

# Sequencer64 Developer/Tester's Reference Manual

## 0.9.9.6

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# Contents

<b>1</b>	<b>Sequencer64</b>	<b>1</b>
1.1	Introduction . . . . .	1
<b>2</b>	<b>User Testing of Sequencer64 with Yoshimi</b>	<b>3</b>
2.1	Introduction . . . . .	3
2.2	Smoke Test . . . . .	3
2.3	Tests in the Patterns Window . . . . .	4
2.3.1	Button Clicks on a Pattern . . . . .	4
2.3.2	Patterns Window Key Shortcuts . . . . .	5
2.3.3	The Sequencer64 User File . . . . .	5
2.4	Tests Using Valgrind . . . . .	5
2.4.1	Valgrind Suppressions . . . . .	5
2.4.2	Full Valgrind Leak-Checking . . . . .	6
2.4.2.1	Leak-Checking Basic Operation . . . . .	6
2.5	Specific Fault Debugging . . . . .	6
2.6	Snipping of a MIDI file. . . . .	6
<b>3</b>	<b>Licenses</b>	<b>9</b>
3.1	License Terms for the This Project. . . . .	9
3.2	XPC Application License . . . . .	9
3.3	XPC Library License . . . . .	10
3.4	XPC Documentation License . . . . .	10
3.5	XPC Affero License . . . . .	10
3.6	XPC License Summary . . . . .	11
<b>4</b>	<b>Todo List</b>	<b>13</b>
<b>5</b>	<b>Hierarchical Index</b>	<b>15</b>
5.1	Class Hierarchy . . . . .	15
<b>6</b>	<b>Data Structure Index</b>	<b>17</b>
6.1	Data Structures . . . . .	17
<b>7</b>	<b>Data Structure Documentation</b>	<b>21</b>

7.1	<a href="#">seq64::AbstractPerfInput Class Reference</a>	21
7.2	<a href="#">seq64::click Class Reference</a>	21
7.2.1	<a href="#">Detailed Description</a>	22
7.2.2	<a href="#">Constructor &amp; Destructor Documentation</a>	23
7.2.2.1	<a href="#">click</a>	23
7.2.2.2	<a href="#">click</a>	23
7.2.2.3	<a href="#">click</a>	23
7.2.3	<a href="#">Member Function Documentation</a>	23
7.2.3.1	<a href="#">operator=</a>	23
7.2.4	<a href="#">Field Documentation</a>	23
7.2.4.1	<a href="#">m_x</a>	23
7.2.4.2	<a href="#">m_y</a>	23
7.2.4.3	<a href="#">m_button</a>	23
7.2.4.4	<a href="#">m_modifier</a>	24
7.3	<a href="#">seq64::configfile Class Reference</a>	24
7.3.1	<a href="#">Constructor &amp; Destructor Documentation</a>	25
7.3.1.1	<a href="#">configfile</a>	25
7.3.2	<a href="#">Member Function Documentation</a>	25
7.3.2.1	<a href="#">next_data_line</a>	25
7.3.2.2	<a href="#">line_after</a>	25
7.3.3	<a href="#">Field Documentation</a>	25
7.3.3.1	<a href="#">m_line</a>	25
7.4	<a href="#">seq64::event Class Reference</a>	25
7.4.1	<a href="#">Detailed Description</a>	28
7.4.2	<a href="#">Constructor &amp; Destructor Documentation</a>	28
7.4.2.1	<a href="#">~event</a>	28
7.4.3	<a href="#">Member Function Documentation</a>	28
7.4.3.1	<a href="#">operator&lt;</a>	28
7.4.3.2	<a href="#">is_channel_msg</a>	29
7.4.3.3	<a href="#">is_one_byte_msg</a>	29
7.4.3.4	<a href="#">is_two_byte_msg</a>	29
7.4.3.5	<a href="#">is_desired_cc_or_not_cc</a>	29
7.4.3.6	<a href="#">mod_timestamp</a>	30
7.4.3.7	<a href="#">set_status</a>	30
7.4.3.8	<a href="#">set_data</a>	30
7.4.3.9	<a href="#">set_data</a>	30
7.4.3.10	<a href="#">get_data</a>	31
7.4.3.11	<a href="#">append_sysex</a>	31
7.4.3.12	<a href="#">get_rank</a>	31
7.4.4	<a href="#">Field Documentation</a>	31

7.4.4.1	<a href="#">m_status</a>	31
7.4.4.2	<a href="#">m_data</a>	31
7.4.4.3	<a href="#">m_sysex</a>	31
7.4.4.4	<a href="#">m_has_link</a>	32
7.5	<a href="#">seq64::event_list::event_key Class Reference</a>	32
7.5.1	<a href="#">Detailed Description</a>	32
7.5.2	<a href="#">Constructor &amp; Destructor Documentation</a>	32
7.5.2.1	<a href="#">event_key</a>	32
7.5.2.2	<a href="#">event_key</a>	32
7.5.3	<a href="#">Member Function Documentation</a>	32
7.5.3.1	<a href="#">operator&lt;</a>	32
7.5.4	<a href="#">Field Documentation</a>	33
7.5.4.1	<a href="#">m_timestamp</a>	33
7.5.4.2	<a href="#">m_rank</a>	33
7.6	<a href="#">seq64::event_list Class Reference</a>	33
7.6.1	<a href="#">Detailed Description</a>	35
7.6.2	<a href="#">Constructor &amp; Destructor Documentation</a>	35
7.6.2.1	<a href="#">event_list</a>	35
7.6.3	<a href="#">Member Function Documentation</a>	35
7.6.3.1	<a href="#">operator=</a>	35
7.6.3.2	<a href="#">count</a>	35
7.6.3.3	<a href="#">add</a>	35
7.6.3.4	<a href="#">merge</a>	35
7.6.3.5	<a href="#">link_new</a>	36
7.6.3.6	<a href="#">verify_and_link</a>	36
7.6.3.7	<a href="#">mark_out_of_range</a>	36
7.6.3.8	<a href="#">any_selected_notes</a>	36
7.6.3.9	<a href="#">count_selected_events</a>	36
7.7	<a href="#">seq64::font Class Reference</a>	36
7.7.1	<a href="#">Member Enumeration Documentation</a>	38
7.7.1.1	<a href="#">Color</a>	38
7.7.2	<a href="#">Member Function Documentation</a>	38
7.7.2.1	<a href="#">init</a>	38
7.7.2.2	<a href="#">render_string_on_drawable</a>	38
7.7.3	<a href="#">Field Documentation</a>	38
7.7.3.1	<a href="#">m_font_w</a>	38
7.7.3.2	<a href="#">m_font_h</a>	38
7.7.3.3	<a href="#">m_pixmap</a>	39
7.7.3.4	<a href="#">m_black_pixmap</a>	39
7.7.3.5	<a href="#">m_white_pixmap</a>	39

7.7.3.6	<code>m_b_on_y_pixmap</code>	39
7.7.3.7	<code>m_y_on_b_pixmap</code>	39
7.7.3.8	<code>m_clip_mask</code>	39
7.8	<code>seq64::gui_assistant</code> Class Reference	39
7.8.1	Detailed Description	40
7.8.2	Constructor & Destructor Documentation	41
7.8.2.1	<code>gui_assistant</code>	41
7.9	<code>seq64::gui_assistant_gtk2</code> Class Reference	41
7.9.1	Field Documentation	42
7.9.1.1	<code>sm_internal_keys</code>	42
7.10	<code>seq64::gui_drawingarea_gtk2</code> Class Reference	42
7.10.1	Detailed Description	45
7.10.2	Member Function Documentation	45
7.10.2.1	<code>set_line</code>	45
7.10.2.2	<code>draw_line</code>	45
7.10.2.3	<code>draw_line</code>	45
7.10.2.4	<code>draw_line_on_pixmap</code>	45
7.10.2.5	<code>draw_line_on_pixmap</code>	45
7.10.2.6	<code>draw_line</code>	46
7.10.2.7	<code>draw_line</code>	46
7.10.2.8	<code>draw_line</code>	46
7.10.2.9	<code>draw_line</code>	46
7.10.2.10	<code>render_string</code>	47
7.10.2.11	<code>render_string_on_pixmap</code>	47
7.10.2.12	<code>draw_rectangle</code>	47
7.10.2.13	<code>draw_rectangle</code>	47
7.10.2.14	<code>draw_rectangle</code>	48
7.10.2.15	<code>draw_rectangle</code>	48
7.10.2.16	<code>draw_rectangle</code>	48
7.10.2.17	<code>draw_rectangle</code>	48
7.10.2.18	<code>draw_rectangle_on_pixmap</code>	49
7.10.2.19	<code>draw_rectangle_on_pixmap</code>	49
7.10.2.20	<code>draw_normal_rectangle_on_pixmap</code>	49
7.10.2.21	<code>on_realize</code>	49
7.10.3	Field Documentation	50
7.10.3.1	<code>m_window</code>	50
7.10.3.2	<code>m_pixmap</code>	50
7.10.3.3	<code>m_background</code>	50
7.10.3.4	<code>m_foreground</code>	50
7.10.3.5	<code>m_mainperf</code>	50

7.10.3.6	<a href="#">m_window_x</a>	50
7.10.3.7	<a href="#">m_drop_x</a>	50
7.11	<a href="#">seq64::gui_palette_gtk2 Class Reference</a>	50
7.11.1	<a href="#">Detailed Description</a>	51
7.11.2	<a href="#">Constructor &amp; Destructor Documentation</a>	51
7.11.2.1	<a href="#">gui_palette_gtk2</a>	51
7.12	<a href="#">seq64::gui_window_gtk2 Class Reference</a>	52
7.12.1	<a href="#">Constructor &amp; Destructor Documentation</a>	53
7.12.1.1	<a href="#">gui_window_gtk2</a>	53
7.12.2	<a href="#">Field Documentation</a>	53
7.12.2.1	<a href="#">m_window_x</a>	53
7.13	<a href="#">seq64::jack_assistant Class Reference</a>	53
7.13.1	<a href="#">Constructor &amp; Destructor Documentation</a>	54
7.13.1.1	<a href="#">jack_assistant</a>	54
7.13.2	<a href="#">Member Function Documentation</a>	54
7.13.2.1	<a href="#">init</a>	54
7.13.2.2	<a href="#">stop</a>	54
7.13.2.3	<a href="#">position</a>	55
7.13.2.4	<a href="#">output</a>	55
7.13.2.5	<a href="#">info_message</a>	55
7.13.2.6	<a href="#">error_message</a>	55
7.13.3	<a href="#">Friends And Related Function Documentation</a>	55
7.13.3.1	<a href="#">jack_sync_callback</a>	55
7.13.3.2	<a href="#">jack_shutdown</a>	56
7.13.3.3	<a href="#">jack_timebase_callback</a>	56
7.14	<a href="#">seq64::jack_scratchpad Struct Reference</a>	56
7.14.1	<a href="#">Detailed Description</a>	56
7.15	<a href="#">seq64::keybindentry Class Reference</a>	56
7.15.1	<a href="#">Member Enumeration Documentation</a>	57
7.15.1.1	<a href="#">type</a>	57
7.15.2	<a href="#">Constructor &amp; Destructor Documentation</a>	57
7.15.2.1	<a href="#">keybindentry</a>	57
7.15.3	<a href="#">Member Function Documentation</a>	57
7.15.3.1	<a href="#">set</a>	57
7.15.3.2	<a href="#">on_key_press_event</a>	58
7.15.4	<a href="#">Field Documentation</a>	58
7.15.4.1	<a href="#">m_key</a>	58
7.16	<a href="#">seq64::keys_perform Class Reference</a>	58
7.16.1	<a href="#">Detailed Description</a>	60
7.16.2	<a href="#">Constructor &amp; Destructor Documentation</a>	60

7.16.2.1	<code>~keys_perform</code>	60
7.16.3	Member Function Documentation	60
7.16.3.1	<code>set_keys</code>	60
7.16.3.2	<code>get_keys</code>	61
7.16.3.3	<code>show_ui_sequence_key</code>	61
7.16.3.4	<code>key_name</code>	61
7.16.3.5	<code>set_all_key_events</code>	61
7.16.3.6	<code>set_all_key_groups</code>	61
7.16.3.7	<code>set_key_event</code>	61
7.16.3.8	<code>set_key_group</code>	61
7.16.4	Field Documentation	62
7.16.4.1	<code>m_key_bpm_up</code>	62
7.17	<code>seq64::keys_perform_gtk2</code> Class Reference	62
7.17.1	Detailed Description	64
7.17.2	Constructor & Destructor Documentation	64
7.17.2.1	<code>~keys_perform_gtk2</code>	64
7.17.3	Member Function Documentation	64
7.17.3.1	<code>key_name</code>	64
7.17.3.2	<code>set_all_key_events</code>	64
7.17.3.3	<code>set_all_key_groups</code>	64
7.18	<code>seq64::keys_perform_transfer</code> Struct Reference	64
7.19	<code>seq64::keystroke</code> Class Reference	64
7.19.1	Detailed Description	65
7.19.2	Constructor & Destructor Documentation	65
7.19.2.1	<code>keystroke</code>	65
7.19.2.2	<code>keystroke</code>	66
7.19.3	Member Function Documentation	66
7.19.3.1	<code>operator=</code>	66
7.19.3.2	<code>is_letter</code>	66
7.19.4	Field Documentation	66
7.19.4.1	<code>m_is_press</code>	66
7.19.4.2	<code>m_key</code>	66
7.19.4.3	<code>m_modifier</code>	67
7.20	<code>seq64::lash</code> Class Reference	67
7.20.1	Detailed Description	67
7.20.2	Constructor & Destructor Documentation	67
7.20.2.1	<code>lash</code>	67
7.20.3	Member Function Documentation	68
7.20.3.1	<code>set_alsa_client_id</code>	68
7.20.3.2	<code>process_events</code>	68



7.20.3.3	init	68
7.20.3.4	handle_event	68
7.20.3.5	handle_config	68
7.21	seq64::maintime Class Reference	68
7.21.1	Constructor & Destructor Documentation	70
7.21.1.1	maintime	70
7.21.2	Member Function Documentation	70
7.21.2.1	idle_progress	70
7.21.2.2	on_realize	70
7.21.2.3	on_expose_event	70
7.22	seq64::mainwid Class Reference	70
7.22.1	Constructor & Destructor Documentation	73
7.22.1.1	mainwid	73
7.22.2	Member Function Documentation	73
7.22.2.1	set_screenset	73
7.22.2.2	update_sequence_on_window	73
7.22.2.3	update_markers	73
7.22.2.4	draw_marker_on_sequence	73
7.22.2.5	valid_sequence	73
7.22.2.6	draw_sequence_on_pixmap	74
7.22.2.7	draw_sequences_on_pixmap	74
7.22.2.8	draw_sequence_pixmap_on_window	74
7.22.2.9	seq_from_xy	74
7.22.2.10	timeout	75
7.22.2.11	redraw	75
7.22.2.12	calculate_base_sizes	75
7.22.2.13	on_realize	75
7.22.2.14	on_expose_event	75
7.22.2.15	on_button_press_event	75
7.22.2.16	on_button_release_event	76
7.22.2.17	on_motion_notify_event	76
7.22.2.18	on_focus_in_event	76
7.22.2.19	on_focus_out_event	76
7.23	seq64::mainwnd Class Reference	76
7.23.1	Constructor & Destructor Documentation	80
7.23.1.1	mainwnd	80
7.23.2	Member Function Documentation	80
7.23.2.1	open_file	80
7.23.2.2	ppqn	80
7.23.2.3	file_import_dialog	81

7.23.2.4	<a href="#">about_dialog</a>	81
7.23.2.5	<a href="#">adj_callback_ss</a>	81
7.23.2.6	<a href="#">timer_callback</a>	81
7.23.2.7	<a href="#">open_performance_edit</a>	81
7.23.2.8	<a href="#">update_window_title</a>	81
7.23.2.9	<a href="#">save_file</a>	81
7.23.2.10	<a href="#">signal_action</a>	82
7.23.2.11	<a href="#">on_delete_event</a>	82
7.23.2.12	<a href="#">on_key_press_event</a>	82
7.23.2.13	<a href="#">on_key_release_event</a>	82
7.23.2.14	<a href="#">on_grouplearnchange</a>	82
7.23.3	<a href="#">Field Documentation</a>	82
7.23.3.1	<a href="#">m_sigpipe</a>	82
7.23.3.2	<a href="#">m_main_wid</a>	82
7.23.3.3	<a href="#">m_spinbutton_load_offset</a>	82
7.24	<a href="#">seq64::midi_container Class Reference</a>	83
7.24.1	<a href="#">Member Function Documentation</a>	84
7.24.1.1	<a href="#">fill</a>	84
7.24.1.2	<a href="#">put</a>	84
7.24.1.3	<a href="#">get</a>	84
7.24.1.4	<a href="#">position</a>	85
7.24.1.5	<a href="#">add_variable</a>	85
7.24.1.6	<a href="#">add_long</a>	85
7.25	<a href="#">seq64::midi_list Class Reference</a>	85
7.25.1	<a href="#">Member Typedef Documentation</a>	87
7.25.1.1	<a href="#">CharList</a>	87
7.25.2	<a href="#">Member Function Documentation</a>	87
7.25.2.1	<a href="#">put</a>	87
7.25.2.2	<a href="#">get</a>	87
7.26	<a href="#">seq64::midi_vector Class Reference</a>	87
7.26.1	<a href="#">Member Function Documentation</a>	89
7.26.1.1	<a href="#">put</a>	89
7.26.1.2	<a href="#">get</a>	89
7.27	<a href="#">seq64::midifile Class Reference</a>	89
7.27.1	<a href="#">Detailed Description</a>	91
7.27.2	<a href="#">Constructor &amp; Destructor Documentation</a>	91
7.27.2.1	<a href="#">midifile</a>	91
7.27.3	<a href="#">Member Function Documentation</a>	92
7.27.3.1	<a href="#">parse</a>	92
7.27.3.2	<a href="#">write</a>	92

7.27.3.3	ppqn	92
7.27.3.4	parse_prop_header	93
7.27.3.5	parse_proprietary_track	93
7.27.3.6	read_long	94
7.27.3.7	read_short	94
7.27.3.8	read_varinum	94
7.27.3.9	write_long	94
7.27.3.10	write_short	94
7.27.3.11	write_byte	94
7.27.3.12	write_varinum	94
7.27.3.13	write_track_name	95
7.27.3.14	write_seq_number	95
7.27.3.15	write_prop_header	95
7.27.3.16	write_proprietary_track	96
7.27.3.17	varinum_size	96
7.27.3.18	prop_item_size	96
7.27.3.19	seq_number_size	96
7.27.4	Field Documentation	96
7.27.4.1	m_pos	96
7.27.4.2	m_data	96
7.27.4.3	m_char_list	97
7.27.4.4	m_new_format	97
7.28	seq64::options Class Reference	97
7.28.1	Field Documentation	97
7.28.1.1	m_notebook	97
7.29	seq64::optionsfile Class Reference	97
7.29.1	Detailed Description	98
7.29.2	Member Function Documentation	98
7.29.2.1	parse	98
7.29.2.2	write	100
7.30	seq64::perfedit Class Reference	100
7.30.1	Detailed Description	103
7.30.2	Constructor & Destructor Documentation	103
7.30.2.1	perfedit	103
7.30.2.2	~perfedit	103
7.30.3	Member Function Documentation	103
7.30.3.1	init_before_show	103
7.30.3.2	set_guides	103
7.30.3.3	expand	103
7.30.3.4	collapse	103

7.30.3.5	copy	103
7.30.3.6	undo	103
7.30.3.7	timeout	104
7.30.3.8	start_playing	104
7.30.3.9	stop_playing	104
7.31	seq64::perfnames Class Reference	104
7.31.1	Detailed Description	106
7.31.2	Constructor & Destructor Documentation	107
7.31.2.1	perfnames	107
7.31.3	Member Function Documentation	107
7.31.3.1	draw_sequence	107
7.31.3.2	on_realize	107
7.31.3.3	on_expose_event	107
7.31.3.4	on_size_allocate	107
7.31.4	Field Documentation	107
7.31.4.1	m_names_chars	107
7.31.4.2	m_char_w	107
7.31.4.3	m_setbox_w	107
7.31.4.4	m_namebox_w	107
7.31.4.5	m_names_y	107
7.31.4.6	m_xy_offset	108
7.32	seq64::perform Class Reference	108
7.32.1	Detailed Description	113
7.32.2	Constructor & Destructor Documentation	113
7.32.2.1	perform	113
7.32.2.2	~perform	113
7.32.3	Member Function Documentation	113
7.32.3.1	sequence_count	113
7.32.3.2	init	114
7.32.3.3	clear_all	114
7.32.3.4	launch_input_thread	114
7.32.3.5	launch_output_thread	114
7.32.3.6	init_jack	114
7.32.3.7	add_sequence	114
7.32.3.8	delete_sequence	114
7.32.3.9	clear_sequence_triggers	114
7.32.3.10	move_triggers	115
7.32.3.11	copy_triggers	115
7.32.3.12	get_midi_control_toggle	115
7.32.3.13	get_midi_control_on	115

7.32.3.14	<a href="#">get_midi_control_off</a>	115
7.32.3.15	<a href="#">get_screen_set_notepad</a>	115
7.32.3.16	<a href="#">set_screen_set_notepad</a>	115
7.32.3.17	<a href="#">set_screenset</a>	116
7.32.3.18	<a href="#">set_playing_screenset</a>	116
7.32.3.19	<a href="#">unset_mode_group_learn</a>	116
7.32.3.20	<a href="#">select_mute_group</a>	116
7.32.3.21	<a href="#">start</a>	116
7.32.3.22	<a href="#">stop</a>	116
7.32.3.23	<a href="#">all_notes_off</a>	116
7.32.3.24	<a href="#">set_active</a>	116
7.32.3.25	<a href="#">set_was_active</a>	117
7.32.3.26	<a href="#">is_active</a>	117
7.32.3.27	<a href="#">is_dirty_main</a>	117
7.32.3.28	<a href="#">is_dirty_edit</a>	117
7.32.3.29	<a href="#">is_dirty_perf</a>	117
7.32.3.30	<a href="#">is_dirty_names</a>	118
7.32.3.31	<a href="#">new_sequence</a>	119
7.32.3.32	<a href="#">get_sequence</a>	119
7.32.3.33	<a href="#">reset_sequences</a>	119
7.32.3.34	<a href="#">play</a>	119
7.32.3.35	<a href="#">set_orig_ticks</a>	119
7.32.3.36	<a href="#">set_beats_per_minute</a>	120
7.32.3.37	<a href="#">set_sequence_control_status</a>	120
7.32.3.38	<a href="#">unset_sequence_control_status</a>	120
7.32.3.39	<a href="#">sequence_playing_off</a>	120
7.32.3.40	<a href="#">output_func</a>	120
7.32.3.41	<a href="#">get_max_trigger</a>	120
7.32.3.42	<a href="#">set_offset</a>	120
7.32.3.43	<a href="#">show_ui_sequence_key</a>	120
7.32.3.44	<a href="#">start_playing</a>	121
7.32.3.45	<a href="#">decrement_beats_per_minute</a>	121
7.32.3.46	<a href="#">increment_beats_per_minute</a>	121
7.32.3.47	<a href="#">set_input_bus</a>	121
7.32.3.48	<a href="#">mainwnd_key_event</a>	121
7.32.3.49	<a href="#">perfroll_key_event</a>	121
7.32.3.50	<a href="#">is_midi_control_valid</a>	121
7.32.3.51	<a href="#">is_screenset_valid</a>	121
7.32.3.52	<a href="#">is_seq_valid</a>	122
7.32.3.53	<a href="#">is_mseq_valid</a>	122

7.32.3.54	<a href="#">install_sequence</a>	122
7.32.3.55	<a href="#">inner_start</a>	122
7.32.3.56	<a href="#">set_key_event</a>	122
7.32.3.57	<a href="#">set_key_group</a>	123
7.32.3.58	<a href="#">clamp_track</a>	123
7.32.4	<a href="#">Friends And Related Function Documentation</a>	123
7.32.4.1	<a href="#">jack_sync_callback</a>	123
7.32.5	<a href="#">Field Documentation</a>	123
7.32.5.1	<a href="#">m_playback_mode</a>	123
7.33	<a href="#">seq64::performcallback Struct Reference</a>	123
7.33.1	<a href="#">Detailed Description</a>	124
7.34	<a href="#">seq64::perfroll Class Reference</a>	124
7.34.1	<a href="#">Constructor &amp; Destructor Documentation</a>	127
7.34.1.1	<a href="#">~perfroll</a>	127
7.34.2	<a href="#">Member Function Documentation</a>	127
7.34.2.1	<a href="#">update_sizes</a>	127
7.34.2.2	<a href="#">init_before_show</a>	128
7.34.2.3	<a href="#">fill_background_pixmap</a>	128
7.34.2.4	<a href="#">set_ppqn</a>	128
7.34.2.5	<a href="#">convert_xy</a>	128
7.34.2.6	<a href="#">convert_x</a>	128
7.34.2.7	<a href="#">snap_x</a>	128
7.34.2.8	<a href="#">start_playing</a>	128
7.34.2.9	<a href="#">stop_playing</a>	128
7.34.2.10	<a href="#">draw_sequence_on</a>	128
7.34.2.11	<a href="#">draw_drawable_row</a>	129
7.34.2.12	<a href="#">on_realize</a>	129
7.34.2.13	<a href="#">on_button_press_event</a>	129
7.34.2.14	<a href="#">on_button_release_event</a>	129
7.34.2.15	<a href="#">on_key_press_event</a>	129
7.34.3	<a href="#">Friends And Related Function Documentation</a>	129
7.34.3.1	<a href="#">FruityPerfInput</a>	129
7.34.4	<a href="#">Field Documentation</a>	129
7.34.4.1	<a href="#">m_fruity_interaction</a>	129
7.35	<a href="#">seq64::perftime Class Reference</a>	129
7.35.1	<a href="#">Constructor &amp; Destructor Documentation</a>	131
7.35.1.1	<a href="#">perftime</a>	131
7.35.2	<a href="#">Member Function Documentation</a>	132
7.35.2.1	<a href="#">on_realize</a>	132
7.35.2.2	<a href="#">on_expose_event</a>	132

7.36 seq64::rc_settings Class Reference . . . . .	132
7.36.1 Member Function Documentation . . . . .	134
7.36.1.1 home_config_directory . . . . .	134
7.36.1.2 make_directory . . . . .	134
7.37 seq64::gui_drawingarea_gtk2::rect Struct Reference . . . . .	135
7.38 seq64::rect Class Reference . . . . .	135
7.39 seq64::Seq24PerfInput Class Reference . . . . .	135
7.39.1 Member Function Documentation . . . . .	136
7.39.1.1 on_button_press_event . . . . .	136
7.39.1.2 on_button_release_event . . . . .	136
7.39.1.3 set_adding . . . . .	136
7.39.1.4 handle_motion_key . . . . .	136
7.40 seq64::Seq24SeqEventInput Struct Reference . . . . .	137
7.40.1 Member Function Documentation . . . . .	137
7.40.1.1 set_adding . . . . .	137
7.40.1.2 on_button_press_event . . . . .	137
7.41 seq64::Seq24SeqRollInput Class Reference . . . . .	137
7.41.1 Member Function Documentation . . . . .	138
7.41.1.1 set_adding . . . . .	138
7.42 seq64::seqdata Class Reference . . . . .	138
7.42.1 Constructor & Destructor Documentation . . . . .	141
7.42.1.1 seqdata . . . . .	141
7.42.2 Member Function Documentation . . . . .	141
7.42.2.1 reset . . . . .	141
7.42.2.2 redraw . . . . .	141
7.42.2.3 set_zoom . . . . .	141
7.42.2.4 set_data_type . . . . .	141
7.42.2.5 idle_redraw . . . . .	141
7.42.2.6 update_sizes . . . . .	141
7.42.2.7 xy_to_rect . . . . .	142
7.42.2.8 on_realize . . . . .	142
7.42.2.9 on_motion_notify_event . . . . .	142
7.42.2.10 on_scroll_event . . . . .	142
7.42.3 Field Documentation . . . . .	142
7.42.3.1 m_number_w . . . . .	142
7.42.3.2 m_number_h . . . . .	142
7.42.3.3 m_number_offset_y . . . . .	142
7.43 seq64::seqedit Class Reference . . . . .	142
7.43.1 Detailed Description . . . . .	146
7.43.2 Constructor & Destructor Documentation . . . . .	146

7.43.2.1	seqedit	146
7.43.3	Member Function Documentation	146
7.43.3.1	set_zoom	146
7.43.3.2	set_snap	146
7.43.3.3	set_note_length	146
7.43.3.4	apply_length	146
7.43.3.5	get_measures	146
7.43.3.6	set_scale	147
7.43.3.7	set_key	147
7.43.3.8	set_background_sequence	147
7.43.3.9	name_change_callback	147
7.43.3.10	set_data_type	147
7.43.3.11	create_menus	147
7.43.3.12	popup_event_menu	147
7.43.3.13	popup_midibus_menu	148
7.43.3.14	popup_sequence_menu	148
7.43.3.15	popup_tool_menu	148
7.43.3.16	do_action	148
7.43.3.17	on_delete_event	148
7.43.4	Field Documentation	148
7.43.4.1	mc_min_zoom	148
7.44	seq64::seqevent Class Reference	148
7.44.1	Member Function Documentation	151
7.44.1.1	set_snap	151
7.44.1.2	set_data_type	151
7.44.1.3	update_sizes	151
7.44.1.4	draw_background	151
7.44.1.5	draw_pixmap_on_window	151
7.44.1.6	idle_redraw	152
7.44.1.7	x_to_w	152
7.44.1.8	drop_event	152
7.44.1.9	start_paste	152
7.44.1.10	convert_x	152
7.44.1.11	convert_t	152
7.44.1.12	snap_x	152
7.44.1.13	on_realize	152
7.44.1.14	on_button_press_event	152
7.44.1.15	on_button_release_event	153
7.44.1.16	on_motion_notify_event	153
7.44.1.17	on_key_press_event	153



7.45	seq64::seqkeys Class Reference	153
7.45.1	Member Function Documentation	155
7.45.1.1	set_hint_state	155
7.45.1.2	draw_key	156
7.45.1.3	on_realize	156
7.45.1.4	on_button_press_event	156
7.45.1.5	on_button_release_event	156
7.46	seq64::seqmenu Class Reference	156
7.46.1	Detailed Description	158
7.46.2	Constructor & Destructor Documentation	158
7.46.2.1	seqmenu	158
7.46.2.2	~seqmenu	159
7.46.3	Member Function Documentation	159
7.46.3.1	popup_menu	159
7.46.3.2	seq_edit	159
7.46.3.3	seq_copy	159
7.46.3.4	seq_cut	159
7.46.3.5	seq_paste	159
7.46.3.6	seq_clear_perf	159
7.46.4	Field Documentation	159
7.46.4.1	m_segedit	159
7.47	seq64::seqroll Class Reference	160
7.47.1	Member Function Documentation	163
7.47.1.1	reset	163
7.47.1.2	redraw_events	163
7.47.1.3	set_data_type	163
7.47.1.4	set_background_sequence	163
7.47.1.5	update_background	163
7.47.1.6	draw_events_on_pixmap	163
7.47.1.7	convert_tn	163
7.47.1.8	snap_x	164
7.47.1.9	draw_events_on	164
7.47.1.10	on_key_press_event	164
7.47.1.11	on_scroll_event	164
7.48	seq64::seqtime Class Reference	164
7.48.1	Member Function Documentation	166
7.48.1.1	on_button_press_event	166
7.48.1.2	on_button_release_event	166
7.49	seq64::sequence Class Reference	166
7.49.1	Detailed Description	172

7.49.2	Member Enumeration Documentation	172
7.49.2.1	select_action_e	172
7.49.3	Member Function Documentation	172
7.49.3.1	operator=	172
7.49.3.2	event_count	172
7.49.3.3	push_undo	173
7.49.3.4	pop_undo	173
7.49.3.5	pop_redo	173
7.49.3.6	push_trigger_undo	173
7.49.3.7	set_beats_per_bar	173
7.49.3.8	set_beat_width	173
7.49.3.9	get_beat_width	173
7.49.3.10	set_rec_vol	173
7.49.3.11	set_length	173
7.49.3.12	set_playing	174
7.49.3.13	toggle_queued	174
7.49.3.14	off_queued	174
7.49.3.15	set_recording	174
7.49.3.16	set_snap_tick	174
7.49.3.17	set_quantized_rec	174
7.49.3.18	set_thru	174
7.49.3.19	is_dirty_main	174
7.49.3.20	is_dirty_edit	175
7.49.3.21	is_dirty_perf	175
7.49.3.22	is_dirty_names	175
7.49.3.23	set_dirty_mp	175
7.49.3.24	set_dirty	175
7.49.3.25	set_midi_channel	175
7.49.3.26	print	175
7.49.3.27	print_triggers	175
7.49.3.28	play	175
7.49.3.29	set_orig_tick	175
7.49.3.30	add_event	176
7.49.3.31	add_trigger	176
7.49.3.32	split_trigger	176
7.49.3.33	grow_trigger	176
7.49.3.34	del_trigger	176
7.49.3.35	get_trigger_state	176
7.49.3.36	select_trigger	176
7.49.3.37	unselect_triggers	177

7.49.3.38 intersect_triggers . . . . .	177
7.49.3.39 intersect_notes . . . . .	177
7.49.3.40 intersect_events . . . . .	177
7.49.3.41 paste_trigger . . . . .	178
7.49.3.42 move_selected_triggers_to . . . . .	178
7.49.3.43 selected_trigger_start . . . . .	178
7.49.3.44 selected_trigger_end . . . . .	178
7.49.3.45 get_max_trigger . . . . .	178
7.49.3.46 move_triggers . . . . .	178
7.49.3.47 copy_triggers . . . . .	179
7.49.3.48 clear_triggers . . . . .	179
7.49.3.49 set_midi_bus . . . . .	179
7.49.3.50 set_master_midi_bus . . . . .	179
7.49.3.51 select_note_events . . . . .	179
7.49.3.52 select_events . . . . .	179
7.49.3.53 select_events . . . . .	179
7.49.3.54 get_num_selected_notes . . . . .	179
7.49.3.55 get_num_selected_events . . . . .	179
7.49.3.56 select_all . . . . .	180
7.49.3.57 copy_selected . . . . .	180
7.49.3.58 paste_selected . . . . .	180
7.49.3.59 add_note . . . . .	180
7.49.3.60 add_event . . . . .	180
7.49.3.61 stream_event . . . . .	180
7.49.3.62 change_event_data_range . . . . .	180
7.49.3.63 increment_selected . . . . .	181
7.49.3.64 decrement_selected . . . . .	181
7.49.3.65 grow_selected . . . . .	181
7.49.3.66 stretch_selected . . . . .	181
7.49.3.67 remove_marked . . . . .	182
7.49.3.68 mark_selected . . . . .	182
7.49.3.69 unpaint_all . . . . .	182
7.49.3.70 unselect . . . . .	182
7.49.3.71 verify_and_link . . . . .	182
7.49.3.72 link_new . . . . .	182
7.49.3.73 zero_markers . . . . .	182
7.49.3.74 play_note_on . . . . .	182
7.49.3.75 play_note_off . . . . .	182
7.49.3.76 off_playing_notes . . . . .	182
7.49.3.77 reset_draw_marker . . . . .	182

7.49.3.78	<a href="#">reset_draw_trigger_marker</a>	183
7.49.3.79	<a href="#">get_next_note_event</a>	183
7.49.3.80	<a href="#">get_lowest_note_event</a>	183
7.49.3.81	<a href="#">get_highest_note_event</a>	183
7.49.3.82	<a href="#">get_next_event</a>	183
7.49.3.83	<a href="#">get_next_event</a>	183
7.49.3.84	<a href="#">fill_container</a>	183
7.49.3.85	<a href="#">transpose_notes</a>	183
7.49.3.86	<a href="#">put_event_on_bus</a>	184
7.49.3.87	<a href="#">set_trigger_offset</a>	184
7.49.3.88	<a href="#">split_trigger</a>	184
7.49.3.89	<a href="#">adjust_trigger_offsets_to_length</a>	184
7.49.3.90	<a href="#">remove</a>	184
7.49.3.91	<a href="#">remove</a>	184
7.49.4	<a href="#">Field Documentation</a>	184
7.49.4.1	<a href="#">m_mutex</a>	184
7.50	<a href="#">seq64::trigger Class Reference</a>	184
7.50.1	<a href="#">Detailed Description</a>	185
7.51	<a href="#">seq64::triggers Class Reference</a>	185
7.51.1	<a href="#">Constructor &amp; Destructor Documentation</a>	188
7.51.1.1	<a href="#">triggers</a>	188
7.51.2	<a href="#">Member Function Documentation</a>	188
7.51.2.1	<a href="#">operator=</a>	188
7.51.2.2	<a href="#">set_length</a>	188
7.51.2.3	<a href="#">print</a>	188
7.51.2.4	<a href="#">play</a>	188
7.51.2.5	<a href="#">add</a>	188
7.51.2.6	<a href="#">adjust_offsets_to_length</a>	189
7.51.2.7	<a href="#">split</a>	189
7.51.2.8	<a href="#">split</a>	189
7.51.2.9	<a href="#">grow</a>	189
7.51.2.10	<a href="#">remove</a>	189
7.51.2.11	<a href="#">get_state</a>	190
7.51.2.12	<a href="#">select</a>	190
7.51.2.13	<a href="#">unselect</a>	190
7.51.2.14	<a href="#">intersect</a>	190
7.51.2.15	<a href="#">paste</a>	190
7.51.2.16	<a href="#">move_selected</a>	191
7.51.2.17	<a href="#">get_selected_start</a>	191
7.51.2.18	<a href="#">get_selected_end</a>	191

7.51.2.19 copy	191
7.51.2.20 next	192
7.51.2.21 next_trigger	192
7.51.2.22 adjust_offset	192
7.51.3 Field Documentation	192
7.51.3.1 m_ppqn	192
7.51.3.2 m_length	193
7.52 seq64::user_instrument Class Reference	193
7.52.1 Detailed Description	194
7.52.2 Member Function Documentation	194
7.52.2.1 set_defaults	194
7.52.2.2 controller_max	194
7.52.2.3 controller_name	194
7.52.2.4 controller_active	194
7.52.2.5 set_controller	194
7.52.2.6 set_name	194
7.52.2.7 copy_definitions	194
7.52.3 Field Documentation	195
7.52.3.1 m_is_valid	195
7.52.3.2 m_controller_count	195
7.53 seq64::user_instrument_t Struct Reference	195
7.53.1 Field Documentation	195
7.53.1.1 instrument	195
7.53.1.2 controllers	195
7.53.1.3 controllers_active	195
7.54 seq64::user_midi_bus Class Reference	195
7.54.1 Detailed Description	196
7.54.2 Member Function Documentation	196
7.54.2.1 set_defaults	196
7.54.2.2 channel_count	197
7.54.2.3 channel_max	197
7.54.2.4 instrument	197
7.54.2.5 set_instrument	197
7.54.2.6 copy_definitions	197
7.54.3 Field Documentation	197
7.54.3.1 m_is_valid	197
7.54.3.2 m_channel_count	197
7.55 seq64::user_midi_bus_t Struct Reference	197
7.55.1 Field Documentation	198
7.55.1.1 alias	198

7.55.1.2	instrument	198
7.56	seq64::user_settings Class Reference	198
7.56.1	Detailed Description	202
7.56.2	Member Typedef Documentation	202
7.56.2.1	Busses	202
7.56.2.2	Instruments	202
7.56.3	Member Function Documentation	203
7.56.3.1	set_defaults	203
7.56.3.2	set_globals	203
7.56.3.3	get_globals	203
7.56.3.4	bus	203
7.56.3.5	instrument	203
7.56.3.6	controller_active	203
7.56.3.7	controller_name	203
7.56.3.8	mainwnd_rows	203
7.56.3.9	mainwnd_cols	203
7.56.3.10	max_sets	203
7.56.3.11	text_x	203
7.56.3.12	text_y	204
7.56.3.13	mainwid_border	204
7.56.3.14	mainwid_spacing	204
7.56.3.15	control_height	204
7.56.3.16	dump_summary	204
7.56.3.17	midi_ppqn	204
7.56.3.18	midi_beats_per_bar	204
7.56.3.19	midi_beats_per_minute	204
7.56.3.20	midi_beat_width	204
7.56.3.21	midi_buss_override	204
7.56.3.22	private_bus	204
7.56.3.23	private_instrument	204
7.56.4	Field Documentation	205
7.56.4.1	m_midi_buses	205
7.56.4.2	m_instruments	205
7.56.4.3	m_mainwnd_rows	205
7.56.4.4	m_mainwnd_cols	205
7.56.4.5	m_seqs_in_set	205
7.56.4.6	m_max_sets	205
7.56.4.7	m_max_sequence	205
7.56.4.8	m_text_x	205
7.56.4.9	m_seqchars_x	206

7.56.4.10 m_seqarea_x . . . . .	206
7.56.4.11 m_seqarea_seq_x . . . . .	206
7.56.4.12 m_mainwid_border . . . . .	206
7.56.4.13 m_control_height . . . . .	206
7.56.4.14 m_mainwid_x . . . . .	206
7.56.4.15 m_midi_ppqn . . . . .	206
7.56.4.16 m_midi_beats_per_measure . . . . .	206
7.56.4.17 m_midi_beats_per_minute . . . . .	207
7.56.4.18 m_midi_beat_width . . . . .	207
7.56.4.19 m_midi_buss_override . . . . .	207
7.57 seq64::userfile Class Reference . . . . .	207
7.57.1 Member Function Documentation . . . . .	208
7.57.1.1 parse . . . . .	209
7.57.1.2 write . . . . .	210
7.57.1.3 dump_setting_summary . . . . .	210
<b>Index</b>	<b>211</b>





# Chapter 1

## Sequencer64

**Author(s)** Chris Ahlstrom 2015-10-17

### 1.1 Introduction

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

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

For now, please read the ROADMAP and README files to understand the genesis of this project.

