XLPE INSULATED CABLES

tci

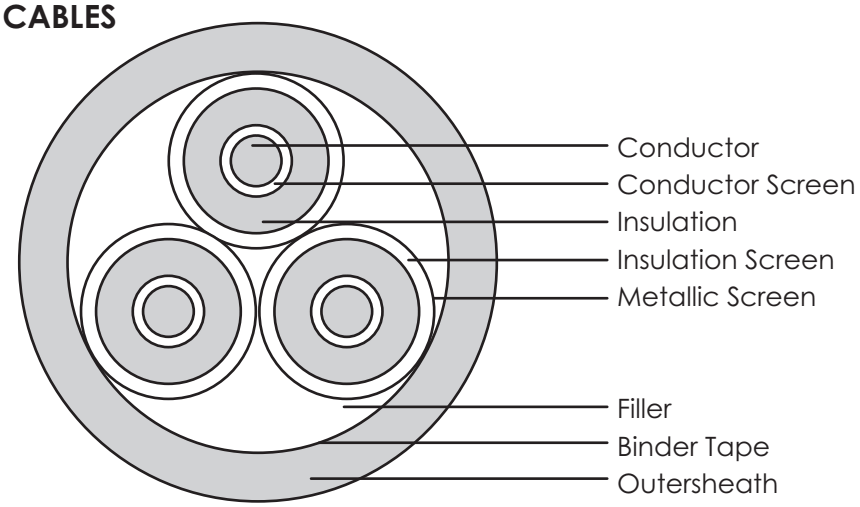
TENAGA CABLE INDUSTRIES SDN. BHD.

Need Power Connections? We Have The Solutions!

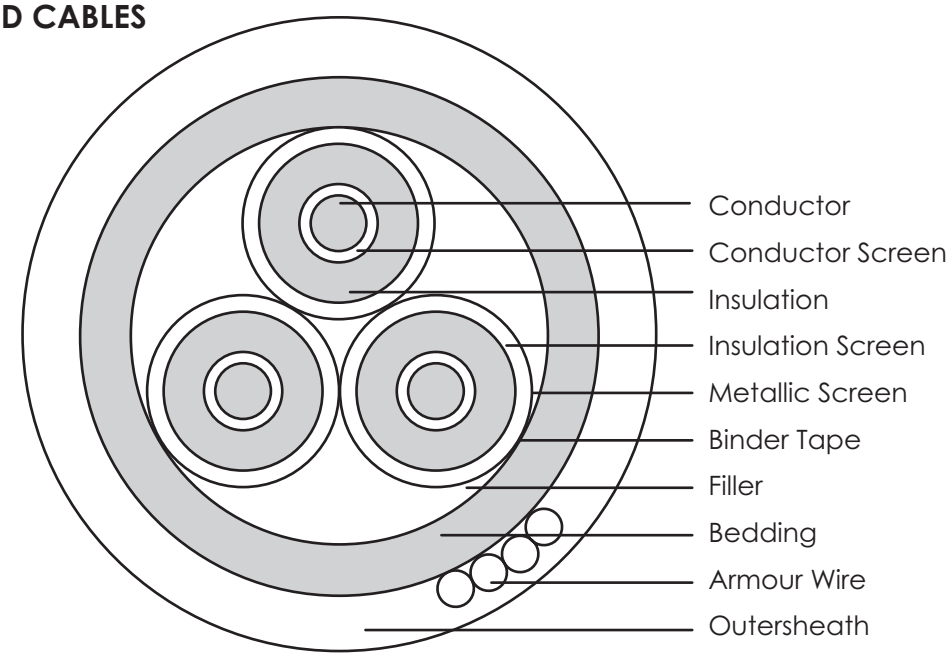
TABLE		REFERENCE	SPECIFICATION
	LOW VOLTAGE XLPE INSULATED POWER CABLES		
1A	Single-Core 600/1000V Unarmoured Cables (Copper Conductor)	12A-1N	BS 5467 / IEC 60502-1
1B	Single-Core 600/1000V Armoured Cables (Copper Conductor)	12A-1A	BS 5467 / IEC 60502-1
2A	Two-Core 600/1000V Unarmoured Cables (Copper Conductor)	12-2N	BS5467 / IEC 60502-1
2B	Two-Core 600/1000V Armoured Cables (Copper Conductor)	12-2S	BS5467 / IEC 60502-1
3A	Three-Core 600/1000V Unarmoured Cables (Copper Conductor)	12-3N	BS5467 / IEC 60502-1
3B	Three-Core 600/1000V Armoured Cables (Copper Conductor)	12-3S	BS5467 / IEC 60502-1
4A	Four-Core 600/1000V Unarmoured Cables (Copper Conductor)	12-4N	BS5467 / IEC 60502-1
4B	Four-Core 600/1000V Armoured Cables (Copper Conductor)	12-4S	BS5467 / IEC 60502-1
4C	Four-Core 600/1000V Armoured Cables (Aluminium Conductor)	T13-4S	BS5467 / IEC 60502-1
4D	Four-Core 600/1000V Copper Tapes Screened Cables (Aluminium Conductor)	T13-4C	TNB Specification
	MEDIUM VOLTAGE XLPE INSULATED POWER CABLES		
5A	Single Core 6kV Unarmoured Cables (Copper Conductor)	TC-6-1-N	TNB Specification
6A	Single Core 11kV Unarmoured Cables (Copper Conductor)	GC-11-1-N	BS 6622 / IEC 60502-2
6B	Single Core 11kV Armoured Cables (Copper Conductor)	GC-11-1-A	BS 6622 / IEC 60502-2
7A	Single Core 11kV Unarmoured Cables (Aluminium Conductor)	GA-11-1-N	BS 6622 / IEC 60502-2
7B	Single Core 11kV Armoured Cables (Aluminium Conductor)	GA-11-1-A	BS 6622 / IEC 60502-2
8	Single Core 11kv Unarmoured Cables (Aluminium Conductor)	TA-11-1-N	TNB Specification
9A	Three Core 11kV Unarmoured Cables (Aluminium Conductor)	GC-11-3-N	BS 6622 / IEC 60502-2
9B	Three Core 11kV Armoured Cables (Copper Conductor)	GC-11-3-S	BS 6622 / IEC 60502-2
10A	Three Core 11kv Unarmoured Cables (Aluminium Conductor)	GA-11-3-N	BS 6622 / IEC 60502-2
10B	Three Core 11kV Armoured Cables (Aluminium Conductor)	GA-11-3-S	BS 6622 / IEC 60502-2
11	Three Core 11kV Armoured Cables (Aluminium Conductor)	TA-11-3-S	TNB Specification
12	Three Core 22kV Armoured Cables (Aluminium Conductor)	GA-22-3-S	BS 6622 / IEC 60502-2
13	Single Core 22kV Unarmoured Cables (Aluminium Conductor)	TA-22-1-N	TNB Specification
14A	Single Core 33kV Unarmoured Cables (Copper Conductor)	GC-33-1-N	BS 6622 / IEC 60502-2
14B	Three Core 33kV Armoured Cables (Copper Conductor)	GC-33-3-S	BS 6622 / IEC 60502-2
15	Single Core 33kV Copper Wire Screened Cables (Aluminium Conductor)	TA-33-1-W	TNB / KLIA Specification
16	Single Core 33kV Copper Wire Screened Cables (Copper Conductor)	TC-33-1-W	TNB / KLIA Specification
17	Single Core 11kV Copper Wire Screened Cables (Copper Conductor)	TC-11-1-W	TNB / KLIA Specification
18	Single Core 11kV Copper Wire Screened Cables (Aluminium Conductor)	TA-11-1-W	TNB / KLIA Specification
19	Single Core 11kV Double-sheathed Cables (Aluminium Conductor)	TA-11-1-DS	TNB Specification
20	Single Core 22kV Double-sheathed Cables (Aluminium Conductor)	TA-22-1-DS	TNB Specification
21	Three Core 11kV Double-sheathed Cables (Aluminium Conductor)	TA-11-3-DS	TNB Specification
22	Triplex 11kV XLPE-Insulated Cables (Aluminium Conductor)	TA-11-3-T	TNB Specification
A	Technical Data For Cable Installation		
A.1	Minimum Bending Radius		
A.2	Maximum Pulling Tension		
A.3	Maximum Side Wall Pressure		
	AERIAL BUNDLED CABLES		
1	Low Voltage Aerial Bundled Cable		
2	11kv Aerial Bundled Cable		
3	33kv Aerial Bundled Cable		

