



**POWERFACTORY**

# PowerFactory 2021

## Technical Reference

### Recloser Block

RelRecI, TypRecI

PF2021

**POWER SYSTEM SOLUTIONS**  
MADE IN GERMANY

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## 1 General Description

The recloser block has the ability to reclose the breaker after a trip and activate/deactivate the associated protective blocks after each operation.

The recloser block allows modelling the reclosing feature of the distance protections, of the overcurrent relays and of the distribution recloser devices. Such high flexibility is implemented using different recloser types.

It's possible to define up to 5 different reclosing times and up to 16 *rules* to activate/deactivate the protective blocks during the different recloser operations.

## 2 Using the block

The recloser type class name is *TypRecI*; the recloser element class name is *RelRecI*.

The recloser block must be used together with the normal protective blocks which must be connected through the *C* input signal to the block output signals of recloser. In this way the recloser can be programmed to block some of the protective blocks accordingly with the protective device characteristic and settings.

To control the breaker the recloser block must be connected through the *Close* output signal to a Logic block having the Breaker Event property set equal to *Close*.

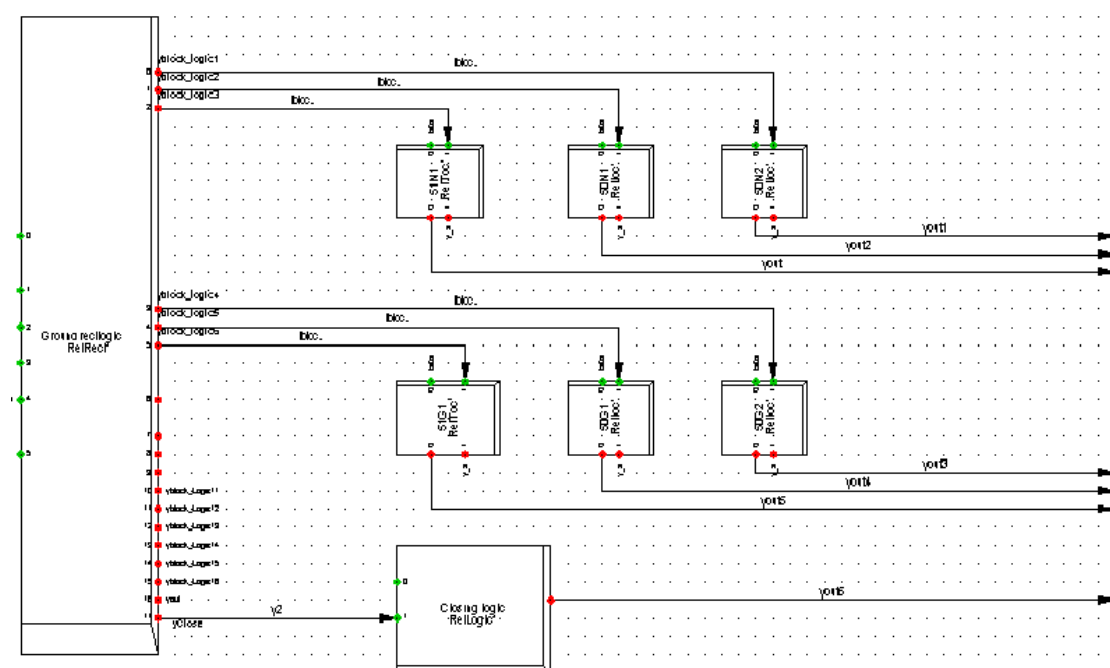


Figure 2.1: Connection of the recloser block in the block definition diagram

More than one recloser block can be used in the same the block definition, it's useful if the device implement different reclosing logic for the phase and the ground protective elements. In this case the recloser blocks must be aware of the presence of the other recloser blocks using the *prefblock* variable in the recloser type dialogic. A circular loop of references must be created.

If *Toc* or *Ioc* protective blocks are connected to a Recloser block in their type dialogue the Reclosing type must be set *Normal* or *Lockout*; the *none* value inhibits the recloser operation.

If the block definition of the device, whose the recloser block is part, is already too much complicate it would be helpful adding the recloser connections to another layer and in the way to be able to hide them whenever they aren't useful to understand the device logic diagram. The recloser block can be also used to open/close the breaker: setting *CloseCommand* equal to 1 the associated breaker will be closed and if it's available the *ColdLoad* feature will be activated; setting *OpenCommand* equal to 1 the associated breaker will be open.

