INTERNATIONAL ELECTROTECHNICAL COMMISSION

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DELAY AND POWER CALCULATION STANDARDS –

Part 4: Design and Verification of Low-Power, Energy-Aware Electronic Systems

CORRIGENDUM 1

9.7.3 Retention modeling for different retention styles

Replace Table 10 with the following table:

VDD	VDD RET	SS && SC	RS && RC	RTC	Retained value	Register value	Register state	Valid next states	Comments
ON	ON	FALSE	FALSE	FALSE	Previous saved data	Previous state value	NORMAL	SAVE, RESTORE	—
ON	ON	FALSE	FALSE	TRUE	Previous saved data	Previous state value	RETAIN_ON	NORMAL, RETAIN_OFF, RESTORE	—
ON	ON	FALSE	TRUE	X	Previous saved data	Retention value	RESTORE	NORMAL, RETAIN_ON	—
ON	ON	TRUE	FALSE	X	Register value	Previous state value	SAVE	RETAIN_ON, NORMAL	—
ON	ON	TRUE	TRUE	X	CORRUPT	CORRUPT	CORRUPT	NA	SAV_RES_COR is set
ON	OFF	X	X	TRUE	CORRUPT	CORRUPT	CORRUPT	NA	—
ON	OFF	X	TRUE	FALSE	CORRUPT	CORRUPT	CORRUPT	NA	RET_SUP_COR is set
ON	OFF	X	FALSE	FALSE	CORRUPT	Previous state value	PARTIAL_ CORRUPT	NORMAL	RET_SUP_COR is set
OFF	OFF	X	X	X	CORRUPT	CORRUPT	CORRUPT	NA	RET_SUP_COR is set
OFF	ON	FALSE	FALSE	FALSE	CORRUPT	CORRUPT	CORRUPT	NA	!RTC
OFF	ON	FALSE	FALSE	TRUE	Previous saved data	CORRUPT	RETAIN_OFF	RETAIN_ON	—
OFF	ON	FALSE	TRUE	X	CORRUPT	CORRUPT	CORRUPT	NA	Restore during power-down
OFF	ON	TRUE	X	X	CORRUPT	CORRUPT	CORRUPT	NA	Save during power-down

[a]The X in this table denotes a "don't care" condition. Valid next states are non-corrupting next states.

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10.6.1.1 Power domain

Replace the table with the following table:

Class name	upfPowerDomainT	
Class membership	upfPowerDomainT, upfExtentClassT, upfBaseUpfT, upfBaseNamedT, upfBaseT	
Handle ID	`<handle ID of upf_parent>/<upf_name of Object>`	
Handle ID examples	`/top/dut_i/PD`	
Property	**Return value**	**Description**
upf_name	upfStringT	Name of object
upf_parent	upfBaseNamedT	Parent of object
upf_file	upfStringT	Filename where object was created
upf_line	upfIntegerT	Line number where object was created
upf_creation_scope	upfHdlScopeT	The HDL scope in which the object was created
upf_effective_extents	upfExtentT	The upfExtentT object that points to the first element in the resolved element_list of corresponding UPF command (see 10.6.3.1 for more details)
upf_supply_set_handles	List of upfSupplySetT	The list of supply set handles defined on the object
upf_upper_boundary	List of upfHdlScopeT	The list of HDL scopes forming the upper boundary of this power domain
upf_lower_boundary	List of upfBaseHdlT	The list of HDL objects forming the lower boundary of this power domain
upf_level_shifter_strategies	List of upfLevelShifterStrategyT	The list of level-shifter strategies defined for this power domain
upf_retention_strategies	List of upfRetentionStrategyT	The list of retention strategies defined for this power domain
upf_isolation_strategies	List of upfIsolationStrategyT	The list of isolation strategies defined for the power domain
upf_repeater_strategies	List of upfRepeaterStrategyT	The list of repeater strategies defined for the power domain
upf_pd_states	List of upfPowerStateT	List of states defined on power domain
upf_pd_state_transitions	List of upfPowerStateTransitionT	List of power state transitions defined by `add_state_transition` command
upf_available_supplies	List of upfSupplySetT	List of supply sets that are present in *effective_available_supply_list* (see 6.20)
upf_boundary_supplies	List of upfSupplySetT	List of supply sets that are present in *effective_boundary_supply_list* (see 6.20)
Dynamic property (only available during simulation)		
upf_current_state	upfPowerStateT	The current state of the object during simulation
upf_current_simstate	upfSimstateE	The current simstate of primary supply set of the power domain

