_client_number, 798
m_is_input, 799
m_is_system, 799
m_is_virtual, 799
m_port_name, 798
m_port_number, 798
m_queue_number, 799
seq64::midi_queue, 568
∼midi_queue, 569
add, 569
allocate, 570
count, 569
deallocate, 570
empty, 569
front, 570
full, 569
m_back, 571
m_front, 571
m_ring, 571
m_ring_size, 571
m_size, 571
midi_queue, 569
pop, 569
pop_front, 570
seq64::midi_splitter, 571
∼midi_splitter, 574
count, 575
increment, 574
initialize, 574
log_main_sequence, 574
m_ppqn, 576
m_smf0_channels, 577
m_smf0_channels_count, 576
m_smf0_main_sequence, 577
m_smf0_seq_number, 577
m_use_default_ppqn, 576
midi_splitter, 573
ppqn, 575
split, 575
split_channel, 575
seq64::midi_timing, 577
beat_width, 579
beats_per_measure, 579
beats_per_minute, 578, 579
m_beat_width, 580
m_beats_per_measure, 580
m_beats_per_minute, 580
m_ppqn, 580
midi_timing, 578
ppqn, 580
seq64::midi_vector, 581
∼midi_vector, 583
CharVector, 583
clear, 585
done, 584
get, 584
m_char_vector, 585
midi_vector, 583
put, 584
size, 584
seq64::midibase, 585
∼midibase, 591
api_clock, 604
api_continue_from, 603
api_deinit_in, 602
api_flush, 603
api_get_midi_event, 602
api_init_in, 603
api_init_in_sub, 602
api_init_out, 603
api_init_out_sub, 602
api_play, 602
api_poll_for_midi, 601
api_start, 604
api_stop, 604
api_sysex, 603

bpm, 593
bus_name, 592, 601
clock, 600
connect_name, 592
continue_from, 600
deinit_in, 598
display_name, 592, 601
flush, 599
get_bus_id, 592
get_bus_index, 592
get_clock, 594
get_clock_mod, 597
get_input, 595
get_midi_event, 597
get_port_id, 593
init_clock, 600
init_in, 598
init_in_sub, 598
init_out, 598
init_out_sub, 598
is_input_port, 593, 594
is_output_port, 594
is_system_port, 594
is_virtual_port, 593
m_bpm, 605
m_bus_id, 605
m_bus_index, 605
m_bus_name, 606
m_clock_mod, 604
m_clock_type, 605
m_display_name, 606
m_inputing, 605
m_is_input_port, 606
m_is_system_port, 606
m_is_virtual_port, 606
m_lasttick, 606
m_mutex, 607
m_port_id, 605
m_port_name, 606
m_ppqn, 605
m_queue, 605
mastermidibus, 604
match, 593
midibase, 590
play, 599
poll_for_midi, 597
port_name, 592, 601
ppqn, 593
print, 600
queue_number, 595
set_alt_name, 596
set_bus_id, 595
set_clock, 594
set_clock_mod, 597
set_clock_status, 594
set_input, 601
set_input_status, 595
set_multi_name, 596
set_name, 595
set_port_id, 601
set_system_port_flag, 594
show_bus_values, 592
start, 599
stop, 599
sysex, 599
seq64::midibus, 607
~midibus, 611
api_clock, 615, 617
api_connect, 615
api_continue_from, 614, 617
api_deinit_in, 613, 616
api_flush, 614
api_get_midi_event, 616
api_init_in, 612, 615
api_init_in_sub, 613, 616
api_init_out, 612, 616
api_init_out_sub, 612, 616
api_play, 613, 618
api_poll_for_midi, 617
api_start, 614, 617
api_stop, 615, 617
api_sysex, 614
get_client, 612
get_port, 612
m_dest_addr_client, 618
m_dest_addr_port, 618
m_input_port_name, 619
m_local_addr_client, 619
m_local_addr_port, 619
m_master_info, 619
m_rt_midi, 619
m_seq, 618
mastermidibus, 618
midibus, 610, 611
set_virtual_name, 615
seq64::midifile, 619
~midifile, 623
add_trigger, 629
checklen, 628
errdump, 636
error_is_fatal, 625
error_message, 625
is_sysex_special_id, 637
m_char_list, 639
m_data, 638
m_disable_reported, 638
m_error_is_fatal, 638
m_error_message, 638
m_file_size, 638
m_global_bgsequence, 639
m_mutex, 638
m_name, 638
m_new_format, 639
m_pos, 638
m_ppqn, 639
m_smf0_splitter, 639

m_use_default_ppqn, 639
midifile, 622
parse, 623
parse_prop_header, 626
parse_proprietary_track, 627
parse_smf_0, 625
parse_smf_1, 626
pow2, 628
ppqn, 625
prop_item_size, 635
read_byte, 629
read_byte_array, 631
read_long, 629
read_seq_number, 633
read_short, 629
read_track_name, 632
read_varinum, 630
seq_number_size, 637
track_end_size, 637
track_name_size, 636
varinum_size, 635
write, 624
write_byte, 631
write_header, 633
write_long, 630
write_prop_header, 633
write_proprietary_track, 634
write_seq_number, 632
write_short, 630
write_song, 625
write_track, 637
write_track_end, 633
write_track_name, 632
write_varinum, 631
seq64::mutex, 640
lock, 641
m_mutex_lock, 641
mutex, 641
sm_recursive_mutex, 641
unlock, 641
seq64::options, 642
add_extended_keys_page, 647
add_jack_sync_page, 647
add_keyboard_page, 647
add_midi_clock_page, 646
add_midi_input_page, 647
add_mouse_page, 647
button, 643
clock_callback_mod, 645
clock_callback_off, 644
clock_callback_on, 645
clock_mod_callback, 645
filter_callback, 645
input_callback, 645
lash_support_callback, 646
m_button_jack_connect, 648
m_button_jack_disconnect, 648
m_button_jack_master, 648
m_button_jack_master_cond, 648
m_button_jack_transport, 648
m_button_ok, 648
m_mainperf, 647
m_notebook, 648
m_tooltips, 647
mouse_click_edit_callback, 646
mouse_fruity_callback, 646
mouse_mod4_callback, 646
mouse_seq24_callback, 646
mouse_snap_split_callback, 646
options, 644
perf, 644
transport_callback, 645
seq64::optionsfile, 649
∼optionsfile, 650
error_message, 653
optionsfile, 650
parse, 650
parse_mute_group_section, 652
write, 652
seq64::perfedit, 653
∼perfedit, 659
collapse, 663
copy, 663
draw_sequences, 664
enqueue_draw, 659
enregister_peer, 660
expand, 663
fast_forward, 661
get_toggle_jack, 660
grow, 663
init_before_show, 659
m_bpm, 671
m_button_bpm, 670
m_button_bw, 670
m_button_collapse, 669
m_button_copy, 669
m_button_expand, 669
m_button_follow, 670
m_button_grow, 669
m_button_jack, 669
m_button_loop, 669
m_button_play, 668
m_button_redo, 669
m_button_snap, 668
m_button_stop, 668
m_button_undo, 669
m_button_xpose, 668
m_bw, 671
m_entry_bpm, 670
m_entry_bw, 670
m_entry_snap, 668
m_entry_xpose, 668
m_hadjust, 667
m_hbox, 670
m_hlbox, 670
m_hscroll, 667

m_image_play, 668
m_is_running, 671
m_menu_bpm, 671
m_menu_bw, 671
m_menu_snap, 667
m_menu_xpose, 668
m_peer_perfedit, 666
m_perfnames, 667
m_perfroll, 667
m_perftime, 667
m_ppqn, 671
m_snap, 671
m_standard_bpm, 671
m_table, 666
m_tooltips, 670
m_vadjust, 667
m_vscroll, 667
on_delete_event, 666
on_key_press_event, 665
on_key_release_event, 666
on_realize, 665
pause_playing, 665
perfedit, 658
popup_menu, 664
redo, 664
rewind, 660
set_beat_width, 662
set_beats_per_bar, 662
set_follow_transport, 661
set_guides, 663
set_image, 664
set_jack_mode, 661
set_looped, 663
set_snap, 662
set_transpose, 661
set_zoom, 660
start_playing, 665
stop_playing, 665
timeout, 664
toggle_follow_transport, 661
toggle_jack, 660
toggle_playing, 665
transpose_button_callback, 662
undo, 664
update_perfedit_sequences, 666
zoom_check, 659
seq64::perfnames, 672
~perfnames, 675
change_vert, 676
convert_y, 675
draw_sequence, 675
draw_sequences, 675
enqueue_draw, 675
m_char_w, 679
m_namebox_w, 679
m_names_chars, 679
m_names_x, 679
m_names_y, 679
m_parent, 678
m_seqs_in_set, 680
m_sequence_active, 680
m_sequence_max, 680
m_sequence_offset, 680
m_setbox_w, 679
m_xy_offset, 679
on_button_press_event, 677
on_button_release_event, 677
on_expose_event, 676
on_realize, 676
on_scroll_event, 678
on_size_allocate, 678
perfedit, 678
perfnames, 674
redraw, 676
redraw_dirty_sequences, 675
seq64::perform, 680
~perform, 695
activate, 739
add_clock, 750
add_input, 750
add_sequence, 705
all_notes_off, 741
any_group_unmutes, 736
apply_song_transpose, 709
armed_saved, 713
clamp_track, 748
clear_all, 704
clear_mute_groups, 710
clear_sequence_triggers, 706
clocks_per_metronome, 698
collapse, 732
combine_bytes, 701
copy, 732
copy_triggers, 727
create_master_bus, 749
current_screen_set_notepad, 735
decrement_beats_per_minute, 722
decrement_screenset, 722
deinit_jack_transport, 744
delete_sequence, 706
enregister, 700
expand, 732
FF_RW_timeout, 702
FF_rewind, 702
fast_forward, 703
ff_rw_button_t, 694
ff_rw_type, 703
filter_by_channel, 699
finish, 707
get_32nds_per_quarter, 698
get_beat_width, 697
get_beats_per_bar, 697
get_beats_per_minute, 710
get_current_jack_position, 755
get_follow_transport, 702
get_group_mute_state, 715

