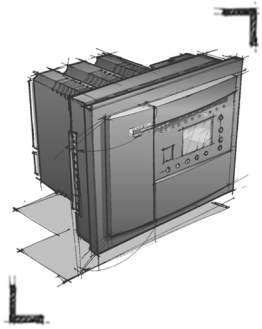
Electrical network protection

Sepam Series 80
Installation, use, commissioning and maintenance

Operation manual

2003



Sepam

a brand of Schneider Electric

Merlin Gerin

General contents

Installation

Use

Commissioning

Maintenance

Contents

Equipment identification **4**

Precautions **6**

Base unit **7**
Dimensions 7
Mounting 8
Connection 9
Phase current inputs connection 10
Residual current inputs connection 11
Phase voltage and residual voltage inputs connection 12

MES120 14 input / 6 output module **14**

1 A / 5 A current transformers **16**

LPCT type current sensors **18**
CLP1 sensors 18
Test accessories 19

CSH120 and CSH200
Core balance CTs **20**

CSH30
Interposing ring CT **21**

ACE990
Core balance CT interface **22**

Remote modules **24**

MET148-2
Temperature sensor modules **25**

MSA141
Analog output module **26**

DSM303
Remote advanced UMI module **27**

Communication accessories **28**

Communication protocols and gateways **29**

Communication interfaces **30**

ACE949-2
2-wire RS 485 network interface **31**

ACE959
4-wire RS 485 network interface **32**

ACE937
Fiber optic interface **33**

ACE909-2
RS 232 / RS 485 converter **34**

ACE919CA and ACE919CC
RS 485 / RS 485 converters **36**

Equipment identification

Identification

Each Sepam is delivered in a separate package containing:

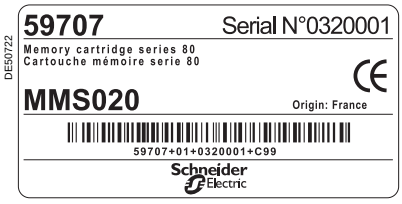
- 1 Sepam series 80 base unit, with its memory cartridge and two connectors Ⓐ and Ⓔ tightened
- 1 battery
- 8 spring clips
- 1 terminal block identification label
- 1 Quick Start

The other optional accessories such as modules, current input connectors and cords are delivered in separate packages.

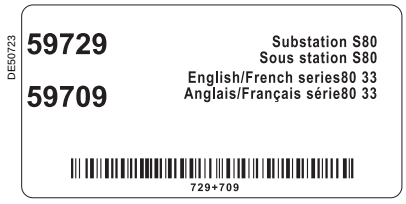
To identify a Sepam, inspect the 3 labels which are visible when the door on the front panel is opened:

- label with base unit hardware reference, stuck on the back of the door on the front panel

- 2 labels stuck on the cartridge:



Cartridge hardware reference.



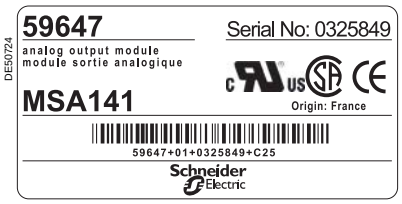
Reference of software loaded in the cartridge:

- application
- working language.

Identification of accessories

The accessories such as optional modules, current or voltage connectors and connection cords come in separate packages, identified by labels.

- example of MSA141 module identification label:



Equipment identification

List of Sepam series 80 references

Reference	Designation
59608	DSM303, remote advanced UMI module
59630	CCA630 connector for 1A/5A CT current sensors
59634	CSH30 interposing ring CT for I0 input
59635	CSH120 residual current sensor, diameter 120 mm
59636	CSH200 residual current sensor, diameter 200 mm
59641	MET148-2 8-temperature sensor module
59642	ACE949-2-wire RS 485 network interface
59643	ACE959 4-wire RS 485 network interface
59644	ACE937 fiber optic interface
59647	MSA141 1 analog output module
59648	ACE909-2 RS 485/RS 232 convertor
59649	ACE919 AC RS 485/RS 485 interface (AC power supply)
59650	ACE919 DC RS 485/RS 485 interface (DC power supply)
59660	CCA770 remote module cord, L = 0.6 m
59661	CCA772 remote module cord, L = 2 m
59662	CCA774 remote module cord, L = 4 m
59663	CCA612 RS 485 network interface communication cord, L = 3 m
59664	CCA783 PC connection cord
59666	CCA613 remote LPCT test plug
59667	ACE917 LPCT injection adapter
59668	CCA620 20-pin screw type connector
59669	CCA622 20-pin ring lug connector
59671	SFT2841 PC configuration software kit, with CCA783 cord
59672	ACE990 core balance CT interface for I0 input
59676	Kit 2640 with 2 sets of spare connectors for MES
59699	ATM820 shield
59702	CCA671 connector for LPCT current sensors
59703	SEP080, base unit without UMI, 24-250 V DC power supply
59704	SEP383, base unit with advanced UMI, 24-250 V DC power supply
59706	AMT880 mounting plate
59707	MMS020 memory cartridge
59709	Working language English/French
59710	Working language English/Spanish
59715	MES120 14 input + 6 output module / 24-250 V DC
59729	Substation application type S80
59730	Substation application type S81
59731	Substation application type S82
59733	Transformer application type T81
59734	Transformer application type T82
59735	Transformer application type T87
59736	Motor application type M81
59737	Motor application type M87
59738	Motor application type M88
59739	Generator application type G82
59741	Generator application type G87
59742	Generator application type G88

Precautions

Installation of Sepam

We recommend that you follow the instructions given in this document for quick, correct installation of your Sepam:

- equipment identification
- assembly
- connection of current and voltage inputs, probes
- connection of power supply
- checking prior to commissioning.

Handling, transport and storage

Sepam in its original packaging

Transport:
Sepam may be shipped to any destination without talking any additional precautions by all usual means of transport.

Handling:
Sepam may be handled without any particular care and can even withstand being dropped by a person handling it (person standing on floor).

Storage:
Sepam may be stored in its original packaging, in an appropriate location for several years:

- temperature between -25 °C and +70 °C
- humidity ⩽ 90 %.

Periodic, yearly checking of the environment and the packaging condition is recommended.
Once Sepam has been unpacked, it should be energized as soon as possible.

Sepam installed in a cubicle

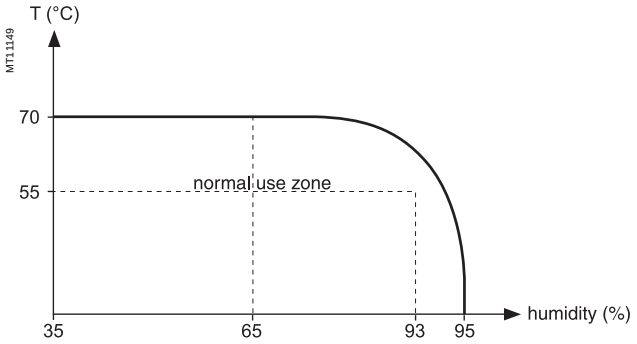
Transport:
Sepam may be transported by all usual means of transport in the customary conditions used for cubicles. Storage conditions should be taken into consideration for a long period of transport.

Handling:
Should the Sepam fall out of a cubicle, check its condition by visual inspection and energizing.

Storage:
Keep the cubicle protection packing for as long as possible. Sepam, like all electronic units, should not be stored in a damp environment for more than a month. Sepam should be energized as quickly as possible. If this is not possible, the cubicle reheating system should be activated.

Environment of the installed Sepam

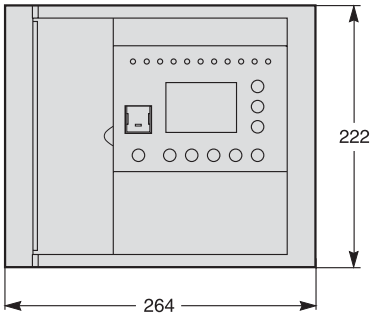
Operation in a damp environment
The temperature/relative humidity factors must compatible with the unit's environmental withstand characteristics.
If the use conditions are outside the normal zone, commissioning arrangements should be made, such as air conditioning of the premises.



Operation in a polluted atmosphere
Sepam is designed to be used in a clean industrial environment as defined by IEC 60654-4 class 1. A contaminated industrial atmosphere components (such as the presence of chlorine, hydrofluoric acid, sulfur, solvents...) may cause corrosion of the electronic components, in which case environmental control arrangements should be made (such as closed, pressurized premises with filtered air, ...) for commissioning.

Base unit
Dimensions

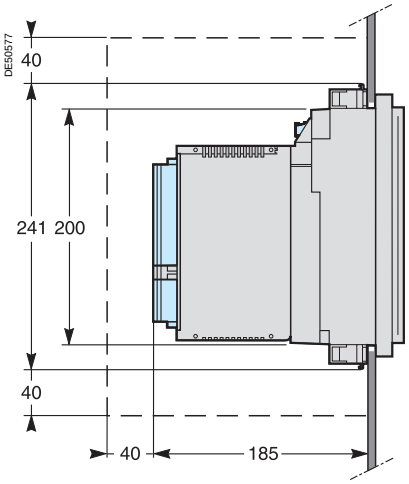
DE50060



Front view of Sepam.

Dimensions

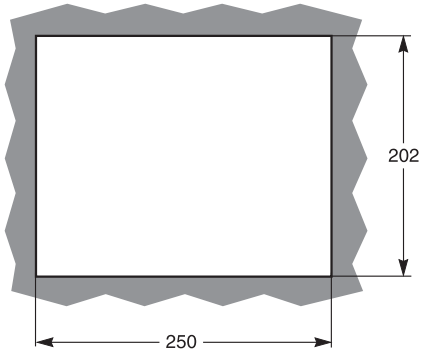
DE50577



Side view of Sepam with MES120, flush-mounted in front panel with spring clips.
Support frame: 1.5 mm to 6 mm thick.

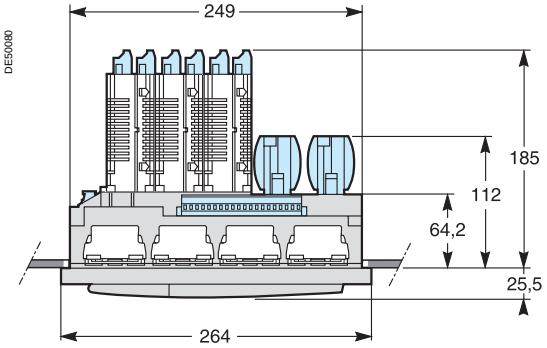
Clearance for Sepam assembly and wiring.

DE50079



Cut-out.

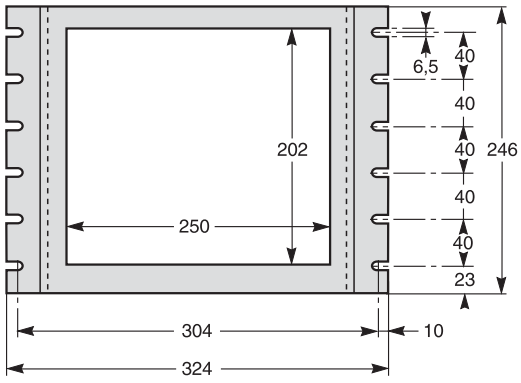
DE50080



Top view of Sepam with MES120, flush-mounted in front panel with spring clips.
Support frame: 1.5 mm to 6 mm thick.

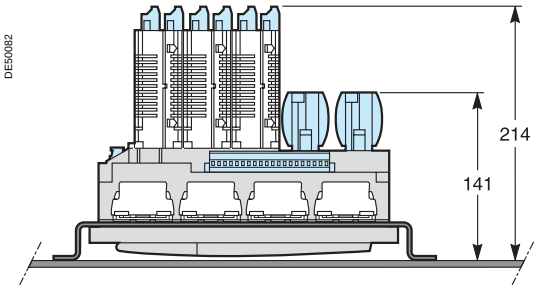
Assembly with AMT880 mounting plate

DE50081



AMT880 mounting plate.

DE50082

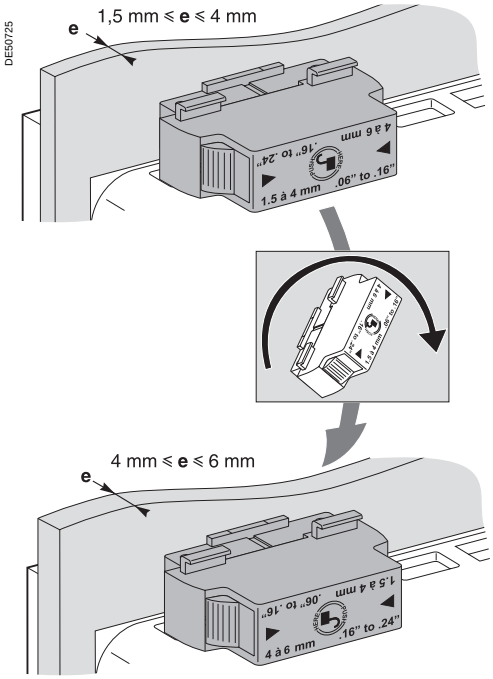


Top view of Sepam with MES120, flush-mounted in front panel with spring clips.
Mounting plate: 3 mm thick.

Base unit
Mounting

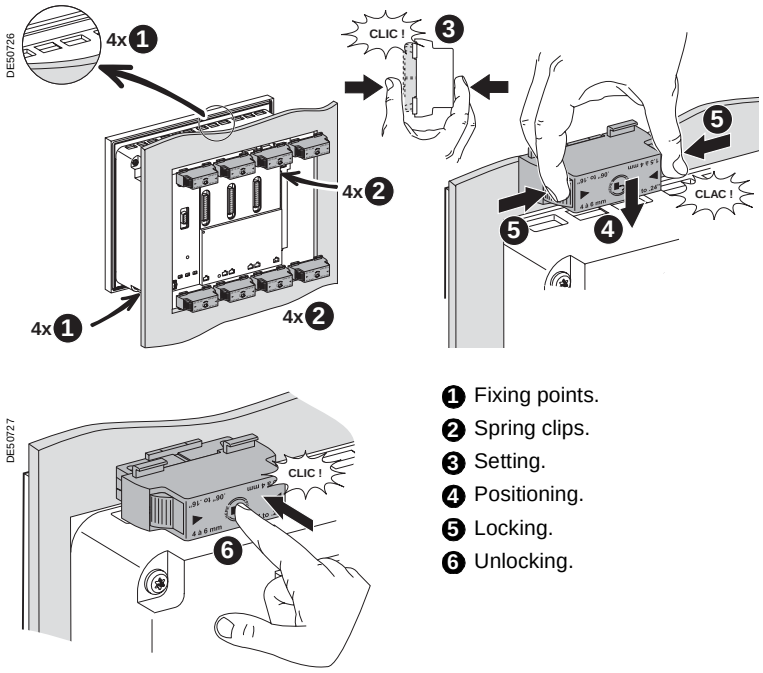
Spring clip mounting direction

The direction in which the spring clips are mounted depends on the thickness of the mounting frame.
The top clips are mounted in the opposite direction to the bottom clips.

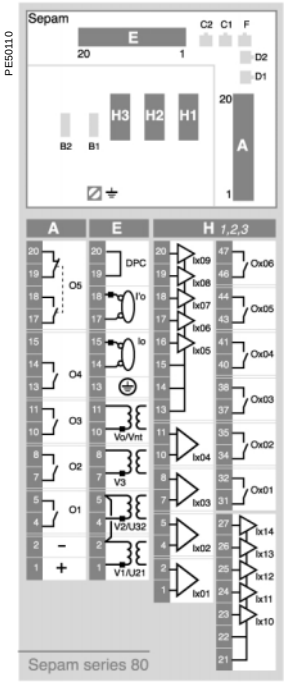


Base unit flush-mounting

Sepam series 80 is mounted on the mounting frame by 8 spring clips.
The mounting surface must be flat and stiff to guarantee tightness.



1. Fixing points.
2. Spring clips.
3. Setting.
4. Positioning.
5. Locking.
6. Unlocking.



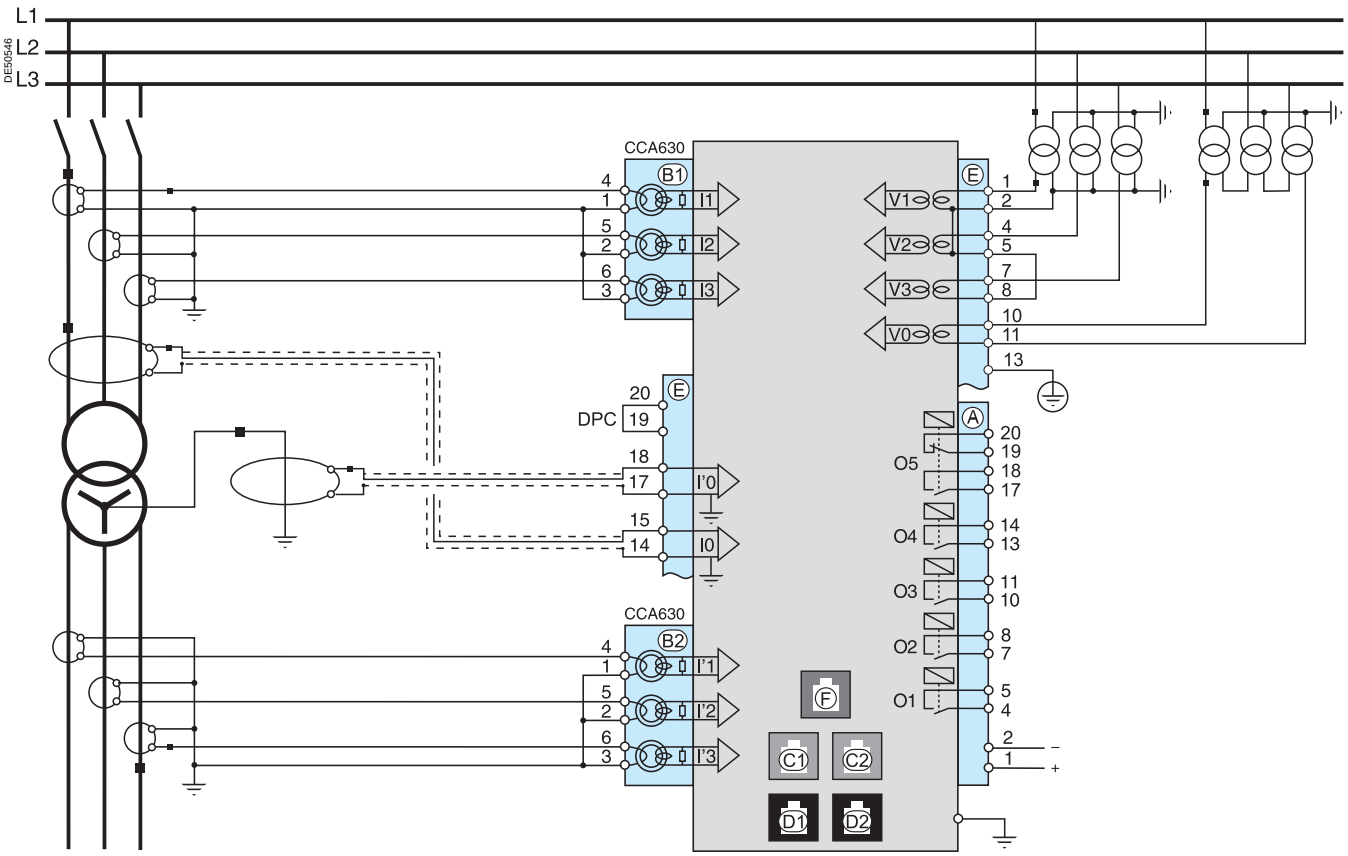
Installing the terminal block identification label

A sticker showing the rear panel of Sepam and terminal assignments is supplied with each base unit to facilitate the installation and connection of Sepam and the MES120 input/output modules.
You may stick it in the location of your choice, e.g. on the side of an MES120 module or on the right-hand side panel of Sepam.

Installing the battery

Install the battery supplied in its housing, in accordance with the polarities indicated.

Base unit
Connection

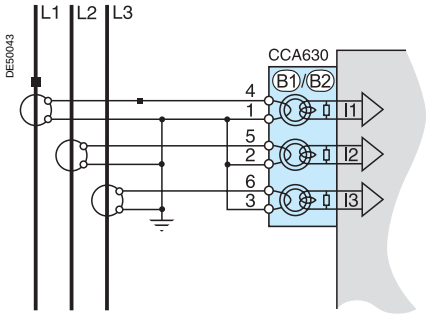


For safety reasons (access to dangerous voltages), all terminals must be screw-tightened, whether or not they are used.

Connector	Type	Reference	Wiring
(A), (E)	Screw type	CCA620	■ wiring with no fittings : □ 1 wire with max. cross-section 0.2 to 2.5 mm² (≥ AWG 24-12) or 2 wires with max. cross-section 0.2 to 1 mm² (≥ AWG 24-16) □ stripped length: 8 to 10 mm ■ wiring with fittings: □ recommended Telemecanique wiring with fittings: - DZ5CE015D for 1 x 1.5 mm² wire - DZ5CE025D for 1 x 2.5 mm² wire - AZ5DE010D for 2 x 1 mm² wires □ tube length: 8.2 mm □ stripped length: 8 mm
	6.35 mm ring lugs	CCA622	■ 6.35 mm ring or spade lugs (1/4") ■ maximum wire cross-section of 0.2 to 2.5 mm² (≥ AWG 24-12) ■ stripped length: 6 mm ■ use an appropriate tool to crimp the lugs on the wires ■ maximum of 2 ring or spade lugs per terminal ■ tightening torque: 0.7 to 1 Nm
(B1), (B2)	4 mm ring lugs	CCA630, for connection of 1 A or 5 A CTs	1.5 to 6 mm² (AWG 16-10)
	RJ45 plug	CCA671, for connection of 3 LPCT sensors	Integrated with LPCT CLP1 sensor
(C1), (C2)	Green RJ45 plug		CCA612
(D1), (D2)	Black RJ45 plug		CCA770: L = 0.6 m CCA772: L = 2 m CCA774: L = 4 m
Functional earth	Ring lug		Earthing braid, to be connected to cubicle grounding: ■ flat copper braid with cross-section ≥ 9 mm² ■ maximum length: 300 mm

Base unit
Phase current inputs connection

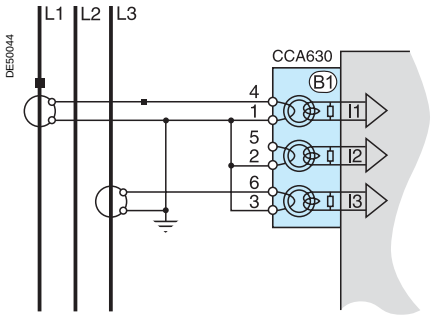
Variant 1: phase current measurement by 3 x 1 A or 5 A CTs (standard connection)



Connection of 3 x 1 A or 5 A sensors to the CCA630 connector.

The measurement of the 3 phase currents allows the calculation of residual current.

Variant 2: phase current measurement by 2 x 1 A or 5 A CTs

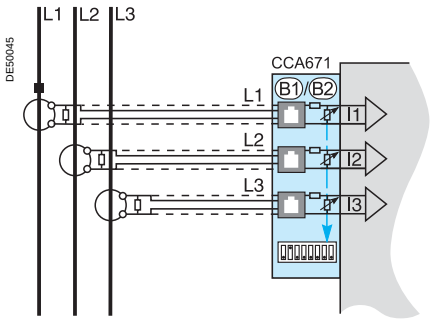


Connection of 2 x 1 A or 5 A sensors to the CCA630 connector.

Measurement of phase 1 and 3 currents is sufficient for all protection functions based on phase current.

This arrangement does not allow the calculation of residual current.

Variant 3: phase current measurement by 3 LPCT type sensors



Connection of 3 Low Power Current Transducer (LPCT) type sensors to the CCA671 connector. It is necessary to connect 3 sensors; if only one or two sensors are connected, Sepam goes into fail-safe position.

Measurement of the 3 phase currents allows the calculation of residual current.

The In parameter, primary rated current measured by an LPCT, is to be chosen from the following values, in Amps: 25, 50, 100, 125, 133, 200, 250, 320, 400, 500, 630, 666, 1000, 1600, 2000, 3150.
Parameter to be set using the SFT2841 software tool, to be completed by hardware setting of the microswitches on the CCA671 connector.

Possible combinations of types of sensors per application

- Sepam units without ANSI 87T or 87M differential protection functions measure 2 or 3 phase currents by means of sensors connected to connector (B1)
- Sepam M87 and G87 units with ANSI 87M machine differential protection measure 2 x 3 phase currents:
  - 3 CTs or 3 LPCTs at the circuit breaker end connected to connector (B1)
  - 3 CTs or 3 LPCTs connected to connector (B2)
- Sepam T87, M88 and G88 units with ANSI 87T transformer differential protection measure 2 x 3 phase currents by means of 2 sets of 3 current transformers:
  - 3 CTs at the circuit breaker end connected to connector (B1)
  - 3 CTs connected to connector (B2).

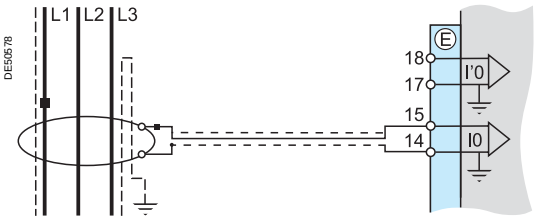
Sensors connected to	Sepam without ANSI 87M or 87T	Sepam with ANSI 87M	Sepam with ANSI 87T
Connector (B1)	2 CTs or 3 CTs connected to CCA630 or 3 LPCTs to CCA671	3 CTs connected to CCA630 or 3 LPCTs to CCA671	3 CT connected to CCA630
Connector (B2)		3 CTs connected to CCA630 or 3 LPCTs to CCA671	3 CTs connected to CCA630

Base unit
Residual current inputs connection

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

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.

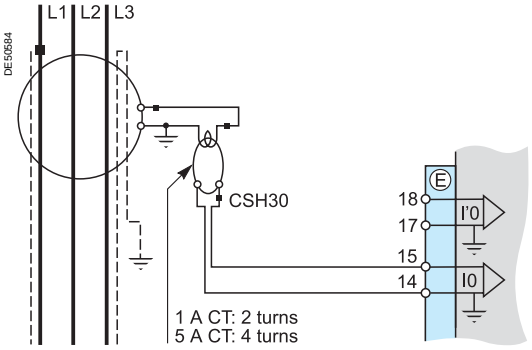
Variant 2: residual current measurement by CSH120 or CSH200 core balance CT (standard connection)



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

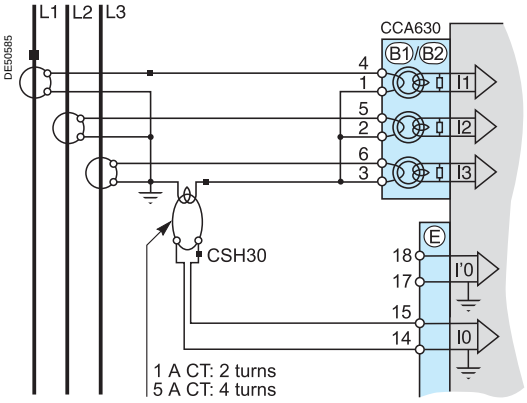
Setting range from 0.01 In0 to 15 In0 (minimum 0.1 A), with In0 = 2 A or 20 A according to parameter setting.

Variant 3: residual current measurement by 1 A or 5 A CTs and CSH30 interposing ring CT

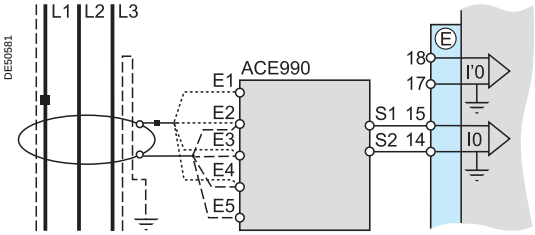


The CSH30 interposing ring CT is used to connect 1 A or 5 A CTs to Sepam to measure residual current:
- CSH30 interposing ring CT connected to 1 A CT: make 2 turns through CSH primary
- CSH30 interposing ring CT connected to 5 A CT: make 4 turns through CSH primary.

Setting range from 0.01 In to 15 In (minimum 0.1 A), with In = CT primary current.



Variant 4: residual current measurement by core balance CT with ratio of 1/n (n between 50 and 1500)



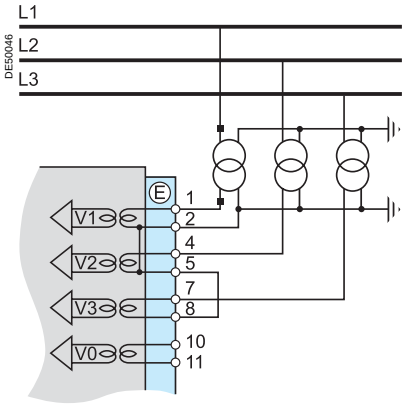
The ACE990 is used as an interface between a MV core balance CT with a ratio of 1/n (50 ⩽ n ⩽ 1500) and the Sepam residual current input.
This arrangement allows the continued use of existing core balance CTs on the installation.

Setting range from 0.01 In0 to 15 In0 (minimum 0.1 A),
with In0 = k.n,
where n = number of core balance CT turns
and k = factor to be determined according to ACE990 wiring and setting range used by Sepam, with a choice of 20 discrete values from 0.00578 to 0.26316.

Base unit
Phase voltage and residual voltage inputs connection

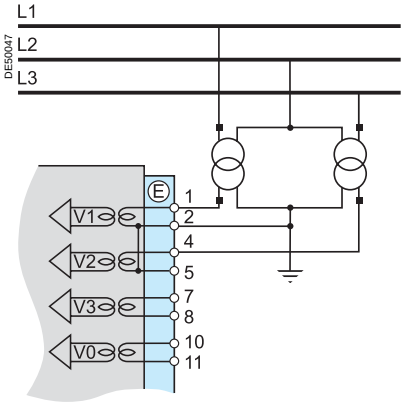
Phase voltage input connection variants

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



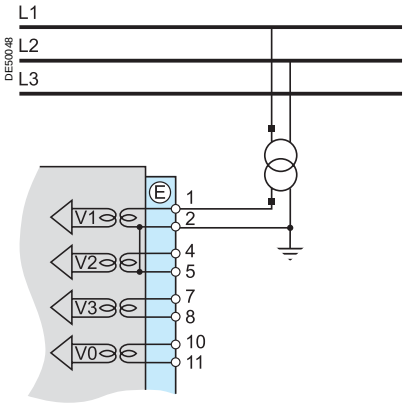
Measurement of the 3 phase-to-neutral voltages allows the calculation of residual voltage, V0Σ.

