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Protection Relay

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Protection functions

Parameters and recorded values



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1 Distance protection Z< (ANSI 21)

Table 1.1: Parameter of the short-circuit distance Z< (21)

Parameter	Value	Unit	Default	Description
X	0.05 – 250.00	ohm	0.80	X setting
R	0.05 – 250.00	ohm	0.80	R setting
MODE	Reverse/Forward/ Undirectional		Forward	Direction mode
t<	0.04 – 300.00	S		Operation delay
LOAD BLOCK	No/Yes		Yes	Load block in use
Common parameters for all zones				
LoadAngle	10 – 40	°	40	Load angle β
LoadR	0.05 – 250.00	ohm	1.00	Load resistance

Table 1.2: Parameters of the earth-fault distance Ze< (21N)

Parameter	Value	Unit	Default	Description
X	0.05 – 250.00	ohm	0.80	X setting
R	0.05 – 250.00	ohm	0.80	R setting
MODE	Reverse/Forward/ Undirectional		Forward	Direction mode
t<	0.04 – 300.00	s		Operation delay
LOAD BLOCK	No/Yes		Yes	Load block in use
Io min input	Io; IoCalc	-	Io	Io input in use for minimum I_0 current
Io min	0.005 – 8.000 (20.000 for IoCalc)	pu	0.050	Minimum Io current for trip
Common parameters for all zones				
LoadAngle	10 – 40	°	40	Load angle β
LoadR	0.05 – 250.00	ohm	1.00	Load resistance
Common parameters for all earth fault zones				
ko	0.00 – 10.00		0.00	Earth factor
φ (ko)	-60 – 60	°	10	Earth factor angle

2 Underimpedance (ANSI 21G)

Table 2.1: Parameters of the underimpedance stages Z<, Z<< (21G)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
TripTime		s	Estimated time to trip	
SCntr			Cumulative start counter	Clr
TCntr			Cumulative trip counter	Clr
SetGrp	1 or 2		Active setting group	Set
SGrpDI	- DIx VIx LEDx VOx		Digital signal to select the active setting group None Digital input Virtual input LED indicator signal Virtual output	Set
Force	Off On		Force flag to enable protection stage activation.	Set
Z		ohm	The supervised value scaled to primary value. "Inf" = infinite	
Z		xZn	The supervised value scaled to per unit (pu). $1 \text{ pu} = 1xZ_N = U_{GN}/(\sqrt{3} \times I_{GN})$. "Inf" = infinite	
Z<, Z<<		ohm	Start value scaled to primary value	
Z<, Z<<		xZn	Start setting in per unit (pu). $1 \text{ pu} = 1xZ_N = U_{GN}/(\sqrt{3} \times I_{GN})$.	Set
t<		s	Definite operation time.	Set
U1		V	Measured value of positive sequence voltage U_1	
I1		A	Measured value of positive sequence current I_1	

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 2.2: Recorded values of the underimpedance stages Z<, Z<< (21G)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		Zn	Minimum fault impedance
EDly		%	Elapsed time of the operating time setting. 100% = trip
SetGrp	1 2		Active setting group during fault

3 Volts/hertz over-excitation stage (ANSI 24)

Table 3.1: Parameters of the volts/hertz overexcitation stage $U_{f>}$, $U_{f>>}$ (24)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr			Cumulative start counter	C
TCntr			Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI	- DIx VIx LEDx VOx		Digital signal to select the active setting group None Digital input Virtual input LED indicator signal Virtual output	Set
Force	Off On		Force flag to enable protection stage activation	Set
Umax		V	The supervised value. Max. of U12, U23 and U31	
f		Hz	The supervised frequency value	
U/f		%	Calculated U_{MAX}/f	
$U_{f>}$, $U_{f>>}$		%	Start setting	Set
$t_{>}$, $t_{>>}$		s	Definite operate time	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 3.2: Recorded values of the volts/hertz over-excitation stage $U_{f>}$, $U_{f>>}$ (24)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		%	Fault value V/Hz
U		% Un	Fault voltage
f		Hz	Fault frequency
EDly		%	Elapsed time of the operating time setting. 100% = trip
SetGrp	1, 2, 3, 4		Active setting group during fault

4 Synchrocheck (ANSI 25)

Table 4.1: Setting parameters of synchrocheck stages SyC1, SyC2 (25)

Parameter	Value	Unit	Default	Description
Side	U12/U12y; U12/U12z; U12y/U12z	-	U12/U12z	Voltage selection. The stage 1 has fixed voltages U12/U12y.
CBObj	Obj1 – Obj6	-	Obj1	The selected object for circuit breaker (CB) control. The synchrocheck closing command will use the closing command of the selected object.
CBObj2	Obj1 – Obj6	-	Obj2	The selected object for CB control. The synchrocheck closing command uses the closing command of the selected object.
ObjSel	Digital inputs	-	-	Input for selecting between CBObj1 and CBObj2. When active CBObj2 is in use
Smode	Async; Sync; Off	-	Sync	Synchrocheck mode. Off = only voltage check Async = the function checks dU, df and dangle. Furthermore, the frequency slip, df, determines the remaining time for closing. This time must be longer than “CB time”. Sync mode = Synchronization is tried to make exactly when angle difference is zero. In this mode, df-setting should be small enough (<0.3Hz).
Umode	-, DD, DL, LD, DD/DL, DD/LD, DL/LD, DD/DL/LD	-	-	Voltage check mode: The first letter refers to the reference voltage and the second letter refers to the comparison voltage. D means that the side must be “dead” when closing (dead = The voltage below the dead voltage limit setting) L means that the side must be “live” when closing (live = The voltage higher than the live voltage limit setting) Example: DL mode for stage 1: The U12 side must be “dead” and the U12y side must be “live”.
Cbtime	0.04 – 0.6	s	0.1	Typical closing time of the CB.
Dibypass	Digital inputs	-	-	Bypass input. If the input is active, the function is bypassed.
Bypass	0; 1	-	0	The bypass status. “1” means that the function is bypassed. This parameter can also be used for manual bypass.
CBCtrl	Open;Close	-	-	CB control
ShowInfo	Off; On	-	On	Additional information display about the synchrocheck status to the mimic display.
SGrpDI	Digital inputs	-	-	The input for changing the setting group.
SetGrp	1, 2, 3, 4	-	1	The active setting group.

Table 4.2: Measured and recorded values of synchrocheck stages SyC1, SyC2 (25)

	Parameter	Value	Unit	Description
Measured values	df	-	Hz	Measured frequency difference
	dU	-	% Un / deg	Measured voltage amplitude and phase angle difference
	UState	-	-	Voltage status (e.g. DD)
	SState	-	-	Synchrocheck status
	ReqTime	-	-	Request time status
	f ¹⁾	-	Hz	Measured frequency (reference side)
	f _y ¹⁾	-	Hz	Measured frequency (comparison side)
	U ₁₂ ¹⁾	-	% Un	Measured voltage (reference side)
	U _{12y} ¹⁾	-	% Un	Measured voltage (comparison side)
Recorded values	ReqCntr	qty	-	Request counter
	SyncCntr	qty	-	Synchronising counter
	FailCntr	qty	-	Fail counter
	f ¹⁾	-	Hz	Recorded frequency (reference side)
	f _y ¹⁾	-	Hz	Recorded frequency (comparison side)
	U ₁₂ ¹⁾	-	% Un	Recorded voltage (reference side)
	U _{12y} ¹⁾	-	% Un	Recorded voltage (comparison side)
	dAng	-	Deg	Recorded phase angle difference when close command is given from the function
	dAngC	-	Deg	Recorded phase angle difference when the circuit-breaker actually closes.
EDly	-	%	The elapsed time compared to the set request timeout setting, 100% = timeout	

1) the labels (parameter names) change according to the voltage selection.

