Electrical network protection

Sepam

series 80

Digital protection relays

Catalogue

Schneider Electric

Selection table

		Substation				Transformer			Motor			Generator			Busbar		Cap.
Protection	**ANSI code**	**S80**	**S81**	**S82**	**S84**	**T81**	**T82**	**T87**	**M81**	**M87**	**M88**	**G82**	**G87**	**G88**	**B80**	**B83**	**C86**
Phase overcurrent (1)	50/51	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Earth fault / Sensitive earth fault (1)	50N/51N 50G/51G	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Breaker failure	50BF	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Negative sequence / unbalance	46	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Thermal overload for cables	49RMS		1	1	1												
Thermal overload for machines (1)	49RMS					2	2	2	2	2	2	2	2	2			
Thermal overload for capacitors	49RMS																1
Capacitor bank unbalance	51C																8
Restricted earth fault	64REF					2	2	2				2		2			
Two-winding transformer differential	87T							1			1			1			
Machine differential	87M									1			1				
Directional phase overcurrent (1)	67			2	2		2	2				2	2	2			
Directional earth fault (1)	67N/67NC		2	2	2	2	2	2	2	2	2	2	2	2			
Directional active overpower	32P		2	2	2	2	2	2	2	2	2	2	2	2			
Directional reactive overpower	32Q								1	1	1	1	1	1			
Directional active underpower	37P				2							2					
Phase undercurrent	37								1	1	1						
Excessive starting time, locked rotor	48/51LR								1	1	1						
Starts per hour	66								1	1	1						
Field loss (underimpedance)	40								1	1	1	1	1	1			
Pole slip	78PS								1	1	1	1	1	1			
Overspeed (2 set points) (2)	12								□	□	□	□	□	□			
Underspeed (2 set points) (2)	14								□	□	□	□	□	□			
Voltage-restrained overcurrent	50V/51V											2	2	2			
Underimpedance	21B											1	1	1			
Inadvertent energization	50/27											1	1	1			
Third harmonic undervoltage / 100 % stator earth fault	27TN/64G2 64G											2	2	2			
Overfluxing (V / Hz)	24							2				2	2	2			
Undervoltage (L-L or L-N)	27	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Positive sequence undercurrent	27D	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Remanent undervoltage	27R	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Overvoltage (L-L or L-N)	59	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Neutral voltage displacement	59N	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Negative sequence overvoltage	47	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Overfrequency	81H	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Underfrequency	81L	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Rate of change of frequency	81R				2												
Recloser (4 cycles) (2)	79	□	□	□	□												
Thermostat / Buchholz (2)	26/63					□	□	□	□		□	□		□			
Temperature monitoring (16 RTDs) (3)	38/49T					□	□	□	□	□	□	□	□	□			□
Synchro-check (4)	25	□	□	□	□	□	□	□				□	□	□	□	□	
Control and monitoring																	
Circuit breaker / contactor control	94/69	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Automatic transfer (AT) (2)		□	□	□	□	□	□	□				□	□	□	□	□	
Load shedding / automatic restart									■	■	■						
De-excitation												■	■	■			
Genset shutdown												■	■	■			
Capacitor step control (2)																	□
Logic discrimination (2)	68	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Latching / acknowledgement	86	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Annunciation	30	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Switching of groups of settings		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Adaptation using logic equations		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Logipam programming (Ladder language)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

The figures indicate the number of relays available for each protection function.
■ standard, □ options.
***(1)** Protection functions with 2 groups of settings.*
***(2)** According to parameter setting and optional MES120 input/output modules.*
***(3)** With optional MET148-2 temperature input modules.*
***(4)** With optional MCS025 synchro-check module.*

Selection table

	Substation				Transformer			Motor			Generator			Busbar		Cap.
Metering	**S80**	**S81**	**S82**	**S84**	**T81**	**T82**	**T87**	**M81**	**M87**	**M88**	**G82**	**G87**	**G88**	**B80**	**B83**	**C86**
Phase current I1, I2, I3 RMS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Measured residual current I0, calculated I0Σ	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Demand current I1, I2, I3	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Peak demand current IM1, IM2, IM3	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Measured residual current I'0	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Voltage U21, U32, U13, V1, V2, V3	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Residual voltage V0	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Positive sequence voltage Vd / rotation direction	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Negative sequence voltage Vi	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Frequency	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Active power P, P1, P2, P3	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Reactive power Q, Q1, Q2, Q3	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Apparent power S, S1, S2, S3	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Peak demand power PM, QM	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Power factor	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Calculated active and reactive energy (±Wh, ±VARh)	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Active and reactive energy by pulse counting [2] (± Wh, ± VARh)	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Phase current I'1, I'2, I'3 RMS							■		■	■		■	■			
Calculated residual current I'0Σ							■		■	■		■	■			
Voltage U'21, V'1 and frequency														■		
Voltage U'21, U'32, U'13, V'1, V'2, V'3, V'd, V'i and frequency															■	
Residual voltage V'0															■	
Temperature (16 RTDs) [3]					□	□	□	□	□	□	□	□	□			□
Rotation speed [2]								□	□	□	□	□	□			
Neutral point voltage Vnt								■	■	■	■	■	■			
Network and machine diagnosis																
Tripping context	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Tripping current TripI1, TripI2, TripI3	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase fault and earth fault trip counters	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Unbalance ratio / negative sequence current Ii	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Harmonic distortion (THD), current and voltage Ithd, Uthd	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase displacement φ0, φ'0, φ0Σ	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase displacement φ1, φ2, φ3	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Disturbance recording	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Thermal capacity used		■	■	■	■	■	■	■	■	■	■	■	■			■
Remaining operating time before overload tripping		■	■	■	■	■	■	■	■	■	■	■	■			■
Waiting time after overload tripping		■	■	■	■	■	■	■	■	■	■	■	■			■
Running hours counter / operating time					■	■	■	■	■	■	■	■	■			■
Starting current and time								■	■	■						
Start inhibit time								■	■	■						
Number of starts before inhibition								■	■	■						
Unbalance ratio / negative sequence current I'i							■		■	■		■	■			
Differential current Idiff1, Idiff2, Idiff3							■		■	■		■	■			
Through current It1, It2, It3							■		■	■		■	■			
Current phase displacement θ							■		■	■		■	■			
Apparent positive sequence impedance Zd		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Apparent phase-to-phase impedances Z21, Z32, Z13		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Third harmonic voltage, neutral point or residual											■	■	■			
Difference in amplitude, frequency and phase of voltages compared for synchro-check [4]	□	□	□	□	□	□	□				□	□	□	□	□	
Capacitor unbalance current and capacitance																■
Switchgear diagnosis **ANSI code**																
CT / VT supervision 60/60FL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Trip circuit supervision [2] 74	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Auxiliary power supply monitoring	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Cumulative breaking current	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Number of operations, operating time, charging time, number of racking out operations [2]	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Additional modules																
8 temperature sensor inputs - MET148-2 module [2]					□	□	□	□	□	□	□	□	□	□	□	□
1 low level analog output - MSA141 module	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Logic inputs/outputs - MES120/MES120G/ MES120H (14I/6O) module	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Communication interface - ACE949-2, ACE959, ACE937, ACE969-2 TP, FO, ACE850 TP, FO or ECI850	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Modbus communication, IEC 60 870-5-103, DNP3 or IEC 61850																
Measurement readout [5] [6]	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Remote indication and time tagging of events [5] [6]	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Remote control orders [5] [6]	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Remote protection setting [5]	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Transfer of disturbance recording data [5] [6]	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
GOOSE message IEC 61850 [6]	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

■ *standard, □ options.*

(2) *According to parameter setting and optional MES120 input/output modules.*

(3) *With optional MET148-2 temperature input modules.*

(4) *With optional MCS025 synchro-check module.*

(5) *With ACE949-2, ACE959, ACE937, ACE969TP-2, ACE969FO-2 or ECI850 communication interface.*

(6) *With ACE850TP or ACE850FO communication interface.*

Metering and diagnosis
Description

Metering

Sepam is a precision metering unit.
All the metering and diagnosis data used for commissioning and required
for the operation and maintenance of your equipment are available locally
or remotely, expressed in the units concerned (A, V, W, etc.).

Phase current

RMS current for each phase, taking into account harmonics up to number 13.
Different types of sensors may be used to meter phase current:
- 1 A or 5 A current transformers
- LPCT type current sensors.

Residual current

Four types of residual current values are available depending on the type of Sepam and sensors connected to it:
- 2 residual currents I0Σ and I'0Σ, calculated by the vector sum of the 3 phase currents
- 2 measured residual currents I0 and I'0.

Different types of sensors may be used to measure residual current:
- CSH120 or CSH200 specific core balance CT
- conventional 1 A or 5 A current transformer with CSH30 interposing ring CT
- any core balance CT with an ACE990 interface.

Demand current and peak demand currents

Demand current and peak demand currents are calculated according to the 3 phase currents I1, I2 and I3:
- demand current is calculated over an adjustable period of 5 to 60 minutes
- peak demand current is the greatest demand current and indicates the current drawn by peak loads.

Peak demand currents may be cleared.

Voltage and frequency

The following measurements are available according to the voltage sensors connected:
- phase-to-neutral voltages V1, V2, V3 and V'1, V'2, V'3
- phase-to-phase voltages U21, U32, U13 and U'21, U'32, U'13
- residual voltage V0, V'0 or neutral point voltage Vnt
- positive sequence voltage Vd, V'd and negative sequence voltage Vi, V'i
- frequency measured on the main and additional voltage channels.

Power

Powers are calculated according to the phase currents I1, I2 and I3:
- active power
- reactive power
- apparent power
- power factor (cos φ).

According to the sensors used, power calculations may be based on the 2 or 3 wattmeter method.
The 2 wattmeter method is only accurate when there is no residual current and it is not applicable if the neutral is distributed.
The 3 wattmeter method gives an accurate calculation of 3-phase and phase by phase powers in all cases, regardless of whether or not the neutral is distributed.

Peak demand powers

The greatest demand active and reactive power values calculated over the same period as the demand current. The peak demand powers may be cleared.

Energy

- 4 accumulated energies calculated according to voltages and phase currents I1, I2 and I3 measured: active energy and reactive energy in both directions
- 1 to 4 additional accumulated energy meters for the acquisition of active or reactive energy pulses from external meters.

Temperature

Accurate measurement of temperature inside equipment fitted with Pt100, Ni100 or Ni120 type RTDs, connected to the optional remote MET148-2 module.

Rotation speed

Calculated by the counting of pulses transmitted by a proximity sensor at each passage of a cam driven by the rotation of the motor or generator shaft.
Acquisition of pulses on a logic input.

Phasor diagram

A phasor diagram is displayed by SFT2841 software and the mimic-based UMI to check cabling and assist in the setting and commissioning of directional and differential protection functions.
According to the connected sensors, all current and voltage information can be selected for display in vector form.

Metering and diagnosis
Description

Network diagnosis assistance

Sepam provides network power quality metering functions, and all the data on network disturbances detected by Sepam are recorded for analysis purposes.

Tripping context

Storage of tripping currents and I0, Ii, U21, U32, U13, V1, V2, V3, V0, Vi, Vd, F, P, Q, Idiff, It and Vnt values when tripping occurs. The values for the last five trips are stored.

Tripping current

Storage of the 3 phase currents and earth fault current at the time of the last Sepam trip order, to indicate fault current.
The values are stored in the tripping contexts.

Number of trips

2 trip counters:
- number of phase fault trips, incremented by each trip triggered by ANSI 50/51, 50V/51V and 67 protection functions
- number of earth fault trips, incremented by each trip triggered by ANSI 50N/51 and 67N/67NC protection functions.

Negative sequence / unbalance

Negative sequence component of phase currents I1, I2 and I3 (and I'1, I'2 and I'3), indicating the degree of unbalance in the power supplied to the protected equipment.

Total harmonic distortion

Two THD values calculated to assess network power quality, taking into account harmonics up to number 13:
- current THD, calculated according to I1
- voltage THD, calculated according to V1 or U21.

Phase displacement

- phase displacement φ1, φ2, φ3 between phase currents I1, I2, I3 and voltages V1, V2, V3 respectively
- phase displacement φ0 between residual current and residual voltage.

Disturbance recording

Recording triggered by user-set events:
- all sampled values of measured currents and voltages
- status of all logic inputs and outputs logic data: pick-up, …

Recording characteristics	
Number of recordings in COMTRADE format	Adjustable from 1 to 19
Total duration of a recording	Adjustable from 1 to 11 s
Number of samples per period	12 or 36
Duration of recording prior to occurrence of the event	Adjustable from 0 to 99 periods

Maximum recording capability		
Network frequency	**12 samples per period**	**36 samples per period**
50 Hz	22 s	7 s
60 Hz	18 s	6 s

Voltage comparison for synchro-check

For the synchro-check function, the MCS025 module continuously measures the amplitude, frequency and phase differences between the 2 voltages to be checked.

Out-of-sync context

Storage of amplitude, frequency and phase differences between the 2 voltages measured by the MCS025 module when a closing order is inhibited by the synchro-check function.

Metering and diagnosis
Description

Machine diagnosis assistance

Sepam assists facility managers by providing:
- data on the operation of their machines
- predictive data to optimize process management
- useful data to facilitate protection function setting and implementation.

Thermal capacity used
Equivalent temperature buildup in the machine, calculated by the thermal overload protection function.
Displayed as a percentage of rated thermal capacity.

Remaining operating time before overload tripping
Predictive data calculated by the thermal overload protection function.
The time is used by facility managers to optimize process management in real time by deciding to:
- interrupt according to procedures
- continue operation with inhibition of thermal protection on overloaded machine.

Waiting time after overload tripping
Predictive data calculated by the thermal overload protection function.
Waiting time to avoid further tripping of thermal overload protection by premature re-energizing of insufficiently cooled down equipment.

Running hours counter / operating time
Equipment is considered to be running whenever a phase current is over 0.1 Ib.
Cumulative operating time is given in hours.

Motor starting / overload current and time
A motor is considered to be starting or overloaded when a phase current is over 1.2 Ib. For each start / overload, Sepam stores:
- maximum current drawn by the motor
- starting / overload time.

The values are stored until the following start / overload.

Number of starts before inhibition/start inhibit time
Indicates the number of starts still allowed by the starts per hour protection function and, if the number is zero, the waiting time before starting is allowed again.

Differential and through current
Values calculated to facilitate the implementation of ANSI 87T and 87M differential protection functions.

Current phase displacement
Phase shift between the main phase currents and additional phase currents to facilitate implementation of ANSI 87T differential protection function.

Apparent positive sequence impedance Zd
Value calculated to facilitate the implementation of the underimpedance field loss protection (ANSI 40).

Apparent phase-to-phase impedances Z21, Z32, Z13
Values calculated to facilitate the implementation of the backup underimpedance protection function (ANSI 21B).

Third harmonic neutral point or residual voltage
Values measured to facilitate the implementation of the third harmonic undervoltage / 100 % stator earth fault protection function (ANSI 27TN/64G2).

Capacitance
Measurement, for each phase, of the total capacitance of the connected capacitor bank steps. This measurement is used to monitor the condition of the capacitors.

Capacitor unbalance current
Measurement of the unbalance current for each capacitor bank step. This measurement is possible when the steps are connected in a double star arrangement.

Metering and diagnosis
Description

Switchgear diagnosis assistance

Switchgear diagnosis data give facility managers information on:
- mechanical condition of breaking device
- Sepam auxiliaries

and assist them for preventive and curative switchgear maintenance actions.
The data are to be compared to switchgear manufacturer data.

ANSI 60/60FL - CT/VT supervision

Used to monitor the entire metering chain:
- CT and VT sensors
- connection
- Sepam analog inputs.

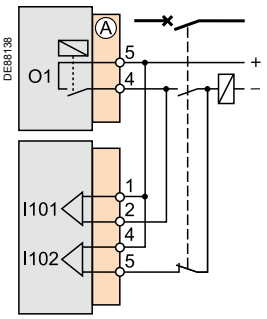
Monitoring includes:
- consistency checking of currents and voltages measured
- acquisition of phase or residual voltage transformer protection fuse blown contacts.

In the event of a loss of current or voltage measurement data, the assigned protection functions may be inhibited to avoid nuisance tripping.

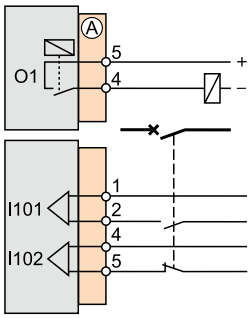
ANSI 74 - Trip/closing circuit supervision

To detect trip circuit and closing circuit failures, Sepam monitors:
- shunt trip coil connection
- closing coil connection
- matching of breaking device open/closed position contacts
- execution of breaking device open and close orders.

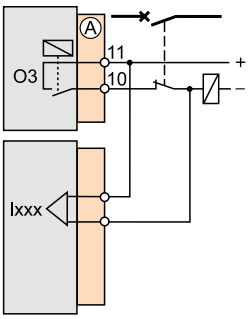
The trip and closing circuits are only supervised when connected as shown below.



Connection for shunt trip coil monitoring.



Connection for undervoltage trip coil monitoring.



Connection for closing circuit supervision

Auxiliary power supply monitoring

The voltage rating of Sepam's auxiliary supply should be set between 24 V DC and 250 V DC.
If the auxiliary supply drifts, 2 alarms may be triggered:
- high set point alarm, adjustable from 105 % to 150 % of rated supply (maximum 275 V)
- low set point alarm, adjustable from 60 % to 95 % of rated supply (minimum 20 V).

Cumulative breaking current monitoring

Six cumulative currents are proposed to assess breaking device pole condition:
- total cumulative breaking current
- cumulative breaking current between 0 and 2 In
- cumulative breaking current between 2 In and 5 In
- cumulative breaking current between 5 In and 10 In
- cumulative breaking current between 10 In and 40 In
- cumulative breaking current > 40 In.

Each time the breaking device opens, the breaking current is added to the cumulative total and to the appropriate range of cumulative breaking current.
Cumulative breaking current is given in $(kA)^2$.
An alarm can be generated when the total cumulative breaking current exceeds a set point.

Number of operations

Cumulative number of opening operations performed by the breaking device.

Circuit breaker operating time and charging time
Number of rackouts

Used to assess the condition of the breaking device operating mechanism.

Metering and diagnosis
Description

Sepam self-diagnosis

Sepam includes a number of self-tests carried out in the base unit and optional modules. The purpose of the self-tests is to:
- detect internal failures that may cause nuisance tripping or failed fault tripping
- put Sepam in fail-safe position to avoid any unwanted operation
- alert the facility manager of the need for maintenance operations.

Internal failure

Two categories of internal failures are monitored:
- major failures: Sepam shutdown (to fail-safe position).

The protection functions are inhibited, the output relays are forced to drop out and the "Watchdog" output indicates Sepam shutdown
- minor failures: downgraded Sepam operation.

Sepam's main functions are operational and equipment protection is ensured.

Battery monitoring

Monitoring of battery voltage to guarantee data is saved in the event of an outage.
A battery fault generates an alarm.

Detection of plugged connectors

The system checks that the current or voltage sensors are plugged in. A missing connector is a major failure.

Configuration checking

The system checks that the optional modules configured are present and working correctly.
The absence or failure of a remote module is a minor failure, the absence or failure of a logic input/output module is a major failure.

