

UVVM Utility Library – Quick Reference

Checks and awaits

```
[v_bool :=] check_value(value, [exp], alert_level, msg, [...])
[v_bool :=] check_value_in_range(value, min_value, max_value, alert_level, msg, [...])
check_stable(target, stable_req, alert_level, msg, [...])
await_change(target, min_time, max_time, alert_level, msg, [...])
await_value(target, exp, min_time, max_time, alert_level, msg, [...])
await_stable(target, stable_req, stable_req_from, timeout, timeout_from, alert_level, msg, [...])
```

Logging and verbosity control

```
set_log_file_name(file_name, [msg_id])
log(msg_id, msg, [...])
log_text_block(msg_id, text_block, formatting, [...])
enable_log_msg(msg_id, [...])
disable_log_msg (msg_id, [...]),
is_log_msg_enabled (msg_id, [msg_id_panel])
```

Alert handling

```
set_alert_file_name(file_name, [msg_id])
alert(alert_level, msg, scope)
[tb_]note(msg, [scope])
[tb_]warning(msg, [scope])
manual_check(msg, [scope])
[tb_]error(msg, [scope])
[tb_]failure(msg, [scope])
set_alert_stop_limit(alert_level, limit)
v_int := get_alert_stop_limit(alert_level)
set_alert_attention(alert_level, attention, [msg])
v_attention := get_alert_attention(alert_level)
increment_expected_alerts(alert_level, number)
```

Reporting

```
report_global_ctrl(VOID)
report_msg_id_panel(VOID)
report_alert_counters(VOID)
```

String handling

```
v_string := to_string(val, [...])
v_string := justify(val, justified, width, format_spaces, truncate)
v_string := fill_string(val, width)
v_string := to_upper(val)
v_character := ascii_to_char(ascii_pos, [ascii_allow])
v_int := char_to_ascii(character)
v_natural := pos_of_leftmost(character, string, [result_if_not_found])
v_natural := pos_of_rightmost(character, string, [result_if_not_found])
v_string := remove_initial_chars(string, number of chars(natural))
v_string := get_procedure_name_from_instance_name(string)
v_string := get_process_name_from_instance_name(string)
v_string := get_entity_name_from_instance_name(string)
v_string := replace(string, target_character, exchange_character)
replace(inout line, target_character, exchange_character)
v_string := pad_string(val, char, width, [side])
```

Randomization

```
v_slv := random(length)
v_sl := random(VOID)
v_int := random(min_value, max_value)
v_real := random(min_value, max_value)
v_time := random(min_value, max_value)
random([min_value, [max_val]], v_seed1, v_seed2, v_target)
randomize(seed1, seed2)
```

Signal generators

```
clock_generator(clock, clock_period)
clock_generator(clock, clock_ena, clock_period, clock_name, [clock_high_percentage])
clock_generator(clock, clock_ena, clock_period, clock_name, clock_high_time)
gen_pulse (target, pulse_duration, [mode]) or (target, clock_signal, num_periods)
```

BFM Common Package

```
normalize_and_check(value, target, mode, value_name, target_name, msg)
wait_until_given_time_after_rising_edge(clk, wait_time)
```