5 Undervoltage (ANSI 27)

Table 5.1: Parameters of the under voltage stages $U<$, $U<<$, $U<<<$ (27)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr		qty	Cumulative start counter	C
TCntr		qty	Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Force	Off On		Force flag to enable protection stage activation	Set
MinU		V	The supervised minimum of line-to-line voltages in primary volts	
$U<$, $U<<$, $U<<<$		V	Start value scaled to primary value	
$U<$, $U<<$, $U<<<$		% U_N	Start value scaled to primary value	Set
$t<$, $t<<$, $t<<<$		S	Definite operate time	Set
LVBlk		% U_N	Low limit for self blocking	Set
RlsDly		S	Release delay ($U<$ stage only)	Set
Hyster	Default 3.0 %	%	Dead band setting	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 5.2: Recorded values of the undervoltage stages (8 last faults) $U<$, $U<<$, $U<<<$ (27)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		% U_N	Minimum fault voltage
EDly		%	Elapsed time of the operate time setting. 100% = trip
PreFlt		% U_N	Supervised value before fault, 1 s average value.
SetGrp	1, 2, 3, 4		Active setting group during fault

6 Positive sequence under voltage (ANSI 27P)

Table 6.1: Parameters of the positive sequence under voltage stages $U_{1<}$, $U_{1<<}$ (27P)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr			Cumulative start counter	C
TCntr			Cumulative trip counter	C
SetGrp	1 or 2		Active setting group	Set
SGrpDI	- DIx VIx LEDx VOx		Digital signal to select the active setting group None Digital input Virtual input LED indicator signal Virtual output	Set
Force	Off On		Force flag for status forcing for test purposes. This is a common flag for all stages and digital outputs, too. Automatically reset by a 5-minute timeout.	Set
U1		V	The supervised positive sequence voltage in primary volts	
U1		%	The supervised positive sequence voltage of $U_N/\sqrt{3}$	
U1<, U1<<		V	Start value scaled to primary value	
U1<, U1<<		%	Start setting of $U_N/\sqrt{3}$	Set
t<, t<<		s	Definite operate time	Set
LVBlk		% U_N	Low limit for selfblocking. This is a common setting for both stages.	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 6.2: Recorded values of the positive sequence under voltages (8 last faults) $U_{1<}$, $U_{1<<}$ (27P)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		% U_N	Minimum fault voltage
EDly		%	Elapsed time of the operating time setting. 100% = trip
SetGrp	1 2		Active setting group during fault

7 Directional power (ANSI 32)

Table 7.1: Setting parameters of P< and P<< stages (32)

Parameter	Value	Unit	Default	Description
P<, P<<	-200.0 – +200.0	%Sn	-4.0 (P<), -20.0(P<<)	P<, P<< start setting
t<	0.3 – 300.0	s	1.0	P<, P<< operational delay
S_On	Enabled; Disabled	-	Enabled	Start on event
S_Off	Enabled; Disabled	-	Enabled	Start off event
T_On	Enabled; Disabled	-	Enabled	Trip on event
T_Off	Enabled; Disabled	-	Enabled	Trip off event

Table 7.2: Measured and recorded values of P< and P<< stages (32)

	Parameter	Value	Unit	Description
Measured value	P		kW	Active power
Recorded values	SCntr		qty	Start counter (Start) reading
	TCntr		qty	Trip counter (Trip) reading
	Flt		%S _N	Max value of fault
	EDly		%	Elapsed time as compared to the set operate time, 100% = tripping

8 Phase undercurrent (ANSI 37)

Table 8.1: Parameters of the phase undercurrent stage I< (37)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr		qty	Start counter (Start) reading	C
TCntr		qty	Trip counter (Trip) reading	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
Force	Off On		Force flag to enable protection stage activation	Set
ILmin		A	Min. value of phase currents IL1, IL2, IL3 in primary value	
Status			Status of protection stage	
I<		A	Start detection current scaled to primary value, calculated by relay	
I<		%I _N or %I _{MOT}	Setting value in percentage of I _n or I _{mot}	
t<		s	Operate time delay [s]	
NoCmp		%I _N or %I _{MOT}	Block limit	
NoCmp		60 A	Block limit scaled to primary value, calculated by relay	
Log			Start and trip time	
Type	1-N 2-N 3-N		Phase 1 - ground fault Phase 2 - ground fault Phase 3 - ground fault	
	1-2 2-3 1-3		Two-phase fault (Phase 1 - Phase 2) Two-phase fault (Phase 3 - Phase 3) Two-phase fault (Phase 1 - Phase 3)	
	1-2-3		Three phase fault (Phase 1 - Phase 2 - Phase 3)	
Flt		xI _N or xI _{MOT}	Min. value of fault current as per times I _{mot}	
Load		xI _N or xI _{MOT}	1s mean value of pre-fault currents IL1—IL3	
Edly		%	Elapsed time as compared to the set operate time, 100% = tripping	

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

9 Loss of field (ANSI 40)

Table 9.1: Parameters of the loss of field stage (40)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
TripTime		s	Estimated time to trip	
SCntr			Cumulative start counter	Clr
TCntr			Cumulative trip counter	Clr
SetGrp	1 or 2		Active setting group	Set
SGrpDI	- DIx VIx LEDx VOx		Digital signal to select the active setting group None Digital input Virtual input LED indicator signal Virtual output	Set
Force	Off On		Force flag for status forcing for test purposes. This is a common flag for all stages and output relays, too. Automatically reset by a 5-minute timeout.	Set
P		%Sgn	The supervised active power value	
Q		%Sgn	The supervised reactive power value	
Q@P0%		%Sgn kvar	Setting 1	Set
Q@P80%		%Sgn kvar	Setting 2	Set
t<		s	Definite operate time	Set
RlsDly		s	Release delay for power swing	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 9.2: Recorded values of the loss of field stage (40)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
P		%Sgn	Active fault power
Q		%Sgn	Reactive fault power
EDly		%	Elapsed time of the operate time setting. 100 % = trip
SetGrp	1 2		Active setting group during fault

10 Under-reactance (21/40)

Table 10.1: Parameters of the under-reactance stages X<, X<< (40)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
TripTime		s	Estimated time to trip	
SCntr			Cumulative start counter	Clr
TCntr			Cumulative trip counter	Clr
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI	- DIx VIx LEDx VOx		Digital signal to select the active setting group None Digital input Virtual input LED indicator signal Virtual output	Set
Force	Off On		Force flag to enable protection stage activation	Set
Z		ohm	The supervised value scaled to primary value. "Inf" = infinite	
Z		xZ_N	The supervised value scaled to per unit (pu) $1 \text{ pu} = 1xZ_N = UGN/(\sqrt{3} \times I_{GN})$ "Inf" = infinite	
Z ϕ		$^\circ$	Angle of the supervised impedance	
X<; X<<		ohm	Start value scaled to primary value	
X<; X<<		xZ_N	Start setting per unit (pu) $1 \text{ pu} = 1xZ_N = UGN/(\sqrt{3} \times I_{GN})$	Set
t<		s	Definite operate time	Set
RlsDly		s	Release delay	Set
Ros		xZ_N	Resistive offset for trip area origin in pu	Set
Xos		xZ_N	Reactive offset for trip area origin in pu	Set
Ros		ohm	Resistive offset for trip area origin in primary ohms	
Xos		xZ_N	Reactive offset for trip area origin in primary ohms	

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 10.2: Recorded values of the under-reactance stages X<, X<< (40)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		xZ_N	Fault impedance
Angle		°	Fault angle
EDly		%	Elapsed time of the operating time setting. 100% = trip
SetGrp	1, 2, 3, 4		Active setting group during fault

11 Negative sequence overcurrent (ANSI 46)

Table 11.1: Parameters of the negative sequence overcurrent $I_2>$ (46)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr			Cumulative start counter	C
TCntr			Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Force	Off On		Force flag to enable protection stage activation	Set
I2/Imot		%I _{MOT}	The supervised value.	
I2>		%I _{MOT}	Start setting	Set
t>		s	Definite operate time (Type=DT)	Set
Type	DT INV		Definite time Dependent time <i>Equation 11.1:</i> $T = \frac{K_1}{\left(\frac{I_2}{I_{MOT}}\right)^2 - K_2^2}$	Set
K1		s	Delay multiplier (Type =INV)	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 11.2: Recorded values of the negative sequence overcurrent $I_2 >$ (46)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		%I _{MOT}	Maximum unbalance current
EDly		%	Elapsed time of the operate time setting. 100% = trip
SetGrp	1, 2, 3, 4		Active setting group during the fault