11.2.2.6 Property ID

Replace Table 40 with the following table:

upfPropertyIdE				
S. no.	**Property name**	**Base class hierarchy**	**Return type**	**Property ID**
1	upf_parent	upfBaseNamedT	upfBaseNamedT	UPF_PARENT
2	upf_name	upfBaseNamedT	upfStringT	UPF_NAME
3	upf_hdl_attributes	upfBaseHdlT, upfDesignT	List of upfAttributeT	UPF_HDL_ ATTRIBUTES
4	upf_extents	upfBaseHdlT	List of upfExtentT	UPF_EXTENTS
5	upf_cell_info	upfBaseHdlT	upfCellT	UPF_CELL_INFO
6	upf_creation_scope	upfBaseUpfT	upfBaseHdlT	UPF_CREATION _SCOPE
7	upf_line	upfBaseUpfT	upfIntegerT	UPF_LINE
8	upf_file	upfBaseUpfT	upfStringT	UPF_FILE
9	upf_effective _extents	upfExtentClassT	upfExtentT	UPF_EFFECTIVE _EXTENTS
10	upf_supply_ set_handles	upfExtentClassT	List of upfSupplySetT	UPF_SUPPLY_ SET_HANDLES
11	upf_lower_boundary	upfPowerDomainT	List of upfBaseHdlT	UPF_LOWER_ BOUNDARY
12	upf_isolation_ strategies	upfPowerDomainT	List of upfIsolationStrategyT	UPF_ISOLATION _STRATEGIES
13	upf_level_shifter_ strategies	upfPowerDomainT	List of upfLevelShifter StrategyT	UPF_LEVEL_SHIFTER _STRATEGIES
14	upf_pd_states	upfPowerDomainT	List of upfPowerStateT	UPF_PD_STATES
15	upf_pd_state_ transitions	upfPowerDomainT	List of upfPowerStateTransitionT	UPF_PD_STATE_ TRANSITIONS
16	upf_subdomains	upfCompositeDomainT	List of upfBaseUpfT	UPF_SUBDOMAINS
17	upf_repeater_ strategies	upfPowerDomainT	List of upfRepeaterStrategyT	UPF_REPEATER_ STRATEGIES
18	upf_retention_ strategies	upfPowerDomainT	List of upfRetentionStrategyT	UPF_RETENTION_ STRATEGIES
19	upf_current_state	upfPowerDomainT	upfPowerStateT	UPF_CURRENT_STATE
20	upf_functions	upfSupplySetT	List of upfNamedRefT	UPF_FUNCTIONS
21	upf_ss_states	upfSupplySetT	List of upfPowerStateT	UPF_SS_STATES
22	upf_ss_transitions	upfSupplySetT	List of upfPowerStateTransitionT	UPF_SS_ TRANSITIONS
23	upf_equivalent_sets	upfSupplySetT	List of upfSupplySetT	UPF_EQUIVALENT _SETS
24	upf_logic_refs	upfStrategyT	List of upfNamedRefT	UPF_LOGIC_REFS
25	upf_is_no_retention	upfRetentionStrategyT	upfBooleanT	UPF_IS_NO_RETENTION
26	upf_is_use_retention_ as_primary	upfRetentionStrategyT	upfBooleanT	UPF_IS_USE_RETENTION _AS_PRIMARY