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/sequencer24-doc.git>

In the present document, we've left out a fair amount of side-code to cut down on the size of the document. For example, the main module, redundant Windows support, utility headers like `easy_macros.h`, simple stuff like the mutex module, the fruity variants (at least the ones already refactored into their own modules), etc., are all left out.



## Chapter 2

# User Testing of Sequencer64 with Yoshimi

**Author(s)** Chris Ahlstrom 2015-10-18

### 2.1 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.

### 2.2 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 seq24 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/sequencer24-doc.git>

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

## 2.3 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.

### 2.3.1 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.

### 2.3.2 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.

### 2.3.3 The Sequencer64 User File

To be discussed.

## 2.4 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.

### 2.4.1 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>

## 2.4.2 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 of 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!)

### 2.4.2.1 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.

## 2.5 Specific Fault Debugging

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

## 2.6 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 there 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()` simply 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 3

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## Chapter 4

# Todo List

### File `globals.h`

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

### File `mainwnd.cpp`

Figure out best way to select non-legacy PPQN behavior, probably, for now, a command-line option.

- Add a GUI element that shows the actual PPQN in force, maybe next to the maintime object, or in the title caption.

### 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 `perroll`?

### Global `seq64::jack_assistant::init ()`

Make sure that `global_with_jack_transport`, and better yet, its new `g_rc_settings` member, gets set properly; what option do we need to provide, if any?

### Global `seq64::mainwnd::timeout ()`

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

### Global `seq64::mainwnd::file_import_dialog ()`

We need to look into the Import process and document it better.

### Global `seq64::mainwnd::mainwnd (perform &a_p)`

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_press_event (GdkEventKey *a_ev)`

Test this functionality in old and new application.

### Global `seq64::mainwnd::on_key_release_event (GdkEventKey *a_ev)`

Test this functionality in old and new application.

### Global `seq64::mainwnd::open_performance_edit ()`

Try to find a way to set `m_modified` only if the song editor actually changes something, instead of just because it was opened.

### Global `seq64::perfedit::perfedit (perform &p, int ppqn=SEQ64_USE_DEFAULT_PPQN, int bpm=DEFAULT_T_BEATS_PER_MEASURE, int bw=DEFAULT_BEAT_WIDTH)`

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

### Global `seq64::perform::set_beats_per_minute (int bpm)`

I think this logic is wrong, in that it needs only one of the two to be stopped before it sets the BPM, while it seems to me that both should be stopped; to be determined.

### Global `seq64::perform::start_playing (bool flag=false)`

Verify the usage and nature of this flag.

**Global `seq64::seqedit::get_measures ()`**

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

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

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

**Global `seq64::seqedit::set_background_sequence (int seq)`**

Make the sequence pointer a reference.

**Global `seq64::seqmenu::seq_clear_perf ()`**

All of `seq_paste()` can be offloaded to a (new) perform member function.

**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::sequence::remove (event *e)`**

Use `find` instead in `sequence::remove()`!

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

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

## Chapter 5

# Hierarchical Index

### 5.1 Class Hierarchy

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

seq64::AbstractPerfInput . . . . .	21
seq64::Seq24PerfInput . . . . .	135
seq64::click . . . . .	21
seq64::configfile . . . . .	24
seq64::optionsfile . . . . .	97
seq64::userfile . . . . .	207
seq64::event . . . . .	25
seq64::event_list::event_key . . . . .	32
seq64::event_list . . . . .	33
seq64::font . . . . .	36
seq64::gui_assistant . . . . .	39
seq64::gui_assistant_gtk2 . . . . .	41
seq64::gui_palette_gtk2 . . . . .	50
seq64::gui_drawingarea_gtk2 . . . . .	42
seq64::maintime . . . . .	68
seq64::mainwid . . . . .	70
seq64::perfnames . . . . .	104
seq64::perfroll . . . . .	124
seq64::perftime . . . . .	129
seq64::seqdata . . . . .	138
seq64::seqevent . . . . .	148
seq64::seqkeys . . . . .	153
seq64::seqroll . . . . .	160
seq64::seqtime . . . . .	164
seq64::gui_window_gtk2 . . . . .	52
seq64::mainwnd . . . . .	76
seq64::perfedit . . . . .	100
seq64::seqedit . . . . .	142
seq64::jack_assistant . . . . .	53
seq64::jack_scratchpad . . . . .	56
seq64::keybindentry . . . . .	56
seq64::keys_perform . . . . .	58
seq64::keys_perform_gtk2 . . . . .	62
seq64::keys_perform_transfer . . . . .	64
seq64::keystroke . . . . .	64
seq64::lash . . . . .	67

seq64::midi_container . . . . .	83
seq64::midi_list . . . . .	85
seq64::midi_vector . . . . .	87
seq64::midifile . . . . .	89
seq64::options . . . . .	97
seq64::perform . . . . .	108
seq64::performcallback . . . . .	123
seq64::mainwnd . . . . .	76
seq64::rc_settings . . . . .	132
seq64::gui_drawingarea_gtk2::rect . . . . .	135
seq64::rect . . . . .	135
seq64::Seq24SeqEventInput . . . . .	137
seq64::Seq24SeqRollInput . . . . .	137
seq64::seqmenu . . . . .	156
seq64::mainwid . . . . .	70
seq64::perfnames . . . . .	104
seq64::sequence . . . . .	166
seq64::trigger . . . . .	184
seq64::triggers . . . . .	185
seq64::user_instrument . . . . .	193
seq64::user_instrument_t . . . . .	195
seq64::user_midi_bus . . . . .	195
seq64::user_midi_bus_t . . . . .	197
seq64::user_settings . . . . .	198



## Chapter 6

# Data Structure Index

### 6.1 Data Structures

Here are the data structures with brief descriptions:

<a href="#">seq64::AbstractPerfInput</a>	Provides an abstract base class to provide the minimal interface for the various "perf input" classes . . . . .	??
<a href="#">seq64::click</a>	Encapsulates any possible mouse click . . . . .	??
<a href="#">seq64::configfile</a>	This class is the abstract base class for optionsfile and userfile . . . . .	??
<a href="#">seq64::event</a>	Provides events for management of MIDI events . . . . .	??
<a href="#">seq64::event_list::event_key</a>	Provides a key value for an event map . . . . .	??
<a href="#">seq64::event_list</a>	Receptable for MIDI events . . . . .	??
<a href="#">seq64::font</a>	This class provides a wrapper for rendering fonts that are encoded as a 16 x 16 pixmap file in XPM format . . . . .	??
<a href="#">seq64::gui_assistant</a>	This class provides an interface for some of the GUI support needed in Sequencer64 . . . . .	??
<a href="#">seq64::gui_assistant_gtk2</a>	This class provides an interface for some of the Gtk/Gdk/Glib support needed in Sequencer64 . . . . .	??
<a href="#">seq64::gui_drawingarea_gtk2</a>	Implements the basic drawing areas of the application . . . . .	??
<a href="#">seq64::gui_palette_gtk2</a>	Implements a stock palette of Gdk::Color elements . . . . .	??
<a href="#">seq64::gui_window_gtk2</a>	This class supports a basic interface for Gtk::Window-derived objects . . . . .	??
<a href="#">seq64::jack_assistant</a>	This class provides the performance mode JACK support . . . . .	??
<a href="#">seq64::jack_scratchpad</a>	Provide a temporary structure for passing data and results between a perform and <a href="#">jack_assistant</a> object . . . . .	??
<a href="#">seq64::keybindentry</a>	Class for management of application key-bindings . . . . .	??
<a href="#">seq64::keys_perform</a>	This class supports the performance mode . . . . .	??
<a href="#">seq64::keys_perform_gtk2</a>	This class supports the performance mode . . . . .	??

<a href="#">seq64::keys_perform_transfer</a>	Provides a data-transfer structure to make it easier to fill in a <a href="#">keys_perform</a> object's members using sscanf() . . . . .	??
<a href="#">seq64::keystroke</a>	Encapsulates any practical keystroke . . . . .	??
<a href="#">seq64::lash</a>	This class supports LASH operations, if compiled with LASH support (i.e . . . . .	??
<a href="#">seq64::maintime</a>	This class provides the drawing of the progress bar at the top of the main window, along with the "pills" that move in time with the measures . . . . .	??
<a href="#">seq64::mainwid</a>	This class implement the piano roll area of the application . . . . .	??
<a href="#">seq64::mainwnd</a>	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 . . . . .	??
<a href="#">seq64::midi_container</a>	This class is the abstract base class for a container of MIDI track information . . . . .	??
<a href="#">seq64::midi_list</a>	This class is the std::list implementation of the <a href="#">midi_container</a> . . . . .	??
<a href="#">seq64::midi_vector</a>	This class is the std::vector implementation of the <a href="#">midi_container</a> . . . . .	??
<a href="#">seq64::midifile</a>	This class handles the parsing and writing of MIDI files . . . . .	??
<a href="#">seq64::options</a>	This class supports a full tabbed options dialog . . . . .	??
<a href="#">seq64::optionsfile</a>	Provides a file for reading and writing the application' main configuration file . . . . .	??
<a href="#">seq64::perfedit</a>	This class supports a Performance Editor that is used to arrange the patterns/sequences defined in the patterns panel . . . . .	??
<a href="#">seq64::perfnames</a>	This class implements the left-side keyboard in the patterns window . . . . .	??
<a href="#">seq64::perform</a>	This class supports the performance mode . . . . .	??
<a href="#">seq64::performcallback</a>	Provides for notification of events . . . . .	??
<a href="#">seq64::perfroll</a>	This class implements the performance roll user interface . . . . .	??
<a href="#">seq64::perftime</a>	This class implements drawing the piano time at the top of the "performance window" (the "song editor") . . . . .	??
<a href="#">seq64::rc_settings</a>	This class contains the options formerly named "global_XXXXXX" . . . . .	??
<a href="#">seq64::gui_drawingarea_gtk2::rect</a>	A small helper structure representing a rectangle . . . . .	??
<a href="#">seq64::rect</a>	A small helper class representing a rectangle . . . . .	??
<a href="#">seq64::Seq24PerfInput</a>	Implements the default (Seq24) performance input characteristics of this application . . . . .	??
<a href="#">seq64::Seq24SeqEventInput</a>	This structure implement the normal interaction methods for Seq24 . . . . .	??
<a href="#">seq64::Seq24SeqRollInput</a>	Implements the Seq24 mouse interaction paradigm for the seqroll . . . . .	??
<a href="#">seq64::seqdata</a>	This class supports drawing piano-roll events on a window . . . . .	??
<a href="#">seq64::seqedit</a>	Implements the Pattern Editor, which has references to: . . . . .	??

<code>seq64::seqevent</code>	Implements the piano event drawing area . . . . .	??
<code>seq64::seqkeys</code>	This class implements the left side piano of the pattern/sequence editor . . . . .	??
<code>seq64::seqmenu</code>	This class handles the right-click menu of the sequence slots in the pattern window . . . . .	??
<code>seq64::seqroll</code>	Implements the piano roll section of the pattern editor . . . . .	??
<code>seq64::seqtime</code>	This class implements the piano time, whatever that is . . . . .	??
<code>seq64::sequence</code>	Firstly a receptable for a single track of MIDI data read from a MIDI file or edited into a pattern	??
<code>seq64::trigger</code>	This class hold a single trigger for a sequence object . . . . .	??
<code>seq64::triggers</code>	Receptable the triggers that can be used with a sequence object . . . . .	??
<code>seq64::user_instrument</code>	Provides data about the MIDI instruments, readable from the "user" configuration file . . . . .	??
<code>seq64::user_instrument_t</code>	This structure corresponds to [user-instrument-N] definitions in the <code>~/.seq24usr</code> or <code>~/.config/sequencer64/sequencer64.usr</code> file . . . . .	??
<code>seq64::user_midi_bus</code>	Provides data about the MIDI busses, readable from the "user" configuration file . . . . .	??
<code>seq64::user_midi_bus_t</code>	This structure corresponds to [user-midi-bus-0] definitions in the <code>~/.seq24usr</code> ("user") file ( <code>~/.config/sequencer64/sequencer64.usr</code> in the latest version of the application) . . . . .	??
<code>seq64::user_settings</code>	Holds the current values of sequence settings and settings that can modify the number of sequences and the configuration of the user-interface . . . . .	??
<code>seq64::userfile</code>	Supports the user's <code>~/.config/sequencer64/sequencer64.usr</code> and <code>~/.seq24usr</code> configuration file . . . . .	??



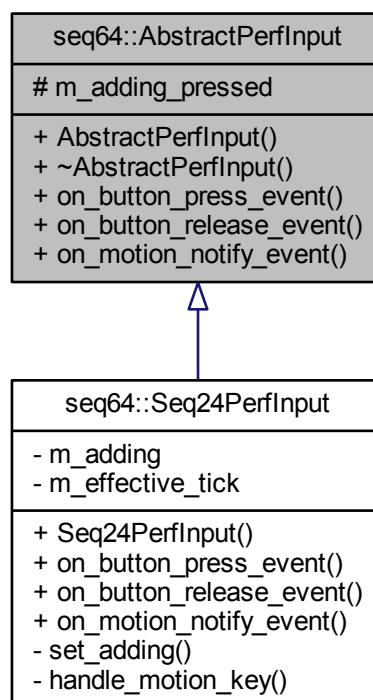
## Chapter 7

# Data Structure Documentation

### 7.1 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:



### 7.2 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.*

### 7.2.1 Detailed Description

Useful in passing more generic events to non-GUI classes.

## 7.2.2 Constructor & Destructor Documentation

### 7.2.2.1 seq64::click::click ( )

Sets all members to false, zero, or the lowest good value.

**7.2.2.2** `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

<i>x</i>	The putative x value of the button click.
<i>y</i>	The putative y value of the button click.
<i>button</i>	The value of the button that was clicked, set to 1, 2, or 3.
<i>press</i>	Set to true if the event was a button press, false if it was a button release.
<i>modkey</i>	Indicates which modifier key (such as Ctrl or Alt), if any, was pressed at the same time as the click action.

### 7.2.2.3 seq64::click::click ( const click & rhs )

It is nice to be explicit about these kinds of functions, even if it gets tedious.

#### Parameters

<i>rhs</i>	Provides the source object to be copied.
------------	--

## 7.2.3 Member Function Documentation

### 7.2.3.1 click & seq64::click::operator= ( const click & rhs )

It is nice to be explicit about these kinds of functions, even if it gets tedious.

#### Parameters

<i>rhs</i>	Provides the source object to be assigned from. The assignment is not made if "this" has the same address as this parameter.
------------	--

## 7.2.4 Field Documentation

### 7.2.4.1 int seq64::click::m\_x [private]

0 is the left-most coordinate.

### 7.2.4.2 int seq64::click::m\_y [private]

0 is the top-most coordinate.

### 7.2.4.3 int seq64::click::m\_button [private]

Left is 1, middle is 2, and right is 3. These numbers are defined via macros, and are Linux-specific and Gtk-specific.

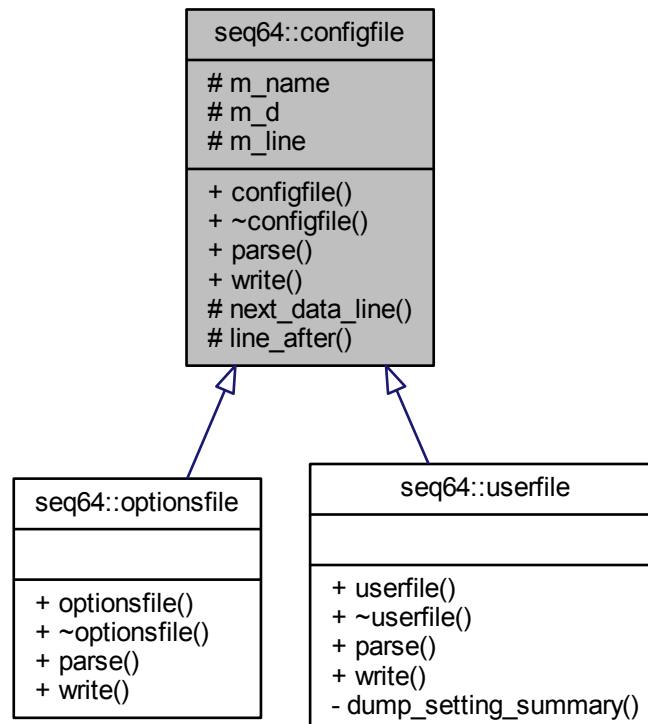
#### 7.2.4.4 seq\_modifier\_t seq64::click::m\_modifier [private]

Note that SEQ64\_NO\_MASK is our word for 0, meaning "no modifier".

### 7.3 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 &a\_name)  
*Provides the string constructor for a configuration file.*
- virtual [~configfile](#) ()  
*A rote destructor needed for a base class.*

#### Protected Member Functions

- void [next\\_data\\_line](#) (std::ifstream &a\_file)  
*Gets the next line of data from an input stream.*
- void [line\\_after](#) (std::ifstream &a\_file, const std::string &a\_tag)  
*This function gets a specific line of text, specified as a tag.*



## Protected Attributes

- `std::string m_name`  
*Provides the name of the file.*
- `unsigned 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.*

### 7.3.1 Constructor & Destructor Documentation

#### 7.3.1.1 seq64::configfile::configfile ( const std::string & name )

##### Parameters

<i>name</i>	The name of the configuration file.
-------------	-------------------------------------

### 7.3.2 Member Function Documentation

#### 7.3.2.1 void 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.

We may try to convert this item to a reference; pointers can be subject to problems. For example, what if someone passes a nullpointer? For speed, we don't check it.

Member `m_line` is a "global" return value.

##### Parameters

<i>a_file</i>	Points to an input stream.
---------------	----------------------------

#### 7.3.2.2 void seq64::configfile::line\_after ( std::ifstream & file, const std::string & tag ) [protected]

##### Parameters

<i>file</i>	Points to the input file stream.
<i>tag</i>	Provides a tag to be found. Lines are read until a match occurs with this tag.

### 7.3.3 Field Documentation

#### 7.3.3.1 char seq64::configfile::m\_line[SEQ64\_LINE\_MAX] [protected]

This member receives an input line, and so needs to be a character buffer.

## 7.4 seq64::event Class Reference

Provides events for management of MIDI events.

## Public Member Functions

- `event ()`  
*This constructor simply initializes all of the class members.*
- `~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 (unsigned long time)`  
*'Setter' function for member `m_timestamp`*
- `long get_timestamp () const`  
*'Getter' function for member `m_timestamp`*
- `unsigned char status () const`  
*'Getter' function for member `m_status`*
- `void mod_timestamp (unsigned long a_mod)`  
*Calculates the value of the current timestamp modulo the given parameter.*
- `void set_status (char status)`  
*Sets the `m_status` member to the value of `a_status`.*
- `unsigned char get_status () const`  
*'Getter' function for member `m_status`*
- `void set_data (char d1)`  
*Clears the most-significant-bit of the `d1` parameter, and sets it into the first byte of `m_data`.*
- `void set_data (char d1, char d2)`  
*Clears the most-significant-bit of both parameters, and sets them into the first and second bytes of `m_data`.*
- `void get_data (unsigned char &d0, unsigned char &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[1]`) and clears the most significant bit.*
- `void decrement_data1 ()`  
*Decrements the first data byte (`m_data[1]`) 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.*
- `void start_sysex ()`  
*Deletes and clears out the SYSEX buffer.*
- `bool append_sysex (unsigned char *data, long size)`  
*Appends SYSEX data to a new buffer.*
- `unsigned char * get_sysex () const`  
*'Getter' function for member `m_sysex`*
- `void set_size (long a_size)`  
*'Setter' function for member `m_size`*
- `long get_size () const`  
*'Getter' function for member `m_size`*
- `void link (event *a_event)`  
*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*
- 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;.*
- unsigned char `data` (int index) const  
*'Getter' function for member m\_data[]*
- unsigned char `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` (char a\_note)  
*Sets the note number, clearing off the most-significant-bit and assigning it to the first data byte, m\_data[0].*
- unsigned char `get_note_velocity` () const  
*'Getter' function for member m\_data[1], the note velocity.*
- void `set_note_velocity` (int a\_vel)  
*Sets the note velocity, with is held in the second data byte, m\_data[1].*
- bool `is_note_on` () const  
*Returns true if m\_status is EVENT\_NOTE\_ON.*
- bool `is_note_off` () const  
*Returns true if m\_status is EVENT\_NOTE\_OFF.*
- void `print` ()  
*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` (unsigned char msg)  
*Static test for channel messages/statuses.*
- static bool `is_one_byte_msg` (unsigned char msg)  
*Static test for channel messages that have only one data byte.*
- static bool `is_two_byte_msg` (unsigned char msg)  
*Static test for channel messages that have two data bytes.*
- static bool `is_desired_cc_or_not_cc` (unsigned char msg, unsigned char cc, unsigned char datum)  
*Static test for channel messages that are either not control-change messages, or are and match the given controller value.*

## Private Attributes

- unsigned char [m\\_status](#)  
*This is status byte without the channel.*
- unsigned char [m\\_data](#) [MIDI\_DATA\_BYTE\_COUNT]  
*The two bytes of data for the MIDI event.*
- unsigned char \* [m\\_sysex](#)  
*Points to the data buffer for SYSEX messages.*
- long [m\\_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."*

### 7.4.1 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.

### 7.4.2 Constructor & Destructor Documentation

#### 7.4.2.1 `seq64::event::~~event ( )`

The [start\\_sysex\(\)](#) function does what we need.

### 7.4.3 Member Function Documentation

#### 7.4.3.1 `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::map` 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).

#### Parameters

<i>rhs</i>	The object to be compared against.
------------	------------------------------------

#### Returns

Returns true if the time-stamp and "rank" are less than those of the comparison object.

**7.4.3.2** `static bool seq64::event::is_channel_msg ( unsigned char msg )` `[inline],[static]`

#### Parameters

<i>msg</i>	The channel status or message byte to be tested.
------------	--

#### Returns

Returns true if the byte represents a MIDI channel message.

**7.4.3.3** `static bool seq64::event::is_one_byte_msg ( unsigned char msg )` `[inline],[static]`

The rest have two.

#### Parameters

<i>msg</i>	The channel status or message byte to be tested.
------------	--

#### 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.

**7.4.3.4** `static bool seq64::event::is_two_byte_msg ( unsigned char msg )` `[inline],[static]`

#### Parameters

<i>msg</i>	The channel status or message byte to be tested.
------------	--

#### 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.

**7.4.3.5** `static bool seq64::event::is_desired_cc_or_not_cc ( unsigned char msg, unsigned char cc, unsigned char 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 msg
    The channel status or message byte to be tested.

\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.
```

**7.4.3.6 void seq64::event::mod\_timestamp ( unsigned long *a\_mod* ) [inline]****Parameters**

<i>a_mod</i>	The value to mod the timestamp against.
--------------	---

**Returns**

Returns a value ranging from 0 to *a\_mod*-1.

**7.4.3.7 void seq64::event::set\_status ( char *status* )**

If *a\_status* is a non-channel event, then the channel portion of the status is cleared using a bitwise AND against `EVENT_CLEAR_CHAN_MASK`.

Is this a better way to do it?

```
m_status = (unsigned char)(status) & EVENT_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()`.

**7.4.3.8 void seq64::event::set\_data ( char *d1* ) [inline]****Parameters**

<i>d1</i>	The byte value to set. We should make these all "midibytes".
-----------	--

**7.4.3.9 void seq64::event::set\_data ( char *d1*, char *d2* ) [inline]**

## Parameters

<i>d1</i>	The first byte value to set. We should make these all "midibytes".
<i>d2</i>	The second byte value to set. We should make these all "midibytes".

7.4.3.10 `void seq64::event::get_data ( unsigned char & d0, unsigned char & d1 ) const` `[inline]`

## Parameters

<i>d0</i>	[out] The return reference for the first byte.
<i>d1</i>	[out] The return reference for the first byte.

7.4.3.11 `bool seq64::event::append_sysex ( unsigned char * data, long dsize )`

First, a buffer of size `m_size+dsize` is created. The existing SYSEX data (stored in `m_sysex`) is copied to this buffer. Then the data represented by `data` and `dsize` is appended to that data buffer. Then the original SYSEX buffer, `m_sysex`, is deleted, and `m_sysex` is assigned to the new buffer.

## Parameters

<i>data</i>	Provides the additional SYSEX data. If not provided, nothing is done, and false is returned.
<i>dsize</i>	Provides the size of the additional SYSEX data. If not provided, nothing is done.

## Returns

Returns false if there was an `EVENT_SYSEX_END` byte in the appended data, or if an error occurred, and the caller needs to stop trying to process the data.

7.4.3.12 `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.

## 7.4.4 Field Documentation

7.4.4.1 `unsigned char seq64::event::m_status` `[private]`

The channel will be appended on the MIDI bus. The high nibble = type of event; The low nibble = channel. Bit 7 is present in all status bytes.

7.4.4.2 `unsigned char seq64::event::m_data[MIDI_DATA_BYTE_COUNT]` `[private]`

Remember that the most-significant bit of a data byte is always 0.

7.4.4.3 `unsigned char* seq64::event::m_sysex` `[private]`

This really ought to be a Boost or STD scoped pointer.

#### 7.4.4.4 `bool seq64::event::m_has_link` [private]

This item is used [via the `get_link()` and `link()` accessors] in the sequence class.

## 7.5 `seq64::event_list::event_key` Class Reference

Provides a key value for an event map.

### Public Member Functions

- `event_key` (unsigned long *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

- unsigned long `m_timestamp`  
*The primary key-value for the key.*
- int `m_rank`  
*The sub-key-value for the key.*

#### 7.5.1 Detailed Description

Its types match the `m_timestamp` and `get_rank()` function of this event class.

#### 7.5.2 Constructor & Destructor Documentation

##### 7.5.2.1 `seq64::event_list::event_key::event_key ( unsigned long tstamp, int rank )`

###### Parameters

<i>tstamp</i>	The time-stamp is the primary part of the key. It is the most important key item.
<i>rank</i>	Rank is an arbitrary number used to prioritize events that have the same time-stamp. See the <code>event::get_rank()</code> function for more information.

##### 7.5.2.2 `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

<i>rhs</i>	Provides the event key to be copied.
------------	--------------------------------------

#### 7.5.3 Member Function Documentation

##### 7.5.3.1 `bool seq64::event_list::event_key::operator< ( const event_key &rhs ) const`



## Parameters

<code>e</code>	Provides the event key to be compared against.
----------------	--

## 7.5.4 Field Documentation

7.5.4.1 unsigned long seq64::event\_list::event\_key::m\_timestamp [private]

7.5.4.2 int seq64::event\_list::event\_key::m\_rank [private]

## 7.6 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.*
- void `add (const event &e, bool postsort=true)`  
*Adds an event to the internal event list in an optionally sorted manner.*
- 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 ()`  
*Wrapper for std::list::sort(), or, since multimaps are always sorted, an empty function.*

## 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.*

## 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](#) (long slength)  
*This function verifies state: all note-ons have an off, and it links note-offs with their note-ons.*
- void [mark\\_selected](#) ()  
*Marks all selected events.*
- void [mark\\_out\\_of\\_range](#) (long slength)  
*Marks all events that have a time-stamp that is out of range.*
- void [unmark\\_all](#) ()  
*Unmarks all 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](#) (unsigned char status, unsigned char 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](#) ()  
*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.*

### 7.6.1 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.

### 7.6.2 Constructor & Destructor Documentation

#### 7.6.2.1 seq64::event\_list::event\_list ( const event\_list & rhs )

Parameters

<i>rhs</i>	Provides the event list to be copied.
------------	---------------------------------------

### 7.6.3 Member Function Documentation

#### 7.6.3.1 event\_list & seq64::event\_list::operator= ( const event\_list & rhs )

Follows the stock rules for such an operator, just assigning member values.

Parameters

<i>rhs</i>	Provides the event list to be assigned.
------------	---

#### 7.6.3.2 int seq64::event\_list::count ( ) const [inline]

We like returning an integer instead of `size_t`, and rename the function so nobody is fooled.

#### 7.6.3.3 void seq64::event\_list::add ( const event & e, bool postsort = true )

It is a wrapper, wrapper for `insert()` or `push_front()`, with an option to call `sort()`.