| | | |
|----------------|--|---|
| await_change() | <p>target(bool), min_time, max_time, alert_level, msg, [scope, [msg_id, [msg_id_panel]]]</p> <p>target(sl), min_time, max_time, alert_level, msg, [scope, [msg_id, [msg_id_panel]]]</p> <p>target(slv), min_time, max_time, alert_level, msg, [scope, [msg_id, [msg_id_panel]]]</p> <p>target(u), min_time, max_time, alert_level, msg, [scope, [msg_id, [msg_id_panel]]]</p> <p>target(s), min_time, max_time, alert_level, msg, [scope, [msg_id, [msg_id_panel]]]</p> <p>target(int), min_time, max_time, alert_level, msg, [scope, [msg_id, [msg_id_panel]]]</p> <p>target(real), min_time, max_time, alert_level, msg, [scope, [msg_id, [msg_id_panel]]]</p> <p>Example</p> <p>await_change(bol, 3 ns, 5 ns, ERROR, "Awaiting change on bol signal");</p> | <p>Waits until the <i>target</i> signal changes, or times out after <i>max_time</i>. An alert is asserted if the signal does not change between <i>min_time</i> and <i>max_time</i>. Note that if the value changes at exactly <i>max_time</i>, the timeout gets precedence. Defaults: <i>scope</i>≤C_TB_SCOPE_DEFAULT, <i>msg_id</i>≤ID_POS_ACK, <i>msg_id_panel</i>≤shared_msg_id_panel</p> |
| await_value() | <p>target(bool), exp(bool), min_time, max_time, alert_level, msg, [scope, (etc.)]</p> <p>target(sl), exp(sl), [match_strictness], min_time, max_time, alert_level, msg, [scope, (etc.)]</p> <p>target(slv), exp(slv), [match_strictness], min_time, max_time, alert_level, msg, [scope, (etc.)]</p> <p>target(u), exp(u), min_time, max_time, alert_level, msg, [scope, (etc.)]</p> <p>target(s), exp(s), min_time, max_time, alert_level, msg, [scope, (etc.)]</p> <p>target(int), exp(int), min_time, max_time, alert_level, msg, [scope, (etc.)]</p> <p>target(real), exp(real), min_time, max_time, alert_level, msg, [scope, (etc.)]</p> <p>Examples</p> <p>await_value(bol, true, 10 ns, 20 ns, ERROR, "Waiting for bol to become true");</p> <p>await_value(slv8, "10101010", MATCH_STD, 3 ns, 7 ns, WARNING, "Waiting for slv8 value");</p> | <p>Waits until the <i>target</i> signal equals the <i>exp</i> signal, or times out after <i>max_time</i>. An alert is asserted if the signal does not equal the expected value between <i>min_time</i> and <i>max_time</i>. Note that if the value changes to the expected value at exactly <i>max_time</i>, the timeout gets precedence. - <i>match_strictness</i>: Specifies if match needs to be exact or std_match, e.g. 'H' = '1'. (MATCH_EXACT, MATCH_STD) Defaults: <i>match_strictness</i>≤MATCH_EXACT, <i>scope</i>≤C_TB_SCOPE_DEFAULT, <i>msg_id</i>≤ID_POS_ACK, <i>msg_id_panel</i>≤shared_msg_id_panel</p> |
| await_stable() | <p>target(bool), stable_req(time), stable_req_from(t_from_point_in_time), timeout (time), timeout_from(t_from_point_in_time), alert_level, msg, [scope, (etc.)]</p> <p>target(sl), stable_req(time), stable_req_from(t_from_point_in_time), timeout (time), timeout_from(t_from_point_in_time), alert_level, msg, [scope, (etc.)]</p> <p>target(slv), stable_req(time), stable_req_from(t_from_point_in_time), timeout (time), timeout_from(t_from_point_in_time), alert_level, msg, [scope, (etc.)]</p> <p>target(u), stable_req(time), stable_req_from(t_from_point_in_time), timeout (time), timeout_from(t_from_point_in_time), alert_level, msg, [scope, (etc.)]</p> <p>target(s), stable_req(time), stable_req_from(t_from_point_in_time), timeout (time), timeout_from(t_from_point_in_time), alert_level, msg, [scope, (etc.)]</p> <p>target(int), stable_req(time), stable_req_from(t_from_point_in_time), timeout (time), timeout_from(t_from_point_in_time), alert_level, msg, [scope, (etc.)]</p> <p>target(real), stable_req(time), stable_req_from(t_from_point_in_time), timeout (time), timeout_from(t_from_point_in_time), alert_level, msg, [scope, (etc.)]</p> <p>Example</p> <p>await_stable(u8, 20 ns, FROM_LAST_EVENT, 100 ns, FROM_NOW, ERROR, "Waiting for u8 to stabilize");</p> | <p>Wait until the target signal has been stable for at least 'stable_req'. Report an error if this does not occur within the time specified by 'timeout'. Note : 'Stable' refers to that the signal has not had an event (i.e. not changed value). Description of special arguments: stable_req_from : - FROM_NOW : Target must be stable 'stable_req' from now - FROM_LAST_EVENT : Target must be stable 'stable_req' from the last event of target. timeout_from : - FROM_NOW : The timeout argument is given in time from now - FROM_LAST_EVENT : The timeout argument is given in time from the last event of target. Defaults: <i>scope</i>≤C_TB_SCOPE_DEFAULT, <i>msg_id</i>≤ID_POS_ACK, <i>msg_id_panel</i>≤shared_msg_id_panel</p> |