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



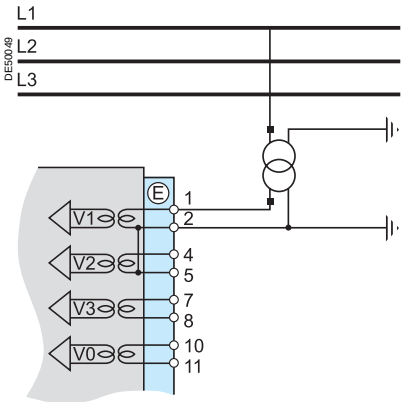
This variant does not allow the calculation of residual voltage.

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



This variant does not allow the calculation of residual voltage.

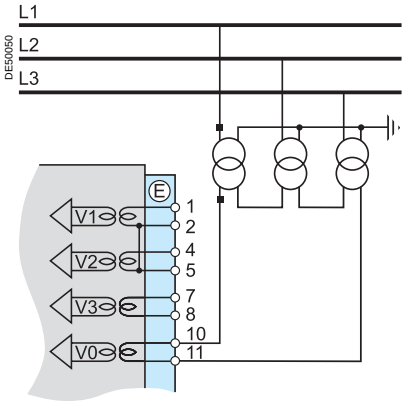
Variant 4: measurement of 1 phase-to-neutral voltage (1 V)



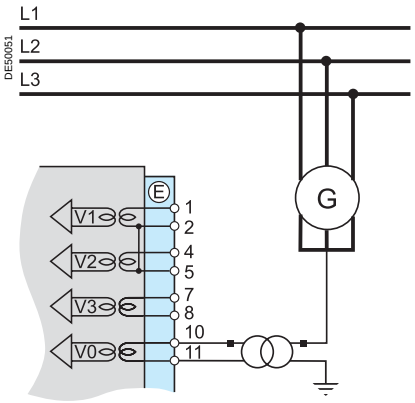
This variant does not allow the calculation of residual voltage.

Residual voltage input connection variants

Variant 5: measurement of residual voltage V0



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



Base unit
Phase voltage and residual voltage inputs connection

The availability of certain protection and metering functions depend on the phase and residual voltages measured by Sepam.

The table below gives the voltage input connection variants for which each protection and metering function dependent on measured voltages is available.
Example:
The directional overcurrent protection function (ANSI 67N/67NC) uses residual voltage V0 as a polarization value.
It is therefore operational in the following cases:
- measurement of the 3 phase-to-neutral voltages and calculation of V0Σ (3 V + V0Σ, variant 1)
- measurement of residual voltage V0 (variant 5).

The protection and metering functions which do not appear in the table below are available regardless of the voltages measured.

Phase voltages measured (connection variant)		**3 V + V0Σ** (var. 1)			**2 U** (var. 2)			**1 U** (var. 3)			**1 V** (var. 4)		
Residual voltage measured (connection variant)		**–**	**V0** (v. 5)	**Vnt** (v. 6)	**–**	**V0** (v. 5)	**Vnt** (v. 6)	**–**	**V0** (v. 5)	**Vnt** (v. 6)	**–**	**V0** (v. 5)	**Vnt** (v. 6)
Protection functions dependent on voltages measured													
Directional phase overcurrent	67	■	■	■	■	■	■						
Directional earth fault	67N/67NC	■	■	■		■			■			■	
Directional active overpower	32P	■	■	■	■	■	■						
Directional reactive active overpower	32Q	■	■	■	■	■	■						
Directional active underpower	37P	■	■	■	■	■	■						
Field loss (underimpedance)	40	■	■	■	■	■	■						
Pole slip	78PS	■	■	■	■	■	■						
Voltage-restrained overcurrent	50V/51V	■	■	■	■	■	■						
Underimpedance	21B	■	■	■	■	■	■						
Inadvertent energization	50/27	■	■	■	■	■	■						
Third harmonic undervoltage / 100 % stator earth fault	27TN/64G2 64G			■			■						
Overfluxing (V/Hz)	24	■	■	■	■	■	■	■	■	■	■	■	■
Positive sequence undervoltage	27D	■	■	■	■	■	■						
Remanent undervoltage	27R	■	■	■	■	■	■	■	■	■	■	■	■
Undervoltage (L-L or L-N)	27	■	■	■	■	■	■	■	■	■	■	■	■
Overvoltage (L-L or L-N)	59	■	■	■	■	■	■	■	■	■	■	■	■
Neutral voltage displacement	59N	■	■	■		■	■		■	■		■	■
Negative sequence overvoltage	47	■	■	■	■	■	■						
Overfrequency	81H	■	■	■	■	■	■	■	■	■	■	■	■
Underfrequency	81L	■	■	■	■	■	■	■	■	■	■	■	■
Measurements dependent on voltages measured													
Phase-to-phase voltage U21, U32, U13		■	■	■	■	■	■	U21	U21	U21			
Phase-to-neutral voltage V1, V2, V3		■	■	■		■					V1	V1	V1
Residual voltage V0		■	■	■		■			■			■	
Neutral point voltage Vnt				■			■			■			■
Third harmonic neutral point voltage				■			■			■			■
Third harmonic residual voltage		■	■	■		■			■			■	
Positive sequence voltage Vd / negative sequence voltage Vi		■	■	■	■	■	■						
Frequency		■	■	■	■	■	■	■	■	■	■	■	■
Active / reactive / apparent power: P, Q, S		■	■	■	■	■	■	■	■	■			
Peak demand power PM, QM		■	■	■	■	■	■	■	■	■			
Active / reactive / apparent power per phase : P1/P2/P3, Q1/Q2/Q3, S1/S2/S3		■ (1)	■ (1)	■ (1)		■ (1)					P1/ Q1/S1	P1/ Q1/S1	P1/ Q1/S1
Power factor		■	■	■	■	■	■	■	■	■			
Calculated active and reactive energy (±Wh, ±VARh)		■	■	■	■	■	■	■	■	■			
Total harmonic distortion, voltage Uthd		■	■	■	■	■	■	■	■	■	■	■	■

(1) *Only if 3 CTs are connected.*

MES120 14 input / 6 output module

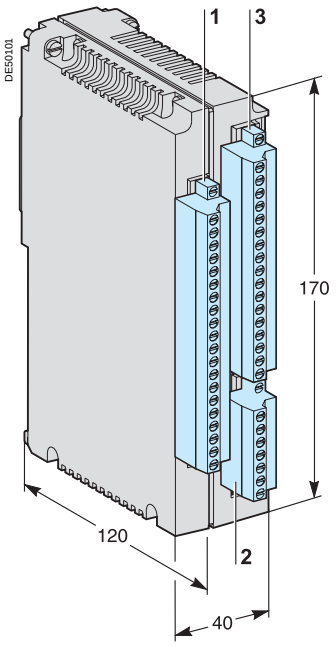
MES120 14 input / 6 output module.

Function

The 5 output relays included on the Sepam series 80 base unit may be extended by adding 1, 2 or 3 MES120 modules with 14 DC logic inputs (24 V DC to 250 V DC) and 6 outputs relays, 1 control relay output and 5 indication relay outputs.

Characteristics

MES120 module					
Weight		0.38 kg			
Operating temperature		-25°C to +70°C			
Environmental characteristics		Same characteristics as Sepam base units			
Logic inputs					
Voltage		24 - 250 V DC -20 / +10 % (19.2 to 275 V DC)			
Typical consumption		3 mA			
Typical switching threshold		14 V DC			
Control relay output					
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 / 4 A	0.7 A	0.3 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			
Indication relay output					
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 / 1 A	0.5 A	0.15 A	
	Load p.f. > 0.3				1 A



Description

3 removable, lockable screw-type connectors.

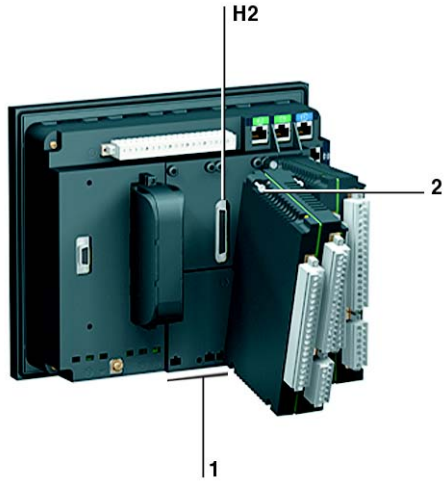
1 20-pin connector for 9 logic inputs:
- Ix01 to Ix04: 4 independent logic inputs
- Ix05 to Ix09: 5 common point logic inputs.

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.

PE50026



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

Assembly

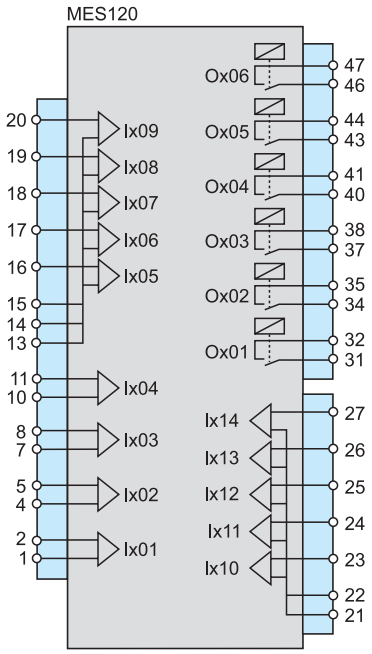
Installation of an MES120 module on the base unit

- insert the 2 pins on the MES module into the slots **1** on the base unit
- flatten the module 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**
- if 3 modules are required (maximum configuration), the 3 connectors **H1**, **H2** and **H3** are used.

DE50105



Connection

For safety reasons (access to dangerous voltages), all terminals must be screwed tight, whether or not they are used.

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

Wiring of connectors

- wiring without fitting:
  - 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
- wiring with fittings:
  - recommended wiring with Telemecanique fitting:
  - DZ5CE015D for one 1.5 mm² wire
  - DZ5CE025D for one 2.5 mm² wire
  - AZ5DE010D for two 1 mm² wires
  - tube length: 8.2 mm
  - stripped length: 8 mm.

1 A / 5 A current transformers

ARJA1.

ARJP3.

Function

Sepam may be connected to any standard 1 A or 5 A current transformer.
Schneider Electric offers a range of current transformers to measure primary currents from 50 A to 2500 A.
Consult us for more information.

Sizing of current transformers

Current transformers are sized so as not to be saturated by the current values they are required to measure accurately (minimum 5 In).

For overcurrent protection functions

■ with DT tripping curve:
the saturation current must be 1.5 times greater than the setting
■ with IDMT tripping curve:
the saturation current must be 1.5 times greater than the highest working value on the curve.

Practical solution when there is no information on the settings

Rated secondary current (in)	Accuracy burden	Accuracy class	CT secondary resistance R_{CT}	Wiring resistance R_f
1 A	2.5 VA	5P 20	< 3 Ω	< 0.075 Ω
5 A	7.5 VA	5P 20	< 0.2 Ω	< 0.075 Ω

For earth fault protection functions

Current transformers must be either:
■ type 5P20, with an accuracy burden $VA_{CT} > R_f.in^2$
■ or defined by a knee-point voltage $Vk \geq (R_{CT} + R_f).20.in$.

Current transformers for the transformer differential and restricted earth fault protection functions must also fulfil the conditions below.

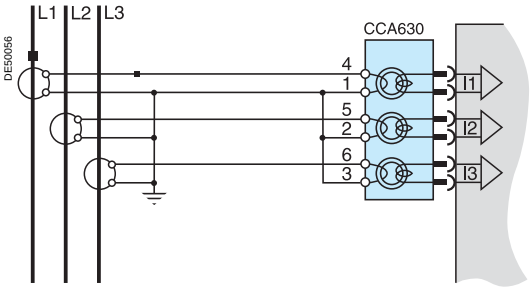
Transformer and transformer-machine unit differential protection (ANSI 87T)
The phase current transformer primary currents must comply with the following rule:

$$0{,}1 \cdot \frac{S}{\sqrt{3}Un1} \leqslant In \leqslant 2{,}5 \cdot \frac{S}{\sqrt{3}Un1}$$ for winding 1

$$0{,}1 \cdot \frac{S}{\sqrt{3}Un2} \leqslant I'n \leqslant 2{,}5 \cdot \frac{S}{\sqrt{3}Un2}$$ for winding 2.

S is the transformer rated power.
In and I'n are the phase CT primary currents of winding 1 and 2 respectively.
Un1 and Un2 are the voltages of windings 1 and 2 respectively.

Restricted earth fault differential protection (ANSI 64REF)
■ the primary current of the neutral point current transformer used must comply with the following rule:
0.1 In ⩽ neutral point CT primary current ⩽ 2 In
with In = primary current of phase CTs on the same winding
■ external fault stability is ensured if the phase CT saturation current is more than 2.4 times the earth fault current and 1.6 times the 3-phase fault current.
Internal fault sensitivity is ensured if the neutral point CT saturation current is more than twice the earth fault current.



CCA630 connector

Function

The CCA630 connector is used to connect Sepam to 1 A or 5 A current transformer secondary windings. It contains 3 interposing ring CTs with through primaries, which ensure impedance matching and isolation between the 1 A or 5 A circuits and Sepam.

The connector may be disconnected with the power on since disconnection does not open the CT secondary circuits.

Connection

- open the 2 side shields for access to the connection terminals.

The shields may be removed, if necessary, to make wiring easier. If removed, they must be replaced after wiring.

- remove the bridging strap, if necessary. The strap links terminals 1, 2 and 3.
- connect the wires using 4 mm ring lugs. The connector accepts wires with cross-sections of 1.5 to 6 mm² (AWG 16 to AWG 10).
- the terminal 1, 2 and 3 bridging strap is supplied with the CCA630
- close the side shields
- plug the connector into the 9-pin inlet on the rear panel
- tighten the 2 CCA630 connector fastening screws on the rear panel of Sepam.

LPCT type current sensors
CLP1 sensors

PE50031

CLP1 sensor.

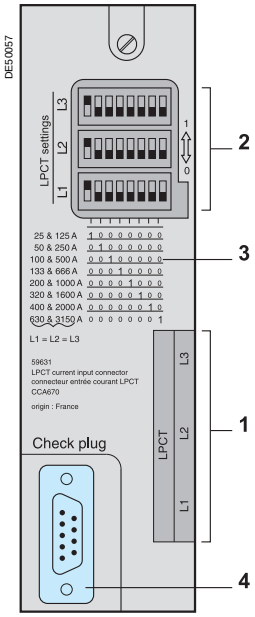
Function

CLP1 sensors are voltage-output sensors of the Low Power Current Transducer (LPCT) type, compliant with the IEC 60044-8 standard.
CLP1 sensors are designed to measure rated currents between 25 A and 1250 A, with a ratio of 100 A / 22.5 mV, and may be used on networks with a maximum voltage of 17.5 kV.

Characteristics

According to IEC 60044-8 standard		
Rated primary current	100 A	
Rated secondary voltage	22.5 mV	
Rated extended primary current	1250 A	
Measurement accuracy class	0.5	0.5% between 100 and 1250 A
		0.75% at 20 A
		1.5% at 5 A
Protection accuracy class	5P	
Rated accuracy limit primary current	40 kA	
Accuracy burden	⩾ 2 kΩ	
Rated thermal short-circuit current	31.5 kA x 4 s - 40 kA x 3 s	
Rated voltage (Um)	17.5 kV	
Rated power frequency withstand voltage	38 kV - 42 kV	
Rated lightning impulse withstand voltage	95 kV	
Weight	8 kg	

DE50057



CCA670/CCA671 connector

Function

The secondary winding of the CLP1 sensor is pre-equipped with a 5-meter shielded cable fitted with a yellow RJ 45 plug. The 3 LPCT current transformers are connected to the CCA670 or CCA671 connector on the rear panel of Sepam.
The connection of just one or two LPCT sensors is not allowed and causes Sepam to go into fail-safe position.
The two CCA670 and CCA671 interface connectors serve the same purpose, the difference being the position of the CLP1 sensor plugs:
- CCA670: lateral plugs, for Sepam series 20 and Sepam series 40
- CCA671: radial plugs, for Sepam series 80.

Description

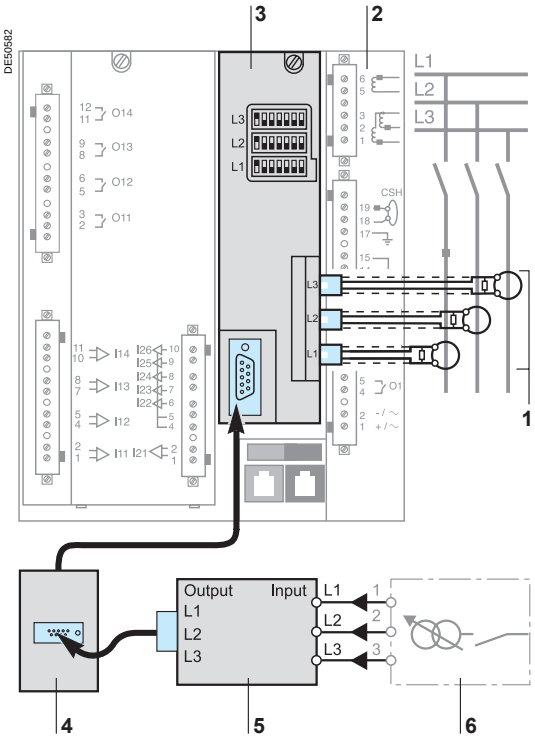
1 3 RJ 45 plugs to connect the LPCT sensors.
2 3 blocks of microswitches to set the CCA670/CCA671 to the rated phase current value.
3 Microswitch setting / selected rated current equivalency table (2 In values per setting).
4 9-pin sub-D connector to connect test equipment (ACE917 for direct connector or via CCA613).

Rating of CCA670/CCA671 connectors

The CCA670/CCA671 connector must be rated according to the rated primary current In measured by the LPCT sensors. The following settings are available, in Amperes: 25, 50, 100, 125, 133, 200, 250, 320, 400, 500, 630, 666, 1000, 1600, 2000, 3150.
The selected In value should be:
- entered as a Sepam general setting
- configured by microswitch on the CCA670/CCA671 connector.

Instructions:
- use a screwdriver to remove the shield located in the "LPCT settings" zone; the shield protects 3 blocks of 8 microswitches marked L1, L2, L3
- on the L1 block, set the microswitch for the selected rated current to "1" (2 In values per microswitch)
- the table of equivalencies between the microswitch settings and the selected rated current In is printed on the connector
- leave the 7 other microswitches set to "0"
- set the other 2 blocks of microswitches L2 and L3 in the same position as the L1 block and close the shield.

LPCT type current sensors
Test accessories



Accessory connection principle

1 CLP1 sensor, equipped with a shielded cable (L = 5 m) fitted with a yellow RJ 45 plug which is plugged directly into the CCA670/CCA671 connector.

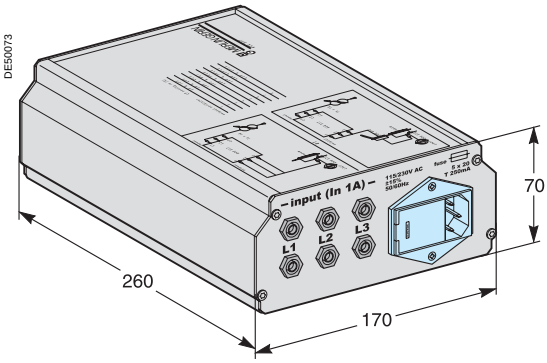
2 Sepam protection unit.

3 CCA670/CCA671 connector, CLP1 voltage interface, with microswitch setting of rated current:
- ■ CCA670: lateral plugs for Sepam series 20 and Sepam series 40
- ■ CCA671: radial plugs for Sepam series 80.

4 CCA613 remote test plug, flush-mounted on the front of the cubicle and equipped with a 3-meter cord to be plugged into the test plug of the CCA670/CCA671 interface connector (9-pin sub-D).

5 ACE917 injection adapter, to test the LPCT protection chain with a standard injection box.

6 Standard injection box.



ACE917 injection adapter

Function

The ACE917 adapter is used to test the protection chain with a standard injection box, when Sepam is connected to LPCT sensors.
The ACE917 adapter is inserted between:
- ■ the standard injection box
- ■ the LPCT test plug:
  - □ integrated in the Sepam CCA670/CCA671 interface connector
  - □ or transferred by means of the CCA613 accessory.

The following are supplied with the ACE917 injection adapter:
- ■ power supply cord
- ■ 3-meter cord to connect the ACE917 to the LPCT test plug on CCA670/CCA671 or CCA613.

Characteristics

Power supply	115 / 230 V AC
Protection by time-delayed fuse 5 mm x 20 mm	0.25 A rating

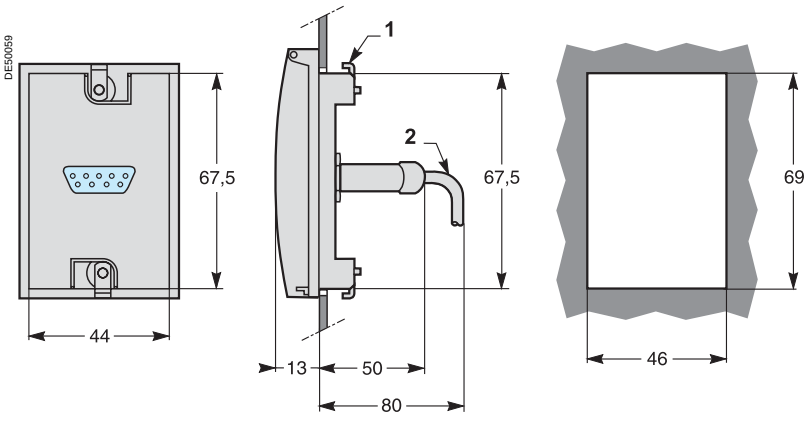
CCA613 remote test plug

Function

The CCA613 test plug, flush-mounted on the front of the cubicle, is equipped with a 3-meter cord to transfer data from the test plug integrated in the CCA670/CCA671 interface connector on the rear of Sepam.

Description and dimensions

1 Mounting lug
2 Cord



Front view with cover lifted. *Right side view.* *Cutout.*

CSH120 and CSH200 Core balance CTs

PE50032

CSH120 and CSH200 core balance CTs.

Function

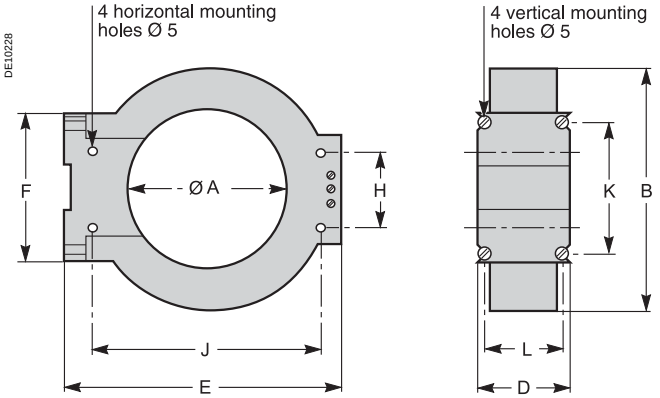
The specifically designed CSH120 and CSH200 core balance CTs are used for direct residual current measurement. The only difference between them is the diameter. Due to their low voltage insulation, they may only be used on cables.

Characteristics

	CSH120	CSH200
Inner diameter	120 mm	200 mm
Weight	0.6 kg	1.4 kg
Accuracy	±5% to 20°C	
	±6% max. from -25°C to 70°C	
Transformation ratio	1/470	
Maximum permissible current	20 kA - 1 s	
Operating temperature	- 25°C to +70°C	
Storage temperature	- 40°C to +85°C	

Dimensions

DE10228

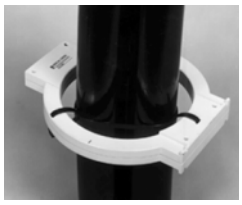


Dimensions	A	B	D	E	F	H	J	K	L
CSH120	120	164	44	190	76	40	166	62	35
CSH200	200	256	46	274	120	60	257	104	37

Assembly

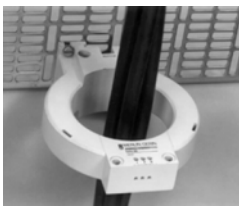
Group the MV cable (or cables) in the middle of the core balance CT.
Use non-conductive binding to hold the cables.
Remember to insert the 3 medium voltage cable shielding earthing cables through the core balance CT.

E40465



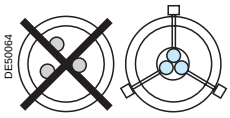
Assembly on MV cables.

E40466

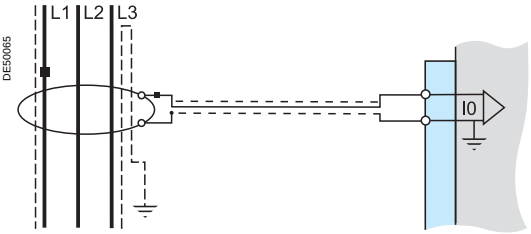


Assembly on mounting plate.

DE50064



DE50065



Connection

Connection to Sepam series 20 and Sepam series 40

To residual current I0 input, on connector (A), terminals 19 and 18 (shielding).

Connection to Sepam series 80

- to residual current I0 input, on connector (E), terminals 15 and 14 (shielding)
- to residual current I'0 input, on connector (E), terminals 18 and 17 (shielding).

Recommended cable

- sheathed cable, shielded by tinned copper braid
- minimum cable cross-section 0.93 mm² (AWG 18)
- resistance per unit length < 100 mΩ/m
- minimum dielectric strength: 1000 V.

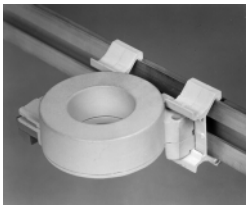
It is essential for the CSH30 to be installed near Sepam (Sepam - CSH30 link less than 2 m.
Flatten the connection cable against the metal frames of the cubicle.
The connection cable shielding is grounded in Sepam. Do not ground the cable by any other means.
The maximum resistance of the Sepam connection wiring must not be more than 4 Ω.

CSH30
Interposing ring CT

E40468

Vertical assembly of CSH30 interposing ring CT.

E44717



Horizontal assembly of CSH30 interposing ring CT.

Function

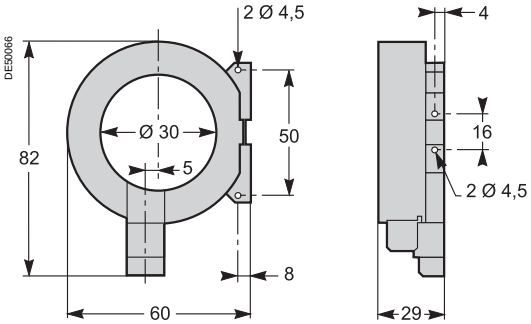
The CSH30 interposing ring CT is used as an interface when the residual current is measured using 1 A or 5 A current transformers.

Characteristics

Weight	0.12 kg
Assembly	On symmetrical DIN rail In vertical or horizontal position

Dimensions

DE50066

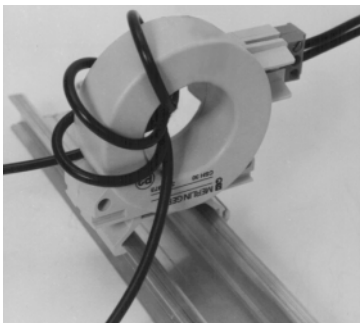


Connection

The CSH30 is adapted for the type of current transformer, 1 A or 5 A, by the number of turns of the secondary wiring through the CSH30 interposing ring CT :
5 A rating - 4 turns
1 A rating - 2 turns.

Connection to 5 A secondary circuit

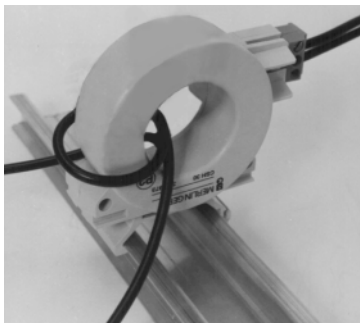
PE50033



- plug into the connector
- insert the transformer secondary wire through the CSH30 core balance CT 4 times.

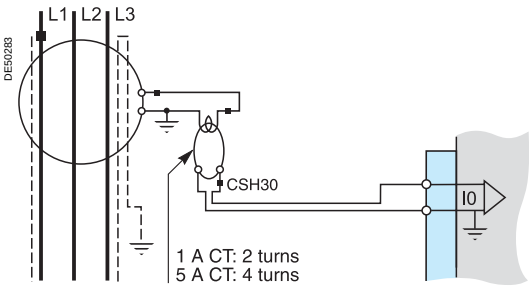
Connection to 1 A secondary circuit

PE50034



- plug into the connector
- insert the transformer secondary wire through the CSH30 core balance CT twice.

DE50283



Connection to Sepam series 20 and Sepam series 40

To residual current I0 input, on connector (A), terminals 19 and 18 (shielding).

Connection to Sepam series 80

- to residual current I0 input, on connector (E), terminals 15 and 14 (shielding)
- to residual current I'0 input, on connector (E), terminals 18 and 17 (shielding).

Recommended cable

- sheathed cable, shielded by tinned copper braid
- minimum cable cross-section 0.93 mm² (AWG 18) (max. 2.5 mm²)
- resistance per unit length < 100 mΩ/m
- minimum dielectric strength: 1000 V.

It is essential for the CSH30 to be installed near Sepam (Sepam - CSH30 link less than 2 meters long).
Flatten the connection cable against the metal frames of the cubicle.
The connection cable shielding is grounded in Sepam. Do not ground the cable by any other means.

ACE990
Core balance CT interface

PE50037

ACE990 core balance CT interface.

Function

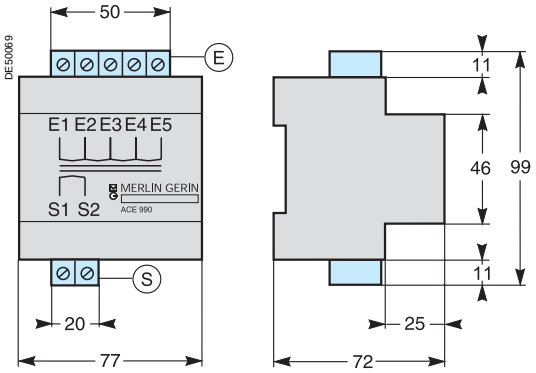
The ACE990 interface is used to adapt measurements between a MV core balance CT with a ratio of 1/n (50 ⩽ n ⩽ 1500), and the Sepam residual current input.