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;
```

#### 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 exploring using a `multimap` as the container.

Parameters

<i>e</i>	Provides the event to be added to the list.
<i>postsort</i>	If true, and the <code>std::list</code> implementation has been built in, then the event list is sorted after the addition. This is a time-consuming operation.

#### 7.6.3.4 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 multi-map. Once all this setup, merging is really just insertion. And, since sorting isn't needed, the multimap actually turns out to be faster.

#### Parameters

<i>el</i>	Provides the event list to be merged into the current event list.
<i>presort</i>	If true, the events are presorted. This is a requirement for merging an <code>std::list</code> , but is a no-op for the <code>std::multimap</code> implementation.

#### 7.6.3.5 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.

#### 7.6.3.6 void seq64::event\_list::verify\_and\_link ( long slength ) [private]

#### Threadsafe

#### Parameters

<i>slength</i>	Provides the length beyond which events will be pruned.
----------------	---

#### 7.6.3.7 void seq64::event\_list::mark\_out\_of\_range ( long 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.

#### Parameters

<i>slength</i>	Provides the length beyond which events will be pruned.
----------------	---

#### 7.6.3.8 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.

#### 7.6.3.9 int seq64::event\_list::count\_selected\_events ( unsigned char status, unsigned char cc ) const [private]

If the event is a control change (CC), then it must also match the given CC value.

## 7.7 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](#) }

## Public Member Functions

- [font](#) ()  
*Rote default constructor.*
- 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) 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

- 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\_yb.xpm is loaded into this object.*
- Glib::RefPtr< Gdk::Pixmap > [m\\_y\\_on\\_b\\_pixmap](#)  
*The pixmap in the file src/pixmaps/font\_by.xpm is loaded into this object.*
- Glib::RefPtr< Gdk::Bitmap > [m\\_clip\\_mask](#)  
*This object is instantiated as a default object.*

## 7.7.1 Member Enumeration Documentation

### 7.7.1.1 enum seq64::font::Color

#### Enumerator

**BLACK** A simple enumeration to describe the basic colors used in writing text. 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).

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.

## 7.7.2 Member Function Documentation

### 7.7.2.1 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.

### 7.7.2.2 void seq64::font::render\_string\_on\_drawable ( Glib::RefPtr< Gdk::GC > a\_gc, int x, int y, Glib::RefPtr< Gdk::Drawable > a\_draw, const char \* str, font::Color col ) 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

<i>a_gc</i>	Provides the graphics context for drawing the text using GTK+.
<i>x</i>	The horizontal location of the text.
<i>y</i>	The vertical location of the text.
<i>a_draw</i>	The drawable object on which to draw the text.
<i>str</i>	The string to draw. Should use a constant string reference instead.
<i>col</i>	The font color to use to draw the string. The supported values are <a href="#">font::BLACK</a> , <a href="#">font::WHITE</a> , <a href="#">font::BLACK_ON_YELLOW</a> , <a href="#">font::YELLOW_ON_BLACK</a> . The actual correct colors are provided by selecting one of four font pixmaps, as described in the <a href="#">init()</a> function.

## 7.7.3 Field Documentation

### 7.7.3.1 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.

### 7.7.3.2 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.

7.7.3.3 `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).

7.7.3.4 `Glib::RefPtr<Gdk::Pixmap> seq64::font::m_black_pixmap` `[private]`

It contains a black font on a white background.

7.7.3.5 `Glib::RefPtr<Gdk::Pixmap> seq64::font::m_white_pixmap` `[private]`

It contains a black font on a white background.

7.7.3.6 `Glib::RefPtr<Gdk::Pixmap> seq64::font::m_b_on_y_pixmap` `[private]`

It contains a black font on a yellow background.

7.7.3.7 `Glib::RefPtr<Gdk::Pixmap> seq64::font::m_y_on_b_pixmap` `[private]`

It contains a yellow font on a black background.

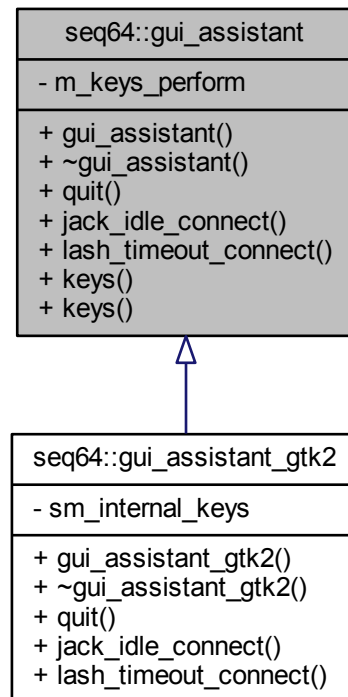
7.7.3.8 `Glib::RefPtr<Gdk::Bitmap> seq64::font::m_clip_mask` `[private]`

All we know is it seems to be a requirement for creating a pixmap object from an XMP file.

## 7.8 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.*
- 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.*

### 7.8.1 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).



## 7.8.2 Constructor & Destructor Documentation

### 7.8.2.1 seq64::gui\_assistant::gui\_assistant ( keys\_perform & kp )

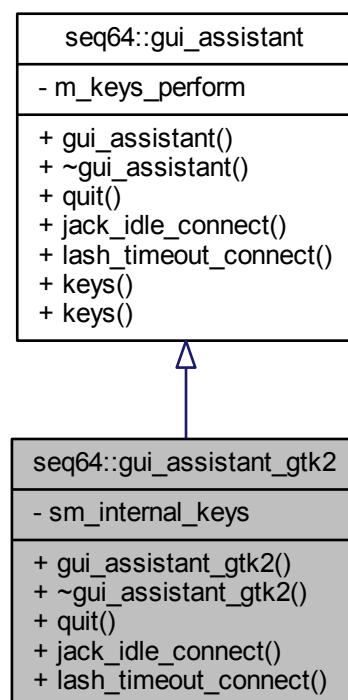
#### Parameters

<i>kp</i>	Provides a set of key codes to be used by the perform object to control patterns and their performance.
-----------	---

## 7.9 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 void [quit \(\)](#)  
*Calls the Glib Main object's [quit\(\)](#) function.*
- virtual void [jack\\_idle\\_connect](#) ([jack\\_assistant](#) &jack)  
*Connects the JACK session-event callback to the Glib idle object.*
- virtual void [lash\\_timeout\\_connect](#) ([lash](#) &lashobject)  
*Connects the LASH timeout-event callback to the Glib timeout object.*



- Principal constructor.*
- [~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

- [perform](#) & [perf](#) ()  
*'Getter' function for member m\_mainperf*
- 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)  
*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)  
*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 [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\\_current\\_x](#)  
*The x and y value of the current location of the mouse (during dragging?).*
- int [m\\_drop\\_x](#)  
*These values are used when roping and highlighting a bunch of events.*

## Private Member Functions

- void [gtk\\_drawarea\\_init](#) ()  
*Does basic initialization for each of the constructors.*

## Additional Inherited Members

### 7.10.1 Detailed Description

Note that this class really "isn't a" `gui_palette_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.

### 7.10.2 Member Function Documentation

**7.10.2.1** `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

<i>ls</i>	Provides the Gtk-specific line style.
<i>width</i>	Provides the width of the line to be drawn. It defaults to the most common value, 1.

**7.10.2.2** `void seq64::gui_drawingarea_gtk2::draw_line ( int x1, int y1, int x2, int y2 )` `[inline]`, `[protected]`

Parameters

<i>x1</i>	The x coordinate of the starting point.
<i>y1</i>	The y coordinate of the starting point.
<i>x2</i>	The x coordinate of the ending point.
<i>y2</i>	The y coordinate of the ending point.

**7.10.2.3** `void seq64::gui_drawingarea_gtk2::draw_line ( const Color & c, int x1, int y1, int x2, int y2 )` `[protected]`

Parameters

<i>c</i>	The foreground color in which to draw the line.
<i>x1</i>	The x coordinate of the starting point.
<i>y1</i>	The y coordinate of the starting point.
<i>x2</i>	The x coordinate of the ending point.
<i>y2</i>	The y coordinate of the ending point.

**7.10.2.4** `void seq64::gui_drawingarea_gtk2::draw_line_on_pixmap ( int x1, int y1, int x2, int y2 )` `[inline]`, `[protected]`

Parameters

<i>x1</i>	The x coordinate of the starting point.
<i>y1</i>	The y coordinate of the starting point.
<i>x2</i>	The x coordinate of the ending point.
<i>y2</i>	The y coordinate of the ending point.

**7.10.2.5** `void seq64::gui_drawingarea_gtk2::draw_line_on_pixmap ( const Color & c, int x1, int y1, int x2, int y2 )` `[protected]`

## Parameters

<i>c</i>	The foreground color in which to draw the line.
<i>x1</i>	The x coordinate of the starting point.
<i>y1</i>	The y coordinate of the starting point.
<i>x2</i>	The x coordinate of the ending point.
<i>y2</i>	The y coordinate of the ending point.

7.10.2.6 `void seq64::gui_drawingarea_gtk2::draw_line ( Glib::RefPtr< Gdk::Pixmap > & pixmap, int x1, int y1, int x2, int y2 )`  
`[inline],[protected]`

## Parameters

<i>pixmap</i>	Provides the Gdk::Pixmap pointer needed to draw the line.
<i>x1</i>	The x coordinate of the starting point.
<i>y1</i>	The y coordinate of the starting point.
<i>x2</i>	The x coordinate of the ending point.
<i>y2</i>	The y coordinate of the ending point.

7.10.2.7 `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

<i>drawable</i>	Provides the Gdk::Drawable pointer needed to draw the line.
<i>c</i>	The foreground color in which to draw the line.
<i>x1</i>	The x coordinate of the starting point.
<i>y1</i>	The y coordinate of the starting point.
<i>x2</i>	The x coordinate of the ending point.
<i>y2</i>	The y coordinate of the ending point.

7.10.2.8 `void seq64::gui_drawingarea_gtk2::draw_line ( Glib::RefPtr< Gdk::Drawable > & drawable, int x1, int y1, int x2, int y2 )`  
`[inline],[protected]`

## Parameters

<i>drawable</i>	Provides the Gdk::Drawable pointer needed to draw the line.
<i>x1</i>	The x coordinate of the starting point.
<i>y1</i>	The y coordinate of the starting point.
<i>x2</i>	The x coordinate of the ending point.
<i>y2</i>	The y coordinate of the ending point.

7.10.2.9 `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

<i>drawable</i>	Provides the Gdk::Drawable pointer needed to draw the line.
<i>c</i>	The foreground color in which to draw the line.

<i>x1</i>	The x coordinate of the starting point.
<i>y1</i>	The y coordinate of the starting point.
<i>x2</i>	The x coordinate of the ending point.
<i>y2</i>	The y coordinate of the ending point.

7.10.2.10 `void seq64::gui_drawingarea_gtk2::render_string ( int x, int y, const std::string & s, font::Color color )`  
`[inline], [protected]`

#### Parameters

<i>x</i>	The x-coordinate of the origin.
<i>y</i>	The y-coordinate of the origin.
<i>s</i>	The string to be drawn.
<i>color</i>	The color with which to draw the string.

7.10.2.11 `void seq64::gui_drawingarea_gtk2::render_string_on_pixmap ( int x, int y, const std::string & s, font::Color color )`  
`[inline], [protected]`

#### Parameters

<i>x</i>	The x-coordinate of the origin.
<i>y</i>	The y-coordinate of the origin.
<i>s</i>	The string to be drawn.
<i>color</i>	The color with which to draw the string.

7.10.2.12 `void seq64::gui_drawingarea_gtk2::draw_rectangle ( int x, int y, int lx, int ly, bool fill = true )` `[inline], [protected]`

#### Parameters

<i>x</i>	The x-coordinate of the origin.
<i>y</i>	The y-coordinate of the origin.
<i>lx</i>	The width of the box.
<i>ly</i>	The height of the box.
<i>fill</i>	If true, fill the rectangle with the current foreground color, as set by <code>m_gc-&gt;set_foreground(color)</code> . Defaults to true.

7.10.2.13 `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

<i>c</i>	Provides the foreground color to set.
<i>x</i>	The x-coordinate of the origin.
<i>y</i>	The y-coordinate of the origin.
<i>lx</i>	The width of the box.
<i>ly</i>	The height of the box.

<i>fill</i>	If true, fill the rectangle with the current foreground color, as set by <code>m_gc-&gt;set_foreground(color)</code> . Defaults to true.
-------------	--

7.10.2.14 `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

<i>drawable</i>	The object on which to draw the rectangle.
<i>x</i>	The x-coordinate of the origin.
<i>y</i>	The y-coordinate of the origin.
<i>lx</i>	The width of the box.
<i>ly</i>	The height of the box.
<i>fill</i>	If true, fill the rectangle with the current foreground color, as set by <code>m_gc-&gt;set_foreground(color)</code> . Defaults to true.

7.10.2.15 `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

<i>drawable</i>	The surface on which to draw the box.
<i>c</i>	Provides the foreground color to set.
<i>x</i>	The x-coordinate of the origin.
<i>y</i>	The y-coordinate of the origin.
<i>lx</i>	The width of the box.
<i>ly</i>	The height of the box.
<i>fill</i>	If true, fill the rectangle with the current foreground color, as set by <code>m_gc-&gt;set_foreground(color)</code> . Defaults to true.

7.10.2.16 `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

<i>drawable</i>	The object on which to draw the rectangle.
<i>x</i>	The x-coordinate of the origin.
<i>y</i>	The y-coordinate of the origin.
<i>lx</i>	The width of the box.
<i>ly</i>	The height of the box.
<i>fill</i>	If true, fill the rectangle with the current foreground color, as set by <code>m_gc-&gt;set_foreground(color)</code> . Defaults to true.

7.10.2.17 `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

<i>pixmap</i>	The surface on which to draw the box.
<i>c</i>	Provides the foreground color to set.
<i>x</i>	The x-coordinate of the origin.
<i>y</i>	The y-coordinate of the origin.
<i>lx</i>	The width of the box.
<i>ly</i>	The height of the box.
<i>fill</i>	If true, fill the rectangle with the current foreground color, as set by <code>m_gc-&gt;set_foreground(color)</code> . Defaults to true.

**7.10.2.18** `void seq64::gui_drawingarea_gtk2::draw_rectangle_on_pixmap ( int x, int y, int lx, int ly, bool fill = true )`  
`[inline], [protected]`

## Parameters

<i>x</i>	The x-coordinate of the origin.
<i>y</i>	The y-coordinate of the origin.
<i>lx</i>	The width of the box.
<i>ly</i>	The height of the box.
<i>fill</i>	If true, fill the rectangle with the current foreground color, as set by <code>m_gc-&gt;set_foreground(color)</code> . Defaults to true.

**7.10.2.19** `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

<i>c</i>	Provides the foreground color to set.
<i>x</i>	The x-coordinate of the origin.
<i>y</i>	The y-coordinate of the origin.
<i>lx</i>	The width of the box.
<i>ly</i>	The height of the box.
<i>fill</i>	If true, fill the rectangle with the current foreground color, as set by <code>m_gc-&gt;set_foreground(color)</code> . Defaults to true.

**7.10.2.20** `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

<i>x</i>	The x-coordinate of the origin.
<i>y</i>	The y-coordinate of the origin.
<i>lx</i>	The width of the box.
<i>ly</i>	The height of the box.
<i>fill</i>	If true, fill the rectangle with the current foreground color, as set by <code>m_gc-&gt;set_foreground(color)</code> . Defaults to true.

**7.10.2.21** `void seq64::gui_drawingarea_gtk2::on_realize ( )` `[protected]`

It allocates any additional resources that weren't initialized in the constructor.

### 7.10.3 Field Documentation

7.10.3.1 `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.

7.10.3.2 `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.

7.10.3.3 `Glib::RefPtr<Gdk::Pixmap> seq64::gui_drawingarea_gtk2::m_background` [protected]

Our wrappers still leave this member exposed <giggle>.

7.10.3.4 `Glib::RefPtr<Gdk::Pixmap> seq64::gui_drawingarea_gtk2::m_foreground` [protected]

Our wrappers still leave this member exposed.

7.10.3.5 `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.

7.10.3.6 `int seq64::gui_drawingarea_gtk2::m_window_x` [protected]

Could make this constant, but some windows are resizable.

7.10.3.7 `int seq64::gui_drawingarea_gtk2::m_drop_x` [protected]

Provides the x and y value of where the dragging started.

## 7.11 seq64::gui\_palette\_gtk2 Class Reference

Implements a stock palette of `Gdk::Color` elements.

[illegible]

- `gui_palette_gtk2 ()`  
*Principal constructor.*
- `~gui_palette_gtk2 ()`  
*Provides a destructor to delete allocated objects.*

- `typedef Gdk::Color Color`  
*Provides a type for the color object.*

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.

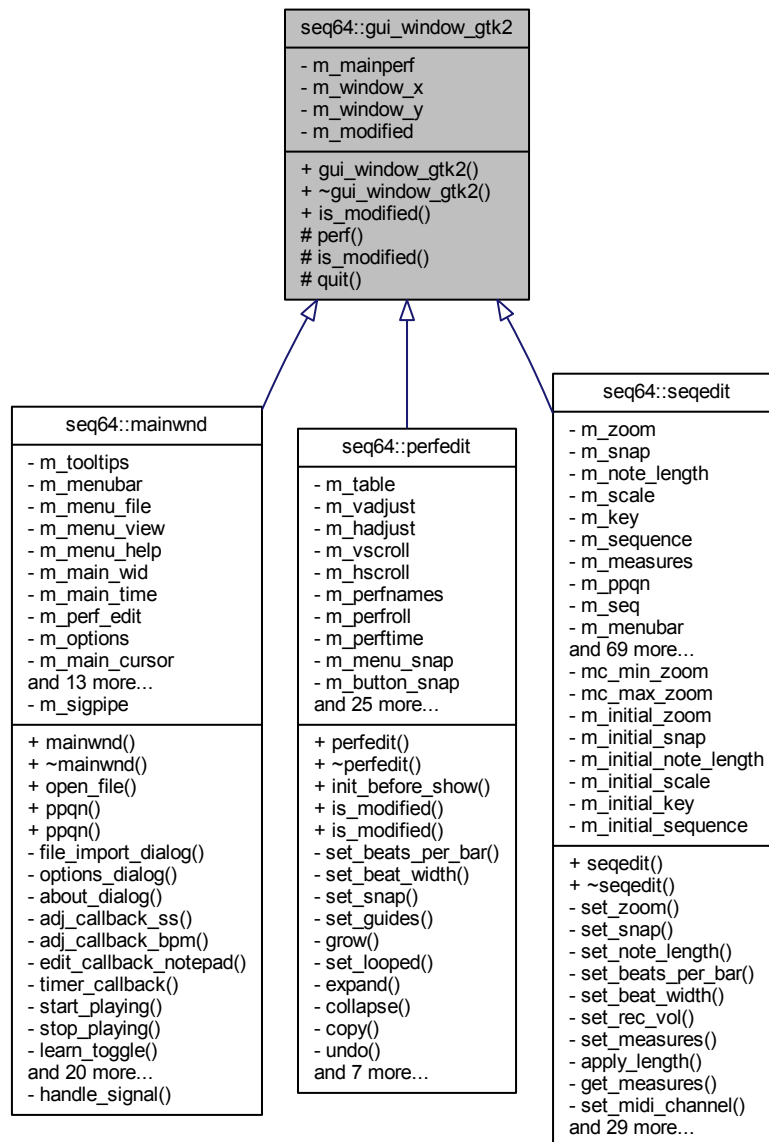
### 7.11.2.1 seq64::gui\_palette\_gtk2::gui\_palette\_gtk2 ( )

Generated on Thu Nov 5 2015 09:55:04 for Sequencer64 Developer/Tester's Reference Manual by Doxygen

## 7.12 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.
- `~gui_window_gtk2` ()  
This rote constructor does nothing.
- `bool is_modified` () const  
'Getter' function for member `m_modified`

## Protected Member Functions

- `perform` & `perf` ()  
*'Getter' function for member m\_mainperf*
- `void is_modified` (bool flag)  
*'Setter' function for member m\_modified*

## Private Attributes

- `int m_window_x`  
*Window sizes.*

## 7.12.1 Constructor & Destructor Documentation

7.12.1.1 `seq64::gui_window_gtk2::gui_window_gtk2 ( perform & p, int window_x = 0, int window_y = 0 )`

### Parameters

<code>a_perf</code>	Refers to the main performance object.
---------------------	--

## 7.12.2 Field Documentation

7.12.2.1 `int seq64::gui_window_gtk2::m_window_x` [`private`]

Could make this constant, but some windows are resizable.

## 7.13 seq64::jack\_assistant Class Reference

This class provides the performance mode JACK support.

## Public Member Functions

- `jack_assistant` (`perform` & `parent`, `int ppqn`=SEQ64\_USE\_DEFAULT\_PPQN)  
*This constructor initializes a number of member variables, some of them public!*
- `~jack_assistant` ()  
*The destructor doesn't need to do anything yet.*
- `bool is_running` () const  
*'Getter' function for member m\_jack\_running*
- `bool is_master` () const  
*'Getter' function for member m\_jack\_master*
- `perform` & `parent` ()  
*'Getter' function for member m\_jack\_parent Needed for external callbacks.*
- `bool init` ()  
*Initializes JACK support.*
- `void deinit` ()  
*Tears down the JACK infrastructure.*
- `void start` ()  
*If JACK is supported, starts the JACK transport.*
- `void stop` ()  
*If JACK is supported, stops the JACK transport.*

- void `position` (bool `a_state`)  
*If JACK is supported and running, sets the position of the transport.*
- bool `output` (`jack_scratchpad` &`pad`)  
*Performance output function for JACK, called by the perform function of the same name.*

## Private Member Functions

- void `info_message` (const std::string &`msg`)  
*Common-code for console messages.*
- void `error_message` (const std::string &`msg`)  
*Common-code for error messages.*

## Friends

- 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` (void \*`arg`)  
*This callback is to shutdown 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`)  
*This function sets the JACK position structure.*

## 7.13.1 Constructor & Destructor Documentation

7.13.1.1 `seq64::jack_assistant::jack_assistant ( perform &parent, int ppqn = SEQ64_USE_DEFAULT_PPQN )`

### Parameters

<code>parent</code>	Provides a reference to the main perform object that needs to control JACK event.
---------------------	---

## 7.13.2 Member Function Documentation

7.13.2.1 `bool seq64::jack_assistant::init ( )`

Then we become a new client of the JACK server.

Who calls this routine?

**Todo** Make sure that `global_with_jack_transport`, and better yet, its new `g_rc_settings` member, gets set properly; what option do we need to provide, if any?

### Returns

Returns true if JACK is now considered to be running (or if it was already running.)

7.13.2.2 `void seq64::jack_assistant::stop ( )`

Should it also set `m_jack_running` to false?

7.13.2.3 void seq64::jack\_assistant::position ( bool *a\_state* )

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

This function is called via [perform::position\\_jack\(\)](#) in the mainwnd, perfedit, perfroll, and seqroll graphical user-interface support objects.

#### Warning

A lot of this code is effectively disabled by an early return statement.

#### Parameters

<i>state</i>	If true, the current tick is set to the leftmost tick.
--------------	--

7.13.2.4 bool seq64::jack\_assistant::output ( jack\_scratchpad & *pad* )

#### Parameters

<i>pad</i>	Provide a JACK scratchpad, whatever that is.
------------	--

#### Returns

Returns true if JACK is running.

7.13.2.5 void seq64::jack\_assistant::info\_message ( const std::string & *msg* ) [private]

Adds markers and a newline.

#### Parameters

<i>msg</i>	The message to print, sans the newline.
------------	---

7.13.2.6 void seq64::jack\_assistant::error\_message ( const std::string & *msg* ) [private]

Adds markers, and sets m\_jack\_running to false.

#### Parameters

<i>msg</i>	The message to print, sans the newline.
------------	---

### 7.13.3 Friends And Related Function Documentation

7.13.3.1 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.

#### Parameters

<i>state</i>	The JACK Transport state.
<i>pos</i>	The JACK position value.

<i>arg</i>	The pointer to the <a href="#">jack_assistant</a> object. Currently not checked for nullity, nor dynamic-casted.
------------	--

7.13.3.2 `void jack_shutdown ( void * arg )` [*friend*]

#### Parameters

<i>arg</i>	Points to the <a href="#">jack_assistant</a> in charge of JACK support for the perform object.
------------	--

7.13.3.3 `void jack_timebase_callback ( jack_transport_state_t state, jack_nframes_t nframes, jack_position_t * pos, int new_pos, void * arg )` [*friend*]

#### Parameters

<i>state</i>	Indicates the current state of JACK transport.
<i>nframes</i>	The number of JACK frames.
<i>pos</i>	Provides the position structure to be filled in.
<i>new_pos</i>	The new positions to be set.
<i>arg</i>	Provides the <a href="#">jack_assistant</a> pointer, currently unchecked for nullity.

## 7.14 seq64::jack\_scratchpad Struct Reference

Provide a temporary structure for passing data and results between a perform and [jack\\_assistant](#) object.

### 7.14.1 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\(\)](#).

## 7.15 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` }

## 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???*

## 7.15.1 Member Enumeration Documentation

### 7.15.1.1 enum seq64::keybindentry::type [private]

#### Enumerator

**location** Provides the type of keybindings that can be made. 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.

## 7.15.2 Constructor & Destructor Documentation

### 7.15.2.1 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

<i>t</i>	Provides the type of key-binding: location, events, or groups.
<i>location_to_write</i>	The location that holds the value of the key associated with the key-binding. The default value of this parameter is the null pointer.
<i>p</i>	Points to the performance object used with this key-binding. The default value of this parameter is the null pointer.
<i>s</i>	Provides the slot value for this key-binding. The default value of this parameter is zero.

## 7.15.3 Member Function Documentation

### 7.15.3.1 void seq64::keybindentry::set ( unsigned int *val* )

Then we call `set_text(buf)`. The `set_width_char()` function is then called.

7.15.3.2 `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`.

#### 7.15.4 Field Documentation

7.15.4.1 `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.

### 7.16 `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!*

- [~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.*
- bool [show\\_ui\\_sequence\\_key](#) () const  
**Accessor** *m\_key\_show\_ui\_sequency\_key*
- 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.*

## Private Attributes

- unsigned int [m\\_key\\_bpm\\_up](#)  
*Provides key assignments for some key sequencer features.*

### 7.16.1 Detailed Description

It has way too many data members, many of the public. Might be ripe for refactoring.

### 7.16.2 Constructor & Destructor Documentation

#### 7.16.2.1 [seq64::keys\\_perform::~~keys\\_perform](#) ( )

Finally, any active patterns/sequences are deleted.

### 7.16.3 Member Function Documentation

#### 7.16.3.1 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

<i>kpt</i>	The structure that holds the values of the keys to be used for various purposes in controlling a performance live.
------------	--

## 7.16.3.2 void seq64::keys\_perform::get\_keys ( keys\_perform\_transfer &amp; kpt )

## Parameters

<i>kpt</i>	The structure that holds the values of the keys to be used for various purposes in controlling a performance live.
------------	--

## 7.16.3.3 bool seq64::keys\_perform::show\_ui\_sequence\_key ( ) const [inline]

Used in mainwid, options, optionsfile, userfile, and perform.

## 7.16.3.4 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

<i>key</i>	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](#).

## 7.16.3.5 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](#).

## 7.16.3.6 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](#).

## 7.16.3.7 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

<i>keycode</i>	The key to be assigned.
<i>sequence_slot</i>	The perform event slot into which the keycode will be assigned.

## 7.16.3.8 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

<i>keycode</i>	The key to be assigned.
<i>group_slot</i>	The perform group slot into which the keycode will be assigned.

## 7.16.4 Field Documentation

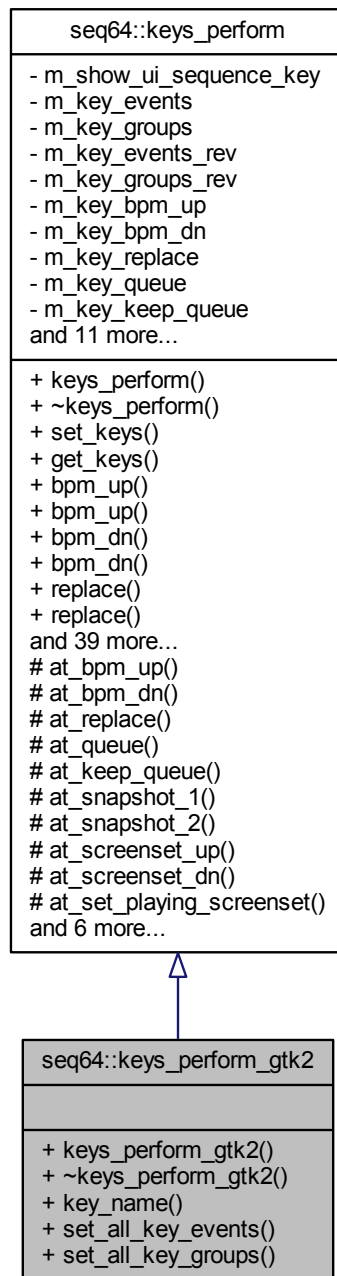
### 7.16.4.1 unsigned int seq64::keys\_perform::m\_key\_bpm\_up [private]

Used in mainwnd, options, optionsfile, perfedit, seqroll, userfile, and perform.

## 7.17 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 ()`

*The destructor sets some running flags to false, signals this condition, then joins the input and output threads if the were launched.*

- virtual std::string [key\\_name](#) (unsigned int key) const  
*Obtains the name of the key.*
- 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

### 7.17.1 Detailed Description

It has way too many data members, many of the public. Might be ripe for refactoring.

### 7.17.2 Constructor & Destructor Documentation

#### 7.17.2.1 `seq64::keys_perform_gtk2::~~keys_perform_gtk2 ( ) [virtual]`

Finally, any active patterns/sequences are deleted.

### 7.17.3 Member Function Documentation

#### 7.17.3.1 `std::string seq64::keys_perform_gtk2::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.

Reimplemented from [seq64::keys\\_perform](#).

#### 7.17.3.2 `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](#).

#### 7.17.3.3 `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](#).

## 7.18 `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()`.

## 7.19 `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](#) (int [ch](#)=SEQ64\_KEYSTROKE\_BAD\_VALUE) const  
*'Getter' function for member m\_key to test letters, handles ASCII only.*
- bool [is\\_delete](#) () const  
*m\_key to test for a delete-causing key.*
- unsigned int [key](#) () const  
*'Getter' function for member m\_key*
- 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.*

### 7.19.1 Detailed Description

Useful in passing more generic events to non-GUI classes.

### 7.19.2 Constructor & Destructor Documentation

- 7.19.2.1** `seq64::keystroke::keystroke ( unsigned int key, bool press = SEQ64_KEYSTROKE_PRESS, int modkey = int (SEQ64_NO_MASK) )`

## Parameters

<i>key</i>	The keystroke number of the key that was pressed or released.
<i>press</i>	If true, the keystroke action was a press, otherwise it was a release.
<i>modkey</i>	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.

## 7.19.2.2 seq64::keystroke::keystroke ( const keystroke &amp; rhs )

## Parameters

<i>rhs</i>	The object to be copied.
------------	--------------------------

## 7.19.3 Member Function Documentation

## 7.19.3.1 keystroke &amp; seq64::keystroke::operator= ( const keystroke &amp; rhs )

## Parameters

<i>rhs</i>	The object to be assigned.
------------	----------------------------

## Returns

Returns the reference to the current object, for use in assignment chains.

## 7.19.3.2 bool seq64::keystroke::is\_letter ( int ch = SEQ64\_KEYSTROKE\_BAD\_VALUE ) const

## Parameters

<i>ch</i>	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

## 7.19.4 Field Documentation

## 7.19.4.1 bool seq64::keystroke::m\_is\_press [private]

See the SEQ64\_KEYSTROKE\_PRESS and SEQ64\_KEYSTROKE\_RELEASE readability macros.

## 7.19.4.2 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.

7.19.4.3 seq\_modifier\_t seq64::keystroke::m\_modifier [private]

Note that SEQ64\_NO\_MASK is our word for 0, meaning "no modifier".

## 7.20 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.*

### 7.20.1 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.

### 7.20.2 Constructor & Destructor Documentation

7.20.2.1 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

---

<i>p</i>	The perform object that needs to implement LASH support.
<i>argc</i>	The number of command-line arguments.
<i>argv</i>	The command-line arguments.

### 7.20.3 Member Function Documentation

7.20.3.1 `void seq64::lash::set_alsa_client_id ( int id )`

/param *id* The ALSA client ID to be set.

7.20.3.2 `bool seq64::lash::process_events ( )`

#### Returns

Always returns true.

7.20.3.3 `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.

7.20.3.4 `void seq64::lash::handle_event ( lash_event_t* ev )` [private]

#### Parameters

<i>ev</i>	Provides the event to be handled.
-----------	-----------------------------------

7.20.3.5 `void seq64::lash::handle_config ( lash_config_t* conf )` [private]

Currently incomplete.

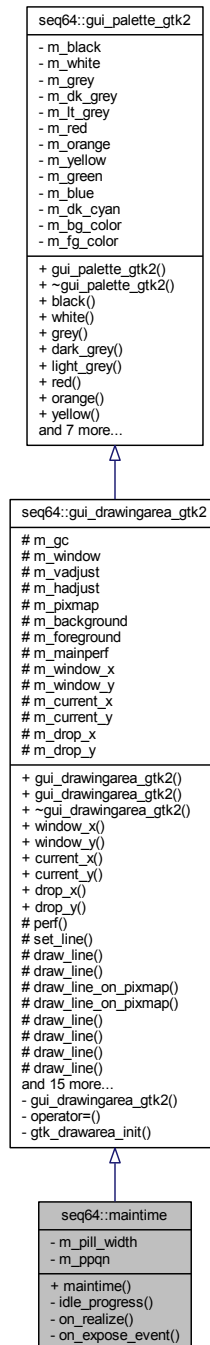
#### Parameters

<i>conf</i>	Provides the configuration item to handle.
-------------	--

## 7.21 seq64::maintime Class Reference

This class provides the drawing of the progress bar at the top of the main window, along with the "pills" that move in time with the measures.

Inheritance diagram for seq64::maintime:



## Public Member Functions

- `maintime` (`perform` &p, int ppqn=SEQ64\_USE\_DEFAULT\_PPQN, int pillwidth=c\_pill\_width, int x=c\_maintime\_x, int y=c\_maintime\_y)

*This constructor sets up the colors black, white, and grey, and then allocates them.*

## Private Member Functions

- int `idle_progress` (long 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.*

## Additional Inherited Members

### 7.21.1 Constructor & Destructor Documentation

**7.21.1.1** `seq64::maintime::maintime ( perform & p, int ppqn = SEQ64_USE_DEFAULT_PPQN, int pillwidth = c_pill_width, int x = c_maintime_x, int y = c_maintime_y )`

In the constructor you can only allocate colors; `get_window()` would return 0 because the windows has not yet been realized.

### 7.21.2 Member Function Documentation

**7.21.2.1** `int seq64::maintime::idle_progress ( long 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

<code>ticks</code>	Provides the main tick setting. This setting is provided by <code>mainwnd()</code> , in its timer callback.
--------------------	---

#### Returns

Always returns 1 (it used to return "true"!).

**7.21.2.2** `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.

**7.21.2.3** `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.

## 7.22 seq64::mainwid Class Reference

This class implement the piano roll area of the application.



- Generated on Thu Nov 5 2015 09:55:04 for Sequencer64 Developer/Tester's Reference Manual by Doxygen

*This function redraws everything and queues up a redraw operation.*

- void [set\\_screenset](#) (int ss)  
*Set the current screen-set.*
- void [update\\_sequence\\_on\\_window](#) (int seq)  
*Updates the image of one sequencer.*
- void [update\\_sequences\\_on\\_window](#) ()  
*Updates the image of multiple sequencers.*
- 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.)*
- void [draw\\_marker\\_on\\_sequence](#) (int seq, int tick)  
*Does the actual drawing of one pattern/sequence position marker, a vertical progress bar.*

## Private Member Functions

- 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 [fill\\_background\\_window](#) ()  
*This function updates the background window, clearing it.*
- void [draw\\_pixmap\\_on\\_window](#) ()  
*This function queues the blit of pixmap to window.*
- void [draw\\_sequence\\_pixmap\\_on\\_window](#) (int seq)  
*This function draws something in the Patterns Panel.*
- int [seq\\_from\\_xy](#) (int x, int y)  
*Translates XY coordinates in the Patterns Panel to a sequence number.*
- int [timeout](#) ()  
*Provides a stock callback, because some kind of callback is need.*
- void [redraw](#) (int seq)  
*Draw the the given pattern/sequence again.*
- 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 [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.*
- 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

- 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 later.*

## Additional Inherited Members

### 7.22.1 Constructor & Destructor Documentation

#### 7.22.1.1 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, and motion, and key presses and focus changes.

Parameters

<code>p</code>	Provides the reference to the all-important perform object.
----------------	---

### 7.22.2 Member Function Documentation

#### 7.22.2.1 void seq64::mainwid::set\_screenset ( `int a_ss` )

Parameters

<code>a_ss</code>	Provides the screen-set number to set.
-------------------	--

#### 7.22.2.2 void seq64::mainwid::update\_sequence\_on\_window ( `int seqnum` )

Parameters

<code>seqnum</code>	Provides the number of the sequence to update.
---------------------	--

#### 7.22.2.3 void seq64::mainwid::update\_markers ( `int ticks` )

Parameters

<code>ticks</code>	Starting point for drawing the markers.
--------------------	---

#### 7.22.2.4 void seq64::mainwid::draw\_marker\_on\_sequence ( `int seqnum`, `int tick` )

If the sequence has no events, this function doesn't bother even drawing a position marker.

Note that, when Sequencer64 first comes up, and [perform::is\\_dirty\\_main\(\)](#) is called, no sequences exist yet.

Parameters

<code>seqnum</code>	Provides the number of the sequence to draw.
<code>tick</code>	Provides the location to draw the marker.

#### 7.22.2.5 bool seq64::mainwid::valid\_sequence ( `int seqnum` ) `[private]`

## Parameters

<i>seqnum</i>	Provides the number of the sequence to validate.
---------------	--

## Returns

Returns true if the sequence number is valid for the current m\_screenset value.

7.22.2.6 `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 now ignore the sequence if it does not exist. :-D

## Note

If only the main window is up, then the sequences just appear to play – the progress bars move in each pattern. Gaps in the song don't change the appearance of the patterns. But, if the Song (performance) Editor window is up, and the song is started using the controls in the Song (performance) Editor windows, then the active patterns are black (!) while playing, and white when gaps in the song are encountered. Also, the muting status in the main window seems to be ignored (based on coloring, anyway). However, the muting in the Song (performance) windows does seem to be in force.

## Parameters

<i>seqnum</i>	Provides the number of the sequence slot that needs to be drawn.
---------------	--

7.22.2.7 `void seq64::mainwid::draw_sequences_on_pixmap ( ) [private]`

Please note that [draw\\_sequence\\_on\\_pixmap\(\)](#) also draws the empty boxes of inactive sequences, so we cannot take shortcuts here.

7.22.2.8 `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). However, if we comment out this code, we can't see any difference in the Patterns Panel, even when playback is ongoing!

## Parameters

<i>seqnum</i>	Provides the number of the sequence to draw.
---------------	--

7.22.2.9 `int seq64::mainwid::seq_from_xy ( int a_x, int a_y ) [private]`

## Parameters

<i>a_x</i>	Provides the x coordinate.
<i>a_y</i>	Provides the y coordinate.

## Returns

Returns -1 if the sequence number cannot be calculated.

7.22.2.10 `int seq64::mainwid::timeout ( ) [private]`

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

#### Returns

Always returns true.

7.22.2.11 `void seq64::mainwid::redraw ( int seqnum ) [private],[virtual]`

#### Parameters

<i>seqnum</i>	Provides the number of the sequence to draw.
---------------	--

Implements [seq64::seqmenu](#).

7.22.2.12 `void seq64::mainwid::calculate_base_sizes ( int seqnum, int & basex, int & basey ) [private]`

The values are returned as side-effects.

#### Parameters

<i>seqnum</i>	Provides the number of the sequence to calculate.
<i>basex</i>	A return parameter for the x coordinate of the base size.
<i>basey</i>	A return parameter for the y coordinate of the base size.

7.22.2.13 `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!

7.22.2.14 `bool seq64::mainwid::on_expose_event ( GdkEventExpose * a_e ) [private]`

#### Parameters

<i>a_e</i>	The expose event.
------------	-------------------

#### Returns

Always returns true.

7.22.2.15 `bool seq64::mainwid::on_button_press_event ( GdkEventButton * p0 ) [private]`

It 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.

#### Parameters

<i>p0</i>	Provides the parameters of the button event.
-----------	--

#### Returns

Always returns true.

#### 7.22.2.16 `bool seq64::mainwid::on_button_release_event ( GdkEventButton * p0 ) [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.

##### Parameters

<i>p0</i>	Provides the parameters of the button event.
-----------	--

##### Returns

Always returns true.

#### 7.22.2.17 `bool seq64::mainwid::on_motion_notify_event ( GdkEventMotion * p0 ) [private]`

This function moves the selected pattern to another pattern slot.

##### Parameters

<i>p0</i>	Provides the parameters of the button event.
-----------	--

##### Returns

Always returns true.

#### 7.22.2.18 `bool seq64::mainwid::on_focus_in_event ( GdkEventFocus * ) [private]`

Just sets the Gtk::HAS\_FOCUS flag.

##### Returns

Always returns false.

#### 7.22.2.19 `bool seq64::mainwid::on_focus_out_event ( GdkEventFocus * ) [private]`

Just unsets the Gtk::HAS\_FOCUS flag.

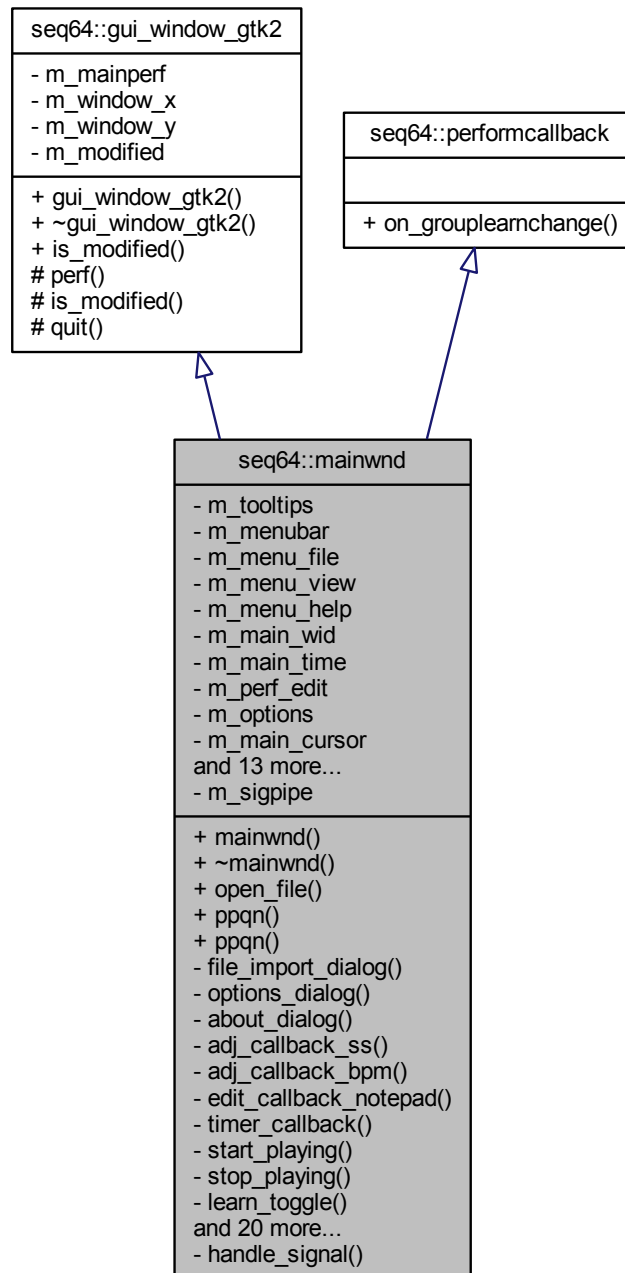
##### Returns

Always returns false.

## 7.23 `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` &`a_p`)  
The constructor the main window of the application.
- `~mainwnd` ()  
This destructor must explicitly delete some allocated resources.
- void `open_file` (const std::string &)

- *Opens and parses (reads) a MIDI file.*
- `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 file_import_dialog ()`  
*Presents a file dialog to import a MIDI file.*
- `void options_dialog ()`  
*Opens the File / Options dialog.*
- `void about_dialog ()`  
*Presents a Help / About dialog.*
- `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 learn_toggle ()`  
*Toggle the group-learn status.*
- `void open_performance_edit ()`  
*Opens the Performance Editor (Song Editor).*
- `void sequence_key (int seq)`  
*Use the sequence key to toggle the playing of an active pattern in the current screen-set.*
- `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 file_save_as ()`  
*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.*
- `int query_save_changes ()`  
*Queries the user to save the changes made while the application was running.*

- 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 [on\\_delete\\_event](#) (GdkEventAny \*a\_e)  
*This callback function handles a delete event from ...?*
- bool [on\\_key\\_press\\_event](#) (GdkEventKey \*a\_ev)  
*Handles a key press event.*
- bool [on\\_key\\_release\\_event](#) (GdkEventKey \*a\_ev)  
*Handles a key release event.*
- 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::MenuBar \* [m\\_menubar](#)  
*Theses objects support the menu and its sub-menus.*
- [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?*
- [perfedit](#) \* [m\\_perf\\_edit](#)  
*A pointer to the song/performance editor.*
- [options](#) \* [m\\_options](#)  
*A pointer to the program options.*
- Gdk::Cursor [m\\_main\\_cursor](#)  
*Mouse cursor?*
- 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::SpinButton \* [m\\_spinbutton\\_bpm](#)  
*The spin/adjustment controls for the BPM (beats-per-minute) value.*
- Gtk::SpinButton \* [m\\_spinbutton\\_ss](#)  
*The spin/adjustment controls for the screen set value.*
- Gtk::SpinButton \* [m\\_spinbutton\\_load\\_offset](#)  
*The spin/adjustment controls for the load offset value.*
- Gtk::Entry \* [m\\_entry\\_notes](#)

*What is this?*

- sigc::connection [m\\_timeout\\_connect](#)

*Provides a timeout handler.*

- int [m\\_ppqn](#)

*Saves the PPQN value obtained from the MIDI file (or the default value, `global_ppqn/c_ppqn`, if `SEQ64_USE_DEFAULT_PPQN` was specified in reading the MIDI file.*

## Static Private Attributes

- static int [m\\_sigpipe](#) [2]

*Interesting; what is this used for.*

## Additional Inherited Members

### 7.23.1 Constructor & Destructor Documentation

#### 7.23.1.1 `seq64::mainwnd::mainwnd ( perform & p )`

This constructor is way too large; it would be nicer to provide a number of well-named initialization functions.

##### Parameters

<i>p</i>	Refers to the main performance object.
----------	--

**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.

File menu items, their accelerator keys, and their hot keys.

View menu items and their hot keys.

Help menu items

Top panel items, including the logo (updated for the new version of this application) and the "timeline" progress bar.

### 7.23.2 Member Function Documentation

#### 7.23.2.1 `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 `c_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 "propformat" parameter of the `midifile` constructor when reading the MIDI file, since reading handles both the old and new formats.

##### Parameters

<i>fn</i>	Provides the file-name for the MIDI file to be opened.
-----------	--

#### 7.23.2.2 `void seq64::mainwnd::ppqn ( int ppqn ) [inline]`