1.2 Logging and verbosity control

| Name | Parameters and examples | Description |
|--------------------------------------|---|--|
| set_log_file_name() | <p>[file_name(string), [msg_id]]</p> <p>Example</p> <pre>set_log_file_name("new_log_file_name.txt");</pre> | <p>Sets the log file name. To ensure that the entire log transcript is written to a single file, this should be called prior to any other procedures (except set_alert_file_name()). If file name is set after a log message has been written to the log file, a warning will be reported. This warning can be disabled by setting C_WARNING_ON_LOG_ALERT_FILE_RUNTIME_RENAME false in the adaptations_pkg.</p> <p>Defaults: file_name<=C_LOG_FILE_NAME, msg_id<=C_UTIL_SETUP</p> |
| log() | <p>msg_id, msg, [scope, [msg_id_panel, [log_destination(t_log_destination), [log_file_name(string), [open_mode(file_open_kind)]]]]]</p> <p>Examples</p> <pre>log(ID_SEQUENCER, "message to log"); log(ID_BFM, "Msg", "MyScope", local_msg_id_panel, LOG_ONLY, "new_log.txt", write_mode);</pre> | <p>Writes message to log. If the msg_id is enabled in msg_id_panel, log the msg. Log destination defines where the message will be written to (CONSOLE_AND_LOG, CONSOLE_ONLY, LOG_ONLY). Log file name defines the log file that the text block shall be written to. open_mode indicates how the log file shall be opened (write_mode, append_mode).</p> <p>Defaults: scope<=C_TB_SCOPE_DEFAULT, msg_id_panel<=shared_msg_id_panel, log_destination<=CONSOLE_AND_LOG, log_file_name<=C_LOG_FILE_NAME, open_mode<=append_mode</p> |
| log_text_block() | <p>msg_id, text_block(line), formatting(t_log_format), [msg_header(string), [scope, [msg_id_panel, [log_if_block_empty(t_log_if_block_empty), [log_destination(t_log_destination), [log_file_name(string), [open_mode(file_open_kind)]]]]]]]</p> <p>Examples</p> <pre>log_text_block(ID_SEQUENCER, v_line, UNFORMATTED); log_text_block(ID_BFM, v_line, FORMATTED, "Header", "MyScope");</pre> | <p>Writes text block from VHDL line to log. Formatting either FORMATTED or UNFORMATTED. msg_header is an optional header message for the text_block. log_if_block_empty defines how an empty text block is handled (WRITE_HDR_IF_BLOCK_EMPTY/SKIP_LOG_IF_BLOCK_EMPTY/NOTIFY_IF_BLOCK_EMPTY). Log destination defines where the message will be written to (CONSOLE_AND_LOG, CONSOLE_ONLY, LOG_ONLY). Log file name defines the log file that the text block shall be written to. open_mode indicates how the log file shall be opened (write_mode, append_mode).</p> <p>Defaults: msg_header<="", scope<=C_TB_SCOPE_DEFAULT, msg_id_panel<=shared_msg_id_panel, log_if_block_empty<=WRITE_HDR_IF_BLOCK_EMPTY, log_destination<=CONSOLE_AND_LOG, log_file_name<=C_LOG_FILE_NAME, open_mode<=append_mode</p> |
| enable_log_msg () | <p>msg_id, [msg]</p> <p>msg_id, msg_id_panel, [msg, [scope]]</p> <p>Example</p> <pre>enable_log_msg(ID_SEQUENCER);</pre> | <p>Enables logging for the given msg_id. (See ID-list on front page for special purpose IDs)</p> <p>Defaults: msg_id_panel<=shared_msg_id_panel, msg<="", scope<=C_TB_SCOPE_DEFAULT</p> |
| disable_log_msg() | <p>msg_id, [msg, [quietness(t_quietness)]]</p> <p>msg_id, msg_id_panel, [msg, [scope, [quietness(t_quietness)]]]</p> <p>Example</p> <pre>disable_log_msg(ID_LOG_HDR);</pre> | <p>Disables logging for the given msg_id. (See ID-list on front page for special purpose IDs). Logging of disable_log_msg() can be turned off by setting quietness=QUIET.</p> <p>Defaults: msg_id_panel<=shared_msg_id_panel, msg<="", scope<=C_TB_SCOPE_DEFAULT, quietness<=NON_QUIET</p> |
| [v_bool :=] is_log_msg_enabled () | <p>msg_id, [msg_id_panel]</p> <p>Example</p> <pre>v_is_enabled := is_log_msg_enabled(ID_SEQUENCER);</pre> | <p>Returns Boolean 'true' if given message ID is enabled. Otherwise 'false'</p> <p>Defaults: msg_id_panel<=shared_msg_id_panel</p> |

1.2.1 General string handling features for log()

- All log messages will be given using the user defined layout in adaptations_pkg.vhd
- \n may be used to force line shifts. Line shift will occur after scope column, before message column
- \r may be used to force line shift at start of log message. The result will be a blank line apart from prefix (message ID, timestamp and scope will be omitted on the first line)

1.3 Alerts

| Name | Parameters and examples | Description |
|---|---|--|
| set_alert_file_name() | file_name(string), [msg_id] Example set_alert_file_name("new_alert_log_file.txt"); | Sets the alert file name. To ensure that the entire log transcript is written to a single file, this should be called prior to any other procedures (except set_alert_file_name()). If file name is set after a log message has been written to the log file, a warning will be reported. This warning can be disabled by setting C_WARNING_ON_LOG_ALERT_FILE_RUNTIME_RENAME false in the adaptations_pkg. Defaults: file_name<=C_ALERT_FILE_NAME, msg_id<=ID_UTIL_SETUP |
| alert() | alert_level, msg, [scope] Example alert(TB_WARNING, "This is a TB warning"); | - Asserts an alert with severity given by alert_level. - Increment the counters for the given alert_level. - If the stop_limit for the given alert_level is reached, stop the simulation. Defaults: scope <=C_TB_SCOPE_DEFAULT |
| note() error() tb_note() tb_error() warning() failure() tb_warning() tb_failure() manual_check() | msg, [scope] Examples note("This is a note"); tb_failure("This is a TB failure", "tb_scope"); | Overloads for alert(). Note that: warning(msg, [scope]) = alert(warning, msg, [scope]). Defaults: scope <=C_TB_SCOPE_DEFAULT |
| increment_expected_alerts() | alert_level, [number (natural) , [msg, [scope]]] Example increment_expected_alerts(WARNING, 2, "Expecting two more warnings"); | Increments the expected alert counter for the given alert_level. Defaults: number<=1, msg<="", scope <=C_TB_SCOPE_DEFAULT |
| set_alert_stop_limit() | alert_level, number (natural) Example set_alert_stop_limit(ERROR, 2); | Simulator will stop on hitting <number> of specified alert type (0 means never stop). |
| v_int := get_alert_stop_limit() | alert_level Example v_int := get_alert_stop_limit(FAILURE); | Returns current stop limit for given alert type. |
| set_alert_attention() | alert_level, attention (t_attention), [msg] Example set_alert_attention(NOTE, IGNORE, "Ignoring all note-alerts"); | Set given alert type to t_attention: IGNORE or REGARD. Defaults: msg <="" |
| v_attention := get_alert_attention() | alert_level Example v_attention := get_alert_attention(WARNING) | Returns current attention (IGNORE or REGARD) for given alert type. |