Characteristics

Weight	0.64 kg
Assembly	Mounted on symmetrical DIN rail
Amplitude accuracy	±1%
Phase accuracy	< 2°
Maximum permissible current	20 kA - 1 s (on the primary winding of a MV core balance CT with a ratio of 1/50 that does not saturate)
Operating temperature	-5°C to +55°C
Storage temperature	-25°C to +70°C

Description and dimensions

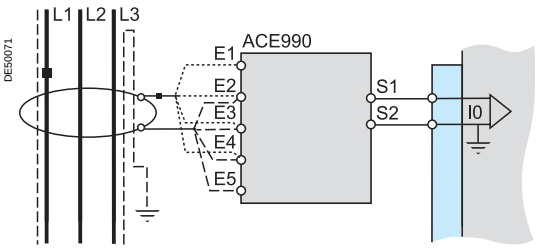
DE50069



(E) ACE990 input terminal block, for connection of the core balance CT.

(S) ACE990 output terminal block, for connection of the Sepam residual current input.

ACE990
Core balance CT interface



Connection

Connection of core balance CT

Only one core balance CT may be connected to the ACE990 interface.
The secondary circuit of the MV core balance CT is connected to 2 of the 5 ACE990 interface input terminals. To define the 2 inputs, it is necessary to know the following:

- core balance CT ratio (1/n)
- core balance CT power
- close approximation of rated current In0

(In0 is a Sepam general setting and defines the earth fault protection setting range between 0.1 In0 and 15 In0).

The table below may be used to determine

- the 2 ACE990 input terminals to be connected to the MV core balance CT secondary
- the type of residual current sensor to set
- the exact value of the rated residual current In0 setting, given by the following formula: **In0 = k x number of core balance CT turns**

with k the factor defined in the table below.

The core balance CT must be connected to the interface in the right direction for correct operation: the MV core balance CT secondary output terminal S1 must be connected to the ACE990 input terminal with the lowest index (Ex).

K value	ACE990 input terminals to be connected	Residual current sensor setting	Min. MV core balance CT power
0.00578	E1 - E5	ACE990 - range 1	0.1 VA
0.00676	E2 - E5	ACE990 - range 1	0.1 VA
0.00885	E1 - E4	ACE990 - range 1	0.1 VA
0.00909	E3 - E5	ACE990 - range 1	0.1 VA
0.01136	**E2 - E4**	**ACE990 - range 1**	**0.1 VA**
0.01587	E1 - E3	ACE990 - range 1	0.1 VA
0.01667	E4 - E5	ACE990 - range 1	0.1 VA
0.02000	E3 - E4	ACE990 - range 1	0.1 VA
0.02632	E2 - E3	ACE990 - range 1	0.1 VA
0.04000	E1 - E2	ACE990 - range 1	0.2 VA
0.05780	E1 - E5	ACE990 - range 2	2.5 VA
0.06757	E2 - E5	ACE990 - range 2	2.5 VA
0.08850	E1 - E4	ACE990 - range 2	3.0 VA
0.09091	E3 - E5	ACE990 - range 2	3.0 VA
0.11364	E2 - E4	ACE990 - range 2	3.0 VA
0.15873	E1 - E3	ACE990 - range 2	4.5 VA
0.16667	E4 - E5	ACE990 - range 2	4.5 VA
0.20000	E3 - E4	ACE990 - range 2	5.5 VA
0.26316	E2 - E3	ACE990 - range 2	7.5 VA

Example:
Given a core balance CT with a ratio of 1/400 2 VA, used within a measurement range of 0.5 A to 60 A.
How should it be connected to Sepam via the ACE990?

1. *Choose a close approximation of the rated current In0, i.e. 5 A.*
2. *Calculate the ratio: approx. In0/number of turns = 5/400 = 0.0125.*
3. *Find the closest value of k in the table opposite: k = 0.01136.*
4. *Check the mininum power required for the core balance CT: 2 VA core balance CT > 0.1 VA ➡ OK.*
5. *Connect the core balance secondary to ACE990 input terminals E2 and E4.*
6. *Set Sepam up with: In0 = 0.0136 x 400 = 4.5 A.*

This value of In0 may be used to monitor current between 0.45 A and 67.5 A.

Wiring of MV core balance secondary circuit:
- *MV core balance CT S1 output to ACE990 E2 input terminal*
- *MV core balance CT S2 output to ACE990 E4 input terminal.*

Connection to Sepam series 20 and Sepam series 40

To residual current I0 input, on connector (A), terminals 19 and 18 (shielding).

Connection to Sepam series 80

- to residual current I0 input, on connector (E), terminals 15 and 14 (shielding)
- to residual current I'0 input, on connector (E), terminals 18 and 17 (shielding).

Recommended cables

- cable between core balance CT and ACE990: less than 50 m long
- sheathed cable, shielded by tinned copper braid between the ACE990 and Sepam, maximum length 2 m
- cable cross-section between 0.93 mm² (AWG 18) and 2.5 mm² (AWG 13)
- resistance per unit length less than 100 mΩ/m
- minimum dielectric strength: 100 V.

Connect the ACE990 connection cable shielding in the shortest manner possible (2 cm maximum) to the shielding terminal on the Sepam connector.
Flatten the connection cable against the metal frames of the cubicle.
The connection cable shielding is grounded in Sepam. Do not ground the cable by any other means.

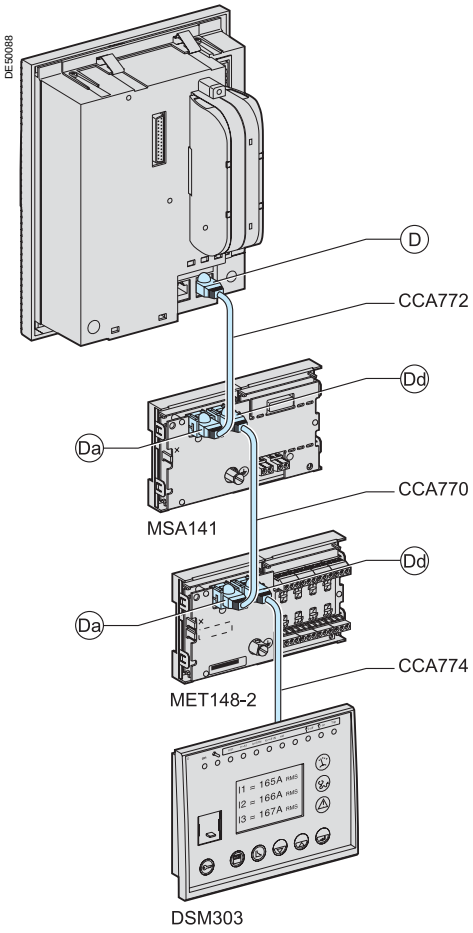
Remote modules

Selection guide

3 remote modules are proposed as options to enhance the Sepam base unit functions:

- the number and type of remote modules compatible with the base unit depend on the Sepam application
- the DSM303 remote advanced UMI module is only compatible with base units that do not have integrated advanced UMIs.

			Sepam series 20		Sepam series 40		Sepam series 80	
			S2x, B2x	T2x, M2x	S4x	T4x, M4x, G4x	S8x	T8x, M8x, G8x
MET148-2	Temperature sensor module	See page 25	0	1	0	2	0	2
MSA141	Analog output module	See page 26	1	1	1	1	1	1
DSM303	Remote advanced UMI module	See page 27	1	1	1	1	1	1
Number of sets of interlinked modules / maximum number of remote modules			1 set of 3 interlinked modules		1 set of 3 interlinked modules		4 modules split between 2 sets of interlinked modules	



Example of inter-module linking on Sepam series 20.

Connection

Connection cords

Different combinations of modules may be connected using cords fitted with 2 black RJ45 connectors, which come in 3 lengths:

- CCA770: length = 0.6 m
- CCA772: length = 2 m
- CCA774: length = 4 m.

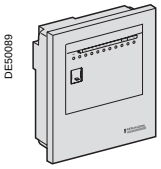
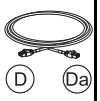
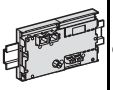
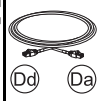
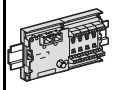
The modules are linked by cords which provide the power supply and act as functional links with the Sepam unit (connector (D) to connector (Da), (Dd) to (Da), …).

Rules on inter-module linking

- linking of 3 modules maximum
- DSM303 module may only be connected at the end of the link.

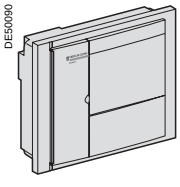
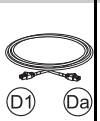
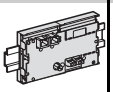
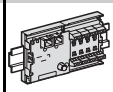
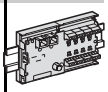
Maximum advisable configurations

Sepam series 20 and Sepam series 40: just 1 set of interlinked modules

Base	Cord	Module 1	Cord	Module 2	Cord	Module 3
						
series 20	CCA772	MSA141	CCA770	MET148-2	CCA774	DSM303
series 40	CCA772	MSA141	CCA770	MET148-2	CCA774	DSM303
series 40	CCA772	MSA141	CCA770	MET148-2	CCA772	MET148-2
series 40	CCA772	MET148-2	CCA770	MET148-2	CCA774	DSM303

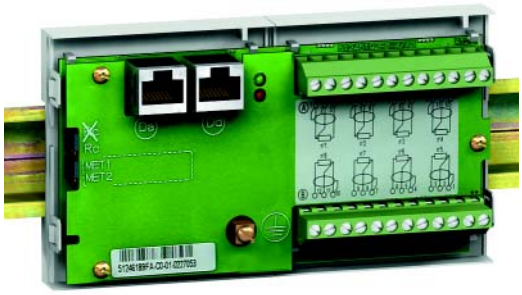
Sepam series 80: 2 sets of interlinked modules

Sepam series 80 has 2 connection ports for remote modules, (D1) and (D2). Modules may be connected to either port.

Base	Cord	Module 1	Cord	Module 2	Cord	Module 3
						
Set 1 (D1)	CCA772	MSA141	CCA770	MET148-2	CCA770	MET148-2
Set 2 (D2)	CCA774	DSM303	-	-	-	-

MET148-2
Temperature sensor modules

PE50021



MET148-2 temperature sensor module.

Function

The MET148-2 module may 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, CCA772 or CCA774 cords (0.6 or 2 or 4 meters))
- 2 modules for each Sepam series 40 or series 80 base unit, to be connected by CCA770, CCA772 or CCA774 cords (0.6 or 2 or 4 meters).

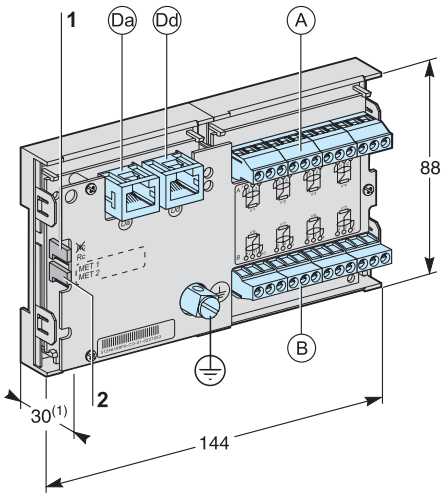
The temperature measurement (e.g. in a transformer or motor winding) is utilized by the following protection functions:

- thermal overload (to take ambient temperature into account)
- temperature monitoring.

Characteristics

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

DE50085



(1) *70 mm 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.

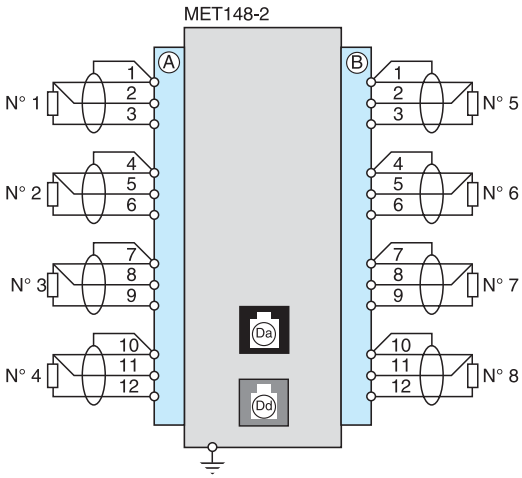
(Dd) RJ45 connector to link up the next remote module with a CCA77x cord (according to application).

(⏚) 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 and series 80 only).

MT10153



Connection

Connection of the earthing terminal

By tinned copper braid or cable fitted with a 4 mm ring lug.

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 24-16).

Recommended cross-sections according to distance:

- up to 100 m ≥ 1 mm², AWG 16
- up to 300 m ≥ 1.5 mm², AWG 14
- up to 1 km ≥ 2.5 mm², AWG 12

Wiring precautions

- it is preferable to use shielded cables

The use of unshielded cables may cause measurement errors, which vary in degree on 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
- ±1°C/km for 1.92 mm² cross-section.

MSA141
Analog output module

MSA141 analog output module.

Function

The MSA141 module converts one of the Sepam measurements into an analog signal:

- selection of the measurement to be converted by parameter setting
- 0-10 mA, 4-20 mA, 0-20 mA analog signal according to parameter setting
- scaling of the analog signal by setting minimum and maximum values of the converted measurement.

Example: the setting used to have phase current 1 as a 0-10 mA analog output with a dynamic range of 0 to 300 A is:

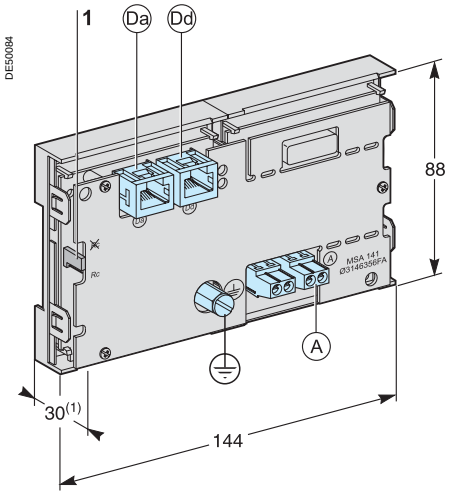
- minimum value = 0
- maximum value = 3000

- a single module for each Sepam base unit, to be connected by one of the CCA770, CCA772 or CCA774 cords (0.6 or 2 or 4 meters).

The analog output may also be remotely managed via the Modbus communication network.

Characteristics

MSA141 module				
Weight	0.2 kg			
Assembly	On symmetrical DIN rail			
Operating temperature	-25 °C to +70 °C			
Environmental characteristics	Same characteristics as Sepam base units			
Analog output				
Current	4-20 mA, 0-20 mA, 0-10 mA			
Scaling (no data input checking)	Minimum value			
	Maximum value			
Load impedance	< 600 Ω (wiring included)			
Accuracy	0.5 %			
Measurements available	**Unit**	**Series 20**	**Series 40**	**Series 80**
Phase and residual currents	0.1 A	■	■	■
Phase-to-neutral and phase-to-phase voltages	1 V	■	■	■
Frequency	0.01 Hz	■	■	■
Thermal capacity used	1%	■	■	■
Temperatures	1 °C	■	■	■
Active power	0.1 kW		■	■
Reactive power	0.1 kVAR		■	■
Apparent power	0.1 kVA		■	■
Power factor	0.01			■
Remote setting via communication link		■	■	■



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

Description and dimensions

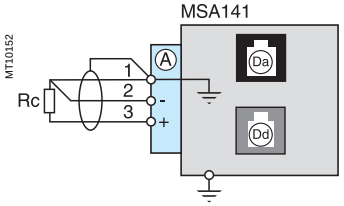
(A) Terminal block for analog output.

(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.



Connection

Earthing terminal connection

By tinned copper braid or cable fitted with a 4 mm ring lug.

Connection of analog output to screw-type connector

- 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 24-16).

Wiring precautions

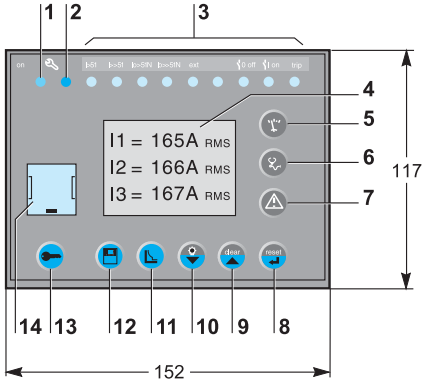
- it is preferable to use shielded cables
- use tinned copper braid to connect the shielding at least at the MSA141 end.

DSM303
Remote advanced UMI module

PE50127

DSM303 remote advanced UMI module.

DE50063

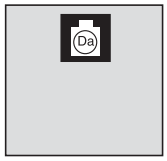


1 Green LED: Sepam on.
2 Red LED:
- steadily on: module unavailable
- flashing: Sepam link unavailable.

3 9 yellow indicator LEDs.
4 Graphical LCD screen.
5 Display of measurements.
6 Display of switchgear, network and machine diagnosis data.
7 Display of alarm messages.
8 Sepam reset (or confirm data entry).
9 Alarm acknowledgement and clearing (or move cursor up).
10 LED test (or move cursor down).
11 Access to protection settings.
12 Access to Sepam parameters.
13 Entry of 2 passwords.
14 PC RS 232 connection port.

DSM303

MT10151



Function

When associated with a Sepam that does not have its own advanced user-machine interface, the DSM303 offers all the functions available on a Sepam integrated advanced UMI.
It may be installed on the front panel of the cubicle in the most suitable operating location:
- reduced depth (< 30 mm)
- a single module for each Sepam, to be connected by one of the CCA772 or CCA774 cords (2 or 4 meters).

The module may not be connected to Sepam units with integrated advanced UMIs.

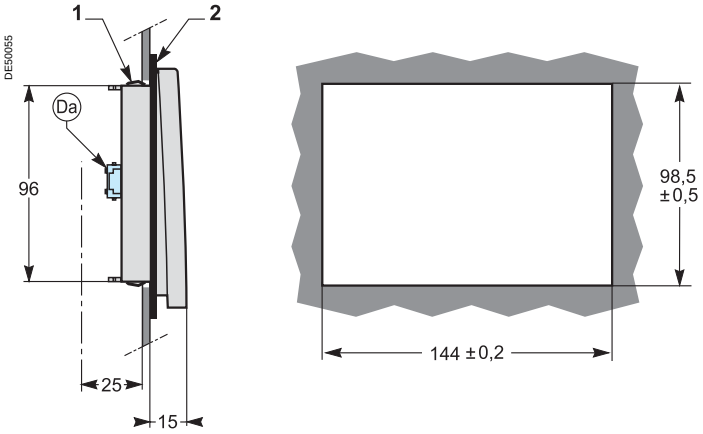
Characteristics

DSM303 module	
Weight	0.3 kg
Assembly	Flush-mounted
Operating temperature	-25°C to +70°C
Environmental characteristics	Same characteristics as Sepam base units

Description and dimensions

Cut-out for flush-mounting (mounting plate thickness < 3 mm)

DE50055



Da RJ45 lateral output connector to connect the module to the base unit with a CCA77x cable.

1 Mounting clip.
2 Gasket to ensure NEMA 12 tightness (gasket delivered with the DSM303 module, to be installed if necessary).

Connection

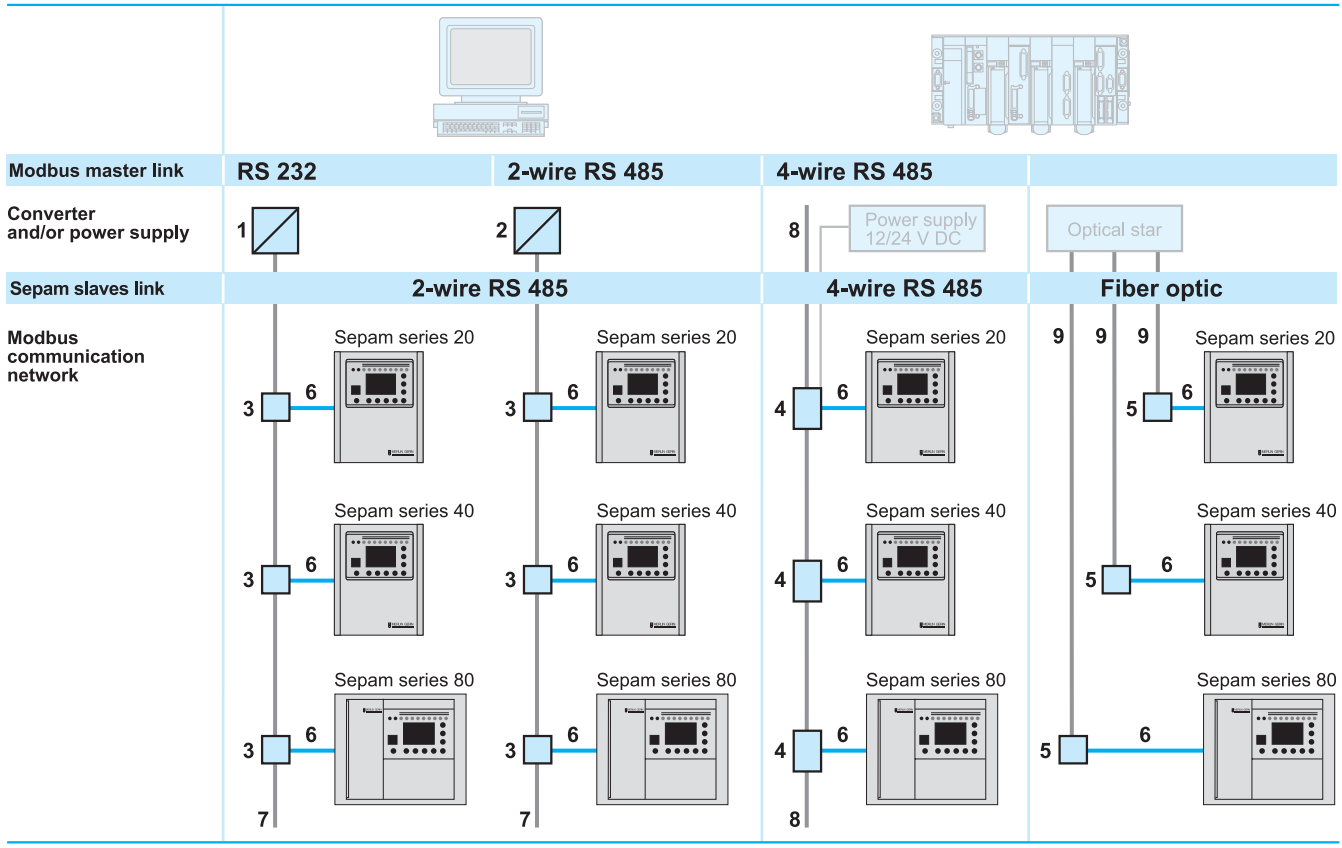
Da RJ45 connector to connect the module to the base unit with a CCA77x cord.
The DSM303 module is always the last interlinked remote module and it systematically ensures impedance matching by load resistor (Rc).

Communication accessories

There are 2 types of Sepam communication accessories:
- communication interfaces, which are essential for connecting Sepam to the communication network
- converters and other accessories, as options, which are used for complete implementation of the communication network.

Communication accessory selection guide

DE50280



1	ACE909-2	RS 232 / 2-wire RS 485 converter with distributed 12 V DC or 24 V DC power supply	See page 34
2	ACE919CA or ACE919CC	2-wire RS 485 / 2-wire RS 485 converter with distributed 12 V DC or 24 V DC power supply	See page 36
3	ACE949-2	2-wire RS 485 network communication interface	See page 31
4	ACE959	4-wire RS 485 network communication interface	See page 32
5	ACE937	Fiber optic network communication interface	See page 33
6	CCA612	Connection cord	See page 30
7		2-wire RS 485 network cable	See page 30
8		4-wire RS 485 network cable	See page 30
9		Fiber optic	

Characteristics

Sepam Modbus communication port	
Type of transmission	Asynchronous serial
Protocol	Modbus
Response time	< 15 ms
Maximum number of slaves	25
Data format	10 bits: 1 start, 8 data, 1 stop or 11 bits: 1 start, 8 data, 1 parity, 1 stop
Parameters	
Slave address	1 to 255
Transmission rate	4800, 9600, 19200, 38400 bauds
Parity check	None, even, odd

Communication protocols and gateways

PE50027

PE50028

EGX200 Ethernet gateway.

Modbus protocol

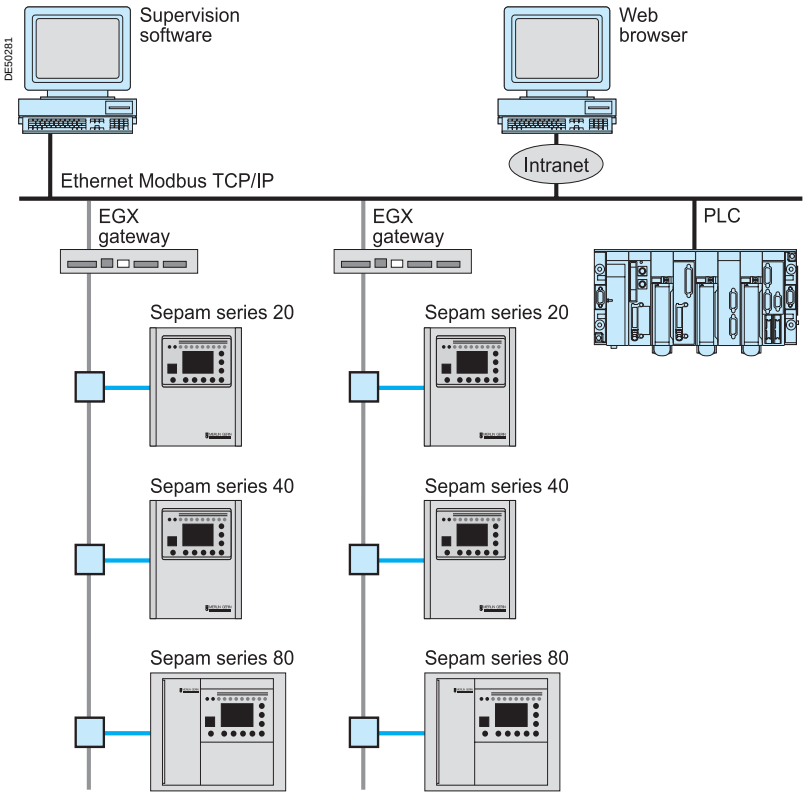
Modbus is an open, international Master / Slave protocol.
Modbus communication networks consist of a Master station and Slave stations. Only the Master station may initiate exchanges (direct communication between Slave stations is not feasible).
Two exchange mechanisms are possible:
- question/answer, whereby the Master sends a request to a given Slave and the Slave is expected to reply
- broadcasting, whereby the Master broadcasts a message to all the Slaves on the network. The slaves execute the orders without sending a reply.

The Modbus protocol used by Sepam is a compatible sub-group of the RTU Modbus protocol. Sepam is always a Slave station.

Ethernet and Webserver connection

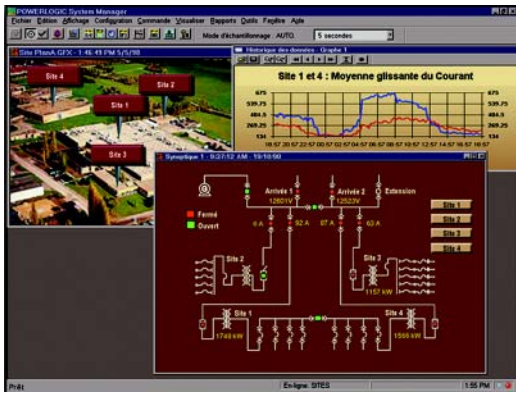
Sepam may be connected to an Ethernet high speed network by means of a Modbus-RS 485/Modbus - Ethernet TCP/IP communication interface.
This interface allows:
- integration of Sepam in a multi-master architecture on Ethernet networks
- consultation of Web pages of data transmitted by Sepam via an Internet/Intranet browser.

DE50281



Example of Sepam integration in a multi-master architecture.

M111019



Supervision of an electrical network equipped with Sepam by means of PowerLogic System SMS software.

Other protocols

Sepam may be connected to communication networks based on protocols other than Modbus by using a gateway / protocol converter.
In particular, a Modbus / DNP3 converter has been qualified for the connection of Sepam to DNP3 networks.
Please consult us for more information.

PowerLogic System

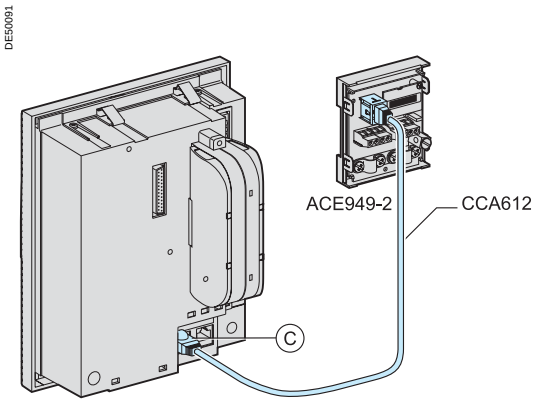
Sepam fits naturally into PowerLogic System power management systems.

CCA612 connection cord

Cord used to connect a communication interface to a Sepam base unit:
- length = 3 m
- fitted with 2 green RJ45 plugs.

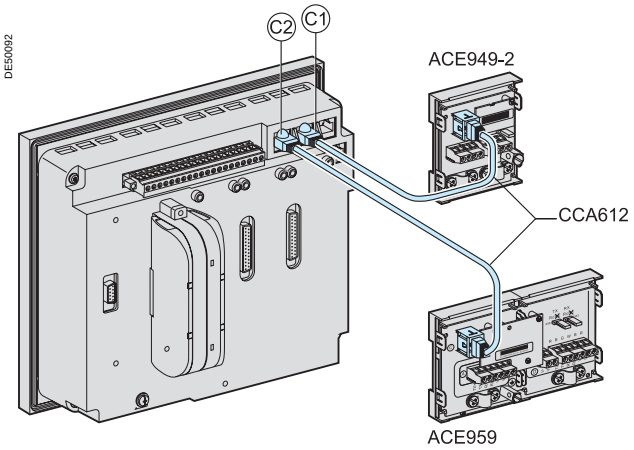
Sepam / communication interface connection

Sepam series 20 and Sepam series 40



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

Sepam series 80



Sepam series 80: 2 communication ports.

RS 485 network cable

Characteristics

RS 485 network cable	2-wire	4-wire
RS 485 medium	1 shielded twisted pair	2 shielded twisted pairs
Distributed power supply	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	
Capacitance between conductors	< 60 pF/m	
Capacitance between conductor and shielding	< 100 pF/m	
Maximum length	1300 m	

Examples of standard cables for 2-wire RS 485 networks
- supplier: BELDEN, reference 9842
- supplier: FILOTEX, reference FMA-2PS.

