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SystemC Quickreference Card

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sc_main

```
#include "systemc.h"
// include module declarations

int sc_main(int argc, char *agv[ ])
{
// Create channels
     sc_signal<type> signal_name, signal_name, ...;
// Create clock
     sc_clock clock_name ("name", period, duty_cycle, start_time, positive_first );
// Module instantiations
     module_name instance_name("name") ;
// Module port bindings
// By name binding, do for each port
     instance_name.port_name (signal_name) ;
// By order port binding
     instance_name ( signal_name, signal_name,      ) ;
// By order using stream
     instance_name << signal_name << signal_name, ...;
// Clock generation
     sc_start(value);

     return 0;
}
```

Clock syntax

sc_clock clock_name ("name**", period, duty_cycle, start_time, positive_first**) ;

name:	*name*	type: char *	
period:	*clock period*	type: variable of type sc_time or constant of type uint64	
duty_cycle:	*clock duty cycle*	type: double	default value: 0.5
start_time:	*time of first edge*	type: variable of type sc_time or constant of type uint64	default value: 0
positive_first:	*first edge positive*	type: bool	default value: true

✍

Clock object methods:

clock_name.**name()**	returns the "name"
clock_name.**period()**	returns the clock period
clock_name.**duty_cycle()**	returns the clock duty cycle
clock_name.**pos()**	Gives a reference to the positive edge of clk usage: sensitive << clock_name.**pos()**
clock_name.**neg()**	Gives a reference to the negative edge of clk usage: sensitive << clock_name.**neg()**

Clock functions

sc_start()	**Generate the waveforms for all sc_clock objects**
sc_stop()	Stops simulations
sc_time_stamp()	Returns the current simulation time as sc_time
sc_simulation_time()	Returns the current simulation time as double

Data Types

Scalar

sc_int<length> variable_name, variable_name, ...**;**
sc_uint<length> variable_name , variable_name, ...**;**
sc_bigint<length> variable_name , variable_name, ...**;**
sc_biguint<length> variable_name , variable_name, ...**;**
✍length: specifies the number of elements in the array.
✍Rightmost is LSB(0), Leftmost is MSB (length-1).
sc_bit variable_name, variable_name, ... **;**
✍Values: '0' , '1'
sc_bv<length> variable_name, variable_name, ... **;**
✍length: specifies the number of elements in the array.
✍Values: '0' , '1'. More than one bit represented by "0011".
sc_logic variable_name, variable_name,   ;
✍Values: '0' , '1', 'X', 'Z'
sc_lv<length> variable_name, variable_name, ... **;**
✍length: specifies the number of elements in the array.
✍Values: '0' , '1', 'X', 'Z' . More than one bit represented by "0011XXZZ".

Fixedpoint

sc_fixed<wl, iwl, q_mode, o_mode, n_bits> object_name, object_name, ... **;**
sc_ufixed<wl, iwl, q_mode, o_mode, n_bits> object_name, object_name, ... **;**
sc_fixed_fast<wl, iwl, q_mode, o_mode, n_bits> object_name, object_name, ..**;**
sc_ufixed_fast<wl, iwl, q_mode, o_mode, n_bits> object_name, object_name. **;**

wl:	total word length, number of bits used in the type
iwl:	integer word length, number of bits to the left of the binary point (.)
q_mode:	quantization mode
o_mode:	overflow mode
n_bits:	number of saturated bits, used for overflow mode

sc_fix object_name **(list of options) ;**
sc_fix_fast object_name **(list of options) ;**
sc_ufix object_name **(list of options) ;**
sc_ufix_fast object_name **(list of options)**

q_mode: SC_RND, SC_RND_ZERO, SC_RND_MIN_INF, SC_RND_INF, SC_RND_CONV, SC_TRN, SC_TRN_ZERO
o_mode: SC_SAT, SC_SAT_ZERO, SC_SAT_SYM, SC_WRAP, SC_WRAP_SM