For testing purposes is possible to set the current operation number using the *starttimeframe* block parameter.



### 3 Available recloser types

The recloser type is set using the *recloser Type* parameter in the Recloser type dialogue.

8 different types of recloser are available:

- Cooper Power Systems Form 4C
- Cooper Power Systems Form 5
- Cooper Power Systems FX-FXA-FXB
- Cooper Power Systems SEF reclosing logic
- Schweitzer reclosing logic
- Standard
- Standard 3 phases
- Standard for Impedance relays

Due to wide range of different recloser model available in the market the recloser element dialogue is not showing a *Reclosing Time* input control if the relevant range definition input control in the recloser type dialogue is void. In this way the user can configure the number of available *Reclosing Time* simply not filling the relevant control in the recloser type dialogue.

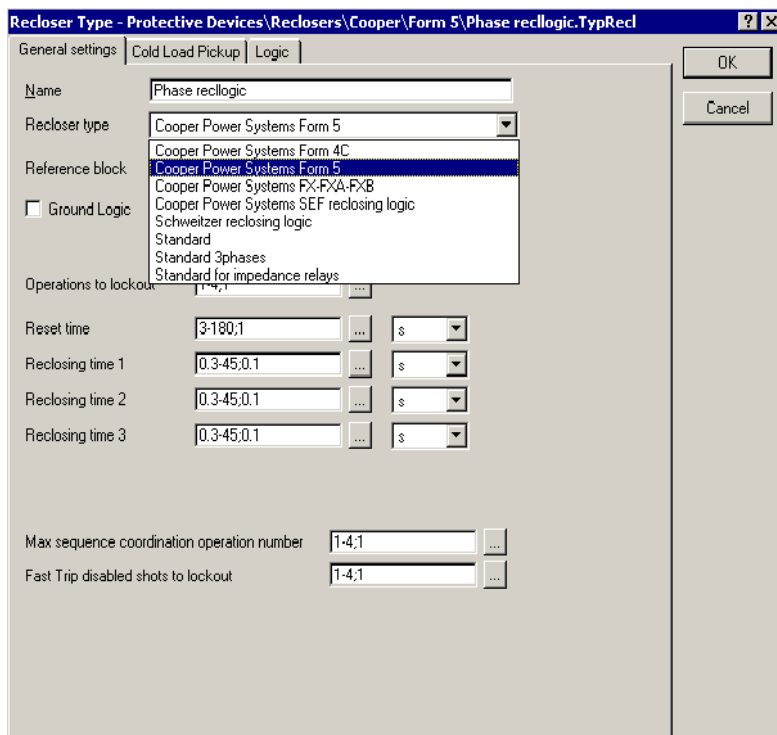


Figure 3.1: The recloser type dialogue

### 3.1 Cooper Power Systems Form 4C

It fully supports the Cooper Power Systems Form 4C distribution recloser: it includes the *Sequence Coordination* and the *Ground Trip Precedence*. It's possible to define the number of operations using TCC1, the number of operations before the lockout, the reclosing times after each operation (up to 3) and the recloser reset time. It's possible to activate/deactivate each High Current element and each High Current to Lockout element during each operation. The ground recloser block allows defining a max number of operations of the Sensitive Earth Fault block before the lockout.

### 3.2 Cooper Power Systems Form 5

It fully supports the Cooper Power Systems Form 5 distribution recloser except the Sensitive Earth Fault reclosing features which are supported by a different recloser type: it includes the *Sequence Coordination*, the *Cold load* feature, the *Fast Trips disabled* feature and the *Ground Trip Precedence*. The *Sequence Coordination* can be inhibited after a given number of operations and it's possible to define a different of operations before the lockout when the *Fast Trips disabled* feature is enabled. The *Cold load* page allows defining an *Activation time* of the feature after that the breaker as been closed (during such time only the relevant Cold Load TCC is activated), an independent number of trip before lockout and an independent reclosing time. Besides that features it's possible to define the number of operations before the lockout, the reclosing time after each operation (up to 3) and the recloser reset time. It's possible to activate/deactivate each High Current element and each High Current to Lockout element during each operation. Four independent TCCs for phase and four for the ground protection can be controlled independently. Three different operation modes are available: *Three phase trip - Three phase lockout*, *Single phase trip - Three phase lockout* and *Single phase trip - Single phase lockout*.