```
m_ppqn = (ppqn == SEQ64_USE_DEFAULT_PPQN) ? global_ppqn : ppqn ;
```



### 7.23.2.3 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. Set versus append.

**Todo** We need to look into the Import process and document it better.

### 7.23.2.4 void seq64::mainwnd::about\_dialog ( ) [private]

I (Chris) took the liberty of tacking my name at the end, and hope to eventually have done enough work to warrant having it there.

### 7.23.2.5 void seq64::mainwnd::adj\_callback\_ss ( ) [private]

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.

Screen-set notepad?

### 7.23.2.6 bool seq64::mainwnd::timer\_callback ( ) [private]

#### 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.

### 7.23.2.7 void seq64::mainwnd::open\_performance\_edit ( ) [private]

**Todo** Try to find a way to set m\_modified only if the song editor actually changes something, instead of just because it was opened.

### 7.23.2.8 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.

### 7.23.2.9 bool seq64::mainwnd::save\_file ( ) [private]

Here we specify the current value of m\_ppqn, which was set when reading the MIDI file.

7.23.2.10 `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.

7.23.2.11 `bool seq64::mainwnd::on_delete_event ( GdkEventAny * a_e )` `[private]`

Any changed data is saved. If the pattern is playing, then it is stopped.

7.23.2.12 `bool seq64::mainwnd::on_key_press_event ( GdkEventKey * a_ev )` `[private]`

It also handles the control-key and modifier-key combinations matching the entries in its list of if statements.

**Todo** Test this functionality in old and new application.

7.23.2.13 `bool seq64::mainwnd::on_key_release_event ( GdkEventKey * a_ev )` `[private]`

Is this worth turning into a switch statement? Or offloading to a perform member function? The latter.

**Todo** Test this functionality in old and new application.

#### Returns

Always returns false.

7.23.2.14 `void seq64::mainwnd::on_grouplearnchange ( bool state )` `[private], [virtual]`

This handler responds to a learn-mode change from [perf\(\)](#).

Reimplemented from [seq64::performcallback](#).

### 7.23.3 Field Documentation

7.23.3.1 `int seq64::mainwnd::m_sigpipe` `[static], [private]`

This static member provides a couple of pipes for signalling/messaging.

7.23.3.2 `mainwid* seq64::mainwnd::m_main_wid` `[private]`

The first is the Patterns Panel.

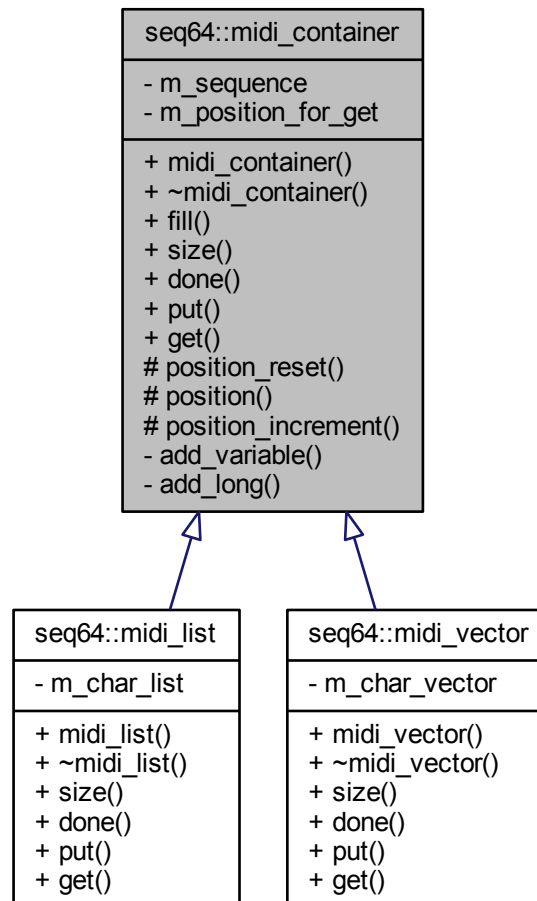
7.23.3.3 `Gtk::SpinButton* seq64::mainwnd::m_spinbutton_load_offset` `[private]`

However, where is this button located? It is handled in the code, but I've never seen the button!

## 7.24 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)  
*This function fills the given character list 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](#) ()=0  
*Provide a way to get the next byte from the container.*

## Protected Member Functions

- unsigned int [position](#) () const  
*Returns the current position.*

## Private Member Functions

- void [add\\_variable](#) (long 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](#) (long x)  
*What is the difference between this function and [add\\_list\\_var\(\)](#)?*

## 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.*

## 7.24.1 Member Function Documentation

### 7.24.1.1 void [seq64::midi\\_container::fill](#) ( int *tracknumber* )

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\\_container\(\)](#).

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 assume to increment. This application doesn't bother with that shortcut.

*Not threadsafe* The sequence object bound to this container needs to provide the locking mechanism when calling this function.

#### Parameters

<i>tracknumber</i>	Provides the track number. This number is masked into the track information.
--------------------	--

### 7.24.1.2 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\\_list](#), and [seq64::midi\\_vector](#).

### 7.24.1.3 virtual midibyte [seq64::midi\\_container::get](#) ( ) [pure virtual]

It also increments `m_position_for_get`.

Implemented in [seq64::midi\\_list](#), and [seq64::midi\\_vector](#).

7.24.1.4 `unsigned int seq64::midi_container::position ( ) const` `[inline]`, `[protected]`

Before the return, the position counter is incremented to the next position.

7.24.1.5 `void seq64::midi_container::add_variable ( long v )` `[private]`

This function "replaces" `sequence::add_list_var()`.

7.24.1.6 `void seq64::midi_container::add_long ( long x )` `[private]`

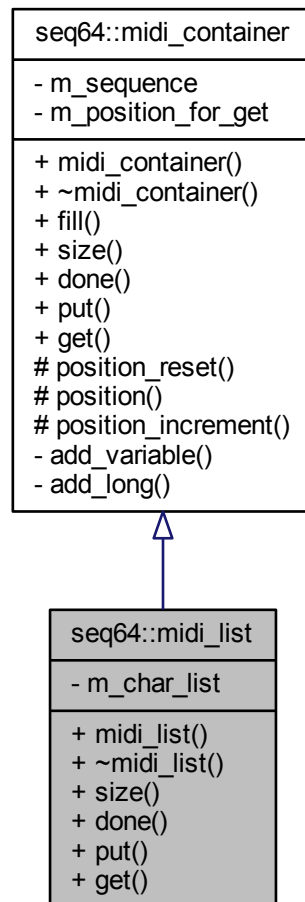
This function "replaces" `sequence::add_long_list()`.

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.

## 7.25 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 ()`

*Provide a way to get the next byte from 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

### 7.25.1 Member Typedef Documentation

7.25.1.1 typedef std::list<midibyte> seq64::midi\_list::CharList [private]

This type is basically the same as the container used in the midifile module, and almost identical to the CharList type defined in the sequence module.

### 7.25.2 Member Function Documentation

7.25.2.1 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](#).

7.25.2.2 virtual midibyte seq64::midi\_list::get ( ) [inline],[virtual]

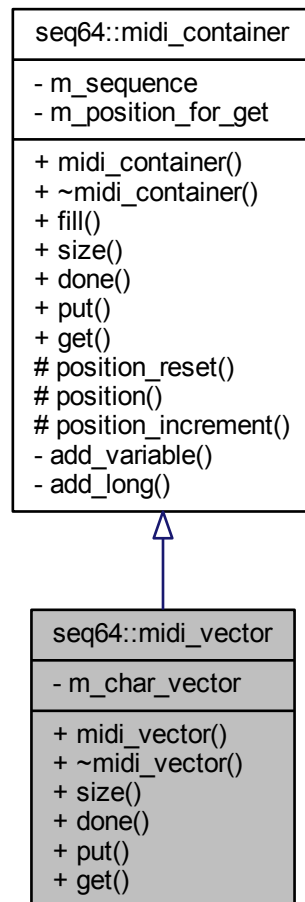
In this implement, m\_position\_for\_get is not used. The elements of the container are popped of backward!

Implements [seq64::midi\\_container](#).

## 7.26 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.*

- virtual `~midi_vector` ()

*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 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` ()

*Provide a way to get the next byte from 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

### 7.26.1 Member Function Documentation

7.26.1.1 virtual void seq64::midi\_vector::put ( midibyte *b* ) [inline],[virtual]

The original seq24 list used an std::list and a push\_front operation.

Implements [seq64::midi\\_container](#).

7.26.1.2 virtual midibyte seq64::midi\_vector::get ( ) [inline],[virtual]

In this implement, m\_position\_for\_get is not used. The elements of the container are popped of backward!

Implements [seq64::midi\\_container](#).

## 7.27 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 propformat=true)  
*Principal constructor.*
- [~midifile](#) ()  
*A rote destructor.*
- bool [parse](#) ([perform](#) &a\_perf, int a\_screen\_set)  
*This function opens a binary MIDI file and parses it into sequences and other application objects.*
- bool [write](#) ([perform](#) &a\_perf)  
*Write the whole MIDI data and Seq24 information out to the file.*
- 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

- unsigned long [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.*

- unsigned long `read_long ()`  
*Reads 4 bytes of data using `read_byte()`.*
- unsigned short `read_short ()`  
*Reads 2 bytes of data using `read_byte()`.*
- unsigned char `read_byte ()`  
*Reads 1 byte of data directly into the `m_data` vector, incrementing `m_pos` after doing so.*
- unsigned long `read_varinum ()`  
*Read a MIDI Variable-Length Value (VLV), which has a variable number of bytes.*
- void `write_long (unsigned long)`  
*Writes 4 bytes, using the `write_byte()` function.*
- void `write_short (unsigned short)`  
*Writes 2 bytes, using the `write_byte()` function.*
- void `write_byte (unsigned char c)`  
*Writes 1 byte.*
- void `write_varinum (unsigned long)`  
*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.*
- void `write_seq_number (unsigned short seqnum)`  
*Writes out a sequence number.*
- void `write_track_end ()`  
*Writes out the end-of-track marker.*
- void `write_prop_header (unsigned long tag, long len)`  
*We want to write:*
- bool `write_proprietary_track (perform &a_perf)`  
*Writes out the proprietary 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.*
- 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.*

## Private Attributes

- int `m_pos`  
*Holds the position in the MIDI file.*
- const std::string `m_name`  
*The unchanging name of the MIDI file.*
- std::vector< unsigned char > `m_data`  
*This vector of characters holds our MIDI data.*
- std::list< unsigned char > `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.*

- int `m_ppqn`

*Provides the current value of the PPQN, which used to be the constant `c_ppqn` (which itself is now the variable `global_ppqn`).*

- bool `m_use_default_ppqn`

*Indicates that the default PPQN is in force.*

### 7.27.1 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.

### 7.27.2 Constructor & Destructor Documentation

**7.27.2.1** `seq64::midifile::midifile ( const std::string & name, int ppqn = SEQ64_USE_DEFAULT_PPQN, bool propformat = true )`

#### Parameters

<i>name</i>	Provides the name of the MIDI file to be read or written.
<i>ppqn</i>	<p>Provides the initial value of the PPQN setting. It is handled differently for parsing (reading) versus writing the MIDI file.</p> <ul style="list-style-type: none"> <li>• Reading. <ul style="list-style-type: none"> <li>– If set to <code>SEQ64_USE_DEFAULT_PPQN</code>, the legacy application behavior is used. The <code>m_ppqn</code> member is set to the default PPQN, <code>global_ppqn</code>. The value read from the MIDI file, <code>ppqn</code>, is then use to scale the running-time of the sequence relative to <code>global_ppqn</code>.</li> <li>– Otherwise, <code>m_ppqn</code> is set to the value read from the MIDI file. No scaling is done. Since the value gets written, specify <code>ppqn</code> as 0, an obviously bogus value, to get this behavior.</li> </ul> </li> <li>• 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 <code>mainwnd</code> class.</li> </ul>

<i>propformat</i>	If true, write out the MIDI file using the new MIDI-compliant sequencer-specific format for the seq24-specific SeqSpec tags defined in the globals module. This option is true by default. Note that this option is only used in writing; reading can handle either format transparently.
-------------------	---

### 7.27.3 Member Function Documentation

#### 7.27.3.1 `bool seq64::midifile::parse ( perform & a_perf, int screenset )`

In addition to the standard MIDI track data in a normal track, Seq24 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

```

Standard MIDI provides for the port and channel specifications, 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?

#### Parameters

<i>a_perf</i>	Provides a reference to the perform object into which sequences/tracks are to be added.
<i>screenset</i>	The screen-set to be updated.

#### Returns

Returns true if the parsing succeeded.

#### 7.27.3.2 `bool seq64::midifile::write ( perform & a_perf )`

#### Parameters

<i>a_perf</i>	Provides the object that will contain and manage the entire performance.
---------------	--

#### Returns

Returns true if the write operations succeeded.

#### Warning

This writing backwards reverses the order of some events that are otherwise equivalent in time-stamp and rank. But it must be done this way, otherwise many items are backward.

#### 7.27.3.3 `int seq64::midifile::ppqn ( ) const [inline]`

The PPQN will be either `global_ppqn = c_ppqn` (legacy behavior) or the value read from the file, depending on the `ppqn` parameter passed to the `midifile` constructor.

#### 7.27.3.4 unsigned long 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:

```
0xFF 0x7F 0x02 length data
```

For convenience, this function first checks the amount of file data left. Then it reads a long value. If the value starts with FF, then that signals the new format. Otherwise, it is probably the old format, and the long value is a control tag (0x242400nn), which can be returned immediately.

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

<i>file_size</i>	The size of the data file. This value is compared against the member <code>m_pos</code> (the position inside <code>m_data[]</code> ), 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.

#### 7.27.3.5 bool seq64::midifile::parse\_proprietary\_track ( perform & *a\_perf*, int *file\_size* ) [private]

It consists of series of tags:

- `c_midictrl`
- `c_midiclocks`
- `c_notes`
- `c_bpmtag` (beats per minute)
- `c_mutegroups`

(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.)

The format is (1) tag ID; (2) length of data; (3) the data.

*Change Note* ca 2015-08-16 First, we separate out this function for a little more clarify. Then we add code to handle reading both the legacy Seq24 format and the new, MIDI-compliant format. Note that the 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.

## Parameters

<i>a_perf</i>	The performance object that is being set via the incoming MIDI file.
<i>file_size</i>	The file size as determined in the <a href="#">parse()</a> function.

There is also an implicit parameter in the `m_pos` member variable.

#### 7.27.3.6 `unsigned long seq64::midifile::read_long ( ) [private]`

## Warning

This code looks endian-dependent and integer-size dependent.

#### 7.27.3.7 `unsigned short seq64::midifile::read_short ( ) [private]`

## Warning

This code looks endian-dependent.

#### 7.27.3.8 `unsigned long 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.

#### 7.27.3.9 `void seq64::midifile::write_long ( unsigned long a_x ) [private]`

## Warning

This code looks endian-dependent.

#### 7.27.3.10 `void seq64::midifile::write_short ( unsigned short a_x ) [private]`

## Warning

This code looks endian-dependent.

#### 7.27.3.11 `void seq64::midifile::write_byte ( unsigned char c ) [inline], [private]`

The byte is written to the `m_char_list` member, using a call to `push_back()`.

#### 7.27.3.12 `void seq64::midifile::write_varinum ( unsigned long 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".
- 0xFFFFFFFF (the largest number) is represented as "0xFF 0xFF 0xFF 0x7F".

Also see the [varinum\\_size\(\)](#) function.

#### 7.27.3.13 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.

#### 7.27.3.14 void seq64::midifile::write\_seq\_number ( unsigned short seqnum ) [private]

The format is "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 assume to increment. This application doesn't bother with that shortcut.

#### 7.27.3.15 void seq64::midifile::write\_prop\_header ( unsigned long control\_tag, long data\_length ) [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, The sequence number, a special value, well out of our normal range.
- The name of the track:
  - "Seq24-Spec"
  - "Sequencer24-S"

Then follows the proprietary 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 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.
```

Writes a "proprietary" Seq24 footer header in either the new MIDI-compliant format, or the legacy Seq24 format. This function does not write the data. It replaces calls such as "write\_long(c\_midich)" in the proprietary section 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. Similarly, <http://sequence15.blogspot.com/2008/12/midi-manufacturer-ids.html> shows that no manufacturer uses 0x24.

### 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

<i>control_tag</i>	Determines the type of sequencer-specific section to be written. It should be one of the value in the globals module, such as <code>c_midibus</code> or <code>c_mutegroups</code> .
<i>data_length</i>	The amount of data that will be written. This parameter does not count the length of the header itself.

**7.27.3.16** `bool seq64::midifile::write_proprietary_track ( perform & a_perf ) [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.

**7.27.3.17** `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](https://en.wikipedia.org/wiki/Variable-length_quantity)

```
1 byte:  0x00 to 0x7F
2 bytes: 0x80 to 0x3FFF
3 bytes: 0x4000 to 0x001FFFFF
4 bytes: 0x200000 to 0x0FFFFFFF
```

### Returns

Returns values as noted above. Anything beyond that range returns 0.

**7.27.3.18** `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 the the data length is added.

**7.27.3.19** `long seq64::midifile::seq_number_size ( ) const [inline],[private]`

## 7.27.4 Field Documentation

**7.27.4.1** `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.

**7.27.4.2** `std::vector<unsigned char> 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.



#### 7.27.4.3 `std::list<unsigned char> 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.

#### 7.27.4.4 `bool seq64::midifile::m_new_format` [private]

In this new format, each sequencer-specific value (0x242400xx, as defined in the `globals` module) is preceded by the sequencer-specific prefix, 0xFF 0x7F len id/date). By default, this value is true, 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 `~/ .seq24rc` configuration file.] Note that reading can handle either format transparently.

## 7.28 seq64::options Class Reference

This class supports a full tabbed options dialog.

Inherits Dialog.

### Private Types

- enum `button`

*Defines buttons indices or IDs for some controls related to JACK.*

### Private Attributes

- `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::Notebook * m_notebook`

*Not sure yet what this notebook is for.*

### 7.28.1 Field Documentation

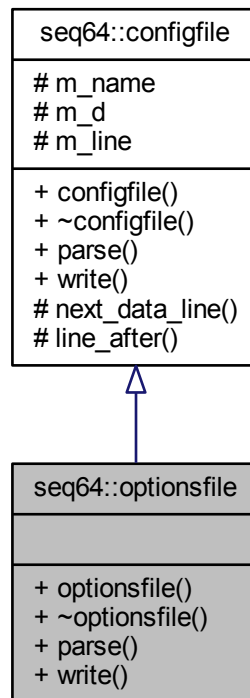
#### 7.28.1.1 `Gtk::Notebook* seq64::options::m_notebook` [private]

Must be a GTK thang.

## 7.29 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 &perf)  
*Parse the `~/seq24rc` or `~/config/sequencer64/sequencer64.rc` file.*
- bool `write` (const perform &perf)  
*This options-writing function is just about as complex as the options-reading function.*

## Additional Inherited Members

### 7.29.1 Detailed Description

The settings that are passed around are provided or used by the perform class.

### 7.29.2 Member Function Documentation

7.29.2.1 bool seq64::optionsfile::parse ( perform & a\_perf ) [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 additional 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.

#### [jack-transport]

This section covers various JACK settings, one setting per line. In order, the following numbers are specified:

- 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.
- jack\_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]

This section covers.... 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.

Implements [seq64::configfile](#).

**7.29.2.2** `bool seq64::optionsfile::write ( const perform & a_perf ) [virtual]`

#### Parameters

<i>a_perf</i>	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

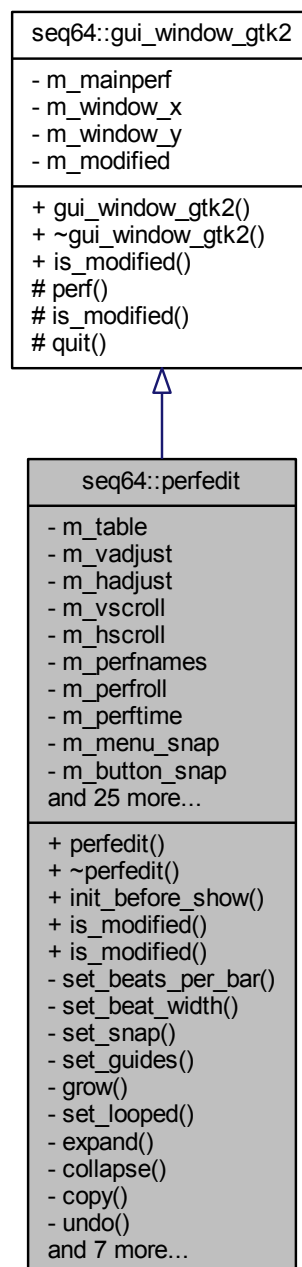
Returns true if the write operations all succeeded.

Implements [seq64::configfile](#).

## 7.30 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, int ppqn=SEQ64\_USE\_DEFAULT\_PPQN, int bpm=DEFAULT\_BEATS\_PER\_MEASURE, int bw=DEFAULT\_BEAT\_WIDTH)

*Principal constructor, has a reference to a perform object.*

- [~perfedit](#) ()

*This rote constructor does nothing.*

- void `init_before_show ()`  
*This function forwards its call to the `perroll` function of the same name.*
- void `is_modified (bool flag)`  
*'Setter' function for member `m_modified`*
- bool `is_modified () const`  
*'Getter' function for member `m_modified`*

## Private Member Functions

- void `set_beats_per_bar (int beats_per_measure)`  
*Sets the beats-per-measure text and value to the given value, and then calls `set_guides()`.*
- void `set_beat_width (int beat_width)`  
*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 `perroll` 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 `popup_menu (Gtk::Menu *menu)`  
*Opens the given popup menu.*
- bool `timeout ()`  
*Handles a drawing timeout.*
- void `start_playing ()`  
*Implement the playing.*
- void `stop_playing ()`  
*Stop the playing.*
- void `on_realize ()`  
*This callback function calls the base-class `on_realize()` function, and then connects the `perfeddit::timeout()` function to the Glib signal-timeout, with a redraw timeout of `m_redraw_ms`.*
- bool `on_key_press_event (GdkEventKey *ev)`  
*This function is the callback for a key-press event.*
- bool `on_delete_event (GdkEventAny *)`  
*All this callback function does is return false.*

## Private Attributes

- Gtk::Menu \* `m_menu_bpm`  
*Menus for time signature, beats per measure, beat width.*
- int `m_snap`  
*Set snap-to in "pulses".*

## Additional Inherited Members

### 7.30.1 Detailed Description

It has a seqroll and piano roll? No, it has a perform, a perfnames, a perroll, and a perftime.

### 7.30.2 Constructor & Destructor Documentation

**7.30.2.1** `seq64::perfedit::perfedit ( perform & p, int ppqn = SEQ64_USE_DEFAULT_PPQN, int bpm = DEFAULT_BEATS_PER_MEASURE, int bw = DEFAULT_BEAT_WIDTH )`

We've reordered the pointer members and put them in the initializer list to make the constructor a bit cleaner.

#### Parameters

<i>p</i>	Refers to the main performance object.
----------	--

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

**7.30.2.2** `seq64::perfedit::~~perfedit ( )`

We're going to have to run the application through valgrind to make sure that nothing is left behind.

### 7.30.3 Member Function Documentation

**7.30.3.1** `void seq64::perfedit::init_before_show ( )`

It does not seem to need to also forward to the perftime function of the same name.

**7.30.3.2** `void seq64::perfedit::set_guides ( ) [private]`

See the [set\\_snap\(\)](#) function.

**7.30.3.3** `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 perroll to redraw.

**7.30.3.4** `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 perroll to redraw.

**7.30.3.5** `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 perroll to redraw.

**7.30.3.6** `void seq64::perfedit::undo ( ) [private]`

We pop an Undo trigger, and then ask the perroll to queue up a (re)drawing action.

#### 7.30.3.7 `bool seq64::perfedit::timeout ( ) [private]`

It redraws "dirty" sequences in the perffroll and the perfnames objects, and shows draw progress on the perffroll.

#### 7.30.3.8 `void seq64::perfedit::start_playing ( ) [inline],[private]`

JACK will be used if it is present and, in the application, enabled. This call also sets `g_rc_settings.is_pattern_↔playing(true)`.

#### 7.30.3.9 `void seq64::perfedit::stop_playing ( ) [inline],[private]`

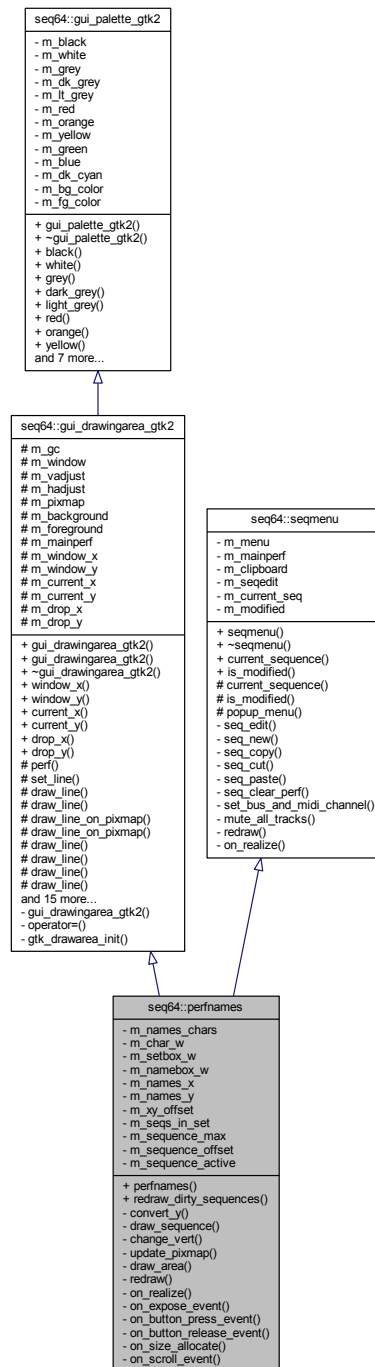
This call also sets `g_rc_settings.is_pattern_playing(true)`.

## 7.31 `seq64::perfnames` Class Reference

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



Inheritance diagram for seq64::pernames:



## Public Member Functions

- [pernames](#) ([perform](#) &p, Gtk::Adjustment &vadjust)

*Principal constructor for this user-interface object.*

- void [redraw\\_dirty\\_sequences](#) ()

*Redraws sequences that have been modified.*

## Private Member Functions

- int [convert\\_y](#) (int y)  
*Converts a y-value into a sequence number and returns it.*
- void [draw\\_sequence](#) (int [sequence](#))  
*Draw the given sequence.*
- void [change\\_vert](#) ()  
*Change the vertical offset of a sequence/pattern.*
- void [update\\_pixmap](#) ()  
*This function does nothing.*
- void [draw\\_area](#) ()  
*This function does nothing.*
- 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.*
- bool [on\\_button\\_release\\_event](#) (GdkEventButton \*ev)  
*Handles a button-release for the right button, bringing up a popup menu.*
- void [on\\_size\\_allocate](#) (Gtk::Allocation &)  
*Handles a size-allocation event.*
- bool [on\\_scroll\\_event](#) (GdkEventScroll \*ev)  
*Handle the scrolling of the window.*

## Private Attributes

- 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.*

## Additional Inherited Members

### 7.31.1 Detailed Description

*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).

## 7.31.2 Constructor & Destructor Documentation

### 7.31.2.1 seq64::perfnames::perfnames ( perform & *p*, 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.

## 7.31.3 Member Function Documentation

### 7.31.3.1 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.

### 7.31.3.2 void seq64::perfnames::on\_realize ( ) [private]

It first calls the base-class version of [on\\_realize\(\)](#). Then it allocates any additional resources needed.

### 7.31.3.3 bool seq64::perfnames::on\_expose\_event ( GdkEventExpose \* *a\_e* ) [private]

It draws all of the sequences.

### 7.31.3.4 void seq64::perfnames::on\_size\_allocate ( Gtk::Allocation & *a* ) [private]

It first calls the base-class version of this function.

## 7.31.4 Field Documentation

### 7.31.4.1 int seq64::perfnames::m\_names\_chars [private]

Pretty much hardwired to 24 at present.

### 7.31.4.2 int seq64::perfnames::m\_char\_w [private]

This value is obtained from a font-renderer accessor function.

### 7.31.4.3 int seq64::perfnames::m\_setbox\_w [private]

This used to be hardwired to 6 \* 2 (character-width times two).

### 7.31.4.4 int seq64::perfnames::m\_namebox\_w [private]

This used to be a weird calculation based on character width.

### 7.31.4.5 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.

7.31.4.6 `int seq64::perfnames::m_xy_offset` `[private]`

Currently hardwired.

## 7.32 `seq64::perform` Class Reference

This class supports the performance mode.

### 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.*
- `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*
- `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*
- `bool is_running` () `const`  
*'Getter' function for member m\_running*
- `bool is_learn_mode` () `const`  
*'Getter' function for member m\_mode\_group\_learn*
- `void enregister` (`performcallback *pfc`)  
*Adds a pointer to an object to be notified by this perform object.*
- `void init` ()  
*Initializes the master MIDI bus.*
- `void clear_all` ()  
*Clears all of the patterns/sequences.*
- `void launch_input_thread` ()  
*Creates the input thread using input\_thread\_func().*
- `void launch_output_thread` ()  
*Creates the output thread using output\_thread\_func().*
- `void init_jack` ()  
*Initializes JACK support, if SEQ64\_JACK\_SUPPORT is defined.*
- `void deinit_jack` ()  
*Tears down the JACK infrastructure.*
- `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.*
- long [get\\_tick](#) () const  
*'Getter' function for member m\_tick*
- void [set\\_left\\_tick](#) (long tick)  
*Set the left marker at the given tick.*
- long [get\\_left\\_tick](#) () const  
*'Getter' function for member m\_left\_tick*
- void [set\\_starting\\_tick](#) (long tick)  
*'Setter' function for member m\_starting\_tick*
- long [get\\_starting\\_tick](#) () const  
*'Getter' function for member m\_starting\_tick*
- void [set\\_right\\_tick](#) (long tick)  
*Set the right marker at the given tick.*
- long [get\\_right\\_tick](#) () const  
*'Getter' function for member m\_right\_tick*
- 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](#) ()  
*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.*
- midi\_control \* [get\\_midi\\_control\\_toggle](#) (unsigned int seq)  
*Retrieves a value from m\_midi\_cc\_toggle[].*
- midi\_control \* [get\\_midi\\_control\\_on](#) (unsigned int seq)  
*Retrieves a value from m\_midi\_cc\_on[].*
- midi\_control \* [get\\_midi\\_control\\_off](#) (unsigned int seq)  
*Retrieves a value from m\_midi\_cc\_off[].*
- void [handle\\_midi\\_control](#) (int control, bool state)  
*Handle the MIDI Control values that provide some automation for the application.*
- 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\\_current\\_screen\\_set\\_notepad](#) (const std::string &note)  
*Sets the notepad text for the current screen-set.*
- void [set\\_screenset](#) (int ss)  
*Sets the m\_screen\_set value (the index or ID of the current screen set).*
- int [get\\_screenset](#) () const  
*'Getter' function for member m\_screen\_set*
- void [set\\_playing\\_screenset](#) ()

- Sets the screen set that is active, based on the value of m\_playing\_screen.*

  - int [get\\_playing\\_screenset](#) () const

*'Getter' function for member m\_playing\_screen*
- void [mute\\_group\\_tracks](#) ()

*Will need to study this one more closely.*
- void [select\\_and\\_mute\\_group](#) (int g\_group)

*Select a mute group and then mutes the track in the group.*
- 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)

*Makes some checks and sets the group mute flag.*
- 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.*
- void [select\\_mute\\_group](#) (int group)

*Will need to study this one more closely.*
- 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)

*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.*
- bool [is\\_active](#) (int seq)

*Checks the pattern/sequence for activity.*
- 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.*
- void [new\\_sequence](#) (int seq)

*Creates a new pattern/sequence for the given slot, and sets the new pattern's master MIDI bus address.*
- [sequence](#) \* [get\\_sequence](#) (int seq)

*Retrieves the actual sequence, based on the pattern/sequence number.*

- void [reset\\_sequences](#) ()  
*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](#) (long tick)  
*Plays all notes to the current tick.*
- void [set\\_orig\\_ticks](#) (long tick)  
*For every pattern/sequence that is active, sets the "original ticks" value for the pattern.*
- void [set\\_beats\\_per\\_minute](#) (int bpm)  
*Sets the value of the BPM into the master MIDI buss, after making sure it is squelched to be between 20 and 500.*
- int [get\\_beats\\_per\\_minute](#) ()  
*Retrieves the BPM setting of the master MIDI buss.*
- void [set\\_looping](#) (bool looping)  
*'Setter' function for member m\_looping*
- 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\\_off](#) (int seq)  
*Turn off the playing of a sequence, if it is active.*
- void [set\\_group\\_mute\\_state](#) (int g\_track, bool mute\_state)  
*'Setter' function for member m\_mute\_group*
- bool [get\\_group\\_mute\\_state](#) (int g\_track)  
*'Getter' function for member m\_mute\_group*
- void [mute\\_all\\_tracks](#) ()  
*Mutes all tracks in the current set of active patterns/sequences.*
- void [output\\_func](#) ()  
*Performance output function.*
- void [input\\_func](#) ()  
*This function is called by input\_thread\_func().*
- long [get\\_max\\_trigger](#) ()  
*Locates the largest trigger value among the active sequences.*
- void [set\\_offset](#) (int offset)  
*Calculates the offset into the screen sets.*
- 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.*
- bool [show\\_ui\\_sequence\\_key](#) () const  
**Accessor** m\_show\_ui\_sequency\_key
- bool [is\\_playing](#) () const  
*'Getter' function for member g\_rc\_settings.is\_pattern\_playing() Provide a convenience function so that clients don't have to mess with a global variable when they're dealing with a perform object.*
- void [start\\_playing](#) (bool flag=false)  
*Encapsulates a series of calls used in mainwnd.*
- void [stop\\_playing](#) ()  
*Encapsulates a series of calls used in mainwnd.*
- void [learn\\_toggle](#) ()  
*Encapsulates some calls used in mainwnd.*
- int [decrement\\_beats\\_per\\_minute](#) ()  
*Encapsulates some calls used in mainwnd.*

- int [increment\\_beats\\_per\\_minute](#) ()  
*Encapsulates some calls used in mainwnd.*
- int [decrement\\_screenset](#) ()  
*Encapsulates some calls used in mainwnd.*
- int [increment\\_screenset](#) ()  
*Encapsulates some calls used in mainwnd.*
- void [sequence\\_key](#) (int seq)  
*Handle a sequence key to toggle the playing of an active pattern in the selected screen-set.*
- void [set\\_input\\_bus](#) (int bus, bool input\_active)  
*Sets the input bus, and handles the special "key-labels-on-sequence" functionality.*
- bool [mainwnd\\_key\\_event](#) (const [keystroke](#) &k)  
*Provided for [mainwnd::on\\_key\\_press\\_event\(\)](#) and [mainwnd::on\\_key\\_release\\_event\(\)](#) to call.*
- bool [perffroll\\_key\\_event](#) (const [keystroke](#) &k, int drop\_sequence)  
*Provided for [perffroll::on\\_key\\_press\\_event\(\)](#) and [perffroll::on\\_key\\_release\\_event\(\)](#) to call.*

## Private Member Functions

- bool [is\\_midi\\_control\\_valid](#) (unsigned int seq) const  
*Checks the parameter against [c\\_midi\\_controls](#).*
- bool [is\\_screenset\\_valid](#) (int screenset) const  
*Checks the screenset against [c\\_max\\_sets](#).*
- void [set\\_running](#) (bool running)  
*'Setter' function for member [m\\_running](#)*
- void [set\\_playback\\_mode](#) (bool playbackmode)  
*'Setter' function for member [m\\_playback\\_mode](#)*
- 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.*
- void [install\\_sequence](#) ([sequence](#) \*seq, int seqnum)  
*A private helper function for [add\\_sequence\(\)](#).*
- void [inner\\_start](#) (bool state)  
*Locks on [m\\_condition\\_var](#).*
- void [inner\\_stop](#) ()  
*Unconditionally, and without locking, clears the running status, resets the sequences, and set [m\\_usemidiclock](#) false.*
- void [set\\_all\\_key\\_events](#) ()  
*Pass-along function for [keys\(\)](#).[set\\_all\\_key\\_events](#).*
- void [set\\_all\\_key\\_groups](#) ()  
*Pass-along function for [keys\(\)](#).[set\\_all\\_key\\_events](#).*
- 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.*
- int [clamp\\_track](#) (int track) const  
*Provides common code to keep the track value valid.*



## Private Attributes

- [gui\\_assistant](#) & [m\\_gui\\_support](#)  
*Support for a wide range of GUI-related operations.*
- bool [m\\_mute\\_group](#) [c\_gmute\_tracks]  
*Mute group support.*
- int [m\\_playing\\_screen](#)  
*Playing screen support.*
- [sequence](#) \* [m\\_seqs](#) [c\_max\_sequence]  
*Provides a vector of patterns/sequences.*
- mastermidibus [m\\_master\\_bus](#)  
*Provides our MIDI buss.*
- pthread\_t [m\\_out\\_thread](#)  
*Provides information for managing pthreads.*
- bool [m\\_playback\\_mode](#)  
*Specifies the playback mode.*
- long [m\\_tick](#)  
*MIDI Clock support.*

## Friends

- int [jack\\_sync\\_callback](#) (jack\_transport\_state\_t state, jack\_position\_t \*pos, void \*arg)  
*Global functions for JACK support and JACK sessions.*

### 7.32.1 Detailed Description

It has way too many data members, many of the public. Might be ripe for refactoring.

### 7.32.2 Constructor & Destructor Documentation

#### 7.32.2.1 seq64::perform::perform ( [gui\\_assistant](#) & *mygui*, int *ppqn* = SEQ64\_USE\_DEFAULT\_PPQN )

##### Parameters

<i>mygui</i>	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 <a href="#">gui_assistant_gtk2</a> class in the seq_gtkmm2 GUI-specific library. Note that we access the <a href="#">m_gui_support</a> member using the <a href="#">gui()</a> accessor function.
--------------	---

#### 7.32.2.2 seq64::perform::~~perform ( )

Finally, any active patterns/sequences are deleted.

### 7.32.3 Member Function Documentation

#### 7.32.3.1 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.

### 7.32.3.2 void seq64::perform::init ( )

Who calls this routine? The main() routine of the application.

### 7.32.3.3 void seq64::perform::clear\_all ( )

The mainwnd module calls this function.

### 7.32.3.4 void seq64::perform::launch\_input\_thread ( )

This might be a good candidate for a small thread class derived from a small base class.

### 7.32.3.5 void seq64::perform::launch\_output\_thread ( )

This might be a good candidate for a small thread class derived from a small base class.

### 7.32.3.6 void seq64::perform::init\_jack ( )

Who calls this routine? The main() routine of the application, and the options module.

### 7.32.3.7 void seq64::perform::add\_sequence ( sequence \* seq, int *prefnum* )

No check is made for a null pointer.

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 quit.

#### 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

<i>seq</i>	The pointer to the pattern/sequence to add.
<i>prefnum</i>	The preferred sequence number of the pattern, as explained above. If this value is out-of-range, then it is basically ignored.

### 7.32.3.8 void seq64::perform::delete\_sequence ( int *seq* )

We now also solidify the deletion by setting the pointer to null after deletion.

### 7.32.3.9 void seq64::perform::clear\_sequence\_triggers ( int *seq* )

## Parameters

<i>seq</i>	Provides the desired sequence. Hopefull, the <a href="#">is_active()</a> function validates this value.
------------	---

7.32.3.10 void seq64::perform::move\_triggers ( bool *a\_direction* )

## Parameters

<i>a_direction</i>	Specifies the desired direction; false = left, true = right.
--------------------	--

## 7.32.3.11 void seq64::perform::copy\_triggers ( )

This copies the triggers between the L marker and R marker to the R marker.

7.32.3.12 midi\_control \* seq64::perform::get\_midi\_control\_toggle ( unsigned int *seq* )

## Parameters

<i>seq</i>	Provides a control value (such as <code>c_midi_control_bpm_up</code> ) to use to retrieve the desired <code>midi_control</code> object. Note that this value is unsigned simply to make the legality check of the parameter easier.
------------	---

7.32.3.13 midi\_control \* seq64::perform::get\_midi\_control\_on ( unsigned int *seq* )

## Parameters

<i>seq</i>	Provides a control value (such as <code>c_midi_control_bpm_up</code> ) to use to retrieve the desired <code>midi_control</code> object.
------------	---

7.32.3.14 midi\_control \* seq64::perform::get\_midi\_control\_off ( unsigned int *seq* )

## Parameters

<i>seq</i>	Provides a control value (such as <code>c_midi_control_bpm_up</code> ) to use to retrieve the desired <code>midi_control</code> object.
------------	---

7.32.3.15 const std::string & seq64::perform::get\_screen\_set\_notepad ( int *screenset* ) const

## Parameters

<i>screenset</i>	The ID number of the string set, an index into the <code>m_screen_set_notepad[]</code> 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.

7.32.3.16 void seq64::perform::set\_screen\_set\_notepad ( int *screenset*, const std::string & *notepad* )

## Parameters

<i>screenset</i>	The ID number of the string set, an index into the <code>m_screen_set_xxx[]</code> arrays.
<i>notepad</i>	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.

7.32.3.17 `void seq64::perform::set_screenset ( int ss )`

## Parameters

<i>ss</i>	The index of the desired string set. It is forced to range from 0 to <code>c_max_sets - 1</code> .
-----------	--

7.32.3.18 `void seq64::perform::set_playing_screenset ( )`

For each value up to `c_seqs_in_set` (32), the index of the current sequence in the currently screen set (`m_playing_↵_screen`) is obtained. If it is active and the sequence actually exists

Modifies `m_playing_screen`, and mutes the group tracks.

7.32.3.19 `void seq64::perform::unset_mode_group_learn ( )`

Then unsets the group-learn mode flag..

7.32.3.20 `void seq64::perform::select_mute_group ( int a_group )`

## Parameters

<i>a_group</i>	Provides the group to mute. Note that this parameter is essentially a track or sequence number.
----------------	---

7.32.3.21 `void seq64::perform::start ( bool a_state )`

## Parameters

<i>a_state</i>	What does this state mean?
----------------	----------------------------

7.32.3.22 `void seq64::perform::stop ( )`

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`?

7.32.3.23 `void seq64::perform::all_notes_off ( )`

Then flush the MIDI buss.

7.32.3.24 `void seq64::perform::set_active ( int seq, bool active )`

## Parameters

<i>seq</i>	Provides the prospective sequence number.
<i>active</i>	True if the sequence is to be set to the active state.

7.32.3.25 void seq64::perform::set\_was\_active ( int *seq* )

Why do we need this routine?

## Parameters

<i>seq</i>	The pattern number. It is checked for invalidity.
------------	---

7.32.3.26 bool seq64::perform::is\_active ( int *seq* )

## Parameters

<i>seq</i>	The pattern number. It is checked for invalidity. This can lead to "too many" (i.e. redundant) checks.
------------	--

## Returns

Returns the value of the active-flag, or false if the pattern was invalid.

7.32.3.27 bool seq64::perform::is\_dirty\_main ( int *seq* )

## Parameters

<i>seq</i>	The pattern number. It is checked for invalidity.
------------	---

## Returns

Returns the was-active-main flag value, before setting it to false. Returns false if the pattern was invalid.

7.32.3.28 bool seq64::perform::is\_dirty\_edit ( int *seq* )

## Parameters

<i>seq</i>	The pattern number. It is checked for invalidity.
------------	---

## Returns

Returns the was-active-edit flag value, before setting it to false. Returns false if the pattern was invalid.

7.32.3.29 bool seq64::perform::is\_dirty\_perf ( int *seq* )

## Parameters

<i>seq</i>	The pattern number. It is checked for invalidity.
------------	---

## Returns

Returns the was-active-perf flag value, before setting it to false. Returns false if the pattern/sequence number was invalid.

7.32.3.30 `bool seq64::perform::is_dirty_names ( int seq )`

## Parameters

<i>seq</i>	The pattern number. It is checked for invalidity.
------------	---

## Returns

Returns the was-active-names flag value, before setting it to false. Returns false if the pattern/sequence number was invalid.

7.32.3.31 void seq64::perform::new\_sequence ( int *seq* )

Then it activates the pattern.

It doesn't deal with thrown exceptions.

7.32.3.32 sequence \* seq64::perform::get\_sequence ( int *seq* )

## 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. Actually, we comment out the message-emitting code, as [is\\_mseq\\_valid\(\)](#) already emits a useful-enough message.

## Parameters

<i>seq</i>	The prospective sequence number.
------------	----------------------------------

## Returns

Returns the value of m\_seqs[seq] if seq is valid. Otherwise, a null pointer is returned.

## 7.32.3.33 void seq64::perform::reset\_sequences ( )

Then flush the MIDI buss.

7.32.3.34 void seq64::perform::play ( long *tick* )

Starts the playing of all the patterns/sequences.

This function just runs down the list of sequences and has them dump their events.

## Parameters

<i>tick</i>	Provides the tick at which to start playing.
-------------	--

7.32.3.35 void seq64::perform::set\_orig\_ticks ( long *tick* )

## Parameters

<i>tick</i>	
-------------	--

7.32.3.36 `void seq64::perform::set_beats_per_minute ( int bpm )`

The value is set only if neither JACK nor this performance object are running.

**Todo** I think this logic is wrong, in that it needs only one of the two to be stopped before it sets the BPM, while it seems to me that both should be stopped; to be determined.

7.32.3.37 `void seq64::perform::set_sequence_control_status ( int a_status )`

Then the given status is OR'd into the `m_control_status`.

7.32.3.38 `void seq64::perform::unset_sequence_control_status ( int a_status )`

Then the given status is reversed in `m_control_status`.

7.32.3.39 `void seq64::perform::sequence_playing_off ( int seq )`

Parameters

<i>seq</i>	The number of the seq to be turned off.
------------	---

7.32.3.40 `void seq64::perform::output_func ( )`

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.

7.32.3.41 `long seq64::perform::get_max_trigger ( )`

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?

7.32.3.42 `void seq64::perform::set_offset ( int offset ) [inline]`

Sets `m_offset = offset * c_mainwnd_rows * c_mainwnd_cols`;

Parameters

<i>offset</i>	The desired offset.
---------------	---------------------

7.32.3.43 `bool seq64::perform::show_ui_sequence_key ( ) const [inline]`

Used in `mainwid`, `options`, `optionsfile`, `userfile`, and `perform`.



7.32.3.44 `void seq64::perform::start_playing ( bool flag = false ) [inline]`

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.

**Todo** Verify the usage and nature of this flag.

7.32.3.45 `int seq64::perform::decrement_beats_per_minute ( ) [inline]`

Actually does a lot of work in those function calls.

7.32.3.46 `int seq64::perform::increment_beats_per_minute ( ) [inline]`

Actually does a lot of work in those function calls.

7.32.3.47 `void seq64::perform::set_input_bus ( int bus, bool input_active )`

This function is called by `options::input_callback()`.

7.32.3.48 `bool seq64::perform::mainwnd_key_event ( const keystroke & k )`

Returns

Returns true if the key was handled.

7.32.3.49 `bool seq64::perform::perfull_key_event ( const keystroke & k, int drop_sequence )`

Returns

Returns true if the key was handled.

7.32.3.50 `bool seq64::perform::is_midi_control_valid ( unsigned int seq ) const [inline], [private]`

Parameters

<i>seq</i>	The value that should be in the <code>c_midi_xxx</code> range.
------------	--

Returns

Returns true if the parameter is valid. For this function, no error print-out is generated.

7.32.3.51 `bool seq64::perform::is_screenset_valid ( int screenset ) const [inline], [private]`

Parameters

<i>screenset</i>	The prospective screenset value.
------------------	----------------------------------

Returns

Returns true if the parameter is valid. For this function, no error print-out is generated.

7.32.3.52 `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

<code>seq</code>	The sequencer number, in interval [0, <code>m_sequence_max</code> ).
------------------	--

#### Returns

Returns true if the sequence number is valid.

7.32.3.53 `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

<code>seq</code>	Provides the sequence number to be checked. It is checked for validity. We cannot compare the sequence number versus the <a href="#">sequence_count()</a> , 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.

7.32.3.54 `void seq64::perform::install_sequence ( sequence * seq, int seqnum ) [private]`

It is common code and using it prevents inconsistencies. It assumes values have already been checked.

#### Parameters

<code>seq</code>	The pointer to the pattern/sequence to add.
<code>seqnum</code>	The sequence number of the pattern to be added.

7.32.3.55 `void seq64::perform::inner_start ( bool a_state ) [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.

7.32.3.56 `void seq64::perform::set_key_event ( unsigned int keycode, long sequence_slot ) [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.

Why are we erasing four items instead of just two?

7.32.3.57 `void seq64::perform::set_key_group ( unsigned int keycode, long group_slot )` `[private]`

It is called 32 times, corresponding the pattern/sequence slots in the Patterns window.

Compare it to the `set_key_events()` function.

7.32.3.58 `int seq64::perform::clamp_track ( int track ) const` `[inline], [private]`

Note the bug we found, where we checked for `track > c_seqs_in_set`, but set it to `c_seqs_in_set - 1` in that case!

## 7.32.4 Friends And Related Function Documentation

7.32.4.1 `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.

Parameters

<i>state</i>	The JACK Transport state.
<i>pos</i>	The JACK position value.
<i>arg</i>	The pointer to the <a href="#">jack_assistant</a> object. Currently not checked for nullity, nor dynamic-casted.

## 7.32.5 Field Documentation

7.32.5.1 `bool seq64::perform::m_playback_mode` `[private]`

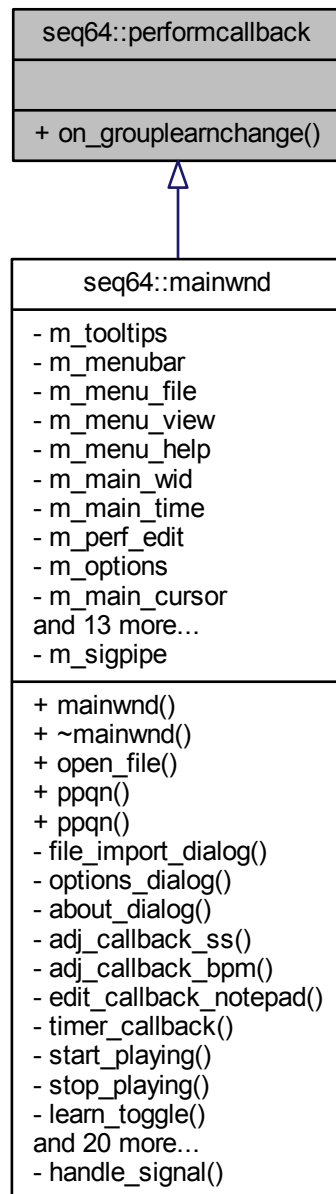
There are two, "live" and "song", but we're not yet sure what "true" indicates. It is most likely:

```
m_playback_mode == false:    live mode
m_playback_mode == true:     playback/song mode
```

## 7.33 seq64::performcallback Struct Reference

Provides for notification of events.

Inheritance diagram for seq64::performcallback:



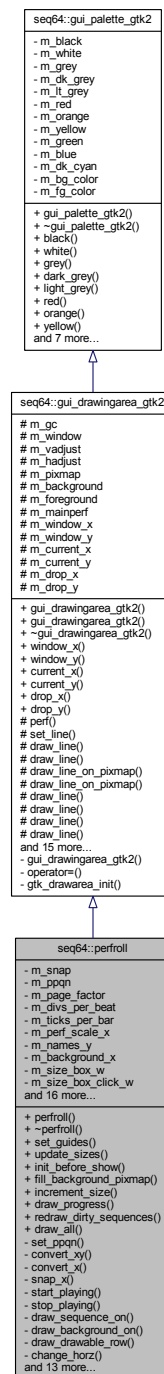
### 7.33.1 Detailed Description

Provide a response to a group-learn change event.

## 7.34 seq64::perftroll Class Reference

This class implements the performance roll user interface.

Inheritance diagram for seq64::perfroll:



## Public Member Functions

- [perfroll](#) ([perform](#) &a\_perf, Gtk::Adjustment &a\_hadjust, Gtk::Adjustment &a\_vadjust, int ppqn=SEQ64\_US↵E\_DEFAULT\_PPQN)

*Principal constructor.*

- [~perfroll](#) ()

*This destructor deletes the interaction object.*

- void [set\\_guides](#) (int a\_snap, int a\_measure, int a\_beat)  
*This function sets the snap, measure, and beats members, fills in the background, and queues up a draw operation.*
- 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 Performance roll.*
- void [increment\\_size](#) ()  
*Increments the value of m\_roll\_length\_ticks by the PPQN \* 512, then calls [update\\_sizes\(\)](#).*
- 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 [draw\\_all](#) ()  
*Provides a very common sequence of calls used in perfroll\_input.*

## Private Member Functions

- void [set\\_ppqn](#) (int ppqn)  
*Handles changes to the PPQN value in one place.*
- void [convert\\_xy](#) (int x, int y, long &ticks, int &seq)  
*Converts a tick-offset....*
- void [convert\\_x](#) (int x, long &ticks)  
*Converts a tick-offset on the x coordinate.*
- void [snap\\_x](#) (int &x)  
*This function performs a 'snap' action on x.*
- void [start\\_playing](#) ()  
*Start the performance playing.*
- void [stop\\_playing](#) ()  
*Stop the performance playing.*
- 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 a\_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 4-bar vertical offset member and queues up a draw operation.*
- void [split\\_trigger](#) (int a\_sequence, long a\_tick)  
*Splits a trigger, whatever than means.*
- void [on\\_realize](#) ()  
*Provides the on-realization callback.*
- bool [on\\_expose\\_event](#) (GdkEventExpose \*a\_ev)  
*Handles the on-expose event.*
- bool [on\\_button\\_press\\_event](#) (GdkEventButton \*a\_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 \*a\_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 \*a\_ev)  
*Handles motion notification by forwarding it to the interaction object's motion-notification callback function.*
- bool [on\\_scroll\\_event](#) (GdkEventScroll \*a\_ev)  
*Handles horizontal and vertical scrolling.*
- bool [on\\_focus\\_in\\_event](#) (GdkEventFocus \*)  
*This callback handles an in-focus event by setting the flag to HAS\_FOCUS.*
- bool [on\\_focus\\_out\\_event](#) (GdkEventFocus \*)  
*This callback handles an out-of-focus event by resetting the flag HAS\_FOCUS.*
- void [on\\_size\\_allocate](#) (Gtk::Allocation &)  
*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 \*a\_p0)  
*This callback function handles a key-press event.*
- void [on\\_size\\_request](#) (GtkRequisition \*)  
*This callback throws away a size request.*

### Private Attributes

- [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.*

### Friends

- class [FruityPerfInput](#)  
*These friend implement interaction-specific behavior, although only the Seq24 interactions support keyboard processing, except for some common functionality provided by [perform::perfroll\\_key\\_event\(\)](#).*

### Additional Inherited Members

#### 7.34.1 Constructor & Destructor Documentation

##### 7.34.1.1 seq64::perfroll::~~perfroll ( )

Well, now there are two objects, so no explicit deletion necessary.

#### 7.34.2 Member Function Documentation

##### 7.34.2.1 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:

$$\text{bars} = \frac{\text{pixels} * \text{ticks} / \text{pixel}}{\text{ticks} / \text{beat} * \text{beats} / \text{bar}}$$

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 perffroll 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.

#### 7.34.2.2 void seq64::perffroll::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.

#### 7.34.2.3 void seq64::perffroll::fill\_background\_pixmap ( )

This first thing done is to clear the background by painting it with a filled white rectangle.

#### 7.34.2.4 void seq64::perffroll::set\_ppqn ( int ppqn ) [private]

The m\_ticks\_per\_bar member replaces the construct "global\_ppqn \* 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.

#### 7.34.2.5 void seq64::perffroll::convert\_xy ( int x, int y, long & d\_tick, int & d\_seq ) [private]

The results are returned via the d\_tick and d\_seq parameters.

#### 7.34.2.6 void seq64::perffroll::convert\_x ( int x, long & tick ) [private]

The result is returned via the tick parameter.

#### 7.34.2.7 void seq64::perffroll::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.

#### 7.34.2.8 void seq64::perffroll::start\_playing ( ) [private]

We need to keep in sync with perffedit's [start\\_playing\(\)](#)... wish we could call it directly. Well, now we go to the source, calling [perform::start\\_playing\(\)](#).

#### 7.34.2.9 void seq64::perffroll::stop\_playing ( ) [private]

We need to keep in sync with perffedit's [stop\\_playing\(\)](#)... wish we could call it directly. Well, now we go to the source, calling [perform::stop\\_playing\(\)](#).

#### 7.34.2.10 void seq64::perffroll::draw\_sequence\_on ( int seqnum ) [private]

Statement nesting from hell!



7.34.2.11 `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 as `y` casted to an `int`, then the drawing of the row is only partial, vertically.

7.34.2.12 `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.

7.34.2.13 `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.

7.34.2.14 `bool seq64::perfroll::on_button_release_event ( GdkEventButton * ev ) [private]`

This gives us Seq24 versus Fruity behavior.

7.34.2.15 `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.

## 7.34.3 Friends And Related Function Documentation

7.34.3.1 `friend class FruityPerfInput [friend]`

## 7.34.4 Field Documentation

7.34.4.1 `FruityPerfInput seq64::perfroll::m_fruity_interaction [private]`

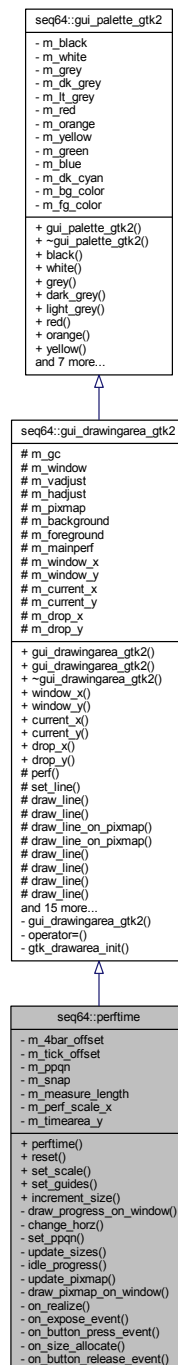
Even if the user specifies the fruity interaction, the Seq24 interaction is still needed to handle our new keystroke support for the perfroll. We need both objects to exist all the time, similar to the Fruity/Seq24 roles in the seqroll object.

*Obsolete* `AbstractPerfInput * m_interaction`

## 7.35 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](#), Gtk::Adjustment &adjust, int ppqn=SEQ64\_USE\_DEFAULT\_PPQN)  
*Principal constructor.*
- void [set\\_guides](#) (int snap, int measure)  
*Sets the snap value and the measure-length members.*
- void [increment\\_size](#) ()

*This function does nothing.*

## Private Member Functions

- void [change\\_horz](#) ()  
*Change the m\_4bar\_offset and queue a draw operation.*
- void [set\\_ppqn](#) (int ppqn)  
*Handles changes to the PPQN value in one place.*
- 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.*
- void [on\\_size\\_allocate](#) (Gtk::Allocation &r)  
*Implements a size-allocation event.*
- bool [on\\_button\\_release\\_event](#) (GdkEventButton \*)  
*This button-release handler does nothing.*

## Private Attributes

- 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 global\_ppqn = c\_ppqn = 192.*
- int [m\\_snap](#)  
*Snap value, starts out very small, equal to m\_ppqn.*

## Additional Inherited Members

### 7.35.1 Constructor & Destructor Documentation

7.35.1.1 `seq64::perftime::perftime ( perform & p, 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.

## 7.35.2 Member Function Documentation

### 7.35.2.1 void seq64::perftime::on\_realize ( ) [private]

It is important to call the base-class version of this function.

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);
```

### 7.35.2.2 bool seq64::perftime::on\_expose\_event ( GdkEventExpose \* ev ) [private]

#### Note

The perfdit 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.

It crashes trying to set the foreground color.

## 7.36 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 [home\\_config\\_directory](#) () const  
*Provides the directory for the configuration file, and also creates the directory if necessary.*
- 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.*
- void [set\\_globals](#) ()  
*Copies the current values of the member variables into their corresponding global variables.*
- void [get\\_globals](#) ()  
*Copies the current values of the global variables into their corresponding member variables.*
- bool [legacy\\_format](#) () const  
**Accessor** *m\_legacy\_format*
- bool [lash\\_support](#) () const  
**Accessor** *m\_lash\_support*

- bool [allow\\_mod4\\_mode](#) () const  
*Accessor m\_allow\_mod4\_mode*
- bool [show\\_midi](#) () const  
*Accessor m\_show\_midi*
- bool [priority](#) () const  
*Accessor m\_priority*
- bool [stats](#) () const  
*Accessor m\_stats*
- bool [pass\\_sysex](#) () const  
*Accessor m\_pass\_sysex*
- bool [with\\_jack\\_transport](#) () const  
*Accessor m\_with\_jack\_transport*
- bool [with\\_jack\\_master](#) () const  
*Accessor m\_with\_jack\_master*
- bool [with\\_jack\\_master\\_cond](#) () const  
*Accessor m\_with\_jack\_master\_cond*
- bool [jack\\_start\\_mode](#) () const  
*Accessor m\_jack\_start\_mode*
- bool [manual\\_alsa\\_ports](#) () const  
*Accessor m\_manual\_alsa\_ports*
- bool [is\\_pattern\\_playing](#) () const  
*Accessor m\_is\_pattern\_playing*
- bool [print\\_keys](#) () const  
*Accessor m\_print\_keys*
- bool [device\\_ignore](#) () const  
*Accessor 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*
- 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*
- const std::string & [config\\_directory](#) () const  
*'Getter' function for member m\_config\_directory*
- 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*
- 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 `filename` (const std::string &value)
- *'Setter' function for member m\_filename*
- void `jack_session_uuid` (const std::string &value)
- *'Setter' function for member m\_jack\_session\_uuid*
- void `last_used_dir` (const std::string &value)
- *'Setter' function for member m\_last\_used\_dir*
- void `config_directory` (const std::string &value)
- *'Setter' function for member m\_config\_directory*
- void `config_filename` (const std::string &value)
- *'Setter' function for member m\_config\_filename*
- void `user_filename` (const std::string &value)
- *'Setter' function for member m\_user\_filename*
- 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 Member Functions

- bool `make_directory` (const std::string &pathname) const  
*An internal function to ensure that the ~/.config/sequencer64 directory exists.*

## Private Attributes

- std::string `m_filename`  
*Provides the name of current MIDI file.*

### 7.36.1 Member Function Documentation

#### 7.36.1.1 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 selection home configuration directory. If it does not exist or could not be created, then an empty string is returned.

#### 7.36.1.2 bool seq64::rc\_settings::make\_directory ( const std::string & *pathname* ) const [private]

This function is actually a little more general than that, but it is not sufficiently general, in general.

#### Parameters

---

<i>pathname</i>	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.

**7.37 seq64::gui\_drawingarea\_gtk2::rect Struct Reference**

A small helper structure representing a rectangle.

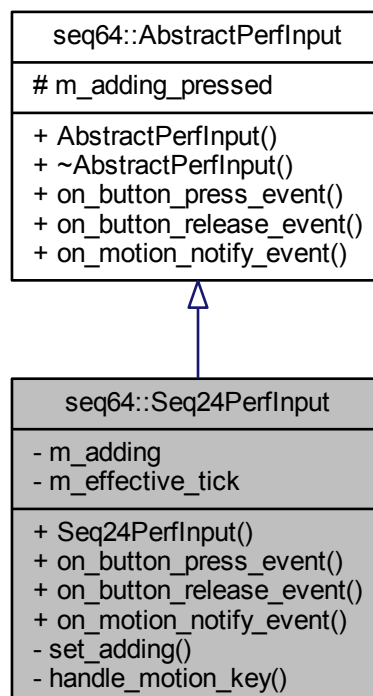
**7.38 seq64::rect Class Reference**

A small helper class representing a rectangle.

**7.39 seq64::Seq24PerfInput Class Reference**

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

Inheritance diagram for seq64::Seq24PerfInput:



## Public Member Functions

- 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

- void [set\\_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.*

## 7.39.1 Member Function Documentation

7.39.1.1 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?

Implements [seq64::AbstractPerfInput](#).

7.39.1.2 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?

Implements [seq64::AbstractPerfInput](#).

7.39.1.3 void [seq64::Seq24PerfInput::set\\_adding](#) ( bool *adding*, [perfroll](#) & *roll* ) [private]

What does it mean?

7.39.1.4 bool [seq64::Seq24PerfInput::handle\\_motion\\_key](#) ( bool *is\_left*, [perfroll](#) & *roll* ) [private]

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

<i>is_left</i>	False denotes the right arrow key, and true denotes the left arrow key.
<i>roll</i>	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.

## 7.40 seq64::Seq24SeqEventInput Struct Reference

This structure implement the normal interaction methods for Seq24.

### Public Member Functions

- [Seq24SeqEventInput](#) ()  
*Default constructor.*
- void [set\\_adding](#) (bool a\_adding, [seqevent](#) &ths)  
*Changes the mouse cursor to a pencil or a left pointer in the given seqevent aobject, depending on the first parameter.*
- bool [on\\_button\\_press\\_event](#) (GdkEventButton \*a\_ev, [seqevent](#) &ths)  
*Implements the on-button-press event callback.*
- bool [on\\_button\\_release\\_event](#) (GdkEventButton \*a\_ev, [seqevent](#) &ths)  
*Implements the on-button-release callback.*
- bool [on\\_motion\\_notify\\_event](#) (GdkEventMotion \*a\_ev, [seqevent](#) &ths)  
*Implements the on-motion-notify event.*

### 7.40.1 Member Function Documentation

7.40.1.1 void seq64::Seq24SeqEventInput::set\_adding ( bool adding, seqevent & seqev )

Modifies m\_adding as well.

7.40.1.2 bool seq64::Seq24SeqEventInput::on\_button\_press\_event ( GdkEventButton \* a\_ev, seqevent & seqev )

Set values for dragging, then reset the box that holds dirty redraw spot. Then do the rest. Needs update.  
seqev.m\_seq.unselect(); ???????

## 7.41 seq64::Seq24SeqRollInput Class Reference

Implements the Seq24 mouse interaction paradigm for the seqroll.

### Public Member Functions

- [Seq24SeqRollInput](#) ()  
*Default constructor.*
- void [set\\_adding](#) (bool a\_adding, [seqroll](#) &ths)  
*Changes the mouse cursor pixmap according to whether a note is being added or not.*
- bool [on\\_button\\_press\\_event](#) (GdkEventButton \*a\_ev, [seqroll](#) &ths)  
*Implements the on-button-press event handling for the Seq24 style of mouse interaction.*
- bool [on\\_button\\_release\\_event](#) (GdkEventButton \*a\_ev, [seqroll](#) &ths)  
*Implements the on-button-release event handling for the Seq24 style of mouse interaction.*

- bool [on\\_motion\\_notify\\_event](#) (GdkEventMotion \*a\_ev, [seqroll](#) &ths)

*Implements the on-motion-notify event handling for the Seq24 style of mouse interaction.*

### 7.41.1 Member Function Documentation

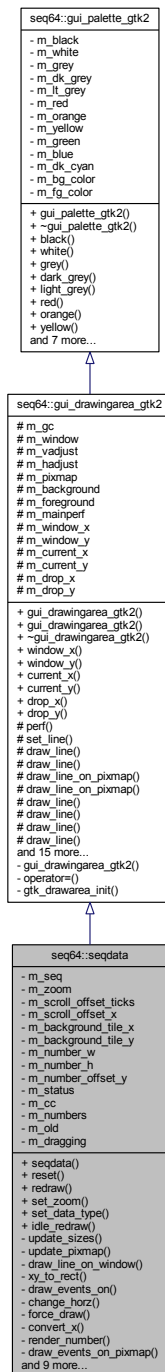
7.41.1.1 void [seq64::Seq24SeqRollInput::set\\_adding](#) ( bool *adding*, [seqroll](#) & *scroll* )

What calls this? It is actually a right click.

## 7.42 [seq64::seqdata](#) Class Reference

This class supports drawing piano-roll events on a window.

Inheritance diagram for seq64::seqdata:



## Public Member Functions

- [seqdata](#) ([sequence](#) &seq, [perform](#) &p, int zoom, Gtk::Adjustment &hadjust)  
*Principal constructor.*
- void [reset](#) ()  
*This function calls update\_size().*
- void [redraw](#) ()

- Updates the pixmap and queues 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](#) (unsigned char a\_status, unsigned char a\_control)
  - Sets the status to the given value, and the control to the optional given value, which defaults to 0, then calls [redraw\(\)](#).*
- int [idle\\_redraw](#) ()
  - Draws events on this object's built-in window and pixmap.*

## Private Member Functions

- 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 a\_x1, int a\_y1, int a\_x2, int a\_y2, int &r\_x, int &r\_y, int &r\_w, int &r\_h)
  - 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 [force\\_draw](#) ()
  - Force a redraw.*
- void [convert\\_x](#) (int x, long &tick)
  - This function takes screen coordinates, and gives the horizontal 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 \*a\_ev)
  - Implements the on-expose event.*
- bool [on\\_button\\_press\\_event](#) (GdkEventButton \*a\_ev)
  - Implement a button-press event.*
- bool [on\\_button\\_release\\_event](#) (GdkEventButton \*a\_ev)
  - Implement a button-release event.*
- bool [on\\_motion\\_notify\\_event](#) (GdkEventMotion \*a\_p0)
  - Handles a motion-notify event.*
- bool [on\\_leave\\_notify\\_event](#) (GdkEventCrossing \*p0)
  - Handles an on-leave notification event.*
- bool [on\\_scroll\\_event](#) (GdkEventScroll \*a\_ev)
  - Implements the on-scroll event.*
- void [on\\_size\\_allocate](#) (Gtk::Allocation &)
  - Handle a size-allocation event.*

## Private Attributes

- int [m\\_zoom](#)  
*one pixel == m\_zoom ticks*
- 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.*
- unsigned char [m\\_status](#)  
*What is the data window currently editing?*

## Additional Inherited Members

### 7.42.1 Constructor & Destructor Documentation

7.42.1.1 `seq64::seqdata::seqdata ( sequence & seq, perform & p, int zoom, Gtk::Adjustment & hadjust )`

In the constructor you can only allocate colors, `get_window()` returns 0 because we have not been realized.

### 7.42.2 Member Function Documentation

7.42.2.1 `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.

7.42.2.2 `void seq64::seqdata::redraw ( ) [inline]`

We need to make this an inline function and use it as common code.

7.42.2.3 `void seq64::seqdata::set_zoom ( int zoom )`

This begs the question, do we have GUI access to the zoom setting?

7.42.2.4 `void seq64::seqdata::set_data_type ( unsigned char status, unsigned char control )`

Perhaps we should check that at least one of the parameters causes a change.

7.42.2.5 `int seq64::seqdata::idle_redraw ( )`

This drawing is done only if there is no dragging in progress, to guarantee no flicker.

7.42.2.6 `void seq64::seqdata::update_sizes ( ) [private]`

It creates a pixmap with window dimensions given by `m_window_x` and `m_window_y`.

```
7.42.2.7 void seq64::seqdata::xy_to_rect( int a_x1, int a_y1, int a_x2, int a_y2, int & r_x, int & r_y, int & r_w, int & r_h )
    [private]
```

It checks the mins/maxes, then fills in x, y, and width, height.

```
7.42.2.8 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).

```
7.42.2.9 bool seq64::seqdata::on_motion_notify_event( GdkEventMotion * a_p0 ) [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.

```
7.42.2.10 bool seq64::seqdata::on_scroll_event( GdkEventScroll * a_ev ) [private]
```

This scroll event only handles basic scrolling, without any modifier keys such as SEQ64\_CONTROL\_MASK or SEQ64K\_SHIFT\_MASK.

### 7.42.3 Field Documentation

```
7.42.3.1 int seq64::seqdata::m_number_w [private]
```

By "adjusted", well this is just a minor tweak for appearances.

```
7.42.3.2 int seq64::seqdata::m_number_h [private]
```

Basically, the character height times 3. By "adjusted", well this is just a minor tweak for appearances.

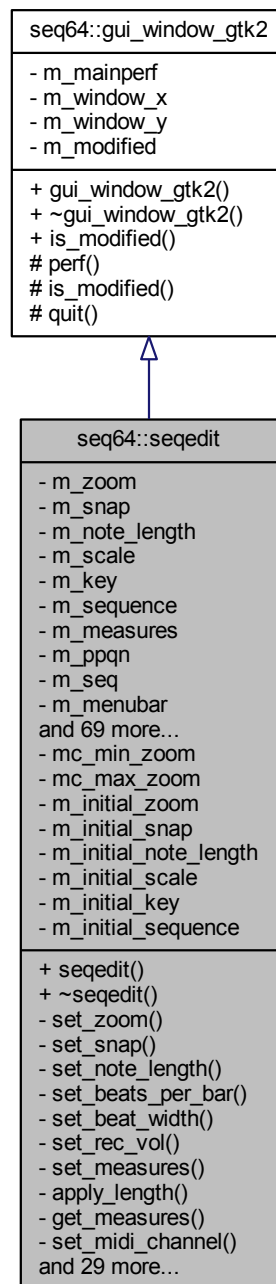
```
7.42.3.3 int seq64::seqdata::m_number_offset_y [private]
```

This value was hardwired as 8, for a character height of 10.

## 7.43 seq64::seqedit Class Reference

Implements the Pattern Editor, which has references to:

Inheritance diagram for seq64::seqedit:



## Public Member Functions

- `seqedit` (`sequence` &seq, `perform` &perf, int pos, int ppqn=SEQ64\_USE\_DEFAULT\_PPQN)  
Connects to a menu item, tells the performance to launch the timer thread.
- `~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.*
- void [set\\_note\\_length](#) (int note\_length)  
*Selects the given note-length value.*
- void [set\\_beats\\_per\\_bar](#) (int beats\_per\_measure)  
*Set the bpm (beats per measure) value, using the given parameter, and some internal values passed to [apply\\_length\(\)](#).*
- void [set\\_beat\\_width](#) (int beat\_width)  
*Set the bw (beat width) value, using the given parameter, and some internal values passed to [apply\\_length\(\)](#).*
- void [set\\_rec\\_vol](#) (int recvol)  
*Passes the given parameter to [sequence::set\\_rec\\_vol\(\)](#).*
- void [set\\_measures](#) (int length\_measures)  
*Set the measures value, using the given parameter, and some internal values passed to [apply\\_length\(\)](#).*
- void [apply\\_length](#) (int 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)  
*Selects the given MIDI channel parameter in the main sequence object, so that it will use that channel.*
- void [set\\_midi\\_bus](#) (int midibus)  
*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\\_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 [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 tell the segroll, seqtime, seqdata, and sequevent objects to redraw.*
- void [redo\\_callback](#) ()  
*Pops a redo operation from the sequence object, and then tell the segroll, seqtime, seqdata, and sequevent objects to redraw.*
- void [set\\_data\\_type](#) (unsigned char status, unsigned char control=0)  
*Sets the data type based on the given parameters.*
- 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 manu pixmap depending on the given state, where true is a full menu (black background), 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 [on\\_realize](#) ()  
*On realization, calls the base-class version, and connects the redraw timeout signal, timed at c\_redraw\_ms.*
- 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

- int [m\\_zoom](#)  
*Provides the zoom values: 0 1 2 3 4, and 1, 2, 4, 8, 16.*
- int [m\\_snap](#)  
*Use in setting the snap-to in pulses, off = 1.*
- int [m\\_scale](#)  
*Settings for the music scale and key.*
- Gtk::Menu \* [m\\_menu\\_length](#)  
*Provides the length in measures.*
- Gtk::Menu \* [m\\_menu\\_bpm](#)  
*These member provide the time signature, beats per measure, and beat width menus.*
- unsigned char [m\\_editing\\_status](#)  
*Indicates what is the data window currently editing?*

## Static Private Attributes

- static const int [mc\\_min\\_zoom](#)  
*Static data members.*

## Additional Inherited Members

### 7.43.1 Detailed Description

- perform
- seqroll
- seqkeys
- seqdata
- seqtime
- sequevent
- sequence

This class has a metric ton of user-interface objects and other members.

### 7.43.2 Constructor & Destructor Documentation

7.43.2.1 `seq64::seqedit::seqedit ( sequence & seq, perform & p, int pos, int ppqn = SEQ64_USE_DEFAULT_PPQN )`

But this is an unused, empty function.

`void seqedit::menu_action_quantise () { }` Principal constructor.

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

### 7.43.3 Member Function Documentation

7.43.3.1 `void seq64::seqedit::set_zoom ( int zoom ) [private]`

It is passed to the seqroll, seqtime, seqdata, and sequevent objects, as well.

7.43.3.2 `void seq64::seqedit::set_snap ( int a_snap ) [private]`

It is passed to the seqroll, sequevent, and sequence objects, as well.

7.43.3.3 `void seq64::seqedit::set_note_length ( int a_note_length ) [private]`

It is passed to the seqroll object, as well.

7.43.3.4 `void seq64::seqedit::apply_length ( int 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 sequevent objects are reset().

7.43.3.5 `long seq64::seqedit::get_measures ( ) [private]`

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

7.43.3.6 void seq64::seqedit::set\_scale ( int *a\_scale* ) [private]

It is passed to the seqroll and seqkeys objects, as well.

7.43.3.7 void seq64::seqedit::set\_key ( int *a\_note* ) [private]

It is passed to the seqroll and seqkeys objects, as well.

7.43.3.8 void seq64::seqedit::set\_background\_sequence ( int *seq* ) [private]

**Todo** Make the sequence pointer a reference.

7.43.3.9 void seq64::seqedit::name\_change\_callback ( ) [private]

That name is the name the user has given to the sequence being edited.

7.43.3.10 void seq64::seqedit::set\_data\_type ( unsigned char *status*, unsigned char *control* = 0 ) [private]

This function uses the hardwired array c\_controller\_names.

#### Parameters

<i>status</i>	The current editing status.
<i>control</i>	The control value. However, we really need to validate it!

7.43.3.11 void seq64::seqedit::create\_menus ( ) [private]

This 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".

The Snap menu is actually the Grid Snap button, which shows two arrows pointing to a central bar.

The note-length menu is on the button that shows four notes.

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 on set the sequence length in bars (not the MIDI channel). The second menu is the m\_menu\_bpm, or BPM, which here means "beats per measure" (not "beats per minute").

7.43.3.12 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.

7.43.3.13 `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.

7.43.3.14 `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.

7.43.3.15 `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.

7.43.3.16 `void seq64::seqedit::do_action ( int a_action, int a_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).

7.43.3.17 `bool seq64::seqedit::on_delete_event ( GdkEventAny * a_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.

### 7.43.4 Field Documentation

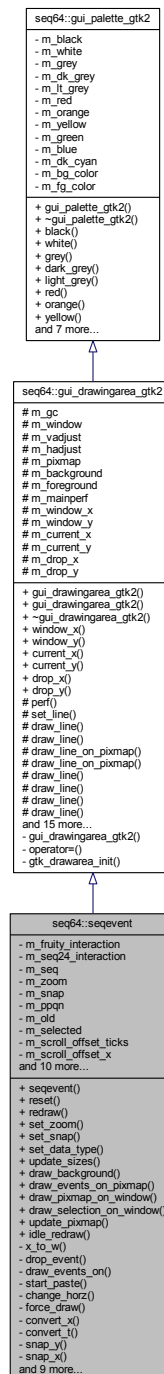
7.43.4.1 `const int seq64::seqedit::mc_min_zoom [static], [private]`

These items apply to all of the instances of `seqedit`.