12 Broken conductor (ANSI 46BC)

Table 12.1: Setting parameters of the broken conductor I_2/I_1 (46BC) in feeder mode

Parameter	Value	Unit	Default	Description
I_2/I_1 >	2 – 70	%	20	Setting value, I_2/I_1
t>	1.0 – 600.0	s	10.0	Definite operate time
Type	DT INV	-	DT	The selection of time characteristics
S_On	Enabled; Disabled	-	Enabled	Start on event
S_Off	Enabled; Disabled	-	Enabled	Start off event
T_On	Enabled; Disabled	-	Enabled	Trip on event
T_Off	Enabled; Disabled	-	Enabled	Trip off event

Table 12.2: Measured and recorded values of the broken conductor (46BC) in feeder mode

	Parameter	Value	Unit	Description
Measured value	I_2/I_1		%	Relative negative sequence component
Recorded values	SCntr			Cumulative start counter
	TCntr			Cumulative trip counter
	Flt		%	Maximum I_2/I_1 fault component
	EDly		%	Elapsed time as compared to the set operate time, 100% = tripping

13 Incorrect phase sequence (ANSI 47)

Table 13.1: Parameters of the incorrect phase sequence $I_{2>>}$ (47)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
$I_{2>>}$		%	Neg. phase seq. current/pos. phase seq. current	

Table 13.2: Recorded values of incorrect phase sequence $I_{2>>}$ (47)

Parameter	Value	unit	Description	Note
SCntr			Start counter (Start) reading	
TCntr			Trip counter (Trip) reading	
Flt		%	Max. value of fault current	
EDly		%	Elapsed time as compared to the set operate time, 100% = tripping	

14 Negative sequence overvoltage protection (ANSI 47)

Table 14.1: Parameters of the negative sequence protection $U_{2>}$, $U_{2>>}$, $U_{2>>>}$

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr			Cumulative start counter	C
TCntr			Cumulative trip counter	C
SetGrp	1, 2, 3 or 4		Active setting group	Set
SGrpDI	- - DIx VIx LEDx VOx		Digital signal to select the active setting group Set None Digital input Virtual input LED indicator signal Virtual output	
Force	Off On		Force flag for status forcing for test purposes. This set is a common flag for all stages and output relays, too. Automatically reset by a 5-minute timeout.	
U_2		%	The supervised negative sequence voltage of Un/	
$U_{2>}$, $U_{2>>}$, $U_{2>>>}$		%	Start setting of Un/	
$t_{>}$, $t_{>>}$, $t_{>>>}$		s	Definite operate time	

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 14.2: Recorded values of the negative sequence protection $U_{2>}$, $U_{2>>}$, $U_{2>>>}$

Parameter	Value	unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt			Maximun fault voltage
EDly		%	Elapsed time of the operating time setting. 100% = trip
SetGrp		1, 2, 3, 4	Active setting group during fault

15 Motor start-up supervision (ANSI 48)

Table 15.1: Parameters of the motor start-up supervision $I_{ST}>$ (48)

	Parameter	Value/unit	Description	
Status	Status		Status of the stage	
	SCntr		Cumulative start counter	
	TCntr		Cumulative trip counter	
	Force	ON/Off	Force flag to enable protection stage activation	
Parameters	IL	A	Phase current IL, not settable	
	Status		Status of stage	
	Ist>	A	Motor start detection current scaled to primary value, calculated by relay	
	Ist>	xI_{MOT}	Motor start detection current. Must be less than initial motor starting current.	
	ImotSt	A	Nominal motor starting current scaled to primary value, calculated by relay	
	ImotSt	xI_{MOT}	Nominal motor starting current	
	Type		DT	Operation charact./ definite time
			Inv	Operation characteristic / dependent time
	t>	S	Operate time [s]	
	tInv>	S	Time multiplier at dependent time	
Recorded values	Log		Start and trip time	
	Flt	xI_{MOT}	Maximum fault current	
	EDly	%	Elapsed time of the operate time setting. 100% = trip	

Table 15.2: Parameters of the motor status (48)

	Parameter	Value / unit	Description
Measured value	Phase current IL	A	
Status	Stopped Starting Running		
SCntr		qty	Cumulative start counter
TCntr		qty	Cumulative run counter
t		minutes	Elapsed time from motor start
Default t		minutes	Default elapsed time from motor start
Mot str		n:o / h	Motor starts in last hour
Event enabling	Start	Enabled; Disabled	Enable Start event
	Started	Enabled; Disabled	Enable Start event
	Run	Enabled; Disabled	Enable Start event
	Stop	Enabled; Disabled	Enable Start event

16 Thermal overload (ANSI 49F/49M)

Table 16.1: Parameters of the thermal overload stage T> (49)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
Time	hh:mm:ss		Estimated time to trip	
SCntr		qty	Cumulative start counter	C
TCntr		qty	Cumulative trip counter	C
Force	Off On		Force flag to enable protection stage activation	Set
T		%	Calculated temperature rise. Trip limit is 100 %.	F
MaxRMS		Arms	Measured current. Highest of the three phases.	
Imax		A	$k \times I_N$ or $\times I_{MOT}$. Current corresponding to the 100 % temperature rise.	
k>		$\times I_N$ or $\times I_{MOT}$	Allowed overload (service factor)	Set
Alarm		%	Alarm level	Set
tau		min	Thermal time constant	Set
ctau		xtau	Coefficient for cooling time constant. Default = 1.0	Set
kTamb		$\times I_N$ or $\times I_{MOT}$	Ambient temperature corrected max. allowed continuous current	
Imax40		$\%I_N$ or $\%I_{MOT}$	Allowed load at Tamb +40 °C. Default = 100 %.	Set
Imax70		$\%I_N$ or $\%I_{MOT}$	Allowed load at Tamb +70 °C.	Set
Tamb		°C	Ambient temperature. Editable Samb=n/a. Default = +40 °C	Set
Samb			Sensor for ambient temperature	Set
	n/a		No sensor in use for Tamb	
	ExtAI1 – 16		External Analogue input 1 – 16	

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

17 Phase overcurrent (ANSI 50/51)

Table 17.1: Parameters of the phase overcurrent stage I> (50/51)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
TripTime		s	Estimated time to trip	
SCntr			Cumulative start counter	C
TCntr			Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
Force	Off		Force flag to enable protection stage activation	Set
	On			
ILmax		A	The supervised value. Max. of IL1, IL2 and IL3	
Status			Current status of the stage	
I>		A	Start value scaled to primary value	
I>		xI_N or xI_{MOT}	Start setting	Set
Curve	DT IEC, IEEE, IEEE2, RI, PrgN		Delay curve family: Definite time Dependent time.	Set
Type	DT NI, VI, EI, LTI, Parameters		Delay type Definite time Dependent time.	Set
t>		s	Definite operate time (for definite time only)	Set
k>			Dependent delay multiplier (for dependent time only)	Set
Dly20x		s	Delay at 20 xI_N or xI_{MOT}	
Dly4x		s	Delay at 4 xI_N or xI_{MOT}	
Dly2x		s	Delay at 2 xI_N or xI_{MOT}	
Dly1x		s	Delay at 1 xI_N or xI_{MOT}	
IncHarm		On/off	Include Harmonics	
Delay curves			Graphic delay curve picture (only local display)	

Parameter	Value	Unit	Description	Note
A, B, C, D, E			User's constants for standard equations. Type=Parameters. See Chapter Dependent operate time in the product user manual.	Set
Recorded values	LOG1		Date and time of trip	
	Type		Fault type	
	Flt	xI_N or xI_{MOT}	Fault current	
	Load	xI_N or xI_{MOT}	Pre-fault current	
	Edly	%	Elapsed delay time	
	SetGrp		Active set group during fault	