High-performance cable (for 2-wire RS 485 networks):
- supplier: FILECA, reference F2644-1 (cable distributed by Schneider Electric in 60 m strands, reference CCR301).

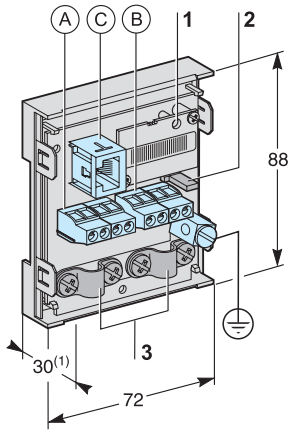
For further information, refer to the "Sepam - RS 485 network connection guide", PCRED399074EN.

ACE949-2
2-wire RS 485 network interface

PE50029

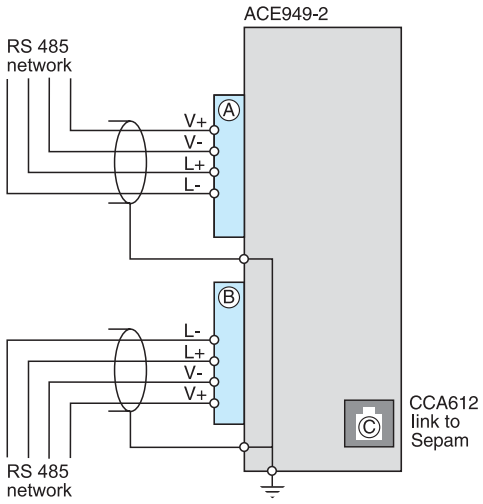
ACE949-2 2-wire RS 485 network connection interface.

DE50074



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

M11048



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
Assembly	On symmetrical DIN rail
Operating temperature	-25°C to +70°C
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 %
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 m
10	180 m	750 m
20	160 m	450 m
25	125 m	375 m

***Note:** lengths multiplied by 3 with FILECA F2644-1 high-performance cable.*

Description and dimensions

(A) and (B) Terminal blocks for network cable.

(C) RJ45 plug to connect the interface to the base unit with a CCA612 cord.

(⏚) Grounding/earthing terminal.

1 Green 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), to be set to:
- ~~Rc~~, if the module is not at one end of the RS 485 network (default position)
- Rc, if the module is at one end of the RS 485 network.

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

Connection

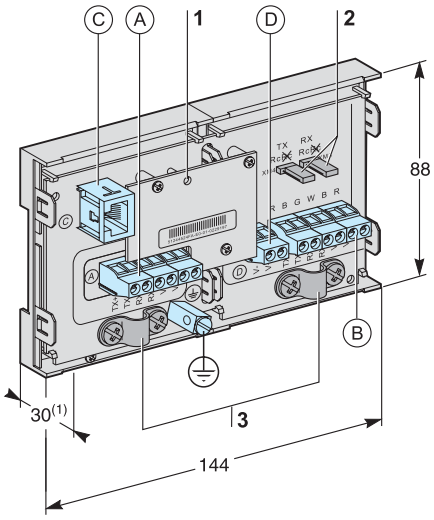
- connection of network cable to screw-type terminal blocks (A) and (B)
- connection of earthing terminal by tinned copper braid or cable fitted with 4 mm ring lug
- the interfaces are fitted with clamps to hold the network cable and recover shielding at the incoming and outgoing points of the network 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, green fittings)
- the interfaces are to be supplied with 12 V DC or 24 V DC
- refer to the "Sepam - RS 485 network connection guide " PCRED399074EN for all the details on how to implement a complete RS 485 network.

ACE959
4-wire RS 485 network interface

PE50023

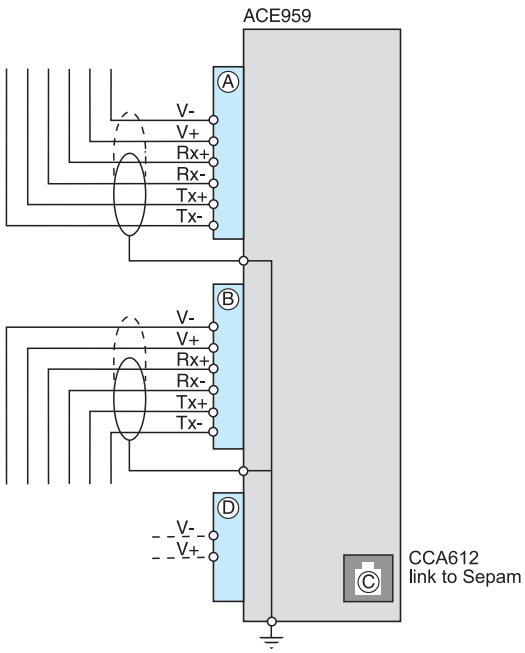
ACE959 4-wire RS 485 network connection interface.

DE50083



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

DE50282



***Nota :** Sepam receiving: Rx+, Rx- (or IN+, IN-)*
Sepam sending: Tx+, Tx- (or OUT+, OUT-).

Function

The ACE959 interface performs 2 functions:
- electrical interface between Sepam and a 4-wire RS 485 communication network
- main network cable branching box for the connection of a Sepam with a CCA612 cord.

Characteristics

ACE959 module	
Weight	0.2 kg
Assembly	On symmetrical DIN rail
Operating temperature	-25°C to +70°C
Environmental characteristics	Same characteristics as Sepam base units
4-wire RS 485 electrical interface	
Standard	EIA 4-wire RS 485 differential
Distributed power supply	External, 12 V DC or 24 V DC ±10 %
Consumption	16 mA in receiving mode
	40 mA maximum in sending mode

Maximum length of 4-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 m
10	180 m	750 m
20	160 m	450 m
25	125 m	375 m

***Note:** lengths multiplied by 3 with FILECA F3644-1 high-performance cable.*

Description and dimensions

(A) and (B) Terminal blocks for network cable.
(C) RJ45 plug to connect the interface to the base unit with a CCA612 cord.
(D) Terminal block for a separate auxiliary power supply (12 V DC or 24 V DC).
(⏚) Grounding/earthing terminal.

1 Green 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), to be set to:
- ~~Rc~~, if the module is not at one end of the RS 485 network (default position)
- Rc, if the module is at one end of the RS 485 network.

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

Connection

- connection of network cable to screw-type terminal blocks (A) and (B)
- connection of earthing terminal by tinned copper braid or cable fitted with 4 mm ring lug
- 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, green fittings)
- the interfaces are to be supplied with 12 V DC or 24 V DC
- the ACE959 can be connected to a separate distributed power supply (not included in shielded cable). Terminal block (D) is used to connect the distributed power supply module
- refer to the "Sepam - RS 485 network connection guide" PCRED399074EN for all the details on how to implement a complete RS 485 network.

ACE937
Fiber optic interface

PE50024

ACE937 fiber optic connection interface.

Function

The ACE937 interface is used to connect Sepam to a fiber optic communication star system.
This remote module is connected to the Sepam base unit by a CCA612 cord.

Characteristics

ACE937 module	
Weight	0.1 kg
Assembly	On symmetrical DIN rail
Power supply	Supplied by Sepam
Operating temperature	-25°C to +70°C
Environmental characteristics	Same characteristics as Sepam base units

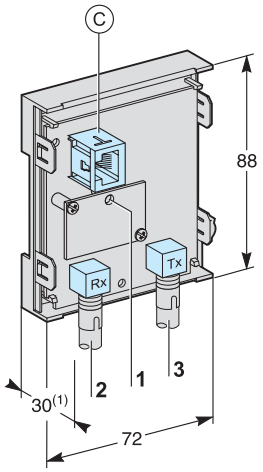
Fiber optic interface	
Wavelength	820 nm (infra-red)
Type of connector	ST
Fiber type	Multimode glass

Fiber optic diameter (µm)	Numerical aperture (NA)	Maximum attenuation (dBm/km)	Minimum optical power available (dBm)	Maximum length of fiber (m)
50/125	0.2	2.7	5.6	700
62.5/125	0.275	3.2	9.4	1800
100/140	0.3	4	14.9	2800
200 (HCS)	0.37	6	19.2	2600

Maximum length calculated with:
- minimum optical power available
- maximum fiber attenuation
- losses in 2 ST connectors: 0.6 dBm
- optical power margin: 3 dBm (according to IEC60870 standard).

Example for a 62.5/125 µm fiber
Lmax = (9.4 - 3 -0.6) / 3.2 = 1.8 km.

DE50273



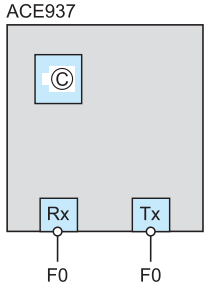
(1) *70 mm with CCA612 cord connected.*

Description and dimensions

(C) RJ 45 plug to connect the interface to the base unit with a CCA612 cord.

1 Green LED, flashes when communication is active (sending or receiving in progress)..
2 Rx, female ST type connector (Sepam receiving).
3 Tx, female ST type connector (Sepam sending).

DE50274



Connection

- the sending and receiving fiber optics fibers must be equipped with male ST type connectors
- fiber optics screw-locked to Rx and Tx connectors
- the interface is to be connected to connector (C) on the base unit using a CCA612 cord (length = 3 m, green fittings).

ACE909-2
RS 232 / RS 485 converter

PE50035

ACE909-2 RS 232 / RS 485 converter.

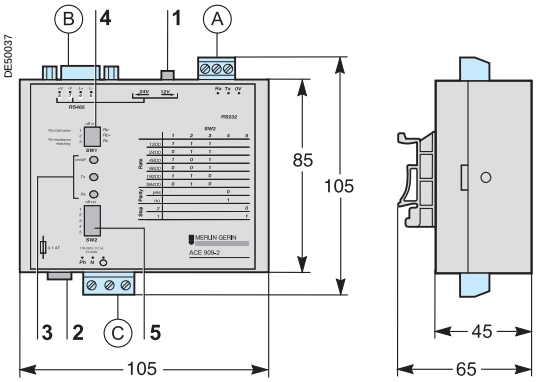
Function

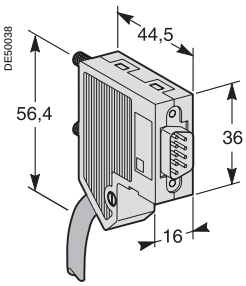
The ACE909-2 converter is used to connect a master/central computer equipped with a V24/RS 232 type serial port as a standard feature to stations connected to a 2-wire RS 485 network.
Without requiring any flow control signals, after the parameters are set, the ACE909-2 converter performs conversion, network polarization and automatic dispatching of Modbus frames between the master and the stations by two-way simplex (half-duplex, single-pair) transmission.
The ACE909-2 converter also provides a 12 V DC or 24 V DC supply for the distributed power supply of the Sepam ACE949-2 or ACE959 interfaces.
The communication settings should be the same as the Sepam and master communication settings.

Characteristics

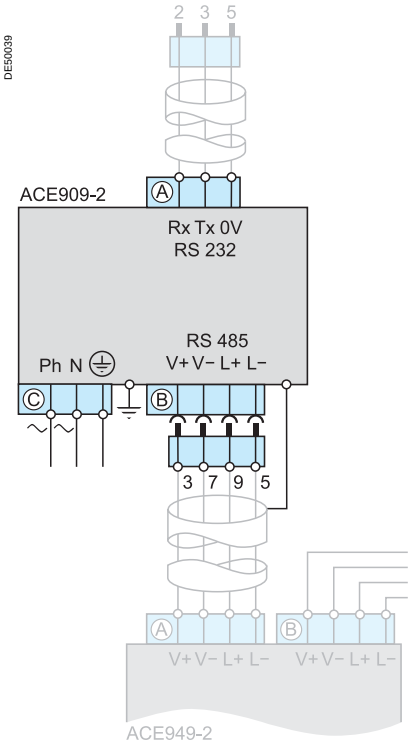
Mechanical characteristics		
Weight	0.280 kg	
Assembly	On symmetrical or asymmetrical DIN rail	
Electrical characteristics		
Power supply	110 to 220 V AC ±10%, 47 to 63 Hz	
Galvanic isolation between power supply and frame, and between power supply and interface supply	2000 Vrms, 50 Hz, 1 min	
Galvanic isolation between RS 232 and RS 485 interfaces	1000 Vms, 50 Hz, 1 min	
Protection by time-delayed fuse 5 mm x 20 mm	1 A rating	
Communication and Sepam interface distributed supply		
Data format	11 bits: 1 start, 8 bits, 1 parity, 1 stop	
Transmission delay	< 100 ns	
distributed power supply for Sepam interfaces	12 V DC or 24 V DC	
Maximum number of Sepam interfaces with distributed supply	12	
Environmental characteristics		
Operating temperature	-5°C to +55°C	
Electromagnetic compatibility	**IEC standard**	**Value**
5 ns fast transient bursts	60255-22-4	4 kV with capacitive coupling in common mode 2 kV with direct coupling in common mode 1 kV with direct coupling in differential mode
1 MHz damped oscillating wave	60255-22-1	1 kV common mode 0.5 kV differential mode
1.2, 50 µs impulse wave	60255-5	3 kV common mode 1 kV differential mode

ACE909-2
RS 232 / RS 485 converter





Male 9-pin sub-D connector supplied with the ACE909-2.



Description and dimensions

(A) Terminal block for RS 232 link limited to 10 m.

(B) Female 9-pin sub-D connector to connect to the 2-wire RS 485 network, with distributed power supply.
1 screw-type male 9-pin sub-D connector is supplied with the converter.

(C) Power supply terminal block.

1 Distributed power supply voltage selector switch, 12 V DC or 24 V DC.
2 Protection fuse, unlocked by a 1/4 turn.
3 Indication LEDs:
- ON/OFF: on if ACE909-2 is energized
- Tx: on if RS 232 sending by ACE909-2 is active
- Rx on: if RS 232 receiving by ACE909-2 is active

4 SW1, parameter setting of 2-wire RS 485 network polarization and line impedance matching resistors

Function	SW1/1	SW1/2	SW1/3
Polarization at 0 V via Rp -470 Ω	ON		
Polarization at 5 V via Rp +470 Ω		ON	
2-wire RS 485 network impedance matching by 150 Ω resistor			ON

5 SW2, parameter setting of asynchronous data transmission rate and format (same parameters as for RS 232 link and 2-wire RS 485 network).

Rate (bauds)	SW2/1	SW2/2	SW2/3		
1200	1	1	1		
2400	0	1	1		
4800	1	0	1		
9600	0	0	1		
19200	1	1	0		
38400	0	1	0		
Format				**SW2/4**	**SW2/5**
With parity check				0	
Without parity check				1	
1 stop bit (compulsory for Sepam)					0
2 stop bits					1

Converter configuration when delivered
- 12 V DC distributed power supply
- 11 bit format, with parity check
- 2-wire RS 485 network polarization and impedance matching resistors activated.

Connection

RS 232 link
- to 2.5 mm² screw-type terminal block (A)
- maximum length 10 m
- Rx/Tx: RS 232 receiving/sending by ACE909-2
- 0V: Rx/Tx common, do not earth.

2-wire RS 485 link with distributed power supply
- to female 9-pin sub-D connector (B)
- 2-wire RS 485 signals: L+, L-
- distributed power supply: V+ = 12 V DC or 24 V DC, V- = 0 V.

Power supply
- to 2.5 mm² screw-type terminal block (C)
- reversible phase and neutral
- earthed via terminal block and metal case (ring lug on back of case).

ACE919CA and ACE919CC RS 485 / RS 485 converters

PE50036

ACE919CC RS 485 / RS 485 converter.

Function

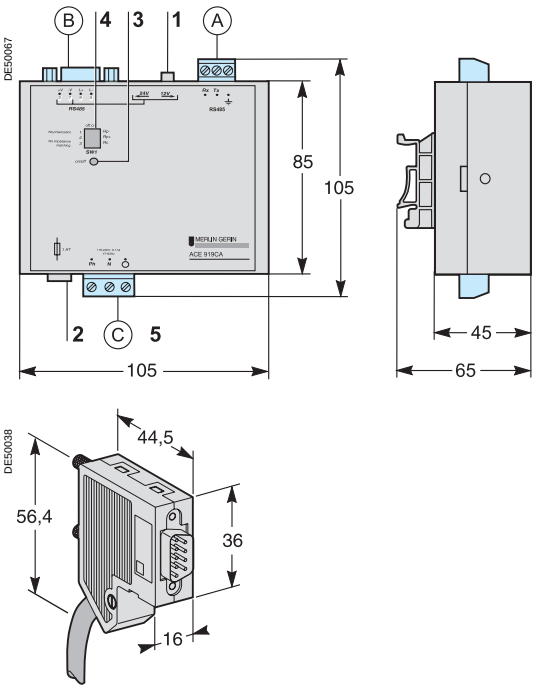
The ACE919 converters are used to connect a master/central computer equipped with an RS 485 type serial port as a standard feature to stations connected to a 2-wire RS 485 network.
Without requiring any flow control signals, the ACE919 converters perform network polarization and impedance matching.
The ACE919 converters also provide a 12 V DC or 24 V DC supply for the distributed power supply of the Sepam ACE949-2 or ACE959 interfaces.
There are 2 types of ACE919:

- ACE919CC, DC-powered
- ACE919CA, AC-powered.

Characteristics

Mechanical characteristics		
Weight	0.280 kg	
Assembly	On symmetrical or asymmetrical DIN rail	
Electrical characteristics	**ACE919CA**	**ACE919CC**
Power supply	110 to 220 V AC ±10%, 47 to 63 Hz	24 to 48 V DC ±20%
Protection by time-delayed fuse 5 mm x 20 mm	1 A rating	1 A rating
Galvanic isolation between power supply and frame, and between power supply and interface supply		2000 Vrms, 50 Hz, 1 min
Communication and Sepam interface distributed supply		
Data fomat	11 bits : 1 start, 8 bits, 1 parity, 1 stop	
Transmission delay	< 100 ns	
Distributed power supply for Sepam interfaces	12 V DC or 24 V DC	
Maximum number of Sepam interfaces with distributed supply	12	
Environmental characteristics		
Operating temperature	-5°C to +55°C	
Electromagnetic compatibility	**IEC standard**	**Value**
5 ns fast transient bursts	60255-22-4	4 kV with capacitive coupling in common mode 2 kV with direct coupling in common mode 1 kV with direct coupling in differential mode
1 MHz damped oscillating wave	60255-22-1	1 kV common mode 0.5 kV differential mode
1.2, 50 µs impulse wave	60255-5	3 kV common mode 1 kV differential mode

ACE919CA and ACE919CC RS 485 / RS 485 converters



Male 9-pin sub-D connector supplied with the ACE919.

Description and dimensions

(A) Terminal block for 2-wire RS 485 link without distributed power supply.

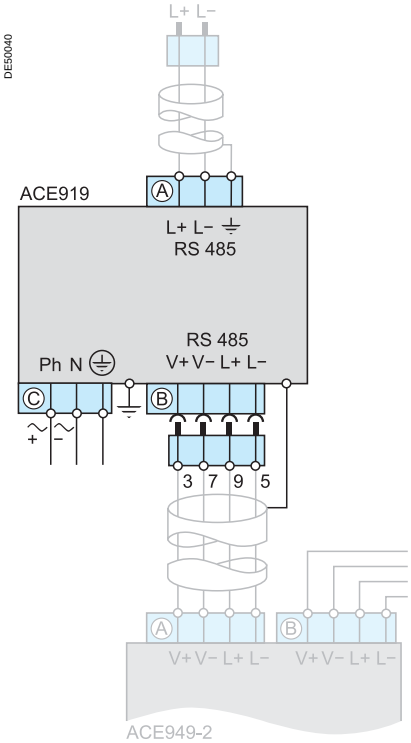
(B) Female 9-pin sub-D connector to connect to the 2-wire RS 485 network, with distributed power supply.
1 screw-type male 9-pin sub-D connector is supplied with the converter.

(C) Power supply terminal block.

1 Distributed power supply voltage selector switch, 12 V DC or 24 V DC.
2 Protection fuse, unlocked by a 1/4 turn.
3 ON/OFF LED: on if ACE919 is energized.
4 SW1, parameter setting of 2-wire RS 485 network polarization and impedance matching resistors.

Function	SW1/1	SW1/2	SW1/3
Polarization at 0 V via Rp -470 Ω	ON		
Polarization at 5 V via Rp +470 Ω		ON	
2-wire RS 485 network impedance matching by 150 Ω resistor			ON

Converter configuration when delivered
- 12 V DC distributed power supply
- 2-wire RS 485 network polarization and impedance matching resistors activated.



Connection

2-wire RS 485 link without distributed power supply
- to 2.5 mm² screw-type terminal block (A)
- L+, L-: 2-wire RS 485 signals
- (⏚) Shielding.

2-wire RS 485 link with distributed power supply
- to female 9-pin sub-D connector (B)
- 2-wire RS 485 signals: L+, L-
- distributed power supply : V+ = 12 V DC or 24 V DC, V- = 0 V.

Power supply
- to 2.5 mm² screw-type terminal block (C)
- reversible phase and neutral (ACE919CA)
- earthed via terminal block and metal case (ring lug on back of case).

Contents

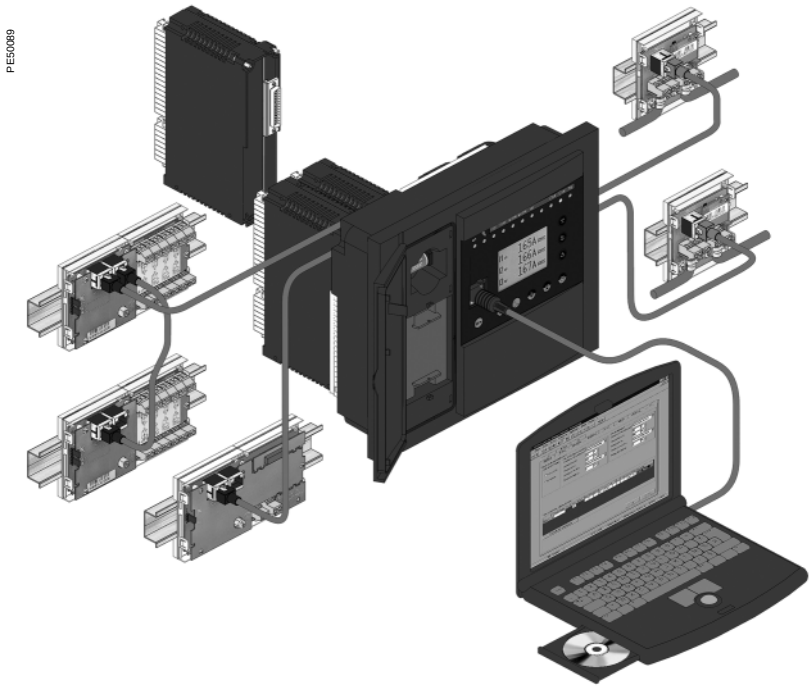
User Machine Interfaces **40**
Expert UMI - SFT2841 **41**
Presentation 41
General screen organization 42
Use of the software 44
Advanced UMI **46**
White keys for current operation 48
Blue keys for parameter and protection setting 50
Data entry principles 52
Default settings **53**

User Machine Interfaces

Sepam series 80 includes a front panel or remote UMI with keypad and graphic LCD display which gives access to all the information necessary for local operation and adjustment of Sepam settings.

The UMI on the front panel of Sepam may be completed by an expert UMI comprising the SFT2841 PC software tool, which may be used for all Sepam parameter setting, local operation and customization functions.

The expert UMI comes as a kit, the SFT2841 kit, which includes:
- ■ a CD-ROM, with
  - □ SFT2841 setting and operation software
  - □ SFT2826 disturbance recording file display software
- ■ CCA783 cord, for connection between the PC and the serial port on the front panel of Sepam.



Expert UMI - SFT2841
Presentation

The expert UMI is available on the screen of a PC equipped with the SFT2841 software tool and connected to the RS 232 link on the front panel of Sepam (run in a Windows 95, 98, NT, 2000 or XP environment).
All the data used for the same task are grouped in the same screen to facilitate operation. Menus and icons are used for fast, direct access to the data required.

Normal operation

- display of all metering and operation data
- display of alarm messages with the time of appearance (date, hour, min, s, ms)
- display of diagnosis data such as tripping current, number of switchgear operations and cumulative breaking current
- display of all protection and parameter settings
- display of the logic status of inputs, outputs and LEDs.

This UMI is the solution suited to occasional local operation, for demanding personnel who require fast access to all the information.

Parameter and protection settings (1)

- display and setting of all the parameters of each protection function on the same page
- control logic parameter setting, parameter setting of general installation and Sepam data
- input data may be prepared ahead of time and transferred into the Sepam in a single operation (loading function).

Main functions performed by SFT2841

- changing of passwords
- entry of general settings (ratings, integration period, …)
- entry of protection settings
- changing of control logic assignments
- enabling/disabling of functions
- saving of files.

Saving

- protection and parameter setting data may be saved
- printing of reports is possible as well.

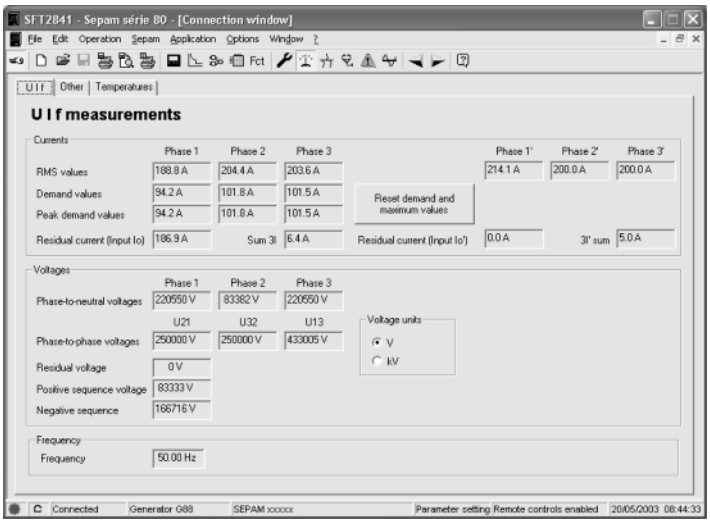
This UMI may also be used to retrieve disturbance recording files and display them using the SFT2826 software tool.

Operating assistance

Access from all screens to a help section containing all the technical information needed to use and commission Sepam.

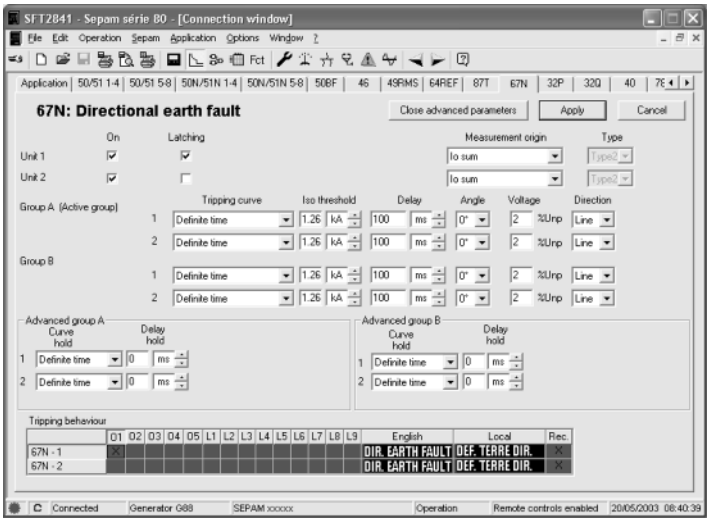
(1) *Modes accessed via 2 passwords (protection setting level, parameter setting level).*

PE50149



Example of a measurement display screen.

PE50150



Example of a directional earth fault protection setting screen.

Expert UMI - SFT2841
General screen organization

A Sepam document is displayed on the screen via a graphic interface that has the conventional Windows features.
All the SFT2841 software screens are set up in the same way.
They include:

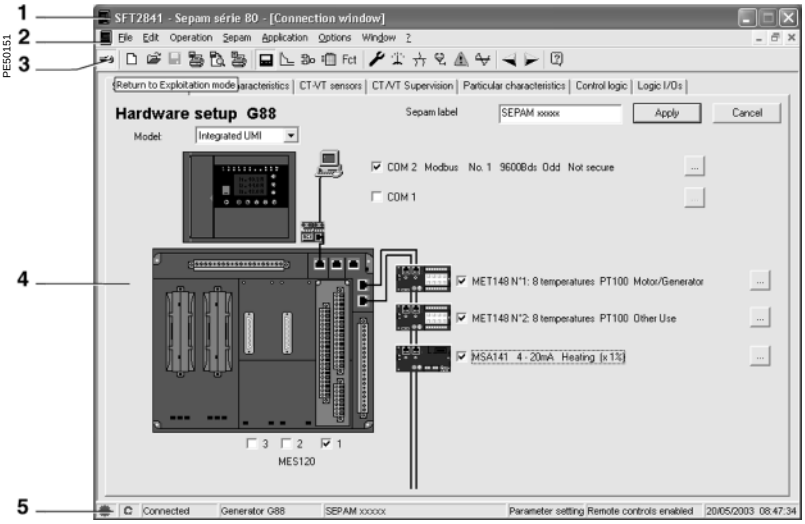
1 The title bar, with:
- name of the application (SFT2841)
- identification of the Sepam document displayed
- corner symbols for window adjustments

2 The menu bar, for access to all the SFT2841 software functions (unavailable functions are dimmed).

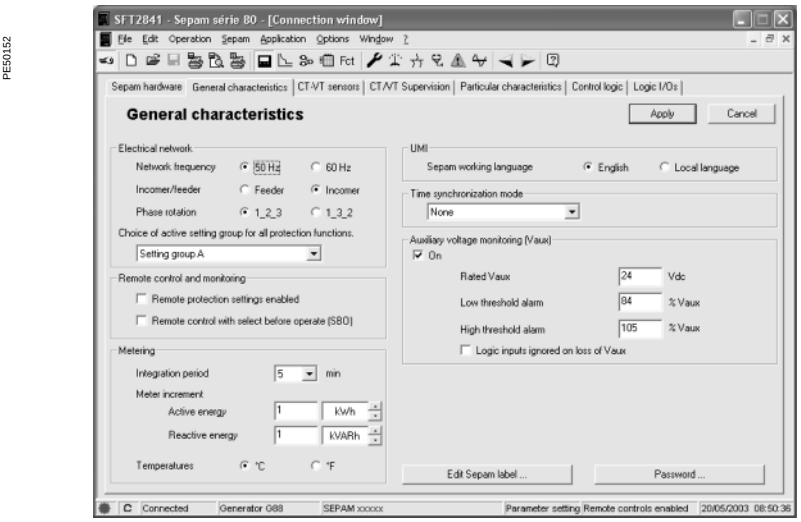
3 The toolbar, a group of contextual icons for quick access to the main functions (also accessed via the menu bar).