Metering and diagnosis
Characteristics

Functions		Measurement range	Accuracy (1)	MSA141	Saving
Metering					
Phase current		0.02 to 40 In	±0.5 %	■	
Residual current	Calculated	0.005 to 40 In	±1 %	■	
	Measured	0.005 to 20 In0	±1 %	■	
Demand current		0.02 to 40 In	±0.5 %		
Peak demand current		0.02 to 40 In	±0.5 %		□
Phase-to-phase voltage	Main channels (U)	0.05 to 1.2 Unp	±0.5 %	■	
	Additional channels (U')	0.05 to 1.2 Unp	±1 %		
Phase-to-neutral voltage	Main channels (V)	0.05 to 1.2 Vnp	±0.5 %	■	
	Additional channels (V')	0.05 to 1.2 Vnp	±1 %		
Residual voltage		0.015 to 3 Vnp	±1 %		
Neutral point voltage		0.015 to 3 Vntp	±1 %		
Positive sequence voltage		0.05 to 1.2 Vnp	±2 %		
Negative sequence voltage		0.05 to 1.2 Vnp	±2 %		
Frequency	Main channels (f)	25 to 65 Hz	±0.01 Hz	■	
	Additional channels (f')	45 to 55 Hz (fn = 50 Hz) 55 to 65 Hz (fn = 60 Hz)	±0.05 Hz		
Active power (total or per phase)		0.008 Sn to 999 MW	±1 %	■	
Reactive power (total or per phase)		0.008 Sn to 999 MVAR	±1 %	■	
Apparent power (total or per phase)		0.008 Sn to 999 MVA	±1 %	■	
Peak demand active power		0.008 Sn to 999 MW	±1 %		□
Peak demand reactive power		0.008 Sn to 999 MVAR	±1 %		□
Power factor		-1 to + 1 (CAP/IND)	±0.01	■	
Calculated active energy		0 to 2.1 x 10^8 MWh	±1 % ±1 digit		□ □
Calculated reactive energy		0 to 2.1 x 10^8 MVARh	±1 % ±1 digit		□ □
Temperature		-30 °C to +200 °C or -22 °F to +392 °F	±1 °C from +20 to +140 °C ±1,8 °F from +68 to +384 °F	■	
Rotation speed		0 to 7200 rpm	±1 rpm		
Network diagnosis assistance					
Tripping context					□
Tripping current		0.02 to 40 In	±5 %		□
Number of trips		0 to 65535	-		□ □
Negative sequence / unbalance		1 to 500 % of Ib	±2 %		
Total harmonic distortion, current		0 to 100 %	±1 %		
Total harmonic distortion, voltage		0 to 100 %	±1 %		
Phase displacement φ0 (between V0 and I0)		0 to 359°	±2°		
Phase displacement φ1, φ2, φ3 (between V and I)		0 to 359°	±2°		
Disturbance recording					□
Amplitude difference		0 to 1.2 Usync1	±1 %		
Frequency difference		0 to 10 Hz	±0.5 Hz		
Phase difference		0 to 359°	±2°		
Out-of-sync context					□
Machine operating assistance					
Thermal capacity used		0 to 800 % (100 % for phase I = Ib)	±1 %	■	□ □
Remaining operating time before overload tripping		0 to 999 min	±1 min		
Waiting time after overload tripping		0 to 999 min	±1 min		
Running hours counter / operating time		0 to 65535 hours	±1 % or ±0.5 h		□ □
Starting current		1.2 Ib to 40 In	±5 %		□
Starting time		0 to 300 s	±300 ms		□
Number of starts before inhibition		0 to 60			
Start inhibit time		0 to 360 min	±1 min		
Differential current		0.015 to 40 In	±1 %		
Through current		0.015 to 40 In	±1 %		
Phase displacement θ1, θ2, θ3 (between I and I')		0 to 359°	±2°		
Apparent impedance Zd, Z21, Z32, Z13		0 to 200 kΩ	±5 %		
Third harmonic neutral point voltage		0.2 to 30 % of Vnp	±1 %		
Third harmonic residual voltage		0.2 to 90 % of Vnp	±1 %		
Capacitance		0 to 30 F	±5 %		
Capacitor unbalance current		0.02 to 40 I'n	±5 %		
Switchgear diagnosis assistance					
Cumulative breaking current		0 to 65535 kA²	±10 %		□ □
Auxiliary supply		24 V DC to 250 V DC	±4 V or ±10 %		□ □
Number of operations		0 to 4 x 10^9	-		□ □
Operating time		20 to 100 ms	±1 ms		□ □
Charging time		1 to 20 s	±0.5 s		□ □
Number of rackouts		0 to 65535	-		□ □

■ *available on MSA141 analog output module, according to setup*
□ *saved in the event of auxiliary supply outage, even without battery*
□ *saved by battery in the event of auxiliary supply outage.*
(1) *Under reference conditions (IEC 60255-6), typical accuracy at In or Unp, cos φ > 0.8.*

Protection
Description

Current protection functions

ANSI 50/51 - Phase overcurrent
Phase-to-phase short-circuit protection.
2 modes:
■ overcurrent protection sensitive to the highest phase current measured
■ machine differential protection sensitive to the highest differential phase currents obtained in self-balancing schemes.

Characteristics
■ 2 groups of settings
■ instantaneous or time-delayed tripping
■ definite time (DT), IDMT (choice of 16 standardized IDMT curves) or customized curve
■ with or without timer hold
■ tripping confirmed or unconfirmed, according to parameter setting:
□ unconfirmed tripping: standard
□ tripping confirmed by negative sequence overvoltage protection (ANSI 47, unit 1), as backup for distant 2-phase short-circuits
□ tripping confirmed by undervoltage protection (ANSI 27, unit 1), as backup for phase-to-phase short-circuits in networks with low short-circuit power.

ANSI 50N/51N or 50G/51G - Earth fault
Earth fault protection based on measured or calculated residual current values:
■ ANSI 50N/51N: residual current calculated or measured by 3 phase current sensors
■ ANSI 50G/51G: residual current measured directly by a specific sensor.

Characteristics
■ 2 groups of settings
■ definite time (DT), IDMT (choice of 17 standardized IDMT curves) or customized curve
■ with or without timer hold
■ second harmonic restraint to ensure stability during transformer energizing, activated by parameter setting.

ANSI 50BF - Breaker failure
If a breaker fails to be triggered by a tripping order, as detected by the non-extinction of the fault current, this backup protection sends a tripping order to the upstream or adjacent breakers.

ANSI 46 - Negative sequence / unbalance
Protection against phase unbalance, detected by the measurement of negative sequence current.
■ sensitive protection to detect 2-phase faults at the ends of long lines
■ protection of equipment against temperature build-up, caused by an unbalanced power supply, phase inversion or loss of phase, and against phase current unbalance.

Characteristi cs
■ 1 definite time (DT) curve
■ 9 IDMT curves: 4 IEC curves and 3 IEEE curves, 1 ANSI curve in RI^2 and 1 specific Schneider curve

ANSI 49RMS - Thermal overload
Protection against thermal damage caused by overloads on
■ machines (transformers, motors or generators)
■ cables
■ capacitors
The thermal capacity used is calculated according to a mathematical model which takes into account:
■ current RMS values
■ ambient temperature
■ negative sequence current, a cause of motor rotor temperature rise.
The thermal capacity used calculations may be used to calculate predictive data for process control assistance.
The protection may be inhibited by a logic input when required by process control conditions.

Thermal overload for machines - Characteristics
■ 2 groups of settings
■ 1 adjustable alarm set point
■ 1 adjustable tripping set point
■ adjustable initial thermal capacity used setting, to adapt protection characteristics to fit manufacturer's thermal withstand curves
■ equipment heating and cooling time constants.
The cooling time constant may be calculated automatically based on measurement of the equipment temperature by a sensor.

Thermal overload for cables - Characteristics
■ 1 group of settings
■ cable current carrying capacity, which determines alarm and trip set points
■ cable heating and cooling time constants.

Thermal overload for capacitors - Characteristics
■ 1 group of settings
■ alarm current, which determines the alarm set point
■ overload current, which determines the tripping set point
■ hot tripping time and current setting, which determine a point on the tripping curve.

ANSI 51C - Capacitor bank unbalance
Detection of capacitor step internal faults by measuring the unbalance current flowing between the two neutral points of a step connected in a double star arrangement. Four unbalance currents can be measured to protect up to 4 steps.

Characteristics
■ 2 set points per step
■ definite time (DT) curve.

Protection
Description

Recloser

ANSI 79
Automation device used to limit down time after tripping due to transient or semi-permanent faults on overhead lines. The recloser orders automatic reclosing of the breaking device after the time delay required to restore the insulation has elapsed.
Recloser operation is easy to adapt for different operating modes by parameter setting.

Characteristics
■ 1 to 4 reclosing cycles, each cycle has an adjustable dead time
■ adjustable, independent reclaim time and safety time until recloser ready time delays
■ cycle activation linked to instantaneous or time-delayed short-circuit protection function (ANSI 50/51, 50N/51N, 67, 67N/67NC) outputs by parameter setting
■ inhibition/locking out of recloser by logic input.

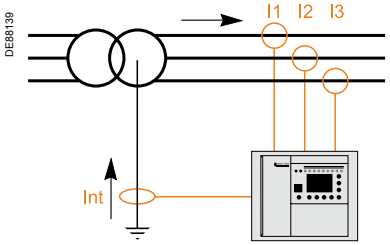
Synchro-check

ANSI 25
This function checks the voltages upstream and downstream of a circuit breaker and allows closing when the differences in amplitude, frequency and phase are within authorized limits.

Characteristics
■ adjustable and independent set points for differences in voltage, frequency and phase
■ adjustable lead time to take into account the circuit-breaker closing time
■ 5 possible operating modes to take no-voltage conditions into account.

Differential protection functions

ANSI 64REF - Restricted earth fault differential
Detection of phase-to-earth faults on 3-phase windings with earthed neutral, by comparison of residual current calculated from the 3 phase currents and residual current measured at the neutral point.



Characteristics
■ instantaneous tripping
■ percentage-based characteristic with fixed slope and adjustable low set point
■ more sensitive than transformer or machine differential protection.

ANSI 87T - Transformer and transformer-machine unit differential (2 windings)
Phase-to-phase short-circuit protection of two-winding transformers or transformer-machine units.
Protection based on phase by phase comparison of the primary and secondary currents with:
■ amplitude and phase correction of the currents in each winding according to the transformer vector shift and the voltage values set
■ clearance of zero sequence current from the primary and secondary windings (suitable for all earthing systems).

Characteristics
■ instantaneous tripping
■ adjustable high set point for fast tripping for violent faults, with no restraint
■ percentage-based characteristic with two adjustable slopes and adjustable low set point
■ restraint based on percentage of harmonics. These restraints prevent nuisance tripping during transformer energizing, during faults outside the zone that provoke saturation of the current transformers and during operation of a transformer supplied with excessive voltage (overfluxing).
□ self-adapting neural network restraint: this restraint analyzes the percentage of harmonics 2 and 5 as well as differential and through currents
□ restraint based on the percentage of harmonic 2 per phase or total
□ restraint based on the percentage of harmonic 5 per phase or total.
Self-adapting restraint is exclusive with respect to restraints on the percentage of harmonic 2 or on the percentage of harmonic 5.
■ restraint on energization. This restraint, based on the magnetizing current of the transformer or on a logic equation or Logipam, ensures stability of transformers that have low harmonic percentages on energization
■ fast restraint upon loss of sensor.

ANSI 87M - Machine differential
Phase-to-phase short-circuit protection, based on phase by phase comparison of the currents on motor and generator windings.

Characteristics
■ instantaneous tripping
■ fixed high set point for fast tripping for violent faults, with no restraint
■ percentage-based characteristic with fixed slope and adjustable low set point
■ tripping restraint according to percentage characteristic activated by detection of:
□ external fault or machine starting
□ sensor saturation or disconnection
□ transformer energizing (harmonic 2 restraint)

Protection
Description

Directional current protection

ANSI 67 - Directional phase overcurrent
Phase-to-phase short-circuit protection, with selective tripping according to fault current direction.
It comprises a phase overcurrent function associated with direction detection, and picks up if the phase overcurrent function in the chosen direction (line or busbar) is activated for at least one of the 3 phases.

Characteristics
- 2 groups of settings
- instantaneous or time-delayed tripping
- choice of tripping direction
- definite time (DT), IDMT (choice of 16 standardized IDMT curves) or customized curve
- with voltage memory to make the protection insensitive to loss of polarization voltage at the time of the fault
- with or without timer hold.

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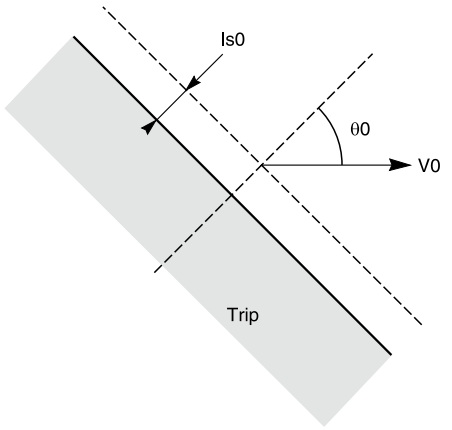

Tripping characteristic of ANSI 67N/67NC type 1 protection (characteristic angle θ0 ≠ 0°).

ANSI 67N/67NC - Directional earth fault
Earth fault protection, with selective tripping according to fault current direction.
2 types of operation:
- type 1, projection
- type 2, according to the magnitude of the residual current phasor.

ANSI 67N/67NC type 1
Directional earth fault protection for impedant, isolated or compensated neutral systems, based on the projection of measured residual current.

Type 1 characteristics
- 2 groups of settings
- instantaneous or time-delayed tripping
- definite time (DT) curve
- choice of tripping direction
- characteristic projection angle
- no timer hold
- with voltage memory to make the protection insensitive to recurrent faults in compensated neutral systems.

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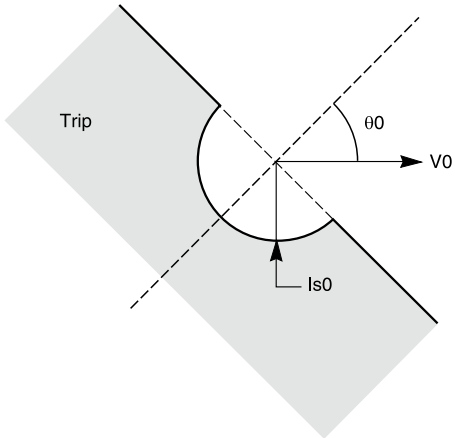

Tripping characteristic of ANSI 67N/67NC type 2 protection (characteristic angle θ0 ≠ 0°).

ANSI 67N/67NC type 2
Directional overcurrent protection for impedance and solidly earthed systems, based on measured or calculated residual current.
It comprises an earth fault function associated with direction detection, and picks up if the earth fault function in the chosen direction (line or busbar) is activated.

Type 2 characteristics
- 2 groups of settings
- instantaneous or time-delayed tripping
- definite time (DT), IDMT (choice of 16 standardized IDMT curves) or customized curve
- choice of tripping direction
- with or without timer hold.

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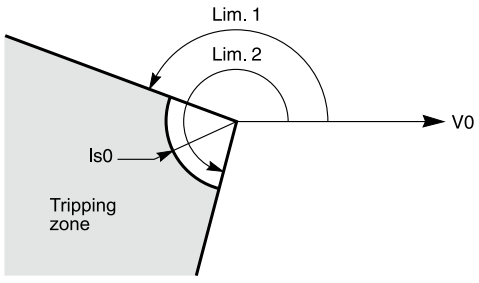


Tripping characteristic of ANSI 67N/67NC type 3 protection.

ANSI 67N/67NC type 3
Directional overcurrent protection for distribution networks in which the neutral earthing system varies according to the operating mode, based on measured residual current.
It comprises an earth fault function associated with direction detection (angular sector tripping zone defined by 2 adjustable angles), and picks up if the earth fault function in the chosen direction (line or busbar) is activated.
This protectionfunction complies with the CEI 0-16 Italian specification.

Type 3 characteristics
- 2 groups of settings
- instantaneous or time-delayed tripping
- definite time (DT) curve
- choice of tripping direction
- no timer hold

Protection
Description

Directional power protection functions

ANSI 32P - Directional active overpower
Two-way protection based on calculated active power, for the following applications:
■ active overpower protection to detect overloads and allow load shedding
■ reverse active power protection:
□ against generators running like motors when the generators consume active power
□ against motors running like generators when the motors supply active power.

ANSI 32Q - Directional reactive overpower
Two-way protection based on calculated reactive power to detect field loss on synchronous machines:
■ reactive overpower protection for motors which consume more reactive power with field loss
■ reverse reactive overpower protection for generators which consume reactive power with field loss.

ANSI 37P - Directional active underpower
Two-way protection based on calculated active power
Checking of active power flows:
■ to adapt the number of parallel sources to fit the network load power demand
■ to create an isolated system in an installation with its own generating unit.

Machine protection functions

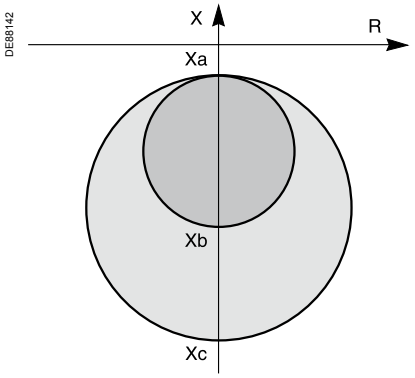
ANSI 37 - Phase undercurrent
Protection of pumps against the consequences of a loss of priming by the detection of motor no-load operation.
It is sensitive to a minimum of current in phase 1, remains stable during breaker tripping and may be inhibited by a logic input.

ANSI 48/51LR - Locked rotor / excessive starting time
Protection of motors against overheating caused by:
■ excessive motor starting time due to overloads (e.g. conveyor) or insufficient supply voltage.
The reacceleration of a motor that is not shut down, indicated by a logic input, may be considered as starting.
■ locked rotor due to motor load (e.g. crusher):
□ in normal operation, after a normal start
□ directly upon starting, before the detection of excessive starting time, with detection of locked rotor by a zero speed detector connected to a logic input, or by the underspeed function.

ANSI 66 - Starts per hour
Protection against motor overheating caused by:
■ too frequent starts: motor energizing is inhibited when the maximum allowable number of starts is reached, after counting of:
□ starts per hour (or adjustable period)
□ consecutive motor hot or cold starts (reacceleration of a motor that is not shut down, indicated by a logic input, may be counted as a start)
■ starts too close together in time: motor re-energizing after a shutdown is only allowed after an adjustable waiting time.

ANSI 40 - Field loss (underimpedance)
Protection of synchronous machines against field loss, based on the calculation of positive sequence impedance on the machine terminals or transformer terminals in the case of transformer-machine units.

Characteristics
■ 2 circular characteristics defined by reactances Xa, Xb and Xc



2 circular tripping characteristics of ANSI 40 protection.

■ tripping when the machine's positive sequence impedance enters one of the circular characteristics.
■ definite (DT) time delay for each circular characteristic
■ setting assistance function included in SFT2841 software to calculate the values of Xa, Xb and Xc according to the electrical characteristics of the machine (and transformer, when applicable).

Protection
Description

ANSI 78PS - Pole slip
Protection against loss of synchronism on synchronous machines, based on calculated active power.
2 types of operation:
■ tripping according to the equal-area criterion, time-delayed
■ tripping according to power swing (number of active power swings):
□ suitable for generators capable of withstanding high electrical and mechanical constraints
□ to be set as a number of rotations.
The 2 types of operation may be used independently or at the same time.

ANSI 12 - Overspeed
Detection of machine overspeed, based on the speed calculated by pulse-counting, to detect synchronous generator racing due to loss of synchronism, or for process monitoring, for example.

ANSI 14 - Underspeed
Machine speed monitoring based on the speed calculated by pulse-counting:
■ detection of machine underspeed after starting, for process monitoring, for example
■ zero speed data for detection of locked rotor upon starting.

ANSI 50V/51V - Voltage-restrained overcurrent
Phase-to-phase short-circuit protection, for generators. The current tripping set point is voltage-adjusted in order to be sensitive to faults close to the generator which cause voltage drops and lowers the short-circuit current.

Characteristics
■ instantaneous or time-delayed tripping
■ definite time (DT), IDMT (choice of 16 standardized IDMT curves) or customized curve
■ with or without timer hold.

ANSI 21B - Underimpedance
Phase-to-phase short-circuit protection, for generators, based on the calculation of apparent phase-to-phase impedance.

$$Z21 = \frac{U21}{I2 - I1}$$

apparent impedance between phases 1 and 2.

Characteristics
■ circular characteristic centered at origin defined by adjustable set point Zs

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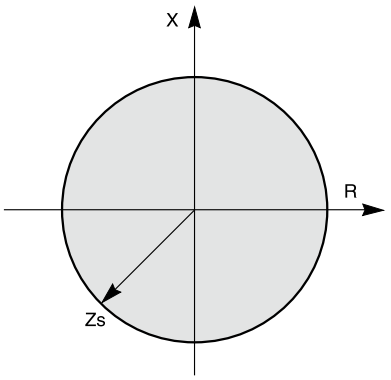

Circular tripping characteristic of ANSI 21B protection.

■ time-delayed definite time (DT) tripping when one of the three apparent impedances enters the circular tripping characteristic.