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 17.2: Parameters of the phase overcurrent stages I>>, I>>> (50/51)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr			Cumulative start counter	C
TCntr			Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Force	Off On		Force flag to enable protection stage activation	Set
ILmax		A	The supervised value. Max. of IL1, IL2 and IL3	
I>>, I>>>		A	Start value scaled to primary value	
I>>, I>>>		xI_N or xI_{MOT}	Start setting	Set
t>>, t>>>		s	Definite operate time	Set
IncHarm		On/off	Include Harmonics	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 17.3: Recorded values of the overcurrent stages (8 last faults) I>, I>>, I>>> (50/51)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Type	1-N 2-N 3-N 1-2 2-3 3-1 1-2-3		Fault type Phase 1 - ground fault Phase 2 - ground fault Phase 3 - ground fault Two-phase fault (Phase 1 - Phase 2) Two-phase fault (Phase 2 - Phase 3) Two-phase fault (Phase 3 - Phase 1) Three phase fault (Phase 1 - Phase 2 - Phase 3)
Flt		xI_N or xI_{MOT}	Maximum fault current
Load		xI_N or xI_{MOT}	1 s average phase currents before the fault
EDly		%	Elapsed time of the operate time setting. 100% = trip
SetGrp	1, 2, 3, 4		Active setting group during fault

18 Earth fault overcurrent (ANSI 50N/51N)

Table 18.1: Parameters of the unidirectional earth fault overcurrent stage $I_0>$ (50N/51N)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
TripTime		s	Estimated time to trip	
SCntr			Cumulative start counter	Clr
TCntr			Cumulative trip counter	Clr
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Force	Off On		Force flag to enable protection stage activation	Set
Io, IoCalc, IoPeak		pu	The supervised value according the parameter "Input" below.	
Io>		A	Start value scaled to primary value	
Io>		pu	Start setting relative to the parameter "Input" and the corresponding CT value	Set
Curve	DT IEC, IEEE, IEEE2, RI, PrgN		Delay curve family: Definite time Dependent time. See Chapter Dependent operate time in the product user manual.	Set
Type	DT NI, VI, EI, LT1, Parameters		Delay type Definite time Dependent time. See Chapter Dependent operate time in the product user manual.	Set
t>		s	Definite operate time (for definite time only)	Set
k>			Dependent delay multiplier (for dependent time only)	Set
Input	Io		X1:7, 8, 9.	Set
	IoCalc		IL1 + IL2 + IL3	
	IoPeak		X1:7, 8, 9. peak mode ($I_0>$ only).	
Intrmt		s	Intermittent time	Set
Dly20x		s	Delay at $20 \times I_{0N}$	

18 Earth fault overcurrent (ANSI 50N/51N)

Parameter	Value	Unit	Description	Note
Dly4x		s	Delay at 4 x I _{0N}	
Dly2x		s	Delay at 2 x I _{0N}	
Dly1x			Delay at 1 x I _{0N}	
A, B, C, D, E			User's constants for standard equations. Type=Parameters. See Chapter Dependent operate time in the product user manual.	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 18.2: Parameters of the unidirectional earth fault overcurrent stage I₀>>, I₀>>>, I₀>>>>, I₀>>>>> (50N/51N)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
TripTime		s	Estimated time to trip	
SCntr			Cumulative start counter	Clr
TCntr			Cumulative trip counter	Clr
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dix		Digital input	
	Vix		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Force	Off On		Force flag to enable protection stage activation	Set
I ₀ I ₀ Calc		pu	The supervised value according the parameter "Input" below.	
I ₀ >>, I ₀ >>>, I ₀ >>>>, I ₀ >>>>>		A	Start value scaled to primary value	
I ₀ >>, I ₀ >>>, I ₀ >>>>, I ₀ >>>>>		pu	Start setting relative to the parameter "Input" and the corresponding CT value	Set
t>		s	Definite operate time (for definite time only)	Set
Input	I ₀		X1:7, 8, 9. See .	Set
	I ₀ Calc		IL1 + IL2 + IL3	

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 18.3: Recorded values of the unidirectional earth fault stages (8 last faults) $I_0>>$, $I_0>>>$, $I_0>>>>$, $I_0>>>>>$ (50N/51N)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		pu	Maximum earth fault current
EDly		%	Elapsed time of the operate time setting. 100% = trip
SetGrp	1, 2, 3, 4		Active setting group during fault

19 Breaker failure (ANSI 50BF)

Table 19.1: Parameters of the breaker failure stage (50BF)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr		qty	Cumulative start counter	C
TCntr		qty	Cumulative trip counter	C
Force	Off On		Force flag to enable protection stage activation	Set
Cbrelay			The supervised digital output*).	Set
	1		Relay T1	
	2		Relay T2	
t>		s	Definite operate time.	Set

*) This setting is used by the circuit breaker condition monitoring, too. .

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 19.2: Recorded values of the breaker failure stage (8 last faults) (50BF)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
EDly		%	Elapsed time of the operate time setting. 100% = trip

20 Switch-onto-fault (ANSI 50HS)

Table 20.1: Parameters of the switch-onto-fault stage SOTF (50HS)

Parameter	Value	Unit	Default	Description
Status	- Blocked Start Trip		-	Current status of the stage
TCntr			0	Cumulative trip counter
Start setting		A		Start value scaled to primary value
Start setting		xI_N	$1.5 \times I_N$	Start value scaled to primary value
Dead line detection delay		s	0.20 s	Dead line detection delay
SOTF active after CB closure		s	1.00s	SOTF active time after CB closure
Dead line detection input	- DI1 – DIx VI1 – VIx		- (=a fixed low limit threshold ($0.03 \times I_N$))	Dead line detection input

21 Capacitor bank unbalance (ANSI 51C)

Table 21.1: Setting parameters of capacitor bank unbalance protection $I_0>>>$, $I_0>>>>$ (51C)

Parameter	Value	Unit	Default	Description
Input	Io1; Io2; IoCalc	-	Io2	Current measurement input. NOTE! Do not use the calculated value which is only for earth fault protection purposes
Io>>>	0.01 – 20.00	pu	0.10	Setting value
Io>>>>	0.01 – 20.00	pu	0.20	Setting value
t>	0.04 – 300.00	s	0.50 (Io>>>) 1.00 (Io>>>>)	Definite operate time
CMode	Off; On (Io>>>); Off; Normal; Location(Io>>>>)	-	Off	Compensation selection
SaveBa	-; Get	-	-	Trigg the phasor recording
SetBal	0.010 – 3.000	pu	0.050	Compensation level
S_On	On; Off	-	On	Start on event
S_Off	On; Off	-	On	Start off event
T_On	On; Off	-	On	Trip on event
T_Off	On; Off	-	On	Trip off event
DIoSav	On; Off	-	Off	Recording triggered event
DIoSav	On; Off	-	Off	Recording ended event

Table 21.2: Measured and recorded values of capacitor bank unbalance protection $I_0>>>$, $I_0>>>>$ (51C)

	Parameter	Value	Unit	Description
Measured values	Io		pu	unbalance current (including the natural unbalance current)
	dIo		A	Compensated unbalance current
Display	Io>>>, Io>>>>		A	Setting value
Recorded values	SCntr		-	Cumulative start counter
	TCntr		-	Cumulative trip counter
	Flt		pu	The max. fault value
	EDly		%	Elapsed time as compared to the set operate time; 100% = tripping
	Isaved		A	Recorded natural unbalance current
	SavedA		deg	Recorded phase angle of natural unbalance current
	Faults (Io>>>>only)		-	Allowed number of element failures
	Total (Io>>>>only)		-	Actual number of element failures in the bank
	Clear (Io>>>>only)	-; Clear	-	Clear the element counters
	L1-B1 (Io>>>>only)		-	Number of element failures in phase L1 in brach 1 (left side)
	L1-B2 (Io>>>>only)		-	Number of element failures in phase L1 in brach 2 (right side)
	L2-B1 (Io>>>>only)		-	Number of element failures in phase L2 in brach 1 (left side)
	L2-B2 (Io>>>>only)		-	Number of element failures in phase L2 in brach 2 (right side)
	L3-B1 (Io>>>>only)		-	Number of element failures in phase L3 in brach 1 (left side)
	L3-B2 (Io>>>>only)		-	Number of element failures in phase L3 in brach 2 (right side)
	Locat (Io>>>>only)		-	Changed unbalance current (after automatic compensation)
LocAng (Io>>>>only)		-	Changed phase angle of the unbalance current (after automatic compensation)	