get_input, 751
get_jack_tick, 707
get_key_events, 716
get_key_events_rev, 716
get_key_groups, 716
get_key_groups_rev, 716
get_left_tick, 708
get_max_trigger, 732
get_offset, 715
get_playing_screenset, 730
get_right_tick, 709
get_screen_set_notepad, 735
get_screenset, 730
get_sequence, 723, 724
get_start_tick, 708
get_tick, 707
get_toggle_jack, 701
get_transpose, 710
gui, 698
handle_midi_control, 734
handle_midi_control_ex, 735
have_redo, 731
have_undo, 731
highlight, 723
increment_beats_per_minute, 722
increment_screenset, 723
init_jack_transport, 743
inner_start, 748
inner_stop, 748
input_func, 714
input_thread_func, 752
install_sequence, 747
is_active, 709
is_control_status, 696
is_dirty_edit, 728
is_dirty_main, 728
is_dirty_names, 729
is_dirty_perf, 729
is_edit_sequence, 697
is_exportable, 729
is_group_learning, 738
is_input_system_port, 751
is_jack_master, 700
is_jack_running, 700
is_modified, 695, 744
is_mseq_valid, 747
is_pattern_playing, 699, 746
is_running, 699
is_screenset_valid, 745
is_seq_valid, 746
is_sequence_in_edit, 706
is_smf_0, 723
jack_assistant, 751
jack_shutdown, 753
jack_sync_callback, 753
jack_timebase_callback, 754
jack_transport_callback, 753
key_name, 716
keybindentry, 751
keys, 699
launch, 704
launch_input_thread, 743
launch_output_thread, 743
learn_toggle, 721
left_right_size, 709
lookup_keyevent_key, 717
lookup_keyevent_seq, 717
lookup_keygroup_group, 719
lookup_keygroup_key, 719
m_32nds_per_quarter, 761
m_FF_RW_button_type, 756
m_armed_saved, 756
m_armed_statuses, 756
m_beat_width, 760
m_beats_per_bar, 760
m_bpm, 760
m_clocks_per_metronome, 760
m_condition_var, 765
m_control_status, 763
m_dont_reset_ticks, 763
m_edit_sequence, 764
m_excell_FF_RW, 756
m_gui_support, 766
m_have_redo, 765
m_have_undo, 765
m_in_thread, 759
m_in_thread_launched, 759
m_inputing, 759
m_is_modified, 765
m_is_pattern_playing, 759
m_jack_asst, 765
m_jack_tick, 762
m_left_tick, 761
m_looping, 760
m_master_bus, 761
m_master_clocks, 761
m_master_inputs, 761
m_max_sets, 764
m_midi_cc_off, 763
m_midi_cc_on, 763
m_midi_cc_toggle, 763
m_midiclockpos, 763
m_midiclockrunning, 762
m_midiclocktick, 762
m_mode_group, 757
m_mode_group_learn, 757
m_mute_group, 756
m_mute_group_selected, 757
m_notify, 766
m_offset, 763
m_one_measure, 761
m_out_thread, 758
m_out_thread_launched, 759
m_outputing, 759
m_playback_mode, 760
m_playing_screen, 757

m_playscreen_offset, 757
m_ppqn, 760
m_redo_vect, 765
m_reposition, 756
m_right_tick, 762
m_running, 759
m_screen_set_notepad, 763
m_screenset, 764
m_seqs, 757
m_seqs_active, 757
m_seqs_in_set, 764
m_sequence_count, 764
m_sequence_high, 764
m_sequence_max, 764
m_sequence_state, 758
m_song_start_mode, 755
m_start_from_perfedit, 755
m_starting_tick, 762
m_tick, 762
m_tracks_mute_state, 756
m_transpose, 758
m_undo_vect, 765
m_us_per_quarter_note, 761
m_usemidiclock, 762
m_was_active_edit, 758
m_was_active_main, 758
m_was_active_names, 758
m_was_active_perf, 758
mainwnd, 751
mainwnd_key_event, 726
master_bus, 699
max_active_set, 743
midi_control_event, 734
midi_control_off, 733
midi_control_on, 733
midi_control_toggle, 732
midifile, 751
modify, 695
move_triggers, 727
mute_all_tracks, 712
mute_group_offset, 746
mute_group_tracks, 737
mute_op_t, 694
mute_screenset, 713
new_sequence, 705
off_sequences, 741
options, 752
optionsfile, 751
output_func, 713
output_thread_func, 752
page_decrement_beats_per_minute, 722
page_increment_beats_per_minute, 722
pause_key, 721
pause_playing, 720
perfedit, 752
perform, 694
perfroll, 752
perfroll_key_event, 726
play, 742
playback_key_event, 726
pop_trigger_redo, 728
pop_trigger_undo, 728
position_jack, 740
ppqn, 695
print_busses, 707
print_group_unmutes, 736
print_triggers, 707
push_trigger_undo, 727
reload_mute_groups, 710
reposition, 704
reset_sequences, 741
restore_playing_state, 715
rewind, 703
save_playing_state, 715
select_and_mute_group, 737
select_group_mute, 738
seq_in_playing_screen, 744
sequence_count, 695
sequence_key, 724
sequence_label, 724
sequence_max, 696
sequence_playing_change, 712
sequence_playing_off, 712
sequence_playing_on, 712
sequence_playing_toggle, 711
set_32nds_per_quarter, 698
set_active, 741
set_and_copy_mute_group, 739
set_beat_width, 697
set_beats_per_bar, 697
set_beats_per_minute, 742
set_clock, 750
set_clock_bus, 725
set_edit_sequence, 696
set_follow_transport, 702
set_group_mute_state, 714
set_have_redo, 731
set_have_undo, 731
set_input, 750
set_input_bus, 725
set_jack_mode, 700
set_jack_stop_tick, 701
set_jack_tick, 707
set_key_event, 749
set_key_group, 749
set_left_tick, 708
set_looping, 743
set_mode_group_learn, 738
set_mode_group_mute, 737
set_offset, 715
set_orig_ticks, 742
set_playback_mode, 746
set_playing_screenset, 736
set_reposition, 703
set_right_tick, 708
set_running, 745

set_screen_set_notepad, 735, 736
set_screenset, 730
set_sequence_control_status, 711
set_song_mute, 737
set_start_tick, 708
set_tick, 707
set_transpose, 710
set_was_active, 741
show_ui_sequence_key, 716
show_ui_sequence_number, 717
sm_mc_dummy, 755
song_start_mode, 700
split_trigger, 732
start, 739
start_from_perfedit, 702
start_jack, 740
start_key, 721
start_playing, 719
stop, 739
stop_jack, 740
stop_key, 721
stop_playing, 721
toggle_all_tracks, 713
toggle_follow_transport, 703
toggle_jack_mode, 700
toggle_other_names, 731
toggle_other_seqs, 730
toggle_playing_tracks, 713
toggle_song_start_mode, 699
unset_edit_sequence, 696
unset_mode_group_learn, 738
unset_mode_group_mute, 738
unset_sequence_control_status, 711
us_per_quarter_note, 698
valid_midi_control_seq, 745
seq64::performcallback, 766
on_grouplearnchange, 768
seq64::perfroll, 768
∼perfroll, 773
change_horz, 777
change_vert, 777
convert_drop_xy, 778
convert_x, 776
convert_xy, 776
draw_all, 775
draw_background_on, 777
draw_drawable_row, 777
draw_progress, 775
draw_sequence_on, 777
enqueue_draw, 778
fill_background_pixmap, 774
follow_progress, 775
FruityPerfInput, 782
horizontal_adjust, 778
horizontal_set, 779
increment_size, 774
init_before_show, 774
m_4bar_offset, 785
m_background_x, 784
m_beat_length, 785
m_divs_per_beat, 784
m_drop_sequence, 786
m_drop_tick, 786
m_drop_tick_trigger_offset, 786
m_fruity_interaction, 787
m_grow_direction, 787
m_growing, 787
m_h_page_increment, 783
m_have_button_press, 785
m_interaction, 787
m_measure_length, 785
m_moving, 787
m_names_y, 784
m_old_progress_ticks, 785
m_page_factor, 783
m_parent, 783
m_perf_scale_x, 784
m_ppqn, 783
m_roll_length_ticks, 786
m_seq24_interaction, 787
m_sequence_active, 786
m_sequence_max, 786
m_sequence_offset, 786
m_size_box_w, 784
m_snap, 783
m_ticks_per_bar, 784
m_trans_button_press, 785
m_transport_follow, 785
m_v_page_increment, 783
m_zoom, 784
on_button_press_event, 780
on_button_release_event, 780
on_expose_event, 780
on_focus_in_event, 781
on_focus_out_event, 781
on_key_press_event, 782
on_motion_notify_event, 781
on_realize, 779
on_scroll_event, 781
on_size_allocate, 781
on_size_request, 782
perfedit, 783
perfroll, 773
redraw_dirty_sequences, 775
redraw_progress, 775
Seq24PerfInput, 782
set_guides, 773
set_ppqn, 775
set_zoom, 778
snap_x, 777
split_trigger, 778
update_sizes, 774
vertical_adjust, 779
vertical_set, 779
seq64::perftime, 788
∼perftime, 791