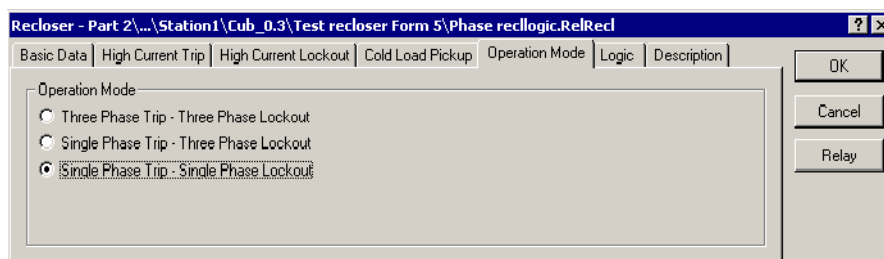


Figure 3.2: The recloser *Operation Mode* page

### 3.3 Cooper Power Systems FX-FXA-FXB

It fully supports the Cooper Power Systems Form FX, FXA and FXB distribution recloser: it includes the *Sequence Coordination* and the *Ground Trip Precedence*. The *Cold load* page allows defining an *Activation time* of the feature after that the breaker as been closed (during such time only the relevant Cold Load TCC is activated), an independent number of trip before lockout. Besides that features it's possible to define the number of operations before the lockout, the reclosing time after each operation (up to 3) and the recloser reset time. It's possible to activate/deactivate each High Current element and each High Current to Lockout element during each operation. Four independent TCCs for phase and four for the ground protection can be controlled independently.



### 3.4 Cooper Power Systems SEF reclosing logic

It fully supports the Cooper Power Systems Form5 Sensitive Earth Fault Logic feature: it's possible to define the number of operations before the lockout, the reclosing time after each operation (up to 3) and the element reset time.

### 3.5 Schweitzer reclosing logic

This recloser type aim to reproduce the reclosing logic available in the Schweitzer (SEL) protective devices: it's possible to define the number of operations before the lockout, the reclosing time after each operation (up to 4) and the element reset time. The *Sequence Coordination* feature is available as well. The block core is located in the *Logic* tab page where, using a matrix, up to 16 rules can be defined to activate/deactivate the protective blocks accordingly with the current operation number. The number of rows of the matrix is equal to the number of *Operations to lockout* defined in the dialogue *Basic Data* page. The labels on the left of the matrix naming each rule can be inserted in the *Logic* page of the recloser type dialogue

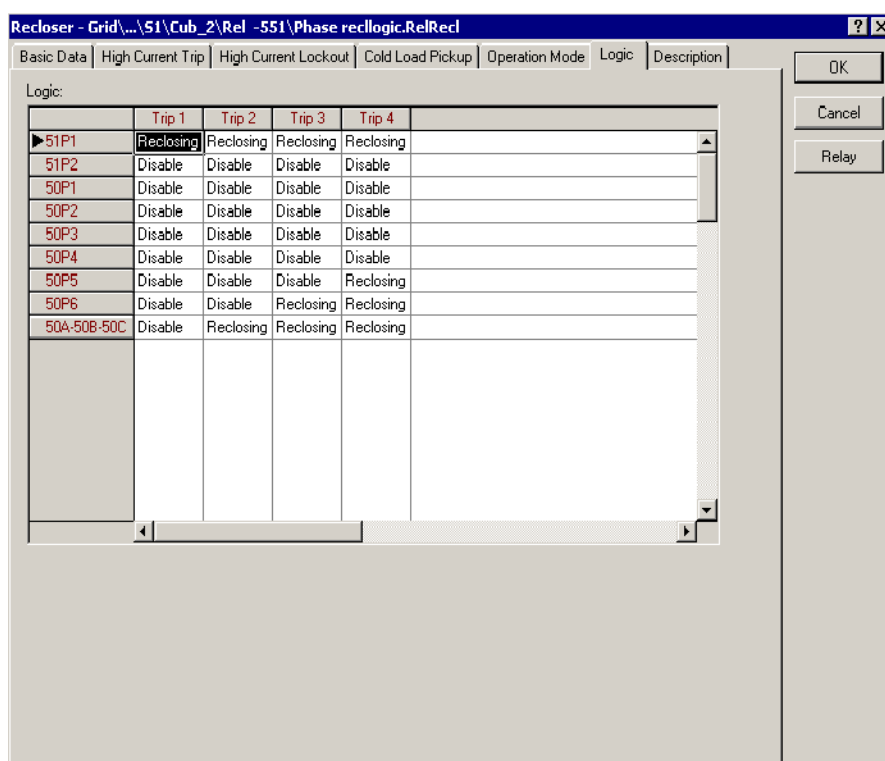


Figure 3.3: The *Logic* page

### 3.6 Standard

It's a standard reclosing type aiming to support a wide range of commercially available reclosing features: it's possible to define the number of operations before the lockout, the reclosing time after each operation (up to 5), the element reset time and the duration of the closing command sent to the breaker. The *Logic* page is available as well.