ANSI 50/27 - Inadvertent energization
Checking of generator starting sequence to detect inadvertent energization of generators that are shut down (a generator which is energized when shut down runs like a motor).
Consists of an instantaneous phase overcurrent protection confirmed by a time-delayed undervoltage protection function.

ANSI 64G - 100 % stator earth fault
Protection of generators with earthed neutral against phase-to-earth insulation faults in stator windings. This function may be used to protect generators connected to step-up transformers
100 % stator earth fault is a combination of two protection functions:
■ ANSI 59N/64G1: neutral voltage displacement, protection of 85 % to 90 % of the stator winding, terminal end.
■ ANSI 27TN/64G2: thrid harmonic undervoltage, protection of 10 % to 20 % of the stator winding, neutral point end.

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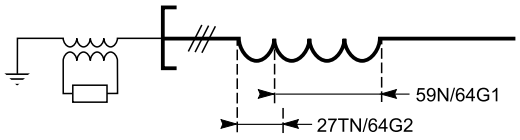

Stator winding of a generator protected 100 % by the combination of ANSI 59N and ANSI 27TN protection functions.

ANSI 27TN/64G2 - Third harmonic undervoltage
Protection of generators with earthed neutral against phase-to-earth insulation faults, by the detection of a reduction of third harmonic residual voltage.
Protects the 10 to 20 % of the stator winding, neutral point end, not protected by the ANSI 59N/64G1 function, neutral voltage displacement.

Characteristics
■ choice of 2 tripping principles, according to the sensors used:
□ fixed third harmonic undervoltage set point
□ adaptive neutral and terminal third harmonic voltage comparator set point
■ time-delayed definite time (DT) tripping.

ANSI 26/63 - Thermostat/Buchholz
Protection of transformers against temperature rise and internal faults via logic inputs linked to devices integrated in the transformer.

ANSI 38/49T - Temperature monitoring
Protection that detects abnormal temperature build-up by measuring the temperature inside equipment fitted with sensors:
■ transformer: protection of primary and secondary windings
■ motor and generator: protection of stator windings and bearings.

Characteristics
■ 16 Pt100, NI100 or Ni120 type RTDs
■ 2 adjustable independent set points for each RTD (alarm and trip).

Protection
Description

Voltage protection functions

ANSI 24 - Overfluxing (V/Hz)
Protection which detects overfluxing of transformer or generator magnetic circuits by calculating the ratio between the greatest phase-to-neutral or phase-to-phase voltage divided by the frequency.

Characteristics
■ machine coupling to be set up
■ definite time (DT) or IDMT time delays (choice of 3 curves).

ANSI 27D - Positive sequence undervoltage
Protection of motors against faulty operation due to insufficient or unbalanced network voltage, and detection of reverse rotation direction.

ANSI 27R - Remanent undervoltage
Protection used to check that remanent voltage sustained by rotating machines has been cleared before allowing the busbar supplying the machines to be re-energized, to avoid electrical and mechanical transients.

ANSI 27 - Undervoltage
Protection of motors against voltage sags or detection of abnormally low network voltage to trigger automatic load shedding or source transfer.
Works with phase-to-phase or phase-to-neutral voltage, each voltage being monitored separately.

Characteristics
■ definite time (DT) curve
■ IDMT curve.

ANSI 59 - Overvoltage
Detection of abnormally high network voltage or checking for sufficient voltage to enable source transfer.
Works with phase-to-phase or phase-to-neutral voltage, each voltage being monitored separately.

ANSI 59N - Neutral voltage displacement
Detection of insulation faults by measuring residual voltage
■ ANSI 59N: in isolated neutral systems
■ ANSI 59N/64G1: in stator windings of generators with earthed neutral. Protects the 85 % to 90 % of the winding, terminal end, not protected by the ANSI 27TN/64G2 function, third harmonic undervoltage.

Characteristics
■ definite time (DT) curve
■ IDMT curve.

ANSI 47 - Negative sequence overvoltage
Protection against phase unbalance resulting from phase inversion, unbalanced supply or distant fault, detected by the measurement of negative sequence voltage.

Frequency protection functions

ANSI 81H - Overfrequency
Detection of abnormally high frequency compared to the rated frequency, to monitor power supply quality.

ANSI 81L - Underfrequency
Detection of abnormally low frequency compared to the rated frequency, to monitor power supply quality.
The protection may be used for overall tripping or load shedding.
Protection stability is ensured in the event of the loss of the main source and presence of remanent voltage by a restraint in the event of a continuous decrease of the frequency, which is activated by parameter setting.

ANSI 81R - Rate of change of frequency
Protection function used for fast disconnection of a generator or load shedding control. Based on the calculation of the frequency variation, it is insensitive to transient voltage disturbances and therefore more stable than a phase-shift protection function.

Disconnection
In installations with autonomous production means connected to a utility, the "rate of change of frequency" protection function is used to detect loss of the main system in view of opening the incoming circuit breaker to:
■ protect the generators from a reconnection without checking synchronization
■ avoid supplying loads outside the installation.

Load shedding
The "rate of change of frequency" protection function is used for load shedding in combination with the underfrequency protection to:
■ either accelerate shedding in the event of a large overload
■ or inhibit shedding following a sudden drop in frequency due to a problem that should not be solved by shedding.

Protection
Tripping curves

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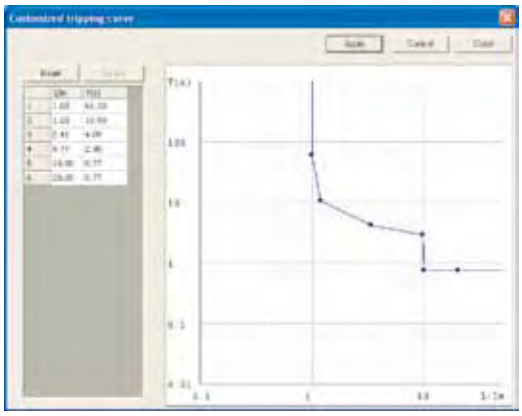


Customized tripping curve set using SFT2841 software.

Customized tripping curve

Defined point by point using the SFT2841 setting and operating software tool, this curve may be used to solve all special cases involving protection coordination or revamping.

IDMT tripping curves

Current IDM T tripping curves

Multiple IDMT tripping curves are offered, to cover most applications:
- IEC curves (SIT, VIT/LTI, EIT)
- IEEE curves (MI, VI, EI)
- usual curves (UIT, RI, IAC).

IEC curves

Equation	Curve type	Coefficient values		
		k	α	β
$td(I) = \frac{k}{\left(\frac{I}{Is}\right)^{\alpha} - 1} \times \frac{T}{\beta}$	Standard inverse / A	0.14	0.02	2.97
	Very inverse / B	13.5	1	1.50
	Long time inverse / B	120	1	13.33
	Extremely inverse / C	80	2	0.808
	Ultra inverse	315.2	2.5	1

RI curve

Equation: $td(I) = \frac{1}{0{,}339 - 0{,}236\left(\frac{I}{Is}\right)^{-1}} \times \frac{T}{3{,}1706}$

IEEE curves

Equation	Curve type	Coefficient values			
		A	B	p	β
$td(I) = \left(\frac{A}{\left(\frac{I}{Is}\right)^{p} - 1} + B\right) \times \frac{T}{\beta}$	Moderately inverse	0.010	0.023	0.02	0.241
	Very inverse	3.922	0.098	2	0.138
	Extremely inverse	5.64	0.0243	2	0.081

IAC curves

Equation	Curve type	Coefficient values					
		A	B	C	D	E	β
$td(I) = \left(A + \frac{B}{\left(\frac{I}{Is} - C\right)} + \frac{D}{\left(\frac{I}{Is} - C\right)^2} + \frac{E}{\left(\frac{I}{Is} - C\right)^3}\right) \times \frac{T}{\beta}$	Inverse	0.208	0.863	0.800	-0.418	0.195	0.297
	Very inverse	0.090	0.795	0.100	-1.288	7.958	0.165
	Extremely inverse	0.004	0.638	0.620	1.787	0.246	0.092

Protection
Setting ranges

Functions	Settings		Time delays
ANSI 12 - Overspeed			
	100 to 160 % of Wn		1 to 300 s
ANSI 14 - Underspeed			
	10 to 100 % of Wn		1 to 300 s
ANSI 21B - Underimpedance			
Impedance Zs	0.05 to 2.00 Vn/Ib		
ANSI 24 - Overfluxing (V/Hz)			
Tripping curve	Definite time		
	IDMT type A, B or C		
Gs set point	1.03 to 2 pu	Definite time	0.1 to 20000 s
		IDMT	0.1 to 1250 s
ANSI 25 - Synchro-check			
Measured voltages	Phase-to-phase	Phase-to-neutral	
Rated primary phase-to-phase voltage			
Unp sync1 (Vnp sync1 = Unp sync1/$\sqrt{3}$)	220 V to 250 kV	220 V to 250 kV	
Unp sync2 (Vnp sync2 = Unp sync2/$\sqrt{3}$)	220 V to 250 kV	220 V to 250 kV	
Rated secondary phase-to-phase voltage			
Uns sync1	90 V to 120 V	90 V to 230 V	
Uns sync2	90 V to 120 V	90 V to 230 V	
Synchro-check setpoints			
dUs set point	3 % to 30 % of Unp sync1	3 % to 30 % of Vnp sync1	
dfs set point	0.05 to 0.5 Hz	0,05 to 0,5 Hz	
dPhi set point	5 to 80°	5 to 80°	
Us high set point	70 % to 110 % Unp sync1	70 % to 110 % Vnp sync1	
Us low set point	10 % to 70 % Unp sync1	10 % to 70 % Vnp sync1	
Other settings			
Lead time	0 to 0.5 s	0 to 0.5 s	
Operating modes: no-voltage conditions for which coupling is allowed	Dead1 AND Live2	Dead1 AND Live2	
	Live1 AND Dead2	Live1 AND Dead2	
	Dead1 XOR Dead2	Dead1 XOR Dead2	
	Dead1 OR Dead2	Dead1 OR Dead2	
	Dead1 AND Dead2	Dead1 AND Dead2	
ANSI 27 - Undervoltage (L-L) or (L-N)			
Tripping curve	Definite time		
	IDMT		
Set point	5 to 100 % of Unp		0.05 to 300 s
Measurement origin	Main channels (U) or additional channels (U')		
ANSI 27D - Positive sequence undervoltage			
Set point and time delay	15 to 60 % of Unp		0.05 to 300 s
Measurement origin	Main channels (U) or additional channels (U')		
ANSI 27R - Remanent undervoltage			
Set point and time delay	5 to 100 % of Unp		0.05 to 300 s
Measurement origin	Main channels (U) or additional channels (U')		
ANSI 27TN/64G2 - Third harmonic undervoltage			
Vs set point (fixed)	0.2 to 20 % of Vntp		0.05 to 300 s
K set point (adaptive)	0.1 to 0.2		0.05 to 300 s
Positive sequence undervoltage	50 to 100 % of Unp		
Minimum apparent power	1 to 90 % of Sb (Sb = 3.Un.Ib)		
ANSI 32P - Directional active overpower			
	1 to 120 % of Sn (1)		0.1 s to 300 s
ANSI 32Q - Directional reactive overpower			
	5 to 120 % of Sn (1)		0.1 s to 300 s
ANSI 37 - Phase undercurrent			
	0.05 to 1 Ib		0.05 to 300 s
ANSI 37P - Directional active underpower			
	5 to 100 % of Sn (1)		0.1 s to 300 s
ANSI 38/49T - Temperature monitoring			
Alarm set point TS1	0 °C to 180 °C or 32 °F to 356 °F		
Trip set point TS2	0 °C to 180 °C or 32 °F to 356 °F		
ANSI 40 - Field loss (underimpedance)			
Common point: Xa	0.02 Vn/Ib to 0.2 Vn/Ib + 187.5 kΩ		
Circle 1: Xb	0.2 Vn/Ib to 1.4 Vn/Ib + 187.5 kΩ		0.05 to 300 s
Circle 2: Xc	0.6 Vn/Ib to 3 Vn/Ib + 187.5 kΩ		0.1 s to 300 s

(1) *Sn = $\sqrt{3}$.In.Unp.*

Protection
Setting ranges

Functions	Settings		Time delays	
ANSI 46 - Negative sequence / unbalance				
Tripping curve	Definite time			
	Schneider Electric			
	IEC: SIT/A, LTI/B, VIT/B, EIT/C			
	IEEE: MI (D), VI (E), EI (F)			
	RI² (setting constant from 1 to 100)			
Is set point	0.1 to 5 Ib	Definite time	0.1 to 300 s	
	0.1 to 5 Ib (Schneider Electric)	IDMT	0.1 to 1s	
	0.1 to 1 Ib (IEC, IEEE)			
	0.03 to 0.2 Ib (RI²)			
Measurement origin	Main channels (I) or additional channels (I')			
ANSI 47 - Negative sequence overvoltage				
Set point and time delay	1 to 50 % of Unp		0.05 to 300 s	
Measurement origin	Main channels (I) or additional channels (I')			
ANSI 48/51LR -Locked rotor / excessive starting time				
Is set point	0.5 Ib to 5 Ib	ST starting time	0.5 to 300 s	
		LT and LTS time delays	0.05 to 300 s	
ANSI 49RMS - Thermal overload for cables				
Admissible current	1 to 1.73 Ib			
Time constant T1	1 to 600 mn			
ANSI 49RMS - Thermal overload for capacitors				
Alarm current		1.05 Ib to 1.70 Ib		
Trip current		1.05 Ib to 1.70 Ib		
Positioning of the hot tripping curve	Current setting	1.02 x trip current to 2 Ib		
	Time setting	1 to 2000 minutes (variable range depending on the trip current and current setting)		
ANSI 49RMS - Thermal overload for machines			**Mode 1**	**Mode 2**
Accounting for negative sequence component		0 - 2.25 - 4.5 - 9		
Time constant	Heating		T1: 1 to 600 mn	T1: 1 to 600 mn
	Cooling		T2: 5 to 600 mn	T2: 5 to 600 mn
Alarm and tripping set points (Es1 and Es2)		0 to 300 % of rated thermal capacity		
Initial thermal capacity used (Es0)		0 to 100 %		
Switching of thermal settings condition		by logic input		
		by Is set point adjustable from 0.25 to 8 Ib		
Maximum equipment temperature		60 to 200 °C (140 °F to 392 °F)		
Measurement origin	Main channels (I) or additional channels (I')			
ANSI 50BF - Breaker failure				
Presence of current	0.2 to 2 In			
Operating time	0.05 s to 3 s			
ANSI 50/27 - Inadvertent energization				
Is set point	0.05 to 4 In			
Vs set point	10 to 100 % Unp		T1: 0 to 10 s	
			T2: 0 to 10 s	
ANSI 50/51 - Phase overcurrent				
	Tripping time delay	**Timer hold**		
Tripping curve	Definite time	DT		
	SIT, LTI, VIT, EIT, UIT (1)	DT		
	RI	DT		
	IEC: SIT/A, LTI/B, VIT/B, EIT/C	DT or IDMT		
	IEEE: MI (D), VI (E), EI (F)	DT or IDMT		
	IA : I, VI, EI	DT or IDMT		
	Customized	DT		
Is set point	0.05 to 24 In	Definite time	Inst; 0.05 s to 300 s	
	0.05 to 2.4 In	IDMT	0.1 s to 12.5 s at 10 Is	
Timer hold	Definite time (DT; timer hold)		Inst; 0.05 s to 300 s	
	IDMT (IDMT; reset time)		0.5 s to 20 s	
Measurement origin	Main channels (I) or additional channels (I')			
Confirmation	None			
	By negative sequence overvoltage			
	By phase-to-phase undervoltage			

(1) *Tripping as of 1.2 Is.*

Protection
Setting ranges

Functions	Settings		Time delays
ANSI 50N/51N or 50G/51G - Earth fault			
	Tripping time delay	**Timer hold**	
Tripping curve	Definite time	DT	
	SIT, LTI, VIT, EIT, UIT (1)	DT	
	RI	DT	
	IEC: SIT/A,LTI/B, VIT/B, EIT/C	DT or IDMT	
	IEEE: MI (D), VI (E), EI (F)	DT or IDMT	
	IAC: I, VI, EI	DT or IDMT	
	EPATR-B, EPATR-C	DT	
	Customized	DT	
	0.6 to 5 A	EPATR-B	0.5 to 1 s
	0.6 to 5 A	EPATR-C	0.1 to 3 s
Is0 set point	0.01 to 15 In0 (min. 0.1 A)	Definite time	Inst; 0.05 s to 300 s
	0.01 to 1 In0 (min. 0.1 A)	IDMT	0.1 s to 12.5 s at 10 Is0
Timer hold	Definite time (DT; timer hold)		Inst; 0.05 s to 300 s
	IDMT (IDMT; reset time)		0.5 s to 20 s
Measurement origin	I0 input, I'0 input, sum of phase currents I0Σ or sum of phase currents I'0Σ		
ANSI 50V/51V - Voltage-restrained overcurrent			
	Tripping time delay	**Timer hold**	
Tripping curve	Definite time	DT	
	SIT, LTI, VIT, EIT, UIT (1)	DT	
	RI	DT	
	IEC : SIT/A, LTI/B, VIT/B, EIT/C	DT or IDMT	
	IEEE : MI (D), VI (E), EI (F)	DT or IDMT	
	IAC : I, VI, EI	DT or IDMT	
	Customized	DT	
Is set point	0.5 to 24 In	Definite time	Inst; 0.05 s to 300 s
	0.5 to 2.4 In	IDMT	0.1 s to 12.5 s at 10 Is0
Timer hold	Definite time (DT; timer hold)		Inst; 0.05 s to 300 s
	IDMT (IDMT; reset time)		0.5 s to 20 s
Measurement origin	Main channels (I) or additional channels (I')		
ANSI 51C - Capacitor bank unbalance			
Is set point	0.05 A to 2 I'n	Definite time	0.1 to 300 s
ANSI 59 - Overvoltage (L-L) or (L-N)			
Set point and time delay	50 to 150 % of Unp or Vnp		0.05 to 300 s
Measurement origin	Main channels (U) or additional channels (U')		
ANSI 59N - Neutral voltage displacement			
Tripping curve	Definite time		
	IDMT		
Set point	2 to 80 % of Unp	Definite time	0.05 to 300 s
	2 to 10 % of Unp	IDMT	0.1 to 100 s
Measurement origin	Main channels (U), additional channels (U') or neutral-point voltage Vnt		
ANSI 64REF - Restricted earth fault differential			
Is0 set point	0.05 to 0.8 In (In ≥ 20 A)		
	0.1 to 0.8 In (In < 20 A)		
Measurement origin	Main channels (I, I0) or additional channels (I', I'0)		
ANSI 66 - Starts per hour			
Total number of starts	1 to 60	Period	1 to 6 h
Number of consecutive starts	1 to 60	T time delay stop/start	0 to 90 mn
ANSI 67 - Directional phase overcurrent			
Characteristic angle	**30°, 45°, 60°**		
	Tripping time delay	**Timer hold delay**	
Tripping curve	Definite time	DT	
	SIT, LTI, VIT, EIT, UIT (1)	DT	
	RI	DT	
	IEC: SIT/A, LTI/B, VIT/B, EIT/C	DT or IDMT	
	IEEE: MI (D), VI (E), EI (F)	DT or IDMT	
	IAC: I, VI, EI	DT or IDMT	
	Customized	DT	
Is set point	0.1 to 24 In	Definite time	Inst; 0.05 s to 300 s
	0.1 to 2.4 In	IDMT	0.1 s to 12.5 s at 10 Is0
Timer hold	Definite time (DT; timer hold)		Inst; 0.05 s to 300 s
	IDMT (IDMT; reset time)		0.5 s to 20 s