1.4 Reporting

| Name | Parameters | Description |
|-------------------------|------------|--|
| report_global_ctrl() | VOID | Logs the values in the global_ctrl signal, which is described in chapter 1.11 |
| report_msg_id_panel() | VOID | Logs the values in the msg_id_panel, which is described in chapter 1.11 |
| report_alert_counters() | VOID | Logs the status of all alert counters, typically at the end of simulation. For each alert_level, the alert counter is compared with the expected counter. |

1.5 String handling

(Methods are defined in `uvvm_util.string_methods`)

| Name | Parameters and examples | Description |
|---|--|---|
| <code>v_string := to_string()</code> *IEEE | value({ANY_SCALAR_TYPE}) value(slv) value(time), unit(time) value(real), digits(natural) value(real), format(string) -- C-style formatting | IEEE defined to_string functions. Return a <i>string</i> with the value of the argument 'value'. |
| <code>v_string := to_string()</code> | val(bool), width(natural), justified(side), format_spaces(t_format_spaces), [truncate(t_truncate_string)] val(int), width(natural), justified(side), format_spaces(t_format_spaces), [truncate(t_truncate_string)] val(slv), radix(t_radix), [format(t_format_zeros), [prefix(t_radix_prefix)]] val(u), radix(t_radix), [format(t_format_zeros), [prefix(t_radix_prefix)]] val(s), radix(t_radix), [format(t_format_zeros), [prefix(t_radix_prefix)]] val(string) -- Removes non printable ascii characters Examples v_string := to_string(v_u8, DEC); v_string := to_string(v_slv8, HEX, AS_IS, INCL_RADIX); | Additions to the IEEE defined to_string functions. Return a <i>string</i> with the value of the argument 'val'. - type t_radix is (BIN, HEX, DEC, HEX_BIN_IF_INVALID) - type t_format_spaces is (KEEP_LEADING_SPACE, SKIP_LEADING_SPACE) - type t_truncate_string is (DISALLOW_TRUNCATE, ALLOW_TRUNCATE) - type t_format_zeros is (AS_IS, SKIP_LEADING_0) - type t_radix_prefix is (EXCL_RADIX, INCL_RADIX) Defaults: justified<=RIGHT, truncate<=DISALLOW_TRUNCATE, prefix<=EXCL_RADIX |
| <code>v_string := to_upper()</code> | val(string) Example v_string := to_upper("lowercase string"); | Returns a <i>string</i> containing an upper case version of the argument 'val' |
| <code>v_string := justify()</code> *IEEE | value(string), [justified(side)], [field(width)] | IEEE implementation of justify. Returns a <i>string</i> where 'value' is justified to the side given by 'justified' (right, left). Defaults: justified<=right, field<=0 |
| <code>v_string := justify()</code> | val(string), justified(side), width(natural), format_spaces(t_format_spaces), truncate(t_truncate_string) Example v_string := justify("string", RIGHT, C_STRING_LENGTH, ALLOW_TRUNCATE, KEEP_LEADING_SPACE); | Addition to the IEEE implementation of justify(). Returns a <i>string</i> where 'val' is justified to the side given by 'justified' (right, left). The string can be truncated with the 'truncate' parameter (ALLOW_TRUNCATE, DISALLOW_TRUNCATE) or leading spaces can be removed with 'format_spaces' (KEEP_LEADING_SPACE, SKIP_LEADING_SPACE). |
| <code>v_string := fill_string()</code> | val(character), width(natural) Example v_string := fill_string('X', 10); | Returns a <i>string</i> filled with the character 'val'. |
| <code>v_character := ascii_to_char()</code> | ascii_pos(int), [ascii_allow (t_ascii_allow)] Example v_char := ascii_to_char(65); -- ASCII 'A' | Return the ASCII to character located at the argument 'ascii_pos' - type t_ascii_allow is (ALLOW_ALL, ALLOW_PRINTABLE_ONLY) Defaults: ascii_allow<=ALLOW_ALL |