## 7.44 seq64::seqevent Class Reference

Implements the piano event drawing area.

Inheritance diagram for seq64::sequevent:



## Public Member Functions

- **seqevent** (sequence &seq, perform &p, int zoom, int snap, seqdata &seqdata\_wid, Gtk::Adjustment &hadjust, int ppgn=SEQ64 USE DEFAULT PPGN)

*Principal constructor.*

- 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 a\_zoom)  
*Sets zoom to the given value, and resets if the value ended up being changed.*
- void [set\\_snap](#) (int a\_snap)  
*'Setter' function for member m\_snap*
- void [set\\_data\\_type](#) (unsigned char a\_status, unsigned char a\_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.*
- int [idle\\_redraw](#) ()  
*Implements redraw while idling.*

## Private Member Functions

- void [x\\_to\\_w](#) (int a\_x1, int a\_x2, int &a\_x, int &a\_w)  
*This function checks the mins / maxes.*
- void [drop\\_event](#) (long a\_tick)  
*Drops (adds) an event at the given tick.*
- void [draw\\_events\\_on](#) (Glib::RefPtr< Gdk::Drawable > a\_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 [force\\_draw](#) ()  
*Forces a draw on the current drawable area of the window.*
- void [convert\\_x](#) (int x, long &tick)  
*Takes the screen x coordinate, multiplies it by the current zoom, and returns the tick value in the given parameter.*
- void [convert\\_t](#) (long ticks, 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 &a\_x)  
*This function performs a 'snap' on x.*
- void [on\\_realize](#) ()  
*Implements the on-realize callback.*
- bool [on\\_expose\\_event](#) (GdkEventExpose \*a\_ev)  
*Implements the on-expose event callback.*
- bool [on\\_button\\_press\\_event](#) (GdkEventButton \*a\_ev)

- Implements the on-button-press event callback.*
- bool [on\\_button\\_release\\_event](#) (GdkEventButton \*a\_ev)  
*Implements the on-button-release event callback.*
- bool [on\\_motion\\_notify\\_event](#) (GdkEventMotion \*a\_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 \*a\_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](#)  
*Why should we need both at the same time? Just load the one that is specified in the configuration.*
- int [m\\_zoom](#)  
*Zoom setting, means that one pixel == m\_zoom ticks.*
- bool [m\\_selecting](#)  
*Used when highlighting a bunch of events.*
- unsigned char [m\\_status](#)  
*Indicates what is the data window currently editing?*

### Additional Inherited Members

#### 7.44.1 Member Function Documentation

7.44.1.1 void seq64::sequevent::set\_snap ( int a\_snap ) [inline]

Simply sets the snap member.

7.44.1.2 void seq64::sequevent::set\_data\_type ( unsigned char status, unsigned char control = 0 )

Then redraws.

7.44.1.3 void seq64::sequevent::update\_sizes ( )

This ends up filling the background with dotted lines, etc.

7.44.1.4 void seq64::sequevent::draw\_background ( )

It sets the foreground to white, draws the rectangle, in order to clear the pixmap.

7.44.1.5 void seq64::sequevent::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.
```

7.44.1.6 `int seq64::sequevent::idle_redraw ( )`

Who calls this routine?

7.44.1.7 `void seq64::sequevent::x_to_w ( int a_x1, int a_x2, int & a_x, int & a_w ) [private]`

Then it fills in x and the width.

7.44.1.8 `void seq64::sequevent::drop_event ( long a_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.

7.44.1.9 `void seq64::sequevent::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.

7.44.1.10 `void seq64::sequevent::convert_x ( int x, long & tick ) [inline], [private]`

Why not just return it normally?

7.44.1.11 `void seq64::sequevent::convert_t ( long ticks, int & x ) [inline], [private]`

Why not just return it normally?

7.44.1.12 `void seq64::sequevent::snap_x ( int & x ) [private]`

- snap = number pulses to snap to
- m\_zoom = number of pulses per pixel,

Therefore snap / m\_zoom = number pixels to snap to.

7.44.1.13 `void seq64::sequevent::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.

7.44.1.14 `bool seq64::sequevent::on_button_press_event ( GdkEventButton * a_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.



7.44.1.15 `bool seq64::sequevent::on_button_release_event ( GdkEventButton * a_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.

7.44.1.16 `bool seq64::sequevent::on_motion_notify_event ( GdkEventMotion * a_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.

7.44.1.17 `bool seq64::sequevent::on_key_press_event ( GdkEventKey * a_p0 ) [private]`

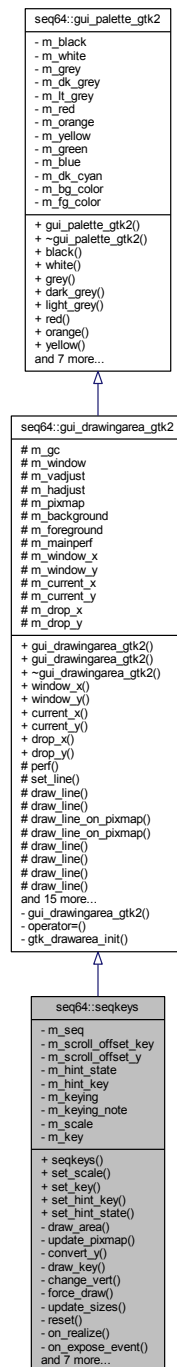
It handles deleted a selection via the Backspace or Delete keys, cut via Ctrl-X, copy via Ctrl-C, paste via Ctrl-V, and undo via Ctrl-Z.

Would be nice to provide redo functionality via Ctrl-Y. :-)

## 7.45 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.*
- void `set_scale` (int a\_scale)  
*Sets the musical scale, then resets.*
- void `set_key` (int a\_key)

- Sets the musical key, then resets.*

  - void [set\\_hint\\_key](#) (int a\_key)

*Sets a key to grey so that it can serve as a scale hint.*
- void [set\\_hint\\_state](#) (bool a\_state)

*Sets the hint state to the given value.*

## Private Member Functions

- 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 a\_y, int &a\_note)

*Takes the screen y coordinate, and returns the note value in the second parameter.*
- void [draw\\_key](#) (int a\_key, bool a\_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 [force\\_draw](#) ()

*Forces a draw operation on the whole window.*
- void [reset](#) ()

*Resetting the keys view updates the pixmap and queues up a draw operation.*
- void [on\\_realize](#) ()

*Implements the on-realize event.*
- bool [on\\_expose\\_event](#) (GdkEventExpose \*a\_ev)

*Implements the on-expose event, by drawing on the window.*
- bool [on\\_button\\_press\\_event](#) (GdkEventButton \*a\_ev)

*Implements the on-button-press event callback.*
- bool [on\\_button\\_release\\_event](#) (GdkEventButton \*a\_ev)

*Implements the on-button-release event callback.*
- bool [on\\_motion\\_notify\\_event](#) (GdkEventMotion \*a\_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 \*a\_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

- bool [m\\_keying](#)

*What is this?*

## Additional Inherited Members

### 7.45.1 Member Function Documentation

#### 7.45.1.1 void seq64::seqkeys::set\_hint\_state ( bool state )

## Parameters

<i>state</i>	Provides the value for hinting, where true == on, false == off.
--------------	---

7.45.1.2 `void seq64::seqkeys::draw_key ( int a_key, bool a_state )` [private]

It accounts for the black keys and the white keys.

## Parameters

<i>a_key</i>	The key to be drawn.
<i>a_state</i>	How the key is to be drawn, where false == normal, true == grayed.

7.45.1.3 `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.

7.45.1.4 `bool seq64::seqkeys::on_button_press_event ( GdkEventButton * ev )` [private]

It currently handles only the left button. This button, pressed on the piano keyboard, causes m\_keying to be set to true, and the given note to play.

7.45.1.5 `bool seq64::seqkeys::on_button_release_event ( GdkEventButton * ev )` [private]

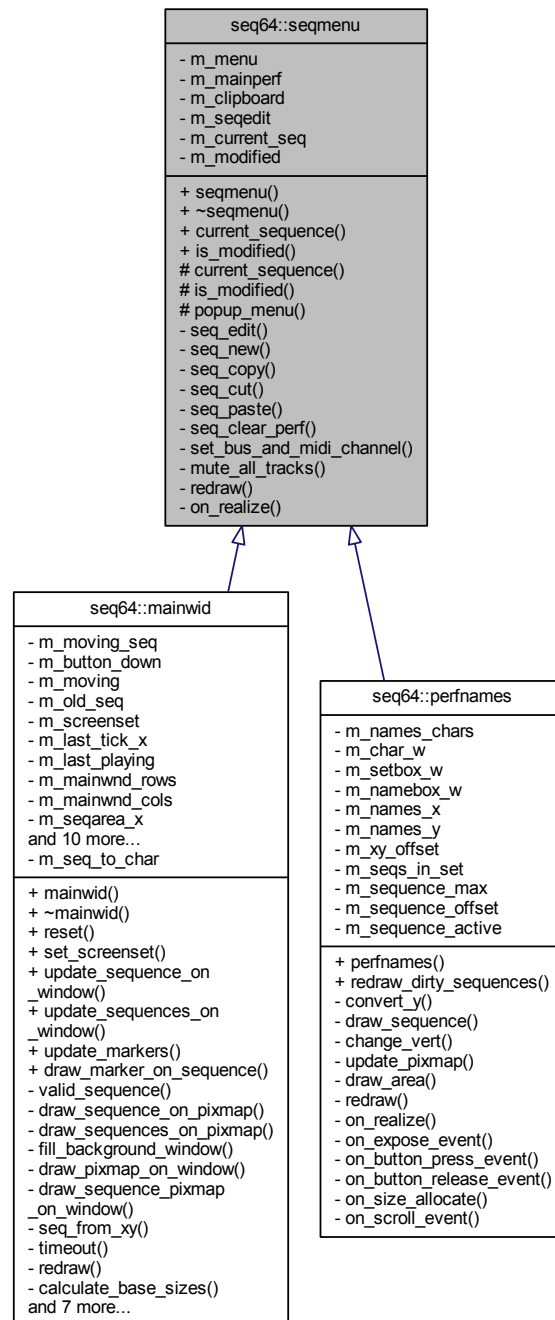
It currently handles only the left button, and only if m\_keying is true.

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.

## 7.46 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\\_sequence](#) () const

- *'Getter' function for member m\_current\_seq*
- bool [is\\_modified](#) () const
- *'Getter' function for member m\_modified*

## Protected Member Functions

- void [current\\_sequence](#) (int seq)
- *'Setter' function for member m\_current\_seq*
- void [is\\_modified](#) (bool flag)
- *'Setter' function for member m\_modified*
- void [popup\\_menu](#) ()
- *This function sets up the File menu entries.*

## Private Member Functions

- void [seq\\_edit](#) ()
- *This menu callback launches the sequence-editor (pattern editor) window.*
- 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 [mute\\_all\\_tracks](#) ()
- *Mutes all tracks in the main perform object.*

## Private Attributes

- [seqedit](#) \* [m\\_seqedit](#)
- *Change Note Added by Chris on 2015-08-02 based on compiler warnings and a comment warning in the [seq\\_edit\(\)](#) function.*

### 7.46.1 Detailed Description

It is an abstract base class.

### 7.46.2 Constructor & Destructor Documentation

#### 7.46.2.1 [seq64::seqmenu::seqmenu](#) ( [perform](#) & [a\\_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.

#### 7.46.2.2 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.

### 7.46.3 Member Function Documentation

#### 7.46.3.1 void seq64::seqmenu::popup\_menu ( ) [protected]

It also sets up the pattern popup menu entries!

#### 7.46.3.2 void seq64::seqmenu::seq\_edit ( ) [private]

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!

#### 7.46.3.3 void seq64::seqmenu::seq\_copy ( ) [private]

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

#### 7.46.3.4 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.

#### 7.46.3.5 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.

#### 7.46.3.6 void seq64::seqmenu::seq\_clear\_perf ( ) [private]

**Todo** All of `seq_paste()` can be offloaded to a (new) perform member function.

### 7.46.4 Field Documentation

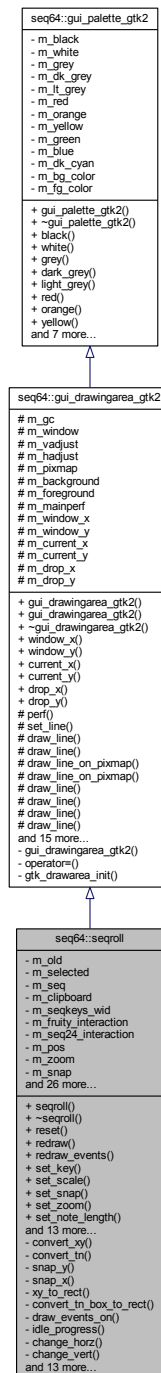
#### 7.46.4.1 seqedit\* seq64::seqmenu::m\_seqedit [private]

We'll save the result of that function here, and will let valgrind tell us later if Gtkmm takes care of it.

## 7.47 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.*

- `~seqroll ()`

*Provides a destructor to delete allocated objects.*

- `void reset ()`

*This function basically resets the whole widget as if it was realized again.*

- `void redraw ()`

*Redraws unless `m_ignore_redraw` is true.*

- `void redraw_events ()`

*Redraws events unless `m_ignore_redraw` is true.*

- `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_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`*

- `void set_ignore_redraw (bool ignore)`

*'Setter' function for member `m_ignore_redraw`*

- `void set_data_type (unsigned char status, unsigned char 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 selection on the main window.*

- `void draw_progress_on_window ()`

*Draw a progress line on the window.*

- `int idle_redraw ()`

*Draw the events on the main window and on the pixmap.*

- `void start_paste ()`

*Starts a paste operation.*

- `void update_and_draw (int force=false)`

*Wraps up some common code.*

## Private Member Functions

- void [convert\\_tn](#) (long 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 [snap\\_x](#) (int &x)  
*Performs a 'snap' operation on the x coordinate.*
- void [xy\\_to\\_rect](#) (int x1, int y1, int x2, int y2, int &x, int &y, int &w, int &h)  
*This function checks the mins / maxes, and then fills in the x, y, width, and height values.*
- void [convert\\_tn\\_box\\_to\\_rect](#) (long tick\_s, long 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 [draw\\_events\\_on](#) (Glib::RefPtr< Gdk::Drawable > draw)  
*Draws events on the given drawable area.*
- void [change\\_horz](#) ()  
*Change the horizontal scrolling offset and redraw.*
- void [change\\_vert](#) ()  
*Change the vertical scrolling offset and redraw.*
- void [force\\_draw](#) ()  
*Set the pixmap into the window and then draws the selection on it.*
- 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

- [FruitySeqRollInput m\\_fruity\\_interaction](#)  
*Provides a fruity input object, whether it is needed or not.*
- [Seq24SeqRollInput m\\_seq24\\_interaction](#)  
*Provides a normal seq24 input object, which is always needed to handle, for example, keystroke input.*
- int [m\\_zoom](#)  
*one pixel == m\_zoom ticks\**

- unsigned char [m\\_status](#)  
*Indicates what is the data window currently editing.*
- bool [m\\_selecting](#)  
*When highlighting a bunch of events.*
- int [m\\_move\\_delta\\_x](#)  
*Tells where the dragging started.*

## Friends

- class [FruitySeqRollInput](#)  
*These friend implement interaction-specific behavior, although only the Seq24 interactions support keyboard processing.*

## Additional Inherited Members

### 7.47.1 Member Function Documentation

#### 7.47.1.1 void seq64::seqroll::reset ( )

It's almost identical to the [change\\_horz\(\)](#) function!

#### 7.47.1.2 void seq64::seqroll::redraw\_events ( )

Almost: `update_and_draw(true)` are almost replaceable by [update\\_background\(\)](#); [update\\_pixmap\(\)](#); [force\\_draw\(\)](#);

#### 7.47.1.3 void seq64::seqroll::set\_data\_type ( unsigned char *status*, unsigned char *control* )

Unlike the same function in `sequevent`, this version does not redraw.

#### 7.47.1.4 void seq64::seqroll::set\_background\_sequence ( bool *state*, int *seq* )

The state parameter sets the boolean `m_drawing_background_seq`.

#### 7.47.1.5 void seq64::seqroll::update\_background ( )

The first thing done is to clear the background, painting it white.

#### 7.47.1.6 void seq64::seqroll::draw\_events\_on\_pixmap ( )

Just calls [draw\\_events\\_on\(\)](#).

#### 7.47.1.7 void seq64::seqroll::convert\_tn ( long *a\_ticks*, int *a\_note*, int & *a\_x*, int & *a\_y* ) [private]

This function is the "inverse" of `convert_xy()`.

**7.47.1.8** `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.

**7.47.1.9** `void seq64::seqroll::draw_events_on( Glib::RefPtr< Gdk::Drawable > draw ) [private]`

"Method 0" seems be the one that draws the background sequence, if active. "Method 1" draws the sequence itself.

**7.47.1.10** `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, 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.

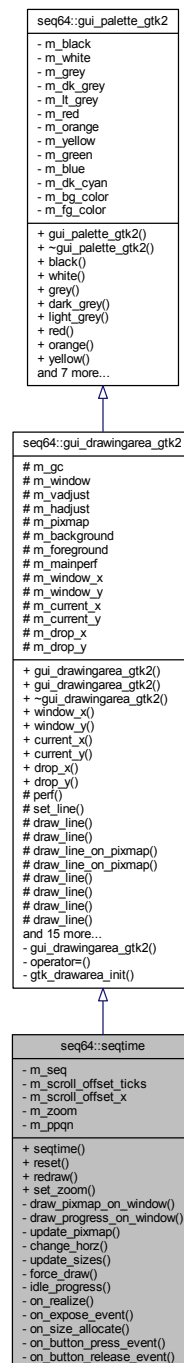
**7.47.1.11** `bool seq64::seqroll::on_scroll_event( GdkEventScroll * ev ) [private]`

This scroll event only handles basic scrolling without any modifier keys such as `SEQ64_CONTROL_MASK` or `SEQ64_SHIFT_MASK`.

## 7.48 seq64::seqtime Class Reference

This class implements the piano time, whatever that is.

Inheritance diagram for seq64::seqtime:



## Public Member Functions

- void [set\\_zoom](#) (int zoom)

*Sets the zoom to the given value and resets the window.*

## Private Member Functions

- bool `idle_progress` ()  
*Simply returns true.*
- 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

- int `m_zoom`  
*one pixel == m\_zoom ticks*

## Additional Inherited Members

### 7.48.1 Member Function Documentation

7.48.1.1 `bool seq64::seqtime::on_button_press_event ( GdkEventButton * )` `[inline],[private]`

Simply returns false.

7.48.1.2 `bool seq64::seqtime::on_button_release_event ( GdkEventButton * )` `[inline],[private]`

Simply returns false.

## 7.49 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` }

## Public Member Functions

- `sequence` (int ppqn=SEQ64\_USE\_DEFAULT\_PPQN)  
*Principal constructor.*
- `~sequence` ()  
*A rote destructor.*
- `sequence & operator=` (const `sequence` &rhs)  
*Principal assignment operator.*
- `event_list` & `events` ()

- 'Getter' function for member `m_events`
- `bool any_selected_notes () const`
  - 'Getter' function for member `m_events.any_selected_notes()`
- `triggers::List & triggerlist ()`
  - 'Getter' function for member `m_triggers`
- `int event_count () const`
  - Returns the number of events stored in `m_events`.
- `void push_undo ()`
  - Pushes the list-event into the undo-list.
- `void pop_undo ()`
  - If there are items on the undo list, this function pushes the list-event into the redo-list, puts the top of the undo-list into the list-event, 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 list-event into the undo-list, puts the top of the redo-list into the list-event, 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 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_beats_per_bar (long beatspermeasure)`
  - 'Setter' function for member `m_time_beats_per_measure`
- `long get_beats_per_bar () const`
  - 'Getter' function for member `m_time_beats_per_measure`
- `void set_beat_width (long beatwidth)`
  - 'Setter' function for member `m_time_beat_width`
- `long get_beat_width () const`
  - 'Getter' function for member `m_time_beat_width`
- `void set_rec_vol (long rec_vol)`
  - 'Setter' function for member `m_rec_vol`
- `void set_song_mute (bool mute)`
  - 'Setter' function for member `m_song_mute`
- `bool get_song_mute () const`
  - 'Getter' function for member `m_song_mute`
- `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 (long len, bool adjust_triggers=true)`
  - Sets the length (`m_length`) and adjusts triggers for it if desired.

- long `get_length` () const  
*'Getter' function for member m\_length*
- long `get_last_tick` ()  
*Returns the last tick played, and is used by the editor's idle function.*
- 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*
- void `off_queued` ()  
*'Setter' function for member m\_queued*
- bool `get_queued` () const  
*'Getter' function for member m\_queued*
- long `get_queued_tick` () const  
*'Getter' function for member m\_queued\_tick*
- 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.*
- unsigned char `get_midi_channel` () const  
*'Getter' function for member m\_midi\_channel*
- void `set_midi_channel` (unsigned char ch)  
*Sets the m\_midi\_channel number.*
- void `print` ()  
*Prints a list of the currently-held events.*
- void `print_triggers` ()



- Prints a list of the currently-held triggers.*
- void [play](#) (long tick, bool playback\_mode)
  - The [play\(\)](#) function dumps notes starting from the given tick, and it pre-buffers ahead.*
- void [set\\_orig\\_tick](#) (long tick)
  - 'Setter' function for member `m_last_tick`*
- void [add\\_event](#) (const [event](#) \*e)
  - Adds an event to the internal event list in a sorted manner.*
- void [add\\_trigger](#) (long tick, long length, long offset=0, bool adjust\_offset=true)
  - Adds a trigger.*
- void [split\\_trigger](#) (long tick)
  - Splits a trigger.*
- void [grow\\_trigger](#) (long tick\_from, long tick\_to, long length)
  - Grows a trigger.*
- void [del\\_trigger](#) (long tick)
  - Deletes a trigger, that brackets the given tick, from the trigger-list.*
- bool [get\\_trigger\\_state](#) (long tick)
  - Checks the list of triggers against the given tick.*
- bool [select\\_trigger](#) (long tick)
  - Checks the list of triggers against the given tick.*
- bool [unselect\\_triggers](#) ()
  - Unselects all triggers.*
- bool [intersect\\_triggers](#) (long position, long &start, long &end)
  - This function examines each trigger in the trigger list.*
- bool [intersect\\_notes](#) (long position, long position\_note, long &start, long &end, long &note)
  - This function examines each note in the event list.*
- bool [intersect\\_events](#) (long posstart, long posend, long status, long &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](#) ()
  - Copies the first selected trigger that is found.*
- void [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](#) (long tick, bool adjust\_offset, int which=2)
  - Moves selected triggers as per the given parameters.*
- long [selected\\_trigger\\_start](#) ()
  - Gets the last-selected trigger's start tick.*
- long [selected\\_trigger\\_end](#) ()
  - Gets the selected trigger's end tick.*
- long [get\\_max\\_trigger](#) ()
  - Get the ending value of the last trigger in the trigger-list.*
- void [move\\_triggers](#) (long start\_tick, long distance, bool direction)
  - Moves triggers in the trigger-list.*
- void [copy\\_triggers](#) (long start\_tick, long distance)
  - Copies triggers to...*
- void [clear\\_triggers](#) ()
  - Clears the whole list of triggers.*
- long [get\\_trigger\\_offset](#) () const
  - 'Getter' function for member `m_trigger_offset`*

- void [set\\_midi\\_bus](#) (char mb)  
*Sets the midibus number to dump 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*
- int [select\\_note\\_events](#) (long tick\_s, int note\_h, long tick\_f, int note\_l, [select\\_action\\_e](#) action)  
*This function selects events in range of tick start, note high, tick end, and note low.*
- int [select\\_events](#) (long tick\_s, long tick\_f, unsigned char status, unsigned char cc, [select\\_action\\_e](#) action)  
*Select all events in the given range, and returns the number selected.*
- int [select\\_events](#) (unsigned char status, unsigned char cc, bool inverse=false)  
*Select all events with the given status, and returns the number selected.*
- int [get\\_num\\_selected\\_notes](#) () const  
*Counts the selected notes in the event list.*
- int [get\\_num\\_selected\\_events](#) (unsigned char status, unsigned char 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 [paste\\_selected](#) (long tick, int note)  
*Pastes the selected notes (and only note events) at the given tick and the given note value.*
- void [get\\_selected\\_box](#) (long &tick\_s, int &note\_h, long &tick\_f, int &note\_l)  
*Returns the 'box' of the selected items.*
- void [get\\_clipboard\\_box](#) (long &tick\_s, int &note\_h, long &tick\_f, int &note\_l)  
*Returns the 'box' of selected items.*
- void [move\\_selected\\_notes](#) (long delta\_tick, int delta\_note)  
*Removes and adds reads selected in position.*
- void [add\\_note](#) (long tick, long length, int note, bool paint=false)  
*Adds a note of a given length and note value, at a given tick location.*
- void [add\\_event](#) (long tick, unsigned char status, unsigned char d0, unsigned char d1, bool paint=false)  
*Adds a event of a given status value and data values, at a given tick location.*
- void [stream\\_event](#) ([event](#) \*ev)  
*Streams the given event.*
- void [change\\_event\\_data\\_range](#) (long tick\_s, long tick\_f, unsigned char status, unsigned char cc, int d\_s, int d\_f)  
*Changes the event data range.*
- void [increment\\_selected](#) (unsigned char status, unsigned char control)  
*Increments events the match the given status and control values.*
- void [decrement\\_selected](#) (unsigned char status, unsigned char control)  
*Decrements events the match the given status and control values.*
- void [grow\\_selected](#) (long delta\_tick)  
*Moves note off event.*
- void [stretch\\_selected](#) (long delta\_tick)  
*Performs a stretch operation on the selected events.*
- void [remove\\_marked](#) ()  
*Removes marked events.*
- void [mark\\_selected](#) ()  
*Marks the selected events.*
- void [unpaint\\_all](#) ()  
*Unpaints all list-events.*

- void `unselect` ()  
*Deselects all events, unconditionally.*
- void `verify_and_link` ()  
*This function verifies state: all note-ons have an 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 `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 `get_next_note_event` (long \*tick\_s, long \*tick\_f, int \*note, bool \*selected, int \*velocity)  
*Each call to seqdata() fills the passed references with a events elements, and returns true.*
- int `get_lowest_note_event` ()  
*Goes through the list of notes, and picks the one with the lowest value.*
- int `get_highest_note_event` ()  
*Goes through the list of notes, and picks the one with the highest value.*
- bool `get_next_event` (unsigned char status, unsigned char cc, long \*tick, unsigned char \*d0, unsigned char \*d1, bool \*selected)  
*Get the next event in the event list that matches the given status and control character.*
- bool `get_next_event` (unsigned char \*status, unsigned char \*cc)  
*Get the next event in the event list.*
- bool `get_next_trigger` (long \*tick\_on, long \*tick\_off, bool \*selected, long \*tick\_offset)  
*Get the next trigger in the trigger list, and set the parameters based on that trigger.*
- void `fill_container` (midi\_container &c, int tracknumber)  
*This function fills the given character list with MIDI data from the current sequence, preparatory to writing it to a file.*
- void `quantize_events` (unsigned char status, unsigned char cc, long snap\_tick, int divide, bool linked=false)  
*Not deleting the ends, not selected.*
- void `transpose_notes` (int steps, int scale)  
*Transposes notes by the given steps, in accordance with the given scale.*

## Private Member Functions

- void `put_event_on_bus` (event \*ev)  
*Takes an event that this sequence is holding, and places it on the midibus.*
- void `remove_all` ()  
*Clears all events from the event container.*
- void `set_trigger_offset` (long trigger\_offset)  
*Sets m\_trigger\_offset and wraps it to m\_length.*
- void `split_trigger` (trigger &trig, long split\_tick)  
*Splits the trigger given by the parameter into two triggers.*
- void `adjust_trigger_offsets_to_length` (long new\_len)  
*Adjusts trigger offsets to the length of ???, for all triggers, and undo triggers.*

- 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 list-event.*

- void [remove](#) (event \*e)

*A helper function, which does not lock/unlock, so it is unsafe to call without supplying an iterator from the list-event.*

## Private Attributes

- [event\\_list m\\_events](#)

*This list holds the current pattern/sequence events.*

- mutex [m\\_mutex](#)

*Provides locking for the sequence.*

## Static Private Attributes

- static [event\\_list m\\_events\\_clipboard](#)

*A static clipboard for holding pattern/sequence events.*

### 7.49.1 Detailed Description

More members than you can shake a stick at.

### 7.49.2 Member Enumeration Documentation

#### 7.49.2.1 enum seq64::sequence::select\_action\_e

##### Enumerator

**e\_select** This enumeration is used in selecting events and note. Se the [select\\_note\\_events\(\)](#) and [select\\_events\(\)](#) functions.

To select ...

**e\_select\_one** To select ...

**e\_is\_selected** The events are selected ...

**e\_would\_select** The events would be selected ...

**e\_deselect** To deselect the event under the cursor.

**e\_toggle\_selection** To toggle the selection of the event under the cursor.

**e\_remove\_one** To remove one note under the cursor.

### 7.49.3 Member Function Documentation

#### 7.49.3.1 [sequence & seq64::sequence::operator= \( const sequence & rhs \)](#)

Follows the stock rules for such an operator, but does a little more then just assign member values. 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.

*Threadsafe*

#### 7.49.3.2 [int seq64::sequence::event\\_count \( \) const](#)

*Threadsafe*

7.49.3.3 void seq64::sequence::push\_undo ( )

*Threadsafe*

7.49.3.4 void seq64::sequence::pop\_undo ( )

*Threadsafe*

7.49.3.5 void seq64::sequence::pop\_redo ( )

*Threadsafe*

7.49.3.6 void seq64::sequence::push\_trigger\_undo ( )

*Threadsafe*

7.49.3.7 void seq64::sequence::set\_beats\_per\_bar ( long *beatspermeasure* )

*Threadsafe*

Parameters

<i>beatspermeasure</i>	The new setting of the beats-per-bar value.
------------------------	---

7.49.3.8 void seq64::sequence::set\_beat\_width ( long *beatwidth* )

*Threadsafe*

Parameters

<i>beatwidth</i>	The new setting of the beat width value.
------------------	--

7.49.3.9 long seq64::sequence::get\_beat\_width ( ) const [inline]

*Threadsafe*

7.49.3.10 void seq64::sequence::set\_rec\_vol ( long *recvol* )

*Threadsafe*

Parameters

<i>recvol</i>	The new setting of the recording volume setting.
---------------	--

7.49.3.11 void seq64::sequence::set\_length ( long *len*, bool *adjust\_triggers* = true )

This function is called in [seqedit::apply\\_length\(\)](#), when the user selects a sequence length in measures. 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*

#### 7.49.3.12 void seq64::sequence::set\_playing ( bool p )

When playing, and the sequencer is running, notes get dumped to the ALSA buffers.

Parameters

<i>p</i>	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.
----------	--

#### 7.49.3.13 void seq64::sequence::toggle\_queued ( )

Toggles the queued flag and sets the dirty-mp flag. Also calculates the queued tick based on `m_last_tick`.

*Threadsafe*

#### 7.49.3.14 void seq64::sequence::off\_queued ( )

Toggles the queued flag and sets the dirty-mp flag.

*Threadsafe*

#### 7.49.3.15 void seq64::sequence::set\_recording ( bool r )

*Threadsafe*

#### 7.49.3.16 void seq64::sequence::set\_snap\_tick ( int st )

*Threadsafe*

#### 7.49.3.17 void seq64::sequence::set\_quantized\_rec ( bool qr )

*Threadsafe*

#### 7.49.3.18 void seq64::sequence::set\_thru ( bool r )

*Threadsafe*

#### 7.49.3.19 bool seq64::sequence::is\_dirty\_main ( )

resets it). This flag signals that a redraw is needed from recording.

*Threadsafe*

7.49.3.20 `bool seq64::sequence::is_dirty_edit ( )`

*Threadsafe*

7.49.3.21 `bool seq64::sequence::is_dirty_perf ( )`

*Threadsafe*

7.49.3.22 `bool seq64::sequence::is_dirty_names ( )`

*Threadsafe*

7.49.3.23 `void seq64::sequence::set_dirty_mp ( )`

*Not threadsafe*

7.49.3.24 `void seq64::sequence::set_dirty ( )`

*Threadsafe*

7.49.3.25 `void seq64::sequence::set_midi_channel ( unsigned char ch )`

*Threadsafe*

7.49.3.26 `void seq64::sequence::print ( )`

*Not threadsafe*

7.49.3.27 `void seq64::sequence::print_triggers ( )`

*Not threadsafe*

7.49.3.28 `void seq64::sequence::play ( long 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.

Parameters

<i>tick</i>	Provides the current end-tick value.
<i>playback_mode</i>	Provides how playback is managed. We think it goes like this: True indicates that it is live playback, controlled by the main windows and its layout of patterns and triggers. False indicate that the performance/song editor is in control of playback.

*Threadsafe*

7.49.3.29 `void seq64::sequence::set_orig_tick ( long tick )`

*Threadsafe*

7.49.3.30 `void seq64::sequence::add_event ( const event * ep )`

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.

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.

*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.

7.49.3.31 `void seq64::sequence::add_trigger ( long tick, long len, long offset = 0, bool fixoffset = true )`

If `a_state = true`, the range is on. If `a_state = false`, the range is off.

7.49.3.32 `void seq64::sequence::split_trigger ( long splittick )`

This is the public overload of `split_trigger`.

*Threadsafe*

7.49.3.33 `void seq64::sequence::grow_trigger ( long tickfrom, long tickto, long len )`

#### Parameters

<i>tickfrom</i>	The desired from-value back which to expand the trigger, if necessary.
<i>tickto</i>	The desired to-value towards which to expand the trigger, if necessary.
<i>len</i>	The additional length to append to tickto for the check.

*Threadsafe*

7.49.3.34 `void seq64::sequence::del_trigger ( long tick )`

*Threadsafe*

7.49.3.35 `bool seq64::sequence::get_trigger_state ( long tick )`

If any trigger is found to bracket that tick, then true is returned.

#### Parameters

<i>tick</i>	Provides the tick of interest.
-------------	--------------------------------

#### Returns

Returns true if a trigger is found that brackets the given tick.

7.49.3.36 `bool seq64::sequence::select_trigger ( long tick )`

If any trigger is found to bracket that tick, then true is returned, and the trigger is marked as selected.



## Parameters

<i>tick</i>	Provides the tick of interest.
-------------	--------------------------------

## Returns

Returns true if a trigger is found that brackets the given tick.

## 7.49.3.37 bool seq64::sequence::unselect\_triggers ( )

## Returns

Always returns false.

7.49.3.38 bool seq64::sequence::intersect\_triggers ( long *position*, long & *start*, long & *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.

*Threadsafe*

## Parameters

<i>position</i>	The position to examine.
<i>start</i>	The destination for the starting tick of the matching trigger.
<i>ender</i>	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.

7.49.3.39 bool seq64::sequence::intersect\_notes ( long *position*, long *position\_note*, long & *start*, long & *ender*, long & *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

<i>position</i>	The position to examine.
<i>position_note</i>	I think this is the note value we might be looking for ???
<i>start</i>	The destination for the starting timestamp of the matching note.
<i>ender</i>	The destination for the ending timestamp of the matching note.
<i>note</i>	The destination for the note of the matching event.

## 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.

7.49.3.40 bool seq64::sequence::intersect\_events ( long *posstart*, long *posend*, long *status*, long & *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**

<i>posstart</i>	The starting position to examine.
<i>posend</i>	The ending position to examine.
<i>status</i>	The desired status value.
<i>start</i>	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.

**7.49.3.41 void seq64::sequence::paste\_trigger ( )**

Why isn't this protected by a mutex? We will eventually enable this see if anything bad happens, such as a deadlock, or corruption.

**7.49.3.42 bool seq64::sequence::move\_selected\_triggers\_to ( long tick, bool adjustoffset, int which = 2 )**

```
min_tick][0          1][max_tick
                2
```

- 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****Returns**

Returns the value of [triggers::move\\_selected\(\)](#), which indicate that the movement could be made. Used in [Seq24PerfInput::handle\\_motion\\_key\(\)](#).

**7.49.3.43 long 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.

**7.49.3.44 long seq64::sequence::selected\_trigger\_end ( )****Threadsafe****7.49.3.45 long seq64::sequence::get\_max\_trigger ( )****Threadsafe****7.49.3.46 void seq64::sequence::move\_triggers ( long starttick, long distance, bool direction )**

Note the dependence on the m\_length member being kept in sync with the parent's value of m\_length.

**Threadsafe**

7.49.3.47 void seq64::sequence::copy\_triggers ( long *starttick*, long *distance* )

*Threadsafe*

7.49.3.48 void seq64::sequence::clear\_triggers ( )

*Threadsafe*

7.49.3.49 void seq64::sequence::set\_midi\_bus ( char *mb* )

*Threadsafe*

7.49.3.50 void seq64::sequence::set\_master\_midi\_bus ( mastermidibus \* *mmb* )

*Threadsafe*

Parameters

<i>mmb</i>	Provides a pointer to the master MIDI buss for this sequence. This should be a reference.
------------	---

7.49.3.51 int seq64::sequence::select\_note\_events ( long *a\_tick\_s*, int *a\_note\_h*, long *a\_tick\_f*, int *a\_note\_l*,  
select\_action\_e *a\_action* )

Returns the number selected.

*Threadsafe*

7.49.3.52 int seq64::sequence::select\_events ( long *tick\_s*, long *tick\_f*, unsigned char *status*, unsigned char *cc*,  
select\_action\_e *action* )

Note that there is also an overloaded version of this function.

*Threadsafe*

7.49.3.53 int seq64::sequence::select\_events ( unsigned char *status*, unsigned char *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.

7.49.3.54 int seq64::sequence::get\_num\_selected\_notes ( ) const

*Threadsafe*

7.49.3.55 int seq64::sequence::get\_num\_selected\_events ( unsigned char *status*, unsigned char *cc* ) const

If the event is a control change (CC), then it must also match the given CC value.

*Threadsafe*

7.49.3.56 `void seq64::sequence::select_all ( )`

*Threadsafe*

7.49.3.57 `void seq64::sequence::copy_selected ( )`

*Threadsafe*

7.49.3.58 `void seq64::sequence::paste_selected ( long tick, int note )`

I wonder if we can get away with just getting a reference to `m_events_clipboard`, rather than copying the whole thing, for speed.

*Threadsafe*

7.49.3.59 `void seq64::sequence::add_note ( long tick, long length, int note, bool paint = false )`

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.

*Threadsafe*

7.49.3.60 `void seq64::sequence::add_event ( long tick, unsigned char status, unsigned char d0, unsigned char d1, bool paint = false )`

The `a_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*

7.49.3.61 `void seq64::sequence::stream_event ( event * ev )`

*Threadsafe*

7.49.3.62 `void seq64::sequence::change_event_data_range ( long tick_s, long tick_f, unsigned char status, unsigned char 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

$$d = \frac{df (t - ts) + ds (tf - t)}{tf - ts}$$

If this were an interpolation formula it would be:

$$d = ds + (df - ds) \frac{t - ts}{tf - ts}$$

Something is not quite right; to be investigated.

```
\param tick_s
    Provides the starting tick value.