4 The work zone available to the user, presented in the form of tab boxes.

5 The status bar, with the following information relating to the active document:
- alarm on
- identification of the connection window
- SFT2841 operating mode, connected or not connected
- type of Sepam
- identification of Sepam edited
- identification level
- Sepam operating mode
- PC date and time.



Example of hardware configuration screen.



Example of general characteristics screen.

Guided navigation

A guided navigation mode is proposed to make it easier to enter all of the Sepam parameter and protection settings. It guides users through all data input screens in the natural order.
The sequencing of the screens in guided mode is controlled by clicking on 2 icons in the toolbar**3**
- ◀: to go back to the previous screen
- ▶: to go to the next screen.

The screens are linked up in the following order:
1. Sepam hardware configuration
2. General characteristics
3. CT/VT sensors
4. CT/VT circuit supervision
5. Particular characteristics
6. Control logic
7. Logic input/output assignments
8. Setting screens for the protection functions available, according to the type of Sepam
9. Logic equation editor
10. Various tabs of the control matrix
11. Parameter setting of the disturbance recording function.

On-line help

The operator may look up on-line help at any time via the "?" command in the menu bar.
Acrobat Reader is required for on-line help. It is provided on the CD.

Details of the different screens

■ identification: entry of the password gives the user access rights to the parameter and protection mode (valid for 5 minutes)

■ selection of a new application from a list of application files with factory settings. The file suffix identifies the application.
e.g.: "appli.G87" is for a Generator 87 application

■ opening of an existing application which, in principle, should be located in the "Sepam" sub-directory of the "SFT2841" directory. A type of application may be selected by choosing the type of file (e.g.: file type *.S80, or *. G87 or *.* to obtain the complete list of files)

■ saving of an application: go to the "Sepam" sub-directory of the "SFT2841" directory, and name the file. The application suffix is updated automatically

■ configuration and complete or partial printing of the current configuration file

■ print preview of the configuration file

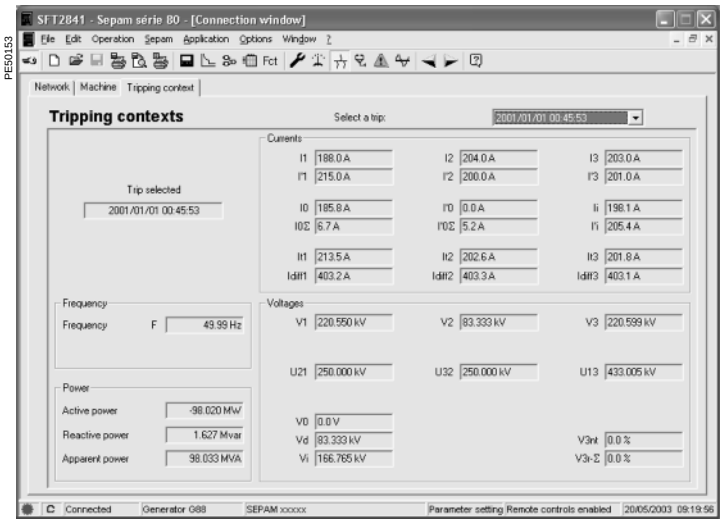
■ hard-copy of the current screen

■ Sepam parameter setting:
□ "Sepam hardware" tab: hardware configuration.
□ "General characteristics" tab: setting of the network, remote control and monitoring, password management and Sepam label printing parameter
□ "CT/VT sensors" tab: configuration of current and voltage sensors
□ "CT/VT supervision" tab: implementation and configuration of CT and VT sensor supervision
□ "Particular characteristics" tab:
parameter setting of transformer, motor/generator rotation speed
□ "Control logic" tab: parameter setting of the switchgear control, logic discrimination, genset shutdown, de-excitation, load shedding and restart functions
□ "Logic I/Os" tab: management of logic input and output assignment

■ protection functions:
□ "Application" tab: overview of the protection functions available in the application with graphical view of the single-line diagram. A double click on a protection function label gives quick access to the setting tab
□ 1 tab per protection function: setting of the parameters of each protection function, with a mini-matrix for setting of the outputs, LEDs and disturbance recording

□ creation of logic equations: see description in "Control and monitoring functions" chapter

■ control matrix: used to assign logic outputs, LEDs and messages to information produced by the protection units, logic inputs and logic equations.
■ this function may also be used to create messages: see "Creation of user messages" on next page



Example of tripping contexts screen.

■ Fct parameter setting of the disturbance recording function

■ **(1)** Sepam diagnosis
□ "Diagnosis" tab: general characteristics, software version, fault indicator and Sepam time-setting
□ "Input, output and LED status" tab: gives status and proposes an output test
□ "Remote indication status" tab: remote indication status

■ **(1)** main measurements
□ "UIF" tab: voltage, current and frequency values
□ "Other" tab: power, energy and rotation speed values
□ "Temperatures" tab

■ **(1)** diagnosis
□ "Network" tab: unbalance / negative sequence, V-I phase displacement, number of phase and earth trips and total harmonic distortion values
□ "Machine" tab: running hours counter, differential and through current, impedance, I-I' phase displacement, H3 voltage and thermal overload values
□ "Tripping context" tab: gives the last 5 tripping contexts

■ **(1)** switchgear diagnosis: cumulative breaking current, auxiliary voltage and circuit breaker data

■ **(1)** management of alarms with history and time-tagging

■ **(1)** disturbance recording: this function is used to record analog signals and logical states. See next page for commissioning information

■ guided navigation: see previous page

■ on-line help: see previous page

(1) *These icons are only accessible in "connected to Sepam" mode.*

2

Not connected to Sepam mode

Sepam parameter and protection setting

Sepam parameter and protection setting using SFT2841 consists of preparing the Sepam file containing all the characteristics that are specific to the application, a file that is then downloaded into Sepam at the time of commissioning.

Operating procedure:

■ create a Sepam file for the type of Sepam to be set up (the newly created file contains the factory settings of the Sepam parameters and protection functions)

■ modify the Sepam general settings and protection function settings:

□ all the data relating to the same function are grouped together in the same screen

□ it is advisable to enter all the parameters and protection settings in the natural order of the screens proposed by the guided navigation mode.

Entry of parameter and protection settings

■ the parameter and protection setting input fields are suited to the type of value:

□ choice buttons

□ numerical value input fields

□ dialogue box (Combo box)

■ the user must "Apply" or "Cancel" the new values entered before going on to the following screen

■ the consistency of the new values applied is checked:

□ an explicit message identifies inconsistent values and specifies the allowable values

□ values that have become inconsistent following a parameter modification are adjusted to the closest consistent value.

Connected to Sepam mode

Precaution

When a laptop is used, given the risks inherent to the accumulation of static electricity, the customary precaution consists of discharging in contact with an earthed metal frame before physically connecting the CCA783 cord (supplied with the SFT2841 kit).

Plugging into Sepam

■ plugging of the 9-pin connector (SUB-D type) into one of the PC communication ports.

Configuration of the PC communication port via the "Communication port" function in the "Options" menu.

■ plugging of the 6-pin connector into the connector (round MiniDin type) situated behind the blanking plate on the front panel of Sepam or the DSM303 module.

Connection to Sepam

2 possibilities for setting up the connection between SFT2841 and Sepam:

■ "Connection" function in the "File" menu

■ choice of "connect to the Sepam" at the start-up of SFT2841.

Once the connection with Sepam has been established, "Connected" appears in the status bar, and the Sepam connection window may be accessed in the work zone.

User identification

The window intended for the entry of the 4-digit password is activated:

■ via the "General characteristics" tab, "Passwords" button…

■ via the "Identification" function in the "Sepam" menu.

The "Return to Operating mode" function in the "Passwords" tab withdraws access rights to the parameter and protection setting mode.

Downloading of parameters and protection settings

Parameter and protection setting files may only be loaded in the connected Sepam in Parameter setting mode.

Once the connection has been established, the procedure for loading a parameter and protection setting file is as follows:

■ activate the "Load Sepam" function in the "Sepam" menu

■ select the file (*.S80, *.S81, *.S82, *.T81, *.T82, *.T87, *.M81, *.M87, *.M88, *.G82, *.G87 or *.G88 according to the type of application) which contains the data to be loaded.

Return to factory settings

This operation is only possible in Parameter setting mode, via the "Sepam" menu. All of the Sepam general settings, protection settings and the control matrix go back to the default values.

The return to factory settings does not erase the logic equations.

The logic equation editor must be used to delete them.

Unloading of parameter and protection settings

The connected Sepam parameter and protection setting file may only be unloaded in Operating mode.

Once the connection has been established, the procedure for unloading a parameter and protection setting file is as follows:

■ activate the "Unload Sepam" function in the "Sepam" menu

■ select the *.rpg file that is to contain the unloaded data

■ acknowledge the end of operation report.

Local operation of Sepam

Connected to Sepam, SFT2841 offers all the local operating functions available in the advanced UMI screen, plus the following functions:

■ setting of Sepam's internal clock, via the "Sepam diagnosis" tab

■ implementation of the disturbance recording function: enabling/disabling of the function, retrieval of Sepam files, start-up of SFT2826

■ consultation of the history of the last 250 Sepam alarms, with time-tagging

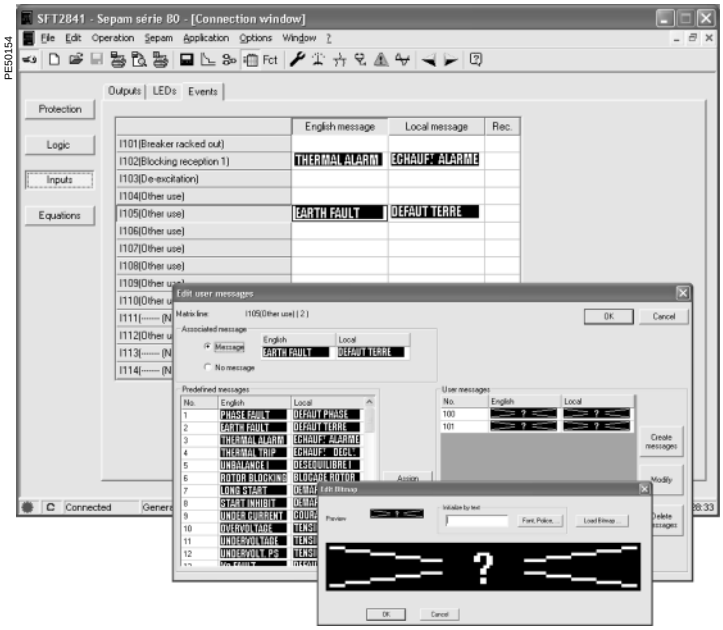
■ access to Sepam diagnostic data, in the "Sepam" tab box, included in "Sepam diagnosis"

■ in Parameter setting mode, switchgear diagnosis values may be modified: operation counter and cumulative breaking current to reset the values after a breaking device is changed.

Creation of user messages

This operation is carried out using the control matrix (icon or "application / set control matrix" menu).

When the matrix is displayed, select the "Events" tab, double-click on the empty box of the message to be created, or on an existing message to modify it.
A new screen may be used to:
- create a new user message:
  - click on the "Create messages" button
- modify the message you have created or an existing user message:
  - select the message number in the "No." column
  - click on the "Modify" button
  - an editing or bitmap window may be used to create text or drawings
- assign the message to the line in the control matrix:
  - select "message" if it has not already been selected
  - select the new predefined or user message in the corresponding "No." column
  - click on "Assign"
  - confirm your choice by clicking on the "OK" button.



Example of message creation screen.

Implementation of disturbance recording

Disturbance recording is set up using the Fct icon.
Select commissioning.
Set the following:
- number of recordings
- duration of each recording
- number of samples stored per period
- number of Pretrig periods (number of periods stored before the disturbance recording triggering event).

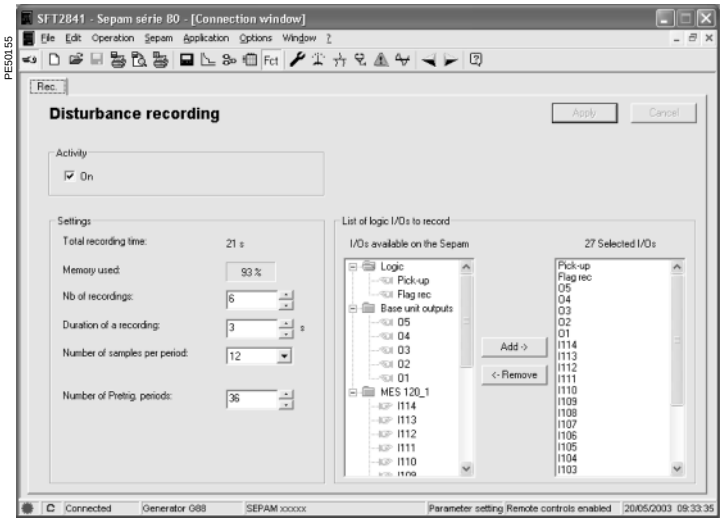
Then make up the list of logic I/Os that should appear in the disturbance recording.
If one of the parameters is changed: number of recordings, duration of a recording, number of Pretrig periods, all the recordings already saved will be erased (a warning message is displayed).
Changes made in the list of logic I/Os do not affect existing recordings.
Click on the "Apply" button.

Disturbance recordings may be displayed by clicking on the icon.

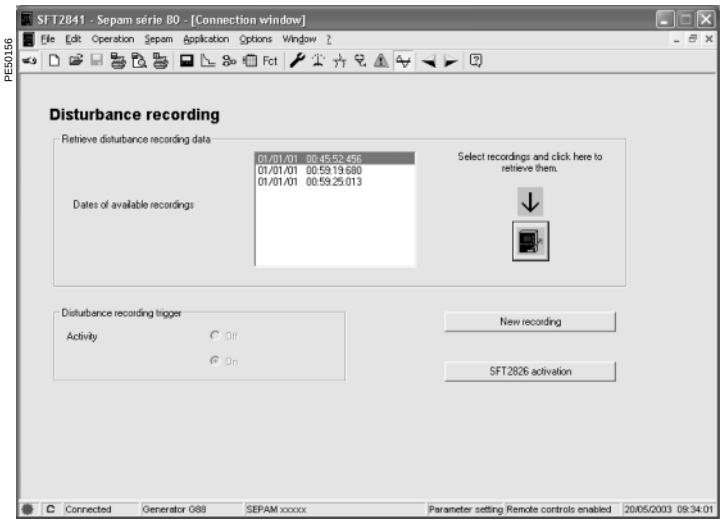
Each recording is identified in the list by the date.

Manual disturbance recording: click on the "New recording" button and a new dated item appears in the list.

Displaying recordings: select one or more disturbance recordings, and click on the "Retrieve" button.
This activates the SFT2826 software for display of the disturbance recording files by selecting the "file" menu / "open" command.



Example of disturbance recording configuration screen.



Example of disturbance recording display screen.

Fixed or remote advanced UMI

■ 2 LEDs indicating Sepam operating status:
□ green "**on**" LED: device on
□ red "**wrench**" LED: device unavailable (initialization phase or detection of internal failure)
■ 9 parameterizable yellow LEDs, with a standard label (the SFT2841 software may be used to print personalized labels)
■ 1 connection port for the RS 232 link with the PC (CCA783 cord), the connector is protected by a sliding cover.
■ **a "graphic" LCD display** for the display of measurements, parameter/protection settings and alarm and operating messages.
The number of lines, size of characters and symbols are in accordance with the screens and language versions.
The LCD display is back-lit when the user presses a key.
■ **a 9-key keypad with 2 operating modes:**

White keys for current operation:

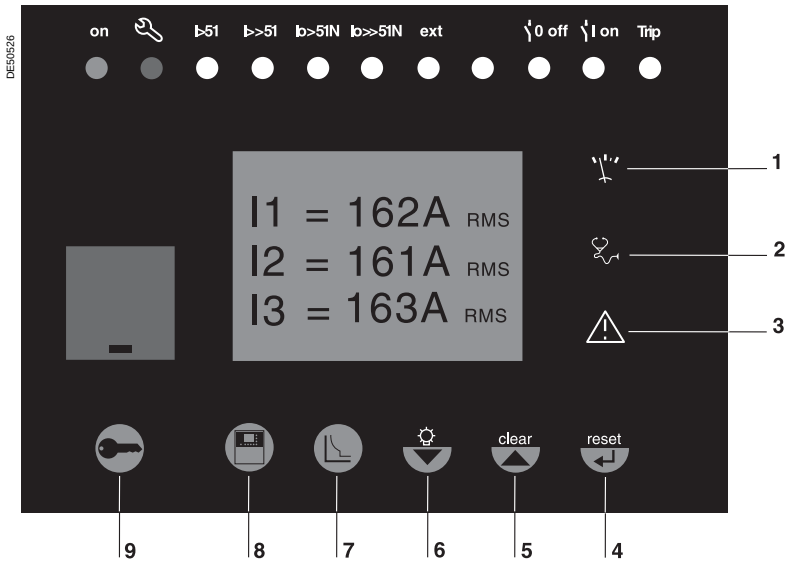
1 Display of measurements.
2 Display of "switchgear, network diagnosis" data.
3 Display of alarm messages.
4 Resetting.
5 Acknowledgment and clearing of alarms.

"LED test" key

6 Switching on sequence of all LEDs.

Blue keys enabled in parameter and protection setting mode:

7 Access to protection settings.
8 Access to Sepam characteristics.
9 Used to enter the 2 passwords required to change protection and parameter settings
The "↵, ▲, ▼ **"** (**4**, **5**, **6**) keys are used to browse through the menus and to scroll and accept the values displayed. "



Access to operating data

All of the Sepam operating data may be accessed using the metering, diagnosis, status and protection keys. A first menu is displayed, giving a series of screens for the user to choose from, as shown in the diagram opposite.

■ the data are split up by category in 4 menus, associated with the following 4 keys:

□ key: measurements
choices: current, voltage, frequency, power, energy

□ key: switchgear, network and machine diagnosis
choices: diagnosis, tripping contexts (x5)

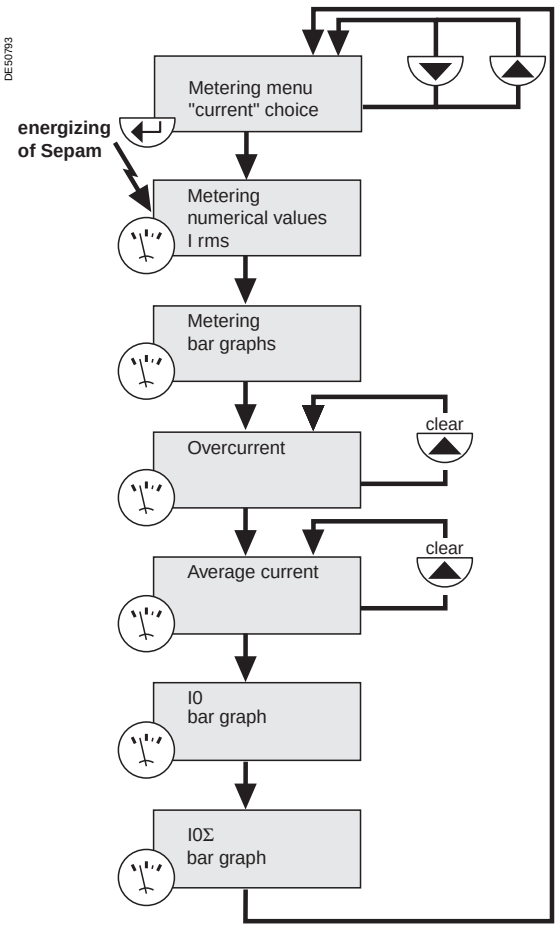
□ key: general characteristics

□ key: protection settings

■ items are chosen from the menus using the cursor keys (,), and selected by pressing the key marked

■ to go on to the next screen, the user presses again on the key of the measurement category displayed. When a screen includes more than 4 lines, the cursor keys (,) are used to move from one item to another.

Example: measurement loop



Protection and parameter setting modes

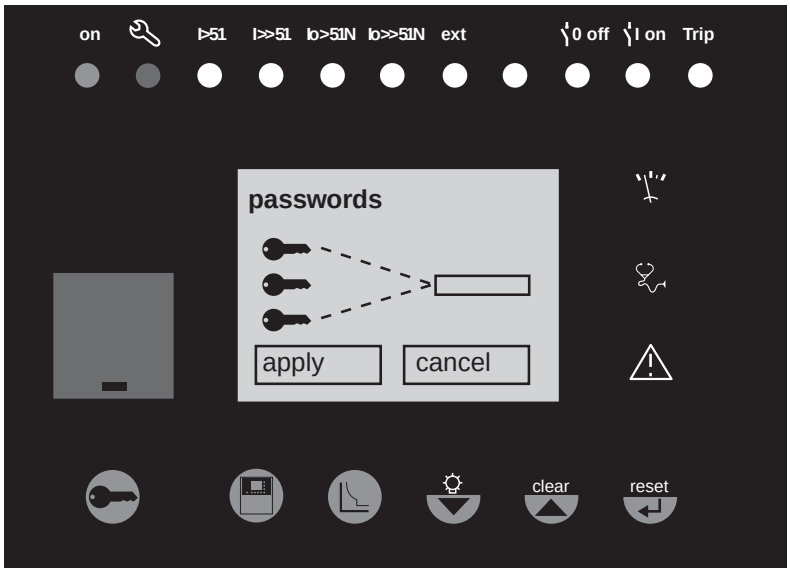
There are 3 levels of use:

■ operator level: provides read access to all the screens and does not require a password

■ protection setter level: requires the entry of the first password (key), allows protection setting key)

■ parameter setter level: requires the entry of the second password (key).

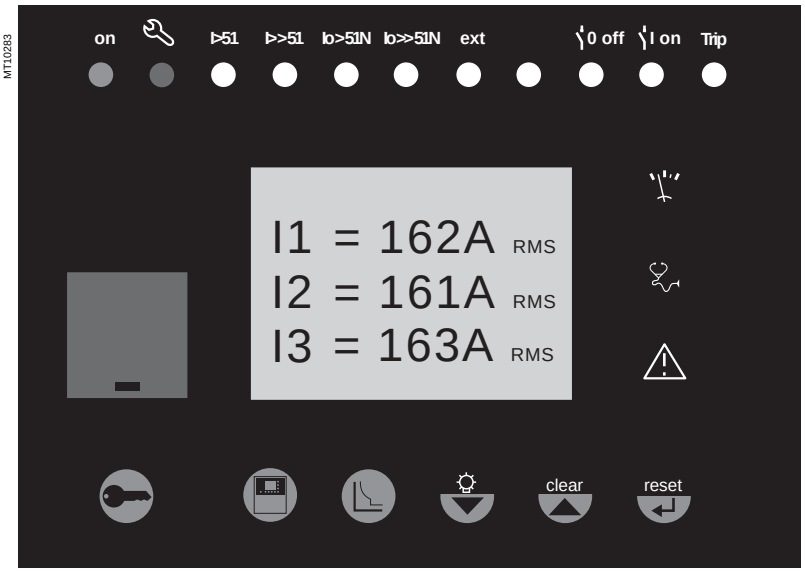
Only parameter setters may modify the passwords.
The passwords have 4 digits.



Advanced UMI
White keys for current operation

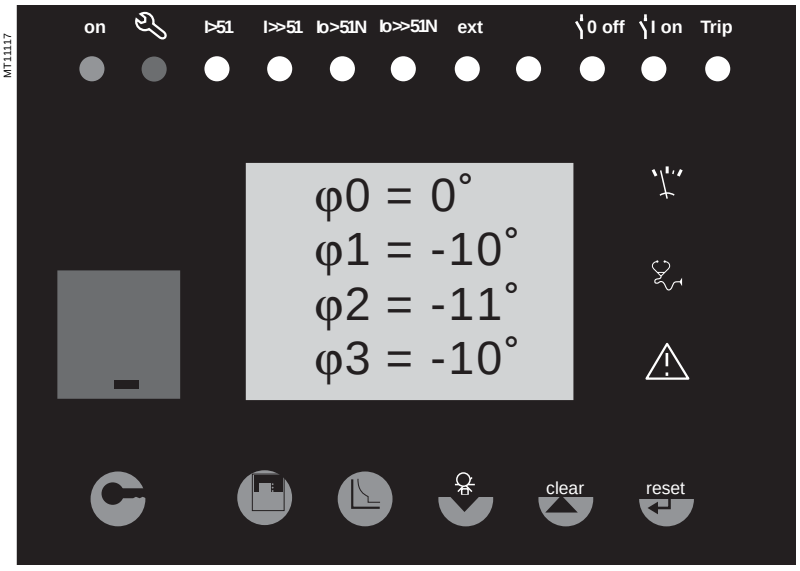
key

The "metering" key is used to display the variables measured by Sepam.



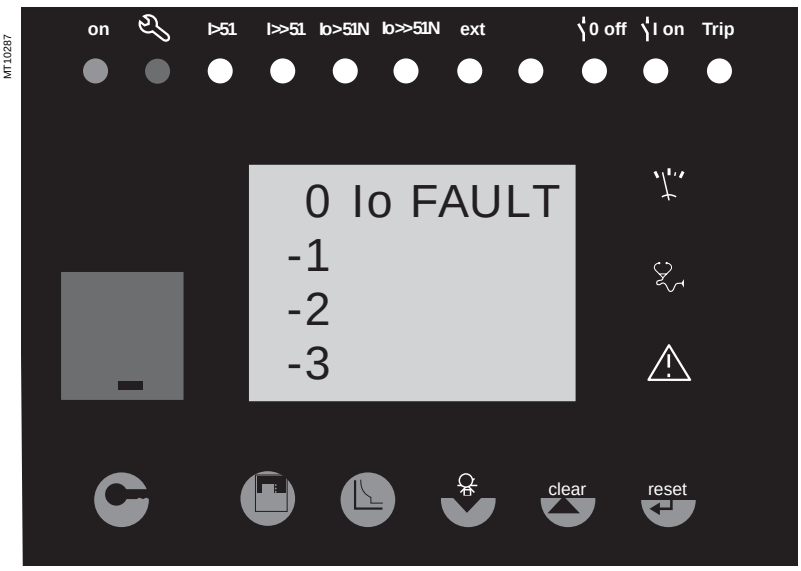
key

The "diagnosis" key provides access to switchgear, network and machine diagnosis data and tripping contexts to facilitate fault analysis.



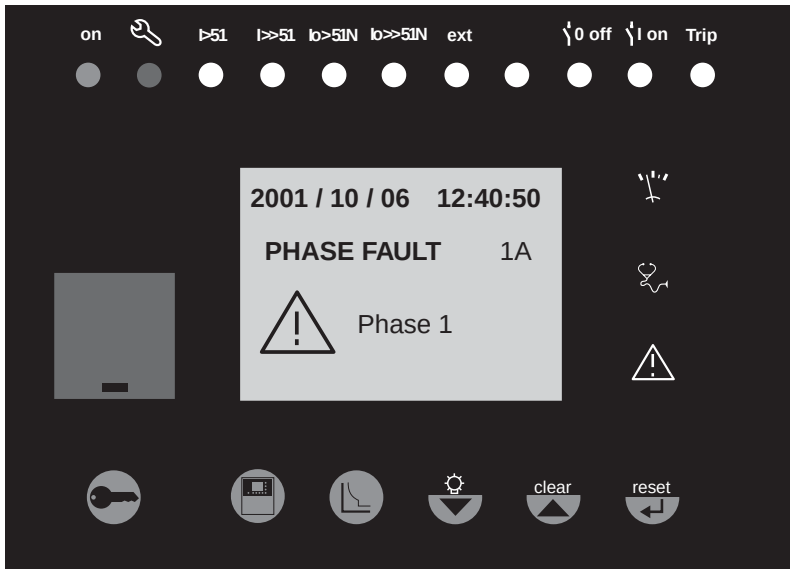
key

The "alarms" key is used to consult the 16 most recent alarms that have not yet been cleared, in list format or in detail, alarm by alarm.



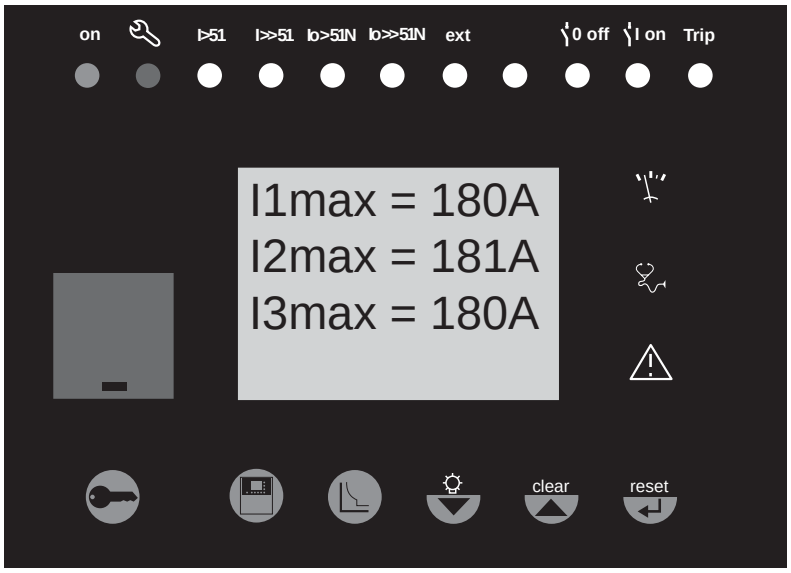
reset key

The "reset" key resets Sepam (extinction of LEDs and resetting of protection units after the disappearance of faults).
The alarm messages are not erased.
Sepam resetting must be confirmed.