(1) *Tripping as of 1.2 Is.*

Protection
Setting ranges

Functions	Settings		Time
ANSI 67N/67NC - Directional earth fault, projection (type 1)			
Characteristic angle	-45°, 0°, 15°, 30°, 45°, 60°, 90°		
Is0 set point	0.01 to 15 In0 (mini. 0,1 A)	Definite time	Inst; 0.05 s to 300 s
Vs0 set point	2 to 80 % of Unp		
Memory time	T0mem time	0; 0.05 s to 300 s	
	V0mem validity set point	0; 2 to 80 % of Unp	
Measurement origin	I0 input, I'0 input		
ANSI 67N/67NC - Directional earth fault, according to I0 vector magnitude (type 2)			
Characteristic angle	-45°, 0°, 15°, 30°, 45°, 60°, 90°		
	Tripping time delay	**Timer hold delay**	
Tripping curve	Definite time	DT	
	SIT, LTI, VIT, EIT, UIT (1)	DT	
	RI	DT	
	IEC: SIT/A,LTI/B, VIT/B, EIT/C	DT or IDMT	
	IEEE: MI (D), VI (E), EI (F)	DT or IDMT	
	IAC: I, VI, EI	DT or IDMT	
	Customized	DT	
Is0 set point	0.1 to 15 In0 (min. 0.1 A)	Definite time	Inst; 0.05 s to 300 s
	0.01 to 1 In0 (min. 0.1 A)	IDMT	0.1 s to 12.5 s at 10 Is0
Vs0 set point	2 to 80 % of Unp		
Timer hold	Definite time (DT; timer hold)		Inst; 0.05 s to 300 s
	IDMT (IDMT; reset time)		0.5 s to 20 s
Measurement origin	I0 input, I'0 input or sum of phase currents I0S		
ANSI 67N/67NC type 3 - Directional earth fault, according to I0 vector magnitude directionalized on a tripping sector			
Tripping sector start angle	0° to 359°		
Tripping sector end angle	0° to 359°		
Is0 set point CSH core balance CT (2 A rating)	0.1 A to 30 A	Definite time	Inst; 0.05 s to 300 s
1 A CT	0.005 to 15 In0 (min. 0.1 A)		
Core balance CT + ACE990 (range 1)	0.01 to 15 In0 (min. 0.1 A)		
Vs0 set point	Calculated V0 (sum of 3 voltages)	2 to 80 % of Unp	
	Measured V0 (external VT)	0.6 to 80 % of Unp	
Measurement origin	I0 input or I'0 input		
ANSI 78PS - Pole slip			
Time delay of the equal-area criterion	0.1 to 300 s		
Maximum number of power swings	1 to 30		
Time between 2 power swings	1 to 300 s		
ANSI 81H - Overfrequency			
Set point and time delay	50 to 55 Hz or 60 to 65 Hz		0.1 to 300 s
Measurement origin	Main channels (U) or additional channels (U')		
ANSI 81L - Underfrequency			
Set point and time delay	40 to 50 Hz or 50 to 60 Hz		0.1 to 300 s
Measurement origin	Main channels (U) or additional channels (U')		
ANSI 81R - Rate of change of frequency			
	0.1 to 10 Hz/s		0.15 to 300 s
ANSI 87M - Machine différential			
Ids set point	0.05 to 0.5 In (In ≥ 20 A)		
	0.1 to 0.5 In (In < 20 A)		
ANSI 87T - Transformer differential			
High set point	3 to 18 In1		
Percentage-based curve			
Ids set point	30 to 100 % In1		
Slope Id/It	15 to 50 %		
Slope Id/It2	without, 50 to 100 %		
Slope change point	1 to 18 In1		
Restraint on energization			
Current threshold	1 to 10 %		
Delay	0 to 300 s		
Restraint on CT loss			
Activity	On / Off		
Retenues sur taux d'harmoniques	**Classic**	**Self-adapting**	
Choice of restraint	Classic	Self-adapting	
High set point	On	On / Off	
Harmonic 2 percentage set point	off, 5 to 40 %		
Harmonic 2 restraint	per phase / total		
Harmonic 5 percentage set point	off, 5 to 40 %		
Harmonic 5 restraint	per phase / total		

Base unit
Technical characteristics

Weight					
		Base unit with advanced UMI		**Base unit with mimic-based UMI**	
Minimum weight (base unit without MES120)		2.4 kg (5.29 lb)		3.0 kg (6.61 lb)	
Maximum weight (base unit with 3 MES120)		4.0 kg (8.82 lb)		4.6 kg (10.1 lb)	
Sensor inputs					
Phase current inputs		**1 A or 5 A CT**			
Input impedance		< 0.02 Ω			
Consumption		< 0.02 VA (1 A CT) < 0.5 VA (5 A CT)			
Continuous thermal withstand		4 In			
1 second overload		100 In			
Voltage inputs		**Phase**		**Residual**	
Input impedance		> 100 k Ω		> 100 k Ω	
Consommation		< 0.015 VA (100 V VT)		< 0.015 VA (100 V VT)	
Continuous thermal withstand		240 V		240 V	
1-second overload		480 V		480 V	
Isolation of inputs in relation to other isolated groups		Enhanced		Enhanced	
Relay outputs					
Control relay outputs O101, O201 and O301					
Voltage	DC	24/48 V DC	127 V DC	220 V DC	
	AC (47.5 to 63 Hz)				100 to 240 V AC
Continuous current		8 A	8 A	8 A	8 A
Breaking capacity	Resistive load	8 A / 4 A	0.7 A	0.3 A	
	Load L/R < 20 ms	6 A / 2 A	0.5 A	0.2 A	
	Load L/R < 40 ms	4 A / 1 A	0.2 A	0.1 A	
	Resistive load				8 A
	Load p.f. > 0.3				5 A
Making capacity		< 15 A for 200 ms			
Isolation of outputs in relation to other isolated groups		Enhanced			
Annunciation relay output O5, O102 to O106, O202 to O206 and O302 to O306					
Voltage	DC	24/48 V DC	127 V DC	220 V DC	
	AC (47.5 to 63 Hz)				100 to 240 V AC
Continuous current		2 A	2 A	2 A	2 A
Breaking capacity	Load L/R < 20 ms	2 A / 1 A	0.5 A	0.15 A	
	Load p.f. > 0.3				1 A
Isolation of outputs in relation to other isolated groups		Enhanced			
Power supply					
Voltage		24 to 250 V DC	-20 % / +10 %		
Maximum consumption		< 16 W			
Inrush current		< 10 A 10 ms			
Acceptable ripple content		12 %			
Acceptable momentary outages		100 ms			
Battery					
Format		1/2 AA lithium 3.6 V			
Service life		10 years Sepam energized			
		3 years minimum, typically 6 years Sepam not energized			

(1) *Relay outputs comptying with clause 6.7 of standard C 97.90 (30 A, 200 ms, 2000 operations)*

Base unit
Environmental characteristics

Electromagnetic compatibility	Standard	Level / Class	Value
Emission tests			
Disturbing field emission	IEC 60255-25		
	EN 55022	A	
Conducted disturbance emission	IEC 60255-25		
	EN 55022	A	
Immunity tests – Radiated disturbances			
Immunity to radiated fields	IEC 60255-22-3		10 V/m; 80 MHz - 1 GHz
	IEC 61000-4-3	III	10 V/m; 80 MHz - 2 GHz
	ANSI C37.90.2 (2004)		20 V/m; 80 MHz - 1 GHz
Electrostatic discharge	IEC 60255-22-2		8 kV air; 6 kV contact
	ANSI C37.90.3		8 kV air; 4 kV contact
Immunity to magnetic fields at network frequency	IEC 61000-4-8	4	30 A/m (continuous) - 300 A/m (1-3 s) (4)
Immunity tests – Conducted disturbances			
Immunity to conducted RF disturbances	IEC 60255-22-6	III	10 V
Electrical fast transients/burst	IEC 60255-22-4	A and B	4 kV; 2.5 kHz / 2 kV; 5 kHz
	IEC 61000-4-4	IV	4 kV; 2.5 kHz
	ANSI C37.90.1		4 kV; 2.5 kHz
1 MHz damped oscillating wave	IEC 60255-22-1		2.5 kV CM; 1 kV DM
	ANSI C37.90.1		2.5 kV CM; 2.5 kV DM
100 kHz damped sine wave	IEC 61000-4-12	III	2 kV CM
Slow damped oscillating wave (100 kHz to 1 MHz)	IEC 61000-4-18	III	2 kV CM
Fast damped oscillating wave (3 MHz, 10 MHz, 30 MHz)	IEC 61000-4-18	III	
Impulse wave	IEC 61000-4-5	III	2 kV CM; 1 kV DM
Immunity to conducted disturbances in common mode from 0 Hz to 150 kHz	IEC 61000-4-16	III	
Voltage interruptions	IEC 60255-11		100 % during 100 ms
Mechanical robustness	**Standard**	**Level / Class**	**Value**
In operation			
Vibrations	IEC 60255-21-1	2	1 Gn; 10 Hz - 150 Hz
	IEC 60068-2-6	Fc	3 Hz - 13.2 Hz; a = ±1 mm
	IEC 60068-2-64	2M1	
Shocks	IEC 60255-21-2	2	10 Gn / 11 ms
Earthquakes	IEC 60255-21-3	2	2 Gn (horizontal axes)
			1 Gn (vertical axes)
De-energized			
Vibrations	IEC 60255-21-1	2	2 Gn; 10 Hz - 150 Hz
Shocks	IEC 60255-21-2	2	27 Gn / 11 ms
Jolts	IEC 60255-21-2	2	20 Gn / 16 ms
Climatic withstand	**Standard**	**Level / Class**	**Value**
In operation			
Exposure to cold	IEC 60068-2-1	Ad	-25 °C
Exposure to dry heat	IEC 60068-2-2	Bd	+70 °C
Continuous exposure to damp heat	IEC 60068-2-78	Cab	10 days; 93 % RH ; 40 °C
Salt mist	IEC 60068-2-52	Kb/2	6 days
Influence of corrosion/Gas test 2	IEC 60068-2-60	C	21 Days, 75% RH, 25°C, 500.10-9 vol/vol H_2S; 1000.10-9 vol/vol SO^2
Influence of corrosion/Gas test 4	IEC 60068-2-60	Method 3	21 Days, 75% RH, 25°C, 10+/-5 H^2S; 200+/-20 SO^2 ; 200+/-20 NO^2, 10+/-5 Cl^2 (10-9 vol/vol)
	EIA 364-65A	IIIA	42 days, 75% RH, 30°C, 100+/-20 H^2S; 200+/-50 SO^2 ; 200+/-50 NO^2, 20+/-5 Cl^2 (10-9 vol/vol)
In storage (3)			
Temperature variation with specified variation rate	IEC 60068-2-14	Nb	-25 °C at +70 °C; 5 °C/min
Exposure to cold	IEC 60068-2-1	Ab	-25 °C
Exposure to dry heat	IEC 60068-2-2	Bb	+70 °C
Continuous exposure to damp heat	IEC 60068-2-78	Cab	56 days; 93 % RH; 40 °C
	IEC 60068-2-30	Db	6 days; 95 % RH; 55 °C

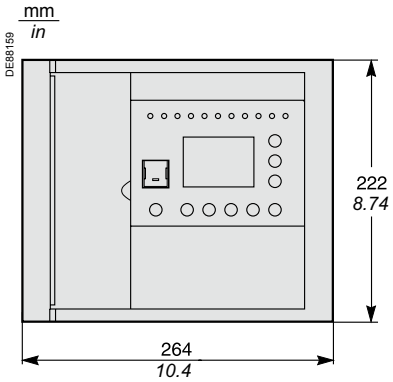
(3) *Sepam must be stored in its original packing.*
(4) *Iso > 0.1 Ino for the 50n/51n and 67n protection functions, with I0 calculated as the sum of the phase currents.*

Base unit
Environmental characteristics

Safety	Standard	Level / Class	Value
Enclosure safety tests			
Front panel tightness	IEC 60529	IP52	Other panels IP20
	NEMA	Type 12	
Fire withstand	IEC 60695-2-11		650 °C with glow wire
Electrical safety tests			
1.2/50 µs impulse wave	IEC 60255-5		5 kV (1)
P ower frequency dielectric withstand	IEC 60255-5		2 kV 1mn (2)
	ANSI C37.90		1 kV 1 mn (indication output) 1.5 kV 1 mn (control output)
Functional safety			
Functional safety of electrical/electronic/programmable electronic safety-related systems	IEC 61508, EN 61508	SIL2	Architecture, hardware and firmware assessment
Certification			
CE	EN 50263 harmonized standard	■ European Electromagnetic Compatibility Directive (EMCD) 2004 / 108 / EC of 15 December 2004 ■ European Low Voltage Directive (LVD) 2006/95/CE of 12 December 2006 ■ 94/9/EC Directive ATEX	
UL-	UL508 - CSA C22.2 n° 14-95		File E212533
CSA	CSA C22.2 n° 14-95 / n° 94-M91 / n° 0.17-00		File 210625

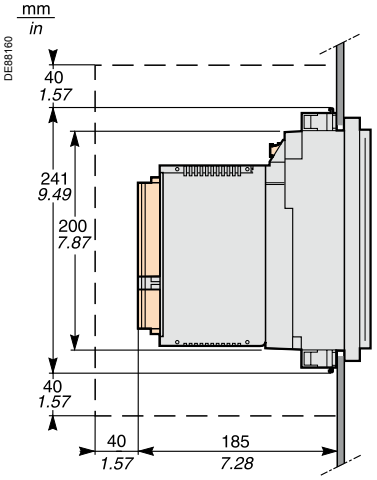
(1) *Except for communication: 3 kV in common mode and 1 kV in differential mode.*
(2) *Except for communication: 1 kVrms.*

Base unit
Dimensions



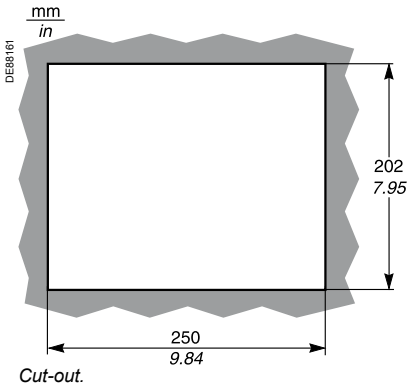
Front view of Sepam.

Dimensions

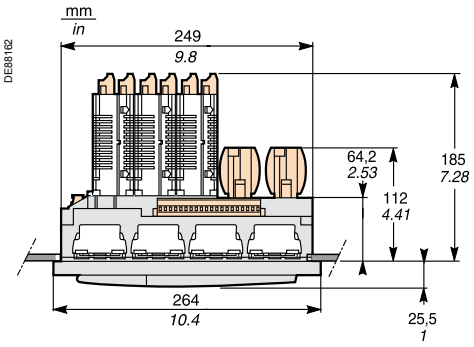


Side view of Sepam with MES120, flush-mounted in front panel with spring clips.
Front panel: 1.5 mm (0.05 In) to 6 mm (0.23 In) thick.

Clearance for Sepam assembly and wiring.



Cut-out.



Top view of Sepam with MES120, flush-mounted in front panel with spring clips.
Front panel: 1.5 mm (0.05 In) to 6 mm (0.23 In) thick.

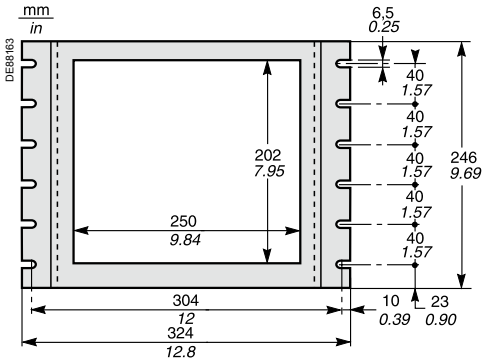
⚠ CAUTION

HAZARD OF CUTS

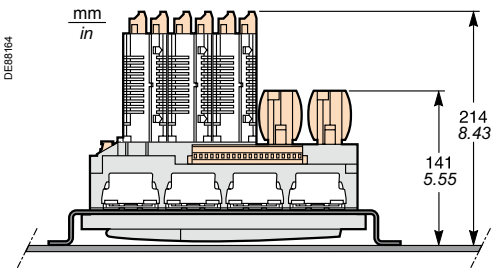
Trim the edges of the cut-out plates to remove any jagged edges.

Failure to follow this instruction can cause serious injury.

Assembly with AMT880 mounting plate

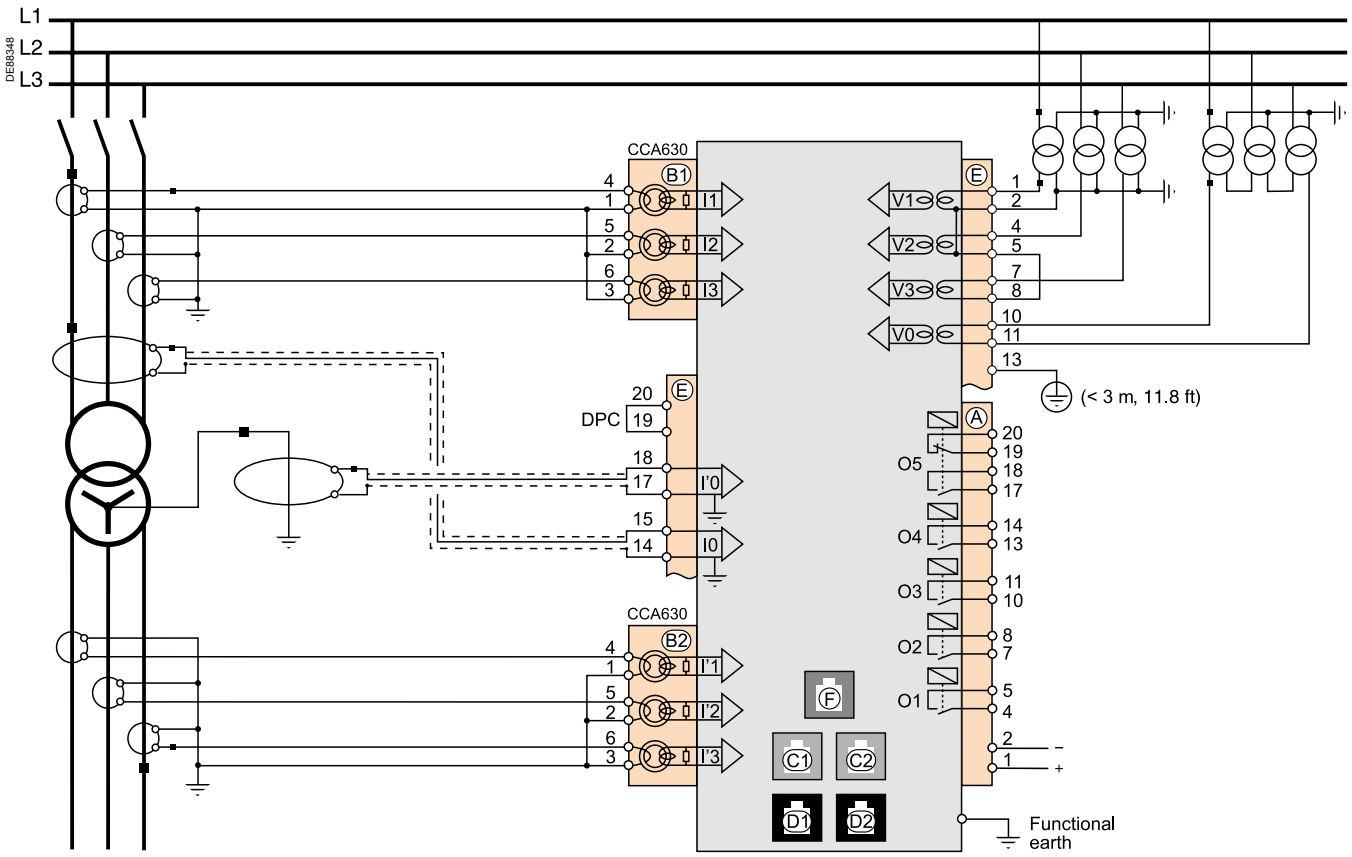


AMT880 mounting plate.



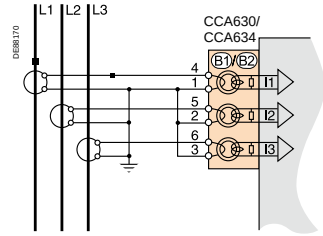
Top view of Sepam with MES120, mounted with AMT880 and spring clips.
Mounting plate: 3 mm (0.11 In) thick.

Base unit
Sepam series 80



Base unit
Residual current inputs

Variant 1: residual current calculation by sum of 3 phase currents

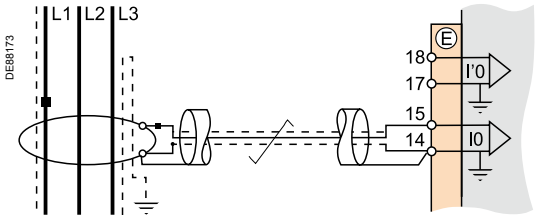


Description
Residual current is calculated by the vector sum of the 3 phase currents I1, I2 and I3, measured by 3 x 1 A or 5 A CTs or by 3 LPCT type sensors.
See current input connection diagrams.