MEDIUM VOLTAGE THREE CORE XLPE INSULATED POWEDR CABLE

UNARMOURED CABLES



ARMOURED CABLES



BASIC CONSTRUCTION

CONDUCTOR	-	COPPER OR ALUMINIUM
CONDUCTOR SHAPE	-	COMPACTED CIRCULAR STRANDED
INSULATION	-	XLPE
BEDDING	-	PVC OR POLYETHYLENE
ARMOUR WIRE	-	GALVANISED STEEL WIRES
SHEATH MATERIAL	-	PVC OR POLYETHYLENE

BS 6622
IEC 60502-2

REFERENCE
GC-11-3-N

MEDIUM VOLTAGE XLPE INSULATED POWER CABLES

TABLE 9A THREE-CORE 11kV UNARMOURED CABLES (COPPER CONDUCTOR)

Nominal Area of Conductors	Thickness of Insulation	Thickness of Outer Sheath	Overall Diameter	Approx. Weight	Electrical Characteristics					
					Current Rating		Conductor Resistance		Reactance at 50Hz	Capacitance
					In Air at 40ºC	In Ground at 25ºC	dc at 20ºC	50Hz at 90ºC		
sq. mm	mm	mm	mm	kg/km	amp	amp	Ω/km	Ω/km	Ω/km	µF/km
16	3.4	2.2	38.7	1660	111	114	1.15	1.47	0.140	0.20
25	3.4	2.2	41.3	2040	123	126	0.727	0.927	0.124	0.22
35	3.4	2.3	43.7	2440	149	153	0.524	0.668	0.116	0.24
50	3.4	2.4	46.4	2910	187	189	0.387	0.493	0.111	0.27
70	3.4	2.5	50.1	3680	230	230	0.268	0.343	0.108	0.30
95	3.4	2.7	54.2	4650	281	270	0.193	0.247	0.100	0.34
120	3.4	2.8	57.6	5530	319	306	0.153	0.196	0.097	0.37
150	3.4	2.9	60.9	6490	366	342	0.124	0.159	0.094	0.40
185	3.4	3.0	64.7	7730	417	387	0.0991	0.128	0.092	0.43
240	3.4	3.1	70.0	9650	485	441	0.0754	0.0984	0.089	0.48
300	3.4	3.3	75.6	11710	553	486	0.0601	0.0797	0.086	0.53
400	3.4	3.5	81.8	14460	629	540	0.0470	0.0639	0.083	0.59

BS 6622
IEC 60502-2

REFERENCE
GC-11-3-S

MEDIUM VOLTAGE XLPE INSULATED POWER CABLES

TABLE 9B THREE-CORE 11kV ARMOURED CABLES (COPPER CONDUCTOR)

Nominal Area of Conductors	Thickness of Insulation	Thickness of Extruded Bedding	Nominal Armour Wire Diameter	Thickness of Outer Sheath	Overall Diameter	Approx. Weight	Electrical Characteristics					
							Current Rating		Conductor Resistance		Reactance at 50Hz	Capacitance
							In Air at 40ºC	In Ground at 25ºC	dc at 20ºC	50Hz at 90ºC		
sq. mm	mm	mm	mm	mm	mm	kg/km	amp	amp	Ω/km	Ω/km	Ω/km	µF/km
16	3.4	1.2	2.0	2.3	47.2	3750	111	114	1.15	1.47	0.140	0.20
25	3.4	1.3	2.5	2.4	50.8	4750	123	126	0.727	0.927	0.124	0.22
35	3.4	1.3	2.5	2.5	53.0	5270	149	153	0.524	0.668	0.116	0.24
50	3.4	1.4	2.5	2.6	55.5	5870	187	189	0.387	0.493	0.111	0.27
70	3.4	1.4	2.5	2.7	59.0	6830	230	230	0.268	0.343	0.108	0.30
95	3.4	1.5	2.5	2.8	62.9	7990	281	270	0.193	0.247	0.100	0.34
120	3.4	1.6	2.5	3.0	66.4	9080	319	306	0.153	0.196	0.097	0.37
150	3.4	1.6	2.5	3.1	69.7	10220	366	342	0.124	0.159	0.094	0.40
185	3.4	1.7	2.5	3.2	73.5	11690	417	387	0.0991	0.128	0.092	0.43
240	3.4	1.8	3.15	3.4	80.2	14990	485	441	0.0754	0.0984	0.089	0.48
300	3.4	1.9	3.15	3.6	85.7	17320	553	486	0.0601	0.0797	0.086	0.53
400	3.4	2.0	3.15	3.8	90.9	20500	629	540	0.0470	0.0639	0.083	0.59

Technical data sheet

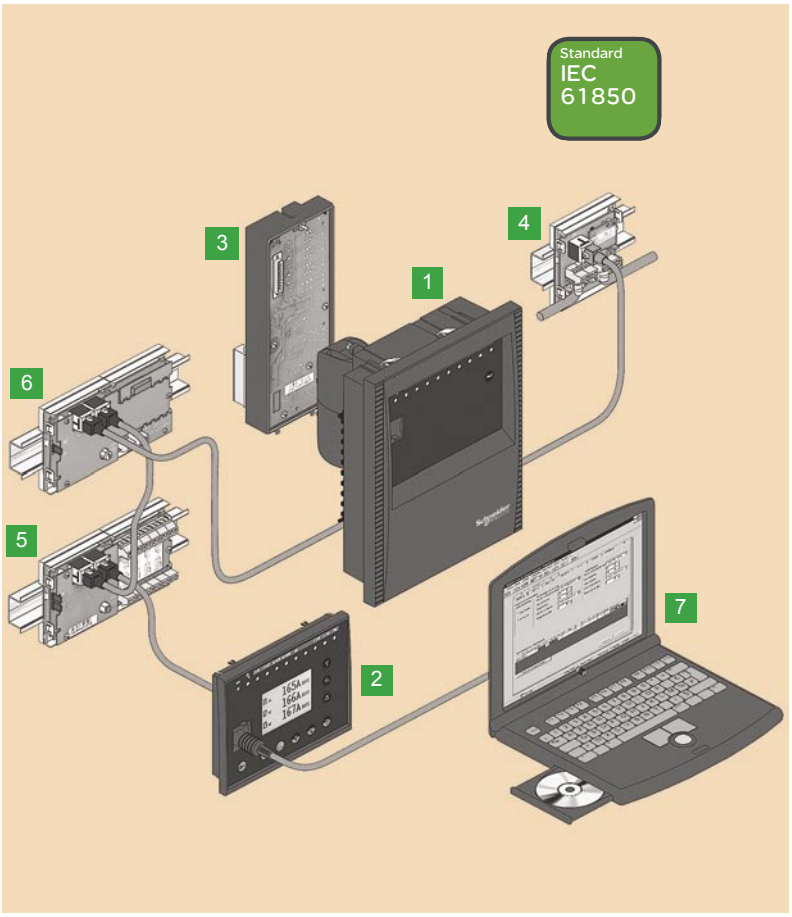
2008

Electrical network protection

Sepam series 40

Sepam *series 40* is a family of *current* and *voltage* digital protection relays, for medium voltage public and industrial distribution networks.

PE50546



Sepam series 40 and its optional modules

1 **Base unit, with various types of User Machine Interfaces (UMI):**
- basic UMI
- advanced UMI with graphical LCD screen.

2 **Remote advanced UMI.**

3 **10 logic inputs and 8 output relays,** 4 outputs on the base unit + 1 optional module providing 10 inputs and 4 outputs.

4 **1 communication port:**
- connection to 1 or 2 S-LAN and/or E-LAN networks
- Modbus, Modbus TCP/IP, IEC60870-5-103, DNP3 and IEC 61850 communication protocols
- RS 485 (2or 4 wire) or fiber optic network.

5 **Temperature data from 16 sensors,** Pt100, Ni100, or Ni120.

6 **1 analog output**, 0-10mA, 4-20mA or 0-20mA.

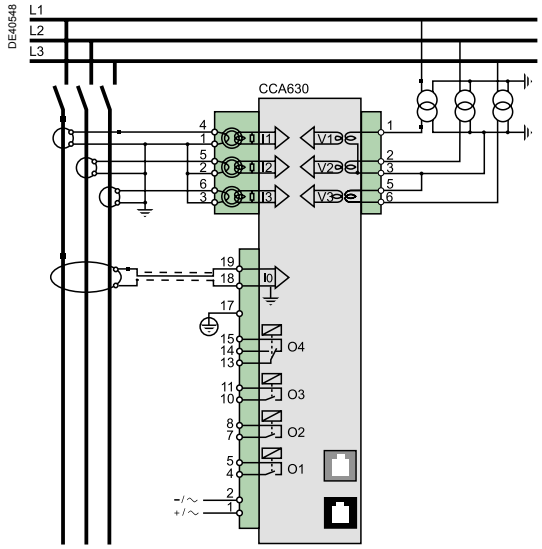
7 **Software tools:**
- Sepam parameter and protection setting and control function customization
- recovery and display of disturbance recording data
- local or remote operation via an E-LAN.