change_horz, 792
draw_background, 792
draw_pixmap_on_window, 794
draw_progress_on_window, 792
enqueue_draw, 792
idle_progress, 794
increment_size, 792
key_press_event, 795
m_4bar_offset, 796
m_left_marker_tick, 797
m_measure_length, 797
m_parent, 796
m_perf_scale_x, 797
m_ppqn, 796
m_right_marker_tick, 797
m_snap, 797
m_tick_offset, 796
m_timearea_y, 797
on_button_press_event, 795
on_button_release_event, 795
on_expose_event, 794
on_realize, 794
on_size_allocate, 795
perfedit, 796
perftime, 790
pixel_to_tick, 793
reset, 791
set_guides, 791
set_ppqn, 792
set_scale, 791
set_zoom, 792
tick_offset, 793
tick_to_pixel, 793
update_pixmap, 794
update_sizes, 794
seq64::rc_settings, 799
allow_click_edit, 806, 811
allow_mod4_mode, 806, 811
allow_snap_split, 806, 811
app_client_name, 810
application_name, 810
auto_option_save, 806, 810
config_directory, 809, 814
config_filename, 809, 814
config_filename_alt, 810, 815
config_filespec, 805
device_ignore, 808, 813
device_ignore_num, 808, 813
filename, 808
filter_by_channel, 807, 812
help_check, 816
home_config_directory, 809
interaction_method, 808, 813
jack_session_uuid, 809, 814
lash_support, 806, 811
last_used_dir, 809
legacy_format, 806, 810
m_allow_click_edit, 817
m_allow_mod4_mode, 817
m_allow_snap_split, 817
m_app_client_name, 821
m_application_name, 820
m_auto_option_save, 817
m_config_directory, 820
m_config_filename, 820
m_config_filename_alt, 820
m_device_ignore, 819
m_device_ignore_num, 819
m_filename, 819
m_filter_by_channel, 819
m_interaction_method, 819
m_jack_session_uuid, 820
m_lash_support, 817
m_last_used_dir, 820
m_legacy_format, 817
m_manual_alsa_ports, 819
m_pass_sysex, 818
m_print_keys, 819
m_priority, 818
m_reveal_alsa_ports, 819
m_show_midi, 818
m_stats, 818
m_user_filename, 820
m_user_filename_alt, 820
m_with_jack_master, 818
m_with_jack_master_cond, 818
m_with_jack_midi, 818
m_with_jack_transport, 818
mainwnd, 816
manual_alsa_ports, 808, 812
operator=, 805
options, 815
optionsfile, 815
parse_command_line_options, 816
pass_sysex, 807, 812
print_keys, 808, 813
priority, 806, 811
rc_settings, 804
reveal_alsa_ports, 808, 813
rtmidi_info, 816
set_config_files, 814
set_defaults, 805
show_midi, 806, 811
stats, 807, 811
user_filename, 810, 815
user_filename_alt, 810, 815
user_filespec, 805
with_jack, 807
with_jack_master, 807, 812
with_jack_master_cond, 807, 812
with_jack_midi, 807, 812
with_jack_transport, 807, 812
seq64::rect, 821
height, 821
width, 822
x, 821

y, 821
seq64::rterror, 823
~rterror, 824
get_message, 825
getType, 825
m_message, 825
m_type, 825
print_message, 825
rterror, 824
Type, 824
what, 825
seq64::rtmidi, 826
~rtmidi, 828
api_clock, 829
api_connect, 828
api_continue_from, 829
api_deinit_in, 830
api_flush, 831
api_get_midi_event, 830
api_init_in, 830
api_init_in_sub, 830
api_init_out, 830
api_init_out_sub, 830
api_play, 828
api_poll_for_midi, 831
api_set_beats_per_minute, 829
api_set_ppqn, 829
api_start, 829
api_stop, 829
api_sysex, 831
delete_api, 833
full_port_count, 832
get_api, 832, 833
get_bus_id, 831
get_bus_name, 831
get_port_count, 832
get_port_id, 832
get_port_name, 832
is_port_open, 831
m_midi_api, 833
m_midi_info, 833
midibus, 833
rtmidi, 828
set_api, 833
seq64::rtmidi_in, 834
~rtmidi_in, 836
cancel_callback, 837
openmidi_api, 837
rtmidi_in, 836
user_callback, 837
seq64::rtmidi_in_data, 838
api_data, 841
continue_sysex, 840
do_input, 840
first_message, 840
ignore_flags, 839, 840
m_api_data, 843
m_continue_sysex, 843
m_do_input, 842
m_first_message, 843
m_ignore_flags, 842
m_message, 842
m_queue, 842
m_user_callback, 843
m_user_data, 843
m_using_callback, 843
message, 839
queue, 839
rtmidi_in_data, 839
test_ignore_flags, 839
user_callback, 842
user_data, 841, 842
using_callback, 841
seq64::rtmidi_info, 843
~rtmidi_info, 846
add_bus, 847
add_input, 847
add_output, 847
api_connect, 851
api_flush, 850
api_get_midi_event, 850
api_poll_for_midi, 850
api_port_start, 850
api_set_beats_per_minute, 850
api_set_ppqn, 850
app_name, 849
bpm, 850
clear, 847
delete_api, 852
full_port_count, 848
get_all_port_info, 849
get_api_info, 851
get_bus_id, 847
get_bus_name, 848
get_compiled_api, 846
get_input, 848
get_port_count, 848
get_port_id, 848
get_port_name, 848
get_system, 849
get_version, 846
get_virtual, 849
global_queue, 849
m_info_api, 853
mastermidibus, 852
midi_mode, 846, 847
midibus, 852
openmidi_api, 852
port_list, 851
ppqn, 849
queue_number, 849
rtmidi_in, 853
rtmidi_info, 846
rtmidi_out, 853
selected_api, 851
set_api_info, 851

sm_selected_api, 853
seq64::rtmidi_out, 854
~rtmidi_out, 855
openmidi_api, 856
rtmidi_out, 855
seq64::seqdata, 862
~seqdata, 866
change_horz, 869
convert_x, 869
draw_events_on, 869
draw_events_on_pixmap, 870
draw_line_on_window, 867
draw_pixmap_on_window, 870
idle_redraw, 867
lfownd, 873
m_cc, 874
m_drag_handle, 875
m_dragging, 875
m_number_h, 874
m_number_offset_y, 874
m_number_w, 874
m_numbers, 874
m_old, 874
m_scroll_offset_ticks, 873
m_scroll_offset_x, 874
m_seq, 873
m_status, 874
m_zoom, 873
on_button_press_event, 871
on_button_release_event, 871
on_expose_event, 870
on_leave_notify_event, 872
on_motion_notify_event, 871
on_realize, 870
on_scroll_event, 872
on_size_allocate, 872
redraw, 866
render_number, 870
reset, 866
seqdata, 865
seqevent, 873
seqroll, 873
set_data_type, 867
set_zoom, 866
update_pixmap, 867
update_sizes, 867
xy_to_rect, 867
seq64::seqedit, 875
~seqedit, 883
apply_length, 887
change_focus, 893
create_menu_image, 892
create_menus, 891
do_action, 892
fill_top_bar, 890
get_measures, 887
handle_close, 893
horizontal_adjust, 886
horizontal_set, 886
m_bgsequence, 897
m_button_bpm, 906
m_button_bus, 903
m_button_bw, 906
m_button_channel, 903
m_button_chord, 905
m_button_data, 906
m_button_key, 905
m_button_length, 904
m_button_lfo, 902
m_button_note_length, 904
m_button_quantize, 903
m_button_rec_vol, 906
m_button_redo, 903
m_button_scale, 905
m_button_sequence, 903
m_button_snap, 904
m_button_tools, 903
m_button_undo, 902
m_button_zoom, 904
m_chord, 897
m_editing_cc, 907
m_editing_status, 907
m_entry_bpm, 906
m_entry_bus, 903
m_entry_bw, 906
m_entry_channel, 904
m_entry_chord, 905
m_entry_data, 906
m_entry_key, 905
m_entry_length, 905
m_entry_name, 907
m_entry_note_length, 904
m_entry_scale, 905
m_entry_sequence, 903
m_entry_snap, 904
m_entry_zoom, 904
m_hadjust, 901
m_have_focus, 907
m_hbox, 902
m_hbox2, 902
m_hscroll_new, 901
m_image_transpose, 899
m_initial_chord, 896
m_initial_note_length, 896
m_initial_snap, 896
m_initial_zoom, 896
m_key, 897
m_lfo_wnd, 902
m_measures, 897
m_menu_bpm, 900
m_menu_bw, 900
m_menu_chords, 900
m_menu_data, 900
m_menu_key, 900
m_menu_length, 899
m_menu_midibus, 899