Parameters

Residual current	rated residual current	Measuring range
Sum of 3 Is	In0 = In, CT primary current	0.01 to 40 In0 (minimum 0.1 A)

Variant 2: residual current measurement by CSH120 or CSH200 core balance CT (standard connection)

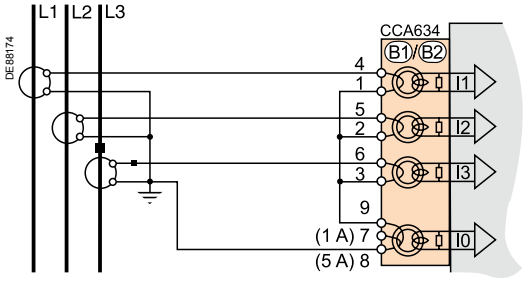


Description
Arrangement recommended for the protection of isolated or compensated neutral systems, in which very low fault currents need to be detected.

Parameters

Residual current	rated residual current	Measuring range
2 A rating CSH	In0 = 2 A	0.1 to 40 A
20 A rating CSH	In0 = 20 A	0.2 to 400 A

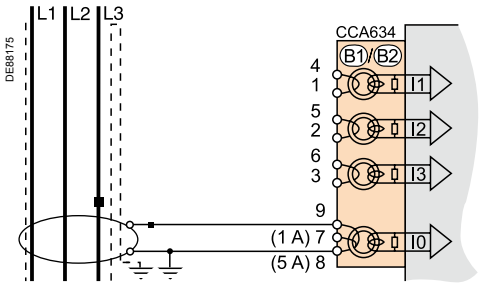
Variant 3: residual current measurement by 1 A or 5 A CTs and CCA634



Description
Residual current measurment by 1 A or 5 A CTs
- Terminal 7: 1 A CT
- Terminal 8: 5 A CT

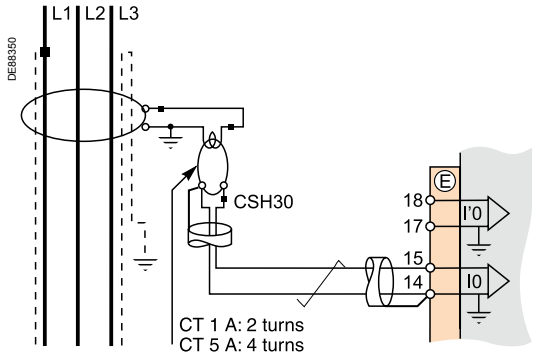
Parameters

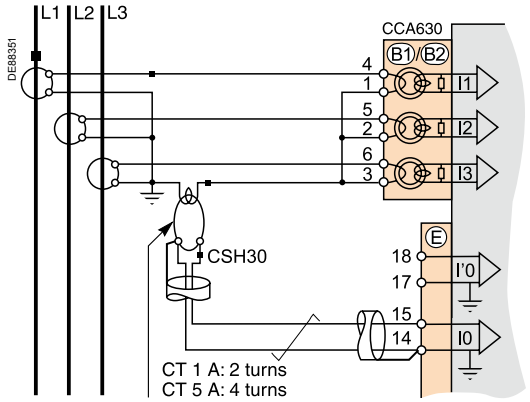
Residual current	rated residual current	Measuring range
1 A CT	In0 = In, CT primary current	0.01 to 20 In0 (minimum 0.1 A)
5 A CT	In0 = In, CT primary current	0.01 to 20 In0 (minimum 0.1 A)



Base unit
Residual current inputs

Variant 4: residual current measurement by 1 A or 5 A CTs and CSH30 interposing ring CT



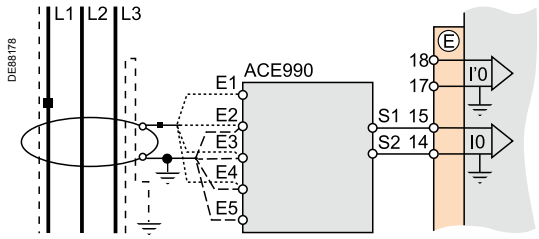


Description
The CSH30 interposing ring CT is used to connect 1 A or 5 A CTs to Sepam to measure residual current:
- CSH30 interposing ring CT connected to 1 A CT: make 2 turns through CSH primary
- CSH30 interposing ring CT connected to 5 A CT: make 4 turns through CSH primary.

Parameters

Residual current	rated residual current	Measuring range
1 A CT	In0 = In, CT primary current	0.01 to 20 In0 (minimum 0.1 A)
5 A CT	In0 = In, CT primary current	0.01 to 20 In0 (minimum 0.1 A)

Variant 5: residual current measurement by core balance CT with ratio of 1/n (n between 50 and 1500)



Description
The ACE990 is used as an interface between a MV core balance CT with a ratio of 1/n (50 ≤ n ≤ 1500) and the Sepam residual current input.
This arrangement allows the continued use of existing core balance CTs on the installation.

Parameters

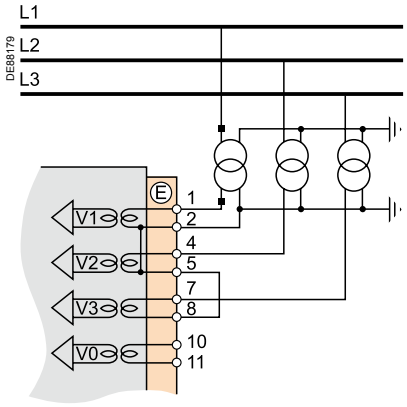
Residual current	rated residual current	Measuring range
ACE990 - range 1 (0.00578 ≤ k ≤ 0.04)	In0 = Ik.n (1)	0.01 to 20 In0 (minimum 0.1 A)
ACE990 - range 2 (0.00578 ≤ k ≤ 0.26316)	In0 = Ik.n (1)	0.01 to 20 In0 (minimum 0.1 A)

(1) n = number of core balance CT turns
k = factor to be determined according to ACE990 wiring and setting range used by Sepam

Phase voltage inputs
Residual voltage input
Main channels

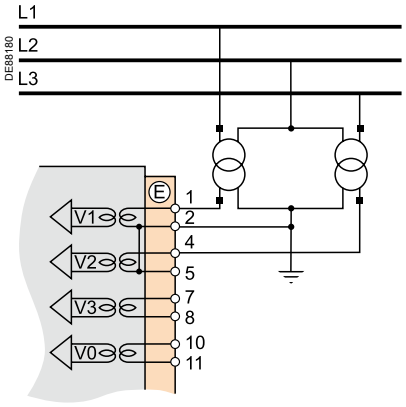
Phase voltage input connection variants

Variant 1: measurement of 3 phase-to-neutral voltages (3 V, standard connection)



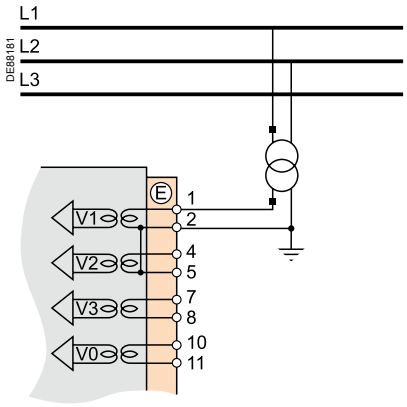
Measurement of the 3 phase-to-neutral voltages allows the calculation of residual voltage, V0Σ.

Variant 2: measurement of 2 phase-to-phase voltages (2 U)



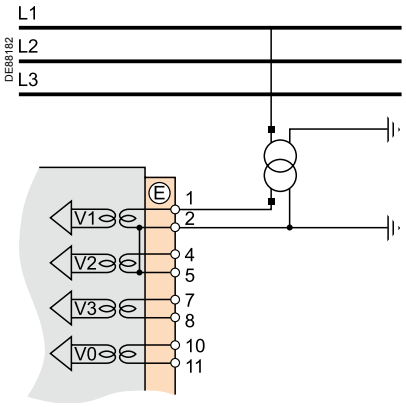
This variant does not allow the calculation of residual voltage.

Variant 3: measurement of 1 phase-to-phase voltage (1 U)



This variant does not allow the calculation of residual voltage.

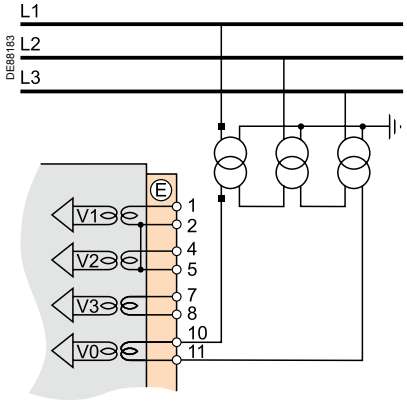
Variant 4: measurement of 1 phase-to-neutral voltage (1 V)



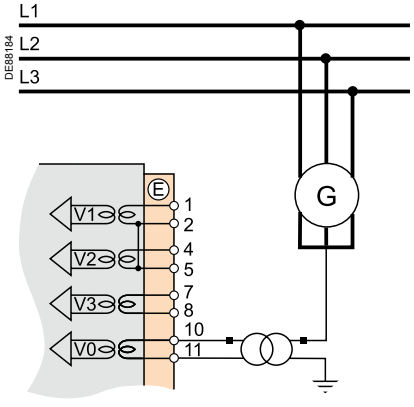
This variant does not allow the calculation of residual voltage.

Residual voltage input connection variants

Variant 5: measurement of residual voltage V0

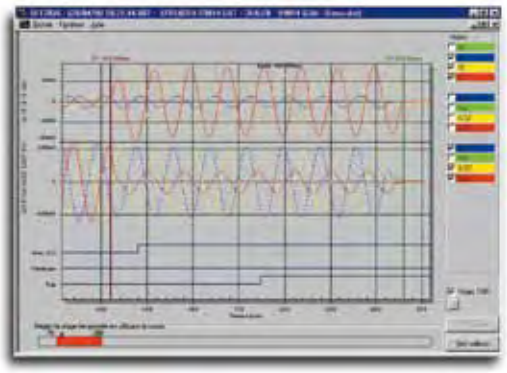


Variant 6: measurement of residual voltage Vnt in generator neutral point



SFT2826 disturbance recording data display software

PE88026



SFT2826: analysis of a disturbance data record.

Function

The SFT2826 software is used to display, analyze and print disturbance data recorded by Sepam.
It uses COMTRADE (IEEE standard: Common format for transient data exchange for power systems) files.

Transfer of disturbance recording data

Before they are analyzed by SFT2826, the disturbance recording data must be transferred from Sepam to the PC:
- by the SFT2841 software
- or by the Modbus communication link.

Analysis of disturbance recording data

- selection of analog signals and logic data for display
- zoom and measurement of time between events
- display of all numerical values recorded
- exporting of data in file format
- printing of curves and/or numerical values recorded.

Characteristics

The SFT2826 software comes with the SFT2841 software:
- 4 languages: English, French, Spanish, Italian
- on-line help with description of software functions.

MES120, MES120G, MES120H
14 input / 6 output module
Presentation

PE88061

MES120 14 input / 6 output module.

Function

The output relays included on the Sepam series 60 and 80 base unit may be extended by adding 1, 2 or 3 MES120 modules with 14 DC logic inputs and 6 outputs relays (1 control relay output and 5 indication relay outputs).

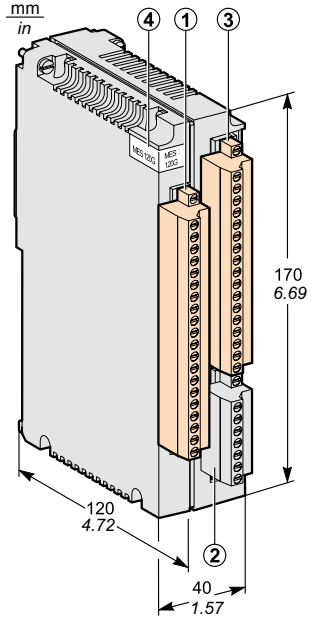
Sepam series	Output on base unit	Extendable with nb max of MES120
series 60	4	2
series 80	5	3

Three modules are available for the different input supply voltage ranges and offer different switching thresholds:
- MES120, 14 inputs 24 V DC to 250 V DC with a typical switching threshold of 14 V DC
- MES120G, 14 inputs 220 V DC to 250 V DC with a typical switching threshold of 155 V DC
- MES120H, 14 inputs 110 V DC to 125 V DC with a typical switching threshold of 82 V DC.

Characteristics

MES120 / MES120G / MES120H modules						
Weight		0,38 kg (0,83 lb)				
Operating temperature		-25 °C to +70 °C (-13 °F to +158 °F)				
Environmental characteristics		Same characteristics as Sepam base units				
Logic inputs		**MES120**	**MES120G**	**MES120H**		
Voltage		24 à 250 V DC	220 to 250 V DC	110 to 125 V DC		
Range		19.2 à 275 V DC	170 to 275 V DC	88 to 150 V DC		
Typical consumption		3 mA	3 mA	3 mA		
Typical switching threshold		14 V DC	155 V DC	82 V DC		
Input limit voltage	At state 0	< 6 V DC	< 144 V DC	< 75 V DC		
	At state 1	> 19 V DC	> 170 V DC	> 88 V DC		
Isolation of inputs from other isolated groups		Enhanced	Enhanced	Enhanced		
Control relay output Ox01						
Voltage	DC	24/48 V DC	127 V DC	220 V DC	250 V DC	
	AC (47.5 to 63 Hz)	-	-	-	-	100 à 240 V AC
Continuous current		8 A	8 A	8 A	8 A	8 A
Breaking capacity	Resistive load	8 / 4 A	0.7 A	0.3 A	0.2 A	8 A
	Load L/R < 20 ms	6 / 2 A	0.5 A	0.2 A	-	-
	Load L/R < 40 ms	4 / 1 A	0.2 A	0.1 A	-	-
	Load p.f > 0.3	-	-	-	-	5 A
Making capacity		< 15 A for 200 ms				
Isolation of inputs from other isolated groups		Enhanced				
Relay output Ox02 to Ox06						
Tension	Continue	24/48 V DC	127 V DC	220 V DC	250 V DC	
	Alternative (47.5 à 63 Hz)	-	-	-	-	100 to 240 V AC
Continuous current		2 A	2 A	2 A	2 A	2 A
Breaking capacity	Load L/R < 20 ms	2 / 1 A	0.5 A	0.15 A	0.2 A	-
	Load p.f > 0.3	-	-	-	-	1 A
Isolation of inputs from other isolated groups		Enhanced				

DE60673



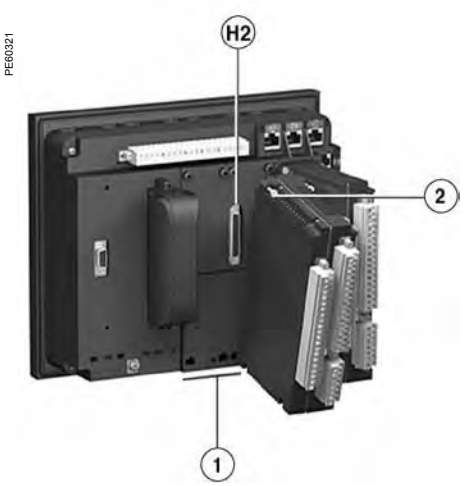
Description

- **3 removable, lockable screw-type connectors.**
- **(1) 20-pin connector for 9 logic inputs:**
- **Ix01 to Ix04: 4 independent logic inputs**
- **Ix05 to Ix09: 5 common point logic inputs.**
- **(2) 7-pin connector for 5 common point logic inputs Ix10 à Ix14.**
- **(3) 17-pin connector for 6 relay outputs:**
- **Ox01: 1 control relay output**
- **Ox02 to Ox06 : 5 indication relay outputs.**

Addressing of MES120 module inputs / outputs:
- **x = 1 for the module connected to H1**
- **x = 2 for the module connected to H2**
- **x = 3 for the module connected to H3.**

(4) MES120G, MES120H identification label (MES120 modules have no labels).

MES120, MES120G, MES120H
14 input / 6 output module
Installation



Installation of the second MES120 module, connected to base unit connector H2.

Assembly

Installation of an MES120 module on the base unit

- insert the 2 pins on the MES module into the slots (1) on the base unit
- push the module flat up against the base unit to plug it into the connector (H2)
- partially tighten the two mounting screws (2) before locking them.

MES120 modules must be mounted in the following order:

- if only one module is required, connect it to connector (H1)
- if 2 modules are required, connect them to connectors (H1) and (H2) (maximum configuration for Sepam series 60)
- if 3 modules are required (maximum configuration for Sepam series 80 only), the 3 connectors (H1) , (H2) and (H3) are used.

Connection

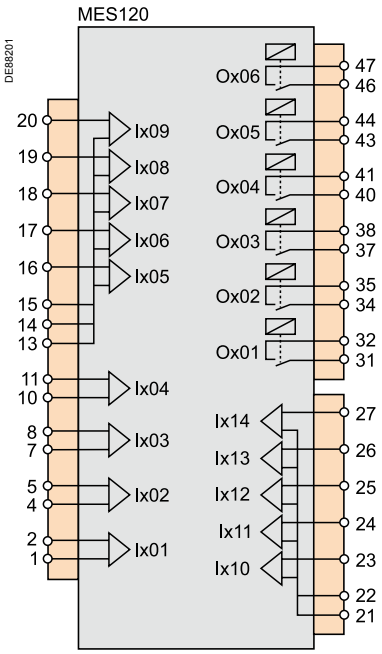
The inputs are potential-free and the DC power supply source is external.

⚠ CAUTION

HAZARD OF ELECTRIC SHOCK, ELECTRIC ARC OR BURNS

- Only qualified personnel should install this equipment. Such work should be performed only after reading this entire set of instructions and checking the technical characteristics of the device.
- NEVER work alone.
- Turn off all power supplying this equipment before working on or inside it. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Screw tight all terminals, even those not in use.

Failure to follow these instructions will result in death or serious injury.



Wiring of connectors

- wiring without fittings:
  - 1 wire with maximum cross-section 0.2 to 2.5 mm² (≥ AWG 24-12)
  - or 2 wires with maximum cross-section 0.2 to 1 mm² (≥ AWG 24-16)
  - stripped length: 8 to 10 mm (0.31 to 0.39 in)
- wiring with fittings:
  - recommended wiring with Schneider Electric fittings:
    - DZ5CE015D for one 1.5 mm² wire (AWG 16)
    - DZ5CE025D for one 2.5 mm² wire (AWG 12)
    - AZ5DE010D for two 1 mm² wires (AWG 18)
  - tube length: 8.2 mm (0.32 in)
  - stripped length: 8 mm (0.31 in).

MES120, MES120G, MES120H
14 input / 6 output module
Logic input / output assignment

Inputs and outputs may be assigned to predefined control and monitoring functions using the SFT2841 software, according to the uses listed in the table below.
The control logic of each input may be inverted for undervoltage type operation.
All the logic inputs, whether or not assigned to predefined functions, may be used for the customization functions according to specific application needs:
■ in the control matrix (SFT2841 software), to connect an input to a logic output, a LED on the front of Sepam or a message for local indication on the display
■ in the logic equation editor (SFT2841 software), as logic equation variables
■ in Logipam (SFT2885 software) as input variables for the program in ladder language.