Characteristics

Conformity to standards	
IEC 60255 - Protection relays	
IEC 60529 - Degree of protection	IP52 on front panel
IEC 60068 - Operating temperature	-25°C to +70°C (-13°F to +158°F)
Certifications	
CE, UL508, CSA C22.2	
Auxiliary power supply	
24-250 V DC and 110-240 V AC	
Overall size of base units (H x W x D)	
222 X 176 X 130 mm	

8 types of Sepam *series 40*

- S40, S41, S42, S43: substation incomers and feeders protection
- T40, T42: transformer protection
- M41: motor protection
- G40: generator protection



Protections	ANSI code	S40	S41	S42	S43	T40	T42	M41	G40
Phase overcurrent	50/51	4	4	4	4	4	4	4	4
Voltage restrained overcurrent	50V/51V								1
Earth fault, sensitive earth fault	50N/51N 50G/51G	4	4	4	4	4	4	4	4
Breaker failure	50BF	1	1	1	1	1	1	1	1
Unbalance/negative sequence	46	2	2	2	2	2	2	2	
Directional phase overcurrent	67			2			2		
Directional earth fault	67N/67NC		2	2	2		2	2	
Directional real overpower	32P		1	1	1			1	1
Directional reactive overpower	32Q/40							1	1
Thermal overload	49 RMS					2	2	2	2
Phase undercurrent	37							1	
Locked rotor, excessive starting time	48/51LR/14							1	
Starts per hour	66							1	
Positive sequence undervoltage	27D							2	
Remanent undervoltage	27R							1	
Undervoltage	27/27S	2	2	2		2	2	2	2
Overvoltage	59	2	2	2		2	2	2	2
Neutral voltage displacement	59N	2	2	2		2	2	2	2
Negative sequence overvoltage	47	1	1	1		1	1	1	1
Overfrequency	81H	2	2	2		2	2	2	2
Underfrequency	81L	4	4	4		4	4	4	4
Recloser (4 cycles)	79	□	□	□	□				
Temperature monitoring) (8 or 16 RTDs, 2 set points per RTD	38/49T					□	□	□	□
Thermostat / Buchholz	26/63					□	□		
Metering									
RMS phase current I1,I2,I3, residual current I0		■	■	■	■	■	■	■	■
Average current I1, I2, I3 Peak demand current IM1, IM2, IM3		■	■	■	■	■	■	■	■
Voltage U21, U32, U13, V1, V2, V3 Residual voltage V0		■	■	■	■	■	■	■	■
Positive sequence voltage Vd/rotation direction, Negative sequence voltage Vi		■	■	■	■	■	■	■	■
Frequency		■	■	■	■	■	■	■	■
Real / reactive / apparent power P, Q, S Peak demand real/reactive power PM, QM Power factor		■	■	■	■	■	■	■	■
Calculated real / reactive energy (±W.h, ±var.h)		■	■	■	■	■	■	■	■
Real/reactive energy impulse counter (±W.h, ±var.h)		□	□	□	□	□	□	□	□
Temperature						□	□	□	□
Network and machine diagnosis									
Tripping current TripI1, TripI2, TripI3, TripI0		■	■	■	■	■	■	■	■
Tripping context		■	■	■	■	■	■	■	■
Unbalance ratio/negative sequence current		■	■	■	■	■	■	■	■
Phase shift ϕ0, φ1, φ2, φ3		■	■	■	■	■	■	■	■
Disturbance recording		■	■	■	■	■	■	■	■
Thermal capacity used						■	■	■	■
Remaining operating time before overload tripping						■	■	■	■
Waiting time after overload tripping						■	■	■	■
Running hours counter / operating time						■	■	■	■
Starting current and time								■	
Start inhibit time delay, number of starts before inhibition								■	
Switchgear diagnosis									
Cumulative breaking current		■	■	■	■	■	■	■	■
Trip circuit supervision		□	□	□	□	□	□	□	□
Number of operations, operating time, charging time		□	□	□	□	□	□	□	□
CT/VT supervision		■	■	■	■	■	■	■	■
Control and monitoring	**ANSI code**								
Circuit breaker / contactor control	94/69	■	■	■	■	■	■	■	■
Latching / acknowledgment	86	■	■	■	■	■	■	■	■
Logic discrimination	68	□	□	□	□	□	□	□	□
Switching of group of settings		■	■	■	■	■	■	■	■
Annunciation	30	■	■	■	■	■	■	■	■
Logical equation editor		■	■	■	■	■	■	■	■
Communication port									
Measurement readout		□	□	□	□	□	□	□	□
Remote indication and time tagging of event		□	□	□	□	□	□	□	□
Remote control orders		□	□	□	□	□	□	□	□
Remote setting of protections		□	□	□	□	□	□	□	□
Transfer of disturbance recording data		□	□	□	□	□	□	□	□

■ *standard*, □ *according to parameter settings and optional modules.*
Note: the figures (in the table) give the number of independant protection sets for each protection function.

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Sepam™ Series 80 Protective Relays

Installation Manual

Instruction Bulletin

63230-216-229-B1

Retain for future use.

Merlin Gerin
Square D
Telemecanique

Schneider Electric

Safety Instructions

Safety Symbols and Messages

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

ANSI symbol

IEC symbol

Risk of Electric Shock

The addition of either symbol to a “Danger” or “Warning” safety label on a device indicates that an electrical hazard exists, which will result in death or personal injury if the instructions are not followed.

Safety Alert

This is the safety alert symbol. It is used to alert you to potential personal injury hazards and prompt you to consult the manual. Obey all safety instructions that follow this symbol in the manual to avoid possible injury or death.

Safety Messages

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death, serious injury or property damage.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **could result in** death, serious injury or property damage.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, minor or moderate injury or property damage.

Important Notes

Restricted Liability

Electrical equipment should be serviced and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this manual. This document is not intended as an instruction manual for untrained persons.

Device Operation

The user is responsible for checking that the rated characteristics of the device are suitable for its application. The user is responsible for reading and following the device’s operating and installation instructions before attempting to commission or maintain it. Failure to follow these instructions can affect device operation and constitute a hazard for people and property.

Protective Grounding

The user is responsible for compliance with all the existing international and national electrical codes concerning protective grounding of any device.

FCC Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. This Class A digital apparatus complies with Canadian ICES-003.

The Sepam™ range of protection relays is designed for operating machines, the electrical distribution networks of industrial installations, and utility substations at all levels of voltage. The Sepam™ family includes:

- *Sepam™ Series 20*
- *Sepam™ Series 40*
- *Sepam™ Series 80*

to cover all needs, from the simplest to the most complete.

PE50278

Sepam™ Series 80 with integrated advanced UMI

Note : *For technical support, contact (615) 287-3400 or go to www.powerlogic.com*

Sepam™ Series 80: Intelligent Solutions for Custom Applications

Specially designed for demanding customers on large industrial sites, Sepam™ Series 80 provides proven solutions for electrical distribution and machine protection

Main Characteristics

The Sepam™ Series 80 offers these features:

- protects closed ring networks or networks with parallel mains by means of directional protection and logic discrimination
- directional ground fault protection for impedance-grounded and isolated or compensated neutral systems
- complete protection of transformers and machine-transformer units
  - stable, sensitive differential protection with neural network restraint
  - linked to all necessary backup protection functions
- complete protection of motors and generators
  - against internal faults:
    - stable, sensitive machine differential protection, with starting and sensor loss restraint
    - field loss, stator ground fault
  - against network and process faults: pole slip, speed control, inadvertent energization
- sync-check between two networks before tie breaker
- measurement of harmonic distortion, current and voltage, to assess network power quality
- 42 inputs / 23 outputs for comprehensive equipment control
- mimic-based UMI for local switchgear control
- SFT2841 parameter setting and operating software, a simple and complete tool that is indispensable for all Sepam™ users:
  - assisted preparation of parameter and protection settings
  - complete information during commissioning
  - remote equipment management and diagnostics during operation
- logic equation editor built into the SFT2841 software to adapt the predefined control functions
- optional SFT2885 programming software (Logipam), to program specific control and monitoring functions
- two communication ports to integrate Sepam™ in two different networks or redundant architectures
- removable memory cartridge to get equipment in operation again quickly after the replacement of a faulty base unit
- battery backup to save historical and disturbance recording data