\param tick_f
    Provides the ending tick value.

\param status
    Provides the event status that is to be changed.

\param cc
    Provides the event control value.

\param data_s
    Provides the starting data value.

\param data_f
    Provides the finishing data value.
```

#### 7.49.3.63 void seq64::sequence::increment\_selected ( unsigned char *astat*, unsigned char *control* )

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*

#### 7.49.3.64 void seq64::sequence::decrement\_selected ( unsigned char *astat*, unsigned char *control* )

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*

#### 7.49.3.65 void seq64::sequence::grow\_selected ( long *delta\_tick* )

*Threadsafe*

#### 7.49.3.66 void seq64::sequence::stretch\_selected ( long *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.

*Threadsafe*

7.49.3.67 void seq64::sequence::remove\_marked ( )

Note how this function handles removing a value to avoid incrementing a now-invalid iterator.

*Threadsafe*

7.49.3.68 void seq64::sequence::mark\_selected ( )

*Threadsafe*

7.49.3.69 void seq64::sequence::unpaint\_all ( )

*Threadsafe*

7.49.3.70 void seq64::sequence::unselect ( )

*Threadsafe*

7.49.3.71 void seq64::sequence::verify\_and\_link ( )

*Threadsafe*

7.49.3.72 void seq64::sequence::link\_new ( )

*Threadsafe*

7.49.3.73 void seq64::sequence::zero\_markers ( )

This function is used when the sequencer stops.

*Threadsafe*

7.49.3.74 void seq64::sequence::play\_note\_on ( int a\_note )

It flushes a note to the midibus to preview its sound, used by the virtual piano.

*Threadsafe*

7.49.3.75 void seq64::sequence::play\_note\_off ( int a\_note )

*Threadsafe*

7.49.3.76 void seq64::sequence::off\_playing\_notes ( )

*Threadsafe*

7.49.3.77 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*

7.49.3.78 void seq64::sequence::reset\_draw\_trigger\_marker ( )

*Threadsafe*

7.49.3.79 draw\_type seq64::sequence::get\_next\_note\_event ( long \* *a\_tick\_s*, long \* *a\_tick\_f*, int \* *a\_note*, bool \* *a\_selected*, int \* *a\_velocity* )

When it has no more events, returns a false.

7.49.3.80 int seq64::sequence::get\_lowest\_note\_event ( )

*Threadsafe*

Returns

Returns the note with the lowest value. If there are no notes in the list, then MIDI\_COUNT\_MAX-1 is returned, which of course doesn't tell the caller much.

7.49.3.81 int seq64::sequence::get\_highest\_note\_event ( )

*Threadsafe*

Returns

Returns the note with the highest value. If there are no notes in the list, then 0 is returned, which of course doesn't tell the caller much.

7.49.3.82 bool seq64::sequence::get\_next\_event ( unsigned char *status*, unsigned char *cc*, long \* *tick*, unsigned char \* *d0*, unsigned char \* *d1*, bool \* *selected* )

Then set the rest of the parameters parameters using that event.

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.

7.49.3.83 bool seq64::sequence::get\_next\_event ( unsigned char \* *a\_status*, unsigned char \* *a\_cc* )

Then set the status and control character parameters using that event.

7.49.3.84 void seq64::sequence::fill\_container ( midi\_container & *c*, int *tracknumber* )

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).

Parameters

<i>c</i>	Provides the std::list object to push events to the front, which thus inserts them in backwards order. (These events are then popped back, which restores the order, with some exceptions).
<i>tracknumber</i>	Provides the track number. This number is masked into the track information.

7.49.3.85 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.

7.49.3.86 `void seq64::sequence::put_event_on_bus ( event * ev ) [private]`

*Threadsafe*

7.49.3.87 `void seq64::sequence::set_trigger_offset ( long trigger_offset ) [private]`

*Threadsafe*

7.49.3.88 `void seq64::sequence::split_trigger ( trigger & trig, long splittick ) [private]`

This is the private overload of `split_trigger`.

*Threadsafe*

Parameters

<i>trig</i>	Provides the original trigger, and also holds the changes made to that trigger as it is shortened.
<i>splittick</i>	The position just after where the original trigger will be truncated, and the new trigger begins.

7.49.3.89 `void seq64::sequence::adjust_trigger_offsets_to_length ( long newlength ) [private]`

*Threadsafe*

Might can get rid of this function?

7.49.3.90 `void seq64::sequence::remove ( event_list::iterator i ) [private]`

If it's a note off, and that note is currently playing, then send a note off.

*Not threadsafe*

7.49.3.91 `void seq64::sequence::remove ( event * e ) [private]`

Finds the given event in `m_events`, and removes the first iterator matching that.

*Not threadsafe*

**Todo** Use `find` instead in `sequence::remove()`!

## 7.49.4 Field Documentation

7.49.4.1 `mutex seq64::sequence::m_mutex [mutable], [private]`

Made mutable for use in certain locked getter functions.

## 7.50 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.*
- long `tick_start` () const
  - 'Getter' function for member `m_tick_start`*
- void `tick_start` (long s)
  - 'Setter' function for member `m_tick_start`*
- void `increment_tick_start` (long s)
  - 'Setter' function for member `m_tick_start`*
- void `decrement_tick_start` (long s)
  - 'Setter' function for member `m_tick_start`*
- long `tick_end` () const
  - 'Getter' function for member `m_tick_end`*
- void `tick_end` (long e)
  - 'Setter' function for member `m_tick_end`*
- void `increment_tick_end` (long s)
  - 'Setter' function for member `m_tick_end`*
- void `decrement_tick_end` (long s)
  - 'Setter' function for member `m_tick_end`*
- long `offset` () const
  - 'Getter' function for member `m_offset`*
- void `offset` (long o)
  - 'Setter' function for member `m_offset`*
- void `increment_offset` (long s)
  - 'Setter' function for member `m_offset`*
- void `decrement_offset` (long 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

- long `m_tick_start`
  - Provides the starting tick for this trigger.*
- long `m_tick_end`
  - Provides the ending tick for this trigger.*
- long `m_offset`
  - Provides the offset for this trigger.*
- bool `m_selected`
  - Indicates that the trigger is part of a selection.*

#### 7.50.1 Detailed Description

This class is used in playback, and is contained in the triggers class.

## 7.51 seq64::triggers Class Reference

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

## Public Types

- `typedef std::list< trigger > List`  
*Exposes the triggers type, currently needed for `midi_container` only.*

## 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.*
- `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 copied into the list-trigger, and then pops from the undo-list.*
- `void print (const std::string &seqname)`  
*Returns the last tick played, and is used by the editor's idle function.*
- `bool play (long &start_tick, long &end_tick)`  
*If playback-mode (live mode?) is in force, that is, if using in-triggers and on/off triggers, this function handles that kind of playback.*
- `void add (long tick, long len, long offset=0, bool adjustoffset=true)`  
*Adds a trigger.*
- `void adjust_offsets_to_length (long newlen)`  
*Adjusts trigger offsets to the length of ???, for all triggers, and undo triggers.*
- `void split (long tick)`  
*Splits the first trigger that brackets the splittick parameter.*
- `void split (trigger &trig, long split_tick)`  
*Splits the trigger given by the parameter into two triggers.*
- `void grow (long tick_from, long tick_to, long length)`  
*Grows a trigger.*
- `void remove (long tick)`  
*Deletes the first trigger that brackets the given tick from the trigger-list.*
- `bool get_state (long tick)`  
*Checks the list of triggers against the given tick.*
- `bool select (long tick)`  
*Checks the list of triggers against the given tick.*
- `bool unselect ()`  
*Unselects all triggers.*
- `bool intersect (long position, long &start, long &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](#) ()  
*If there is a copied trigger, then this function grabs it from the trigger clipboard and adds it.*
- bool [move\\_selected](#) (long tick, bool adjustoffset, int which=2)  
*Moves selected triggers as per the given parameters.*
- long [get\\_selected\\_start](#) ()  
*Gets the selected trigger's start tick.*
- long [get\\_selected\\_end](#) ()  
*Gets the selected trigger's end tick.*
- long [get\\_maximum](#) ()  
*Get the ending value of the last trigger in the trigger-list.*
- void [move](#) (long start\_tick, long distance, bool direction)  
*Moves triggers in the trigger-list.*
- void [copy](#) (long start\_tick, long distance)  
*Not sure what these diagrams are for yet.*
- void [clear](#) ()  
*Clears the whole list of triggers.*
- bool [next](#) (long \*tick\_on, long \*tick\_off, bool \*selected, long \*tick\_offset)  
*'Getter' function for member m\_trigger\_offset*
- [trigger next\\_trigger](#) ()  
*Get the next trigger in the trigger list, and set the parameters based on that trigger.*
- void [reset\\_draw\\_trigger\\_marker](#) ()  
*Sets the draw-trigger iterator to the beginning of the trigger list.*

### Private Member Functions

- long [adjust\\_offset](#) (long offset)  
*Adjusts the given offset by mod'ing it with m\_length and adding m\_length if needed, and returning the result.*

### 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.*
- long [m\\_trigger\\_offset](#)  
*Offset.*

- 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.*

### 7.51.1 Constructor & Destructor Documentation

#### 7.51.1.1 `seq64::triggers::triggers ( sequence & parent )`

##### Parameters

<i>parent</i>	The triggers object often needs to tell its parent sequence object what to do (such as stop playing).
---------------	---

### 7.51.2 Member Function Documentation

#### 7.51.2.1 `triggers & seq64::triggers::operator= ( const triggers & rhs )`

Follows the stock rules for such an operator, but does a little more than just assign member values. 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.

#### 7.51.2.2 `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.

#### 7.51.2.3 `void seq64::triggers::print ( const std::string & seqname )`

`long triggers::get_last_tick () { return (m_last_tick + (m_length - m_trigger_offset)) % m_length; }` Prints a list of the currently-held triggers.

#### 7.51.2.4 `bool seq64::triggers::play ( long & start_tick, long & end_tick )`

##### Parameters

<i>start_tick</i>	Provides the starting tick value, and returns the modified value as a side-effect.
<i>end_tick</i>	Provides the ending tick value, and returns the modified value as a side-effect.

##### Returns

Returns true if we're through playing the frame, and the caller should stop the playback.

#### 7.51.2.5 `void seq64::triggers::add ( long tick, long len, long offset = 0, bool fixoffset = true )`

If `a_state = true`, the range is on. If `a_state = false`, the range is off.

What is this?

```

is      ie
<      ><      ><      >
es      ee
<      >
XX
```

```

es ee
< >
<>

es     ee
<     >
<     >

es     ee
<     >
<     >

```

#### 7.51.2.6 void seq64::triggers::adjust\_offsets\_to\_length ( long *newlength* )

##### Parameters

<i>newlength</i>	
------------------	--

COMMON CODE?

COMMON CODE?

#### 7.51.2.7 void seq64::triggers::split ( long *splittick* )

This is the first trigger where splittick is greater than L and less than R.

##### Parameters

<i>splittick</i>	Provides the tick that must be bracketed for the split to be made.
------------------	--

#### 7.51.2.8 void seq64::triggers::split ( trigger & *trig*, long *splittick* )

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

<i>trig</i>	Provides the original trigger, and also holds the changes made to that trigger as it is shortened.
<i>splittick</i>	The position just after where the original trigger will be truncated, and the new trigger begins.

#### 7.51.2.9 void seq64::triggers::grow ( long *tickfrom*, long *tickto*, long *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

<i>tickfrom</i>	The desired from-value back which to expand the trigger, if necessary.
<i>tickto</i>	The desired to-value towards which to expand the trigger, if necessary.
<i>len</i>	The additional length to append to tickto for the check.

#### 7.51.2.10 void seq64::triggers::remove ( long *tick* )

## Parameters

<i>tick</i>	Provides the tick to be examined.
-------------	-----------------------------------

7.51.2.11 `bool seq64::triggers::get_state ( long tick )`

If any trigger is found to bracket that tick, then true is returned.

## Parameters

<i>tick</i>	Provides the tick of interest.
-------------	--------------------------------

## Returns

Returns true if a trigger is found that brackets the given tick.

7.51.2.12 `bool seq64::triggers::select ( long tick )`

If any trigger is found to bracket that tick, then true is returned, and the trigger is marked as selected.

## Parameters

<i>tick</i>	Provides the tick of interest.
-------------	--------------------------------

## Returns

Returns true if a trigger is found that brackets the given tick.

7.51.2.13 `bool seq64::triggers::unselect ( )`

## Returns

Always returns false.

7.51.2.14 `bool seq64::triggers::intersect ( long position, long & start, long & ender )`

If the given position is between the current trigger's tick-start and tick-end values, then these values are copied to the start and end parameters, respectively, and then we exit.

## Parameters

<i>position</i>	The position to examine.
<i>start</i>	The destination for the starting tick ( <code>m_tick_start</code> ) of the matching trigger.
<i>ender</i>	The destination for the ending tick ( <code>m_tick_end</code> ) 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.

7.51.2.15 `void seq64::triggers::paste ( )`

It pastes at the copy end.

7.51.2.16 `bool seq64::triggers::move_selected ( long tick, bool fixoffset, int which = 2 )`

```

    mintick][0
                2
                1][maxtick

```

## Parameters

<i>which</i>	<p>Selects which movement will be done. This parameter has three possible values:</p> <ul style="list-style-type: none"> <li>• If we are moving the 0, use first as offset.</li> <li>• If we are moving the 1, use the last as the offset.</li> <li>• If we are moving both (2), use first as offset.</li> </ul>
--------------	--

## Returns

Returns true if there was room to move. Otherwise, false is returned. We need this feature to support keystroke movement of a selected trigger in the perroll window, and keep it from continually incremented 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.

7.51.2.17 `long 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 -1 is returned.

7.51.2.18 `long seq64::triggers::get_selected_end ( )`

## Returns

Returns the tick\_end() value of the last-selected trigger. If no triggers are selected, then -1 is returned.

7.51.2.19 `void seq64::triggers::copy ( long starttick, long distance )`

```

... a
[      ][      ]
...
... a
...

5   7   play
3    offset
8   10  play

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
[      ] [      ]

```

Copies triggers to...

**7.51.2.20** `bool seq64::triggers::next ( long * tick_on, long * tick_off, bool * selected, long * offset )`

Get the next trigger in the trigger list, and set the parameters based on that trigger.

```
long get_trigger_offset () const { return m_trigger_offset; }
```

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

#### Parameters

<i>tick_on</i>	Return value for the retrieval of the starting tick for the trigger.
<i>tick_off</i>	Return value for the retrieval of the ending tick for the trigger.
<i>selected</i>	Return value for the retrieval of the is-selected flag for the trigger.
<i>offset</i>	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.

**7.51.2.21** `trigger seq64::triggers::next_trigger ( )`

#### Returns

Returns the next trigger. If there is none, a default trigger object is returned.

**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.

**7.51.2.22** `long seq64::triggers::adjust_offset ( long offset )` `[private]`

#### Parameters

<i>offset</i>	Provides the offset, mod'ed against <code>m_length</code> , 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.

## 7.51.3 Field Documentation

**7.51.3.1** `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.



7.51.3.2 int seq64::triggers::m\_length [private]

This might change, we're not yet sure.

## 7.52 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*
- 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.*

### 7.52.1 Detailed Description

Will later make the size adjustable, if it makes sense to do so.

### 7.52.2 Member Function Documentation

#### 7.52.2.1 `void seq64::user_instrument::set_defaults ( )`

Also invalidates the object.

#### 7.52.2.2 `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).

#### 7.52.2.3 `const std::string & seq64::user_instrument::controller_name ( int c ) const`

##### Parameters

<code>c</code>	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.

#### 7.52.2.4 `bool seq64::user_instrument::controller_active ( int c ) const`

##### Parameters

<code>c</code>	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.

#### 7.52.2.5 `void seq64::user_instrument::set_controller ( int c, const std::string & cname, bool isactive )`

##### Parameters

<code>c</code>	The index of the desired controller.
<code>cname</code>	The name of the controller to be set as the controller name.
<code>isactive</code>	A flag that indicates if the desired controller is active.

#### 7.52.2.6 `void seq64::user_instrument::set_name ( const std::string & instname )` `[private]`

If the name parameter is not empty, the validity flag is set to true, otherwise it is set to false. Too tricky?

#### 7.52.2.7 `void seq64::user_instrument::copy_definitions ( const user_instrument & rhs )` `[private]`

Does not include the validity flag.

### 7.52.3 Field Documentation

#### 7.52.3.1 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.

#### 7.52.3.2 int seq64::user\_instrument::m\_controller\_count [private]

Often, the "user" configuration file has only a few out of the 128 assigned explicitly.

## 7.53 seq64::user\_instrument\_t Struct Reference

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

### Data Fields

- std::string `instrument`  
*Provides the name of the "instrument" being supported.*
- std::string `controllers` [MIDI\_CONTROLLER\_MAX]  
*Provides a list of up to 128 controllers (e.g.*
- bool `controllers_active` [MIDI\_CONTROLLER\_MAX]  
*Provides a flag that indicates if each of up to 128 controller is active and supported.*

### 7.53.1 Field Documentation

#### 7.53.1.1 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.

#### 7.53.1.2 std::string seq64::user\_instrument\_t::controllers[MIDI\_CONTROLLER\_MAX]

"Modulation"). If a controller isn't present, or if General MIDI is in force, this name might be empty.

#### 7.53.1.3 bool seq64::user\_instrument\_t::controllers\_active[MIDI\_CONTROLLER\_MAX]

If false, it might be an unsupported controller or a General MIDI device.

## 7.54 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 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.*

### 7.54.1 Detailed Description

Will later make the size adjustable, if it makes sense to do so.

### 7.54.2 Member Function Documentation

#### 7.54.2.1 `void seq64::user_midi_bus::set_defaults ( )`

Also invalidates the object. All 16 of the channels are set to GM\_INSTRUMENT\_FLAG (-1).

7.54.2.2 `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.

7.54.2.3 `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).

7.54.2.4 `int seq64::user_midi_bus::instrument ( int channel ) const`

#### Parameters

<i>channel</i>	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 GM\_INSTRUMENT\_FLAG (-1) is returned.

7.54.2.5 `void seq64::user_midi_bus::set_instrument ( int channel, int instrum )`

Does not alter the validity flag, just checks it.

#### Parameters

<i>channel</i>	Provides the desired buss channel number.
<i>instrum</i>	Provides the instrument number to set that channel to.

7.54.2.6 `void seq64::user_midi_bus::copy_definitions ( const user_midi_bus & rhs ) [private]`

Does not include the validity flag.

### 7.54.3 Field Documentation

7.54.3.1 `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.

7.54.3.2 `int seq64::user_midi_bus::m_channel_count [private]`

Often, the "user" configuration file has only a few out of the 16 assigned explicitly.

## 7.55 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 [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.*

### 7.55.1 Field Documentation

#### 7.55.1.1 `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.

#### 7.55.1.2 `int seq64::user_midi_bus_t::instrument[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.

## 7.56 `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.*
- `void set_globals () const`  
*Copies the current values of the member variables into their corresponding global variables.*
- `void get_globals ()`  
*Copies the current values of the global variables into their corresponding member variables.*
- `bool add_bus (const std::string &alias)`  
*Adds a user bus 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 [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 [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*
- int [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*

## Protected Member Functions

- 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\\_ppqn](#) (int ppqn)  
*'Setter' function for member m\_midi\_ppqn This value can be set from 96 to 960 (this upper limit will be determined by what Sequencer64 can actually handle).*
- 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](#) (int 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.*
- void [midi\\_buss\\_override](#) (char buss)  
*'Setter' function for member m\_midi\_buss\_override This value can be set from 1 to 32.*

## Private Types

- typedef std::vector< [user\\_midi\\_bus](#) > [Busses](#)  
*[user-midi-bus-definitions]*
- typedef std::vector< [user\\_instrument](#) > [Instruments](#)  
*[user-instrument-definitions]*

## 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.*
- int [m\\_mainwnd\\_rows](#)  
*Number of rows in the Patterns Panel.*
- int [m\\_mainwnd\\_cols](#)  
*Number of columns in the Patterns Panel.*

- 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\\_sets](#)  
*Maximum number of screen sets that can be supported.*
- 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\\_text\\_x](#)  
*Constants for the mainwid class.*
- int [m\\_seqchars\\_x](#)  
*Constants for the mainwid class.*
- 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\\_seq\\_x](#)  
*Area of what? Doesn't look at all like it is based on the size of characters.*
- int [m\\_mainwid\\_border](#)  
*These control sizes.*
- 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\\_mainwid\\_x](#)  
*The width of the main pattern/sequence grid, in pixels.*
- int [m\\_midi\\_ppqn](#)  
*Provides the universal PPQN setting for the duration of this setting.*
- int [m\\_midi\\_beats\\_per\\_measure](#)  
*Provides the universal MIDI value for beats per measure, also called "beats per bar" (BPB).*
- int [m\\_midi\\_beats\\_per\\_minute](#)  
*Provides the universal 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 testing.*

### 7.56.1 Detailed Description

These settings will eventually be made part of the "user" settings file.

### 7.56.2 Member Typedef Documentation

#### 7.56.2.1 `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.

#### 7.56.2.2 `typedef std::vector<user_instrument> seq64::user_settings::Instruments` [private]

Internal type for the container of [user\\_instrument](#) objects.

### 7.56.3 Member Function Documentation

#### 7.56.3.1 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!

#### 7.56.3.2 void seq64::user\_settings::set\_globals ( ) const

Should be called at initialization, and after settings are read from the "user" configuration file.

DO NOT PUT ANY GLOBALS HERE UNTIL THEIR EFFECTS HAVE BEEN TESTED!!!!

#### 7.56.3.3 void seq64::user\_settings::get\_globals ( )

Should be called before settings are written to the "user" configuration file.

#### 7.56.3.4 const user\_midi\_bus& seq64::user\_settings::bus ( int *index* ) [inline]

Cannot append the const specifier.

#### 7.56.3.5 const user\_instrument& seq64::user\_settings::instrument ( int *index* ) [inline]

Cannot append the const specifier.

#### 7.56.3.6 bool seq64::user\_settings::controller\_active ( int *buss*, int *channel*, int *cc* ) [inline]

It also has a shorter name.

#### 7.56.3.7 const std::string& seq64::user\_settings::controller\_name ( int *buss*, int *channel*, int *cc* ) [inline]

It also has a shorter name.

#### 7.56.3.8 void seq64::user\_settings::mainwnd\_rows ( int *value* ) [protected]

The default value is 4. Dependent values are recalculated after the assignment.

#### 7.56.3.9 void seq64::user\_settings::mainwnd\_cols ( int *value* ) [protected]

The default value is 8. Dependent values are recalculated after the assignment.

#### 7.56.3.10 void seq64::user\_settings::max\_sets ( int *value* ) [protected]

The default value is 32. Dependent values are recalculated after the assignment.

#### 7.56.3.11 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.

**7.56.3.12** `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.

**7.56.3.13** `void seq64::user_settings::mainwid_border ( int value )` [protected]

The default value is 0. Dependent values are recalculated after the assignment.

**7.56.3.14** `void seq64::user_settings::mainwid_spacing ( int value )` [protected]

The default value is 2. Dependent values are recalculated after the assignment.

**7.56.3.15** `void seq64::user_settings::control_height ( int value )` [protected]

The default value is 0. Dependent values are recalculated after the assignment.

**7.56.3.16** `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.

**7.56.3.17** `void seq64::user_settings::midi_ppqn ( int value )` [protected]

The default value is 192. Dependent values may be recalculated after the assignment.

**7.56.3.18** `void seq64::user_settings::midi_beats_per_bar ( int value )` [protected]

The default value is 4.

**7.56.3.19** `void seq64::user_settings::midi_beats_per_minute ( int value )` [protected]

The default value is 120.

**7.56.3.20** `void seq64::user_settings::midi_beat_width ( int bw )` [protected]

The default value is 4.

**7.56.3.21** `void seq64::user_settings::midi_buss_override ( char buss )` [protected]

The default value is -1, which means that there is no buss override.

**7.56.3.22** `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.

**7.56.3.23** `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.

### 7.56.4 Field Documentation

#### 7.56.4.1 Busses seq64::user\_settings::m\_midi\_buses [private]

Since this object is a vector, its size is adjustable.

#### 7.56.4.2 Instruments seq64::user\_settings::m\_instruments [private]

The size is adjustable, and grows as objects are added.

#### 7.56.4.3 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.

#### 7.56.4.4 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".

#### 7.56.4.5 int seq64::user\_settings::m\_seqs\_in\_set [private]

This value is  $4 \times 8 = 32$  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.

#### 7.56.4.6 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.

#### 7.56.4.7 int seq64::user\_settings::m\_max\_sequence [private]

`m_max_sequence = m_seqs_in_set * m_max_sets;`

#### 7.56.4.8 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.

**7.56.4.9** `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.

**7.56.4.10** `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.

**7.56.4.11** `int seq64::user_settings::m_seqarea_seq_x [private]`

These are used only in the `mainwid` module.

**7.56.4.12** `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.

**7.56.4.13** `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.

**7.56.4.14** `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
);
```

**7.56.4.15** `int seq64::user_settings::m_midi_ppqn [private]`

This variable will replace `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.

**7.56.4.16** `int seq64::user_settings::m_midi_beats_per_measure [private]`

This variable will replace `global_beats_per_measure`. The default value of this variable is 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 BPB value, either for MIDI purposes or for drawing the user-interface. So we might need a couple different versions of this variable.

7.56.4.17 `int seq64::user_settings::m_midi_beats_per_minute` `[private]`

This variable will replace `global_beats_per_minute`. The default value of this variable is 120. This variable should apply to the whole session; there's probably no way to support a different tempo for each sequence. But we shall see.

7.56.4.18 `int seq64::user_settings::m_midi_beat_width` `[private]`

This variable will replace `global_beat_width`. The default value of this variable is

1. 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.

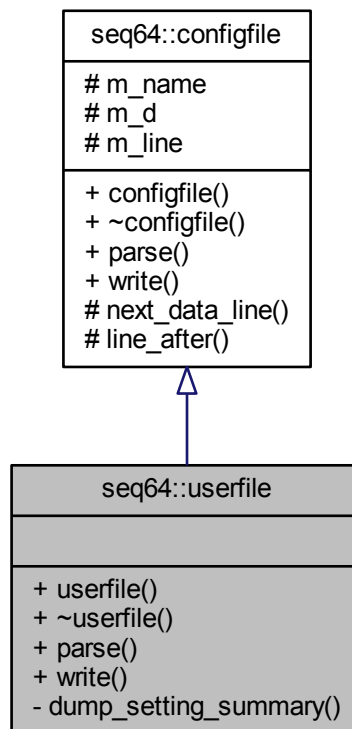
7.56.4.19 `char seq64::user_settings::m_midi_buss_override` `[private]`

This variable replaces the `global_buss_override`, and is set via the command-line option `-bus`.

## 7.57 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

### 7.57.1 Member Function Documentation



7.57.1.1 `bool seq64::userfile::parse ( perform & a_perf )` [virtual]

This function opens the file as a text file (line-oriented).

## Parameters

<i>a_perf</i>	The performance object, currently unused.
---------------	---

Implements [seq64::configfile](#).

7.57.1.2 `bool seq64::userfile::write ( const perform & a_perf ) [virtual]`

## Parameters

<i>a_perf</i>	The performance object, currently unused.
---------------	---

Implements [seq64::configfile](#).

7.57.1.3 `void seq64::userfile::dump_setting_summary ( ) [private]`

Does work only if PLATFORM\_DEBUG is defined; see the [user\\_settings](#) class..

# Index

- ~event
  - seq64::event, [28](#)
- ~keys\_perform
  - seq64::keys\_perform, [60](#)
- ~keys\_perform\_gtk2
  - seq64::keys\_perform\_gtk2, [64](#)
- ~perfedit
  - seq64::perfedit, [103](#)
- ~perform
  - seq64::perform, [113](#)
- ~perfroll
  - seq64::perfroll, [127](#)
- ~seqmenu
  - seq64::seqmenu, [158](#)
- about\_dialog
  - seq64::mainwnd, [81](#)
- add
  - seq64::event\_list, [35](#)
  - seq64::triggers, [188](#)
- add\_event
  - seq64::sequence, [175](#), [180](#)
- add\_long
  - seq64::midi\_container, [85](#)
- add\_note
  - seq64::sequence, [180](#)
- add\_sequence
  - seq64::perform, [114](#)
- add\_trigger
  - seq64::sequence, [176](#)
- add\_variable
  - seq64::midi\_container, [85](#)
- adj\_callback\_ss
  - seq64::mainwnd, [81](#)
- adjust\_offset
  - seq64::triggers, [192](#)
- adjust\_offsets\_to\_length
  - seq64::triggers, [189](#)
- adjust\_trigger\_offsets\_to\_length
  - seq64::sequence, [184](#)
- alias
  - seq64::user\_midi\_bus\_t, [198](#)
- all\_notes\_off
  - seq64::perform, [116](#)
- any\_selected\_notes
  - seq64::event\_list, [36](#)
- append\_sysex
  - seq64::event, [31](#)
- apply\_length
  - seq64::seqedit, [146](#)
- BLACK
  - seq64::font, [38](#)
- BLACK\_ON\_YELLOW
  - seq64::font, [38](#)
- bus
  - seq64::user\_settings, [203](#)
- Busses
  - seq64::user\_settings, [202](#)
- calculate\_base\_sizes
  - seq64::mainwid, [75](#)
- change\_event\_data\_range
  - seq64::sequence, [180](#)
- channel\_count
  - seq64::user\_midi\_bus, [196](#)
- channel\_max
  - seq64::user\_midi\_bus, [197](#)
- CharList
  - seq64::midi\_list, [87](#)
- clamp\_track
  - seq64::perform, [123](#)
- clear\_all
  - seq64::perform, [114](#)
- clear\_sequence\_triggers
  - seq64::perform, [114](#)
- clear\_triggers
  - seq64::sequence, [179](#)
- click
  - seq64::click, [23](#)
- collapse
  - seq64::perfedit, [103](#)
- Color
  - seq64::font, [38](#)
- configfile
  - seq64::configfile, [25](#)
- control\_height
  - seq64::user\_settings, [204](#)
- controller\_active
  - seq64::user\_instrument, [194](#)
  - seq64::user\_settings, [203](#)
- controller\_max
  - seq64::user\_instrument, [194](#)
- controller\_name
  - seq64::user\_instrument, [194](#)
  - seq64::user\_settings, [203](#)
- controllers
  - seq64::user\_instrument\_t, [195](#)
- controllers\_active
  - seq64::user\_instrument\_t, [195](#)
- convert\_t

- seq64::seqevent, 152
- convert\_tn
  - seq64::seqroll, 163
- convert\_x
  - seq64::perfroll, 128
  - seq64::seqevent, 152
- convert\_xy
  - seq64::perfroll, 128
- copy
  - seq64::perfedit, 103
  - seq64::triggers, 191
- copy\_definitions
  - seq64::user\_instrument, 194
  - seq64::user\_midi\_bus, 197
- copy\_selected
  - seq64::sequence, 180
- copy\_triggers
  - seq64::perform, 115
  - seq64::sequence, 178
- count
  - seq64::event\_list, 35
- count\_selected\_events
  - seq64::event\_list, 36
- create\_menus
  - seq64::seqedit, 147
- decrement\_beats\_per\_minute
  - seq64::perform, 121
- decrement\_selected
  - seq64::sequence, 181
- del\_trigger
  - seq64::sequence, 176
- delete\_sequence
  - seq64::perform, 114
- do\_action
  - seq64::seqedit, 148
- draw\_background
  - seq64::seqevent, 151
- draw\_drawable\_row
  - seq64::perfroll, 128
- draw\_events\_on
  - seq64::seqroll, 164
- draw\_events\_on\_pixmap
  - seq64::seqroll, 163
- draw\_key
  - seq64::seqkeys, 156
- draw\_line
  - seq64::gui\_drawingarea\_gtk2, 45, 46
- draw\_line\_on\_pixmap
  - seq64::gui\_drawingarea\_gtk2, 45
- draw\_marker\_on\_sequence
  - seq64::mainwid, 73
- draw\_normal\_rectangle\_on\_pixmap
  - seq64::gui\_drawingarea\_gtk2, 49
- draw\_pixmap\_on\_window
  - seq64::seqevent, 151
- draw\_rectangle
  - seq64::gui\_drawingarea\_gtk2, 47, 48
- draw\_rectangle\_on\_pixmap
  - seq64::gui\_drawingarea\_gtk2, 49
- draw\_sequence
  - seq64::perfnames, 107
- draw\_sequence\_on
  - seq64::perfroll, 128
- draw\_sequence\_on\_pixmap
  - seq64::mainwid, 74
- draw\_sequence\_pixmap\_on\_window
  - seq64::mainwid, 74
- draw\_sequences\_on\_pixmap
  - seq64::mainwid, 74
- drop\_event
  - seq64::seqevent, 152
- dump\_setting\_summary
  - seq64::userfile, 210
- dump\_summary
  - seq64::user\_settings, 204
- e\_deselect
  - seq64::sequence, 172
- e\_is\_selected
  - seq64::sequence, 172
- e\_remove\_one
  - seq64::sequence, 172
- e\_select
  - seq64::sequence, 172
- e\_select\_one
  - seq64::sequence, 172
- e\_toggle\_selection
  - seq64::sequence, 172
- e\_would\_select
  - seq64::sequence, 172
- error\_message
  - seq64::jack\_assistant, 55
- event\_count
  - seq64::sequence, 172
- event\_key
  - seq64::event\_list::event\_key, 32
- event\_list
  - seq64::event\_list, 35
- events
  - seq64::keybindentry, 57
- expand
  - seq64::perfedit, 103
- file\_import\_dialog
  - seq64::mainwnd, 80
- fill
  - seq64::midi\_container, 84
- fill\_background\_pixmap
  - seq64::perfroll, 128
- fill\_container
  - seq64::sequence, 183
- FruityPerfInput
  - seq64::perfroll, 129
- get
  - seq64::midi\_container, 84
  - seq64::midi\_list, 87

- seq64::midi\_vector, 89
- get\_beat\_width
  - seq64::sequence, 173
- get\_data
  - seq64::event, 31
- get\_globals
  - seq64::user\_settings, 203
- get\_highest\_note\_event
  - seq64::sequence, 183
- get\_keys
  - seq64::keys\_perform, 61
- get\_lowest\_note\_event
  - seq64::sequence, 183
- get\_max\_trigger
  - seq64::perform, 120
  - seq64::sequence, 178
- get\_measures
  - seq64::seqedit, 146
- get\_midi\_control\_off
  - seq64::perform, 115
- get\_midi\_control\_on
  - seq64::perform, 115
- get\_midi\_control\_toggle
  - seq64::perform, 115
- get\_next\_event
  - seq64::sequence, 183
- get\_next\_note\_event
  - seq64::sequence, 183
- get\_num\_selected\_events
  - seq64::sequence, 179
- get\_num\_selected\_notes
  - seq64::sequence, 179
- get\_rank
  - seq64::event, 31
- get\_screen\_set\_notepad
  - seq64::perform, 115
- get\_selected\_end
  - seq64::triggers, 191
- get\_selected\_start
  - seq64::triggers, 191
- get\_sequence
  - seq64::perform, 119
- get\_state
  - seq64::triggers, 190
- get\_trigger\_state
  - seq64::sequence, 176
- groups
  - seq64::keybindentry, 57
- grow
  - seq64::triggers, 189
- grow\_selected
  - seq64::sequence, 181
- grow\_trigger
  - seq64::sequence, 176
- gui\_assistant
  - seq64::gui\_assistant, 41
- gui\_palette\_gtk2
  - seq64::gui\_palette\_gtk2, 51
- gui\_window\_gtk2
  - seq64::gui\_window\_gtk2, 53
- handle\_config
  - seq64::lash, 68
- handle\_event
  - seq64::lash, 68
- handle\_motion\_key
  - seq64::Seq24PerfInput, 136
- home\_config\_directory
  - seq64::rc\_settings, 134
- idle\_progress
  - seq64::maintime, 70
- idle\_redraw
  - seq64::seqdata, 141
  - seq64::seqevent, 151
- increment\_beats\_per\_minute
  - seq64::perform, 121
- increment\_selected
  - seq64::sequence, 181
- info\_message
  - seq64::jack\_assistant, 55
- init
  - seq64::font, 38
  - seq64::jack\_assistant, 54
  - seq64::lash, 68
  - seq64::perform, 113
- init\_before\_show
  - seq64::perfedited, 103
  - seq64::perfroll, 128
- init\_jack
  - seq64::perform, 114
- inner\_start
  - seq64::perform, 122
- install\_sequence
  - seq64::perform, 122
- instrument
  - seq64::user\_instrument\_t, 195
  - seq64::user\_midi\_bus, 197
  - seq64::user\_midi\_bus\_t, 198
  - seq64::user\_settings, 203
- Instruments
  - seq64::user\_settings, 202
- intersect
  - seq64::triggers, 190
- intersect\_events
  - seq64::sequence, 177
- intersect\_notes
  - seq64::sequence, 177
- intersect\_triggers
  - seq64::sequence, 177
- is\_active
  - seq64::perform, 117
- is\_channel\_msg
  - seq64::event, 29
- is\_desired\_cc\_or\_not\_cc
  - seq64::event, 29
- is\_dirty\_edit

- seq64::perform, 117
- seq64::sequence, 174
- is\_dirty\_main
  - seq64::perform, 117
  - seq64::sequence, 174
- is\_dirty\_names
  - seq64::perform, 117
  - seq64::sequence, 175
- is\_dirty\_perf
  - seq64::perform, 117
  - seq64::sequence, 175
- is\_letter
  - seq64::keystroke, 66
- is\_midi\_control\_valid
  - seq64::perform, 121
- is\_mseq\_valid
  - seq64::perform, 122
- is\_one\_byte\_msg
  - seq64::event, 29
- is\_screenset\_valid
  - seq64::perform, 121
- is\_seq\_valid
  - seq64::perform, 121
- is\_two\_byte\_msg
  - seq64::event, 29
- jack\_assistant
  - seq64::jack\_assistant, 54
- jack\_shutdown
  - seq64::jack\_assistant, 56
- jack\_sync\_callback
  - seq64::jack\_assistant, 55
  - seq64::perform, 123
- jack\_timebase\_callback
  - seq64::jack\_assistant, 56
- key\_name
  - seq64::keys\_perform, 61
  - seq64::keys\_perform\_gtk2, 64
- keybindentry
  - seq64::keybindentry, 57
- keystroke
  - seq64::keystroke, 65, 66
- lash
  - seq64::lash, 67
- launch\_input\_thread
  - seq64::perform, 114
- launch\_output\_thread
  - seq64::perform, 114
- line\_after
  - seq64::configfile, 25
- link\_new
  - seq64::event\_list, 36
  - seq64::sequence, 182
- location
  - seq64::keybindentry, 57
- m\_b\_on\_y\_pixmap
  - seq64::font, 39
- m\_background
  - seq64::gui\_drawingarea\_gtk2, 50
- m\_black\_pixmap
  - seq64::font, 39
- m\_button
  - seq64::click, 23
- m\_channel\_count
  - seq64::user\_midi\_bus, 197
- m\_char\_list
  - seq64::midifile, 96
- m\_char\_w
  - seq64::perfnames, 107
- m\_clip\_mask
  - seq64::font, 39
- m\_control\_height
  - seq64::user\_settings, 206
- m\_controller\_count
  - seq64::user\_instrument, 195
- m\_data
  - seq64::event, 31
  - seq64::midifile, 96
- m\_drop\_x
  - seq64::gui\_drawingarea\_gtk2, 50
- m\_font\_h
  - seq64::font, 38
- m\_font\_w
  - seq64::font, 38
- m\_foreground
  - seq64::gui\_drawingarea\_gtk2, 50
- m\_fruity\_interaction
  - seq64::perfroll, 129
- m\_has\_link
  - seq64::event, 31
- m\_instruments
  - seq64::user\_settings, 205
- m\_is\_press
  - seq64::keystroke, 66
- m\_is\_valid
  - seq64::user\_instrument, 195
  - seq64::user\_midi\_bus, 197
- m\_key
  - seq64::keybindentry, 58
  - seq64::keystroke, 66
- m\_key\_bpm\_up
  - seq64::keys\_perform, 62
- m\_length
  - seq64::triggers, 192
- m\_line
  - seq64::configfile, 25
- m\_main\_wid
  - seq64::mainwnd, 82
- m\_mainperf
  - seq64::gui\_drawingarea\_gtk2, 50
- m\_mainwid\_border
  - seq64::user\_settings, 206
- m\_mainwid\_x
  - seq64::user\_settings, 206