Logic Ox output assignment table

Functions	S80	S81	S82	S84	T81	T82 T87	M87	M81 M88	G87	G82 G88	B80	B83	C86	Assignment
Tripping / contactor control	■	■	■	■	■	■	■	■	■	■	■	■	■	O1
Inhibit closing	■	■	■	■	■	■	■	■	■	■	■	■	■	O2 by default
Closing	■	■	■	■	■	■	■	■	■	■	■	■	■	O3 by default
Watchdog	■	■	■	■	■	■	■	■	■	■	■	■	■	O5
Logic discrimination, blocking send 1	■	■	■	■	■	■	■	■	■	■	■	■	■	O102 by default
Logic discrimination, blocking send 2			■	■		■			■	■				O103 by default
Genset shutdown									■	■				Free
De-excitation									■	■				Free
Load shedding							■	■						Free
AT, closing of NO circuit breaker	■	■	■	■	■	■			■	■	■	■		Free
AT, closing of coupling	■	■	■	■	■	■			■	■	■	■		Free
AT, opening of coupling	■	■	■	■	■	■			■	■	■	■		Free
Tripping of capacitor step (1 to 4)													■	Free
Tripping of capacitor step (1 to 4)													■	Free

Note: *The logic outputs assigned by default may be freely reassigned.*

Assignment table for logic Ix inputs common to all applications

Functions	S80	S81	S82	S84	T81	T82 T87	M87	M81 M88	G87	G82 G88	B80	B83	C86	Assignment
Closed circuit breaker	■	■	■	■	■	■	■	■	■	■	■	■	■	I101
Open circuit breaker	■	■	■	■	■	■	■	■	■	■	■	■	■	I102
Synchronization of Sepam internal clock via external pulse	■	■	■	■	■	■	■	■	■	■	■	■	■	I103
Switching of groups of settings A/B	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
External reset	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Earthing switch closed	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Earthing switch open	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
External trip 1	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
External trip 2	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
External trip 3	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
End of charging position	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Inhibit remote control (Local)	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
SF6 pressure default	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Inhibit closing	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Open order	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Close order	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Phase VT fuse blown	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
V0 VT fuse blown	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
External positive active energy meter	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
External negative active energy meter	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
External positive reactive energy meter	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
External negative reactive energy meter	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Racked out circuit breaker	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Switch A closed	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Switch A open	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Switch B closed	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Switch B open	■	■	■	■	■	■	■	■	■	■	■	■	■	Free
Closing-coil monitoring	■	■	■	■	■	■	■	■	■	■	■	■	■	Free

MES120, MES120G, MES120H
14 input / 6 output module
Logic input / output assignment

Assignment table of logic Ix inputs by application

Functions	S80	S81	S82	S84	T81	T82 T87	M87	M81 M88	G87	G82 G88	B80	B83	C86	Assignment
Inhibit recloser	■	■	■	■										Free
Inhibit thermal overload		■	■	■	■	■	■	■	■	■			■	Free
Switching of thermal settings					■	■	■	■	■	■				Free
Blocking reception 1	■	■	■	■	■	■			■	■	■	■		Free
Blocking reception 2			■	■		■			■	■				Free
Buchholz trip					■	■		■		■				Free
Thermostat trip					■	■		■		■				Free
Pressure trip					■	■		■		■				Free
Thermistor trip					■	■	■	■	■	■				Free
Buchholz alarm					■	■		■		■				Free
Thermostat alarm					■	■		■		■				Free
Pressure alarm					■	■		■		■				Free
Thermistor alarm					■	■	■	■	■	■				Free
Rotor speed measurement							■	■	■	■				I104
Rotor rotation detection							■	■						Free
Motor re-acceleration							■	■						Free
Load shedding request							■	■						Free
Inhibit undercurrent							■	■						Free
Priority genset shutdown									■	■				Free
De-excitation									■	■				Free
Close enable (ANSI 25)	■	■	■	■	■	■			■	■	■	■		Free
Inhibit opposite-side remote control (local)	■	■	■	■	■	■			■	■	■	■		Free
Inhibit remote-control coupling (local)	■	■	■	■	■	■			■	■	■	■		Free
Coupling open	■	■	■	■	■	■			■	■	■	■		Free
Coupling closed	■	■	■	■	■	■			■	■	■	■		Free
Opposite side open	■	■	■	■	■	■			■	■	■	■		Free
Opposite side closed	■	■	■	■	■	■			■	■	■	■		Free
Selector set to Manual (ANSI 43)	■	■	■	■	■	■			■	■	■	■		Free
Selector set to Auto (ANSI 43)	■	■	■	■	■	■			■	■	■	■		Free
Selector set to Circuit breaker (ANSI 10)	■	■	■	■	■	■			■	■	■	■		Free
Selector set to Coupling (ANSI 10)	■	■	■	■	■	■			■	■	■	■		Free
Opposite-side circuit breaker disconnected	■	■	■	■	■	■			■	■	■	■		Free
Coupling circuit breaker disconnected	■	■	■	■	■	■			■	■	■	■		Free
Coupling close order	■	■	■	■	■	■			■	■	■	■		Free
Opposite-side voltage OK	■	■	■	■	■	■			■	■	■	■		Free
Inhibit closing of coupling	■	■	■	■	■	■			■	■	■	■		Free
Automatic closing order	■	■	■	■	■	■			■	■	■	■		Free
External closing order 1											■	■		Free
External closing order 2											■	■		Free
Additional phase voltage transformer fuse blown											■	■		Free
Additional V0 voltage transformer fuse blown												■		Free
Capacitor step 1 open													■	Free
Capacitor step 1 closed													■	Free
Capacitor step 2 open													■	Free
Capacitor step 2 closed													■	Free
Capacitor step 3 open													■	Free
Capacitor step 3 closed													■	Free
Capacitor step 4 open													■	Free
Capacitor step 4 closed													■	Free
Step 1 opening order													■	Free
Step 2 opening order													■	Free
Step 3 opening order													■	Free
Step 4 opening order													■	Free
Step 1 closing order													■	Free
Step 2 closing order													■	Free
Step 3 closing order													■	Free
Step 4 closing order													■	Free
Step 1 external trip													■	Free
Step 2 external trip													■	Free
Step 3 external trip													■	Free
Step 4 external trip													■	Free
Capacitor step 1 VAR control													■	Free
Capacitor step 2 VAR control													■	Free
Capacitor step 3 VAR control													■	Free
Capacitor step 4 VAR control													■	Free
External capacitor step control inhibit													■	Free
Manual capacitor step control													■	Free
Automatic capacitor step control													■	Free

MET148-2 Temperature sensor module

PE88063

MET148-2 Temperature sensor module.

Function

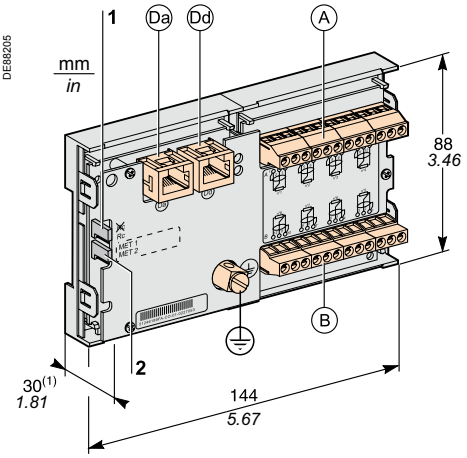
The MET148-2 module can be used to connect 8 temperature sensors (RTDs) of the same type:
- Pt100, Ni100 or Ni120 type RTDs, according to parameter setting
- 3-wire temperature sensors
- A single module for each Sepam series 20 base unit, to be connected by one of the CCA770 (0.6 or 2 ft), CCA772 (2 m or 6.6 ft) or CCA774 (4 m or 13.1 ft) cords
- 2 modules for each Sepam series 40 or series 80 base unit, to be connected by CCA770 (0.6 or 2 ft), CCA772 (2 m or 6.6 ft) or CCA774 (4 m or 13.1 ft) cords

The temperature measurement (e.g. in a transformer or motor winding) is utilized by the following protection functions:
- Thermal overload (to take ambient temperature into account)
- Temperature monitoring.

Characteristics

MET148-2 module		
Weight	0.2 kg (0.441 lb)	
Assembly	On symmetrical DIN rail	
Operating temperature	-25 °C to +70 °C (-13 °F to +158 °F)	
Environmental characteristics	Same characteristics as Sepam base units	
Temperature sensors	**Pt100**	**Ni100 / Ni120**
Isolation from earth	None	None
Current injected in RTD	4 mA	4 mA

DE88205



(1) *70 mm (2.8 in) with CCA77x cord connected.*

Description and dimensions

(A) Terminal block for RTDs 1 to 4.

(B) Terminal block for RTDs 5 to 8.

(Da) RJ45 connector to connect the module to the base unit with a CCA77x cord

(Dd) RJ45 connector to link up the next remote module with a CCA77x cord (according to application).

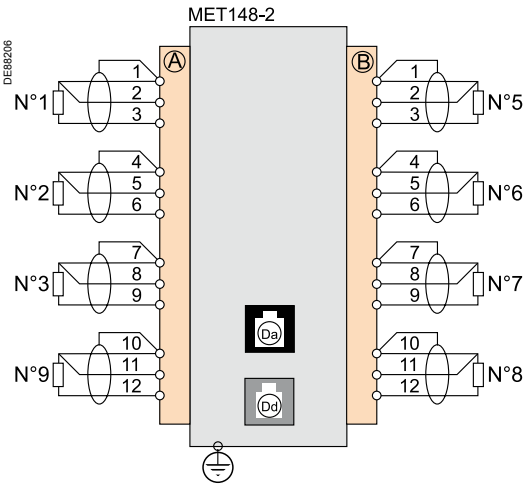
(⏚) Grounding/earthing terminal.

1 Jumper for impedance matching with load resistor (Rc), to be set to:
- ~~Rc~~, if the module is not the last interlinked module (default position)
- Rc, if the module is the last interlinked module.

2 Jumper used to select module number, to be set to:
- MET1: 1st MET148-2 module, to measure temperatures T1 to T8 (default position)
- MET2: 2nd MET148-2 module, to measure temperatures T9 to T16 (for Sepam series 40, series 60 and series 80 only).

MET148-2 Temperature sensor module

Connection



⚠ CAUTION

HAZARD OF ELECTRIC SHOCK, ELECTRIC ARC OR BURNS

- Only qualified personnel should install this equipment. Such work should be performed only after reading this entire set of instructions and checking the technical characteristics of the device.
- NEVER work alone.
- Check that the temperature sensors are isolated from dangerous voltages.

Failure to follow these instructions will result in death or serious injury.

Connection of the earthing terminal

By tinned copper braid with cross-section ≥ 6 mm² (AWG 10) or cable with cross-section ≥ 2.5 mm² (AWG 12) and length ≤ 200 mm (7.9 in), fitted with a 4 mm (0.16 in) ring lug.

Check the tightness (maximum tightening torque 2.2 Nm or 19.5 lb-in).

Connection of RTDs to screw-type connectors

- 1 wire with cross-section 0.2 to 2.5 mm² (AWG 24-12)
- or 2 wires with cross-section 0.2 to 1 mm² (AWG 24-18).

Recommended cross-sections according to distance:

- Up to 100 m (330 ft) ≥ 1 mm² (AWG 18)
- Up to 300 m (990 ft) ≥ 1.5 mm² (AWG 16)
- Up to 1 km (0.62 mi) ≥ 2.5 mm² (AWG 12)

Maximum distance between sensor and module: 1 km (0.62 mi).

Wiring precautions

- It is preferable to use shielded cables.

The use of unshielded cables can cause measurement errors which vary in degree according to the level of surrounding electromagnetic disturbance

- Only connect the shielding at the MET148-2 end, in the shortest manner possible, to the corresponding terminals of connectors (A) and (B)
- Do not connect the shielding at the RTD end.

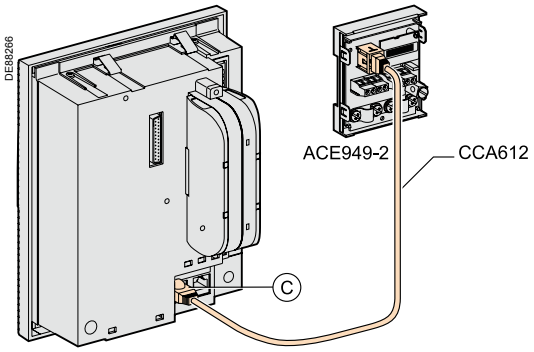
Accuracy derating according to wiring

The error Δt is proportional to the length of the cable and inversely proportional to the cable cross-section:

$$\Delta t(°C) = 2 \times \frac{L(km)}{S(mm^2)}$$

- ±2.1°C/km for 0.93 mm² cross-section (AWG 18)
- ±1°C/km for 1.92 mm² cross-section (AWG 14).

Communication interface connection



Sepam series 20 and Sepam series 40: 1 communication port.

CCA612 connection cord

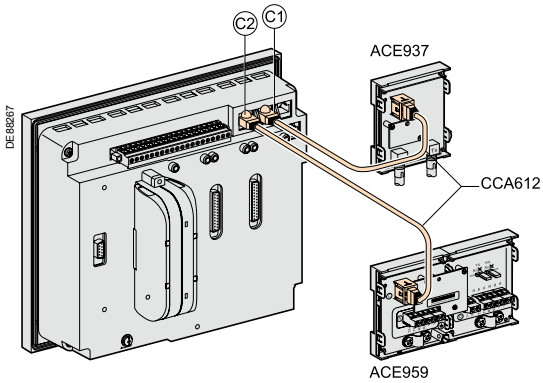
Function

The CCA612 prefabricated cord is used to connect ACE942-2, ACE959, ACE937, ACE969TP-2 and ACE969FO-2 communication interfaces:

- to the white communication port (C) on a Sepam series 20 or series 40 base unit, or
- to the white communication port (C1) on a Speam series 60 base unit.
- to the white communication port (C1) or (C2) on a Sepam series 80 base unit.

Characteristics

- Length = 3 m (9.8 ft)
- Fitted with 2 white RJ45 plugs.



Sepam series 80 : 2 communication ports.

CAUTION

HAZARD OF DEFECTIVE COMMUNICATION

- Never use both communication ports (C2) and (F) on a Sepam series 80 at the same time.
- The only communication ports that can be used simultaneously on a Sepam series 80 unit are ports (C1) and (C2) or ports (C1) and (F).

Failure to follow this instruction can result in equipment damage.

CCA614 connection cord

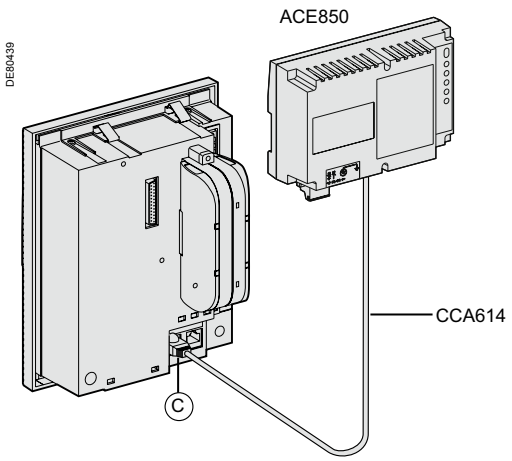
Function

The CCA614 prefabricated cord can be used to connect ACE850TP and ACE850FO communication interfaces:

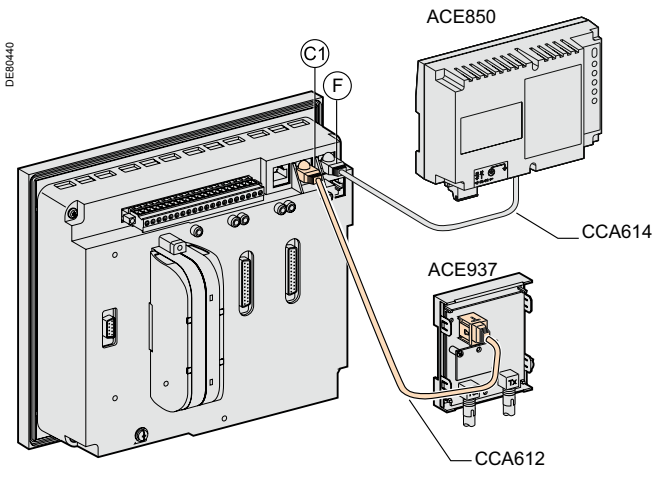
- to the white communication port (C) on a Sepam series 40 base unit, or
- to the blue communication port (F) on a Sepam series 60 or series 80 base unit.

Characteristics

- Length = 3 m (9.8 ft)
- Fitted with 2 blue RJ45 connectors
- Minimum curvature radius = 50 mm (1.97 in)



Sepam series 40



Sepam series 80

Communication interface connection

Connection to the communication network

RS485 network for ACE949-2, ACE959 and ACE969TP-2 interfaces

RS 485 network cable	2-wire	2-wire
RS 485 medium	1 shielded twisted pair	2 shielded twisted pairs
Distributed power supply (1)	1 shielded twisted pair	1 shielded twisted pair
Shielding	Tinned copper braid, coverage > 65 %	
Characteristic impedance	120 Ω	
Gauge	AWG 24	
Resistance per unit length	< 100 Ω/km (62.1Ω/mi)	
Capacitance between conductors	< 60 pF/m (18.3 pF/ft)	
Capacitance between conductor and shielding	< 100 pF/m (30.5 pF/ft)	
Maximum length	1300 m (4270 ft)	

Fiber-optic network for ACE937 and ACE969FO-2 interfaces

Fiber optic				
Fiber type	Graded-index multimode silica			
Wavelength	820 nm (invisible infra-red)			
Type of connector	ST (BFOC bayonet fiber optic connector)			
Fiber optic diameter (µm)	**Numerical aperture (NA)**	**Maximum attenuation (dBm/km)**	**Minimum optical power available (dBm)**	**Maximum fiber length**
50/125	0,2	2,7	5,6	700 m (2300 ft)
62,5/125	0,275	3,2	9,4	1800 m (5900 ft)
100/140	0,3	4	14,9	2800 m (9200 ft)
200 (HCS)	0,37	6	19,2	2600 m (8500 ft)

Fiber optic Ethernet network for the ACE850FO communication interface

Fiber optic communication port					
Fiber type	Multimode				
Wavelength	1300 nm				
Type of connector	SC				
Fiber optic diameter (µm)	**Minimum optical power TX (dBm)**	**Maximum optical power TX (dBm)**	**Sensitivity RX (dBm)**	**Saturation RX (dBm)**	**Maximum distance**
50/125	-22,5	-14	-33,9	-14	2 km (1,24 mi)
62,5/125	-19	-14	-33,9	-14	2 km (1,24 mi)

Wired Ethernet network for the ACE850TP communication interface

Wired communication port			
Type of connector	**Data**	**Medium**	**Maximum distance**
RJ45	10/100 Mbps	Cat 5 STP or FTP or SFTP	100 m (328 ft)

ACE949-2
2-wire RS 485 network interface

ACE949-2 2-wire RS 485 network connection interface.

Function

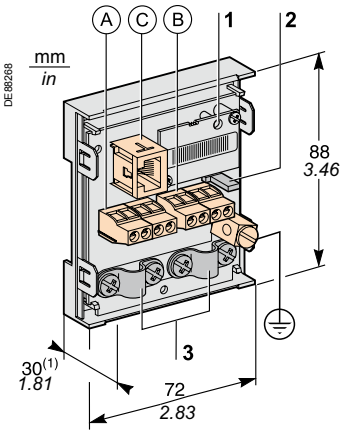
The ACE949-2 interface performs 2 functions:
- Electrical interface between Sepam and a 2-wire RS 485 communication network
- Main network cable branching box for the connection of a Sepam with a CCA612 cord.

Characteristics

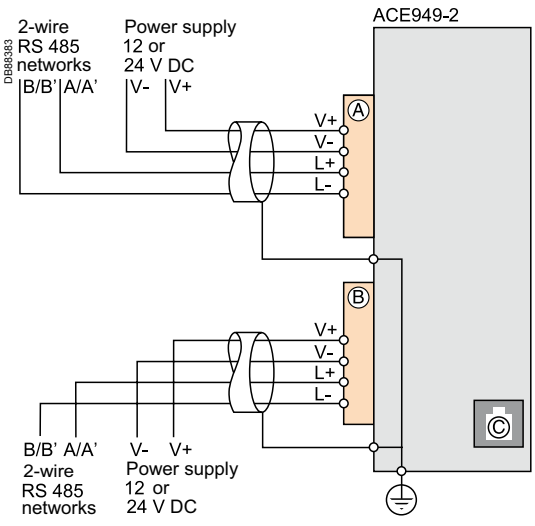
ACE949-2 module	
Weight	0.1 kg (0.22 lb)
Assembly	On symmetrical DIN rail
Operating temperature	-25°C to +70°C (-13°F to +158°F)
Environmental characteristics	Same characteristics as Sepam base units
2-wire RS 485 electrical interface	
Standard	EIA 2-wire RS 485 differential
Distributed power supply	External, 12 V DC or 24 V DC ±10%
Power consumption	16 mA in receiving mode
	40 mA maximum in sending mode

Maximum length of 2-wire RS 485 network with standard cable

Number of Sepam units	Maximum length with 12 V DC power supply	Maximum length with 24 V DC power supply
5	320 m (1000 ft)	1000 m (3300 ft)
10	180 m (590 ft)	750 m (2500 ft)
20	160 m (520 ft)	450 m (1500 ft)
25	125 m (410 ft)	375 m (1200 ft)



(1) *70 mm (2.8 in) with CCA612 cord connected.*



Description and dimensions

(A) and (B) Terminal blocks for network cable
(C) RJ45 socket to connect the interface to the base unit with a CCA612 cord
(⏚) Grounding/earthing terminal

1 Link activity LED, flashes when communication is active (sending or receiving in progress).
2 Jumper for RS 485 network line-end impedance matching with load resistor (Rc = 150 Ω), to be set to:
- ~~Rc~~, if the module is not at one end of the network (default position)
- Rc, if the module is at one end of the network.