22 Locked rotor (ANSI 51LR)

Table 22.1: Parameter of the locked rotor $I_{lr>}$ (51LR)

	Parameter	Value/unit	Description	
Status	Status	-, Start, Trip, Blocked	Status of the stage	
	SCntr	qty	Cumulative start counter	
	TCntr	qty	Cumulative trip counter	
	Force	ON/Off	Force flag to enable protection stage activation	
Parameters	IL	A	Phase current IL, not settable	
	Status	-, Start, Trip, Blocked	Status of stage	
	$I_{lr>}$	A	Start current setting $I_{lr>}$ scaled to primary value, calculated by relay	
	$I_{lr>}$	% I_{motSt}	Start setting	
	I_{motSt}	A	Nominal motor starting current scaled to primary value	
	Type	DT		Operation charact./ definite time
		Inv		Operation charact./ dependent time
	$t>$	S	Operate time [s]	
$t_{Inv>}$	S	Time multiplier at dependent time		
Recorded values	Log		Start and trip time	
	Fit	xI_{MOT}	Maximum fault current	
	EDly	%	Elapsed time of the operate time setting. 100% = trip	

23 Voltage-dependent overcurrent (ANSI 51V)

Table 23.1: Parameters of the voltage-dependent overcurrent stage $I_{V>}$ (51V)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr			Cumulative start counter	C
TCntr			Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI	- DIx VIx LEDx VOx		Digital signal to select the active setting group None Digital input Virtual input LED indicator signal Virtual output	Set
Force	Off On		Force flag to enable protection stage activation	Set
ILmax		A	The supervised value. Max. of IL1, IL2 and IL3	
$I_{V>}$		A	Start value scaled to primary value	
$I_{V>}$		xI_N	Start setting	Set
$t_{>}$		s	Definite operate time	Set
X1		%U1	Voltage for the 1st knee point.	Set
X2		%U1	Voltage for the 2nd knee point	Set
Y1		% $I_{V>}$	Multiplier for start setting at the 1st knee point	Set
Y2		% $I_{V>}$	Multiplier for start setting at the 1st knee point	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

**Table 23.2: Recorded values of the Voltage-dependent overcurrent stages
(last eight faults) $I_{V>}$ (51V)**

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Type	1-N 2-N 3-N 1-2 2-3 3-1 1-2-3		Fault type Phase 1 - ground fault Phase 2 - ground fault Phase 3 - ground fault Two-phase fault (Phase 1 - Phase 2) Two-phase fault (Phase 2 - Phase 3) Two-phase fault (Phase 3 - Phase 1) Three phase fault (Phase 1 - Phase 2 - Phase 3)
Flt		xI_N	Maximum fault current
Load		xI_N	1 s average phase currents before the fault
EDly		%	Elapsed time of the operating time setting. 100% = trip
SetGrp			Active setting group during the fault

24 Overvoltage (ANSI 59)

Table 24.1: Parameters of the overvoltage stages U>, U>>, U>>> (59)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr		qty	Cumulative start counter	C
TCntr		qty	Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	DIx		Digital input	
	VIx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Force	Off On		Force flag to enable protection stage activation	Set
Umax		V	The supervised value. Max. of U12, U23 and U31	
U>, U>>, U>>>		V	Start value scaled to primary value	
U>, U>>, U>>>		% Un	Start setting relative to U _N	Set
t>, t>>, t>>>		s	Definite operate time	Set
RlsDly		s	Release delay (U> stage only)	Set
Hyster	3 (default)	%	Hysteresis	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 24.2: Recorded values of the overvoltage stages (8 last faults) U>, U>>, U>>> (59)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		% Un	Maximum fault voltage
EDly		%	Elapsed time of the operate time setting. 100% = trip
SetGrp	1, 2, 3, 4		Active setting group during fault

25 Capacitor overvoltage (ANSI 59C)

Table 25.1: Parameters of the capacitor overvoltage $U_C >$ (59C)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip			F F
SCntr				Clr
TCntr				Clr
SetGrp	1, 2, 3, 4			Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Force	Off On		Force flag to enable protection stage activation	Set
Ucl1 Ucl3 Ucl2		pu	The supervised values in per unit values. 1 pu = UclLN. <i>Equation 25.1:</i> $U_C = \frac{X_C}{U_{CLN}} \sum_{n=1}^{15} \frac{I_n}{n}$	
Uc>		pu	Start setting	Set
t>		s	Definite operate time	Set
C		uF	Value of a phase to star point capacitor	Set
UclLN		V	Rated voltage for phase to star point capacitor = 1 pu	Set
Qcn		kvar	Rated power of the capacitor bank. <i>Equation 25.2:</i> $Q_N = 2\pi f_N U_{CLN}^2 C_{SET}$	
fn	50 or 60	Hz	System frequency used to calculate rated power Qcn. Automatically set according the adapted frequency.	
Xc		ohm	Reactance of the capacitor(s)	
fXc		Hz	Measured average frequency for Xc and UclLN calculation	

Parameter	Value	Unit	Description	Note
UcLL		V	$\sqrt{3} \times U_{cLN}$	

Table 25.2: Recorded values of the capacitor overvoltage stage (8 latest faults) $U_C >$ (59C)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Type	1-N 2-N 3-N 1-2 2-3 3-1 1-2-3		Fault type Phase 1 - ground fault Phase 2 - ground fault Phase 3 - ground fault Two-phase fault (Phase 1 - Phase 2) Two-phase fault (Phase 2 - Phase 3) Two-phase fault (Phase 3 - Phase 1) Three phase fault (Phase 1 - Phase 2 - Phase 3)
Flt		pu	Maximum fault voltage
EDly		%	Elapsed time of the operate time setting. 100% = trip
SetGrp	1, 2, 3, 4		Active setting group during the fault

26 Neutral voltage displacement (ANSI 59N)

Table 26.1: Parameters of the neutral voltage displacement stages $U_{0>}$, $U_{0>>}$, $U_{0>>>}$ (59N)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr		qty	Cumulative start counter	C
TCntr		qty	Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Force	Off On		Force flag to enable protection stage activation	Set
U ₀		%	The supervised value relative to $U_n / \sqrt{3}$	
U _{0>} , U _{0>>} , U _{0>>>}		%	Start value relative to $U_n / \sqrt{3}$	Set
t _{>} , t _{>>} , t _{>>>}		s	Definite operate time	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 26.2: Recorded values of the neutral voltage displacement stages $U_{0>}$, $U_{0>>}$, $U_{0>>>}$ (59N), $U_{0>>>}$

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		%	Fault voltage relative to $U_n / \sqrt{3}$
EDly		%	Elapsed time of the operating time setting. 100% = trip
SetGrp	1, 2, 3, 4		Active setting group during fault

27

Stator earth-fault (ANSI 64S)

Table 27.1: Parameters of the 100 % stator earth fault stage $U_{0F3<}$ (64S)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	
SCntr			Cumulative start counter	
TCntr			Cumulative trip counter	
SetGrp	1, 2, 3, 4		Active setting group	
SGrpDI	- DIx VIx LEDx VOx		Digital signal to select the active setting group None Digital input Virtual input LED indicator signal Virtual output	
Force	Off On		Force flag to enable protection stage activation	
Uof3		%	The supervised value relative to U_{0N} .	
Uof3<		%	Start value relative to U_{0N} .	
t<		min	Definite operate time in minutes	