m_menu_midich, 899
m_menu_note_length, 899
m_menu_rec_vol, 900
m_menu_scale, 900
m_menu_sequences, 900
m_menu_snap, 899
m_menu_tools, 898
m_menu_zoom, 899
m_menubar, 898
m_note_length, 897
m_pp_eighth, 898
m_pp_sixteenth, 898
m_pp_whole, 898
m_ppqn, 898
m_scale, 897
m_seq, 898
m_seqdata_wid, 901
m_seqevent_wid, 901
m_seqkeys_wid, 901
m_seqroll_wid, 902
m_seqtime_wid, 901
m_snap, 897
m_table, 902
m_toggle_play, 906
m_toggle_q_rec, 907
m_toggle_record, 907
m_toggle_thru, 907
m_toggle_transpose, 899
m_tooltips, 905
m_vadjust, 901
m_vbox, 902
m_vscroll_new, 901
m_zoom, 897
mouse_action, 893
name_change_callback, 889
on_delete_event, 894
on_focus_in_event, 894
on_focus_out_event, 894
on_key_press_event, 895
on_realize, 893
on_scroll_event, 894
on_set_focus, 894
play_change_callback, 889
popup_event_menu, 891
popup_menu, 891
popup_midibus_menu, 891
popup_midich_menu, 892
popup_sequence_menu, 892
popup_tool_menu, 892
q_rec_change_callback, 889
record_change_callback, 889
redo_callback, 890
seqedit, 883
seqmenu, 896
set_background_sequence, 888
set_beat_width, 885
set_beats_per_bar, 884
set_chord, 888
set_data_type, 890
set_key, 888
set_measures, 887
set_midi_bus, 888
set_midi_channel, 887
set_note_length, 884
set_rec_vol, 885
set_scale, 888
set_snap, 884
set_transpose_image, 885
set_zoom, 883
start_playing, 893
stop_playing, 893
thru_change_callback, 889
timeout, 892
transpose_change_callback, 889
undo_callback, 890
update_all_windows, 890
vertical_adjust, 886
vertical_set, 886
seq64::seqevent, 908
~seqevent, 911
change_horz, 915
convert_t, 916
convert_x, 915
draw_background, 913
draw_events_on, 915
draw_events_on_pixmap, 913
draw_pixmap_on_window, 913
draw_selection_on_window, 913
drop_event, 914
force_draw, 914
FruitySeqEventInput, 919
idle_redraw, 914
m_cc, 922
m_fruity_interaction, 920
m_growing, 921
m_move_snap_offset_x, 922
m_moving, 921
m_moving_init, 921
m_old, 920
m_painting, 921
m_paste, 922
m_ppqn, 920
m_scroll_offset_ticks, 921
m_scroll_offset_x, 921
m_selected, 920
m_selecting, 921
m_seq, 920
m_seq24_interaction, 920
m_seqdata_wid, 921
m_snap, 920
m_status, 922
m_zoom, 920
on_button_press_event, 917
on_button_release_event, 917
on_expose_event, 917
on_focus_in_event, 918

on_focus_out_event, 918
on_key_press_event, 918
on_motion_notify_event, 918
on_realize, 916
on_size_allocate, 919
redraw, 912
reset, 912
Seq24SeqEventInput, 919
seqevent, 911
set_data_type, 912
set_snap, 912
set_zoom, 912
snap_x, 916
snap_y, 916
start_paste, 915
update_pixmap, 913
update_sizes, 913
x_to_w, 914
seq64::seqkeys, 922
~seqkeys, 926
change_vert, 929
convert_y, 928
draw_area, 928
draw_key, 928
force_draw, 927
FruitySeqRollInput, 932
is_black_key, 929
m_hint_key, 933
m_hint_state, 933
m_key, 933
m_keying, 933
m_keying_note, 933
m_scale, 933
m_scroll_offset_key, 932
m_scroll_offset_y, 933
m_seq, 932
m_show_octave_letters, 933
on_button_press_event, 930
on_button_release_event, 930
on_enter_notify_event, 931
on_expose_event, 930
on_leave_notify_event, 931
on_motion_notify_event, 931
on_realize, 929
on_scroll_event, 931
on_size_allocate, 932
reset, 929
seqkeys, 925
seqroll, 932
set_hint_key, 926
set_hint_state, 927
set_key, 926
set_listen_button_press, 927
set_listen_button_release, 927
set_listen_motion_notify, 927
set_scale, 926
update_pixmap, 928
update_sizes, 929
seq64::seqmenu, 934
~seqmenu, 939
const_iterator, 938
create_seqedit, 942
current_seq, 939
delete_current_sequence, 941
get_current_sequence, 940
get_sequence, 940
is_current_seq_active, 940
is_current_seq_in_edit, 940
is_edit_sequence, 940
is_modified, 939, 940
iterator, 938
m_clipboard, 946
m_current_seq, 946
m_eventedit, 946
m_mainperf, 946
m_menu, 946
m_modified, 947
m_seqedit, 946
mainwnd, 945
mute_all_tracks, 945
new_current_sequence, 940
new_sequence, 941
on_realize, 945
popup_menu, 941
redraw, 943
remove_seqedit, 942
seq_clear_perf, 944
seq_copy, 943
seq_cut, 943
seq_edit, 941
seq_event_edit, 941
seq_new, 943
seq_paste, 944
seq_set_and_edit, 942
seq_set_and_eventedit, 943
seqedit, 945
SeqeditMap, 938
SeqeditPair, 938
seqmenu, 938
set_bus_and_midi_channel, 944
set_edit_sequence, 939
set_transposable, 944
sm_seqedit_list, 946
toggle_all_tracks, 945
toggle_current_sequence, 941
unmute_all_tracks, 945
unset_edit_sequence, 939
seq64::seqroll, 947
~seqroll, 954
add_chord, 955
add_note, 955
adding, 969
align_selection, 966
button_press, 966
button_press_initial, 965
button_release, 966

change_horz, 964
change_vert, 964
clear_flags, 967
clear_old, 967
clear_selected, 967
complete_paste, 959
convert_sel_box_to_rect, 962
convert_tn, 961
convert_tn_box_to_rect, 962
convert_xy, 961
draw_background_on_pixmap, 957
draw_events_on, 963
draw_events_on_pixmap, 957
draw_progress_on_window, 958
draw_selection_on_window, 958
drop_action, 970
follow_progress, 959
force_draw, 959
FruitySeqRollInput, 975
get_selected_box, 963
grow_selected_notes, 965
growing, 970
horizontal_adjust, 959
idle_progress, 963
idle_redraw, 963
m_adding, 977
m_background_sequence, 979
m_cc, 980
m_chord, 977
m_drawing_background_seq, 979
m_fruity_interaction, 976
m_growing, 977
m_horizontal_adjust, 975
m_is_drag_pasting, 978
m_is_drag_pasting_start, 978
m_justselected_one, 978
m_key, 977
m_move_delta_x, 978
m_move_delta_y, 978
m_move_snap_offset_x, 978
m_moving, 977
m_moving_init, 977
m_note_length, 976
m_old, 975
m_painting, 977
m_paste, 978
m_pos, 976
m_ppqn, 976
m_progress_x, 978
m_scale, 976
m_scroll_offset_key, 979
m_scroll_offset_ticks, 979
m_scroll_offset_x, 979
m_scroll_offset_y, 979
m_selected, 975
m_selecting, 977
m_seq, 975
m_seqkeys_wid, 976
m_snap, 976
m_status, 980
m_trans_button_press, 979
m_transport_follow, 979
m_vertical_adjust, 975
m_zoom, 976
motion_notify, 967
move_selected_notes, 964
move_selection_box, 964
moving, 970
normal_action, 970
note_off_length, 955
on_button_press_event, 971
on_button_release_event, 971
on_enter_notify_event, 974
on_expose_event, 971
on_focus_in_event, 972
on_focus_out_event, 972
on_key_press_event, 973
on_leave_notify_event, 974
on_motion_notify_event, 972
on_realize, 971
on_scroll_event, 973
on_size_allocate, 974
redraw, 959
redraw_events, 959
reset, 958
scroll_offset_x, 967
scroll_offset_y, 969
select_action, 970
selecting, 970
seqroll, 953
set_adding, 965
set_background_sequence, 956
set_chord, 956
set_current_offset_x_y, 969
set_data_type, 956
set_key, 956
set_note_length, 955
set_scale, 956
set_snap, 954
set_zoom, 954
snap_x, 960
snap_y, 960
start_paste, 959
update_and_draw, 958
update_background, 957
update_mouse_pointer, 965
update_pixmap, 957
update_sizes, 957
vertical_adjust, 960
xy_to_rect, 961
seq64::seqtime, 980
~seqtime, 983
change_horz, 984
draw_pixmap_on_window, 983
draw_progress_on_window, 983
idle_progress, 985