### 3.7 Standard 3 phase

It's a standard reclosing type aiming to support a wide range of commercially available reclosing features: it has the same features of the *Standard* recloser plus the ability to define the trip/reclosing logic accordingly with the rules defined in the *operation mode* page: such rules allow defining if, depending upon the type of fault, the trip can be a single phase trip and if the reclosing process is started after the trip.

### 3.8 Standard for Impedance relays

It's a standard reclosing type for the impedance devices aiming to support a wide range of reclosing features available in the distance protections. It's possible to define the number of operations before the lockout, the reclosing time after each operation (up to 5), the element reset time and the duration of the closing command sent to the breaker. It's also possible to set the reclosing time after the first operation if such operation is a single phase trip. The Logic page is available as well as the ability to define the trip/reclosing logic accordingly with the rules defined in the *operation mode* page. This logic is based on the info coming from the trip elements or, if the signal is connected, on the value of the *wfaulttype* signal (usually coming from the distance protection starting element).

## 4 Input Parameters definition

### 4.1 RecloserType (*TypRecloser*)

Parameter	Description	Unit
Prefblock	Pointer to another recloser block. It's must filled if more than one reclosing block is used in the same block definition diagram (i.e. for the CPS reclosers).	
Groundlogic	Flag defining if the recloser unit block is a phase or a ground unit	Y/N
RTCC1op	Range of the number of operations using TCC1 as tripping characteristic (CPS Form 4C only)	
Roplockout	Range of the number of operations before the lockout	
Rresettime	Range of the recloser reset time	s
Recltime1	Range of the reclosing time after the first operation	s
Recltime11ph	Range of the reclosing time after the first operation for single phase faults (impedance device recloser only)	s
Recltime2	Range of the reclosing time after the second operation	s
Recltime3	Range of the reclosing time after the third operation	s
Recltime4	Range of the reclosing time after the 4th operation	s
Recltime5	Range of the reclosing time after the 5th operation	s
Rclosingcomtime	Range of the duration of the closing time (impedance relay only)	s
Rmaxseqcpsno	Range of the maximum number of operations during which the sequence coordination is active (CPS Form 5 only)	
Rfasttripdislock	Range of the maximum number of operation before lockout when the fasttrips are disabled (CPS Form 5 only)	
RSEFtriptolock	Range of the maximum number of operation of the Sensitive Earth Fault element (CPS Form 4C)	
Rclactivationt	Range of the Cold Load Element activation time (CPS Form 5 and FX-FXA-FXB)	s
Rcltripstolockout	Range of the Cold Load Element number of operations before lockout (CPS Form 5 and FX-FXA-FXB)	
Rclrecloseinterval	Range of the Cold Load Element reclosing Interval (CPS Form 5 only)	s
Rresettimeunit	Unit of the range of the recloser reset time	(s/cycles)
Rclosingcomtimeunit	Unit of the range of the duration of the closing time (impedance relay only)	(s/cycles)
Recltime1unit	Unit of the range of the reclosing time after the first operation	(s/cycles)

Parameter	Description	Unit
Rrecltime11phunit	Unit of the range of the reclosing time after the first operation for single phase faults (impedance device recloser only)	(s/cycles)
Rrecltime2unit	Unit of the range of the reclosing time after the second operation	(s/cycles)
Rrecltime3unit	Unit of the range of the reclosing time after the third operation	(s/cycles)
Rrecltime4unit	Unit of the range of the reclosing time after the 4th operation	(s/cycles)
Rrecltime5unit	Unit of the range of the reclosing time after the 5th operation	(s/cycles)
Rclactivationtunit	Unit of the range of the Cold Load Element activation time (CPS Form 5 and FX-FXA-FXB)	(s/cycles)
Rclrecloseintervalunit	Unit of the range of the Cold Load Element reclosing Interval (CPS Form 5 only)	(s/cycles)