| | | |
|--|---|---|
| v_int := char_to_ascii() | char(character) Example v_int := char_to_ascii('A'); -- Returns 65 | Return the ASCII value (integer) of the argument 'char' |
| v_natural := pos_of_leftmost() | target(character), vector(string), [result_if_not_found (natural)] Example v_natural := pos_of_leftmost('x', v_string); | Returns position of left most 'character' in 'string', alternatively return-value if not found Defaults: result_if_not_found <= 1 |
| v_natural := pos_of_rightmost() | target(character), vector(string), [result_if_not_found (natural)] Example v_natural := pos_of_rightmost('A', v_string); | Returns position of right most 'character' in 'string', alternatively return-value if not found Defaults: result_if_not_found <= 1 |
| v_string := remove_initial_chars() | source(string), num(natural) Example v_string := remove_initial_chars("abcde", 1); -- Returns "bcde" | Return string less the num (number of chars) first characters |
| v_string := get_procedure_name_from_instance_name() | val(string) Example v_string := get_procedure_name_from_instance_name(c_int'instance_name); | Returns procedure, process or entity name from the given instance name as <i>string</i> . The instance name must be <object>'instance_name, where object is a signal, variable or constant defined in the procedure, process and entity/process respectively e.g. get_entity_name_from_instance_name(my_process_variable'instance-name) |
| v_string := get_process_name_from_instance_name() | val(string) Example v_string := get_process_name_from_instance_name(c_int'instance_name); | |
| v_string := get_entity_name_from_instance_name() | val(string) Example v_string := get_entity_name_from_instance_name(c_int'instance_name); | |
| v_string := replace() | val(string), target_char(character), exchange_char(character) Example v_string := replace("string_x", 'x', 'y'); -- Returns "string_y" | String function returns a <i>string</i> where the target character has been replaced by the exchange character. |
| replace() | variable text_line(inout line), target_char(character), exchange_char(character) Example replace(str, 'a', 'b'); | Similar to function version of replace(). Line procedure replaces the input with a line where the target character has been replaced by the exchange character. |
| v_string := pad_string() | val(string), char(character), width(natural), [side(side)] Example v_string := pad_string("abcde", '-', 10, LEFT); | Returns a string of width 'width' with the string 'val' on the side of the string given in 'side' (LEFT, RIGHT). The remaining width is padded with 'char'. Defaults: side <= LEFT |

Note: See section 1.2.1 for general string handling features for the log() procedure

1.6 Randomization

| Name | Parameters and examples | Description |
|--------------------------------------|--|---|
| v_slv := random() | length(int) Example v_slv := random(v_slv'length); | Returns a random std_logic_vector of size <i>length</i> . The function uses and updates a global seed. |
| v_sl := random() | VOID Example v_sl := random(VOID); | Returns a random std_logic. The function uses and updates a global seed |
| {v_int,v_real,v_time} := random() | min_value(int), max_value(int) min_value(real), max_value(real) min_value(time), max_value(time) Example v_int := random(1, 10); | Returns a random <i>integer, real</i> or <i>time</i> between min_value and max_value. The function uses and updates a global seed |
| random() | v_seed1(positive <i>variable</i>), v_seed2(positive <i>variable</i>), v_target(slv <i>variable</i>) Example random(v_seed1, v_seed2, v_slv) | Sets v_target to a random value. The procedure uses and updates v_seed1 and v_seed2. |
| random() | min_value(int), max_value(int), v_seed1(positive <i>var</i>), v_seed2(positive <i>var</i>), v_target(int <i>var</i>) min_value(real), max_value(real), v_seed1(positive <i>var</i>), v_seed2(positive <i>var</i>), v_target(real <i>var</i>) min_value(time), max_value(time), v_seed1(positive <i>var</i>), v_seed2(positive <i>var</i>), v_target(time <i>var</i>) Example random(0.01, 0.03, v_seed1, v_seed2, v_real); | Sets v_target to a random value between min_value and max_value. The procedure uses and updates v_seed1 and v_seed2. |
| randomize() | seed1(positive), seed2(positive) , [msg, [scope]] Example randomize(12, 14, "Setting global seeds"); | Sets the global seeds to <i>seed1</i> and <i>seed2</i> . |

1.7 Signal generators

| Name | Parameters and examples | Description |
|-------------------|--|--|
| clock_generator() | clock_signal(slv), clock_period(time) clock_signal(slv), clock_ena(boolean), clock_period(time), clock_name(string), [clock_high_percentage(natural range 1 to 99)] clock_signal(slv), clock_ena(boolean), clock_period(time), clock_name(string), clock_high_time(time) Examples clock_generator(clk50M, 20 ns); clock_generator(clk100M, clk100M_ena, 10 ns, "100 MHz with 60% duty cycle", 60); clock_generator(clk100M, clk100M_ena, 10 ns, "100 MHz with 60% duty cycle", 6 ns); | Generates a clock signal. Usage: Include the the clock_generator as a concurrent procedure from your test bench. By using the variant with the <i>clock_ena</i> input, the clock can be started and stopped during simulation. Each start/stop is logged (if the msg_id ID_CLOCK_GEN is enabled). Duty cycle can be controlled either by percentage or time. Defaults: <i>clock_high_percentage</i> <= 50 |
| gen_pulse() | target(slv), pulse_duration(time), mode(t_mode), msg, [scope, [msg_id, [msg_id_panel]]] target(slv), clock_signal(slv), num_periods(int), msg, [scope, [msg_id, [msg_id_panel]]] target(slv), pulse_value(slv), clock_signal(slv), num_periods(int), msg, [scope, [msg_id, [msg_id_panel]]] Examples gen_pulse(slv_1, 50 ns, BLOCKING, "Pulsing for 50 ns"); gen_pulse(slv8, x"AB", clk100M, 2, "Pulsing SLV for 2 clock periods"); | Generates a pulse on the target signal for a certain amount of time or a number of clock cycles. - If mode = BLOCKING: Procedure blocks the caller (f.ex the test sequencer) until the pulse is done. - If mode = NON_BLOCKING : Procedure starts the pulse and schedules the end of the pulse, so that the caller can continue immediately. Defaults: <i>scope</i> <= C_TB_SCOPE_DEFAULT, <i>msg_id</i> <= ID_GEN_PULSE, <i>msg_id_panel</i> <= shared_msg_id_panel |