Data Operations/Functions

Operation / **Type**	sc_bit sc_bc sc_lv	sc_bc sc_lv	sc_int, sc_uint sc_bigint, sc_biguint	sc_fixed, sc_ufixed, sc_fix, sc_ufix
Bitwise	~ & ^ |	~ & ^ | << >>	~ & ^ | << >>	~ & ^ |
Arithmetic			+ - * / %	+ - * / % >> <<
Logical				
Equality	== !=	== !=	== !=	== !=
Relational			> < <= >=	
Assignment	= &= |= ^=	= &= |= ^=	= += -= *= /= %= &= |= ^=	= += -= *= /= %= &= |= ^=
Increment Decrement			++ --	++ --
Arithmetic if				
Concatenation	,	,	,	,
Bitselect		[x]	[x]	
Partselect		range()	range()	
Reduction		and_reduce or_reduce xor_reduce		

Channels

Name	**Methods**
sc_signal	**read(), write(), event()**
sc_signal_rv	**read(), event(), write()**

For vectors,, allows multiple writers

sc_signal_resolved	**read(), event(), write()**

For non vectors, allows multiple writers

sc_fifo	**read(), nb_read(), num_available(), write(), nb_write(), num_free()**

Point to point communication , one reader, one writer per fifo

sc_mutex	**kind(), lock(), trylock(), unlock()**

Multipoint communication, only one writer/reader at the time

sc_semaphore	**kind(), wait(), trywait(), get_value(), post()**

Limited concurrent access, specify number of concurrent users

sc_buffer	**kind()**

Like sc_signal, value_change_event() and default_event() are triggered on each write

Resolved ports/signals

Syntax:
```
SC_MODULE ( module_name) {
// ports
    sc_in_rv<N> port_name, port_name,...;
    sc_out_rv<N> port_name, port_name,...;
    sc_inout_rv<N> port_name, port_name,...;
    sc_signal_rv<N> signal_name,signal_name,. ;
//  rest of module
} ;      // N is the number of bits
         // Every bit can have either a 0, 1, X or  Z value
```

sc_signal channel methods

read()	retunrs value of signal or port
write()	assigns value to signal or port
event()	returns true or false if event on signal or port
default_event()	any change of value
value_changed_event()	any change of value
posedge()	returns true if 0 -> 1 transition
negedge()	returns true if 1 -> 0 transition

Modules

```
// Header file
SC_MODULE(module_name) {
    // module port declarations
    // signal variable declarations
    // data variable declarations
    // process declarations
    // other method declarations
    // module instantiations
SC_CTOR(module_name){
    // process registration & declarations of sensitivity lists
    // module instantiations & port connection declarations
    // global watching registration
                }
} ;

// Implementation file
void module_name::process_or_method_name() {
    // process implementation
    // SC_THREAD and SC_CTHREAD has
    // while(true) loop
}
```

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Scalar Syntax:

```
SC_MODULE(module_name) {
// ports
   sc_in<port_type>  port_name, port_name,... ;
   sc_out<port_type> port_name, port_name,... ;
   sc_inout<port_type> port_name, port_name,... ;
   sc_port<channel_type<port_type>, connections > port_name, port_name,... ;
   sc_port<channel_type<port_type>, connections > port_name, port_name,... ;
   sc_port<channel_type<port_type>, conections > port_name, port_name,... ;
// clock input (for SystemC 2.0 it is recommended to use sc_in<bool>)
   sc_in_clk clock_name;
// clock output (for SystemC 2.0 is is recommended to use sc_out<bool>)
   sc_out_clk clock_name;
// signals
   sc_signal<signal_type> signal_name, signal_name, ...;
//  variables
   type variable_name, variable_name...;
//  rest of module};
```

Array Syntax:

```
SC_MODULE ( module_name) {
// ports
   sc_in<port_type>  port_name[size], port_name[size], ... ;
   sc_out<port_type> port_name[size], port_name[size], ... ;
   sc_inout<port_type> port_name[size], port_name[size], ...;
   sc_port<channel_type <port_type>, connections >port_name[size], port_name[size], ... ;
   sc_port<channel_type <port_type>, connections >port_name[size], port_name[size], ... ;
   sc_port<channel_type <port_type>, connections >port_name[size], port_name[size], ...;
// signals
   sc_signal<signal_type> signal_name [size], signal_name [size], ...
//  variables
   type variable_name[size], variable_name[size],...;;
//  rest of module
} ;
```