Selection Guide

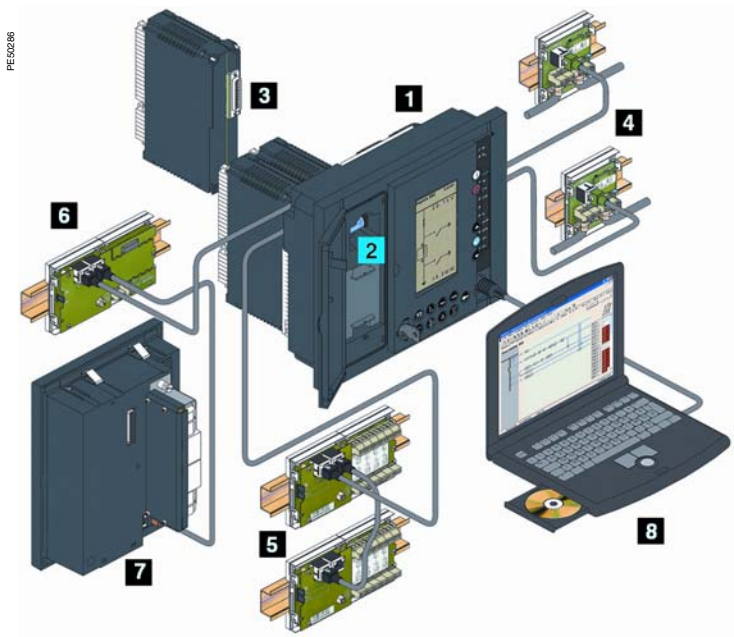
The Sepam™ Series 80 family includes 16 types to offer the right solution for each application.

Specific Protection Functions Available	Applications					
	Substation	**Transformer**	**Motor**	**Generator**	**Bus**	**Capacitor**
Non-directional phase and ground faults	S80				B80	
Directional ground fault	S81	T81	M81			
Directional ground fault and phase overcurrent	S82	T82		G82		
Check on 3-phase voltages on two sets of buss					B83	
Rate of change of frequency	S84					
Capacitor bank unbalance						C86
Transformer or machine differential		T87	M87	G87		
Machine-transformer unit differential			M88	G88		

Introduction
Modular Architecture

Flexibility and Upgrading Capability

The user can add optional modules to Sepam™ at any time for increased functionality. This gives Sepam™ exceptional versatility, adapting to as many situations as possible, and allowing for future installation upgrade,



1 Base unit, with different types of User Machine Interfaces (UMI):
- integrated mimic-based UMI
- integrated or remote advanced UMI

2 Parameter and protection settings saved on removable memory cartridge.

3 42 logic inputs and 23 output relays
with three optional modules providing 14 inputs and 6 outputs.

4 Two independent communication ports
- direct connection to 2-wire RS485, 4-wire RS 485 and fiber optic networks
- connection to Ethernet TCP/IP network via PowerLogic Ethernet server (Transparent Ready™)

5 Processing of data from 16 temperature sensors,
Pt100, Ni100, or Ni120.

6 1 low level analog output,
0-10 mA, 4-20 mA or 0-20 mA

7 Sync-check module

8 Software tools:
- Sepam™ parameter and protection setting, and predefined control functions adaptation
- local or remote installation operation
- programming specific functions (Logipam)
- retrieval and display of disturbance recording data

Easy Installation

- light, compact base unit
- easy to integrate due to Sepam's adaptation capabilities:
  - universal supply voltage and logic inputs: 24 to 250 V DC
  - phase currents may be measured by 1A or 5A current transformers, or LPCT (Low Power Current Transducer) type sensors
  - residual current calculated or measured by a choice of methods to fit requirements
- the same, easy-to-install remote modules for all Sepam™ units:
  - mounted on DIN rail
  - connected to the Sepam™ base unit by prefabricated cables

Commissioning Assistance

- predefined functions implemented by simple parameter setting
- user-friendly, powerful SFT2841 PC setting software tool used on all Sepam™ units to provide users with all the possibilities offered by Sepam™.

Intuitive Use

- integrated or remote advanced User Machine Interface (UMI) installed in the most convenient place for the facility manager
- integrated mimic-based User Machine Interface for local control of switchgear
- user-friendly User Machine Interface, with direct access to data
- clear graphic LCD display of all data required for local operation and installation diagnosis
- working language may be customized to be understood by all users

Introduction
Selection Table

		Substation				Transformer			Motor			Generator			Bus		Cap.
Protection	**ANSI Code**	**S80**	**S81**	**S82**	**S84**	**T81**	**T82**	**T87**	**M81**	**M87**	**M88**	**G82**	**G87**	**G88**	**B80**	**B83**	**C86**
Phase overcurrent (1)	50/51	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Ground fault / Sensitive ground fault (1)	50N/51N 50G/51G	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Breaker failure	50BF	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Negative sequence / unbalance	46	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Thermal overload for cables	49RMS		2	2	2												
Thermal overload for machines (1)	49RMS					2	2	2	2	2	2	2	2	2			
Thermal overload for capacitors	49RMS																2
Capacitor bank unbalance	51C																8
Restricted ground fault	64REF					2	2	2				2		2			
Two-winding transformer differential	87T							1			1			1			
Machine differential	87M									1			1				
Directional phase overcurrent (1)	67			2	2		2	2				2	2	2			
Directional ground fault (1)	67N/67NC		2	2	2	2	2	2	2	2	2	2	2	2			
Directional active overpower	32P		2	2	2	2	2	2	2	2	2	2	2	2			
Directional reactive overpower	32Q								1	1	1	1	1	1			
Directional active underpower	37P				2							2					
Phase undercurrent	37								1	1	1						
Excessive starting time, locked rotor	48/51LR								1	1	1						
Starts per hour	66								1	1	1						
Field loss (underimpedance)	40								1	1	1	1	1	1			
Pole slip	78PS								1	1	1	1	1	1			
Overspeed (2 set points) (2)	12								□	□	□	□	□	□			
Underspeed (2 set points) (2)	14								□	□	□	□	□	□			
Voltage-restrained overcurrent	50V/51V											2	2	2			
Underimpedance	21B											1	1	1			
Inadvertent energization	50/27											1	1	1			
Third harmonic undervoltage / 100 % stator ground fault	27TN/64G2 64G											2	2	2			
Overfluxing (V / Hz)	24							2				2	2	2			
Positive sequence undervoltage	27D	2	2	2	4	2	2	2	2	2	2	2	2	2	4	4	4
Remanent undervoltage	27R	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Undervoltage (L-L or L-n)	27	4	4	4	2	4	4	4	4	4	4	4	4	4	2	2	2
Overvoltage (L-L or L-n)	59	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Neutral voltage displacement	59N	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Negative sequence overvoltage	47	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Overfrequency	81H	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Underfrequency	81L	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Rate of change of frequency	81R				2												
Recloser (4 shots) (2)	79	□	□	□	□												
Thermostat / Sudden pressure (2)	26/63					□	□	□	□		□	□		□			
Temperature monitoring (16 RTDs) (3)	38/49T					□	□	□	□	□	□	□	□	□			□
Sync-check (4)	25	□	□	□	□	□	□	□				□	□	□	□	□	
Control and Monitoring																	
Circuit breaker / contactor control	94/69	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Automatic transfer (AT) (2)		□	□	□	□	□	□	□				□	□	□	□	□	
Load shedding / automatic restart									■	■	■						
De-excitation	41											■	■	■			
Genset shutdown												■	■	■			
Capacitor step control (2)																	□
Logic discrimination (2)	68	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Latching / acknowledgement	86	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Annunciation	30	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Switching of groups of settings		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Adaptation using logic equations		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Logipam programming (Ladder language)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

The figures indicate the number of relays available for each protection function.
■ *standard,* □ *options.*
(1) *Protection functions with two groups of settings.*
(2) *According to parameter setting and optional MES120 input/output modules.*
(3) *With optional MET1482 temperature input modules.*
(4) *With optional MCS025 sync-check module.*