1.8 BFM Common package

(Methods are defined in *uvvm_util.bfm_common_pkg*)

| Name | Parameters and examples | Description |
|---|--|--|
| {slv, u, s} := normalize_and_check() | value(slv), target(slv), mode (t_normalization_mode), value_name, target_name, msg value(u), target (u), mode (t_normalization_mode), value_name, target_name, msg value(s), target (s), mode (t_normalization_mode), value_name, target_name, msg Example v_slv8 := normalize_and_check(v_slv5, v_slv8, ALLOW_NARROWER, "8bit slv", "5bit slv", "Normalizing and checking slv"); | Normalize 'value' to the width given by 'target'. If value'length > target'length, remove leading zeros (or sign bits) from value If value'length < target'length, add padding (leading zeros, or sign bits) to value Mode (t_normalization_mode) is used for sanity checks, and can be one of : ALLOW_WIDER : Allow only value'length > target'length ALLOW_NARROWER : Allow only value'length < target'length ALLOW_WIDER_NARROWER : Allow both of the above ALLOW_EXACT_ONLY : Allow only value'length = target'length |
| wait_until_given_time_after_rising_edge() | clk(slv), wait_time(time) Example wait_until_given_time_after_rising_edge(clk50M, 5 ns); | Wait until wait_time after rising_edge(clk) If the time passed since the previous rising_edge is less than wait_time, don't wait until the next rising_edge, just wait_time after the previous rising_edge. |
| wait_num_rising_edge() | clk(slv), num_rising_edge(natural) Example wait_num_rising_edge(clk10M, 5); | Waits for 'num_rising_edge' rising edges of the clk signal |
| wait_num_rising_edge_plus_margin() | clk(slv), num_rising_edge(natural), margin(time) Example wait_num_rising_edge_plus_margin(clk50M, 3, 4 ns); | Waits for 'num_rising_edge' rising edges of the clk signal, and then waits for 'margin'. |

1.9 Message IDs

A sub set of message IDs is listed in this table. All the message IDs are defined in `uvvm_util.adaptations_pkg`.

| Message ID | Description |
|--------------------|---|
| ID_LOG_HDR | For all test sequencer log headers. Special format with preceding empty line and underlined message (also applies to ID_LOG_HDR_LARGE and ID_LOG_HDR_XL). |
| ID_SEQUENCER | For all other test sequencer messages |
| ID_SEQUENCER_SUB | For general purpose procedures defined inside TB and called from test sequencer |
| ID_POS_ACK | A general positive acknowledge for check routines (incl. awaits) |
| ID_BFM | BFM operation (e.g. message that a write operation is completed) (BFM: Bus Functional Model, basically a procedure to handle a physical interface) |
| ID_BFM_WAIT | Typically BFM is waiting for response (e.g. waiting for ready, or predefined number of wait states) |
| ID_BFM_POLL | Used inside a BFM when polling until reading a given value, i.e., to show all reads until expected value found. |
| ID_PACKET_INITIATE | A packet has been initiated (Either about to start or just started) |
| ID_PACKET_COMPLETE | Packet completion |
| ID_PACKET_HDR | Packet header information |
| ID_PACKET_DATA | Packet data information |
| ID_LOG_MSG_CTRL | Dedicated ID for enable/disable_log_msg |
| ID_CLOCK_GEN | Used for logging when clock generators are enabled or disabled |
| ID_GEN_PULSE | Used for logging when a gen_pulse procedure starts pulsing a signal |
| ALL_MESSAGES | Not an ID. Applies to all IDs (apart from ID_NEVER) |

1.10 Common arguments in checks and awaits

Most check and await methods have two groups of arguments:

- arguments specific to this function/procedure
- **common_args**: arguments common for all functions/procedures:
 - o alert_level, msg, [scope], [msg_id], [msg_id_panel]

For example: `check_value(val, exp, ERROR, "Check that the val signal equals the exp signal", C_SCOPE);`

The **common arguments** are described in the following table.

| Argument | Type | Example | Description |
|--------------|----------------|----------------------------|---|
| alert_level | t_alert_level; | ERROR | Set the severity for the alert that may be asserted by the method. |
| msg | string; | "Check that bus is stable" | A custom message to be appended in the log/alert. |
| scope | string; | "TB Sequencer" | A string describing the scope from which the log/alert originates. |
| msg_id | t_msg_id | ID_BFM | Optional message ID, defined in the adaptations package. Default value for check routines = ID_POS_ACK; |
| msg_id_panel | t_msg_id_panel | local_msg_id_panel | Optional msg_id_panel, controlling verbosity within a specified scope. Defaults to a common ID panel defined in the adaptations package. |

1.11 Using Hierarchical Alert Reporting

Enable hierarchical alerts via the constant `C_ENABLE_HIERARCHICAL_ALERTS` in the adaptations package.