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 27.2: Recorded values of the 100 % stator earth fault stage $U_{0F3<}$ (64S)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		%	3rd harmonic value relative to $U_n / \sqrt{3}$ during fault
EDly		%	Elapsed time of the operating time setting. 100% = trip
SetGrp	1, 2, 3, 4		Active setting group during fault

28 Motor restart inhibition (ANSI 66)

Table 28.1: Parameters of the motor restart inhibition N> (66)

	Parameter	Value/unit	Description
Measured value	Status	Disabled/ Enabled	Stage status
	SCntr	qty	Start counter
	Mot strs	qty/h	Motor starts in last hour
	ETAR N>	Min	Estimated time to allow restart
	t	Min	Elapsed time from motor start
	Force	On / Off	Force flag to enable protection stage activation
Setting values	Mot strs	qty/h	Max. starts in one hour
	t	Min	Elapsed time from motor start
	Default t	0 min or 120 min	Default elapsed time from motor start
	Status	Enabled, One left, Disabled, Blocked	Stage status
	SCntr	qty	Start counter
	Sts/h	qty/h	Max. motor start per hour
	Interval	Min	Min. interval between two consecutive starts
Recorded values	LOG1		Date and time of trip
	N.st / h		Motor starts / hour
	TimeFromSt		Elapsed time from motor start
	Tot Mot Strs		Number of total motor starts
	Type		Fault type
Event Enabling	Alr_on		Alarm on event
	Alr_off		Alarm off Event
	MoStrt_dis		Motor start disabled
	MotStrt_En		Motor start enabled

29 Directional phase overcurrent (ANSI 67)

Table 29.1: Parameters of the directional phase overcurrent stages $I_{\phi>}$, $I_{\phi>>}$ (67)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
TripTime		s	Estimated time to trip	
SCntr			Cumulative start counter	C
TCntr			Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
Fx		Function key		
Force	Off / On		Force flag to enable protection stage activation	Set
ILmax		A	The supervised value. Max. of IL1, IL2 and IL3	
$I_{\phi>}$, $I_{\phi>>}$		A	Start value scaled to primary value	
$I_{\phi>}$, $I_{\phi>>}$		xI_N or xI_{MOT}	Start setting	Set
Curve	DT		Delay curve family: Definite time	Set
	IEC, IEEE, IEEE2, RI, PrgN		Dependent time. See Chapter Dependent operate time in the product user manual.	
Type	DT		Delay type Definite time	Set
	NI, VI, EI, LTI, Parameters		Dependent time. See Chapter Dependent operate time in the product user manual.	
t>		s	Definite operate time (for definite time only)	Set
k>			Inverse delay multiplier (for dependent time only)	Set
Dly20x		s	Delay at 20xImode	
Dly4x		s	Delay at 4xImode	
Dly2x		s	Delay at 2xImode	
Dly1x		s	Delay at 1xImode	
Mode	Dir		Directional mode (67)	Set
	Unidir		Unidirectional (50/51)	
	Dir+back-up		Directional and unidirectional backup	

29 Directional phase overcurrent
(ANSI 67)

Parameter	Value	Unit	Description	Note
Offset		°	Angle offset in degrees	Set
U/I angle		°	Measured U_1/I_1 angle	
U1		% U_N	Measured positive sequence voltage	
A, B, C, D, E			User's constants for standard equations. Type=Parameters. See Chapter Dependent operate time in the product user manual.	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 29.2: Parameters of the directional phase overcurrent stages $I_{\phi}>>>$, $I_{\phi}>>>>$ (67)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr			Cumulative start counter	C
TCntr			Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dix		Digital input	
	Vix		Virtual input	
	LEDx		LED indicator signal	
	Vox		Virtual output	
Force	Off		Force flag to enable protection stage activation	Set
	On			
ILmax		A	The supervised value. Max. of IL1, IL2 and IL3	
$I_{\phi}>>>$, $I_{\phi}>>>>$		A	Start value scaled to primary value	
$I_{\phi}>>>$, $I_{\phi}>>>>$		xI_N or xI_{MOT}	Start setting	Set
$t>>>$ $t>>>>$		s	Definite operate time (for definite time only)	Set
Mode	Dir Undir Dir+back-up		Directional (67) Undirectional (50/51) Directional and undirectional backup	Set
Offset		°	Angle offset in degrees	Set
U/I angle		°	Measured U_1/I_1 angle	
U1		% U_N	Measured positive sequence voltage	

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 29.3: Recorded values of the directional phase overcurrent stages (8 last faults) $I_{\phi}>$, $I_{\phi}>>$, $I_{\phi}>>>$, $I_{\phi}>>>>$ (67)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Type	1-N 2-N 3-N 1-2 2-3 3-1 1-2-3 1-2-N 2-3-N 3-1-N 1-2-3-N		Fault type Phase 1 - ground fault Phase 2 - ground fault Phase 3 - ground fault Two-phase fault (Phase 1 - Phase 2) Two-phase fault (Phase 2 - Phase 3) Two-phase fault (Phase 3 - Phase 1) Three phase fault (Phase 1 - Phase 2 - Phase 3) Two phase fault (phase 1 - phase 2) with ground contact Two phase fault (phase 2 - phase 2) with ground contact Two phase fault (phase 3 - phase 1) with ground Three phase fault (phase1 - phase 2 - phase 3) with ground contact
Flt		xI_N	Maximum fault current
Load		xI_N	1 s average phase currents before the fault
EDly		%	Elapsed time of the operate time setting. 100% = trip
Angle		°	Fault angle in degrees
U1		xU_N	Positive sequence voltage during fault
SetGrp	1, 2, 3, 4		Active setting group during fault
Direction mode			Dir, undir, dir+back-up

30 Directional earth fault overcurrent (ANSI 67N)

Table 30.1: Parameters of the directional earth fault overcurrent stages $I_{0\phi>}$, $I_{0\phi>>}$, $I_{0\phi>>>}$ (67N)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
TripTime		s	Estimated time to trip	
SCntr		qty	Cumulative start counter	Clr
TCntr		qty	Cumulative trip counter	Clr
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Force	Off On		Force flag to enable protection stage activation	Set
Io IoCalc IoPeak		pu	The supervised value according the parameter "Input" below. ($I_{0\phi>}$ only)	
IoRes		pu	Resistive part of I_0 (only when "InUse"=Res)	
IoCap		pu	Capacitive part of I_0 (only when "InUse"=Cap)	
$I_{0\phi>}$		A	Start value scaled to primary value	
$I_{0\phi>}$		pu	Start setting relative to the parameter "Input" and the corresponding CT value	Set
$U_{0>}$		%	Start setting for U_0	Set
U_0		%	Measured U_0	
Curve	DT IEC, IEEE, IEEE2, RI, PrgN		Delay curve family: Definite time Dependent time. See Chapter Dependent operate time in the product user manual.	Set
Type	DT NI, VI, EI, LTI, Parameters		Delay type. Definite time Dependent time. See Chapter Dependent operate time in the product user manual.	Set
$t_{>}$		s	Definite operate time (for definite time only)	Set
$k_{>}$			Dependent delay multiplier (for dependent time only)	Set

Parameter	Value	Unit	Description	Note
Mode	ResCap Sector Undir		High-impedance earthed nets Low-impedance earthed nets Undirectional mode	Set
Offset		°	Angle offset (MTA) for ResCap and Sector modes	Set
Sector	Default = 88	±°	Half sector size of the trip area on both sides of the offset angle	Set
ChCtrl			Res/Cap control in mode ResCap	Set
	Res		Fixed to Resistive characteristic	
	Cap		Fixed to Capacitive characteristic	
	Dlx		Controlled by digital input Dlx activated ==> Cap mode in use Dlx deactivated ==> Res mode in use	
	Vlx		Controlled by virtual input	
InUse			Selected submode in mode ResCap.	
	-		Mode is not ResCap	
	Res		Submode = resistive	
	Cap		Submode = capacitive	
Input	Io		X1:7, 8, 9.	Set
	IoCalc		IL1 + IL2 + IL3	
	IoPeak		X1:7, 8, 9 peak mode ($I_{0\phi} >$ only)	
Intrmt		s	Intermittent time	Set
Dly20x		s	Delay at $20 \times I_{0N}$	
Dly4x		s	Delay at $4 \times I_{0N}$	
Dly2x		s	Delay at $2 \times I_{0N}$	
Dly1x		s	Delay at $1 \times I_{0N}$	
A, B, C, D, E			User's constants for standard equations. Type=Parameters. See Chapter Dependent operate time in the product user manual.	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 30.2: Recorded values of the directional earth fault overcurrent stages (8 last faults) $I_{0\phi} >$, $I_{0\phi} >>$, $I_{0\phi} >>>$ (67N)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		pu	Maximum earth fault current Resistive part of I_0 (only when "InUse"=Res) Capacitive part of I_0 (only when "InUse"=Cap)
EDly		%	Elapsed time of the operate time setting. 100% = trip
Angle	°		Fault angle of I_0 $-U_0 = 0^\circ$
Uo		%	Max. U_0 voltage during the fault
SetGrp	1, 2, 3, 4		Active setting group during fault