Introduction
Selection Table

		Substation				Transformer			Motor			Generator			Bus		Cap.
Metering		**S80**	**S81**	**S82**	**S84**	**T81**	**T82**	**T87**	**M81**	**M87**	**M88**	**G82**	**G87**	**G88**	**B80**	**B83**	**C86**
Phase current Ia, Ib, Ic RMS		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Measured residual current Ir, calculated IrΣ		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Demand current Ia, Ib, Ic		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Peak demand current Iamax, Ibmax, Icmax		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Measured residual current I'r		■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Voltage Vab, Vbc, Vca, Van, Vbn, Vcn		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Residual voltage Vr		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Positive sequence voltage V1 / rotation direction		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Negative sequence voltage V2		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Frequency f		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Active power P, Pa, Pb, Pc		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Reactive power Q, Qa, Qb, Qc		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Apparent power S, Sa, Sb, Sc		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Peak demand power Pmax, Qmax		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Power factor pf		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Calculated active and reactive energy (±Wh, ±VARh)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Active and reactive energy by pulse counting (2) (± Wh, ± VARh)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Phase current I'a, I'b, I'c RMS								■		■	■		■	■			
Calculated residual current I'rΣ								■		■	■		■	■			
Voltage V'ab, V'an and frequency															■		
Voltage V'ab, V'bc, V'ca, V'an, V'bn, V'cn, V'1, V'2, and frequency																■	
Residual voltage V'r																■	
Temperature (16 RTDs) (3)						□	□	□	□	□	□	□	□	□			□
Rotation speed (2)									□	□	□	□	□	□			
Neutral point voltage Vnt									■	■	■	■	■	■			
Network and Machine Diagnosis																	
Tripping context		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Tripping current TripIa, TripIb, TripIc		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase fault and ground fault trip counters		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Unbalance ratio / negative sequence current I2		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Harmonic distortion (thD), current (Ithd), and voltage (Vthd)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase displacement φr, φ'r, φrΣ		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Phase displacement φa, φb, φc		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Disturbance recording		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Thermal capacity used			■	■	■	■	■	■	■	■	■	■	■	■			■
Remaining operating time before overload tripping			■	■	■	■	■	■	■	■	■	■	■	■			■
Waiting time after overload tripping			■	■	■	■	■	■	■	■	■	■	■	■			■
Running hours counter / operating time						■	■	■	■	■	■	■	■	■			■
Starting current and time									■	■	■						
Start block time									■	■	■						
Number of starts before blocking									■	■	■						
Unbalance ratio / negative sequence current I'2								■		■	■		■	■			
Differential current Idiffa, Idiffb, Idiffc								■		■	■		■	■			
Through current Ita, Itb, Itc								■		■	■		■	■			
Current phase displacement θ								■		■	■		■	■			
Apparent positive sequence impedance Z1			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Apparent phase-to-phase impedances Zab Zbc, Zac			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Third harmonic voltage, neutral point (VntH3) or residual (VrH3)												■	■	■			
Difference in amplitude, frequency and phase of voltages compared for sync-check (4)		□	□	□	□	□	□	□				□	□	□	□	□	
Capacitor unbalance current and capacitance																	■
Switchgear Diagnosis	**ANSI Code**																
CT / VT supervision	60/60FL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Trip circuit supervision (2)	74	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Auxiliary power supply monitoring	27DC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Cumulative breaking current		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Number of operations, operating time, charging time, number of racking out operations (2)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Modbus, IEC 60870-5-103 or DNP3 Communication																	
Measurement readout (4)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Remote indication and time tagging of events (4)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Remote control commands (4)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Remote protection setting (4)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Transfer of disturbance recording data (4)		□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□

■ *standard,* □ *options.*

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

(3) *With optional MET1482 temperature input modules.*

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

(5) *With ACE9492, ACE959, ACE937, ACE969TP or ACE969FO communication interface.*

Weight					
		Base Unit with Advanced UMI		**Base Unit with Mimic-Based UMI**	
Minimum weight (base unit without MES120 I/O module)		5.29 lb (2.4 kg)		6.61 lb (3.0 kg)	
Maximum weight (base unit with 3 MES120 I/O modules)		8.82 lb (4.0 kg)		10.1 lb (4.6 kg)	
Sensor Inputs					
Phase Current Inputs		**1A or 5A CT**			
Input impedance		< 0.02 Ω			
Burden		< 0.02 VA (1 A CT) < 0.5 VA (5 A CT)			
Continuous thermal withstand		4 I_N (1)			
1 second overload		100 I_N (1)			
Voltage Inputs		**Phase**		**Residual**	
Input impedance		> 100 kΩ		> 100 kΩ	
Burden		< 0.015 VA (100 V VT)		< 0.015 VA (100 V VT)	
Continuous thermal withstand		240 V		240 V	
1-second overload		480 V		480 V	
Isolation of inputs from other isolated groups		Enhanced		Enhanced	
Relay Outputs					
Control Relay Outputs O1 to O4 and Ox01 (2)					
Voltage	DC	24/48 V DC	127 V DC	250 V DC	
	AC (47.5 to 63 Hz)				100 to 240 V AC
Continuous current		8 A	8 A	8 A	8 A
Breaking capacity	Resistive load	8 A / 4 A	0.7 A	0.3 A	
	Load L/R < 20	6 A / 2 A	0.5 A	0.2 A	
	Load L/R < 40 ms	4 A / 1 A	0.2 A	0.1 A	
	Resistive load				8 A
	Load p.f. > 0.3				5 A
Making capacity		30 A for 200 ms(2)			
Isolation of outputs from other isolated groups		Enhanced			
Annunciation Relay Output O5 and Ox02 to Ox06					
Voltage	DC	24/48 V DC	127 V DC	250 V DC	
	AC (47.5 to 63 Hz)				100 to 240 V AC
Continuous current		2 A	2 A	2 A	2 A
Breaking capacity	Load L/R < 20 ms	2 A / 1 A	0.5 A	0.15 A	
	Load p.f. > 0.3				1 A
Isolation of outputs from other isolated groups		Enhanced			
Power Supply					
Voltage		24 to 250 V DC	–20 % / +10 %		
Maximum burden		< 16 W			
Inrush current		< 10 A 10 ms			
Acceptable ripple content		12 %			
Acceptable momentary outages		100 ms			
Battery					
Format		1/2 AA lithium 3.6 V			
Service life		10 years, if Sepam™ is energized			
		8 years, if Sepam™ is not energized			

***(1) I_N** = primary CT rating*
***(2)** Relay outputs complying with clause 6.7 of ANSI standard C37.90 (30 A, 200 ms, 2000 operations).*

Introduction
Environmental Characteristics

Electromagnetic Compatibility	Standard	Level / Class	Value
Emission Tests			
Disturbing field emission	IEC 60255-25		
	EN 55022	A	
Conducted disturbance emission	IEC 60255-25		
	EN 55022	A	
Immunity Tests – Radiated Disturbances			
Immunity to radiated fields	ANSI C37.90.2 (1995)		35 V/m; 25 MHz - 1 GHz
	IEC 60255-22-3		10 V/m; 80 MHz - 1 GHz
	IEC 61000-4-3	III	10 V/m; 80 MHz - 2 GHz
Electrostatic discharge	ANSI C37.90.3		8 kV air; 4 kV contact
	IEC 60255-22-2		8 kV air; 6kV contact
Immunity to magnetic fields at network frequency	IEC 61000-4-8	4	30 A/m (continuous) - 300 A/m (1 - 3 s)
Immunity Tests – Conducted Disturbances			
Immunity to conducted RF disturbances	IEC 60255-22-6	III	10 V
Fast transient bursts	ANSI C37.90.1		4 kV; 2.5 kHz
	IEC 60255-22-7	A and B	4 kV; 2.5 kHz / 2 kV; 5 kHz
	IEC 61000-4-4	IV	4 kV; 2,5 kHz
1 MHz damped oscillating wave	ANSI C37.90.1		2.5 kV; 2.5 kHz
	IEC 60255-22-1		2.5 kV CM; 1 kV DM
Surges	IEC 61000-4-5	III	2 kV CM; 1 kV DM
Voltage interruptions	IEC 60255-11		100 % during 100 ms
Hardware Parameters	**Standard**	**Level / Class**	**Value**
In Operation			
Vibrations	IEC 60255-21-1	2	1 Gn; 10 Hz - 150 Hz
	IEC 60068-2-6	Fc	2 Hz - 13.2 Hz ; a = ±1 mm
Shocks	IEC 60255-21-2	2	10 Gn / 11 ms
Earthquakes	IEC 60255-21-3	2	2 Gn (horizontal axes)
			1 Gn (vertical axes)
De-Energized			
Vibrations	IEC 60255-21-1	2	2 Gn; 10 Hz - 150 Hz
Shocks	IEC 60255-21-2	2	27 Gn / 11 ms
Jolts	IEC 60255-21-2	2	20 Gn / 16 ms
Climate Variables	**Standard**	**Level / Class**	**Value**
In Operation			
Exposure to cold	IEC 60068-2-1	Ad	–25°C (–13°F)
Exposure to dry heat	IEC 60068-2-2	Bd	+70°C (+158°F)
Continuous exposure to damp heat	IEC 60068-2-78	Cab	10 days; 93 % RH; 40°C (104°F)
Salt mist	IEC 60068-2-52	Kb/2	6 days
Influence of corrosion/2-gas test	IEC 60068-2-60		21 days; 75 % RH; 25°C (77°F); 0.5 ppm H_2S; 1 ppm SO_2
Influence of corrosion/4-gas test	IEC 60068-2-60		21 days; 75 % RH; 25°C (77°F); 0.01 ppm H_2S; 0.2 ppm SO_2; 0.2 ppm NO_2; 0.01 ppm Cl_2
In Storage (1)			
Temperature variation with specified variation rate	IEC 60068-2-14	Nb	–25°C to +70°C (–13°F to +158°F); 5°C/min
Exposure to cold	IEC 60068-2-1	Ab	–25°C (–13°F)
Exposure to dry heat	IEC 60068-2-2	Bb	+70°C (+158°F)
Continuous exposure to damp heat	IEC 60068-2-78	Cab	56 days; 93 % RH; 40°C (104°F)
	IEC 60068-2-30	Db	6 days; 95 % RH; 55°C (131°F)
Safety	**Standard**	**Level / Class**	**Value**
Enclosure Safety Tests			
Front panel tightness	IEC 60529	IP52	Other panels IP20
	NEMA	Type 12	
Fire withstand	IEC 60695-2-11		650°C (1200°F) with glow wire
Electrical Safety Tests			
1.2/50 µs impulse wave	IEC 60255-5		5 kV (2)
Power frequency dielectric withstand	ANSI C37.90		1 kV 1 min (indication output) 1.5 kV 1 min (control output)
	IEC 60255-5		2 kV 1 min (3)
Certification		**European Directives:**	
CE	EN 50263 harmonized standard	89/336/EEC Electromagnetic Compatibility (EMC) Directive ■ 92/31/EEC Amendment ■ 93/68/EEC Amendment 73/23/EEC Low Voltage Directive ■ 93/68/EEC Amendment	
UL	UL508 - CSA C22.2 no. 14-95		File E212533
CSA	CSA C22.2 no. 14-95 / no. 94-M91 / no. 0.17-00		File 210625