The procedures used for hierarchical alert reporting are described in the following table.

| Name | Parameters and examples | Description |
|--|--|---|
| <code>add_to_alert_hierarchy()</code> | <code>scope(string), [parent_scope(string), [stop_limit(t_alert_counters)]]</code> Example <code>add_to_alert_hierarchy("tier_2", "tier_1");</code> | Add a scope as a node in the alert hierarchy tree. Defaults: <code>parent_scope</code> \leq <code>C_BASE_HIERARCHY_LEVEL</code> , <code>stop_limit</code> \leq (others \Rightarrow 0) |
| <code>increment_expected_alerts()</code> | <code>scope(string), alert_level, [amount(natural)]</code> Example <code>increment_expected_alerts("tier_2", ERROR, 2);</code> | Increment the expected alert counter for a node. Defaults: <code>amount</code> \leq 1 |
| <code>set_expected_alerts()</code> | <code>scope(string), alert_level, expected_alerts(natural)</code> Example <code>set_expected_alerts("tier_2", WARNING, 5);</code> | Set the expected alert counter for a node. |
| <code>increment_stop_limit()</code> | <code>scope(string), alert_level, [amount(natural)]</code> Example <code>increment_stop_limit("tier_1", ERROR);</code> | Increment the stop limit for a node. Defaults: <code>amount</code> \leq 1 |
| <code>set_stop_limit()</code> | <code>scope(string), alert_level, stop_limit (natural)</code> Example <code>set_stop_limit("tier_1", ERROR, 5);</code> | Set the stop limit for a node. |

- By default there will be only one node in the hierarchy tree, the base node with name given by `C_BASE_HIERARCHY_LEVEL` in the adaptations package. This node has a stop limit of 0 by default.
- To add a scope as a node to the hierarchy, call `add_to_alert_hierarchy()`.
- Any scope that is not registered in the hierarchy will be automatically registered if an alert is triggered in that scope. The parent scope will then be `C_BASE_HIERARCHY_LEVEL`. Changing the parent is possible by calling `add_to_alert_hierarchy()` with another scope as parent. This is only allowed if the parent is `C_BASE_HIERARCHY_LEVEL`, and may cause an odd looking summary (total summary will be correct).
- A good way to set up the hierarchy is to let every scope register themselves with the default parent scope, and then in addition make every parent register each of its children.
 - o Example:
 - In the child, call `add_to_alert_hierarchy(<child scope>)`. This will add the scope of the child to the hierarchy with the default (base) parent.
 - In the parent, first call `add_to_alert_hierarchy(<parent scope>)`. Then call immediately `add_to_alert_hierarchy(<child scope>, <parent scope>)` for each of the scopes that shall be children of this parent scope. This will re-register the children to the correct parent.

Example output:

```

*** FINAL SUMMARY OF ALL ALERTS ***      Format: REGARDED/EXPECTED/IGNORED
=====
TB seq      :      5/5/5      TB_NOTE    5/5/5      WARNING  5/5/5      TB_WARNING 5/5/5      MANUAL_CHECK 5/5/5      ERROR      5/5/5      TB_ERROR    5/5/5      FAILURE    5/5/5      TB_FAILURE   5/5/5
`- first_node :      4/4/4      4/4/4      4/4/4      4/4/4      4/4/4      4/4/4      4/4/4      4/4/4      4/4/4      4/4/4
    |- second_node :      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1
    `- third_node  :      2/2/2      2/2/2      2/2/2      2/2/2      2/2/2      2/2/2      2/2/2      2/2/2      2/2/2      2/2/2
        |- fourth_node :      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1      1/1/1
=====
>> Simulation SUCCESS: No mismatch between counted and expected serious alerts
=====

```

1.12 Adaptation package

The `adaptations_pkg.vhd` is intended for local modifications to library behaviour and log layout.

This way only one file needs to be merged when a new version of the library is released.

This package may of course also be used to set up a company or project specific behaviour and layout.

The layout constants and global signals are described in the following tables.