Module inheritance

```
SC_MODULE( base_module )
{
...
// constructor
SC_CTOR( base_module )
   { ... }
};
   class derived_module : public base_module
{
// process(es)
   void proc_a();
   SC_HAS_PROCESS( derived_module );
// parameter(s)
   int some_parameter;
// constructor
   derived_module( sc_module_name name_, int some_value )
   : base_module( name_ ), some_parameter( some_value )
{
   SC_THREAD( proc_a );
}
};
```

Processes

```
// Header file
SC_MODULE(module_name) {
// module port declarations
// signal variable declarations
// data variable declarations
// process declarations
   void process_name_A();
   void process_name_B();
   void process_name_C();
// other method declarations
// module instantiations
   SC_CTOR(module_name){
// process registration
   SC_METHOD(process_name_A);
// Sensitivity list
   SC_THREAD(process_name_B);
// Sensitivity list
   SC_CTHREAD(process_name_C, clock_edge_reference);
   //clock_name.pos() or clock_name.neg()
// global watching registration
// no sensitivity list
/ module instantiations & port connection declarations
}
} ;
```

Sensitivity list

```
Sensitive to any change on port(s) or signal(s)
   sensitive(port_or_signal)
   sensitive << port_or_signal << port_or_signal    ;
Sensitive to the positive edge of boolean port(s) or signal(s)
   sensitive_pos(port_or_signal)
   sensitive_pos << port_or_signal << port_or_signal    ;
Sensitive to the negative edge of boolean port(s) or signal(s)
   sensitive_neg(port_or_signal)
   sensitive_neg << port_or_signal << port_or_signal    ;
```

Module instantiation

Style 1

```
// Header file
SC_MODULE(module_name) {
   // module port declarations
   // signal variable declarations
   // data variable declarations
   // process declarations
   // other method declarations
module_name_A instance_name_A; // module instantiation..
module_name_N instance_name_N; // module instantiation

SC_CTOR(module_name):
instance_name_A("name_A"),
instance_name_N("name_N")
{
// by name port binding
   instance_name_A.port_1(signal_or_port);
// by order port binding
   instance_name_N(signal_or_port, signal_or_port,...);
// process registration & declarations of sensitivity lists
// global watching registration
}
} ;
```

Style 2

```
// Header file
SC_MODULE(module_name) {
   // module port declarations
   // signal variable declarations
   // data variable declarations
   // process declarations
   // other method declarations
module_name_A *instance_name_A; // module instantiation..
module_name_N *instance_name_N; // module instantiation
SC_CTOR(module_name)
{
   instance_name_A = new module_name_A("name_A"),
   instance_name_N = new module_name_N("name_N")
   instance_name_A->port_1(signal_or_port);
   instance_name_A->port_2(signal_or_port);
(*instance_name_N)(signal_or_port, signal_or_port,...);
// process registration & declarations of sensitivity lists
// global watching registration
}
} ;
```

Watching

```
// Header file
SC_MODULE(module_name) {
   // module port declarations
   // signal variable declarations
   // data variable declarations
   // process declarations
void process_name();// other method declarations
// module instantiations
SC_CTOR(module_name){
SC_CTHREAD(process_name, clock_edge_reference  // global watching registration
                watching (reset.delayed() = = 1);  // delayed() method required
}
```

Event

```
sc_event my_event;    // event
sc_time t_zero (0,sc_ns);
sc_time t(10, sc_ms); // variable t of type sc_time

Immediate:
   my_event.notify();
   notify(my_event);
Delayed:
   my_event.notify(t_zero);       // next delta cycle
   notify(t_zero, my_event);      // next delta cycle
Timed:
   my_event.notify(t);        // 10 ms delay
   notify(t, my_event);       // 10 ms delay
```

Dynamic sensitivity

```
wait for an event in a list of events:
   wait(e1);
   wait(e1 | e2 | e3);
   wait( e1 & e2 & e3);
wait for specific amount of time:
   wait(200, sc_ns);
wait on events with timeout:
   wait(200, sc_ns, e1 | e2 | e3);
wait for number of clock cycles:
   wait(200); // wait for 200 clock cycles, only for SC_CTHREAD
wait for one delta cycle:
   wait( 0, sc_ns ); // wait one delta cycle.
   wait( SC_ZERO_TIME ); // wait one delta cycle.
```