upfPropertyIdE				
S. no.	**Property name**	**Base class hierarchy**	**Return type**	**Property ID**
27	upf_restore_ condition	upfRetentionStrategyT	upfExpressionT	UPF_RESTORE_ CONDITION
28	upf_retention_ condition	upfRetentionStrategyT	upfExpressionT	UPF_RETENTION_ CONDITION
29	upf_save_condition	upfRetentionStrategyT	upfExpressionT	UPF_SAVE_CONDITION
30	upf_retention_ parameters	upfRetentionStrategyT	upfRetentionParamE	UPF_RETENTION_ PARAMETERS
31	upf_restore_signal	upfRetentionStrategyT	upfSignalSenseT	UPF_RESTORE_SIGNAL
32	upf_save_signal	upfRetentionStrategyT	upfSignalSenseT	UPF_SAVE_SIGNAL
33	upf_sink_filter	upfBoundaryStrategyT	upfSupplySetT	UPF_SINK_FILTER
34	upf_source_filter	upfBoundaryStrategyT	upfSupplySetT	UPF_SOURCE_FILTER
35	upf_is_use_ equivalence	upfBoundaryStrategyT	upfBooleanT	UPF_IS_USE_ EQUIVALENCE
36	upf_location	upfBoundaryStrategyT	upfLocationE	UPF_LOCATION
37	upf_applies_to	upfBoundaryStrategyT	upfPortDirE	UPF_APPLIES_TO
38	upf_name_prefix	upfBoundaryStrategyT	upfStringT	UPF_NAME_PREFIX
39	upf_name_suffix	upfBoundaryStrategyT	upfStringT	UPF_NAME_SUFFIX
40	upf_clamp_values	upfIsolationStrategyT	List of upfIsolationClampE	UPF_CLAMP_VALUES
41	upf_isolation_ controls	upfIsolationStrategyT	List of upfSignalSenseT	UPF_ISOLATION_ CONTROLS
42	upf_user_clamp_ values	upfIsolationStrategyT	List of upfStringT	UPF_USER_CLAMP _VALUES
43	upf_is_diff_supply _only	upfIsolationStrategyT	upfBooleanT	UPF_IS_DIFF_SUPPLY _ONLY
44	upf_is_force_ isolation	upfIsolationStrategyT	upfBooleanT	UPF_IS_FORCE_ ISOLATION
45	upf_is_no_isolation	upfIsolationStrategyT	upfBooleanT	UPF_IS_NO_ISOLATION
46	upf_is_force_shift	upfLevelShifterStrategyT	upfBooleanT	UPF_IS_FORCE_SHIFT
47	upf_is_no_shift	upfLevelShifterStrategyT	upfBooleanT	UPF_IS_NO_SHIFT
48	upf_level_shift_rule	upfLevelShifterStrategyT	upfLevelShifterRuleE	UPF_LEVEL_SHIFT_RULE
49	upf_threshold_value	upfLevelShifterStrategyT	upfRealT	UPF_THRESHOLD_ VALUE
50	upf_is_illegal	upfStateClassT	upfBooleanT	UPF_IS_ILLEGAL
51	upf_is_active	upfPowerStateT	upfBooleanT	UPF_IS_ACTIVE
52	upf_logic_expr	upfPowerStateT	upfExpressionT	UPF_LOGIC_EXPR
53	upf_supply_expr	upfPowerStateT	upfExpressionT	UPF_SUPPLY_EXPR
54	upf_simstate	upfPowerStateT	upfSimstateE	UPF_SIMSTATE
55	upf_pst_header	upfPowerStateTableT	List of upfBaseNamedT	UPF_PST_HEADER
56	upf_pst_states	upfPowerStateTableT	List of upfPstStateT	UPF_PST_STATES
57	upf_from_states	upfPowerStateTransitionT	List of upfPowerStateT	UPF_FROM_STATES
58	upf_to_states	upfPowerStateTransitionT	List of upfPowerStateT	UPF_TO_STATES
59	upf_switch_expr	upfPowerSwitchStateT	upfExpressionT	UPF_SWITCH_EXPR