m_ppqn, 986
m_scroll_offset_ticks, 986
m_scroll_offset_x, 986
m_seq, 986
m_zoom, 986
on_button_press_event, 985
on_button_release_event, 985
on_expose_event, 985
on_realize, 985
on_size_allocate, 985
redraw, 983
reset, 983
seqtime, 982
set_zoom, 983
update_pixmap, 984
update_sizes, 984
seq64::sequence, 986
~sequence, 998
add_chord, 1015
add_event, 1015, 1016
add_note, 1014
add_trigger, 1017
adjust_offset, 1048
adjust_timestamp, 1031
adjust_trigger_offsets_to_length, 1048
any_selected_notes, 999
append_event, 1016
apply_song_transpose, 1006
background_sequence, 1045, 1046
change_event_data_lfo, 1035
change_event_data_range, 1034
channel_match, 1049
check_queued_tick, 1010
clear_triggers, 1024
clip_timestamp, 1032
clocks_per_metronome, 1004
copy_events, 1046
copy_selected, 1029
copy_selected_trigger, 1021
copy_triggers, 1023
cut_selected, 1029
cut_selected_trigger, 1021
decrement_selected, 1036
del_selected_trigger, 1021
del_trigger, 1018
event_count, 1000
event_in_range, 1046
EventStack, 997
events, 999
get_32nds_per_quarter, 1004
get_beat_width, 1004
get_beats_per_bar, 1003
get_clipboard_box, 1031
get_editing, 1006
get_hold_undo, 1001
get_last_tick, 1008
get_length, 1008
get_max_trigger, 1023
get_measures, 1003
get_midi_bus, 1024
get_midi_channel, 1012
get_minmax_note_events, 1042
get_name, 1006
get_next_event, 1042, 1043
get_next_note_event, 1040
get_next_trigger, 1043
get_num_selected_events, 1028
get_num_selected_notes, 1028
get_playing, 1009
get_ppqn, 1003
get_quantized_rec, 1010
get_queued, 1009
get_queued_tick, 1009
get_raise, 1007
get_recording, 1010
get_selected_box, 1030
get_song_mute, 1005
get_thru, 1011
get_transposable, 1006
get_trigger_count, 999
get_trigger_offset, 1024
get_trigger_paste_tick, 999
get_trigger_state, 1018
get_triggers, 1019
grow_selected, 1037
grow_trigger, 1018
have_redo, 1001
have_undo, 1001
increment_selected, 1036
intersect_events, 1021
intersect_notes, 1020
intersect_triggers, 1019
is_dirty_edit, 1011
is_dirty_main, 1011
is_dirty_names, 1011
is_dirty_perf, 1011
is_smf_0, 1012
link_new, 1039
m_32nds_per_quarter, 1055
m_background_sequence, 1056
m_bus, 1051
m_channel_match, 1051
m_clocks_per_metronome, 1055
m_dirty_edit, 1053
m_dirty_main, 1053
m_dirty_names, 1053
m_dirty_perf, 1053
m_editing, 1053
m_events, 1050
m_events_clipboard, 1050
m_events_redo, 1051
m_events_undo, 1051
m_events_undo_hold, 1050
m_have_redo, 1051
m_have_undo, 1050
m_iterator_draw, 1051

m_last_tick, 1054
m_length, 1055
m_masterbus, 1052
m_maxbeats, 1054
m_midi_channel, 1051
m_musical_key, 1056
m_musical_scale, 1056
m_mutex, 1056
m_name, 1054
m_note_off_margin, 1057
m_note_off_velocity, 1056
m_note_on_velocity, 1056
m_notes_on, 1052
m_parent, 1050
m_playing, 1052
m_playing_notes, 1052
m_ppqn, 1054
m_quantized_rec, 1053
m_queued, 1053
m_queued_tick, 1054
m_raise, 1054
m_rec_vol, 1056
m_recording, 1052
m_seq_number, 1054
m_snap_tick, 1055
m_song_mute, 1052
m_thru, 1053
m_time_beat_width, 1055
m_time_beats_per_measure, 1055
m_transposable, 1052
m_trigger_offset, 1054
m_triggers, 1050
m_us_per_quarter_note, 1055
m_was_playing, 1052
mark_selected, 1038
measures_to_ticks, 1004
mod_last_tick, 1008
modify, 1000
move_selected_notes, 1033
move_selected_triggers_to, 1022
move_triggers, 1023
multiply_pattern, 1045
musical_key, 1045
musical_scale, 1045
name, 1006
note_off_margin, 1046
number, 1000
off_playing_notes, 1039
off_queued, 1009
on_queued, 1009
operator=, 998
partial_assign, 998
paste_selected, 1030
paste_trigger, 1021
pause, 1040
perform, 1049
play, 1013
play_note_off, 1039
play_note_on, 1039
play_queue, 1013
pop_redo, 1002
pop_trigger_redo, 1002
pop_trigger_undo, 1002
pop_undo, 1002
print, 1013
print_triggers, 1013
push_quantize, 1044
push_trigger_undo, 1002
push_undo, 1001
put_event_on_bus, 1047
quantize_events, 1043
remove, 1048, 1049
remove_all, 1049
remove_marked, 1038
remove_selected, 1038
reset_draw_marker, 1040
reset_draw_trigger_marker, 1040
select_action_e, 997
select_all, 1029
select_all_notes, 1028
select_even_or_odd_notes, 1028
select_event_handle, 1027
select_events, 1025, 1026
select_linked, 1027
select_note_events, 1025
select_trigger, 1019
selected_trigger_end, 1022
selected_trigger_start, 1022
sequence, 998
set_32nds_per_quarter, 1004
set_beat_width, 1003
set_beats_per_bar, 1003
set_dirty, 1012
set_dirty_mp, 1012
set_editing, 1006
set_have_redo, 1001
set_have_undo, 1001
set_hold_undo, 1000
set_last_tick, 1008
set_length, 1007
set_master_midi_bus, 1024
set_measures, 1003
set_midi_bus, 1024
set_midi_channel, 1012
set_name, 1002
set_parent, 1047
set_playing, 1008
set_quantized_rec, 1010
set_raise, 1007
set_rec_vol, 1005
set_recording, 1010
set_snap_tick, 1010
set_song_mute, 1005
set_thru, 1010
set_transposable, 1006
set_trigger_offset, 1048

set_trigger_paste_tick, 999
shift_notes, 1045
show_events, 1046
sort_events, 1017
split_trigger, 1017
stop, 1040
stream_event, 1033
stretch_selected, 1037
toggle_playing, 1009
toggle_queued, 1009
toggle_song_mute, 1005
transpose_notes, 1044
triggerlist, 999
triggers, 1050
trim_timestamp, 1032
unpaint_all, 1038
unselect, 1038
unselect_triggers, 1019
us_per_quarter_note, 1005
verify_and_link, 1038
zero_markers, 1039
seq64::trigger, 1057
decrement_offset, 1060
decrement_tick_end, 1060
decrement_tick_start, 1059
increment_offset, 1060
increment_tick_end, 1059
increment_tick_start, 1059
length, 1058
m_offset, 1061
m_selected, 1061
m_tick_end, 1061
m_tick_start, 1061
offset, 1060
operator<, 1058
selected, 1060
tick_end, 1059
tick_start, 1059
trigger, 1058
seq64::triggers, 1061
~triggers, 1065
add, 1067
adjust_offset, 1075
adjust_offsets_to_length, 1068
clear, 1073
copy, 1072
copy_selected, 1070
FruityPerfInput, 1076
get_maximum, 1072
get_selected_end, 1072
get_selected_start, 1071
get_state, 1069
get_trigger_paste_tick, 1075
grow, 1068
grow_edit_t, 1064
intersect, 1070
List, 1064
m_clipboard, 1076
m_iterator_draw_trigger, 1077
m_iterator_play_trigger, 1077
m_length, 1077
m_parent, 1076
m_paste_tick, 1077
m_ppqn, 1077
m_redo_stack, 1077
m_trigger_copied, 1077
m_triggers, 1076
m_undo_stack, 1077
midi_container, 1075
midifile, 1076
move, 1072
move_selected, 1071
next, 1074
next_trigger, 1074
operator=, 1065
paste, 1070
play, 1067
pop_redo, 1066
pop_undo, 1066
print, 1066
push_undo, 1066
remove, 1069
remove_selected, 1070
reset_draw_trigger_marker, 1074
select, 1069
Seq24PerfInput, 1076
sequence, 1076
set_length, 1066
set_ppqn, 1066
set_trigger_paste_tick, 1074
split, 1068, 1075
Stack, 1064
triggerlist, 1066
triggers, 1065
unselect, 1070
seq64::user_instrument, 1078
controller_active, 1081
controller_count, 1080
controller_max, 1080
controller_name, 1080
copy_definitions, 1082
is_valid, 1080
m_controller_count, 1082
m_instrument_def, 1082
m_is_valid, 1082
name, 1080
operator=, 1079
set_controller, 1081
set_defaults, 1080
set_name, 1081
user_instrument, 1079
seq64::user_instrument_t, 1082
controllers, 1083
controllers_active, 1083
instrument, 1083
seq64::user_midi_bus, 1083