(1) *Sepam™ must be stored in its original packing.*
(2) *Except for communication: 3 kV in common mode and 1 kV in differential mode.*
(3) *Except for communication: 1 kVrms.*

Introduction
Precautions

Follow the instructions in this document for proper installation of your Sepam™ unit:

- *Equipment identification*
- *Assembly*
- *Connecting current, voltage, and sensor inputs*
- *Power supply connection*
- *Checking prior to commissioning*

Handling, Transport, and Storage

Sepam™ in its Original Packaging

Transport:
Sepam™ can be shipped to any destination by all usual means of transport without taking any additional precautions.

Handling:
Normal handling procedures apply to Sepam™. Under normal care Sepam™ can withstand being dropped by a person standing at floor-level.

Storage:
You can store Sepam™ in its original packaging in an appropriate location (preferably a cool, dry environment) for several years. Keep the original packaging as long as possible. Sepam™, like all electronic units, cannot be stored in damp environments for more than a month. Storage characteristics are as follows:

- Temperature from –25°C to +70°C (–13°F to +158°F)
- Humidity ≤ 90%.

Annual periodic inspections of the environment and equipment are recommended. Sepam™ should be placed into service as soon as possible after it has been unpacked.

Sepam™ Installed in a Cubicle

Transport:
Transport Sepam™ by normal means. Monitor storage conditions for long periods of transport.

Handling:
Visually inspect for damage and test Sepam™ if the unit is dropped.

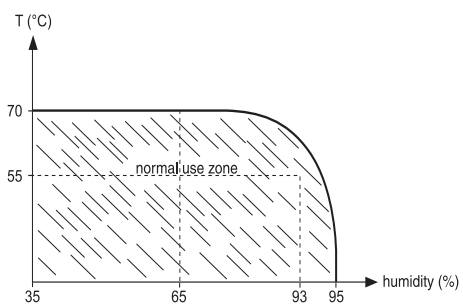
Storage:
Store Sepam™ in a cool, dry environment. If damp conditions exist, place it into service and energize as soon as possible. If this is not possible, cubicle storage conditions must be modified.

Environment of the Installed Sepam™

Operation in a Damp Environment
Temperature and relative humidity factors must be compatible with the unit's environmental operating and storage characteristics. If conditions for use fall outside the normal operating range of the equipment, make all special arrangements necessary to manage and control Sepam™'s operating environment prior to commissioning.

Operation in a Contaminated Atmosphere
A contaminated industrial atmosphere (such as the presence of chlorine, hydrofluoric acid, sulfur, solvents) can corrode electronic components. Sepam™ is certified Level C according to IEC 60068-2-60 standard under the following test conditions:

- 2-gas test: 21 days, 25°C (77°F), 75% relative humidity, 0.5 ppm H_2S, 1 ppm SO_2
- 4-gas test: 21 days, 25°C (77°F), 75% relative humidity, 0.01 ppm H_2S, 0.2 ppm SO_2, 0.2 ppm NO_2, 0.01 ppm Cl_2



Environmental control arrangements should be made (such as pressurized premises with filtered air, etc.) as necessary before commissioning.

Equipment Identification

Package Contents

The following items are packaged separately with each Sepam™:

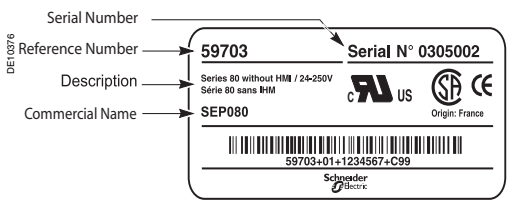
- One Sepam™ Series 80 base unit, with memory cartridge and two connectors Ⓐ and Ⓔ tightened
- One or two CCA 630s (or CCA634s) for CTs
  - or CCA671 for LPCTs
  - OR CCT640 for extra VTs
- Two 20-point ring lug type terminal blocks (CCA620) for control power, ground sensor input, and four main unit outputs
- One battery
- Eight spring clips
- One terminal block identification label
- Instruction materials (see below)

Optional accessories such as modules, current input connectors, and cables are delivered in separate packages.

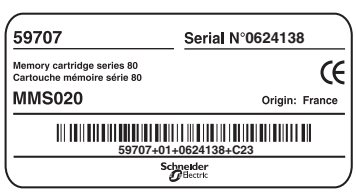
Note : *Sepam™ SFT2841 software ships separately, even if it is ordered at the same time.*

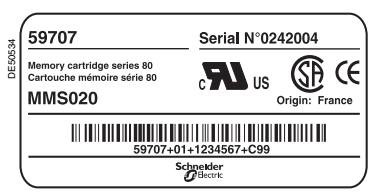
Identification of the Base Unit

To identify a Sepam™, inspect the three labels located behind the front door of the panel board. A base unit hardware label is on the back of the door.



The two labels below are mounted on the cartridge:



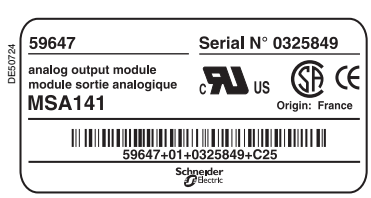


Cartridge hardware reference label

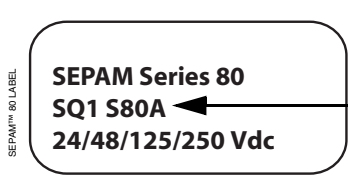
The software reference label identifies the specific application and working language.

Accessory Identification

Accessories — such as optional modules, current or voltage connectors and connection cables — come in separate packages and are identified by labels.



MSA141 Module Identification Label Example



Label for units sold in US

A 4-alpha suffix denotes a deviation from one or more of these standard features:

- Second language = US English*
- Connection for current input
- Terminal blocks for A and E for ring lugs (see diagram on page 16)

For example, SQM87A-UFLR has one LPCT connector

Note : *The second language will be US English; the default language will be UK English*

Instruction Materials

Your Sepam™ Series 80 base unit is shipped with the following instruction documents:

- *Sepam™ Series 80: Installation, Use, Commissioning and Maintenance Manual* (this bulletin), reference number 63230-216-229 (for North American users)
- *Sepam™ Series 80: Quick Start,* reference number 63230-216-234
- *Contact Sheet/Registration Card*, number 63220-060-79

The following documents are available online at www.powerlogic.com:

- This guide
- *Sepam™ Series 80: Metering, Protection, Control and Monitoring Guide,* reference number 63230-216-230 (for North American users)
- *Sepam™ Series 80: Modbus Communication,* reference number 63230-216-231 (for North American Users)
- *DNP3 Communication Manual*, reference number 63230-216-236
- *IEC 60870-5-103 Communication Manual*, reference number 63230-216-237
- *Sepam™ Family Catalog*, reference number 63230-216-238

Sepam™ Series 80 Equipment List
Main Units

⚠ CAUTION

LOSS OF PROTECTION
If dc control power is used, a backup power source is recommended to supply control power to the Sepam™ Series 80 during a power outage.