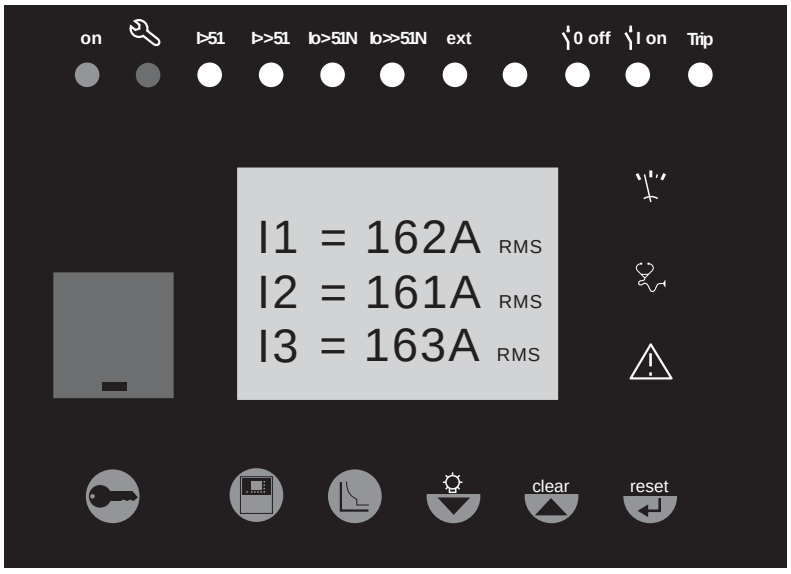
clear key

When an alarm is present on the Sepam display, the "clear" key is used to return to the screen that was present prior to the appearance of the alarm or to a less recent unacknowledged alarm. Sepam is not reset.
In the metering or diagnosis or alarm menus, the "clear" key may be used to reset the demand currents, peak demand currents, running hours counter and alarm stack when they are shown on the display.



key

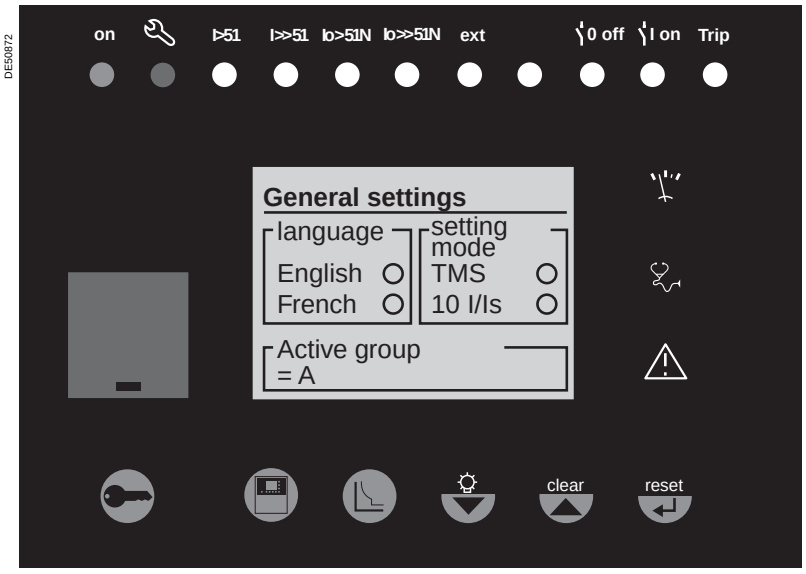
Press the "LED test" key for 5 seconds to start up a LED and display test sequence.
When an alarm is present, the "LED test" key is disabled.



Advanced UMI
Blue keys for parameter and protection setting

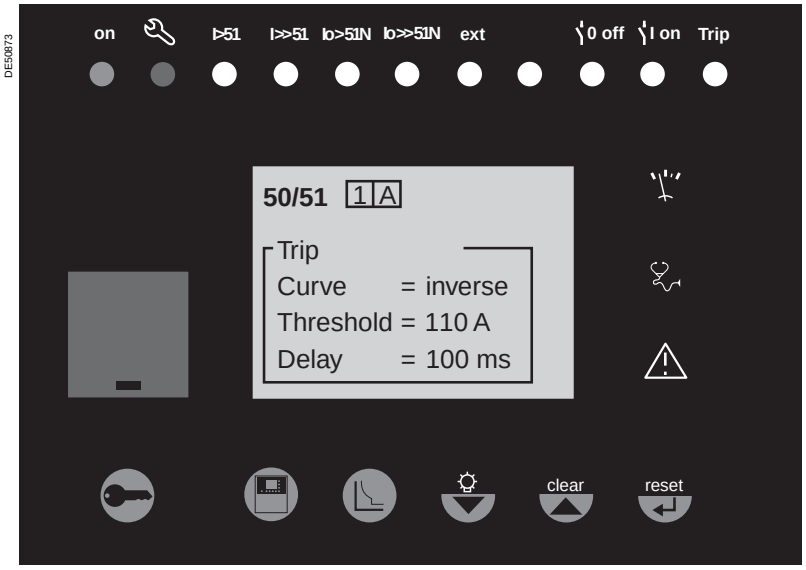
key

The "status" key is used to display Sepam versions and Sepam characteristics.



key

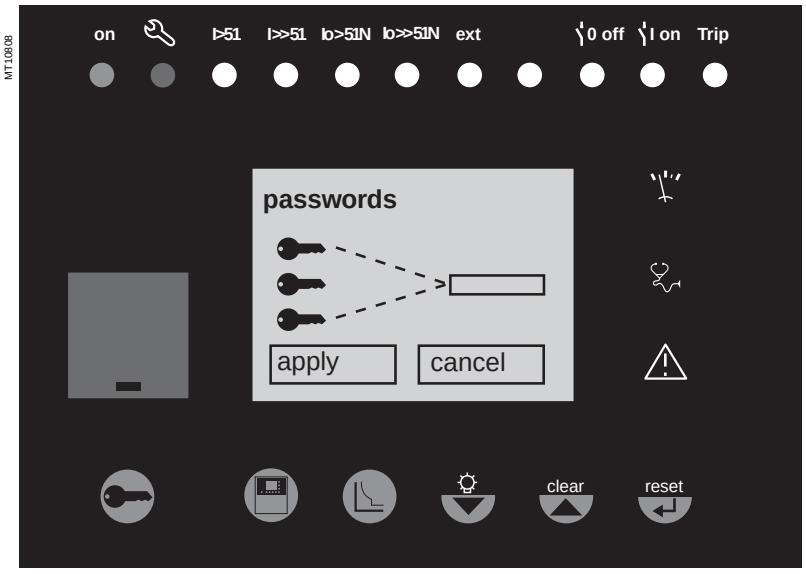
The "protection" key is used to display the list of protection functions enabled (via the SFT2841) and the "delay" and "threshold" settings of most of the protection functions.



key

The "key" key is used to enter the passwords for access to the different modes:
- protection setting
- parameter setting.

and return to "operating" mode (with no passwords).

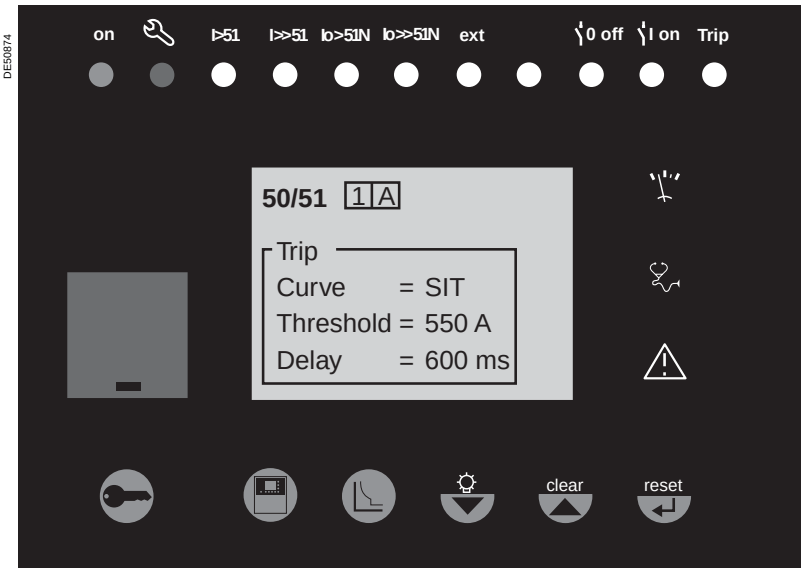


Nota : *for parameter setting of LEDs and output relays, it is necessary to use the SFT2841 software, "control logic" menu.*

Advanced UMI
Blue keys for parameter and protection setting

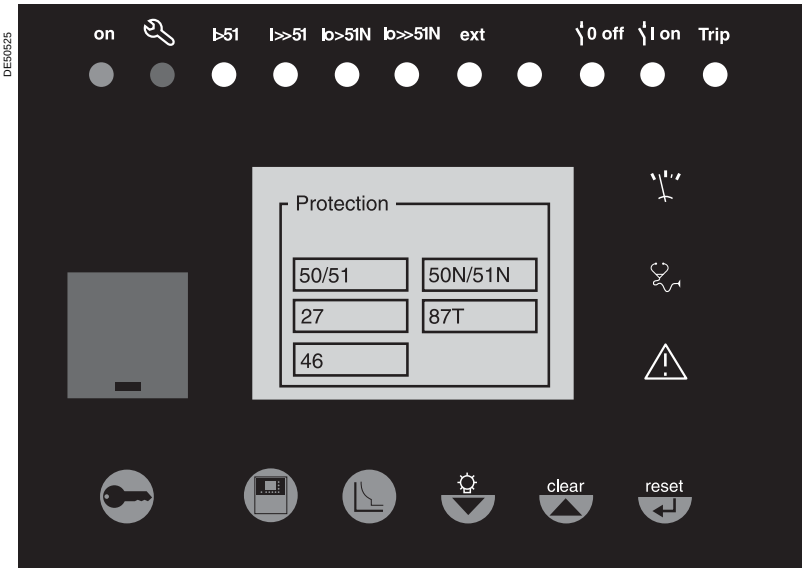
reset key

The ↵ key is used to confirm the protection settings, parameter settings, choice of menu and passwords.



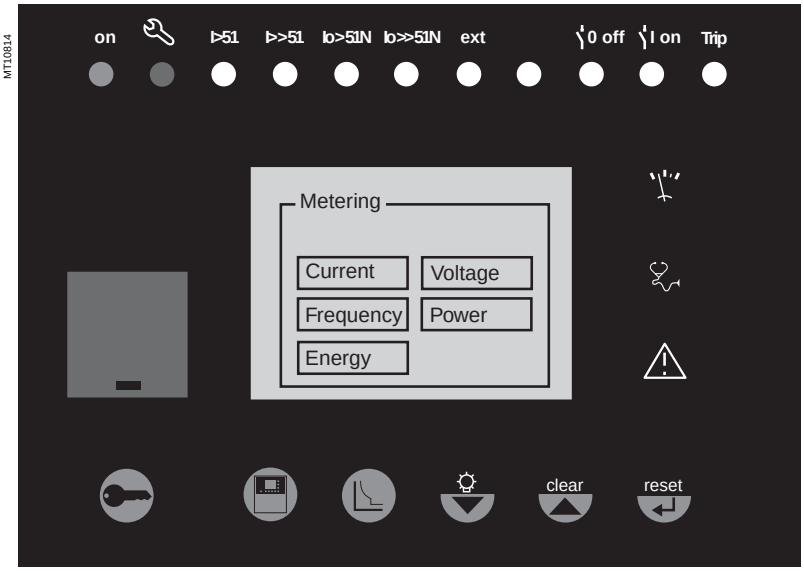
clear key

When there are no alarms on the Sepam display and the user is in the status, protection or alarm menu, the ▲ key is used to move the cursor upward.



key

When there are no alarms on the Sepam display and the user is in the status, protection or alarm menu, the ▼ key is used to move the cursor downward.



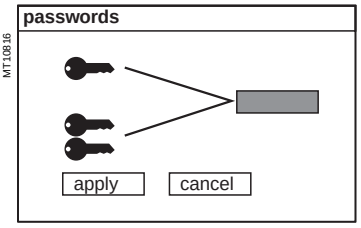
2

Use of passwords

Sepam has two 4-digit passwords:
- the first password, symbolized by a key, is used to modify the protection settings
- the second password, symbolized by two keys, is used to modify the protection settings and all the general settings (using SFT2841).

The 2 factory-set passwords are: 0000

Entry of passwords
Press the key to display the next screen:



MT10816

Press the key to position the cursor on the first digit.
0 X X X
Scroll the digits using the cursor keys (▲, ▼) then confirm to go on to the following digit by pressing the key. Do not use characters other than numbers 0 to 9 for each of the 4 digits.
When the password for your qualification level is entered, press the ▼ key to position the cursor on the box marked apply. Press the key again to confirm.
When Sepam is in protection setting mode, a key appears at the top of the display.
When Sepam is in parameter setting mode, two keys appear at the top of the display.
Access to the protection setting and parameter setting modes is disabled:
- by pressing the key
- automatically if no keys are activated for more than 5 minutes.

Modification of passwords
Only the parameter setting qualification level (2 keys) or the SFT2841 allow modification of the passwords.
Passwords are modified in the general settings screen, .key.

Loss of passwords
If the factory-set passwords have been modified and the latest passwords entered have been irretrievably lost by the user, please contact your local after-sales service representative.

Entry of parameters and protection settings

Principle applicable to all Sepam screens
(example of phase overcurrent protection)
- enter the password
- press the key the number of times necessary to reach the required screen
- move the cursor using the ▼ key to access the required field (e.g. curve)
- press the key to confirm the choice, then select the type of curve using the key marked ▲ or ▼ and confirm using the key
- press the ▼ key to go to the following fields, until you reach the box marked apply. Press the key to confirm the setting.

Entry of numerical values
(e.g. current threshold value).
- move the cursor to the required field using the "▲, ▼" keys and confirm the choice by pressing the key.
- the first digit to be entered is selected; set the value using the ▲, ▼ keys (choice of ____. 0…….9)
- press the key to confirm the choice and go on to the following digit.

The values are entered with 3 significant digits and a decimal point.
The units (e.g. A or kA) are chosen using the last digit.
- press the key to confirm the entry, then press the key for access to the next field
- all of the values entered are only effective after the user confirms by selecting the apply box at the bottom of the screen and presses the key.

Default settings

The default settings (or factory settings) are present in Sepam the first time it is used. It is possible to go back to the Sepam default settings at any time by using the "Factory settings" function in the SFT2841 configuration software. These settings are also used to initialize the SFT2841 configuration software setting files.

Parameter	Default value
Hardware configuration	
Model	Integrated UMI
Identification	Sepam xxx
COM1, COM2	Off
MET148-2 No. 1, 2	Off
MSA141	Off
MES120 No. 1, 2, 3	Off
General characteristics	
Frequency	50 Hz
Incomer/feeder	S80, S81, S82, M81, M87, M88 applications: feeder G82, G87, G88, T81, T82, T87 applications: incomer
Phase rotation direction	1_2_3
Group of settings	Group A
Remote protection setting enabled	Off
Remote control with select before operate (SBO)	Off
Integration period	5 min
Active-energy increment	0.1 kWh
Reactive-energy increment	0.1 kVARh
Temperature	°C
Sepam working language	English
Time synchronization mode	None
Auxiliary voltage monitoring	Off
Protection setting password	0000
Parameter setting password	0000
CT-VT sensors	
Single-line type	1
I - CT rating	5 A
I - Number of CTs	I1, I2, I3
I – Rated current (In)	630 A
I - Base current (Ib)	630 A
I0 – Residual current	None
I'0 – Residual current	None
I' - CT rating	5 A
I' - Number of CTs	I1, I2, I3
I' – Rated current (I'n)	630 A
I' - Base current (I'b)	630 A
V – number of VTs	V1V2V3
V - Rated primary voltage (Unp)	20 kV
V - Rated secondary voltage (Uns)	100 V
V0	3V sum
Vnt -	None
Particular characteristics	
Transformer present	T87, G88, M88: yes Other applications: no
Rated voltage Un1	20 kV
Rated voltage Un2	20 kV
Rated power	30 MVA
Vector shift	0
Rated speed	3000 rpm
Zero speed threshold	5 %
Pulses per rotation	1
Control logic	
Switchgear control	On, circuit breaker
Logic discrimination	Off
Genset shutdown	Off
De-excitation	Off
Load shedding	Off
Restart	Off
Logic I/O assignment	
O1, O3	On, NO, permanent
O2, O5	On, NC, permanent
O4	Off

Default settings

Parameter	Default value
Protection	
Activity	All protection functions are "off"
Latching	21B, 27D, 32P, 32Q, 38/49T, 40, 46, 48/51LR, 49RMS, 50BF, 50/27, 50/51, 50N/51N, 50V/51V, 64REF, 67, 67N, 78PS, 87M, 87T
Participation in switchgear control:	21B, 32P, 32Q, 37, 38/49T, 40, 46, 48/51LR, 49RMS, 50/27, 50/51, 50N/51N, 50V/51V, 64REF, 67, 67N, 78PS, 87M, 87T
Genset shutdown	12, 40, 50/51 (units 6, 7), 50N/51N (units 6, 7), 59N, 64REF, 67, 67N, 87M, 87T
De-excitation	12, 40, 50/51 (units 6, 7), 50N/51N (units 6, 7), 59, 59N, 64REF, 67, 67N, 87M, 87T
Setting	Approximate values consistent with general characteristics by default
Matrix	
LED	According to front panel marking
Disturbance recording	Pick-up All protection functions except for 14, 27R, 38/49T, 48/51LR, 49RMS, 50BF, 66
Logic outputs	O1: tripping O2: inhibit closing O3: closing O5: watchdog
Disturbance recording	
Activity	On
Number of recordings	6
Duration of a recording	3
Number of samples per period	12
Number of Pretrig periods	36

Contents

Principles and methods **56**
Testing and metering equipment required **57**
General examination and preliminary actions **58**
Checking of parameter and protection settings **59**
Checking of phase current and voltage input connection **60**
With 3-phase generator 60
With single-phase generator and voltages delivered by 3 VTs 62
With single-phase generator and voltages delivered by 2 VTs 63
Checking of phase current input connection **64**
For differential applications 64
Checking of residual current input connection **65**
Checking of residual voltage input connection **66**
With voltage delivered by 3 VTs in open delta arrangement 66
With voltage delivered by 1 neutral point VT 67
Checking of residual current and residual voltage input connection **68**
Checking of phase current input connection **69**
LPCT type current sensors 69
Checking of logic input and output connection and optional module connection **70**
Validation of the complete protection chain **71**
Test sheet **72**
Sepam series 80 72

Protection relay testing

Protection relays are tested prior to commissioning, with the dual aim of maximizing availability and minimizing the risk of malfunctioning of the assembly being commissioned. The problem consists of defining the consistency of the appropriate tests, keeping in mind that the relay is always involved as the main link in the protection chain.
Therefore, protection relays based on electromechanical and static technologies, the performances of which are not totally reproducible, must be systematically submitted to detailed testing, not only to qualify relay commissioning, but also to check that they actually are in good operating order and maintain the required level of performance.

The Sepam concept makes it possible to do away with such testing, since:

- the use of digital technology guarantees the reproducibility of the performances announced
- each of the Sepam functions has undergone full factory-qualification
- an internal self-testing system provides continuous information on the state of the electronic components and the integrity of the functions (e.g. automatic tests diagnose the level of component polarization voltages, the continuity of the analog value acquisition chain, non-alteration of RAM memory, absence of settings outside the tolerance range) and thereby guarantees a high level of availability

Sepam is therefore ready to operate without requiring any additional qualification testing that concerns it directly.

For differential applications (2 x 3 CTs), perform the test described on page 64 in addition to the tests for the basic configuration chosen in the chart opposite.

Sepam commissioning tests

The preliminary Sepam commissioning tests may be limited to a commissioning check, i.e.:

- checking of compliance with BOMs and hardware installation diagrams and rules during a preliminary general check
- checking of the compliance of the general settings and protection settings entered with the setting sheets
- checking of current or voltage input connection by secondary injection tests
- checking of logic input and output connection by simulation of input data and forcing of output status
- validation of the complete protection chain (possible customized logical functions included)
- checking of the connection of the optional MET148-2 and MSA141 modules.

The various checks are described further on.

General principles

- **all the tests should be carried out with the MV cubicle completely isolated and the MV circuit breaker racked out (disconnected and open)**
- **all the tests are to be performed in the operating situation: no wiring or setting changes, even temporary changes to facilitate testing, are allowed.**
- the SFT2841 parameter setting and operating software is the basic tool for all Sepam users. It is especially useful during Sepam commissioning tests. The tests described in this document are systematically based on the use of that tool.

The commissioning tests may be performed without the SFT2841 software for Sepam units with advanced UMIs.

Method

For each Sepam:

- only carry out the checks suited to the hardware configuration and the functions activated

(A comprehensive description of all the tests is given further on)

- use the test sheet provided to record the results of the commissioning tests.

Checking of current and voltage input connections

The secondary injection tests to be carried out to check the connection of the current and voltage inputs are described according to:

- the type of current and voltage sensors connected to Sepam, in particular for residual current and voltage measurement
- the type of injection generator used for the tests: three-phase or single-phase generator.

The different possible tests are described further on by:

- a detailed test procedure
- the connection diagram of the associated test generator.

The table below specifies the tests to be carried out according to the type of measurement sensors and type of generator used, and indicates the page on which each test is described.

Current sensors	Voltage sensors	Three-phase generator	Single-phase generator
3 CTs or 3 LPCTs	3 VTs	page 60	page 62
3 CTs or 3 LPCTs 1 or 2 core bal. CTs	3 VTs	page 60 page 65	page 62 page 65
3 CTs or 3 LPCTs	3 VTs 3 V0 VTs	page 60 page 66	page 62 page 66
3 CTs or 3 LPCTs 1 or 2 core bal. CTs	3 VTs 3 V0 VTs	page 60 page 68	page 62 page 68
3 CTs or 3 LPCTs	2 phase VTs 3 V0 VTs	page 61 page 66	page 63 page 66
3 CTs or 3 LPCTs 1 or 2 core balance CTs	2 phase VTs 3 V0 VTs	page 61 page 68	page 63 page 68
3 CTs or 3 LPCTs	3 VTs 1 neutral pt VT	page 60 page 67	page 62 page 67
3 CTs or 3 LPCTs 1 or 2 core bal. CTs	3 VTs 1 neutral pt VT	page 60 pages 65 and 67	page 62 pages 65 and 67
3 CTs or 3 LPCTs	2 phase VTs 1 neutral pt VT	page 61 page 67	page 63 page 67
3 CTs or 3 LPCTs 1 or 2 core bal. CTs	2 phase VTs 1 neutral pt VT	page 61 pages 65 and 67	page 63 pages 65 and 67

Testing and metering equipment required

Generators

■ dual sinusoidal AC current and voltage generator:
□ 50 or 60 Hz frequency (according to the country)
□ current adjustable up to at least 5 A rms
□ adjustable up to the rated secondary phase-to-phase voltage of the VTs
□ adjustable relative phase displacement (V, I)
□ three-phase or single-phase type
■ DC voltage generator:
□ adjustable from 48 to 250 V DC, for adaptation to the voltage level of the logic input being tested.

Accessories

■ plug with cord to match the "current" test terminal box installed
■ plug with cord to match the "voltage" test terminal box installed
■ electric cord with clamps, wire grip or touch probes.

Metering devices (built into the generator or separate)

■ 1 ammeter, 0 to 5 A rms
■ 1 voltmeter, 0 to 230 V rms
■ 1 phasemeter (if phase displacement (V, I) is not identified on the voltage and current generator).

Computer equipment

■ PC with minimal configuration:
□ MicroSoft Windows 95 / 98 / NT4.0 / 2000 / XP
□ 133 MHz Pentium processor,
□ 64 MB of RAM (32 MB with Windows 95 / 98)
□ 64 MB free on hard disk
□ CD-ROM drive
■ SFT2841 software
■ CCA783 serial connection cord between the PC and Sepam.

Documents

■ complete connection diagram of Sepam and additional modules, with:
□ phase current input connection to the corresponding CTs via the test terminal box
□ residual current input connection
□ phase voltage input connection to the corresponding VTs via the test terminal box
□ residual voltage input connection to the corresponding VTs via the test terminal box
□ logic input and output connection
□ temperature sensor connection
□ analog output connection
■ hardware BOMs and installation rules
■ group of Sepam parameter and protection settings, available in paper format.

General examination and preliminary actions

Checking to be done prior to energizing

Apart from the mechanical state of the equipment, use the diagrams and BOMs provided by the contractor to check:

- identification of Sepam and accessories determined by the contractor
- correct earthing of Sepam (via terminal 13 of the 20-pin connector (E) and the functional earthing terminal located on the back of the Sepam unit)
- correct connection of auxiliary voltage (terminal 1: positive polarity; terminal 2: negative polarity)
- presence of the DPC (detection of plugged connectors) bridge on terminals 19-20 of the 20-pin connector (E).
- presence of a residual current measurement core balance CT and/or additional modules connected to Sepam, when applicable
- presence of test terminal boxes upstream from the current inputs and voltage inputs
- conformity of connections between Sepam terminals and the test terminal boxes.

Connections

Check that the connections are tightened (with equipment non-energized).
The Sepam connectors must be correctly plugged in and locked.

Energizing

Switch on the auxiliary power supply.
Check that Sepam performs the following initialization sequence, which lasts approximately 6 seconds:

- green ON and red indicators on
- red indicator off
- pick-up of "watchdog" contact.

The first screen displayed is the phase current measurement screen.

Implementation of the SFT2841 software for PC

- start up the PC
- connect the PC RS 232 serial port to the communication port on the front panel of Sepam using the CCA783 cord
- start up the SFT2841 software, by clicking on the related icon
- choose to connect to the Sepam to be checked.

Identification of Sepam

- note the Sepam serial number given on the label stuck to the right side plate of the base unit
- note the references defining the type of application indicated on the adhesive label on the Sepam cartridge
- note the Sepam type and software version using the SFT2841 software, "Sepam Diagnosis" screen
- enter them in the test sheet.

Checking of parameter and protection settings

Determination of parameter and protection settings

All of the Sepam parameter and protection settings are determined ahead of time by the design department in charge of the application, and should be approved by the customer.
It is presumed that the study has been carried out with all the attention necessary, or even consolidated by a network coordination study.
All of the Sepam parameter and protection settings should be available at the time of commissioning:

- in paper file format (with the SFT2841 software, the parameter and protection setting file for a Sepam may be printed directly)
- and, when applicable, in the format of a file to be downloaded into Sepam using the SFT2841 software.

Checking of parameters and protection settings

Check to be made when the Sepam parameter and protection settings have not been entered or downloaded during commissioning testing, to confirm the conformity of the parameter and protection settings entered with the values determined during the study.
The aim of this check is not to confirm the relevance of the parameter and protection settings.

- go through all the parameter and protection setting screens in the SFT2841 software, in the order proposed in guided mode
- for each screen, compare the values entered in the Sepam with the values recorded in the parameter and protection setting file
- correct any parameter and protection settings that have not been entered correctly, proceeding as indicated in the SFT2841 section of the Use chapter of this manual.

Conclusion

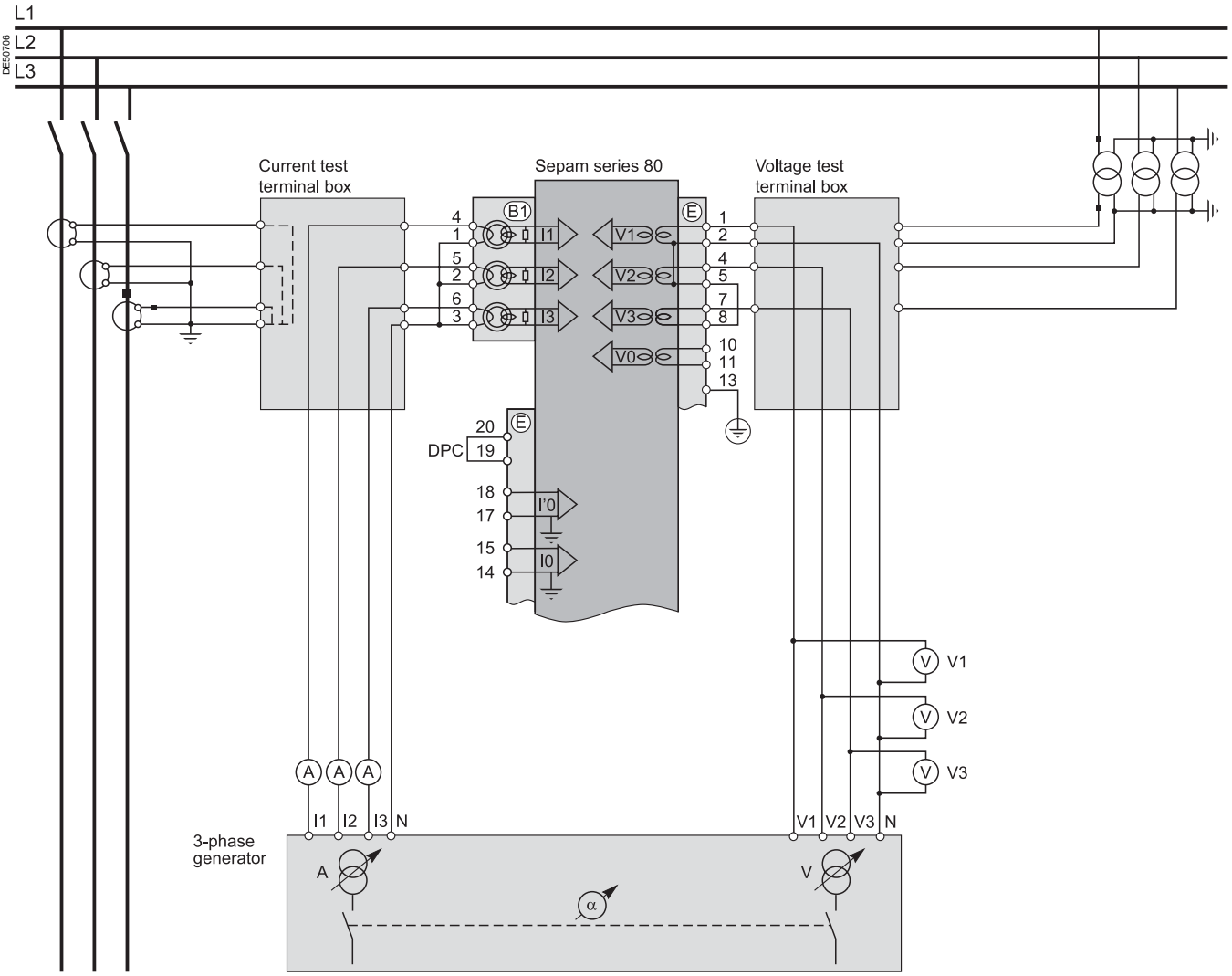
Once the checking has been done and proven to be conclusive, as of that phase, the parameter and protection settings should not be changed any further and are considered to be final.
In order to be conclusive, the tests which follow must be performed with these parameter and protection settings; no temporary modification of any of the values entered, with the aim of facilitating a test, is permissible.