## 4.2 RecloserElement (*RelRecloser*)

Parameter	Description	Unit
Reclnotactive	Flag to enable/disable the recloser operations	Y/N
Grtripblock	Flag to enable/disable the ground operations (ground recloser only)	Y/N
SEFtripblock	Flag to enable/disable the Sensitive Earth Fault Element	Y/N
TCC1op	Number of operations using TCC1 as tripping characteristic (CPS Form 4C only)	
Oplockout	Number of operations before the lockout	
Resettime	Recloser reset time	s
Recltime1	Reclosing time after the first operation	s
Recltime11ph	Reclosing time after the first operation for single phase faults (impedance device recloser only)	s
Recltime2	Reclosing time after the second operation	s
Recltime3	Reclosing time after the third operation	s
Recltime4	Reclosing time after the 4th operation	s
Recltime5	Reclosing time after the 5th operation	s
Closingcomtime	Duration of the closing time (impedance relay only)	s
Seqaccessory	Flag to enable/disable the sequence accessory features	Y/N
Maxseqcpsno	Maximum number of operations during which the sequence coordination is active (CPS Form 5 only)	
Groundtripprec	Flag to enable/disable the ground trip precedence feature	Y/N
Fasttripdisabl	Flag to enable/disable the Fast trip disabled feature	Y/N
Fasttripdislock	Maximum number of operation before lockout when the fasttrips are disabled (CPS Form 5 only)	

Parameter	Description	Unit
SEFtriptolock	Maximum number of operation of the Sensitive Earth Fault element (CPS Form 4C)	
Clenable	Flag to enable/disable the Cold Load feature	Y/N
Clactivationt	Cold Load Element activation time (CPS Form 5 and FX-FXA-FXB)	s
Cltripstolockout	Cold Load Element number of operations before lockout (CPS Form 5 and FX-FXA-FXB)	
Clrecloseinterval	Cold Load Element reclosing Interval (CPS Form 5 only)	s
Hctrip1enable	Flag to enable/disable the high current element during the first operation (CPS reclosers only)	Y/N
Hctrip2enable	Flag to enable/disable the high current element during the second operation (CPS reclosers only)	Y/N
Hctrip3enable	Flag to enable/disable the high current element during the third operation (CPS reclosers only)	Y/N
Hctrip4enable	Flag to enable/disable the high current element during the 4th operation (CPS reclosers only)	Y/N
Hctrip5enable	Flag to enable/disable the high current element during the 5th operation (CPS reclosers only)	Y/N
hcl1active	Flag to enable/disable the high current to lockout element during the first operation (CPS reclosers only)	Y/N
hcl2active	Flag to enable/disable the high current to lockout element during the second operation (CPS reclosers only)	Y/N
hcl3active	Flag to enable/disable the high current to lockout element during the third operation (CPS reclosers only)	Y/N
hcl4active	Flag to enable/disable the high current to lockout element during the 4th operation (CPS reclosers only)	Y/N
Operationmode	<p>Recloser Operation mode; if the recloser type is <i>CPS Form 5</i> it can be <i>Three Phase Trip - Three Phase Lockout</i> or <i>Single Phase Trip - Three Phase Lockout</i> or <i>Single Phase Trip - Single Phase Lockout</i>.</p> <p>If the recloser type is <i>Standard for Impedance relays</i> it can be <i>3-pole auto reclosing for all types of faults</i> or <i>1-pole auto reclosing for 1 phase faults, no reclosing for multi-phase faults</i> or <i>1-pole auto reclosing for 1 phase faults and for 2-phases faults without earth, no reclosing for multi-phase faults</i> or <i>1-pole auto reclosing for 1 phase and 3 pole auto reclosing for multi-phase faults</i> or <i>1-pole auto reclosing for 1 phase faults and for 2-phases faults without earth, 3-pole auto reclosing for other faults</i></p>	
Starttimeframe	Parameter allowing to set the recloser current operation	

Parameter	Description	Unit
llogic	Matrix containing the rules to enable/disable the associated protective blocks during each recloser operation	

## 5 Input/output Signals definition

Input Signal	Description	Unit
wphase_start	Phase element start signal	
wphase_start_A	Phase A element start signal	
wphase_start_B	Phase B element start signal	
wphase_start_C	Phase C element start signal	
wground_start	Ground element start signal	
wground_start_A	Ground A element start signal	
wground_start_B	Ground B element start signal	
wground_start_C	Ground C element start signal	
wfaulttype	The Fault type id (ABC = 1, AG=2, BG=3, CG=4, AB=5, BC=6, CA=7, ABG=8, BCG=9, CAG=10)	
wOverMinI	Current present flag	
wOverMinI_A	Current phase A present flag	
wOverMinI_B	Current phase B present flag	
wOverMinI_C	Current phase C present flag	