Failure to observe this precaution can cause the Series 80 to become inoperative if primary control power is lost.

U.S. Catalog*	Description**
SQ1 S80 A	S80 (substa) adv UMI 24-250 Vdc
SQ1 S81 A	S81 (substa) adv UMI 24-250 Vdc
SQ1 S82 A	S82 (substa) adv UMI 24-250 Vdc
SQ1 T81 A	T81 (transformer) adv UMI 24-250 Vdc
SQ1 T82 A	T82 (transformer) adv UMI 24-250 Vdc
SQ1 M81 A	M81 (motor) adv UMI 24-250 Vdc
SQ1 G82 A	G82 (generator) adv UMI 24-250 Vdc
SQ1 M87 A	M87 (motor) adv UMI 24-250 Vdc
SQ1 G87 A	G87 (generator) adv UMI 24-250 Vdc
SQ1 T87 A	T87 (transformer) adv UMI 24-250 Vdc
SQ1 M88 A	M88 (motor) adv UMI 24-250 Vdc
SQ1 G88 A	G88 (generator) adv UMI 24-250 Vdc
SQ1 S84 A	S84 (substa) adv UMI 24-250 Vdc
SQ1 B80 A	B80 (bus) adv UMI 24-250 Vdc
SQ1 B83 A	B83 (bus) adv UMI 24-250 Vdc
SQ1 C86 A	C86 (capbank) adv UMI 24-250 Vdc

**** Suffix:***
A - *includes LCD display, LEDs, PBs, front port in advanced User Machine Interface (UMI(*
P - *larger mimic-based LCD display, LEDs, PBs, front port in "Pro" UMI*
B - *receives no UMI. Requires remote display DSM303 for local panel UMI*

***** Application***
Application features may be found in "Selection Table", page 5 of this manual.

Sepam™ Series 80 Equipment List
Accessories

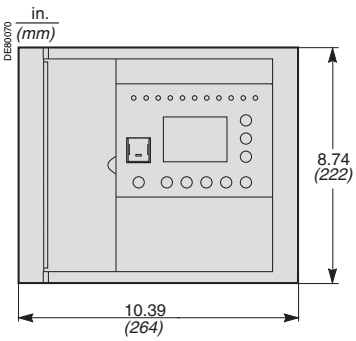
U.S. Catalog	Description
DSM303	Remote advanced UMI module
AMT880	Sepam™ Series 80 mounting plate
CCA630	Connector for 1A / 5A CT current sensors
CCA634	Connector for 1A / 5A + Ir Current Transformer (CT) current sensors
CCT640	Connector for VT voltage sensors
	Working language English/French
	Working language English/Spanish
SFT080	Logipam option
MCS025	Sync-check module
MES120	14 input + 6 output module / 24-250 V DC
MES120G	14 input + 6 output module / 220-250 V DC
MES120H	14 input + 6 output module / 110-125 V DC
ACE969TP	2-wire RS485 multi-protocol interface (Modbus, DNP3 or IEC 60870-5-103)
ACE969FO	Fiber-optic multi-protocol interface (Modbus, DNP3 or IEC 60870-5-103)
CSH30	Interposing ring CT for Ir input
CSH120	Residual current sensor, diameter 4.75 in (120 mm)
CSH200	Residual current sensor, diameter 7.87 in (200 mm)
AMT852	Lead sealing accessory
MET1482	8-temperature sensor module
ACE949	2-wire RS485 network interface
ACE959	4-wire RS485 network interface
ACE937	Ffiber optic interface
ACE969FO	T/P and F/O
ACE969TP	T/P and T/P
MSA141	1 analog output module
ACE9092	RS485/RS232 convertor
ACE919 AC	RS485/RS485 interface (AC power supply)
ACE919 DC	RS485/RS485 interface (DC power supply)
CCA770	Remote module cable, L = 2 ft (0.6 m)
CCA772	Remote module cable, L = 6.6 ft (2 m)
CCA774	Remote module cable, L = 13.1 fr (4 m)
CCA783	PC connection cable
CCA613	Remote LPCT test plug
ACE917	LPCT injection adapter
AMT840	MCS025 mounting plate
ACE990	Zero sequence CT interface for Ir input
SFT2841CD	CD-ROM with SFT2841 and SFT2826 software (without CCA83 cable)
CD SFT2885	CD-ROM with Logipam software
AMT820	Blanking plate

Sepam™ Series 80 Equipment List
Replacement Equipment

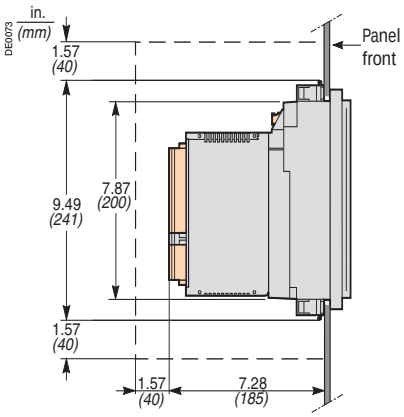
U.S. Catalog	Description
CCA671	Connector for LPCT current sensors
SEP080	Base unit without UMI, 24-250 V DC power supply
SEP383	Base unit with advanced UMI, 24-250 V DC power supply
SEP888	Base unit with mimic-based UMI, 24-250 V DC power supply
MMS020S80	Substation application type S80 Memory Cartridges
MMS020S81	Substation application type S81 Memory Cartridges
MMS020S82	Substation application type S82 Memory Cartridges
MMS020S84	Substation application type S84 Memory Cartridges
MMS020T81	Transformer application type T81 Memory Cartridges
MMS020T82	Transformer application type T82 Memory Cartridges
MMS020T87	Transformer application type T87 Memory Cartridges
MMS020M81	Motor application type M81 Memory Cartridges
MMS020M87	Motor application type M87 Memory Cartridges
MMS020M88	Motor application type M88 Memory Cartridges
MMS020G82	Generator application type G82 Memory Cartridges
MMS020G87	Generator application type G87 Memory Cartridges
MMS020G88	Generator application type G88 Memory Cartridges
MMS020B80	Bus application type B80 Memory Cartridges
MMS020B83	Bus application type B83 Memory Cartridges
MMS020C86	Capacitor application type C86 Memory Cartridges
CCA612	RS485 network interface communication cable, L = 9.8 ft (3 m)
CCA785	MCS025 module connection cable
CCA620	20-pin screw type connector
CCA622	20-pin ring lug connector
2640KIT	Kit with two sets of spare connectors for MES

Base Unit
Dimensions

Dimensions

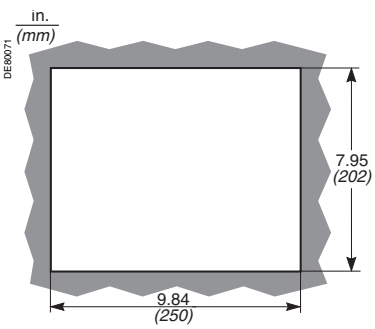


Front View of Sepam™

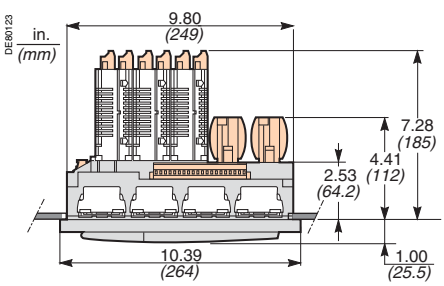


Side view of Sepam™ with MES120, flush-mounted in front panel with spring clips.
Front panel: 1.5 mm (0.05 in) to 6 mm (0.23 in) thick

***Note**: Dashed lines | _ _ | represent clearance needed for Sepam™ assembly and wiring*

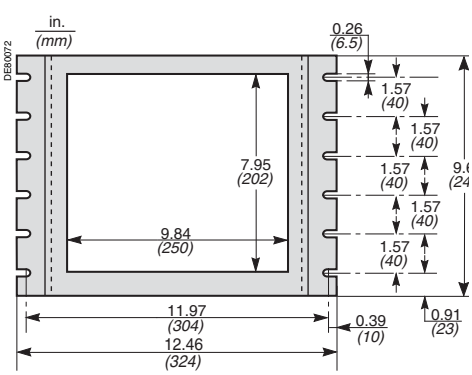


Cut Out

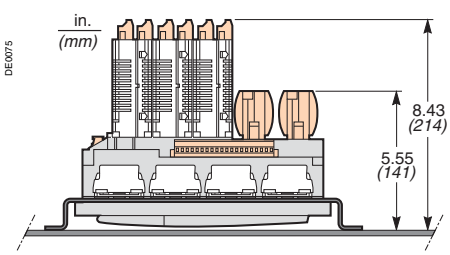


Top view of Sepam™ with MES120, flush-mounted in front panel with spring clips
Front panel: 1.5 mm (0.05 in) to 6 mm (0.23 in) thick