upfPropertyIdE				
S. no.	**Property name**	**Base class hierarchy**	**Return type**	**Property ID**
60	upf_input_ supply_port	upfPowerSwitchStateT	upfSupplyPortT	UPF_INPUT_ SUPPLY_PORT
61	upf_switch_ output_state	upfPowerSwitchStateT	upfSupplyStateE	UPF_SWITCH_ OUTPUT_STATE
62	upf_supply_states	upfPstStateT	List of upfSupplyPortStateT	UPF_SUPPLY_STATES
63	upf_volt_max	upfSupplyPortStateT	upfRealT	UPF_VOLT_MAX
64	upf_volt_min	upfSupplyPortStateT	upfRealT	UPF_VOLT_MIN
65	upf_volt_nom	upfSupplyPortStateT	upfRealT	UPF_VOLT_NOM
66	upf_supply_state	upfSupplyPortStateT	upfSupplyStateE	UPF_SUPPLY_STATE
67	upf_volt_kind	upfSupplyPortStateT	upfVoltKindE	UPF_VOLT_KIND
68	upf_network_ attributes	upfNetworkClassT	List of upfAttributeT	UPF_NETWORK_ ATTRIBUTES
69	upf_hdl_ implementation	upfNetworkClassT	upfHdlDeclT	UPF_HDL_ IMPLEMENTATION
70	upf_root_driver	upfNetworkClassT	upfNetworkClassT	UPF_ROOT_DRIVER
71	upf_fanin_conn	upfNetClassT	List of upfPortClassT	UPF_FANIN_CONN
72	upf_fanout_conn	upfNetClassT	List of upfPortClassT	UPF_FANOUT_CONN
73	upf_hiconn	upfPortClassT	List of upfNetworkClassT	UPF_HICONN
74	upf_loconn	upfPortClassT	List of upfNetworkClassT	UPF_LOCONN
75	upf_port_dir	upfPortClassT	upfPortDirE	UPF_PORT_DIR
76	upf_ack_delay	upfAckPortT	upfStringT	UPF_ACK_DELAY
77	upf_ref_object	upfNamedRefT	upfBaseNamedT	UPF_REF_OBJECT
78	upf_ref_kind	upfNamedRefT	upfNamedRefKindE	UPF_REF_KIND
79	upf_ack_ports	upfPowerSwitchT	List of upfAckPortT	UPF_ACK_PORTS
80	upf_control_ports	upfPowerSwitchT	List of upfLogicPortT	UPF_CONTROL_PORTS
81	upf_sw_states	upfPowerSwitchT	List of upfPowerSwitchStateT	UPF_SW_STATES
82	upf_input_supply _ports	upfPowerSwitchT	List of upfSupplyPortT	UPF_INPUT_SUPPLY _PORTS
83	upf_output_supply _port	upfPowerSwitchT	upfSupplyPortT	UPF_OUTPUT_SUPPLY _PORT
84	upf_resolve_type	upfSupplyNetT	upfResolveE	UPF_RESOLVE_TYPE
85	upf_sp_states	upfSupplyPortT	List of upfSupplyPortStateT	UPF_SP_STATES
86	upf_slice_bits	upfHdlMultiBitSliceT	List of upfHdlNetBitT	UPF_SLICE_BITS
87	upf_lsb	upfHdlMultiBitSliceT	upfIntegerT	UPF_LSB
88	upf_msb	upfHdlMultiBitSliceT	upfIntegerT	UPF_MSB
89	upf_normalized_bits	upfHdlPortMultiBitT	List of upfHdlPortBitT	UPF_NORMALIZED_BITS
90	upf_hdl_width	upfHdlPortMultiBitT	upfIntegerT	UPF_HDL_WIDTH
91	upf_items	upfHdlScopeT	List of upfBaseUpfT	UPF_ITEMS
92	upf_hdl_items	upfHdlScopeT	List of upfHdlDeclT	UPF_HDL_ITEMS
93	upf_hdl_ports	upfHdlScopeT	List of upfHdlDeclT	UPF_HDL_PORTS
94	upf_child_instances	upfHdlScopeT	List of upfHdlScopeT	UPF_CHILD_INSTANCES