channel_count, 1086
channel_max, 1086
copy_definitions, 1087
instrument, 1086
is_valid, 1085
m_channel_count, 1087
m_is_valid, 1087
m_midi_bus_def, 1087
name, 1085
operator=, 1085
set_defaults, 1085
set_instrument, 1086
set_name, 1087
user_midi_bus, 1084, 1085
seq64::user_midi_bus_t, 1088
alias, 1088
instrument, 1088
seq64::user_settings, 1088
add_bus, 1098
add_instrument, 1099
allow_two_perfedits, 1106, 1111
baseline_ppqn, 1111
bpm_page_increment, 1110, 1113
bpm_precision, 1110, 1113
bpm_step_increment, 1110, 1113
bus, 1099
bus_count, 1099
bus_instrument, 1099
bus_name, 1099
BussConstIterator, 1097
BussIterator, 1097
Busses, 1096
control_height, 1104, 1109
controller_active, 1100
controller_name, 1101
dump_summary, 1109
global_seq_feature, 1104
gmute_tracks, 1102
grid_brackets, 1101, 1107
grid_is_black, 1101
grid_is_normal, 1101
grid_is_white, 1101
grid_style, 1101, 1107
instrument, 1099
instrument_controller_active, 1100
instrument_controller_name, 1101
instrument_count, 1100
instrument_name, 1100
InstrumentConstIterator, 1097
InstrumentIterator, 1097
Instruments, 1097
inverse_colors, 1106, 1112
m_allow_two_perfedits, 1117
m_bpm_page_increment, 1121
m_bpm_precision, 1121
m_bpm_step_increment, 1121
m_control_height, 1116
m_current_zoom, 1116
m_global_seq_feature_save, 1116
m_gmute_tracks, 1122
m_grid_brackets, 1115
m_grid_style, 1115
m_h_perf_page_increment, 1118
m_instruments, 1115
m_inverse_colors, 1118
m_mainwid_border, 1116
m_mainwid_spacing, 1116
m_mainwid_x, 1123
m_mainwid_y, 1123
m_mainwnd_cols, 1116
m_mainwnd_rows, 1115
m_max_sequence, 1122
m_max_sets, 1116
m_midi_beat_width, 1120
m_midi_beats_per_measure, 1120
m_midi_beats_per_minute, 1120
m_midi_buses, 1115
m_midi_buss_override, 1120
m_midi_ppqn, 1119
m_progress_bar_colored, 1118
m_progress_bar_thick, 1118
m_save_user_config, 1123
m_seqarea_seq_x, 1122
m_seqarea_seq_y, 1122
m_seqarea_x, 1122
m_seqarea_y, 1122
m_seqchars_x, 1119
m_seqchars_y, 1119
m_seqedit_bgsequence, 1117
m_seqedit_key, 1117
m_seqedit_scale, 1117
m_seqs_in_set, 1121
m_text_x, 1119
m_text_y, 1119
m_total_seqs, 1121
m_use_more_icons, 1118
m_use_new_font, 1117
m_user_option_daemonize, 1124
m_user_option_logfile, 1124
m_v_perf_page_increment, 1118
m_velocity_override, 1120
m_window_redraw_rate_ms, 1118
mainwid_border, 1103, 1109
mainwid_grid_style_t, 1097
mainwid_spacing, 1103, 1109
mainwid_x, 1104
mainwid_y, 1104
mainwnd_cols, 1102, 1107
mainwnd_rows, 1102, 1107
max_sequence, 1102
max_sets, 1102, 1107
max_zoom, 1111
mc_baseline_ppqn, 1123
mc_max_zoom, 1123
mc_min_zoom, 1123
midi_beat_width, 1110, 1114

midi_beats_per_bar, 1109, 1114
midi_beats_per_minute, 1110, 1114
midi_buss_override, 1110, 1113
midi_ppqn, 1109, 1113
min_zoom, 1110
normalize, 1098
operator=, 1098
option_daemonize, 1111, 1112
option_logfile, 1111, 1113
perf_h_page_increment, 1106, 1111
perf_v_page_increment, 1106, 1112
private_bus, 1114
private_instrument, 1114
progress_bar_colored, 1106, 1112
progress_bar_thick, 1106, 1112
save_user_config, 1107
seqarea_seq_x, 1103, 1108
seqarea_seq_y, 1103, 1109
seqarea_x, 1103, 1108
seqarea_y, 1103, 1108
seqchars_x, 1103, 1108
seqchars_y, 1103, 1108
seqedit_bgsequence, 1105
seqedit_key, 1105
seqedit_scale, 1105
seqs_in_set, 1102
set_bus_instrument, 1099
set_defaults, 1098
set_instrument_controllers, 1100
text_x, 1102, 1108
text_y, 1102, 1108
use_more_icons, 1106, 1112
use_new_font, 1105, 1111
user_settings, 1098
userfile, 1114
velocity_override, 1110, 1113
window_redraw_rate, 1106, 1112
zoom, 1104
seq64::userfile, 1124
~userfile, 1126
dump_setting_summary, 1127
parse, 1126
userfile, 1126
write, 1126
seq_app_name
seq64, 103
seq_clear_perf
seq64::seqmenu, 944
seq_client_name
seq64, 103
seq_copy
seq64::seqmenu, 943
seq_cut
seq64::seqmenu, 943
seq_edit
seq64::seqmenu, 941
seq_event_edit
seq64::seqmenu, 941
seq_event_type_t
seq64, 67
seq_from_xy
seq64::mainwid, 410
seq_in_playing_screen
seq64::perform, 744
seq_modifier_t
seq64, 66
seq_new
seq64::seqmenu, 943
seq_number_size
seq64::midifile, 637
seq_paste
seq64::seqmenu, 944
seq_scroll_direction_t
seq64, 67
seq_set_and_edit
seq64::mainwid, 408
seq64::seqmenu, 942
seq_set_and_eventedit
seq64::mainwid, 408
seq64::seqmenu, 943
seq_version
seq64, 103
seqarea_seq_x
seq64::user_settings, 1103, 1108
seqarea_seq_y
seq64::user_settings, 1103, 1109
seqarea_x
seq64::user_settings, 1103, 1108
seqarea_y
seq64::user_settings, 1103, 1108
seqchars_x
seq64::user_settings, 1103, 1108
seqchars_y
seq64::user_settings, 1103, 1108
seqdata
seq64::seqdata, 865
seqedit
seq64::seqedit, 883
seq64::seqmenu, 945
seqedit_bgsequence
seq64::user_settings, 1105
seqedit_key
seq64::user_settings, 1105
seqedit_scale
seq64::user_settings, 1105
SeqeditMap
seq64::seqmenu, 938
SeqeditPair
seq64::seqmenu, 938
seqevent
seq64::seqdata, 873
seq64::seqevent, 911
seqkeys
seq64::seqkeys, 925
seqmenu
seq64::seqedit, 896

seq64::seqmenu, 938
seqroll
seq64::seqdata, 873
seq64::seqkeys, 932
seq64::seqroll, 953
seqs_in_set
seq64::user_settings, 1102
seqspec_string
seq64::editable_event, 178
seqtime
seq64::seqtime, 982
sequence
seq64::event_list, 224
seq64::sequence, 998
seq64::triggers, 1076
sequence_count
seq64::perform, 695
sequence_key
seq64::mainwnd, 427
seq64::perform, 724
sequence_label
seq64::perform, 724
sequence_max
seq64::perform, 696
sequence_playing_change
seq64::perform, 712
sequence_playing_off
seq64::perform, 712
sequence_playing_on
seq64::perform, 712
sequence_playing_toggle
seq64::perform, 711
session_event
seq64::jack_assistant, 324
set
seq64::keybindentry, 345
seq64::midi_control, 507
set_32nds_per_quarter
seq64::perform, 698
seq64::sequence, 1004
set_active
seq64::perform, 741
set_adding
seq64::AbstractPerfInput, 138
seq64::Seq24SeqEventInput, 860
seq64::seqroll, 965
set_adding_pressed
seq64::AbstractPerfInput, 138
set_all_clocks
seq64::busarray, 145
set_all_inputs
seq64::busarray, 148
set_all_key_events
seq64::keys_perform, 366
seq64::keys_perform_gtk2, 378
set_all_key_groups
seq64::keys_perform, 366
seq64::keys_perform_gtk2, 379
set_alsa_client_id
seq64::lash, 389
set_alt_name
seq64::midibase, 596
set_and_copy_mute_group
seq64::perform, 739
set_api
seq64::rtmidi, 833
set_api_info
seq64::rtmidi_info, 851
set_background_sequence
seq64::seqedit, 888
seq64::seqroll, 956
set_beat_width
seq64::jack_assistant, 321
seq64::perfedit, 662
seq64::perform, 697
seq64::seqedit, 885
seq64::sequence, 1003
set_beats_per_bar
seq64::perfedit, 662
seq64::perform, 697
seq64::seqedit, 884
seq64::sequence, 1003
set_beats_per_measure
seq64::jack_assistant, 322
set_beats_per_minute
seq64::jack_assistant, 322
seq64::mastermidibase, 453
seq64::perform, 742
set_bus_and_midi_channel
seq64::seqmenu, 944
set_bus_id
seq64::midibase, 595
set_bus_instrument
seq64::user_settings, 1099
set_channel
seq64::event, 201
set_chord
seq64::seqedit, 888
seq64::seqroll, 956
set_clock
seq64::busarray, 145
seq64::mastermidibase, 451
seq64::midibase, 594
seq64::perform, 750
set_clock_bus
seq64::perform, 725
set_clock_mod
seq64::midibase, 597
set_clock_status
seq64::midibase, 594
set_config_files
seq64::rc_settings, 814
set_controller
seq64::user_instrument, 1081
set_current_drop_x
seq64::gui_drawingarea_gtk2, 297