3 Network cable clamps (inner diameter of clamp = 6 mm or 0.24 in).

Connection

- Connection of network cable to screw-type terminal blocks (A) and (B)
- Connection of the earthing terminal by tinned copper braid with cross-section ≥ 6 mm² (AWG 10) or cable with cross-section ≥ 2.5 mm² (AWG 12) and length ≤ 200 mm (7.9 in), fitted with a 4 mm (0.16 in) ring lug.
Check the tightness (maximum tightening torque 2.2 Nm or 19.5 lb-in).
- The interfaces are fitted with clamps to hold the network cable and recover shielding at the incoming and outgoing points of the network cable:
  - ☐ the network cable must be stripped
  - ☐ the cable shielding braid must be around and in contact with the clamp
- The interface is to be connected to connector (C) on the base unit using a CCA612 cord (length = 3 m or 9.8 ft, green fittings)
- The interfaces are to be supplied with 12 V DC or 24 V DC.

ACE850TP and ACE850FO network interfaces

PB105301

ACE850TP communication interface.

PB105300

ACE850FO communication interface.

ACE850TP and ACE850FO

Function

ACE850 multi-protocol communication interfaces are for Sepam series 40 and Sepam series 80 units.
They have two Ethernet communication ports to connect a Sepam unit to a single Ethernet network depending on the topology (star or ring):
■ For a star topology, only one communication port is used.
■ For a ring topology, both Ethernet communication ports are used to provide redundancy. This redundancy conforms to the RSTP 802.1d 2004 standard.

Either port can be used for connection:
■ To the S-LAN (Supervisory Local Area Network) port to connect a Sepam unit to an Ethernet communication network dedicated to supervision, using either of the following protocols:
□ IEC 61850
□ eModbus TCP/IP TRA 15.
■ To the E-LAN (Engineering Local Area Network) port, reserved for remote parameter setting and operation of a Sepam unit using SFT2841 software.

There are two versions of the ACE850 interface, which are identical except for the type of port featured:
■ ACE850TP (Twisted Pair), for connection to an Ethernet network (S-LAN or E-LAN) using a copper RJ45 10/100 Base TX Ethernet link.
■ ACE850FO (Fiber Optic), for connection to an Ethernet network (S-LAN or E-LAN) using a 100Base FX fiber optic connection (star or ring).

Compatible Sepam units

The ACE850TP and ACE850FO multi-protocol interfaces are compatible with the following Sepam units:
■ Sepam series 40, series 60 version ≥ V7.00
■ Sepam series 80 base version and application version ≥ V6.00 .

ACE850TP and ACE850FO network interfaces

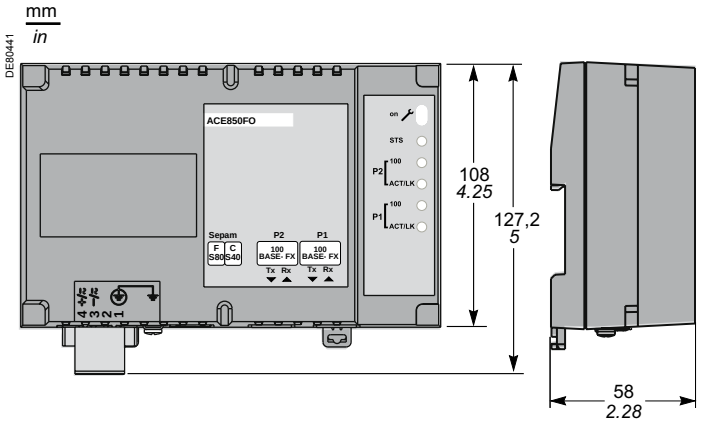
Characteristics

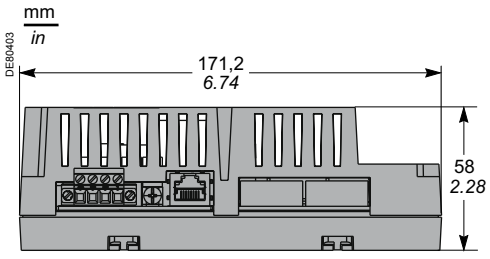
ACE850TP and ACE850FO module			
Technical characteristics			
Weight		0,4 kg (0.88 lb)	
Assembly		On symmetrical DIN rail	
Operating temperature		-25°C to +70°C (-13°F to +158°F)	
Environmental characteristics		Same characteristics as Sepam base units	
Power supply			
Voltage		24 to 250 V CC	110 to 240 V CA
Range		-20 % / +10 %	-20 % / +10 %
Maximum consumption	ACE850TP	3,5 W in CC	1,5 VA in CA
	ACE850FO	6,5 W in CC	2,5 VA in CA
Inrush current		< 10 A 10 ms in CC	< 15 A 10 ms in CA
Acceptable ripple content		12 %	
Acceptable momentary outages		100 ms	
Wired Ethernet communication ports (ACE850TP)			
Number of ports		2 x RJ45 ports	
Type of port		10/100 Base TX	
Protocols		HTTP, FTP, SNMP, SNTP, ARP, SFT, CEI61850, TCP/IP, RSTP 801.1d 2004	
Baud rate		10 or 100 Mbits/s	
Medium		CAT 5 STP or FTP or SFTP	
Maximum distance		100 m (328 ft)	
Fiber optic Ethernet communication ports (ACE850FO)			
Number of ports		2	
Type of port		100 Base FX	
Protocols		HTTP, FTP, SNMP, SNTP, ARP, SFT, CEI61850, TCP/IP, RSTP 801.1d 2004	
Baud rate		100 Mbits/s	
Fiber type		Multimode	
Wavelength		1300 nm	
Type of connector		SC	

Maximum length of fiber optic network

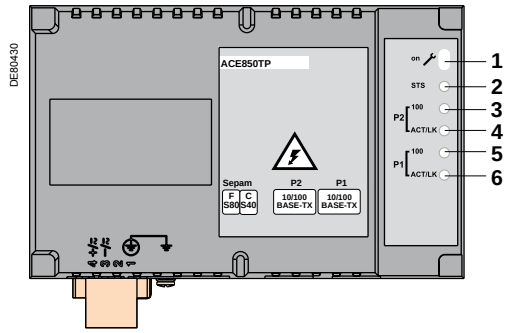
Fiber optic diameter (µm)	Minimum optical power Tx (dBm)	Maximum optical power Tx (dBm)	Sensitivity RX (dBm)	Saturation RX (dBm)	Maximum distance
50/125	-22,5	-14	-33,9	-14	2 km (1.24 mi)
62,5/125	-19	-14	-33,9	-14	2 km (1.24 mi)

Dimensions

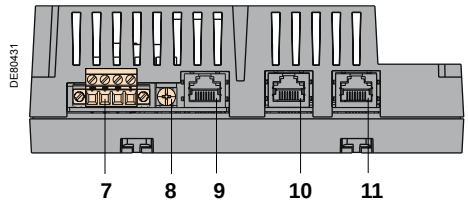




ACE850TP and ACE850FO network interfaces
Connection



ACE850TP: Front view



ACE850TP: View of underside

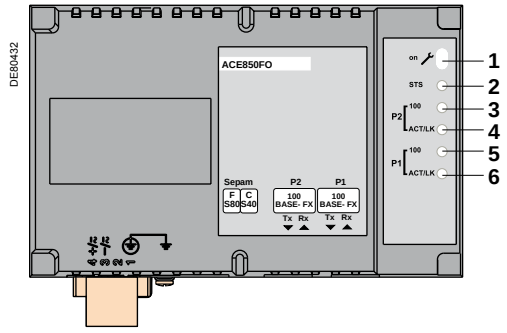
ACE850TP communication interfaces

1 ACE850 communication interface status LED
- LED off = ACE850 de-energized
- Green LED permanently on = ACE850 energized and operational
- Red LED flashing = ACE850 not configured and/or not connected to the base unit
- Red LED permanently on = ACE850 not operational (initialization in progress or failed)

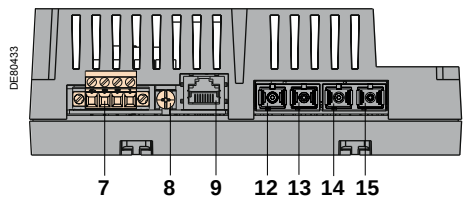
2 STS LED: communication status: green permanently on = OK
3 Ethernet Port 2 100 green LED: off = 10Mbps, permanently on = 100 Mbps
4 Ethernet Port 2 activity LED: flashing on transmission/reception
5 Ethernet Port 2 100 green LED: off = 10Mbps, permanently on = 100 Mbps
6 Ethernet Port 1 activity LED: flashing on transmission/reception

7 Power-supply terminal block
8 Grounding/earthing terminal using supplied braid
9 RJ45 socket to connect the interface to the Sepam base unit with a CCA614 cord :
- Sepam series 40: communication port (C) (identified by a white label on the Sepam unit)
- Sepam series 80: port (F) (identified by a blue label on the Sepam unit)

10 RJ45 10/100 Base TX Ethernet communication port P2 (E-LAN or S-LAN)
11 RJ45 10/100 Base TX Ethernet communication port P1 (E-LAN or S-LAN)



ACE850FO: Front view



ACE850FO: View of underside

ACE850FO communication interfaces

1 ACE850 communication interface status LED
- LED off = ACE850 de-energized
- Green LED permanently on = ACE850 energized and operational
- Red LED flashing = ACE850 not configured and/or not connected to the base unit
- Red LED permanently on = ACE850 not operational (initialization in progress or failed)

2 STS LED: communication status: green permanently on = OK
3 Ethernet Port 2 100 green LED: permanently on = 100 Mbps
4 Ethernet Port 2 activity LED: flashing on transmission/reception
5 Ethernet Port 2 100 green LED: permanently on = 100 Mbps
6 Ethernet Port 1 activity LED: flashing on transmission/reception

7 Power-supply terminal block
8 Grounding/earthing terminal using supplied braid
9 RJ45 socket to connect the interface to the Sepam base unit with a CCA614 cord :
- Sepam series 40: communication port (C) (identified by a white label on the Sepam unit)
- Sepam series 80: port (F) (identified by a blue label on the Sepam unit)

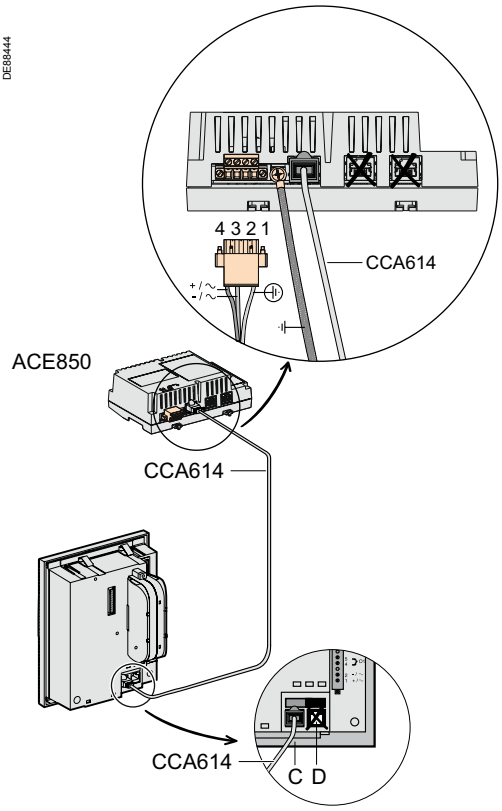
12 Tx fiber of 100 Base FX SC connector for Ethernet communication port P2 (E-LAN or S-LAN)
13 Rx fiber of 100 Base FX SC connector for Ethernet communication port P2 (E-LAN or S-LAN)
14 Tx fiber of 100 Base FX SC connector for Ethernet communication port P1 (E-LAN or S-LAN)
15 Rx fiber of 100 Base FX SC connector for Ethernet communication port P1 (E-LAN or S-LAN)

⚠ CAUTION

HAZARD OF BLINDING
Never look directly into the fiber optic.
Failure to follow this instruction can cause serious injury.

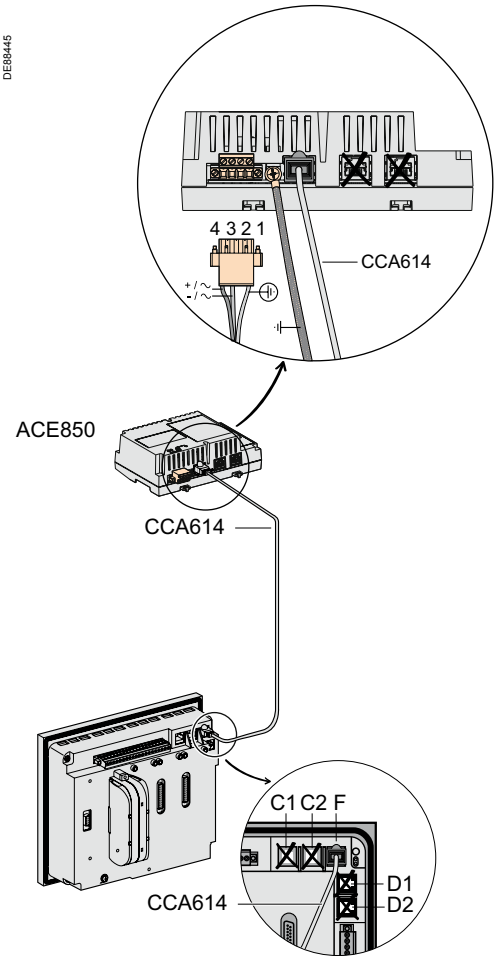
ACE850TP and ACE850FO network interfaces
Connection

DE88444



Connecting the ACE850 to a Sepam series 40

DE88445



Connecting the ACE850 to a Sepam series 60 and series 80.

Connection to Sepam

■ The ACE850 communication interface should only be connected to Sepam series 40 or Sepam series 80 base units using a CCA614 prefabricated cord (length = 3m or 9.8ft, blue RJ45 fittings).
■ Sepam series 40: Connect the CCA614 cord to the connector C on the Sepam base unit (white label).
■ Sepam series 60 and series 80: Connect the CCA614 cord to the connector F on the Sepam base unit (blue label).

Connection to Sepam

ACE850 interfaces must be powered by a 24 to 250 V DC or 110 to 240 V AC supply.

⚠ CAUTION

HAZARD OF ELECTRIC SHOCK, ELECTRIC ARC OR BURNS
■ Only qualified personnel should install this equipment. Such work should be performed only after reading this entire set of instructions and checking the technical characteristics of the device.
■ NEVER work alone.
■ Turn off all power supplying this equipment before working on or inside it. Consider all sources of power, including the possibility of backfeeding.
■ Always use a properly rated voltage sensing device to confirm that all power is off.
■ Start by connecting the device to the protective ground and to the functional ground.
■ Screw tight all terminals, even those not in use.

Failure to follow these instructions will result in death or serious injury.

Terminals	Type	Wiring
3 4	- / ~ + / ~	■ Wiring without fittings: □ 1 wire with maximum cross-section of 0.2 to 2.5 mm² (≥ AWG 20-12) or 2 wires with maximum cross-section of 0.5 to 1 mm² (≥ AWG 20-18) □ stripped length: 8 to 10 mm (0.31 to 0.39 in) ■ Wiring with fittings: □ recommended wiring with Schneider Electric fitting: - DZ5CE015D for 1 wire 1.5 mm² (AWG 16) - DZ5CE025D for 1 wire 2.5 mm² (AWG 12) - AZ5DE010D for 2 wires 1 mm² (AWG 18) □ tube length: 8.2 mm (0.32 in). □ stripped length: 8 mm (0.31 in).
DE88281 ⏚ Protective earth	Screw terminal	1 green/yellow wire, max. length 3 m (9.8 ft) and max. cross-section 2.5 mm² (AWG 12)
DE88282 Functional earth	4 mm (0.16 in) ring lug	Earthing braid, supplied for connection to cubicle grounding

Sepam IEC 61850 level 1
ECI850

PE88026

Sepam ECI850 server for IEC 61850.

Function

The ECI850 connects Sepam series 20, Sepam series 40 and Sepam series 80 units to an Ethernet network using the IEC 61850 protocol.
It acts as the interface between the Ethernet/IEC 61850 network and a Sepam RS485/Modbus network.
1 PRI surge arrester (cat. no. 16339) is supplied with the ECI850 to protect its power supply.

Characteristics

ECI850 module	
Technical characteristics	
Weight	0.17 kg (0,37 lb)
Assembly	On symmetrical DIN rail
Power supply	
Voltage	24 V DC (±10 %) supplied by a class 2 supply
Maximum consumption	4 W
Dielectric strength	1.5 kV
Environmental characteristics	
Operating temperature	-25 °C to +70 °C (-13 °F to +158 °F)
Storage temperature	-40 °C to +85 °C (-40 °F to +185 °F)
Relative humidity	5 to 95 % (without condensation) at +55 °C (131 °F)
Pollution degree	Class 2
Degree of protection	IP30
Electromagnetic compatibility	
Emission tests	
Emission (radiated and conducted)	EN 55022/EN 55011/FCC Class A
Immunity tests – Radiated disturbances	
Electrostatic discharge	EN 61000-4-2
Radiated radio-frequency fields	EN 61000-4-3
Magnetic fields at power frequency	EN 61000-4-8
Immunity tests – Conducted disturbances	
Fast transient bursts	EN 61000-4-4
Surges	EN 61000-4-5
Conducted disturbances, induced by radio-frequency fields	EN 61000-4-6
Safety	
International	IEC 60950
United States	UL 508/UL 60950
Canada	cUL (in compliance with CSA C22.2, no. 60950)
Australia / New Zealand	AS/NZS 60950
Certification	
Europe	CE
2-wire/4-wire RS485 communication ports	
Electrical interface	
Standard	EIA 2-wire/4-wire RS485 differential
Max. number of Sepam units per ECI850	2 Sepam series 60 and series 80 or 3 Sepam series 40 or 5 Sepam series 20
Maximum length of 2-wire/4-wire RS485 network	
Maximum length of network	1000 m (3300 ft)
Ethernet communication port	
Number of ports	1
Type of port	10/100 Base Tx
Protocols	HTTP, FTP, SNMP, SNTP, ARP, SFT, IEC 61850 TCP/IP
Transmission rate	10/100 Mbits/s

Compatibility

An ECI850 module can be used on the following Sepam base units, starting from indicated versions:

- base S20: V0526
- base S40: V3.0
- base S60: V1.00
- base S80: V3.0

Sepam IEC 61850 level 1
ECI850

Characteristics (cont.)

PRI surge arrester	
Electrical characteristics	
Utilisation voltage	48 VDC
Full discharge current	10 kA (8/20 µs wave)
Rated discharge current	5 kA (8/20 µs wave)
Level of protection	70 V
Response time	< 1 ns
Connection	
Tunnel terminals	Wires with maximum cross-section of 2.5 mm² to 4 mm² (AWG 12-10)

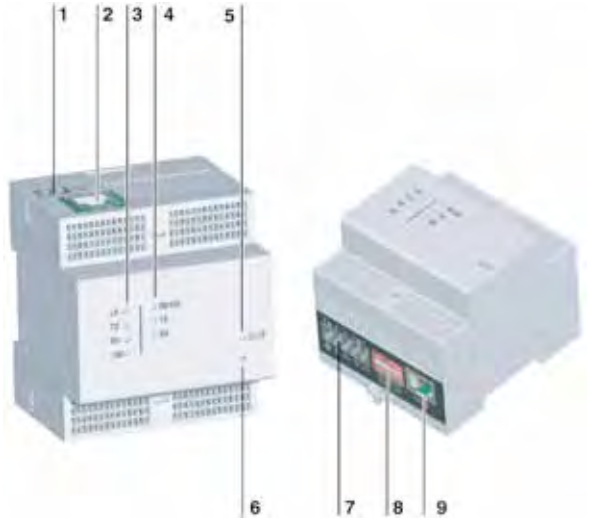
Description

1 ⏻ / 🔧 LED: Power on and maintenance
2 Serial-link LEDs:
- ■ RS485 LED: link to network activated
- □ On: RS485 mode
- □ Off: RS232 mode
- ■ flashing TX LED: ECI850 sending
- ■ flashing RX LED: ECI850 receiving

3 Ethernet LEDs:
- ■ green LK LED on: link to network activated
- ■ flashing green Tx LED: ECI850 sending
- ■ flashing green Rx LED: ECI850 receiving
- ■ green 100 LED:
- □ On: transmission rate = 100 Mbit/s
- □ Off: transmission rate = 10 Mbit/s

4 10/100 Base Tx port for Ethernet connection via RJ45 connector
5 24 V DC connection
6 Reset button
7 RS485 connector
8 RS485 setup switches
9 RS232 connector

PE88076



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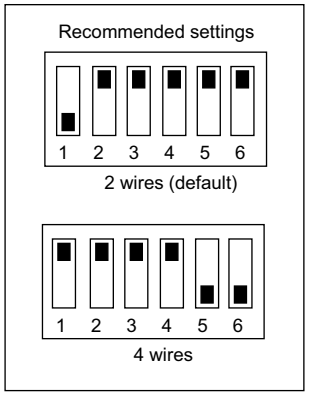


RS485 network setup.