- m\_mainwnd\_cols
  - seq64::user\_settings, 205
- m\_mainwnd\_rows
  - seq64::user\_settings, 205
- m\_max\_sequence
  - seq64::user\_settings, 205
- m\_max\_sets
  - seq64::user\_settings, 205
- m\_midi\_beat\_width
  - seq64::user\_settings, 207
- m\_midi\_beats\_per\_measure
  - seq64::user\_settings, 206
- m\_midi\_beats\_per\_minute
  - seq64::user\_settings, 206
- m\_midi\_buses
  - seq64::user\_settings, 205
- m\_midi\_buss\_override
  - seq64::user\_settings, 207
- m\_midi\_ppqn
  - seq64::user\_settings, 206
- m\_modifier
  - seq64::click, 23
  - seq64::keystroke, 66
- m\_mutex
  - seq64::sequence, 184
- m\_namebox\_w
  - seq64::perfnames, 107
- m\_names\_chars
  - seq64::perfnames, 107
- m\_names\_y
  - seq64::perfnames, 107
- m\_new\_format
  - seq64::midifile, 97
- m\_notebook
  - seq64::options, 97
- m\_number\_h
  - seq64::seqdata, 142
- m\_number\_offset\_y
  - seq64::seqdata, 142
- m\_number\_w
  - seq64::seqdata, 142
- m\_pixmap
  - seq64::font, 38
  - seq64::gui\_drawingarea\_gtk2, 50
- m\_playback\_mode
  - seq64::perform, 123
- m\_pos
  - seq64::midifile, 96
- m\_ppqn
  - seq64::triggers, 192
- m\_rank
  - seq64::event\_list::event\_key, 33
- m\_seqarea\_seq\_x
  - seq64::user\_settings, 206
- m\_seqarea\_x
  - seq64::user\_settings, 206
- m\_seqchars\_x
  - seq64::user\_settings, 206
- m\_seqedit
  - seq64::seqmenu, 159
- m\_seqs\_in\_set
  - seq64::user\_settings, 205
- m\_setbox\_w
  - seq64::perfnames, 107
- m\_sigpipe
  - seq64::mainwnd, 82
- m\_spinbutton\_load\_offset
  - seq64::mainwnd, 82
- m\_status
  - seq64::event, 31
- m\_sysex
  - seq64::event, 31
- m\_text\_x
  - seq64::user\_settings, 205
- m\_timestamp
  - seq64::event\_list::event\_key, 33
- m\_white\_pixmap
  - seq64::font, 39
- m\_window
  - seq64::gui\_drawingarea\_gtk2, 50
- m\_window\_x
  - seq64::gui\_drawingarea\_gtk2, 50
  - seq64::gui\_window\_gtk2, 53
- m\_x
  - seq64::click, 23
- m\_xy\_offset
  - seq64::perfnames, 107
- m\_y
  - seq64::click, 23
- m\_y\_on\_b\_pixmap
  - seq64::font, 39
- maintime
  - seq64::maintime, 70
- mainwid
  - seq64::mainwid, 73
- mainwid\_border
  - seq64::user\_settings, 204
- mainwid\_spacing
  - seq64::user\_settings, 204
- mainwnd
  - seq64::mainwnd, 80
- mainwnd\_cols
  - seq64::user\_settings, 203
- mainwnd\_key\_event
  - seq64::perform, 121
- mainwnd\_rows
  - seq64::user\_settings, 203
- make\_directory
  - seq64::rc\_settings, 134
- mark\_out\_of\_range
  - seq64::event\_list, 36
- mark\_selected
  - seq64::sequence, 182
- max\_sets
  - seq64::user\_settings, 203
- mc\_min\_zoom

- seq64::seqedit, 148
- merge
  - seq64::event\_list, 35
- midi\_beat\_width
  - seq64::user\_settings, 204
- midi\_beats\_per\_bar
  - seq64::user\_settings, 204
- midi\_beats\_per\_minute
  - seq64::user\_settings, 204
- midi\_buss\_override
  - seq64::user\_settings, 204
- midi\_ppqn
  - seq64::user\_settings, 204
- midifile
  - seq64::midifile, 91
- mod\_timestamp
  - seq64::event, 30
- move\_selected
  - seq64::triggers, 190
- move\_selected\_triggers\_to
  - seq64::sequence, 178
- move\_triggers
  - seq64::perform, 115
  - seq64::sequence, 178
- name\_change\_callback
  - seq64::seqedit, 147
- new\_sequence
  - seq64::perform, 119
- next
  - seq64::triggers, 192
- next\_data\_line
  - seq64::configfile, 25
- next\_trigger
  - seq64::triggers, 192
- off\_playing\_notes
  - seq64::sequence, 182
- off\_queued
  - seq64::sequence, 174
- on\_button\_press\_event
  - seq64::Seq24PerfInput, 136
  - seq64::Seq24SeqEventInput, 137
  - seq64::mainwid, 75
  - seq64::perfroll, 129
  - seq64::seqevent, 152
  - seq64::seqkeys, 156
  - seq64::seqtime, 166
- on\_button\_release\_event
  - seq64::Seq24PerfInput, 136
  - seq64::mainwid, 75
  - seq64::perfroll, 129
  - seq64::seqevent, 152
  - seq64::seqkeys, 156
  - seq64::seqtime, 166
- on\_delete\_event
  - seq64::mainwnd, 82
  - seq64::seqedit, 148
- on\_expose\_event
  - seq64::maintime, 70
  - seq64::mainwid, 75
  - seq64::perfnames, 107
  - seq64::perftime, 132
- on\_focus\_in\_event
  - seq64::mainwid, 76
- on\_focus\_out\_event
  - seq64::mainwid, 76
- on\_grouplearnchange
  - seq64::mainwnd, 82
- on\_key\_press\_event
  - seq64::keybindentry, 57
  - seq64::mainwnd, 82
  - seq64::perfroll, 129
  - seq64::seqevent, 153
  - seq64::seqroll, 164
- on\_key\_release\_event
  - seq64::mainwnd, 82
- on\_motion\_notify\_event
  - seq64::mainwid, 76
  - seq64::seqdata, 142
  - seq64::seqevent, 153
- on\_realize
  - seq64::gui\_drawingarea\_gtk2, 49
  - seq64::maintime, 70
  - seq64::mainwid, 75
  - seq64::perfnames, 107
  - seq64::perfroll, 129
  - seq64::perftime, 132
  - seq64::seqdata, 142
  - seq64::seqevent, 152
  - seq64::seqkeys, 156
- on\_scroll\_event
  - seq64::seqdata, 142
  - seq64::seqroll, 164
- on\_size\_allocate
  - seq64::perfnames, 107
- open\_file
  - seq64::mainwnd, 80
- open\_performance\_edit
  - seq64::mainwnd, 81
- operator<
  - seq64::event, 28
  - seq64::event\_list::event\_key, 32
- operator=
  - seq64::click, 23
  - seq64::event\_list, 35
  - seq64::keystroke, 66
  - seq64::sequence, 172
  - seq64::triggers, 188
- output
  - seq64::jack\_assistant, 55
- output\_func
  - seq64::perform, 120
- parse
  - seq64::midifile, 92
  - seq64::optionsfile, 98
  - seq64::userfile, 208



- parse\_prop\_header
  - seq64::midifile, [92](#)
- parse\_proprietary\_track
  - seq64::midifile, [93](#)
- paste
  - seq64::triggers, [190](#)
- paste\_selected
  - seq64::sequence, [180](#)
- paste\_trigger
  - seq64::sequence, [178](#)
- perfeddit
  - seq64::perfeddit, [103](#)
- perfnames
  - seq64::perfnames, [107](#)
- perform
  - seq64::perform, [113](#)
- perfull\_key\_event
  - seq64::perform, [121](#)
- perftime
  - seq64::perftime, [131](#)
- play
  - seq64::perform, [119](#)
  - seq64::sequence, [175](#)
  - seq64::triggers, [188](#)
- play\_note\_off
  - seq64::sequence, [182](#)
- play\_note\_on
  - seq64::sequence, [182](#)
- pop\_redo
  - seq64::sequence, [173](#)
- pop\_undo
  - seq64::sequence, [173](#)
- popup\_event\_menu
  - seq64::seqedit, [147](#)
- popup\_menu
  - seq64::seqmenu, [159](#)
- popup\_midibus\_menu
  - seq64::seqedit, [147](#)
- popup\_sequence\_menu
  - seq64::seqedit, [148](#)
- popup\_tool\_menu
  - seq64::seqedit, [148](#)
- position
  - seq64::jack\_assistant, [54](#)
  - seq64::midi\_container, [84](#)
- ppqn
  - seq64::mainwnd, [80](#)
  - seq64::midifile, [92](#)
- print
  - seq64::sequence, [175](#)
  - seq64::triggers, [188](#)
- print\_triggers
  - seq64::sequence, [175](#)
- private\_bus
  - seq64::user\_settings, [204](#)
- private\_instrument
  - seq64::user\_settings, [204](#)
- process\_events
  - seq64::lash, [68](#)
- prop\_item\_size
  - seq64::midifile, [96](#)
- push\_trigger\_undo
  - seq64::sequence, [173](#)
- push\_undo
  - seq64::sequence, [172](#)
- put
  - seq64::midi\_container, [84](#)
  - seq64::midi\_list, [87](#)
  - seq64::midi\_vector, [89](#)
- put\_event\_on\_bus
  - seq64::sequence, [183](#)
- read\_long
  - seq64::midifile, [94](#)
- read\_short
  - seq64::midifile, [94](#)
- read\_varinum
  - seq64::midifile, [94](#)
- redraw
  - seq64::mainwid, [75](#)
  - seq64::seqdata, [141](#)
- redraw\_events
  - seq64::seqroll, [163](#)
- remove
  - seq64::sequence, [184](#)
  - seq64::triggers, [189](#)
- remove\_marked
  - seq64::sequence, [181](#)
- render\_string
  - seq64::gui\_drawingarea\_gtk2, [47](#)
- render\_string\_on\_drawable
  - seq64::font, [38](#)
- render\_string\_on\_pixmap
  - seq64::gui\_drawingarea\_gtk2, [47](#)
- reset
  - seq64::seqdata, [141](#)
  - seq64::seqroll, [163](#)
- reset\_draw\_marker
  - seq64::sequence, [182](#)
- reset\_draw\_trigger\_marker
  - seq64::sequence, [182](#)
- reset\_sequences
  - seq64::perform, [119](#)
- save\_file
  - seq64::mainwnd, [81](#)
- select
  - seq64::triggers, [190](#)
- select\_action\_e
  - seq64::sequence, [172](#)
- select\_all
  - seq64::sequence, [179](#)
- select\_events
  - seq64::sequence, [179](#)
- select\_mute\_group
  - seq64::perform, [116](#)
- select\_note\_events

- seq64::sequence, 179
- select\_trigger
  - seq64::sequence, 176
- selected\_trigger\_end
  - seq64::sequence, 178
- selected\_trigger\_start
  - seq64::sequence, 178
- seq64::AbstractPerfInput, 21
- seq64::Seq24PerfInput, 135
  - handle\_motion\_key, 136
  - on\_button\_press\_event, 136
  - on\_button\_release\_event, 136
  - set\_adding, 136
- seq64::Seq24SeqEventInput, 137
  - on\_button\_press\_event, 137
  - set\_adding, 137
- seq64::Seq24SeqRollInput, 137
  - set\_adding, 138
- seq64::click, 21
  - click, 23
  - m\_button, 23
  - m\_modifier, 23
  - m\_x, 23
  - m\_y, 23
  - operator=, 23
- seq64::configfile, 24
  - configfile, 25
  - line\_after, 25
  - m\_line, 25
  - next\_data\_line, 25
- seq64::event, 25
  - ~event, 28
  - append\_sysex, 31
  - get\_data, 31
  - get\_rank, 31
  - is\_channel\_msg, 29
  - is\_desired\_cc\_or\_not\_cc, 29
  - is\_one\_byte\_msg, 29
  - is\_two\_byte\_msg, 29
  - m\_data, 31
  - m\_has\_link, 31
  - m\_status, 31
  - m\_sysex, 31
  - mod\_timestamp, 30
  - operator<, 28
  - set\_data, 30
  - set\_status, 30
- seq64::event\_list, 33
  - add, 35
  - any\_selected\_notes, 36
  - count, 35
  - count\_selected\_events, 36
  - event\_list, 35
  - link\_new, 36
  - mark\_out\_of\_range, 36
  - merge, 35
  - operator=, 35
  - verify\_and\_link, 36
- seq64::event\_list::event\_key, 32
  - event\_key, 32
  - m\_rank, 33
  - m\_timestamp, 33
  - operator<, 32
- seq64::font, 36
  - BLACK, 38
  - BLACK\_ON\_YELLOW, 38
  - Color, 38
  - init, 38
  - m\_b\_on\_y\_pixmap, 39
  - m\_black\_pixmap, 39
  - m\_clip\_mask, 39
  - m\_font\_h, 38
  - m\_font\_w, 38
  - m\_pixmap, 38
  - m\_white\_pixmap, 39
  - m\_y\_on\_b\_pixmap, 39
  - render\_string\_on\_drawable, 38
  - WHITE, 38
  - YELLOW\_ON\_BLACK, 38
- seq64::gui\_assistant, 39
  - gui\_assistant, 41
- seq64::gui\_assistant\_gtk2, 41
  - sm\_internal\_keys, 42
- seq64::gui\_drawingarea\_gtk2, 42
  - draw\_line, 45, 46
  - draw\_line\_on\_pixmap, 45
  - draw\_normal\_rectangle\_on\_pixmap, 49
  - draw\_rectangle, 47, 48
  - draw\_rectangle\_on\_pixmap, 49
  - m\_background, 50
  - m\_drop\_x, 50
  - m\_foreground, 50
  - m\_mainperf, 50
  - m\_pixmap, 50
  - m\_window, 50
  - m\_window\_x, 50
  - on\_realize, 49
  - render\_string, 47
  - render\_string\_on\_pixmap, 47
  - set\_line, 45
- seq64::gui\_drawingarea\_gtk2::rect, 135
- seq64::gui\_palette\_gtk2, 50
  - gui\_palette\_gtk2, 51
- seq64::gui\_window\_gtk2, 52
  - gui\_window\_gtk2, 53
  - m\_window\_x, 53
- seq64::jack\_assistant, 53
  - error\_message, 55
  - info\_message, 55
  - init, 54
  - jack\_assistant, 54
  - jack\_shutdown, 56
  - jack\_sync\_callback, 55
  - jack\_timebase\_callback, 56
  - output, 55
  - position, 54

- stop, 54
- seq64::jack\_scratchpad, 56
- seq64::keybindentry, 56
  - events, 57
  - groups, 57
  - keybindentry, 57
  - location, 57
  - m\_key, 58
  - on\_key\_press\_event, 57
  - set, 57
  - type, 57
- seq64::keys\_perform, 58
  - ~keys\_perform, 60
  - get\_keys, 61
  - key\_name, 61
  - m\_key\_bpm\_up, 62
  - set\_all\_key\_events, 61
  - set\_all\_key\_groups, 61
  - set\_key\_event, 61
  - set\_key\_group, 61
  - set\_keys, 60
  - show\_ui\_sequence\_key, 61
- seq64::keys\_perform\_gtk2, 62
  - ~keys\_perform\_gtk2, 64
  - key\_name, 64
  - set\_all\_key\_events, 64
  - set\_all\_key\_groups, 64
- seq64::keys\_perform\_transfer, 64
- seq64::keystroke, 64
  - is\_letter, 66
  - keystroke, 65, 66
  - m\_is\_press, 66
  - m\_key, 66
  - m\_modifier, 66
  - operator=, 66
- seq64::lash, 67
  - handle\_config, 68
  - handle\_event, 68
  - init, 68
  - lash, 67
  - process\_events, 68
  - set\_alsa\_client\_id, 68
- seq64::maintime, 68
  - idle\_progress, 70
  - maintime, 70
  - on\_expose\_event, 70
  - on\_realize, 70
- seq64::mainwid, 70
  - calculate\_base\_sizes, 75
  - draw\_marker\_on\_sequence, 73
  - draw\_sequence\_on\_pixmap, 74
  - draw\_sequence\_pixmap\_on\_window, 74
  - draw\_sequences\_on\_pixmap, 74
  - mainwid, 73
  - on\_button\_press\_event, 75
  - on\_button\_release\_event, 75
  - on\_expose\_event, 75
  - on\_focus\_in\_event, 76
  - on\_focus\_out\_event, 76
  - on\_motion\_notify\_event, 76
  - on\_realize, 75
  - redraw, 75
  - seq\_from\_xy, 74
  - set\_screenset, 73
  - timeout, 74
  - update\_markers, 73
  - update\_sequence\_on\_window, 73
  - valid\_sequence, 73
- seq64::mainwnd, 76
  - about\_dialog, 81
  - adj\_callback\_ss, 81
  - file\_import\_dialog, 80
  - m\_main\_wid, 82
  - m\_sigpipe, 82
  - m\_spinbutton\_load\_offset, 82
  - mainwnd, 80
  - on\_delete\_event, 82
  - on\_grouplearnchange, 82
  - on\_key\_press\_event, 82
  - on\_key\_release\_event, 82
  - open\_file, 80
  - open\_performance\_edit, 81
  - ppqn, 80
  - save\_file, 81
  - signal\_action, 81
  - timer\_callback, 81
  - update\_window\_title, 81
- seq64::midi\_container, 83
  - add\_long, 85
  - add\_variable, 85
  - fill, 84
  - get, 84
  - position, 84
  - put, 84
- seq64::midi\_list, 85
  - CharList, 87
  - get, 87
  - put, 87
- seq64::midi\_vector, 87
  - get, 89
  - put, 89
- seq64::midifile, 89
  - m\_char\_list, 96
  - m\_data, 96
  - m\_new\_format, 97
  - m\_pos, 96
  - midifile, 91
  - parse, 92
  - parse\_prop\_header, 92
  - parse\_proprietary\_track, 93
  - ppqn, 92
  - prop\_item\_size, 96
  - read\_long, 94
  - read\_short, 94
  - read\_varinum, 94
  - seq\_number\_size, 96

- varinum\_size, 96
- write, 92
- write\_byte, 94
- write\_long, 94
- write\_prop\_header, 95
- write\_proprietary\_track, 96
- write\_seq\_number, 95
- write\_short, 94
- write\_track\_name, 95
- write\_varinum, 94
- seq64::options, 97
  - m\_notebook, 97
- seq64::optionsfile, 97
  - parse, 98
  - write, 100
- seq64::perfedit, 100
  - ~perfedit, 103
  - collapse, 103
  - copy, 103
  - expand, 103
  - init\_before\_show, 103
  - perfedit, 103
  - set\_guides, 103
  - start\_playing, 104
  - stop\_playing, 104
  - timeout, 103
  - undo, 103
- seq64::perfnames, 104
  - draw\_sequence, 107
  - m\_char\_w, 107
  - m\_namebox\_w, 107
  - m\_names\_chars, 107
  - m\_names\_y, 107
  - m\_setbox\_w, 107
  - m\_xy\_offset, 107
  - on\_expose\_event, 107
  - on\_realize, 107
  - on\_size\_allocate, 107
  - perfnames, 107
- seq64::perform, 108
  - ~perform, 113
  - add\_sequence, 114
  - all\_notes\_off, 116
  - clamp\_track, 123
  - clear\_all, 114
  - clear\_sequence\_triggers, 114
  - copy\_triggers, 115
  - decrement\_beats\_per\_minute, 121
  - delete\_sequence, 114
  - get\_max\_trigger, 120
  - get\_midi\_control\_off, 115
  - get\_midi\_control\_on, 115
  - get\_midi\_control\_toggle, 115
  - get\_screen\_set\_notepad, 115
  - get\_sequence, 119
  - increment\_beats\_per\_minute, 121
  - init, 113
  - init\_jack, 114
  - inner\_start, 122
  - install\_sequence, 122
  - is\_active, 117
  - is\_dirty\_edit, 117
  - is\_dirty\_main, 117
  - is\_dirty\_names, 117
  - is\_dirty\_perf, 117
  - is\_midi\_control\_valid, 121
  - is\_mseq\_valid, 122
  - is\_screenset\_valid, 121
  - is\_seq\_valid, 121
  - jack\_sync\_callback, 123
  - launch\_input\_thread, 114
  - launch\_output\_thread, 114
  - m\_playback\_mode, 123
  - mainwnd\_key\_event, 121
  - move\_triggers, 115
  - new\_sequence, 119
  - output\_func, 120
  - perform, 113
  - perffroll\_key\_event, 121
  - play, 119
  - reset\_sequences, 119
  - select\_mute\_group, 116
  - sequence\_count, 113
  - sequence\_playing\_off, 120
  - set\_active, 116
  - set\_beats\_per\_minute, 119
  - set\_input\_bus, 121
  - set\_key\_event, 122
  - set\_key\_group, 122
  - set\_offset, 120
  - set\_orig\_ticks, 119
  - set\_playing\_screenset, 116
  - set\_screen\_set\_notepad, 115
  - set\_screenset, 116
  - set\_sequence\_control\_status, 120
  - set\_was\_active, 117
  - show\_ui\_sequence\_key, 120
  - start, 116
  - start\_playing, 120
  - stop, 116
  - unset\_mode\_group\_learn, 116
  - unset\_sequence\_control\_status, 120
- seq64::performcallback, 123
- seq64::perffroll, 124
  - ~perffroll, 127
  - convert\_x, 128
  - convert\_xy, 128
  - draw\_drawable\_row, 128
  - draw\_sequence\_on, 128
  - fill\_background\_pixmap, 128
  - FruityPerfInput, 129
  - init\_before\_show, 128
  - m\_fruity\_interaction, 129
  - on\_button\_press\_event, 129
  - on\_button\_release\_event, 129
  - on\_key\_press\_event, 129

- on\_realize, 129
- set\_ppqn, 128
- snap\_x, 128
- start\_playing, 128
- stop\_playing, 128
- update\_sizes, 127
- seq64::perftime, 129
  - on\_expose\_event, 132
  - on\_realize, 132
  - perftime, 131
- seq64::rc\_settings, 132
  - home\_config\_directory, 134
  - make\_directory, 134
- seq64::rect, 135
- seq64::seqdata, 138
  - idle\_redraw, 141
  - m\_number\_h, 142
  - m\_number\_offset\_y, 142
  - m\_number\_w, 142
  - on\_motion\_notify\_event, 142
  - on\_realize, 142
  - on\_scroll\_event, 142
  - redraw, 141
  - reset, 141
  - seqdata, 141
  - set\_data\_type, 141
  - set\_zoom, 141
  - update\_sizes, 141
  - xy\_to\_rect, 141
- seq64::seqedit, 142
  - apply\_length, 146
  - create\_menus, 147
  - do\_action, 148
  - get\_measures, 146
  - mc\_min\_zoom, 148
  - name\_change\_callback, 147
  - on\_delete\_event, 148
  - popup\_event\_menu, 147
  - popup\_midibus\_menu, 147
  - popup\_sequence\_menu, 148
  - popup\_tool\_menu, 148
  - seqedit, 146
  - set\_background\_sequence, 147
  - set\_data\_type, 147
  - set\_key, 147
  - set\_note\_length, 146
  - set\_scale, 146
  - set\_snap, 146
  - set\_zoom, 146
- seq64::sequevent, 148
  - convert\_t, 152
  - convert\_x, 152
  - draw\_background, 151
  - draw\_pixmap\_on\_window, 151
  - drop\_event, 152
  - idle\_redraw, 151
  - on\_button\_press\_event, 152
  - on\_button\_release\_event, 152
  - on\_key\_press\_event, 153
  - on\_motion\_notify\_event, 153
  - on\_realize, 152
  - set\_data\_type, 151
  - set\_snap, 151
  - snap\_x, 152
  - start\_paste, 152
  - update\_sizes, 151
  - x\_to\_w, 152
- seq64::seqkeys, 153
  - draw\_key, 156
  - on\_button\_press\_event, 156
  - on\_button\_release\_event, 156
  - on\_realize, 156
  - set\_hint\_state, 155
- seq64::seqmenu, 156
  - ~seqmenu, 158
  - m\_seqedit, 159
  - popup\_menu, 159
  - seq\_clear\_perf, 159
  - seq\_copy, 159
  - seq\_cut, 159
  - seq\_edit, 159
  - seq\_paste, 159
  - seqmenu, 158
- seq64::seqroll, 160
  - convert\_tn, 163
  - draw\_events\_on, 164
  - draw\_events\_on\_pixmap, 163
  - on\_key\_press\_event, 164
  - on\_scroll\_event, 164
  - redraw\_events, 163
  - reset, 163
  - set\_background\_sequence, 163
  - set\_data\_type, 163
  - snap\_x, 163
  - update\_background, 163
- seq64::seqtime, 164
  - on\_button\_press\_event, 166
  - on\_button\_release\_event, 166
- seq64::sequence, 166
  - add\_event, 175, 180
  - add\_note, 180
  - add\_trigger, 176
  - adjust\_trigger\_offsets\_to\_length, 184
  - change\_event\_data\_range, 180
  - clear\_triggers, 179
  - copy\_selected, 180
  - copy\_triggers, 178
  - decrement\_selected, 181
  - del\_trigger, 176
  - e\_deselect, 172
  - e\_is\_selected, 172
  - e\_remove\_one, 172
  - e\_select, 172
  - e\_select\_one, 172
  - e\_toggle\_selection, 172
  - e\_would\_select, 172

- event\_count, 172
- fill\_container, 183
- get\_beat\_width, 173
- get\_highest\_note\_event, 183
- get\_lowest\_note\_event, 183
- get\_max\_trigger, 178
- get\_next\_event, 183
- get\_next\_note\_event, 183
- get\_num\_selected\_events, 179
- get\_num\_selected\_notes, 179
- get\_trigger\_state, 176
- grow\_selected, 181
- grow\_trigger, 176
- increment\_selected, 181
- intersect\_events, 177
- intersect\_notes, 177
- intersect\_triggers, 177
- is\_dirty\_edit, 174
- is\_dirty\_main, 174
- is\_dirty\_names, 175
- is\_dirty\_perf, 175
- link\_new, 182
- m\_mutex, 184
- mark\_selected, 182
- move\_selected\_triggers\_to, 178
- move\_triggers, 178
- off\_playing\_notes, 182
- off\_queued, 174
- operator=, 172
- paste\_selected, 180
- paste\_trigger, 178
- play, 175
- play\_note\_off, 182
- play\_note\_on, 182
- pop\_redo, 173
- pop\_undo, 173
- print, 175
- print\_triggers, 175
- push\_trigger\_undo, 173
- push\_undo, 172
- put\_event\_on\_bus, 183
- remove, 184
- remove\_marked, 181
- reset\_draw\_marker, 182
- reset\_draw\_trigger\_marker, 182
- select\_action\_e, 172
- select\_all, 179
- select\_events, 179
- select\_note\_events, 179
- select\_trigger, 176
- selected\_trigger\_end, 178
- selected\_trigger\_start, 178
- set\_beat\_width, 173
- set\_beats\_per\_bar, 173
- set\_dirty, 175
- set\_dirty\_mp, 175
- set\_length, 173
- set\_master\_midi\_bus, 179
- set\_midi\_bus, 179
- set\_midi\_channel, 175
- set\_orig\_tick, 175
- set\_playing, 174
- set\_quantized\_rec, 174
- set\_rec\_vol, 173
- set\_recording, 174
- set\_snap\_tick, 174
- set\_thru, 174
- set\_trigger\_offset, 184
- split\_trigger, 176, 184
- stream\_event, 180
- stretch\_selected, 181
- toggle\_queued, 174
- transpose\_notes, 183
- unpaint\_all, 182
- unselect, 182
- unselect\_triggers, 177
- verify\_and\_link, 182
- zero\_markers, 182
- seq64::trigger, 184
- seq64::triggers, 185
  - add, 188
  - adjust\_offset, 192
  - adjust\_offsets\_to\_length, 189
  - copy, 191
  - get\_selected\_end, 191
  - get\_selected\_start, 191
  - get\_state, 190
  - grow, 189
  - intersect, 190
  - m\_length, 192
  - m\_ppqn, 192
  - move\_selected, 190
  - next, 192
  - next\_trigger, 192
  - operator=, 188
  - paste, 190
  - play, 188
  - print, 188
  - remove, 189
  - select, 190
  - set\_length, 188
  - split, 189
  - triggers, 188
  - unselect, 190
- seq64::user\_instrument, 193
  - controller\_active, 194
  - controller\_max, 194
  - controller\_name, 194
  - copy\_definitions, 194
  - m\_controller\_count, 195
  - m\_is\_valid, 195
  - set\_controller, 194
  - set\_defaults, 194
  - set\_name, 194
- seq64::user\_instrument\_t, 195
  - controllers, 195

- controllers\_active, 195
- instrument, 195
- seq64::user\_midi\_bus, 195
  - channel\_count, 196
  - channel\_max, 197
  - copy\_definitions, 197
  - instrument, 197
  - m\_channel\_count, 197
  - m\_is\_valid, 197
  - set\_defaults, 196
  - set\_instrument, 197
- seq64::user\_midi\_bus\_t, 197
  - alias, 198
  - instrument, 198
- seq64::user\_settings, 198
  - bus, 203
  - Busses, 202
  - control\_height, 204
  - controller\_active, 203
  - controller\_name, 203
  - dump\_summary, 204
  - get\_globals, 203
  - instrument, 203
  - Instruments, 202
  - m\_control\_height, 206
  - m\_instruments, 205
  - m\_mainwid\_border, 206
  - m\_mainwid\_x, 206
  - m\_mainwnd\_cols, 205
  - m\_mainwnd\_rows, 205
  - m\_max\_sequence, 205
  - m\_max\_sets, 205
  - m\_midi\_beat\_width, 207
  - m\_midi\_beats\_per\_measure, 206
  - m\_midi\_beats\_per\_minute, 206
  - m\_midi\_buses, 205
  - m\_midi\_buss\_override, 207
  - m\_midi\_ppqn, 206
  - m\_seqarea\_seq\_x, 206
  - m\_seqarea\_x, 206
  - m\_seqchars\_x, 206
  - m\_seqs\_in\_set, 205
  - m\_text\_x, 205
  - mainwid\_border, 204
  - mainwid\_spacing, 204
  - mainwnd\_cols, 203
  - mainwnd\_rows, 203
  - max\_sets, 203
  - midi\_beat\_width, 204
  - midi\_beats\_per\_bar, 204
  - midi\_beats\_per\_minute, 204
  - midi\_buss\_override, 204
  - midi\_ppqn, 204
  - private\_bus, 204
  - private\_instrument, 204
  - set\_defaults, 203
  - set\_globals, 203
  - text\_x, 203
  - text\_y, 203
- seq64::userfile, 207
  - dump\_setting\_summary, 210
  - parse, 208
  - write, 210
- seq\_clear\_perf
  - seq64::seqmenu, 159
- seq\_copy
  - seq64::seqmenu, 159
- seq\_cut
  - seq64::seqmenu, 159
- seq\_edit
  - seq64::seqmenu, 159
- seq\_from\_xy
  - seq64::mainwid, 74
- seq\_number\_size
  - seq64::midifile, 96
- seq\_paste
  - seq64::seqmenu, 159
- seqdata
  - seq64::seqdata, 141
- seqedit
  - seq64::seqedit, 146
- seqmenu
  - seq64::seqmenu, 158
- sequence\_count
  - seq64::perform, 113
- sequence\_playing\_off
  - seq64::perform, 120
- set
  - seq64::keybindentry, 57
- set\_active
  - seq64::perform, 116
- set\_adding
  - seq64::Seq24PerfInput, 136
  - seq64::Seq24SeqEventInput, 137
  - seq64::Seq24SeqRollInput, 138
- set\_all\_key\_events
  - seq64::keys\_perform, 61
  - seq64::keys\_perform\_gtk2, 64
- set\_all\_key\_groups
  - seq64::keys\_perform, 61
  - seq64::keys\_perform\_gtk2, 64
- set\_alsa\_client\_id
  - seq64::lash, 68
- set\_background\_sequence
  - seq64::seqedit, 147
  - seq64::seqroll, 163
- set\_beat\_width
  - seq64::sequence, 173
- set\_beats\_per\_bar
  - seq64::sequence, 173
- set\_beats\_per\_minute
  - seq64::perform, 119
- set\_controller
  - seq64::user\_instrument, 194
- set\_data
  - seq64::event, 30

- set\_data\_type
  - seq64::seqdata, [141](#)
  - seq64::seqedit, [147](#)
  - seq64::seqevent, [151](#)
  - seq64::seqroll, [163](#)
- set\_defaults
  - seq64::user\_instrument, [194](#)
  - seq64::user\_midi\_bus, [196](#)
  - seq64::user\_settings, [203](#)
- set\_dirty
  - seq64::sequence, [175](#)
- set\_dirty\_mp
  - seq64::sequence, [175](#)
- set\_globals
  - seq64::user\_settings, [203](#)
- set\_guides
  - seq64::perfedit, [103](#)
- set\_hint\_state
  - seq64::seqkeys, [155](#)
- set\_input\_bus
  - seq64::perform, [121](#)
- set\_instrument
  - seq64::user\_midi\_bus, [197](#)
- set\_key
  - seq64::seqedit, [147](#)
- set\_key\_event
  - seq64::keys\_perform, [61](#)
  - seq64::perform, [122](#)
- set\_key\_group
  - seq64::keys\_perform, [61](#)
  - seq64::perform, [122](#)
- set\_keys
  - seq64::keys\_perform, [60](#)
- set\_length
  - seq64::sequence, [173](#)
  - seq64::triggers, [188](#)
- set\_line
  - seq64::gui\_drawingarea\_gtk2, [45](#)
- set\_master\_midi\_bus
  - seq64::sequence, [179](#)
- set\_midi\_bus
  - seq64::sequence, [179](#)
- set\_midi\_channel
  - seq64::sequence, [175](#)
- set\_name
  - seq64::user\_instrument, [194](#)
- set\_note\_length
  - seq64::seqedit, [146](#)
- set\_offset
  - seq64::perform, [120](#)
- set\_orig\_tick
  - seq64::sequence, [175](#)
- set\_orig\_ticks
  - seq64::perform, [119](#)
- set\_playing
  - seq64::sequence, [174](#)
- set\_playing\_screenset
  - seq64::perform, [116](#)
- set\_ppqn
  - seq64::perfroll, [128](#)
- set\_quantized\_rec
  - seq64::sequence, [174](#)
- set\_rec\_vol
  - seq64::sequence, [173](#)
- set\_recording
  - seq64::sequence, [174](#)
- set\_scale
  - seq64::seqedit, [146](#)
- set\_screen\_set\_notepad
  - seq64::perform, [115](#)
- set\_screenset
  - seq64::mainwid, [73](#)
  - seq64::perform, [116](#)
- set\_sequence\_control\_status
  - seq64::perform, [120](#)
- set\_snap
  - seq64::seqedit, [146](#)
  - seq64::seqevent, [151](#)
- set\_snap\_tick
  - seq64::sequence, [174](#)
- set\_status
  - seq64::event, [30](#)
- set\_thru
  - seq64::sequence, [174](#)
- set\_trigger\_offset
  - seq64::sequence, [184](#)
- set\_was\_active
  - seq64::perform, [117](#)
- set\_zoom
  - seq64::seqdata, [141](#)
  - seq64::seqedit, [146](#)
- show\_ui\_sequence\_key
  - seq64::keys\_perform, [61](#)
  - seq64::perform, [120](#)
- signal\_action
  - seq64::mainwnd, [81](#)
- sm\_internal\_keys
  - seq64::gui\_assistant\_gtk2, [42](#)
- snap\_x
  - seq64::perfroll, [128](#)
  - seq64::seqevent, [152](#)
  - seq64::seqroll, [163](#)
- split
  - seq64::triggers, [189](#)
- split\_trigger
  - seq64::sequence, [176](#), [184](#)
- start
  - seq64::perform, [116](#)
- start\_paste
  - seq64::seqevent, [152](#)
- start\_playing
  - seq64::perfedit, [104](#)
  - seq64::perform, [120](#)
  - seq64::perfroll, [128](#)
- stop
  - seq64::jack\_assistant, [54](#)



- seq64::perform, 116
- stop\_playing
  - seq64::perfedit, 104
  - seq64::perfroll, 128
- stream\_event
  - seq64::sequence, 180
- stretch\_selected
  - seq64::sequence, 181
- text\_x
  - seq64::user\_settings, 203
- text\_y
  - seq64::user\_settings, 203
- timeout
  - seq64::mainwid, 74
  - seq64::perfedit, 103
- timer\_callback
  - seq64::mainwnd, 81
- toggle\_queued
  - seq64::sequence, 174
- transpose\_notes
  - seq64::sequence, 183
- triggers
  - seq64::triggers, 188
- type
  - seq64::keybindentry, 57
- undo
  - seq64::perfedit, 103
- unpaint\_all
  - seq64::sequence, 182
- unselect
  - seq64::sequence, 182
  - seq64::triggers, 190
- unselect\_triggers
  - seq64::sequence, 177
- unset\_mode\_group\_learn
  - seq64::perform, 116
- unset\_sequence\_control\_status
  - seq64::perform, 120
- update\_background
  - seq64::seqroll, 163
- update\_markers
  - seq64::mainwid, 73
- update\_sequence\_on\_window
  - seq64::mainwid, 73
- update\_sizes
  - seq64::perfroll, 127
  - seq64::seqdata, 141
  - seq64::seqevent, 151
- update\_window\_title
  - seq64::mainwnd, 81
- valid\_sequence
  - seq64::mainwid, 73
- varinum\_size
  - seq64::midifile, 96
- verify\_and\_link
  - seq64::event\_list, 36
- seq64::sequence, 182
- WHITE
  - seq64::font, 38
- write
  - seq64::midifile, 92
  - seq64::optionsfile, 100
  - seq64::userfile, 210
- write\_byte
  - seq64::midifile, 94
- write\_long
  - seq64::midifile, 94
- write\_prop\_header
  - seq64::midifile, 95
- write\_proprietary\_track
  - seq64::midifile, 96
- write\_seq\_number
  - seq64::midifile, 95
- write\_short
  - seq64::midifile, 94
- write\_track\_name
  - seq64::midifile, 95
- write\_varinum
  - seq64::midifile, 94
- x\_to\_w
  - seq64::seqevent, 152
- xy\_to\_rect
  - seq64::seqdata, 141
- YELLOW\_ON\_BLACK
  - seq64::font, 38
- zero\_markers
  - seq64::sequence, 182