Checking of phase current and voltage input connection
With 3-phase generator

Procedure

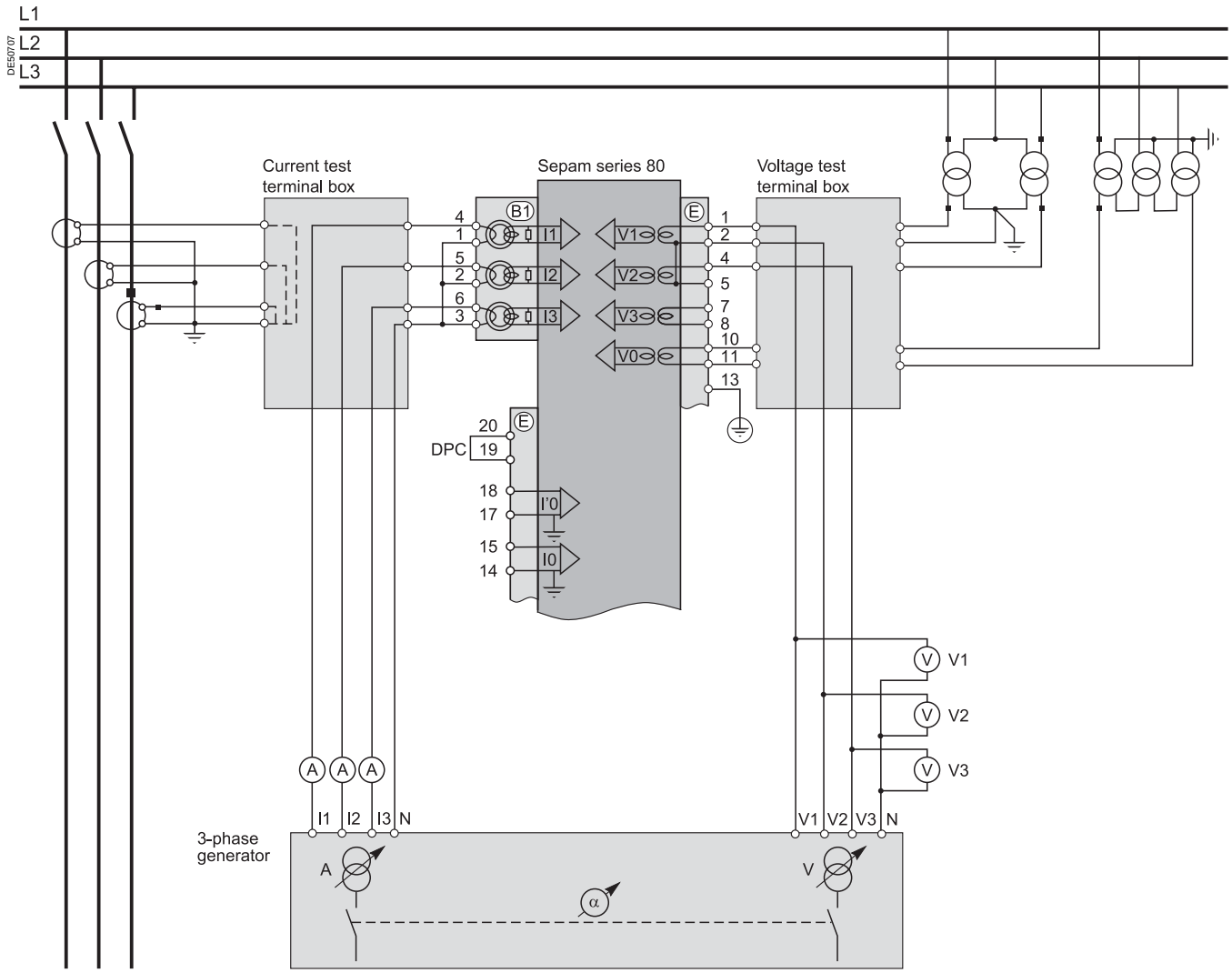
Connect the 3-phase voltage and current generator to the corresponding test terminal boxes, using the plugs provided, according to the appropriate diagram in terms of the number of VTs connected to Sepam.

Block diagram with 3 VTs connected to Sepam



Checking of phase current and voltage input connection
With 3-phase generator

Block diagram with 2 VTs connected to Sepam



■ turn the generator on
■ apply the 3 generator voltages V1-N, V2-N and V3-N, balanced and set to the rated secondary phase-to-neutral voltage of the VTs (i.e. Vns = Uns/$\sqrt{3}$)
■ inject the 3 generator currents I1, I2 and I3, balanced and set to the rated secondary current of the CTs (i.e. 1 A or 5 A) and in phase with the voltages applied (i.e. generator phase displacement:
$\alpha 1$(V1-N, I1) = $\alpha 2$(V2-N, I2) = $\alpha 3$(V3-N, I3) = 0°)
■ use the SFT2841 software to check the following:
□ the value indicated for each of the phase currents I1, I2 and I3 is approximately equal to the rated primary current of the CTs
□ the value indicated for each of the phase-to-neutral voltages V1, V2 and V3 is approximately equal to the rated primary phase-to-neutral voltage of the VT (Vnp = Unp/$\sqrt{3}$)
□ the value indicated for each phase displacement $\varphi 1$(V1, I1), $\varphi 2$(V2, I2) and $\varphi 3$(V3, I3) between currents I1, I2 or I3 and voltages V1, V2 or V3 respectively is approximately equal to 0°
■ turn the generator off.

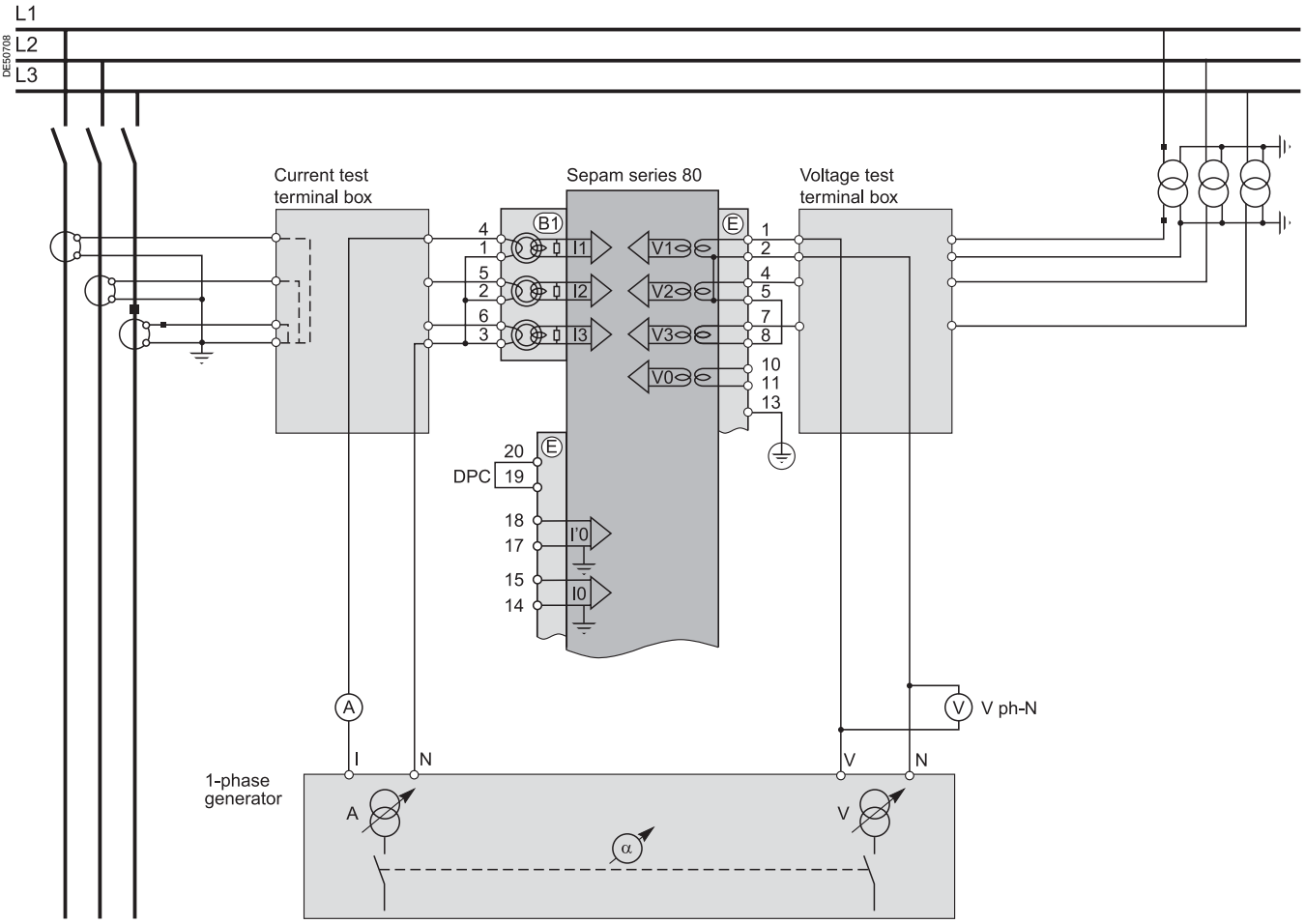
Checking of phase current and voltage input connection

With single-phase generator and voltages delivered by 3 VTs

Procedure

Connect the single-phase voltage and current generator to the corresponding test terminal boxes, using the plugs provided, according to the block diagram below.

Block diagram



■ turn the generator on

■ apply the generator V-N voltage set to the rated secondary phase-to-neutral voltage of the VTs (i.e. Vns = Uns/$\sqrt{3}$) between Sepam's phase 1 voltage input terminals (via the test box)

■ inject the generator I current, set to the rated secondary current of the CTs (i.e. 1 A or 5 A) and in phase vith the V-N voltage applied (i.e. generator phase displacement α(V-N, I) = 0°) to Sepam's phase 1 current input (via the text box)

■ use the SFT2841 software to check the following:

□ the value indicated for I1 phase current is approximately equal to the rated primary current of the CT

□ the value indicated for V1 phase-to-neutral voltage is approximately equal to the rated primary phase-to-neutral voltage of the VT (Vnp = Unp/$\sqrt{3}$)

□ the value indicated for the phase displacement φ1(V1, I1) between the I1 current and V1 voltage is approximately equal to 0°

■ proceed in the same way by circular permutation with the phase 2 and 3 voltages and currents, to check the I2, V2, φ2(V2, I2) and I3, V3, φ3(V3, I3) values

■ turn the generator off.

Checking of phase current and voltage input connection

With single-phase generator and voltages delivered by 2 VTs

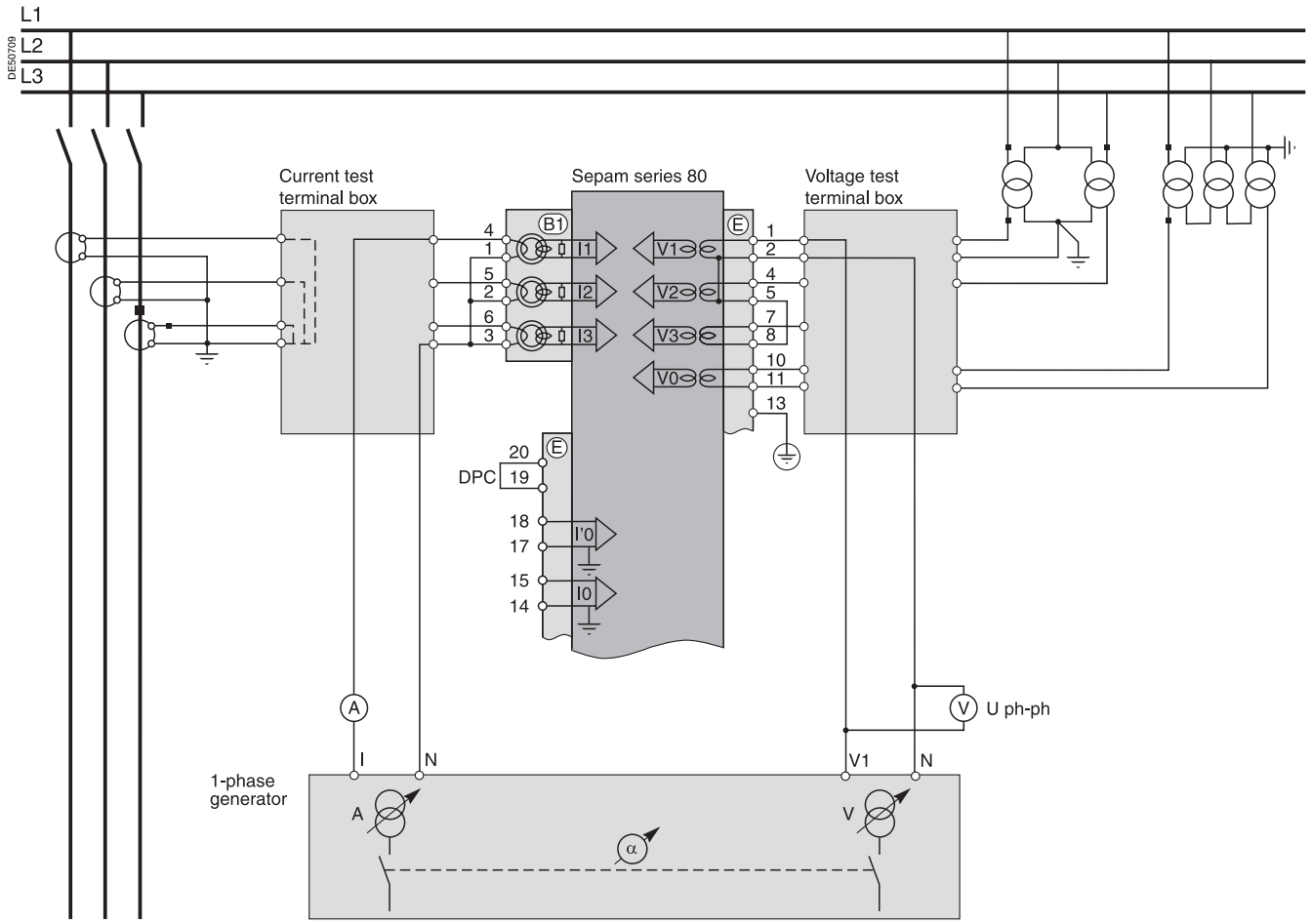
Description

Check to be carried out when the voltages are supplied by a 2 VT assembly, with the VT primary circuits connected between phases of the distributed voltage, which means that the residual voltage is obtained outside Sepam (by 3 VTs connected via their secondary circuits in an open delta arrangement) or, when applicable, is not used for the protection function.

Procedure

Connect the single-phase voltage and current generator to the corresponding test terminal boxes, using the plugs provided, according to the block diagram below.

Block diagram



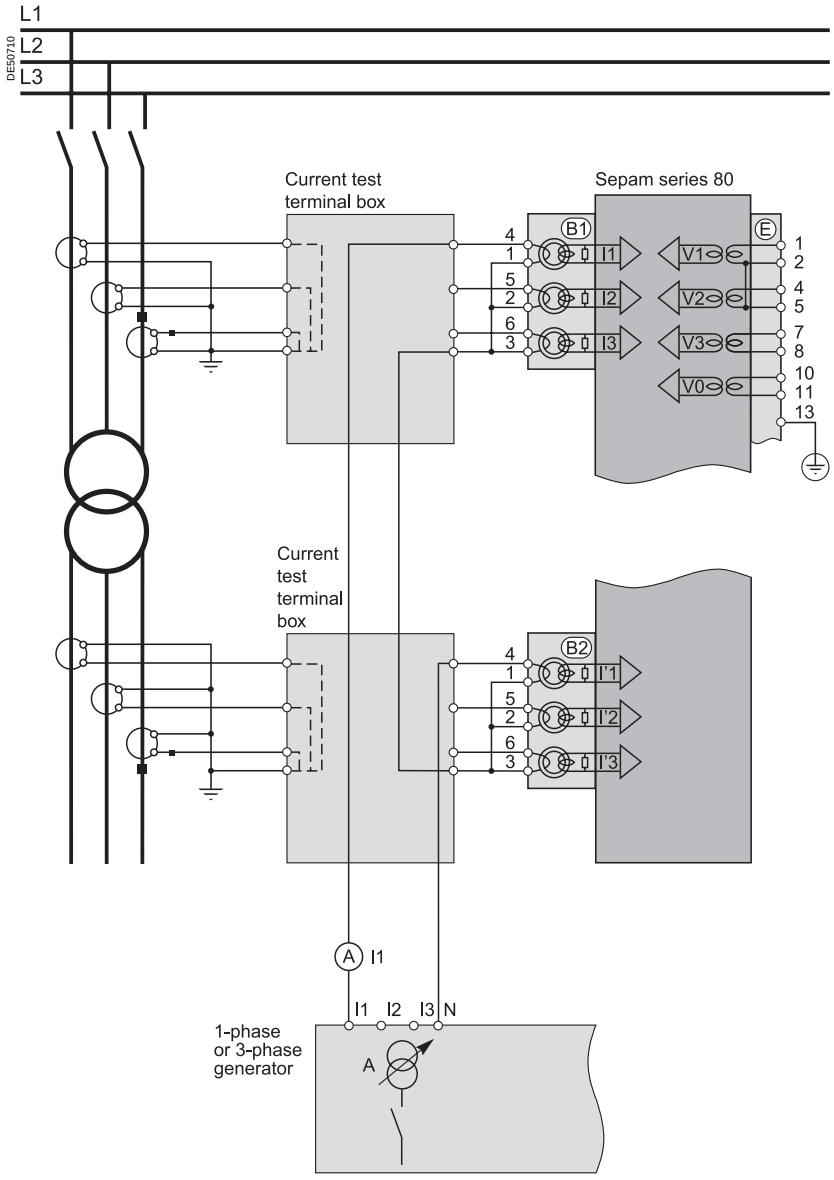
■ turn the generator on
■ apply (via the test box) the voltage delivered at the V-N terminals of the generator, set to $\sqrt{3}/2$ times the rated secondary phase-to-phase voltage of the VTs (i.e. $\sqrt{3}$ Uns/2) between terminals 1-2 of Sepam's voltage inputs
■ inject the generator I current, set to the rated secondary current of the CTs (i.e. 1 A or 5 A) and in phase with the V-N voltage applied (i.e. generator phase displacement α(V-N, I) = 0°) to Sepam's phase 1 current input (via the test box)
■ use the SFT2841 software to check the following:
□ the value indicated for I1 phase current is approximately equal to the rated primary current of the CT (Inp)
□ the value indicated for V1 phase-to-neutral voltage is approximately equal to the rated primary phase-to-neutral voltage of the VT (Vnp = Unp/$\sqrt{3}$)
□ the value indicated for the phase displacement φ1(V1, I1) between the I1 current and V1 voltage is approximately equal to 0°
■ proceed in the same way to check the I2, V2, φ2(V2, I2) values:
□ apply the generator V-N voltage set to $\sqrt{3}$ Uns/2 in parallel between terminals 1-2 and 4-2 of Sepam's voltage inputs (via the test box)
□ inject an I current set to 1 A or 5 A and in phase opposition with the V-N voltage (i.e. α(V-N, I) = 180°) to Sepam's phase 2 current input (via the test box)
□ obtain I2 ≅ Inp, V2 ≅ Vnp = Unp/$\sqrt{3}$ and φ2 ≅ 0°. In the absence of residual voltage, V3 = 0, U32 = $\sqrt{3}$ Unp/2
■ check the I3, V3, φ3(V3, I3) values as well:
□ apply the generator V-N voltage set to $\sqrt{3}$ Uns/2 between terminals 4-2 of Sepam's voltage inputs (via the test box)
□ inject a current equal to 1 A or 5 A and in phase with the V-N voltage (i.e. α(V-N, I) = 0°) to Sepam's phase 3 current input (via the test box)
□ obtain I3 ≅ Inp, V3 ≅ Vnp = Unp/$\sqrt{3}$ and φ3 ≅ 0°. In the absence of residual voltage, V3 = 0, U32 = $\sqrt{3}$ Unp/2
■ turn the generator off.

Checking of phase current input connection
For differential applications

Description
Check to be carried out for differential applications (machine, transformer or transformer-machine unit). This test is carried out along with checking of the phase current and phase voltage input wiring. The purpose is to check the wiring of the second Sepam current input.

Procedure
Connect the generator current terminals to the corresponding current test terminal boxes using the plugs provided, according to the block diagram below

Block diagram



Should the secondary circuits of the CTs connected to each of the Sepam current inputs not have the same ratings (1 and 5 A or 5 and 1 A), set the injection to the lowest secondary rating. The value indicated for the phase currents (I1, I2, I3) or (I'1, I'2, I'3), as the case may be, is then equal to the CT rated primary current divided by 5 (In/5).

- turn the generator on
- inject, in series, into the phase 1 current input terminals of each Sepam connector (B1), (B2) connected in opposition (via the test boxes, according to the diagram above), current I from the generator, set to match the CT rated secondary current (1 A or 5 A)
- use the SFT2841 software to check the following:
  - the value indicated for phase current I1 is approximately equal to the rated primary current of the CT (In) wired to the Sepam (B1) connector
  - the value indicated for phase current I'1 is approximately equal to the rated primary current of the CT (I'n) wired to the Sepam (B2) connector
  - the value indicated for the phase displacement θ(I, I') between currents I1 and I'1 is equal to 0°
- check the I2 and I'2, I3 and I'3 and θ(I, I') values as well the values between I2-I'2 and I3-I'3 after transferring the injection plugs to the phase 2 current and then phase 3 current input terminals of each of the Sepam connectors
- turn the generator off.

Checking of residual current input connection

Description

Check to be carried out when the residual current is measured by a specific sensor such as:

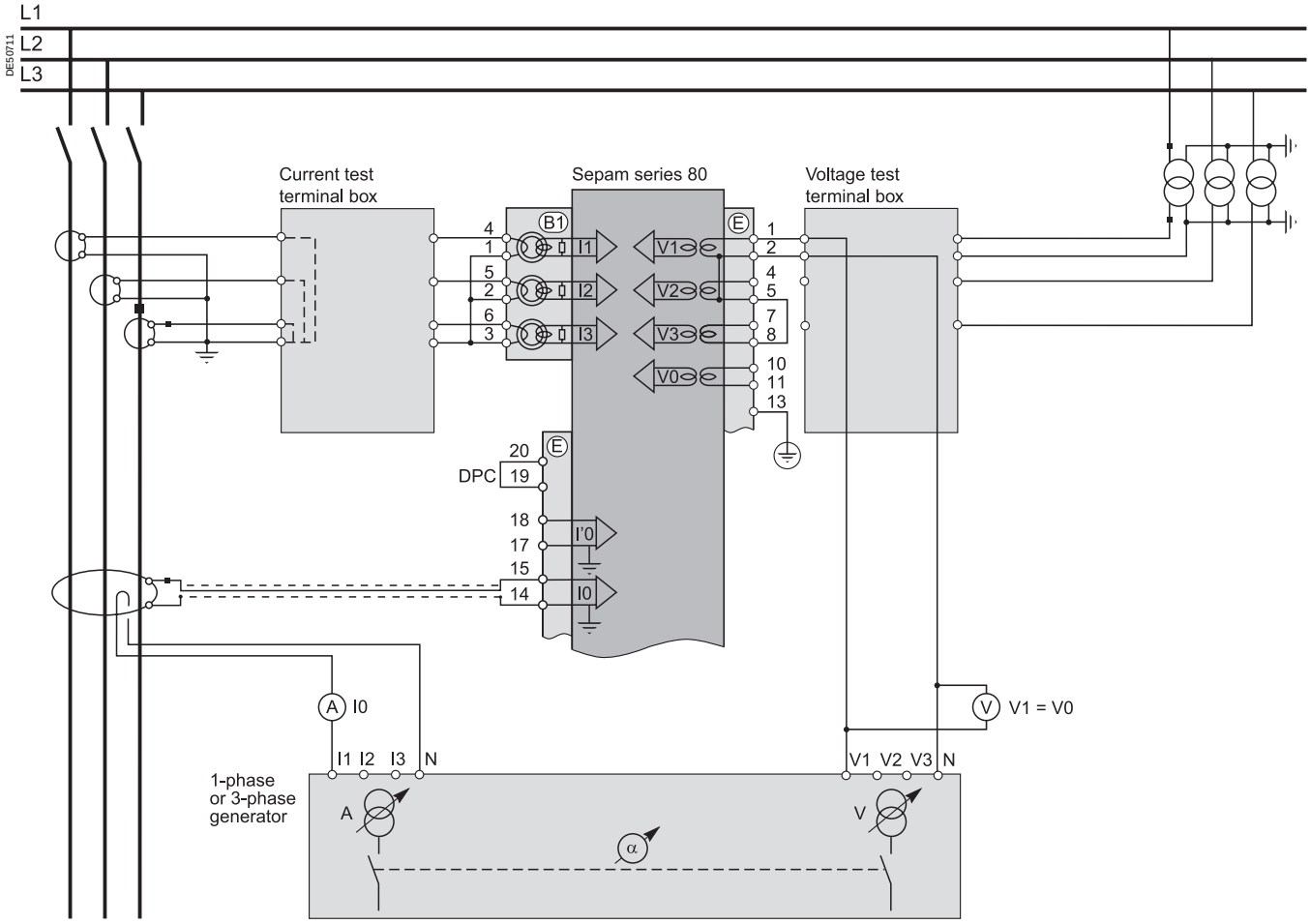
- CSH120 or CSH200 core balance CT
- CSH30 interposing ring CT (whether it is installed on the secondary circuit of a single 1 A or 5 A CT which encompasses the 3 phases, or on the neutral connection of the three 1 A or 5 A phase CTs)
- other core balance CT connected to an ACE990 interface,
- and when the residual voltage is calculated in Sepam or cannot be calculated (e.g.: assembly with 2 VTs connected via their primary circuits) and is therefore not available for the protection function.

Procedure

- connect according to the diagram below:
  - a wire between the generator current terminals to inject current into the primary circuit of the core balance CT or CT, with the wire passing through the core balance CT or CT in the P1-P2 direction, with P1 the busbar end and P2 the cable end
  - when applicable, the generator voltage terminals to the voltage test terminal box, so as to only supply Sepam's phase 1 voltage input and therefore obtain a residual voltage V0 = V1.

Block diagram

Note: *the number of CTs connected to the Sepam current connector phase inputs is given as an example and is not used for the test.*



Sepam series 80 is equipped with 2 independent residual current inputs which may be connected to a core balance CT installed on the cables, tank earthing cable or neutral point of a transformer, or on the earthing cable of a motor or generator. In some cases, reading of the φ0 or φ'0 angle is impossible due to the position of the core balance CT (e.g. transformer neutral point or tank earthing cable) or because only one of the two I0 or V0 measurements is necessary or possible. When this is the case, simply check the measured residual current value I0 or I'0.

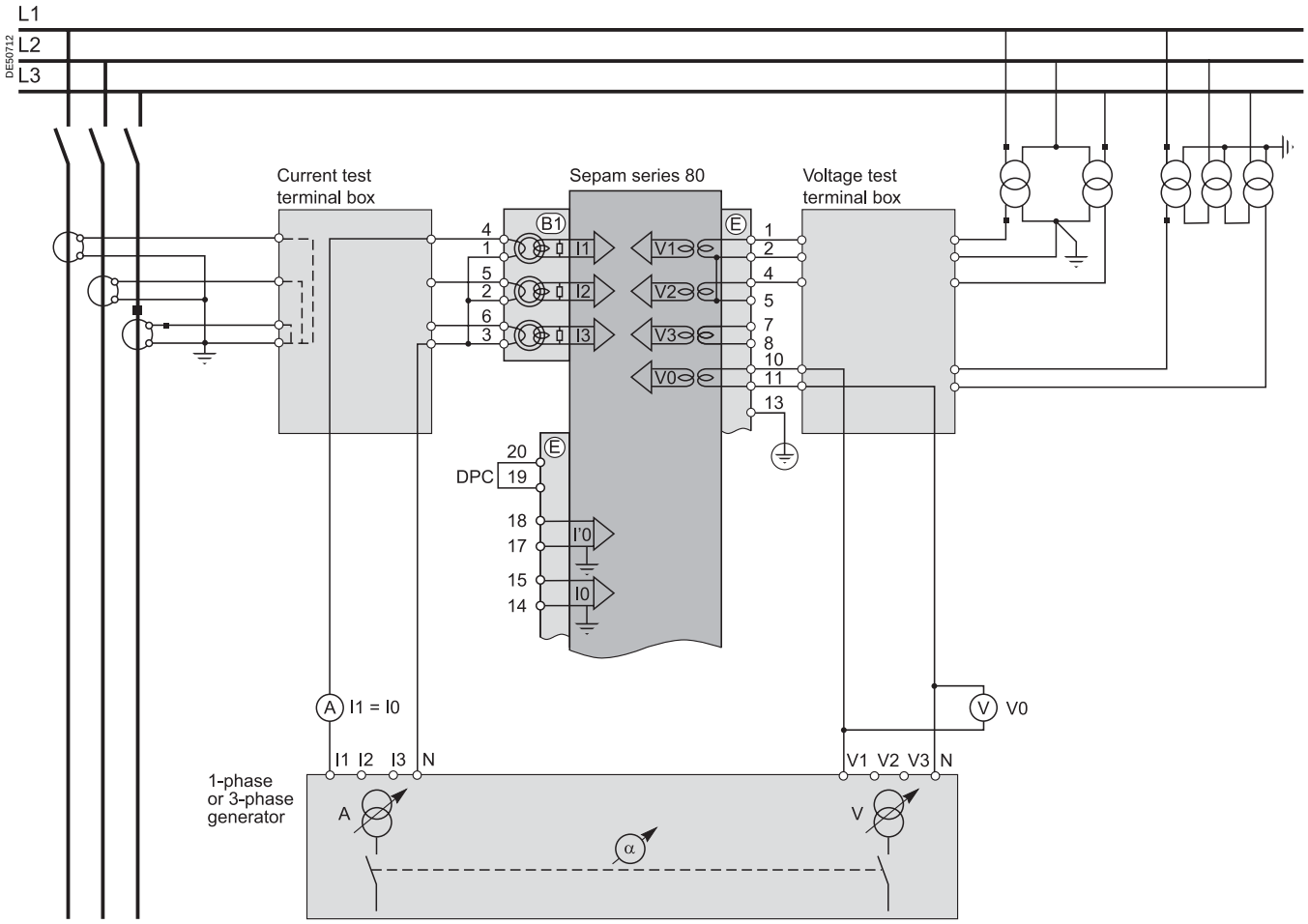
- turn the generator on
- when applicable, apply a V-N voltage set to the rated secondary phase-to-neutral voltage of the VT (i.e. Vns = Uns/$\sqrt{3}$)
- inject an I current set to 5 A, and when applicable in phase with the V-N voltage applied (i.e. generator phase displacement α(V-N, I) = 0°)
- use the SFT2841 software to check the following:
  - the value indicated for the measured I0 residual current is approximately equal to 5 A
  - when applicable, the value indicated for calculated V0 residual voltage is approximately equal to the rated primary phase-to-neutral voltage of the VTs (i.e. Vnp = Unp/$\sqrt{3}$)
  - when applicable, the value indicated for the phase displacement φ0(V0, I0) between the I0 current and V0 voltage is approximately equal to 0°
- use the same procedure if the I'0 input is connected. When this is the case, the phase displacement angle to be checked is φ'0(V0, I'0), between the I'0 current and V0 voltage
- turn the generator off.