31 Transient intermittent earth fault (ANSI 67NI)

Table 31.1: Parameters of the transient intermittent earth fault stage $I_{0INT}>$ (67NI)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr			Cumulative start counter	Clr
TCntr			Cumulative trip counter	Clr
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Io input	IoPeak		I_0 Connectors X:1-7, 8, 9	Set
Force	Off On		Force flag to enable protection stage activation	Set
Io peak		pu	The detected I_0 value according the parameter "Input" below.	
Uo		%	The measured U_0 value. $U_{0N} = 100\%$	
Direction mode	Forward Reverse		Setting between direction towards line or bus	Set
Uo>		%	U_0 start level. $U_{0N} = 100\%$	Set
t>	0.04 – 300	s	Operation delay setting	Set
Min. peaks	1 – 20		Minimum number of peaks required	Set
Reset	0.06 – 300	s	Reset delay setting	Set
Intrmt		s	Intermittent time. When the next fault occurs within this time, the delay counting continues from the previous value.	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 31.2: Recorded values of the transient intermittent earth fault stage (8 latest faults) $I_{0INT}>$ (67NI)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Fit		pu	Maximum detected earth fault current
EDly		%	Elapsed time of the operate time setting. 100% = trip
Uo		%	Max. U_0 voltage during the fault
SetGrp	1, 2, 3, 4		Active setting group during fault
FWD peaks		pcs	Number of detected peaks to forward direction
REV peaks		pcs	Number of detected peaks to reverse direction

32 Magnetising inrush detection (ANSI 68F2)

Table 32.1: Setting parameters of magnetising inrush detection (68F2)

Parameter	Value	Unit	Default	Description
If2>	10 – 100	%	10	Setting value If2/Ifund
t_f2	0.05 – 300.0	s	0.05	Definite operating time
S_On	Enabled; Disabled	-	Enabled	Start on event
S_Off	Enabled; Disabled	-	Enabled	Start off event
T_On	Enabled; Disabled	-	Enabled	Trip on event
T_Off	Enabled; Disabled	-	Enabled	Trip off event

Table 32.2: Measured and recorded values of magnetising inrush detection (68F2)

	Parameter	Value	Unit	Description
Measured values	IL1H2.		%	2. harmonic of IL1, proportional to the fundamental value of IL1
	IL2H2.		%	2. harmonic of IL2
	IL3H2.		%	2. harmonic of IL3
Recorded values	Flt		%	The max. fault value
	EDly		%	Elapsed time as compared to the set operate time; 100% = tripping

33

Fifth harmonic detection (ANSI 68H5)

Table 33.1: Setting parameters of the fifth harmonic detection (68H5)

Parameter	Value	Unit	Default	Description
If5>	10 – 100	%	10	Setting value If5/Ifund
t_f5	0.05 – 300.0	s	0.05	Definite operate time
S_On	Enabled; Disabled	-	Enabled	Start on event
S_Off	Enabled; Disabled	-	Enabled	Start off event
T_On	Enabled; Disabled	-	Enabled	Trip on event
T_Off	Enabled; Disabled	-	Enabled	Trip off event

Table 33.2: Measured and recorded values of the fifth harmonic detection (68H5)

	Parameter	Value	Unit	Description
Measured values	IL1H5.		%	5. harmonic of IL1, proportional to the fundamental value of IL1
	IL2H5.		%	5. harmonic of IL2
	IL3H5.		%	5. harmonic of IL3
Recorded values	Flt		%	The max. fault value
	EDly		%	Elapsed time as compared to the set operate time; 100% = tripping

34 Pole slip protection (ANSI 78)

Table 34.1: Parameters of the out-of-step (pole slip) stage (78)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr			Cumulative start counter	C
TCntr			Cumulative trip counter	C
SetGrp	1 or 2		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Group	1, 2, 3 or 4		Active setting group	Set
R setting forward		xZn	Pole slip detection area forward R limit	Set
R setting reverse		xZn	Pole slip detection area reverse R limit	Set
X setting forward		xZn	Pole slip detection area forward X limit	Set
X setting reverse		xZn	Pole slip detection area reverse X limit	Set
I1 min setting		xIn	Positive sequence current threshold limit	Set
Number of pole slips			Number of pole slips to trip	Set
Time window		s	Time window to detect required amount of slips	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 34.2: Recorded values of the out-of-step (pole slip) stage (78)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Group	1, 2, 3 or 4		Active setting group during the fault
I1 fault value		xIn	Positive sequence current during the fault
U1 fault value		xUn	Positive sequence voltage during the fault
Pole slips			Number of pole slips during the fault
Fault type	Mot/Gen		Pole slip direction
Elapsed time	0 – 100	%	Elapsed time of the time window setting.

35

Auto-recloser function (ANSI 79)

Table 35.1: Setting parameters of AR function (79)

Parameter	Value	Unit	Default	Description
ARena	ARon; ARoff	-	ARon	Enabling/disabling the autoreclose
ExtSync	None, any digital input, virtual input or virtual output	-	-	The digital input for blocking CB close. This can be used for Synchrocheck.
AR_DI	None, any digital input, virtual input or virtual output	-	-	The digital input for toggling the enabling/disabling parameter (ARena)
AR2grp	ARon; ARoff	-	ARon	Enabling/disabling the autoreclose for group 2
RecIT	0.02 – 300.00	s	10.00	Reclaim time setting. This is common for all the shots.
CB	Obj1 – Obj6		Obj1	Breaker object in use
CB1	Obj1 – Obj6		Obj1	Breaker 1 object
CB2	Obj1 – Obj6		-	Breaker 2 object
AutoCBSel	On; Off		off	Enabling/disabling the auto CB selection
CB2Sel	None, any digital input, virtual input or virtual output		-	The digital input for selecting the CB2.
ARreq	On; Off	-	Off	AR request event
ShotS	On; Off	-	Off	AR shot start event
ARlock	On; Off	-	Off	AR locked event
CritAr	On; Off	-	Off	AR critical signal event
ARrun	On; Off	-	Off	AR running event
FinTrp	On; Off	-	Off	AR final trip event
ReqEnd	On; Off	-	Off	AR end of request event
ShtEnd	On; Off	-	Off	AR end of shot event
CriEnd	On; Off	-	Off	AR end of critical signal event
ARUnl	On; Off	-	Off	AR release event
ARStop	On; Off	-	Off	AR stopped event
FTrEnd	On; Off	-	Off	AR final trip ready event
ARon	On; Off	-	Off	AR enabled event
ARoff	On; Off	-	Off	AR disabled event
CRITri	On; Off	-	On	AR critical final trip on event
AR1Tri	On; Off	-	On	AR AR1 final trip on event
AR2Tri	On; Off	-	On	AR AR2 final trip on event
Shot settings				
DeadT	0.02 – 300.00	s	5.00	The dead time setting for this shot. This is a common setting for all the AR lines in this shot