set_current_drop_y
seq64::gui_drawingarea_gtk2, 297
set_current_event
seq64::eventslots, 247
set_current_offset_x_y
seq64::seqroll, 969
set_data
seq64::event, 202
set_data_type
seq64::seqdata, 867
seq64::seqedit, 890
seq64::seqevent, 912
seq64::seqroll, 956
set_defaults
seq64::rc_settings, 805
seq64::user_instrument, 1080
seq64::user_midi_bus, 1085
seq64::user_settings, 1098
set_dirty
seq64::eventedit, 233
seq64::sequence, 1012
set_dirty_mp
seq64::sequence, 1012
set_edit_sequence
seq64::perform, 696
seq64::seqmenu, 939
set_editing
seq64::sequence, 1006
set_error_message
seq64::configfile, 166
set_event_category
seq64::eventedit, 232
set_event_data_0
seq64::eventedit, 232
set_event_data_1
seq64::eventedit, 232
set_event_name
seq64::eventedit, 232
set_event_timestamp
seq64::eventedit, 232
set_follow_transport
seq64::jack_assistant, 328
seq64::perfedit, 661
seq64::perform, 702
set_group_mute_state
seq64::perform, 714
set_guides
seq64::perfedit, 663
seq64::perfroll, 773
seq64::perftime, 791
set_have_redo
seq64::perform, 731
seq64::sequence, 1001
set_have_undo
seq64::perform, 731
seq64::sequence, 1001
set_hint_key
seq64::seqkeys, 926
set_hint_state
seq64::seqkeys, 927
set_hold_undo
seq64::sequence, 1000
set_image
seq64::perfedit, 664
set_input
seq64::busarray, 147
seq64::mastermidibase, 452
seq64::midibase, 601
seq64::perform, 750
set_input_bus
seq64::perform, 725
set_input_status
seq64::midibase, 595
set_instrument
seq64::user_midi_bus, 1086
set_instrument_controllers
seq64::user_settings, 1100
set_jack_mode
seq64::jack_assistant, 327
seq64::perfedit, 661
seq64::perform, 700
set_jack_running
seq64::jack_assistant, 329
set_jack_stop_tick
seq64::jack_assistant, 327
seq64::perform, 701
set_jack_tick
seq64::perform, 707
set_key
seq64::seqedit, 888
seq64::seqkeys, 926
seq64::seqroll, 956
set_key_event
seq64::keys_perform, 367
seq64::perform, 749
set_key_group
seq64::keys_perform, 367
seq64::perform, 749
set_keys
seq64::keys_perform, 354
set_last_tick
seq64::sequence, 1008
set_left_tick
seq64::perform, 708
set_length
seq64::sequence, 1007
seq64::triggers, 1066
set_line
seq64::gui_drawingarea_gtk2, 287
set_listen_button_press
seq64::seqkeys, 927
set_listen_button_release
seq64::seqkeys, 927
set_listen_motion_notify
seq64::seqkeys, 927
set_looped

seq64::perfedit, 663
set_looping
seq64::perform, 743
set_master_midi_bus
seq64::sequence, 1024
set_measures
seq64::seqedit, 887
seq64::sequence, 1003
set_midi_bus
seq64::seqedit, 888
seq64::sequence, 1024
set_midi_channel
seq64::seqedit, 887
seq64::sequence, 1012
set_mode_group_learn
seq64::perform, 738
set_mode_group_mute
seq64::perform, 737
set_multi_name
seq64::midibase, 596
set_name
seq64::midibase, 595
seq64::sequence, 1002
seq64::user_instrument, 1081
seq64::user_midi_bus, 1087
set_note
seq64::event, 207
set_note_length
seq64::seqedit, 884
seq64::seqroll, 955
set_note_velocity
seq64::event, 208
set_offset
seq64::perform, 715
set_orig_ticks
seq64::perform, 742
set_parent
seq64::sequence, 1047
set_play_image
seq64::mainwnd, 425
set_playback_mode
seq64::perform, 746
set_playing
seq64::sequence, 1008
set_playing_screenset
seq64::keys_perform, 358
seq64::perform, 736
set_port_id
seq64::midibase, 601
set_port_open
seq64::midi_api, 493
set_position
seq64::jack_assistant, 332
set_ppqn
seq64::jack_assistant, 326
seq64::mastermidibase, 453
seq64::perfroll, 775
seq64::perftime, 792
seq64::triggers, 1066
set_quantized_rec
seq64::sequence, 1010
set_raise
seq64::sequence, 1007
set_rec_vol
seq64::seqedit, 885
seq64::sequence, 1005
set_recording
seq64::sequence, 1010
set_reposition
seq64::perform, 703
set_right_tick
seq64::perform, 708
set_running
seq64::perform, 745
set_scale
seq64::perftime, 791
seq64::seqedit, 888
seq64::seqkeys, 926
seq64::seqroll, 956
set_screen_set_notepad
seq64::perform, 735, 736
set_screenset
seq64::mainwid, 407
seq64::perform, 730
set_seq_count
seq64::eventedit, 231
set_seq_ppqn
seq64::eventedit, 231
set_seq_time_sig
seq64::eventedit, 231
set_seq_title
seq64::eventedit, 231
set_sequence_control_status
seq64::perform, 711
set_sequence_input
seq64::mastermidibase, 449
set_snap
seq64::perfedit, 662
seq64::seqedit, 884
seq64::seqevent, 912
seq64::seqroll, 954
set_snap_tick
seq64::sequence, 1010
set_song_mute
seq64::mainwnd, 428
seq64::perform, 737
seq64::sequence, 1005
set_songlive_image
seq64::mainwnd, 425
set_start_from_perfedit
seq64::jack_assistant, 328
set_start_tick
seq64::perform, 708
set_status
seq64::event, 200, 201
set_status_from_string

seq64::editable_event, 177
set_status_keep_channel
seq64::event, 201
set_sysex_size
seq64::event, 205
set_system_port_flag
seq64::midibase, 594
set_text
seq64::eventslots, 251
set_thru
seq64::sequence, 1010
set_tick
seq64::perform, 707
set_timestamp
seq64::event, 196
set_transposable
seq64::seqmenu, 944
seq64::sequence, 1006
set_transpose
seq64::perfedit, 661
seq64::perform, 710
set_transpose_image
seq64::seqedit, 885
set_trigger_offset
seq64::sequence, 1048
set_trigger_paste_tick
seq64::sequence, 999
seq64::triggers, 1074
set_virtual_name
seq64::midi_alsa, 477
seq64::midi_jack, 538
seq64::midibus, 615
set_was_active
seq64::perform, 741
set_zoom
seq64::perfedit, 660
seq64::perfroll, 778
seq64::perftime, 792
seq64::seqdata, 866
seq64::seqedit, 883
seq64::seqevent, 912
seq64::seqroll, 954
seq64::seqtime, 983
shift_lock
seq64::keystroke, 387
shift_notes
seq64::sequence, 1045
shorten_file_spec
seq64, 76
show_bus_values
seq64::midibase, 592
show_events
seq64::sequence, 1046
show_jack_statuses
seq64, 96
show_midi
seq64::rc_settings, 806, 811
show_position
seq64::jack_assistant, 330
show_ui_sequence_key
seq64::keys_perform, 364
seq64::perform, 716
show_ui_sequence_number
seq64::keys_perform, 364
seq64::perform, 717
signal
seq64::condition_var, 162
signal_action
seq64::mainwnd, 431
silence_jack_errors
seq64, 108
silence_jack_info
seq64, 108
size
seq64::midi_container, 498
seq64::midi_list, 552
seq64::midi_vector, 584
SlotMap
seq64::keys_perform, 353
sm_category_arrays
seq64::editable_event, 179
sm_category_names
seq64::editable_event, 179
sm_channel_event_names
seq64::editable_event, 179
sm_cond
seq64::condition_var, 163
sm_input_caps
seq64::midi_alsa_info, 484
sm_internal_keys
seq64::gui_assistant_gtk2, 281
sm_mc_dummy
seq64::perform, 755
sm_meta_event_names
seq64::editable_event, 179
sm_output_caps
seq64::midi_alsa_info, 484
sm_prop_event_names
seq64::editable_event, 179
sm_recursive_mutex
seq64::mutex, 641
sm_selected_api
seq64::rtmidi_info, 853
sm_seqedit_list
seq64::seqmenu, 946
sm_status_pairs
seq64::jack_assistant, 337
sm_system_event_names
seq64::editable_event, 179
snap_x
seq64::perfroll, 777
seq64::seqevent, 916
seq64::seqroll, 960
snap_y
seq64::seqevent, 916
seq64::seqroll, 960

snapshot_1
seq64::keys_perform, 356
snapshot_2
seq64::keys_perform, 357
song_fill_seq_event
seq64::midi_container, 503
song_fill_seq_trigger
seq64::midi_container, 503
song_mode
seq64::keys_perform, 361
song_start_mode
seq64::jack_assistant, 328
seq64::perform, 700
sort
seq64::event_list, 220
sort_events
seq64::sequence, 1017
split
seq64::midi_splitter, 575
seq64::triggers, 1068, 1075
split_channel
seq64::midi_splitter, 575
split_trigger
seq64::perform, 732
seq64::perfroll, 778
seq64::sequence, 1017
Stack
seq64::triggers, 1064
start
seq64::busarray, 144
seq64::businfo, 154
seq64::jack_assistant, 324
seq64::keys_perform, 359
seq64::lash, 389
seq64::mastermidibase, 445
seq64::midibase, 599
seq64::perform, 739
start_from_perfedit
seq64::perform, 702
start_jack
seq64::perform, 740
start_key
seq64::perform, 721
start_paste
seq64::seqevent, 915
seq64::seqroll, 959
start_playing
seq64::mainwnd, 425
seq64::perfedit, 665
seq64::perform, 719
seq64::seqedit, 893
stats
seq64::rc_settings, 807, 811
status
seq64::midi_control, 506
status_string
seq64::editable_event, 177
stock_event_string
seq64::editable_event, 177
stop
seq64::busarray, 144
seq64::businfo, 154
seq64::jack_assistant, 324
seq64::keys_perform, 361
seq64::mastermidibase, 446
seq64::midibase, 599
seq64::perform, 739
seq64::sequence, 1040
stop_jack
seq64::perform, 740
stop_key
seq64::perform, 721
stop_playing
seq64::mainwnd, 426
seq64::perfedit, 665
seq64::perform, 721
seq64::seqedit, 893
stream_event
seq64::sequence, 1033
stretch_selected
seq64::sequence, 1037
string_is_void
seq64, 77
string_not_void
seq64, 76
string_to_midibyte
seq64, 76
string_to_pulses
seq64, 75
seq64::editable_events, 185
strings_match
seq64, 77
swap
seq64, 70
sync
seq64::jack_assistant, 331
sysex
seq64::busarray, 145
seq64::businfo, 155
seq64::mastermidibase, 448
seq64::midibase, 599
SysexContainer
seq64::event, 194