Checking of residual voltage input connection
With voltage delivered by 3 VTs in open delta arrangement

Description
Check to be carried out when the residual voltage is delivered by 3 VTs on the secondary circuits connected in an open delta arrangement, and when the residual current is calculated in Sepam or cannot be calculated (e.g.: assembly with 2 CTs) and is therefore not available for the protection function.

Procedure
■ connect according to the diagram below:
□ the generator voltage terminals to the voltage test terminal box, so as to only supply Sepam's residual voltage input
□ when applicable, the generator current terminals to the current test terminal box, so as to only supply Sepam's phase 1 current input, and therefore obtain a residual current I0Σ = I1.

Block diagram
Note: *the number of VTs connected to the Sepam voltage connector phase inputs is given as an example and is not used for the test.*



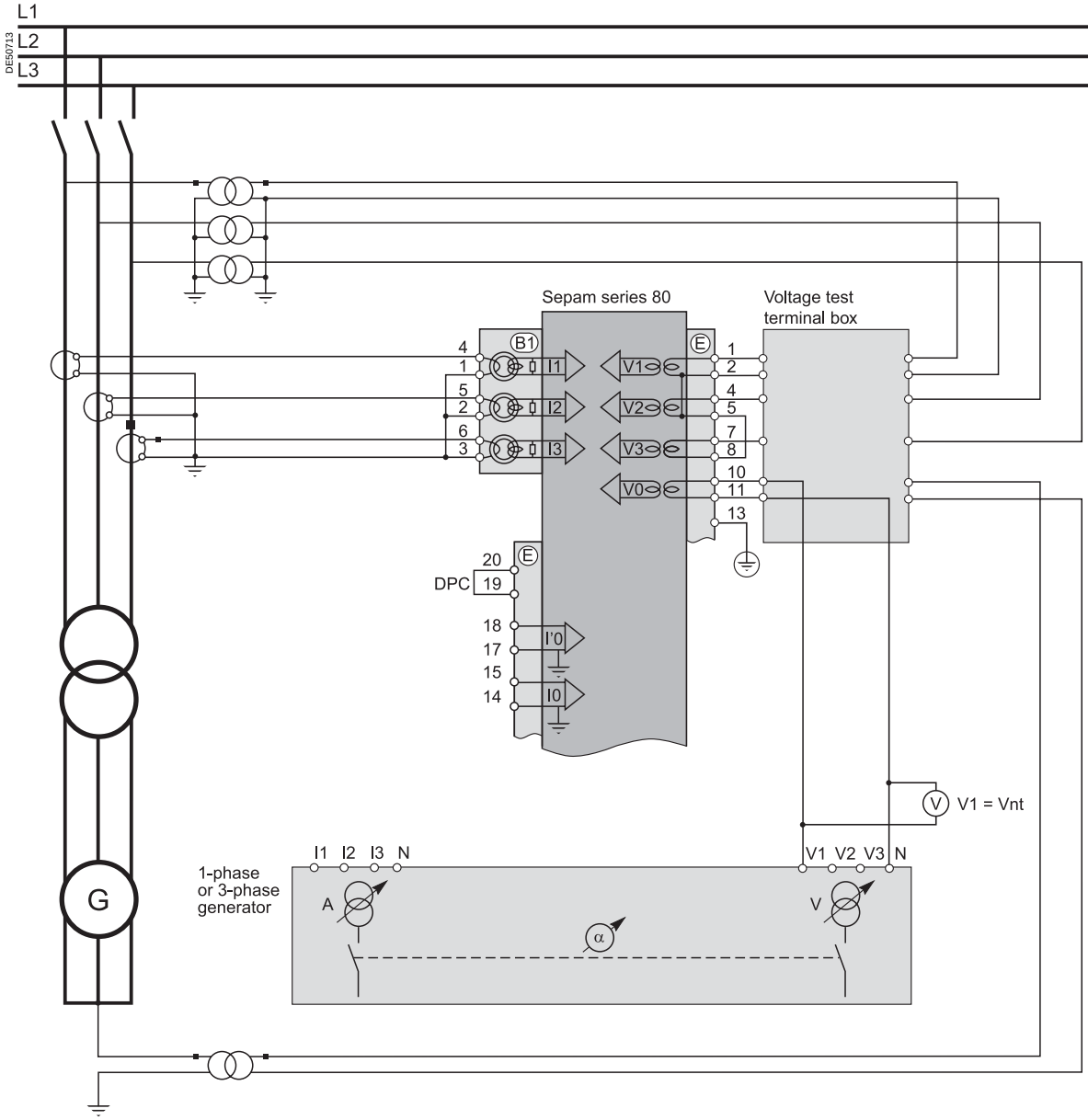
■ turn the generator on
■ apply a V-N voltage set to the rated secondary voltage of the VTs installed in an open delta arrangement (i.e., depending on the case, Uns/$\sqrt{3}$ or Uns/3)
■ when applicable, inject an I current set to the rated secondary current of the CTs (i.e. 1 A or 5 A) and in phase with the voltage applied (i.e. generator phase displacement α(V-N, I) = 0°)
■ use the SFT2841 software to check the following:
□ the value indicated for the measured V0 residual voltage is approximately equal to the rated primary phase-to-neutral voltage of the VTs (i.e. Vnp = Unp/$\sqrt{3}$)
□ when applicable, the value indicated for the calculated I0Σ residual current is approximately equal to the rated primary current of the CTs
□ when applicable, the value indicated for the phase displacement φ0Σ (V0, I0Σ) between the I0Σ current and V0 voltage is approximately equal to 0°
■ turn the generator off.

Checking of residual voltage input connection
With voltage delivered by 1 neutral point VT

Description
Check to be carried out when the Sepam residual voltage input is connected to 1 VT installed on the neutral point of a motor or generator (in which case the VT is a power transformer).

Procedure
Connect the generator voltage terminals to the voltage test terminal box, so as to only supply Sepam's residual voltage input

Block diagram
Note: *the number of CTs/VTs connected to the Sepam current/voltage connector phase inputs is given as an example and is not used for the test.*



- turn the generator on
- apply a V-N voltage set to the rated secondary voltage of the neutral pointt VT (i.e. Vnts)
- use the SFT2841 software to check that the measured neutral point voltage Vnt is approximately equal to the rated primary phase-to-neutral voltage of the VTs (i.e. Vnts)
- turn the generator off.

Checking of residual current and residual voltage input connection

Description

Check to be carried out when the residual voltage is delivered by 3 VTs on the secondary circuits connected in an open delta arrangement and when the residual current is obtained by a specific sensor such as:

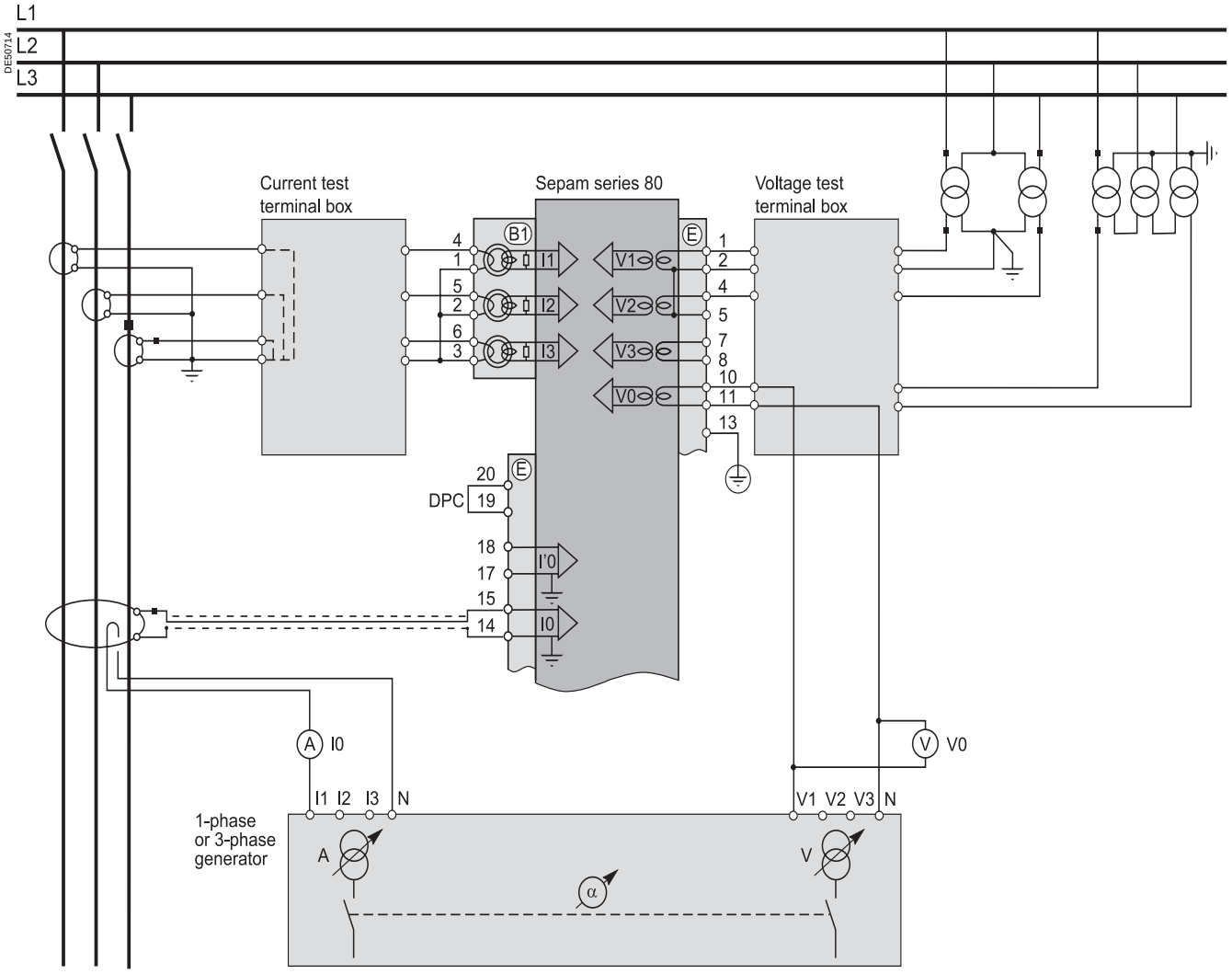
- CSH120 or CSH200 core balance CT
- CSH30 interposing ring CT (whether it is installed on the secondary circuit of a single 1 A or 5 A CT which encompasses the 3 phases, or on the neutral connection of the three 1 A or 5 A phase CTs)
- other core balance CT connected to an ACE990 interface.

Procedure

- connect according to the diagram below:
  - the generator voltage terminals to the voltage test terminal box using the plug provided,
  - a wire between the generator current terminals to inject current into the primary circuit of the core balance CT or CT, with the wire passing through the core balance CT or CT in the P1-P2 direction, with P1 the busbar end and P2 the cable end.

Block diagram

Note: *the number of CTs/VTs connected to the Sepam current/voltage connector phase inputs is given as an example and is not used for the test.*



Sepam series 80 is equipped with 2 independent residual current inputs which may be connected to a core balance CT installed on the cables, tank earthing cable or neutral point of a transformer, or on the earthing cable of a motor or generator. In some cases, reading of the φ0 or φ'0 angle is impossible due to the position of the core balance CT (e.g.: transformer tank earthing cable or neutral point) or because only one of the two I0 or V0 measurements is necessary or possible. When this is the case, simply check the measured residual current value I0 or I'0.

- turn the generator on
- apply a V-N voltage set to the rated secondary voltage of the VTs connected in an open delta arrangement (i.e. Uns/$\sqrt{3}$ or Uns/3)
- inject an I current set to 5 A, and in phase with the voltage applied (i.e. generator phase displacement α(V-N, I) = 0°)
- use the SFT2841 software to check the following:
  - the value indicated for the measured I0 residual current is approximately equal to 5 A
  - the value indicated for the measured V0 residual voltage is approximately equal to the rated primary phase-to-neutral voltage of the VTs (i.e. Vnp = Unp/$\sqrt{3}$)
  - the value indicated for the phase displacement φ0(V0, I0) between the I0 current and V0 voltage is approximatelyequal to 0°
- use the same procedure if the I'0 input is connected. When this is the case, the phase displacement angle to be checked is φ'0(V0, I'0), between the I'0 current and V0 voltage
- turn the generator off.

Checking of phase current input connection
LPCT type current sensors

Reminder

■ The 3 LPCT current sensors are connected via an RJ45 plug to the CCA671 connector which is to be mounted on the rear panel of Sepam, identified as.(B1) and/or(B2)

■ The rated primary current In measured by the LPCT sensors is to be entered as a Sepam general setting and configured by microswitches on the CCA671 connector.

Note: *the connection of only one or two LPCT sensors is not allowed and causes Sepam to go into the fail-safe position.*

Possible combinations of types of sensors

The combinations possible depend directly on the type of Sepam application.

■ Sepam units without ANSI 87T or 87M differential protection functions measure 2 or 3 phase currents by means of sensors wired to connector(B1)

■ Sepam M87 and G87 units with ANSI 87M machine differential protection measure 2 x 3 phase currents:

□ 3 CTs or 3 LPCTs at the circuit breaker end wired to connector(B1)

□ 3 CTs or 3 LPCTs wired to connector (B2)

■ Sepam T87, M88 and G88 units with ANSI 87T transformer differential protection measure 2 x 3 phase currents by means of 2 sets of 3 current transformers:

□ 3 CTs at the circuit breaker end wired to connector(B1)

□ 3 CTs wired to connector (B2).

Sensors connected	Sepam without ANSI 87M or 87T	Sepam with ANSI 87M	Sepam with ANSI 87T
To connector (B1)	2 CTs or 3 CTs to CCA630 or 3 LPCTs to CCA671	3 CTs to CCA630 or 3 LPCTs to CCA671	3 CTs to CCA630
To connector (B2)		3 CTs to CCA630 or 3 LPCTs to CCA671	3 CTs to CCA630

Procedure

The tests to be carried out to check phase current input connections are the same whether the phase currents are measured by CTs or LPCT sensors. Only the Sepam current input connection procedure and current injection values change.

To test current inputs connected to LPCT sensors with a standard injection box, the ACE917 injection adapter is required.

The ACE917 adapter is inserted between:

■ the standard injection box

■ the LPCT test plug:

□ integrated in the Sepam CCA671 connector

□ or transferred by means of the CCA613 accessory.

The ACE917 injection adapter should be set according to the currents selected on the CCA671 connector using the 8-position thumbwheel switch which gives the 8 possible microswitch settings.

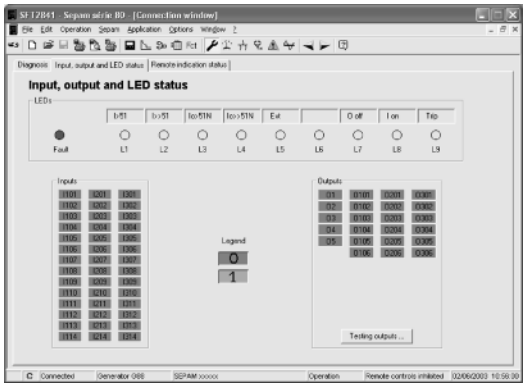
The injection value depends on the rated primary current selected on the CCA671 connector and entered in the Sepam general settings, i.e.:

■ 1 A for the following values (in Amps): 25, 50, 100, 133, 200, 320, 400, 630

■ 5 A for the following values (in Amps): 125, 250, 500, 666, 1000, 1600, 2000, 3150

Checking of logic input and output connection and optional module connection

Checking of logic input connection



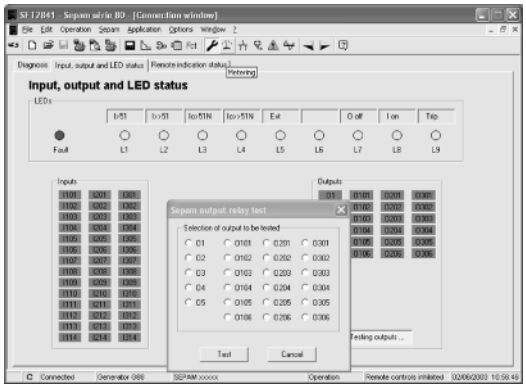
SFT2841: input, output, indicator status.

Procedure

Proceed as follows for each input:

- **if the input supply voltage is present,** use an electric cord to short-circuit the contact that delivers logic data to the input
- **if the input supply voltage is not present,** apply a voltage supplied by the DC voltage generator to the terminal of the contact linked to the chosen input, being sure to comply with the suitable polarity and level
- **observe the change of status of the input** using the SFT2841 software, in the "Input, output, indicator status" screen
- at the end of the test, if necessary, press the SFT2841 Reset key to clear all messages and deactivate all outputs.

Checking of logic output connection



SFT2841: output relay test.

Procedure

Check carried out using the "Output relay test" function, activated via the SFT2841 software, in the "Sepam Diagnosis" screen.
Only output O5, when used for the watchdog, can be tested.
This function requires prior entry of the "Parameter setting" password.

- activate each output relay using the buttons in the SFT2841 software
- the activated output relay changes status over a period of 5 seconds
- observe the change of status of the output relay through the operation of the related switchgear (if it is ready to operate and is powered), or connect a voltmeter to the terminals of the output contact (the voltage cancels itself out when the contact closes)
- at the end of the test, press the SFT2841 Reset key to clear all messages and deactivate all outputs.

Checking of optional module connection

Checking of RTD inputs to the MET148-2 module

The temperature monitoring function provided by Sepam T81, T82, T87, M81, M87, M88, G82, G87, G88 units checks the connection of each RTD that is configured.
An "RTD FAULT" alarm is generated whenever one of the RTDs is detected as being short-circuted or disconnected (absent).
To identify the faulty RTD or RTDs:

- display the temperature values measured by Sepam using the SFT2841 software
- check the consistency of the temperatures measured:
  - the temperature displayed is "****" if the RTD is short-circuited (T < -35 °C)
  - the temperature displayed is "-****" if the RTD is disconnected (T > 205 °C).

Checking of analog output connection to the MSA141 module

- identify the measurement associated by parameter setting to the analog output using the SFT2841 software
- simulate, if necessary, the measurement linked to the analog output by injection
- check the consistency between the value measured by Sepam and the indication given by the device connected to the analog output.

Validation of the complete protection chain

Principle

The complete protection chain is validated during the simulation of a fault that causes tripping of the breaking device by Sepam.

Procedure

- select one of the protection functions that triggers tripping of the breaking device and separately, according to their incidence in the chain, the function or functions related to the programmed or reprogrammed parts of the program logic
- according to the selected function or functions, inject a current and/or apply a voltage that corresponds to a fault
- observe the tripping of the breaking device and the operation of the adapted parts of the program logic.

At the end of all the voltage and current application type checks, put the covers back on the test terminal boxes.

Test sheet
Sepam series 80

Project: **Type of Sepam**

Switchboard: **Serial number**

Cubicle: **Software version** V

Overall checks
Check off the box ☐ when the check has been made and been conclusive

Type of check	
Preliminary general examination, prior to energizing	☐
Energizing	☐
Parameter and protection settings	☐
Logic input connection	☐
Logic output connection	☐
Validation of the complete protection chain	☐
Validation of the customized logical functions	☐
Analog output connection to the MSA141 module	☐
Temperature sensor input connection to the MET148-2 module (for types T81, T82, T87, M81, M87, M88, G82, G87, G88)	☐

Checking of phase current and voltage inputs
Check off the box ☐ when the check has been made and been conclusive

Type of check	Test performed	Result	Display	
Phase current and phase voltage input connection	Secondary injection of CT rated current into (B1), i.e. 1 A or 5 A	Rated primary current of CTs connected to (B1)	I1 = ...	☐
			I2 = ...	☐
			I3 = ...	☐
	Secondary injection of phase voltage (the value to be injected depends on the test being performed)	VT rated primary phase-to-neutral voltage Unp/√3	V1 = ...	☐
			V2 = ...	☐
			V3 = ...	☐
		Phase displacement φ(V, I) ≅ 0°	φ1 = ...	☐
			φ2 = ...	☐
			φ3 = ...	☐
Connection of current inputs for differential applications	Secondary injection of CT rated current into (B1)/(B2), i.e. 1 A or 5 A (1 A if secondary ratings are different)	Primary In (or In/5) of CTs connected to (B1) (depending on secondary ratings)	I1 = ...	☐
			I2 = ...	☐
			I3 = ...	☐
		Primary I'n (or I'n/5) of CTs connected to (B2) (depending on secondary ratings)	I'1 = ...	☐
			I'2 = ...	☐
			I'3 = ...	☐
		Phase displacement θ(I, I') ≅ 0°	θ(I1, I'1) = ...	☐
			θ(I2, I'2) = ...	☐
			θ(I3, I'3) = ...	☐

Tests performed on: .....

By:.....

Signatures

Comments:

.....

.....

.....

Test sheet
Sepam series 80

Project: **Type of Sepam** ☐☐☐

Switchboard: **Serial number** ☐☐☐☐☐☐☐☐☐

Cubicle: **Software version** V☐☐☐☐☐

Overall checks

Check off the box ☐ when the check has been made and been conclusive

Type of check	Test performed	Result	Display	
Residual current input connection	Injection of 5 A into the core balance CT primary circuit	Injected current value I0 and/or I'0	I0 =.....	☐
			I'0 =.....	☐
	When applicable, secondary injection of the rated phase-to-neutral voltage of a phase VT Uns/√3	VT rated primary phase-to-neutral voltage Unp/√3	V0 = ...	☐
		Phase displacement φ0(V0, I0) and/or φ'0(V0, I'0) ≅ 0°	φ0 =.....	☐
			φ'0 =.....	☐
Residual voltage input connection To 3 VTs in open delta arrangement	Secondary injection of the rated voltage of the VTs in an open delta arrangement (Unp/√3 or Unp/3)	VT rated primary phase-to-neutral voltage Unp/√3	V0 = ...	☐
	When applicable, secondary injection of CT rated current, i.e. 1 A or 5 A	CT rated primary current	I0Σ =.....	☐
		Phase displacement φ0Σ(I0, I0Σ)	φ0Σ = ...	☐
To 1 neutral point VT	Secondary injection of the rated voltage of the neutral point VT (Vnts)	VT rated primary phase-to-neutral voltage Vntp	Vnt = ...	☐
Residual current and residual voltage input connection	Injection of 5 A into the core balance CT primary circuit	Injected current value I0 and/or I'0	I0 =.....	☐
			I'0 =.....	☐
	Secondary injection of the rated voltage of the VTs in an open delta arrangement (Unp/√3 or Unp/3)	VT rated primary phase-to-neutral voltage Unp/√3	V0 = ...	☐
		Phase displacement φ0(V0, I0) and/or φ'0(V0, I'0) ≅ 0°	φ0 =.....	☐
			φ'0 =.....	☐

Tests performed on:	**Signatures**
By:	

Comments:

.....

.....

.....

SEPED303003EN_4-MaintenanceTDM.fm Page 75 Mardi, 24. juin 2003 2:19 14

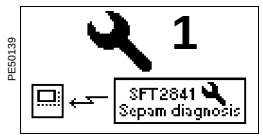
Contents

Troubleshooting assistance **76**

SEPED303003EN_4-Maintenance.fm Page 76 Mardi, 24. juin 2003 2:19 14

Troubleshooting assistance

Fault message on advanced UMI:



Major faults are only cleared after the cause of the fault is corrected and Sepam is switched on again.

Nothing happens when Sepam is switched on

All LEDs off.
Nothing displayed on advanced UMI screen.

There is probably an auxiliary power fault.	
Possible cause	**Action / remedy**
Connector A not plugged in.	Plug in connector A.
Connectors A and E reversed.	Put connectors in correct positions.
Auxiliary power absent.	Check the auxiliary power level (range = 24 V DC to 250 V DC).
Polarities reversed on terminals 1 and 2 of connector A.	Check that the + polarity is on terminal 1 and the – polarity on terminal 2. Correct if necessary.
Internal problem.	Change base unit.

MAJOR fault: Sepam is in fail-safe position

- ON LED on advanced UMI on
- LED on integrated advanced UMI steadily on
- LED on remote advanced UMI flashing
- green LED on rear panel on
- red LED on rear panel steadily on.

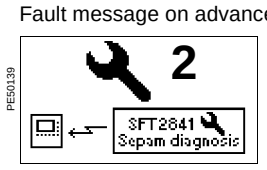
Connection cannot be made with SFT2841	
Possible cause	**Action / remedy**
Memory cartridge absent.	Switch off Sepam. Install the memory cartridge and secure it by tightening the 2 integrated screws. Switch Sepam on again.
Major internal fault.	Change base unit.

Connection can be made with SFT2841	
Possible cause	**Action / remedy**
The hardware configuration is incorrect or incomplete	Use the SFT2841 software, in connected mode, to determine the cause. The SFT2841 Diagnosis screen displays the missing items in red:

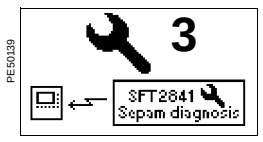
Diagnosis screen	**Possible cause**	**Action / remedy**
CCA630 or CCA671 connector in **B1** or **B2** position displayed in red.	Connector absent.	Install a connector. If the connector is present, check that it is plugged in correctly and held in place by the 2 screws.
	LPCT sensors not connected.	Connect the LPCT sensors.
Connector in position **E** displayed in red.	Connector **E** unplugged or no jumper between terminals 19 and 20.	Plug in the connector correctly. Fit the jumper.
MES120 module in **H1**, **H2** or **H3** position displayed in red.	MES120 module absent.	Install MES120 module. If the MES120 module is present, check that it is plugged in correctly and held in place by the 2 screws. If the fault is still present, replace the module.
SFT2841 indicates major fault, but no missing module.	Base unit internal fault.	Change base unit.

Troubleshooting assistance

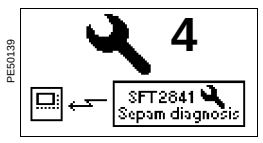
Fault message on advanced UMI:



Fault message on advanced UMI:



Fault message on advanced UMI:



MINOR fault: Sepam is operating in downgraded mode

- ON LED on advanced UMI on
- LED on remote advanced UMI flashing
- green LED on rear panel on
- red LED on rear panel flashing.

Inter-module link fault	
Possible cause	**Action / remedy**
Faulty wiring.	Check remote module connections: RJ45 plugs of CCA77x cords clipped correctly into sockets

MET148 module not available		
LEDs	**Possible cause**	**Action / remedy**
MET148 green and red LEDs off.	Faulty wiring.	Check module connections: RJ45 plugs of CCA77x cords clipped correctly into sockets
MET148 green LED on. MET148 red LED off.	No response from MET148 module.	Check the position of the module number selection jumper: ■ MET1 for first MET148-2 module (temperatures T1 to T8) ■ MET2 for second MET148-2 module (temperatures T9 to T16). ■ If the jumper position needs to be changed, reboot the MET148 module (by disconnecting and reconnecting the interconnection cord).
MET148 red LED flashing.	Faulty wiring, MET148 powered but loss of dialogue with base unit.	Check module connections: RJ45 plugs of CCA77x cords clipped correctly into sockets. If the MET148 module is the last in the chain, check that the line terminating jumper is in the **Rc** position. In all other cases, the jumper should be in the position marked **Rc**.
MET148 red LED steadily on.	More than 3 remote modules connected to connector D1 or D2 on base unit.	Distribute remote modules between D1 and D2.
	MET148 module internal fault.	Change MET148 module.

MSA141 module not available		
LEDs	**Possible cause**	**Action / remedy**
MSA141 green and red LEDs off.	Faulty wiring, MSA141 not powered.	Check module connections: RJ45 plugs of CCA77x cords clipped correctly into sockets.
MSA141 green LED on. MSA141 red LED flashing.	Faulty wiring, MET141 powered but loss of dialogue with base unit.	Check module connections: RJ45 plugs of CCA77x cords clipped correctly into sockets. If the MSA141 module is the last in the chain, check that the line terminating jumper is in the **Rc** position. In all other cases, the jumper should be in the position marked **Rc**.
MSA141 red LED steadily on.	More than 3 remote modules connected to connector D1 or D2 on base unit.	Distribute remote modules between D1 and D2.
	MSA141 module internal fault.	Change MSA141 module.

SEPED303003EN_4-Maintenance.fm Page 78 Mardi, 24. juin 2003 2:19 14

Troubleshooting assistance

Faulty advanced UMI module

- ON LED on advanced UMI on
- LED on advanced UMI steadily on
- advanced UMI display off
- green LED on rear panel on
- red LED on rear panel flashing.

Faulty advanced UMI module	
Possible cause	**Action / remedy**
Module internal fault	Remote advanced UMI module: replace DSM303 module.
	Integrated advanced UMI module: replace base unit.

Alarms

"**METx FAULT**" message.

RTD fault	
Possible cause	**Action / remedy**
An RTD on the MET148 module (x = 1 or 2) is disconnected or short-circuited.	Since the alarm is common to the 8 channels of the module, go the temperature measurement display screen to determine which channel is affected by the fault. Measurement displayed: Tx.x = -**** = RTD disconnected (T > 205 °C) Tx.x = -**** = RTD short-circuited (T < -35 °C)

"**BATTERY LOW**" message.

Battery fault	
Possible cause	**Action / remedy**
Battery low (or absent)	Replace the battery by a 1/2AA format 3.6 V, 0.8 Ah lithium battery, being careful to match the polarities. The recommended batteries are: ■ SAFT model LS14250 ■ SONNENSCHEIN model SL-350/S. Dead batteries are to be disposed of via an authorized and approved circuit .

SEPED303003EN_4-Maintenance.fm Page 79 Mardi, 24. juin 2003 2:19 14

Notes

SEPED303003EN_4-Maintenance.fm Page 80 Mardi, 24. juin 2003 2:19 14

Notes

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