Parameter	Value	Unit	Default	Description
AR1	On; Off	-	Off	Indicates if this AR signal starts this shot
AR2	On; Off	-	Off	Indicates if this AR signal starts this shot
AR3	On; Off	-	Off	Indicates if this AR signal starts this shot
AR4	On; Off	-	Off	Indicates if this AR signal starts this shot
Start1	0.02 – 300.00	s	0.02	AR1 Start delay setting for this shot
Start2	0.02 – 300.00	s	0.02	AR2 Start delay setting for this shot
Start3	0.02 – 300.00	s	0.02	AR3 Start delay setting for this shot
Start4	0.02 – 300.00	s	0.02	AR4 Start delay setting for this shot
Discr1	0.02 – 300.00	s	0.02	AR1 Discrimination time setting for this shot
Discr2	0.02 – 300.00	s	0.02	AR2 Discrimination time setting for this shot
Discr3	0.02 – 300.00	s	0.02	AR3 Discrimination time setting for this shot
Discr4	0.02 – 300.00	s	0.02	AR4 Discrimination time setting for this shot

Table 35.2: Measured and recorded values of AR function (79)

	Parameter	Value	Unit	Description
Measured or recorded values	Obj1	UNDEFINED; OPEN; CLOSE; OPEN_REQUEST; CLOSE_REQUEST; READY; NOT_READY; INFO_NOT_AVAILABLE; FAIL	-	Object 1 state
	Status	INIT; RECLAIM_TIME; READY; WAIT_CB_OPEN; WAIT_CB_CLOSE; DISCRIMINATION_TIME; LOCKED; FINAL_TRIP; CB_FAIL; INHIBIT	-	AR-function state
	Shot#	1 – 5	-	The currently running shot
	RecIT	RECLAIMTIME; STARTTIME; DEADTIME; DISCRIMINATIONTIME	-	The currently running time (or last executed)
	SCntr		-	Total start counter
	Fail		-	The counter for failed AR shots
	Shot1*		-	Shot1 start counter
	Shot2*		-	Shot2 start counter
	Shot3*		-	Shot3 start counter
	Shot4*		-	Shot4 start counter
Shot5*		-	Shot5 start counter	

* There are 5 counters available for each one of the two AR signals.

36 Overfrequency and underfrequency (ANSI 81)

Table 36.1: Parameters of the overfrequency and underfrequency stages (81)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr		qty	Cumulative start counter	C
TCntr		qty	Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
	Fx		Function key	
Force	Off On		Force flag to enable protection stage activation	Set
f		Hz	The supervised value	
fX fXX f< f<<		Hz	Start value Over/under stage f><. See row "Mode". Over/under stage f>><<. Under stage f< Under stage f<<	Set
tX tXX t< t<<		s	Definite operate time f>< stage f>><< stage f< stage f<< stage	Set
Mode	> <		Operation mode (only for f>< and f>><<) Overfrequency mode Underfrequency mode	Set
LVbck		% Un	Low limit for self blocking. This is a common setting for all four stages.	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 36.2: Recorded values of the overfrequency and underfrequency stages (8 last faults) $f > <$, $f > < <$, $f <$, $f < <$ (81)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		Hz	Faulty frequency
EDly		%	Elapsed time of the operate time setting. 100% = trip
SetGrp	1, 2, 3, 4		Active setting group during fault

37 Rate of change of frequency (ANSI 81R)

Table 37.1: Setting parameters of df/dt stage (81R)

Parameter	Value	Unit	Default	Description
df/dt	0.2 – 10.0	Hz/s	5.0	df/dt start setting
t>	0.14 – 10.0	s	0.50	df/dt operational delay
tMin>	0.14 – 10.0	s	0.50	df/dt minimum delay
S_On	Enabled; Disabled	-	Enabled	Start on event
S_Off	Enabled; Disabled	-	Enabled	Start off event
T_On	Enabled; Disabled	-	Enabled	Trip on event
T_Off	Enabled; Disabled	-	Enabled	Trip off event

Table 37.2: Measured and recorded values of df/dt stage (81R)

	Parameter	Value	Unit	Description
Measured value	f		Hz	Frequency
	df/dt		Hz/s	Frequency rate of change
Recorded values	SCntr	qty	-	Start counter (Start) reading
	TCntr	qty	-	Trip counter (Trip) reading
	FIt		%Hz/s	Max rate of change fault value
	EDly		%	Elapsed time as compared to the set operate time, 100% = tripping

38 Differential overcurrent protection (ANSI 87M / 87L)

Table 38.1: Parameters of the differential overcurrent stages $\Delta I >$ (87)

	Parameter	Value/Unit	Description	
Setting values	Slope1	%	Slope 1 setting	
	Slope2	%	Slope 2 setting	
	Harm2>	On / Off	Second harmonic blocking enable/disable	
	Harm2>	%	Second harmonic block limit	
	TCntr		Cumulative trip counter	
	Type	1-N, 2-N, 3-N		Fault type/single-phase fault e.g.: 1 – N = fault on phase L1
		1-2, 2-3, 1-3		Fault type/two-phase fault e.g.: 2 – 3 = fault between L2 and L3
1-2-3			Fault type/three-phase fault	

Table 38.2: Parameters of the differential overcurrent stages $\Delta I >>$ (87)

	Parameter	Value/Unit	Description
Recorded values	TCntr		Cumulative trip counter
Recorded values	Type	1-N, 2-N, 3-N	Fault type/single-phase fault e.g.: 1-N = fault on phase L1
		1-2, 2-3, 1-3	Fault type/two-phase fault e.g.: 2-3 = fault between L2 and L3
		1-2-3	Fault type/three-phase fault

39 Cold load start and magnetising inrush

Table 39.1: Parameters of the cold load and inrush detection function

Parameter	Value	Unit	Description	Note
ColdLd	- Start Trip		Status of cold load detection: Cold load situation is active Timeout	
Inrush	- Start Trip		Status of inrush detection: Inrush is detected Timeout	
ILmax		A	The supervised value. Max. of IL1, IL2 and IL3	
Start		A	Primary scaled start value	
Idle		A	Primary scaled upper limit for idle current	
MaxTime		s		Set
Idle		xI_N or xI_{MOT}	Current limit setting for idle situation	Set
Start		xI_N or xI_{MOT}	Start setting for minimum start current	Set
	80	ms	Maximum transition time for start recognition	
Startf2		%	Start value for relative amount of the second harmonic, I_{f2}/I_{f1}	Set

Set = An editable parameter (password needed).

40 Programmable stages (99)

Table 40.1: Parameters of the programmable stages PrgN (99)

Parameter	Value	Unit	Description	Note
Status	- Blocked Start Trip		Current status of the stage	F F
SCntr			Cumulative start counter	C
TCntr			Cumulative trip counter	C
SetGrp	1, 2, 3, 4		Active setting group	Set
SGrpDI			Digital signal to select the active setting group	Set
	-		None	
	Dlx		Digital input	
	Vlx		Virtual input	
	LEDx		LED indicator signal	
	VOx		Virtual output	
Force	Off		Force flag to enable protection stage activation.	Set
	On			
Link	See Table "Available signals to be supervised by the programmable stages" in the product user manual.		Name for the supervised signal	Set
Table "Available signals to be supervised by the programmable stages" in the product user manual			Value of the supervised signal	
Cmp			Mode of comparison	Set
	>		Overprotection	
	<		Underprotection	
	Diff		Difference	
	AbsDiff		Absolut difference	
Start			Start value scaled to primary level	
Start		pu	Start setting in pu	Set
t		s	Definite operate time	Set
Hyster		%	Dead band setting	Set
NoCmp		pu	Minimum value to start under comparison. (Mode='<')	Set

Set = An editable parameter (password needed). C = Can be cleared to zero. F = Editable when force flag is on.

Table 40.2: Recorded values of the programmable stages PrgN (99)

Parameter	Value	Unit	Description
	yyyy-mm-dd		Time stamp of the recording, date
	hh:mm:ss.ms		Time stamp, time of day
Flt		pu	Fault value
EDly		%	Elapsed time of the operate time setting. 100% = trip
SetGrp	1, 2, 3, 4		Active setting group during fault



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