Output Signal	Description	Unit
yblock_TOC1	TOC1 block signal	
yblock_TOC1_A	TOC1 Phase A block signal	
yblock_TOC1_B	TOC1 Phase B block signal	
yblock_TOC1_C	TOC1 Phase C block signal	
yblock_TOC2	TOC2 block signal	
yblock_TOC2_A	TOC2 Phase A block signal	
yblock_TOC2_B	TOC2 Phase B block signal	
yblock_TOC2_C	TOC2 Phase C block signal	
yblock_TOC3	TOC3 block signal	
yblock_TOC3_A	TOC3 Phase A block signal	
yblock_TOC3_B	TOC3 Phase B block signal	
yblock_TOC3_C	TOC3 Phase C block signal	
yblock_TOC4	TOC4 block signal	
yblock_TOC4_A	TOC4 Phase A block signal	
yblock_TOC4_B	TOC4 Phase B block signal	
yblock_TOC4_C	TOC4 Phase C block signal	
yblock_TOC5	TOC5 block signal	
yblock_TOC5_A	TOC5 Phase A block signal	
yblock_TOC5_B	TOC5 Phase B block signal	
yblock_TOC5_C	TOC5 Phase C block signal	
yblock_CLTOC	Cold Load TOC block signal	
yblock_CLTOC_A	Cold Load TOC Phase A block signal	
yblock_CLTOC_B	Cold Load TOC Phase B block signal	
yblock_CLTOC_C	Cold Load TOC Phase C block signal	
yblock_FTDTOC	Fast Trip disabled TOC block signal	

Output Signal	Description	Unit
yblock_FTDTOC_A	Fast Trip disabled TOC Phase A block signal	
yblock_FTDTOC_B	Fast Trip disabled TOC Phase B block signal	
yblock_FTDTOC_C	Fast Trip disabled TOC Phase C block signal	
yblock_HClockout	High current block signal	
yblock_Hclockout_A	High current Phase A block signal	
yblock_Hclockout_B	High current Phase B block signal	
yblock_Hclockout_C	High current Phase C block signal	
yblock_Hclockout1	High current 1 block signal (Form 5 only)	
yblock_Hclockout1_A	High current 1 Phase A block signal(Form 5 only)	
yblock_Hclockout1_B	High current 1Phase B block signal(Form 5 only)	
yblock_Hclockout1_C	High current 1 Phase C block signal(Form 5 only)	
yblock_Hclockout2	High current 2 block signal (Form 5 only)	
yblock_Hclockout2_A	High current 2 Phase A block signal(Form 5 only)	
yblock_Hclockout2_B	High current 2Phase B block signal(Form 5 only)	
yblock_Hclockout2_C	High current 2 Phase C block signal(Form 5 only)	
yblock_Hclockout3	High current 3 block signal (Form 5 only)	
yblock_Hclockout3_A	High current 3 Phase A block signal(Form 5 only)	
yblock_Hclockout3_B	High current 3Phase B block signal(Form 5 only)	
yblock_Hclockout3_C	High current 3 Phase C block signal(Form 5 only)	
yblock_HC	High Current block signal	
yblock_HC_A	High Current Phase A block signal	
yblock_HC_B	High Current Phase B block signal	
yblock_HC_C	High Current Phase C block signal	
yblock_SEFTOC	Sensitive Earth Fault block signal	
yblock_Logic1	Block output associated to Logic1	
yblock_Logic2	Block output associated to Logic2	
yblock_Logic3	Block output associated to Logic3	
yblock_Logic4	Block output associated to Logic4	
yblock_Logic5	Block output associated to Logic5	
yblock_Logic6	Block output associated to Logic6	
yblock_Logic7	Block output associated to Logic7	
yblock_Logic8	Block output associated to Logic8	
yblock_Logic9	Block output associated to Logic9	
yblock_Logic10	Block output associated to Logic10	
yblock_Logic11	Block output associated to Logic11	
yblock_Logic12	Block output associated to Logic12	
yblock_Logic13	Block output associated to Logic13	
yblock_Logic14	Block output associated to Logic14	
yblock_Logic15	Block output associated to Logic15	
yblock_Logic16	Block output associated to Logic16	
yout	Trip signal	
yout_A	Phase A Trip signal	
yout_B	Phase B Trip signal	



Output Signal	Description	Unit
yout_C	Phase C Trip signal	