tap_bpm
seq64::keys_perform, 363
tempo_us_from_bpm
seq64, 79
tempo_us_to_bytes
seq64, 78
test_ignore_flags
seq64::rtmidi_in_data, 839
test_widget_click
seq64, 107
text_x
seq64::user_settings, 1102, 1108
text_y

seq64::user_settings, 1102, 1108
thru_change_callback
seq64::seqedit, 889
tick_end
seq64::trigger, 1059
tick_multiplier
seq64::jack_assistant, 329
tick_offset
seq64::perftime, 793
tick_start
seq64::trigger, 1059
tick_to_pixel
seq64::perftime, 793
ticks_to_delta_time_us
seq64, 81
time_as_measures
seq64::editable_event, 176
time_as_minutes
seq64::editable_event, 176
time_as_pulses
seq64::editable_event, 176
timeout
seq64::mainwid, 410
seq64::perfedit, 664
seq64::seqedit, 892
timer_callback
seq64::mainwnd, 425
timestamp
seq64::editable_event, 176
seq64::midi_message, 558
timestamp_format_t
seq64::editable_event, 172
timestamp_string
seq64::editable_event, 175
timestring_to_pulses
seq64, 75, 101
timing
seq64::editable_events, 185
to_string
seq64, 90
toLower
seq64::mainwnd, 427
toggle_all_tracks
seq64::perform, 713
seq64::seqmenu, 945
toggle_current_sequence
seq64::seqmenu, 941
toggle_follow_transport
seq64::jack_assistant, 328
seq64::perfedit, 661
seq64::perform, 703
toggle_jack
seq64::keys_perform, 363
seq64::perfedit, 660
toggle_jack_mode
seq64::jack_assistant, 327
seq64::perform, 700
toggle_mutes
seq64::keys_perform, 363
toggle_other_names
seq64::perform, 731
toggle_other_seqs
seq64::perform, 730
toggle_playing
seq64::mainwnd, 426
seq64::perfedit, 665
seq64::sequence, 1009
toggle_playing_tracks
seq64::perform, 713
toggle_queued
seq64::sequence, 1009
toggle_song_mute
seq64::sequence, 1005
toggle_song_start_mode
seq64::jack_assistant, 328
seq64::perform, 699
toggle_visible
seq64::lfownd, 394
top_index
seq64::eventslots, 246
track_end_size
seq64::midifile, 637
track_name_size
seq64::midifile, 636
transport_callback
seq64::options, 645
transport_not_starting
seq64::jack_assistant, 322
transport_state
seq64::jack_assistant, 322
transpose_button_callback
seq64::perfedit, 662
transpose_change_callback
seq64::seqedit, 889
transpose_note
seq64::event, 207
transpose_notes
seq64::sequence, 1044
trigger
seq64::trigger, 1058
triggerlist
seq64::sequence, 999
seq64::triggers, 1066
triggers
seq64::sequence, 1050
seq64::triggers, 1065
trim_timestamp
seq64::sequence, 1032
Type
seq64::rterror, 824
type
seq64::keybindentry, 344

undo
seq64::perfedit, 664
undo_callback
seq64::seqedit, 890

unlock
seq64::mutex, 641
unmark
seq64::event, 206
unmark_all
seq64::event_list, 222
unmodify
seq64::event_list, 219
unmute_all_tracks
seq64::seqmenu, 945
unpaint
seq64::event, 206
unpaint_all
seq64::event_list, 222
seq64::sequence, 1038
unselect
seq64::event, 206
seq64::sequence, 1038
seq64::triggers, 1070
unselect_all
seq64::event_list, 223
unselect_triggers
seq64::sequence, 1019
unset_edit_sequence
seq64::perform, 696
seq64::seqmenu, 939
unset_mode_group_learn
seq64::perform, 738
unset_mode_group_mute
seq64::perform, 738
unset_sequence_control_status
seq64::perform, 711
update_all_windows
seq64::seqedit, 890
update_and_draw
seq64::seqroll, 958
update_background
seq64::seqroll, 957
update_mainwid_sequences
seq64, 107
seq64::mainwid, 414
update_markers
seq64::mainwid, 409
update_mouse_pointer
seq64::FruityPerfInput, 268
seq64::FruitySeqEventInput, 271
seq64::FruitySeqRollInput, 274
seq64::seqroll, 965
update_perfedit_sequences
seq64, 107
seq64::perfedit, 666
update_pixmap
seq64::perftime, 794
seq64::seqdata, 867
seq64::seqevent, 913
seq64::seqkeys, 928
seq64::seqroll, 957
seq64::seqtime, 984
update_sequences_on_window
seq64::mainwid, 407
update_sizes
seq64::perfroll, 774
seq64::perftime, 794
seq64::seqdata, 867
seq64::seqevent, 913
seq64::seqkeys, 929
seq64::seqroll, 957
seq64::seqtime, 984
update_window_title
seq64::mainwnd, 427
us_per_quarter_note
seq64::perform, 698
seq64::sequence, 1005
use_more_icons
seq64::user_settings, 1106, 1112
use_new_font
seq64::user_settings, 1105, 1111
user_callback
seq64::midi_api, 493
seq64::rtmidi_in, 837
seq64::rtmidi_in_data, 842
user_data
seq64::rtmidi_in_data, 841, 842
user_filename
seq64::rc_settings, 810, 815
user_filename_alt
seq64::rc_settings, 810, 815
user_filespec
seq64::rc_settings, 805
user_instrument
seq64::user_instrument, 1079
user_midi_bus
seq64::user_midi_bus, 1084, 1085
user_settings
seq64::user_settings, 1098
userfile
seq64::user_settings, 1114
seq64::userfile, 1126
using_callback
seq64::rtmidi_in_data, 841
usr
seq64, 100

v_adjustment
seq64::eventedit, 233
valid_buffer
seq64::midi_jack_data, 540
valid_midi_control_seq
seq64::perform, 745
valid_sequence
seq64::mainwid, 409
value_to_name
seq64::editable_event, 174
varinum_size
seq64::midifile, 635
velocity_override
seq64::user_settings, 1110, 1113

verify_and_link
seq64::event_list, 221
seq64::sequence, 1038
versiontext
seq64, 126
vertical_adjust
seq64::perfroll, 779
seq64::seqedit, 886
seq64::seqroll, 960
vertical_set
seq64::perfroll, 779
seq64::seqedit, 886

wait
seq64::condition_var, 162
wave_func
seq64, 83
wave_type_name
seq64, 71
wave_type_t
seq64, 66
what
seq64::rterror, 825
white
seq64::gui_palette_gtk2, 306
white_key
seq64::gui_palette_gtk2, 307
white_paint
seq64::gui_palette_gtk2, 307
width
seq64::gui_drawingarea_gtk2::rect, 822
seq64::rect, 822
window_redraw_rate
seq64::user_settings, 1106, 1112
window_x
seq64::gui_drawingarea_gtk2, 286
window_y
seq64::gui_drawingarea_gtk2, 286
with_jack
seq64::rc_settings, 807
with_jack_master
seq64::rc_settings, 807, 812
with_jack_master_cond
seq64::rc_settings, 807, 812
with_jack_midi
seq64::rc_settings, 807, 812
with_jack_transport
seq64::rc_settings, 807, 812
write
seq64::configfile, 166
seq64::midifile, 624
seq64::optionsfile, 652
seq64::userfile, 1126
write_byte
seq64::midifile, 631
write_header
seq64::midifile, 633
write_long
seq64::midifile, 630
write_options_files
seq64, 88
write_prop_header
seq64::midifile, 633
write_proprietary_track
seq64::midifile, 634
write_seq_number
seq64::midifile, 632
write_short
seq64::midifile, 630
write_song
seq64::midifile, 625
write_track
seq64::midifile, 637
write_track_end
seq64::midifile, 633
write_track_name
seq64::midifile, 632
write_varinum
seq64::midifile, 631

x
seq64::click, 159
seq64::gui_drawingarea_gtk2::rect, 822
seq64::rect, 821
x_to_w
seq64::seqevent, 914
xy_to_rect
seq64::seqdata, 867
seq64::seqroll, 961

y
seq64::click, 159
seq64::gui_drawingarea_gtk2::rect, 822
seq64::rect, 821
yellow
seq64::gui_palette_gtk2, 307

zero_markers
seq64::sequence, 1039
zoom
seq64::user_settings, 1104
zoom_check
seq64::perfedit, 659
zoom_power_of_2
seq64, 78