| Constant | Description |
|--|---|
| C_ALERT_FILE_NAME | Name of the alert file. |
| C_LOG_FILE_NAME | Name of the log file. |
| C_SHOW_UVVM_UTILITY_LIBRARY_INFO | General information about the UVVM Utility Library will be shown when this is enabled. |
| C_SHOW_UVVM_UTILITY_LIBRARY_RELEASE_INFO | Release information will be shown when this is enabled. |
| C_LOG_PREFIX | The prefix to all log messages. "UVVM: " by default. |
| C_LOG_PREFIX_WIDTH | Number of characters to be used for the log prefix. |
| C_LOG_MSG_ID_WIDTH | Number of characters to be used for the message ID. |
| C_LOG_TIME_WIDTH | Number of characters to be used for the log time. Three characters are used for time unit, .e.g., 'ns'. |
| C_LOG_TIME_BASE | The unit in which time is shown in the log. Either ns or ps. |
| C_LOG_TIME_DECIMALS | Number of decimals to show for the time. |
| C_LOG_SCOPE_WIDTH | Number of characters to be used to show log scope. |
| C_LOG_LINE_WIDTH | Number of characters allowed in each line in the log. |
| C_LOG_INFO_WIDTH | Number of characters of information allowed in each line in the log. By default this is set to C_LOG_LINE_WIDTH – C_LOG_PREFIX_WIDTH. |
| C_LOG_HDR_FOR_WAVEVIEW_WIDTH | Number of characters for a string in the waveview indicating last log header. |
| C_WARNING_ON_LOG_ALERT_FILE_RUNTIME_RENAME | Whether or not to report a warning if the log or alert files are renamed after they have been written. |
| C_USE_BACKSLASH_N_AS_LF | If true '\n' will be interpreted as line feed. |
| C_USE_BACKSLASH_R_AS_LF | If true '\r' placed as the first character in the string will be interpreted as a LF where the timestamp, Id etc. will be omitted. |
| C_SINGLE_LINE_ALERT | If true prints alerts on a single line. Default false. |
| C_SINGLE_LINE_LOG | If true prints logs messages on a single line. Default false. |
| C_TB_SCOPE_DEFAULT | The default scope in the test sequencer. |
| C_LOG_TIME_TRUNC_WARNING | Yields a single TB_WARNING if time stamp truncated. Otherwise none. |
| C_DEFAULT_MSG_ID_PANEL | Sets the default message IDs that shall be shown in the log. |

| | |
|----------------------------------|--|
| C_MSG_ID_INDENT | Sets the indentation for each message ID. |
| C_DEFAULT_ALERT_ATTENTION | Sets the default alert attention. |
| C_DEFAULT_STOP_LIMIT | Sets the default alert stop limit. |
| C_ENABLE_HIERARCHICAL_ALERTS | Whether or not to enable hierarchical alert summary. Default false. |
| C_BASE_HIERARCHY_LEVEL | The name of the base/top level node that all other nodes in the tree will originate from. |
| C_DEPRECATED_SETTING | Sets how the user is to be notified if a procedure has been deprecated, and will be removed in later versions. |
| C_VVC_RESULT_DEFAULT_ARRAY_DEPTH | Default for how many results (e.g. reads) a VVC can store before overwriting old results |
| C_VVC_MSG_ID_PANEL_DEFAULT | Default message ID panel to use in VVCs |

| Global signal | Signal type | Description |
|------------------------------|-------------|--|
| global_show_log_id | boolean | If true the message IDs will be shown in the log. |
| global_show_log_scope | boolean | If true the message scope will be shown in the log. |
| global_show_msg_for_uvvm_cmd | boolean | If true messages for Bitvis UVVM commands will be shown if applicable. |

Additional Documentation

There are two other main documents for the UVVM Utility Library (available from our Downloads page)

- ‘Making a simple, structured and efficient VHDL testbench – Step-by-step’
- ‘Bitvis Utility Library – Concepts and Usage’

There is also a webinar available on ‘Making a simple, structured and efficient VHDL testbench – Step-by-step’ (via Aldec). Link on our downloads page.

2 Compilation

UVVM Utility Library may only be compiled with VHDL 2008.

Compile order for UVVM Utility Library:

| Compile to library | File |
|--------------------|---|
| uvvm_util | uvvm_util/src/types_pkg.vhd |
| uvvm_util | uvvm_util/src/adaptations_pkg.vhd |
| uvvm_util | uvvm_util/src/string_methods_pkg.vhd |
| uvvm_util | uvvm_util/src/protected_types_pkg.vhd |
| uvvm_util | uvvm_util/src/hierarchy_linked_list_pkg.vhd |
| uvvm_util | uvvm_util/src/alert_hierarchy_pkg.vhd |
| uvvm_util | uvvm_util/src/license_pkg.vhd |
| uvvm_util | uvvm_util/src/methods_pkg.vhd |
| uvvm_util | uvvm_util/src/bfm_common_pkg.vhd |
| uvvm_util | uvvm_util/src/uvvm_util_context.vhd |

Modelsim and Riviera-PRO users can compile the library by sourcing the following files:

```
script/compile_src.do
```

Note that the compile script compiles the Utility Library with the following Modelsim directives for the vcom command:

| Directive | Description |
|---------------------|---|
| -suppress 1346,1236 | Suppress warnings about the use of protected types. These can be ignored. |

The uvvm_util project is opened by opening `sim/uvvm_util.mpf` in Modelsim.

3 Simulator compatibility and setup

UVVM Utility Library has been compiled and tested with Modelsim, Riviera-PRO and Active HDL.

Required setup:

- Textio buffering should be removed or reduced. (Modelsim.ini: Set UnbufferedOutput to 1)
- Simulator transcript (and log file viewer) should be set to a fixed width font type for proper alignment (e.g. Courier New 8)
- Simulator must be set up to break the simulation on failure (or lower severity)