upfPropertyIdE				
S. no.	**Property name**	**Base class hierarchy**	**Return type**	**Property ID**
95	upf_attr_name	upfAttributeT	upfStringT	UPF_ATTR_NAME
96	upf_attr_value	upfAttributeT	upfStringT	UPF_ATTR_VALUE
97	upf_source_extents	upfCellT	List of upfExtentT	UPF_SOURCE_EXTENTS
98	upf_cell_kind	upfCellT	upfCellKindE	UPF_CELL_KIND
99	upf_cell_origin	upfCellT	upfCellOriginE	UPF_CELL_ORIGIN
100	upf_hdl_cell_kind	upfCellT	upfHdlCellKindE	UPF_HDL_CELL_KIND
101	upf_model_name	upfCellT	upfStringT	UPF_MODEL_NAME
102	upf_expr_operands	upfExpressionT	List of upfBaseNamedT	UPF_EXPR_OPERANDS
103	upf_current_value	upfExpressionT	upfBooleanT	UPF_CURRENT_VALUE
104	upf_expr_string	upfExpressionT	upfStringT	UPF_EXPR_STRING
105	upf_cells	upfExtentT	List of upfBaseHdlT	UPF_CELLS
106	upf_hdl_element	upfExtentT	upfBaseHdlT	UPF_HDL_ELEMENT
107	upf_object	upfExtentT	upfExtentClassT	UPF_OBJECT
108	upf_control_signal	upfSignalSenseT	upfBaseNamedT	UPF_CONTROL_SIGNAL
109	upf_signal_sensitivity	upfSignalSenseT	upfSignalSenseKindE	UPF_SIGNAL_SENSITIVITY
110	upf_voltage	upfSupplyTypeT	upfIntegerT	UPF_VOLTAGE
111	upf_state	upfSupplyTypeT	upfSupplyStateE	UPF_STATE
112	upf_normalized _idx	upfHdlPortBitT, upfHdlNetBitT	upfIntegerT	UPF_NORMALIZED _IDX
113	upf_smallest_ atomic_slice	upfHdlPortBitT, upfHdlNetBitT	upfHdlMultiBitSliceT	UPF_SMALLEST_ ATOMIC_SLICE
114	upf_group_states	upfPowerStateGroupT	List of upfPowerStateT	UPF_GROUP_STATES
115	upf_group_state_ transitions	upfPowerStateGroupT	List of upfPowerStateTransitionT	UPF_GROUP_STATE_ TRANSITIONS
116	upf_for_models	upfPowerModelT	upfStringT	UPF_FOR_MODELS
117	upf_sn_states	upfSupplyNetT	List of upfSupplyPortStateT	UPF_SN_STATES
118	upf_power_expr	upfPowerStateT	upfStringT	UPF_POWER_EXPR
119	upf_correlated_supplies	upfSupplyPortT, upfSupplyNetT	List of upfNetworkClassT	UPF_CORRELATED_ SUPPLIES
120	upf_upper_boundary	upfPowerDomainT	upfHdlScopeT	UPF_UPPER_BOUNDARY
121	upf_next_extent	upfExtentT	upfExtentT	UPF_NEXT_EXTENT
122	upf_available_supplies	upfPowerDomainT	List of upfSupplySetT	UPF_AVAILABLE_SUPPLIES
123	upf_boundary_supplies	upfPowerDomainT	List of upfSupplySetT	UPF_BOUNDARY_SUPPLIES
124	upf_current_simstate	upfPowerDomainT, upfSupplySetT	upfSimstateE	UPF_CURRENT_SIMSTATE
125	upf_power_models	upfDesignT	List of upfPowerModelT	UPF_POWER_MODELS
126	upf_partial_on_ translation	upfDesignT	upfSupplyStateE	UPF_PARTIAL_ON_ TRANSLATION
127	upf_power_domains	upfDesignT, upfHdlScopeT	List of upfPowerDomainT	UPF_POWER_DOMAINS
128	upf_switch_type	upfPowerSwitchT	upfSwitchTypeE	UPF_SWITCH_TYPE
129	upf_applies_to_ boundary	upfBoundaryStrategyT	upfAppliesToBoundaryE	UPF_APPLIES_TO_ BOUNDARY

C.4 Superseded UPF queries

Replace Table C.1 with the following table:

S. no.	Query command	UPF IM property mappings
1	query_associate_supply_set	upf_equivalent_sets property on upfSupplySetT
2	query_bind_checker	-
3	query_cell_instances	find_objects -model, -domain can be achieved by iterating over extent of given domain and then using find_objects -model in that scope
4	query_cell_mapped	upf_cell_info property on upfHdlScopeT
5	query_composite_domain	upfCompositeDomainT
6	query_design_attributes	upf_hdl_attributes property on upfHdlScopeT
7	query_hdl2upf_vct	-
8	query_isolation	upfIsolationStrategyT
9	query_isolation_control	upfIsolationStrategyT
10	query_level_shifter	upfLevelShifterStrategyT
11	query_map_isolation_cell	upf_cells property on upfExtentT
12	query_map_level_shifter_cell	upf_cells property on upfExtentT
13	query_map_power_switch	upf_cells property on upfExtentT
14	query_map_retention_cell	upf_cells property on upfExtentT
15	query_name_format	upf_name_prefix and upf_name_suffix properties on upfIsolationStrategyT, upfLevelShifterStrategyT and upfRepeaterStrategyT
16	query_net_ports	upf_fanin_conn and upf_fanout_conn on upfSupplyNetT and upfLogicNetT
17	query_partial_on_translation	-
18	query_pin_related_supply	-
19	query_port_attributes	upf_hdl_attributes property on upfHdlPortClassT
20	query_port_direction	upf_port_dir property on upfHdlPortClassT
21	query_port_net	upf_hiconn and upf_loconn properties on upfSupplyPortT and upfLogicPortT
22	query_port_state	upf_sp_states property on upfSupplyPortT
23	query_power_domain	upfPowerDomainT
24	query_power_domain_element	upfExtentT, see Figure 16
25	query_power_state	upfPowerStateT
26	query_power_switch	upfPowerSwitchT
27	query_pst	upfPowerStateTableT
28	query_pst_state	upfPstStateT
29	query_retention	upfRetentionStrategyT
30	query_retention_control	upfRetentionStrategyT
31	query_retention_elements	-
32	query_simstate_behavior	-
33	query_state_transition	upfPowerStateTransitionT
34	query_supply_net	upfSupplyNetT
35	query_supply_port	upfSupplyPortT
36	query_supply_set	upfSupplySetT
37	query_upf2hdl_vct	-
38	query_use_interface_cell	upfExtentT, see Figure 16

D.3 Recommendations for replacing deprecated and legacy constructs

Replace Table D.1 with the following table:

Command	Options	Recommended command	Recommended options	Reasons for the recommendation
add_port_state	*port_name* **-state** {*name* <*options*>}	**add_power_state**	*object_name* **-supply_expr** {*boolean_expression*}	**add_power_state** is intended to replace the whole of the PST commands
add_port_state	*port_state* **-state** {*name* <*options*> }	**add_supply_state**	*object_name* **-state** {*name* <*options*>}	Superseded by a more generic function
add_pst_state	*state_name* **-pst** *table_name* **-state** *supply_states*	**add_power_state**	**-state** *state_name* N/A **-supply_expr** {*boolean_expression*}	**add_power_state** is intended to replace the whole of the PST commands
begin_power_model		**define_power_model**		**define_power_model** is intended to replace **begin_power_model** and **end_power_model** commands
create_pst	*table_name* **-supplies** *supply_list*	**add_power_state**	**-state** *state_name* N/A **-supply_expr** {*boolean_expression*}	**add_power_state** is intended to replace the whole of the PST commands
end_power_model		**define_power_model**		**define_power_model** is intended to replace **begin_power_model** and **end_power_model** commands
describe_state_transition	*transition_name* **-object** *object_name* [**-from** *from_list* **-to** *to_list*] [**-paired** {{*from_state to_state*}*}] [**-legal** | **-illegal**]	**add_state_transition**	*object_name* [**-transition** {*transition_name* [**-from** *from_list* **-to** *to_list*] [**-paired** {{*from_state to_state*}*}] [**-legal** | **-***illegal*]}]*	**add_state_transition** is intended to replace **describe_state_transition**
load_upf_protected	*upf_file_name* [**-hide_globals**] [**-scope** *instance_name_list*] [**-params** *param_list*]	**load_upf**	*upf_file_name* [**-hide_globals**] [**-scope** *instance_name_list*] [**-parameters** {{*parameter_name* [*parameter_value*]}*}]	Simplification of **load_upf_protected** and **load_upf**

Command	Options	Recommended command	Recommended options	Reasons for the recommendation
set_domain_supply_net	*domain_name* **-primary_power_net** *net* **-primary_ground_net** *net*	**associate_supply_set**	*supply_set* **-handle** *supply_set_handle* (for both)	Superseded by a a more abstract concept
set_isolation **set_level_shifter** **set_repreater**	**-use_equivalence**	**set_isolation** **set_level_shifter** **set_repreater**	**-use_functional_equivalence**	Renamed for clarity of usage
set_isolation	**-isolation_power_net** *net* **-isolation_ground_net** *net*	**set_isolation**	**-isolation_supply** *supply_set_list* (for both)	Superseded by a more abstract concept
set_retention	**-retention_power_net** *net* **-retention_ground_net** *net*	**set_retention**	**-retention_supply** *ret_supply_set* (for both)	Superseded by a more abstract concept