RS485 network setup

The RS485 setup switches are used to select the network-polarisation (bias) and line-impedance matching resistors and the type of RS485 network (2-wire/4-wire). The default settings are for a 2-wire RS485 with network-polarization and line-impedance matching resistors.

Line-impedance matching using resistors	SW1	SW2	SW3	SW4	SW5	SW6
2-wire RS485	OFF	ON				
4-wire RS485	ON	ON				

Polarisation (bias)	SW1	SW2	SW3	SW4	SW5	SW6
at 0 V			ON			
at 5 V				ON		

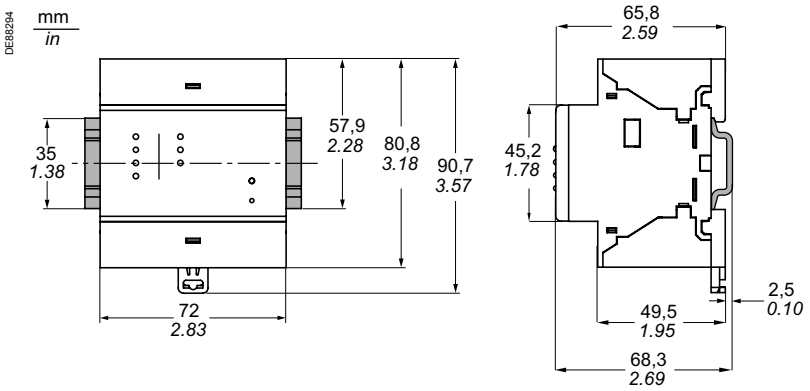
RS485 network type	SW1	SW2	SW3	SW4	SW5	SW6
2-wire					ON	ON
4-wire					OFF	OFF

Ethernet link set-up

The TCSEAK0100 configuration kit can be used to connect a PC to the ECI850 to set up the Ethernet link.

Sepam IEC 61850 level 1
ECI850

Dimensions



CAUTION

TO AVOID DAMAGING THE ECI850

■ Connect the PRI surge arrester as indicated in the diagrams below.

■ Check the quality of the earthing conductors connected to the surge arresters.

The equipment may be damaged if these instructions are not followed.

Connection

■ Connect the supply and the RS485 twisted pair using the ⩽ 2.5 mm² cable (⩾ AWG 12).

■ Connect the 24 V DC supply and earth to inputs 1, 5 and 3 on the PRI surge arresters supplied with the ECI850.

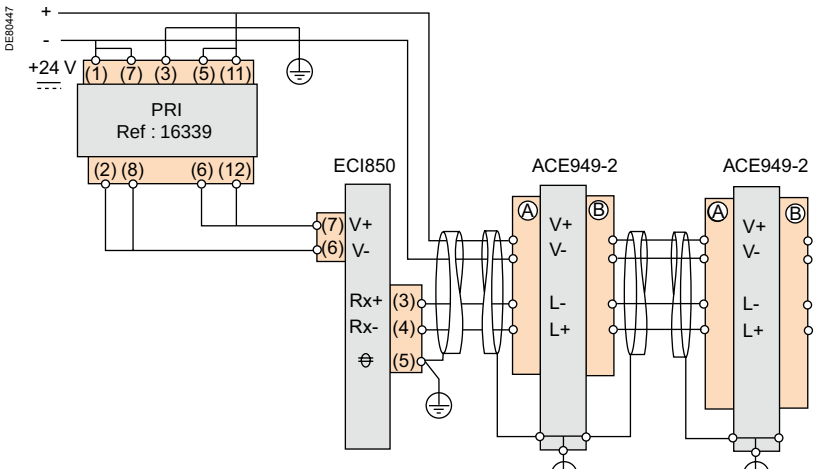
■ Connect outputs 2 and 6 of PRI surge arresters (cat. no. 16595) to the - and + terminals on the terminal block with black screws.

■ Connect the RS485 twisted pair (2 or 4 wires) to the terminals (RX+ RX- or RX+ RX- TX+ TX-) on the terminal block with black screws.

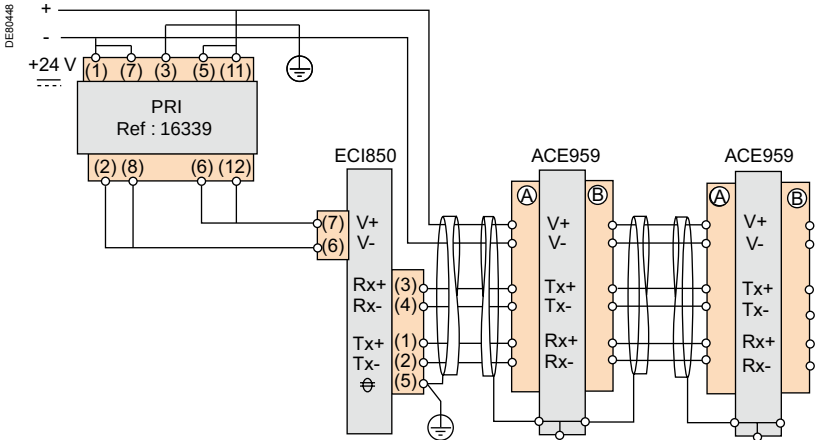
■ Connect the shielding of the RS485 twisted pair to the ⏚ terminal on the terminal block with black screws.

■ Connect the Ethernet cable to the green RJ45 connector.

2-wire RS485 network



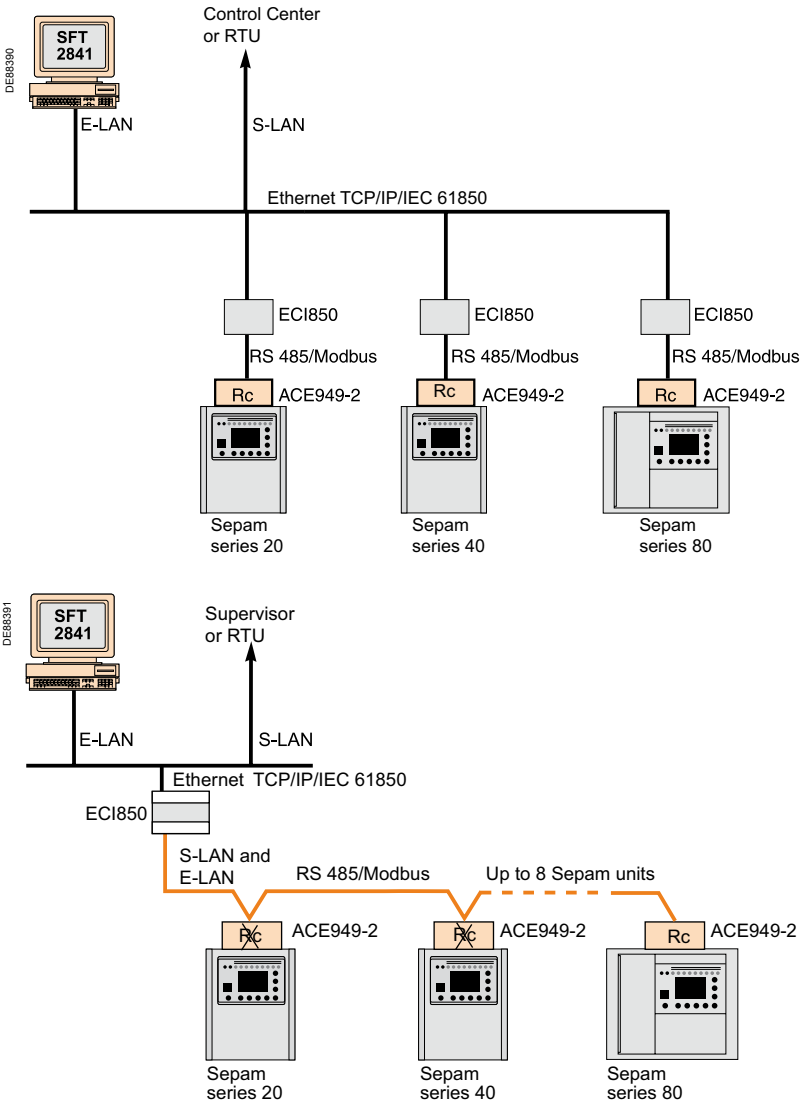
4-wire RS485 network



Sepam IEC 61850 level 1
ECI850

Architecture example

The diagrams below show two examples of communication architectures using the ECI850.



***Note: Rc** = line-impedance matching resistor.*

The maximum Sepam configuration for a Sepam IEC 61850 level 1 server is:
2 Sepam series 60 and series 80 units or 3 Sepam series 40 units or 5 Sepam series 20 units.

PowerLogic EGX100
Ethernet gateway

PE86138

PowerLogic EGX100

Function

The EGX100 serves as an Ethernet gateway for PowerLogic system devices and for any other communicating devices utilising the Modbus protocol. The EGX100 gateway offers complete access to status and measurement information provided by the connected devices via PowerLogic software installed on a PC.

PowerLogic software compatibility

PowerLogic software is recommeded as a user interface because they provide access to all status and measurement information. They also prepare summary reports. The EGX100 is compatible with:

- PowerLogic ION EEM enterprise energy management software
- PowerLogic ION Enterprise power management software
- PowerLogic System Manager power management software
- PowerLogic PowerView power monitoring software

Architecture

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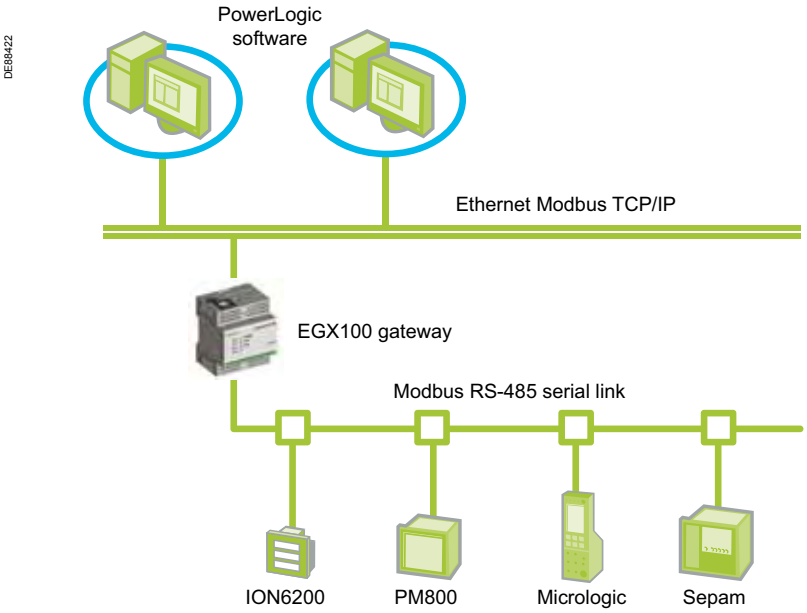

Setup

Setup via an Ethernet network

Once connected to an Ethernet network, the EGX100 gateway can be accessed by a standard internet browser via its IP address to:

- specify the IP address, subnet mask, and gateway address of the EGX gateway
- configure the serial port parameters (baud rate, parity, protocol, mode, physical interface, and timeout value)
- create user accounts
- create or update the list of the connected products with their Modbus or PowerLogic communication parameters
- configure IP filtering to control access to serial devices
- access Ethernet and serial port diagnostic data
- update the firmware.
- specify the user language.

Setup via a serial connection

Serial setup is carried out using a PC connected to the EGX100 via an RS232 link. This setup:

- specifies the IP address, subnet mask, and gateway address of the EGX gateway
- specifies the language used for the setup session.

Part numbers

EGX100	
EGX100	**EGX100**

PowerLogic EGX300
Integrated gateway-server

PE86181

PowerLogic EGX300

Function

The EGX300 integrated gateway-server uses only a simple web browser and Ethernet network to access, log and display real-time data and trend plots from up to 64 PowerLogic system devices, including other gateway devices on the same network. The EGX300 embedded web page function and 512 Mb of onboard memory allow users to create pages for viewing data from their electrical system and store third-party web pages and documents such as instruction bulletins or equipment and system diagrams.

PowerLogic software compatibility

Combine the EGX300 with PowerLogic software for extensive analysis and additional functionality. The EGX300 is compatible with:

- PowerLogic ION EEM enterprise energy management software
- PowerLogic ION Enterprise power management software
- PowerLogic System Manager power management software
- PowerLogic PowerView power monitoring software

Architecture

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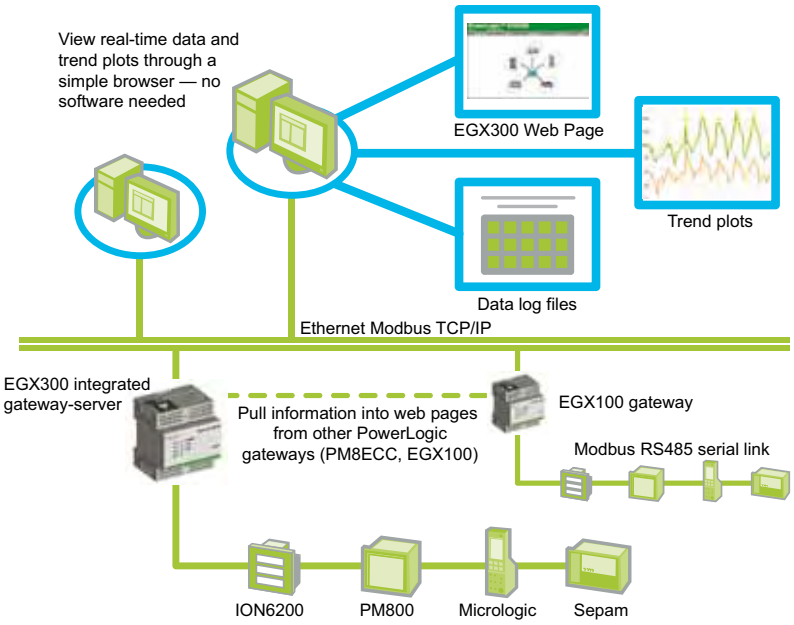


Features

- View real-time and historical information from multiple locations via any Microsoft-compatible web browser
- Automatically detect networked devices for easy setup
- Automatically email or FTP selected logged data to your PC for additional analysis
- Select the logging intervals and topics you want logged
- Ensures data and system security through password protection and controlled network access to individual web pages
- Simplifies installation by receiving control power through the Ethernet cable utilising Power-over-Ethernet and offers the option to utilise 24 Vdc control power

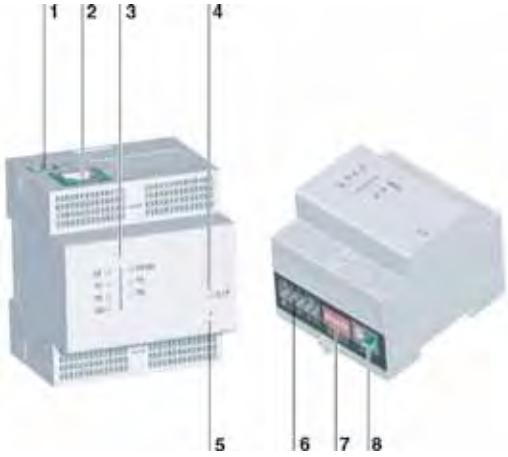
Part numbers

EGX300	
EGX300	**EGX300**

Ethernet EGX100 gateway
Ethernet EGX300 server

EGX100

DE88079



1 *24 Vdc power connection.*
2 *10/100 Base TX (802.3af) port for connection to Ethernet via an RJ45 connector.*
3 *Ethernet and serial indication LEDs.*
4 *Power/Status LED.*
5 *Reset button.*
6 *RS485 connection.*
7 *Dip switches for biasing, termination, and 2-wire/4-wire jumpers.*
8 *RS232 connection.*

EGX300

PE86181

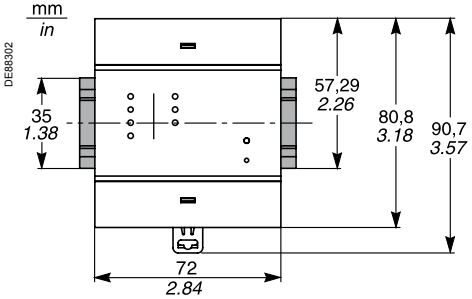
Characteristics

	EGX100	EGX300
Weight	170 g	170 g
Dimensions (H x W x D)	91 x 72 x 68 mm	91 x 72 x 68 mm
Mounting	Din rail	Din rail
Power-over-Ethernet (PoE)	Class 3	Class 3
Power supply	24 V DC if not using PoE	24 V DC if not using PoE
Operating temperature	-25 to 70ºC	-25 to 70ºC
Humidity rating	5 % to 95 % relative humidity (without condensation) at +55 °C	5 % to 95 % relative humidity (without condensation) at +55 °C
Regulatory/standards compliance for electromagnetic interference		
Emissions (radiated and conducted)	EN 55022/EN 55011/ FCC class A	EN 55022/EN 55011/ FCC class A
Immunity for industrial environments:	EN 61000-6-2	EN 61000-6-2
- electrostatic discharge	EN 61000-4-2	EN 61000-4-2
- radiated RF	EN 61000-4-3	EN 61000-4-3
- electrical fast transients	EN 61000-4-4	EN 61000-4-4
- surge	EN 61000-4-5	EN 61000-4-5
- conducted RF	EN 61000-4-6	EN 61000-4-6
- power frequency magnetic field	EN 61000-4-8	EN 61000-4-8
Regulatory/standards compliance for safety		
International (CB scheme)	IEC 60950	IEC 60950
USA	UL508/UL60950	UL508/UL60950
Canada	cUL (complies with CSA C22.2, no. 60950)	cUL (complies with CSA C22.2, no. 60950)
Europe	EN 60950	EN 60950
Australia/New Zealand	AS/NZS25 60950	AS/NZS 60950
Serial ports		
Number of ports	1	1
Types of ports	RS232 or RS485 (2-wire or 4-wire), depending on settings	RS232 or RS485 (2-wire or 4-wire), depending on settings
Protocol	Modbus RTU/ASCII PowerLogic® (SY/MAX), JBus	Modbus RTU/ASCII PowerLogic® (SY/MAX), JBus
Maximum baud rate	38400 or 57600 baud depending on settings	57600
Maximum number of directly connected devices	32	64
Ethernet port		
Number of ports	1	1
Types of ports	One 10/100 base TX (802.3af) port	One 10/100 base TX (802.3af) port
Protocol	HTTP, Modbus TCP/IP, FTP, SNMP (MIB II), SNTP, SMTP	HTTP, Modbus TCP/IP, FTP, SNMP (MIB II), SNTP, SMTP
Baud rate	10/100 MB	10/100 MB
Web server		
Memory for custom HTML pages	None	512 Mo

Installation

DIN rail mounting (EGX100, EGX300)

DE88302



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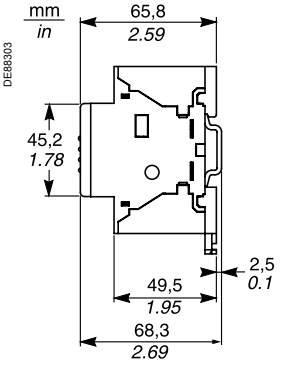

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