Assembly with AMT880 Mounting Plate



AMT880 Mounting Plate



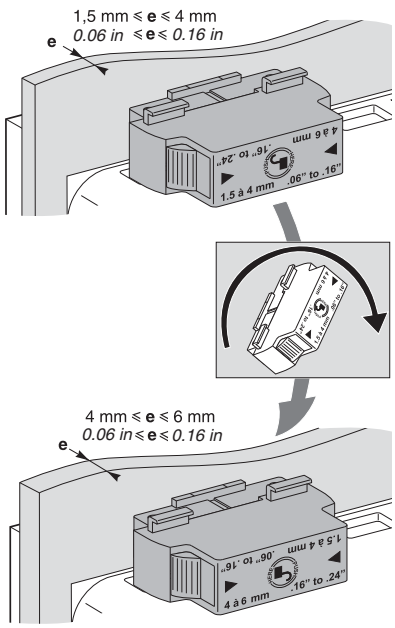
Top view of Sepam™ with MES120, flush-mounted in front panel with spring clips.
Mounting plate: 3 mm (0.11 in) thick

Base Unit
Mounting

Spring Clip Mounting Direction

The direction 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.

DE80101



Base Unit Flush-Mounting

The Sepam™ Series 80 uses eight spring clips to frame mount the unit. The mounting surface must be flat and stiff to guarantee tightness.

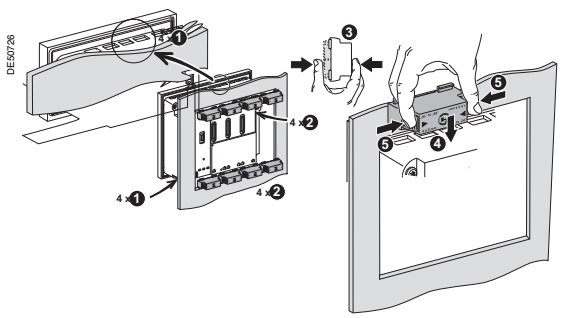
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

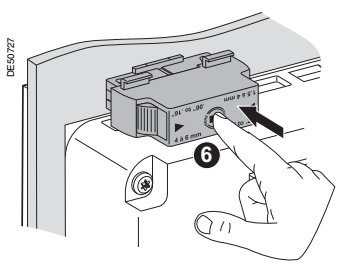
- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Turn off all power supplying the power meter and the equipment in which it is installed before working on it. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.

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

DE50726

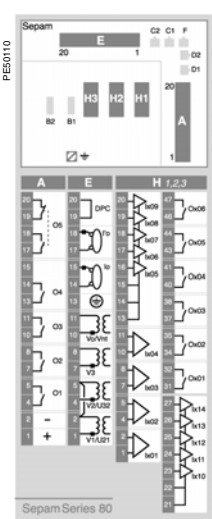


DE50727



❶ Mounting notches
❷ Spring clips
❸ Setting
❹ Positioning
❺ Locking
❻ Unlocking

PE50110



Terminal block identification label

Attaching the Terminal Block Identification Label

A sticker showing the rear panel of Sepam™ and terminal assignments comes with each base unit to help connect Sepam™ and the MES120 input/output modules. This label is usually on the side of an MES120 module or on a side panel of Sepam™ (usually the right side or bottom).

Refer to the figures above and perform the following steps to mount the base unit:

1 Shut off all power sources for the equipment cubicle.
2 Locate the mounting notches at the top and bottom of the case ❶
3 Determine clip mounting direction based on the panel sheet thickness. ❷
4 Compress and latch the spring clips. ❸
5 Insert the case into the prepared cut-out of the cubicle and insert spring clips in the notches at the top and bottom. ❹
6 Squeeze to release and lock the latched clips and hold relay to panel. ❺
7 To unlock the clip and remove the case, press the end of each clip toward the panel. ❻

Base Unit
Connection

Items located on the rear panel are:

1 Base unit
2 Eight spring clips (four top, four bottom)
3 Red LED: Sepam™ unavailable
4 Green LED: Sepam™ on
5 Gasket

(A) 20-pin connector for:

- 24 V DC to 250 V DC auxiliary supply
- five relay outputs

(B1) Connector for 3 phase current Ia, Ib, Ic inputs

(B2) Sepam™ T87, M87, M88, G87, G88: connector for 3-phase current I'a, I'b, I'c inputs
- Sepam™ B83: connector for
  - ☐ 3-phase voltage V'an, V'bn, V'cn inputs
  - ☐ 1 residual voltage V'r input (see page 25)
- Sepam™ C86: connector for capacitor unbalance current inputs (see page 29)

(C1) Communication port 1

(C2) Communication port 2

(D1) Remote module connection port 1

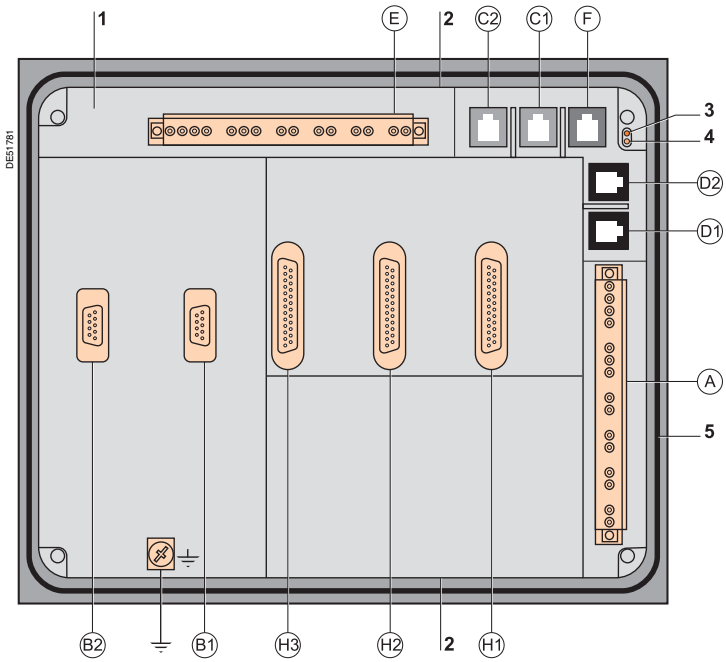
(D2) Remote module connection port 2

(E) 20-pin connector for:

- 3 phase voltage Van, Vbn, Vcn inputs
- 1 residual voltage Vr input
- 2 residual current Ir, I'r inputs

(F) Spare port

Rear Panel Description



(H1) Connector for first MES120 input/output module.

(H2) Connector for second MES120 input/output module.

(H3) Connector for third MES120 input/output module.

⏚ Functional ground.

Connection Characteristics

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 (0.31 to 0.39 in) Wiring with fittings: ■ Recommended wiring with Telemecanique fittings: □ DZ5CE015D for 1 x 1.5 mm² wire (AWG 16) □ DZ5CE025D for 1 x 2.5 mm² wire (AWG 12) □ AZ5DE010D for 2 x 1 mm² wires (AWG 18) ■ Tube length: 8.2 mm (0.32 in) ■ Stripped length: 8 mm (0.31 in)
	6.35 mm (0.25 in) ring lugs	CCA622	■ 6.35 mm ring or spade lugs (0.25 in) (1/4") ■ Maximum wire cross-section of 0.2 to 2.5 mm² (≥ AWG 24-12) ■ Stripped length: 6 mm (0.23 in) ■ Use an appropriate tool to crimp the lugs on the wires ■ Maximum of 2 ring or spade lugs per terminal ■ Tightening torque: 6.1 - 8.8 in-lb (0.7 to 1 Nm)
(B1), (B2)	4 mm (0.15 in) ring lugs	CCA630 or CCA634, to connect 1A or 5A CTs	1.5 to 6 mm² (AWG 16-10)
	RJ45 plug	CCA671, to connect 3 LPCT sensors	Integrated with LPCT sensor
(C1), (C2)	Green RJ45 plug		CCA612
(D1), (D2)	Black RJ45 plug		CCA770: L = 2 ft (0.6 m) CCA772: L = 6.6 ft (2 m) CCA774: L = 13.1 ft (4 m) CCA785 for MCS025 module: L = 6.6 ft (2 m)
DE51845 ⏚ Functional ground	Ring lug		Grounding braid, to be connected to cubicle ground: ■ Flat copper braid with cross-section ⩾ 9 mm² (> AWG 8) ■ Maximum length: 11.8 in (300 mm)

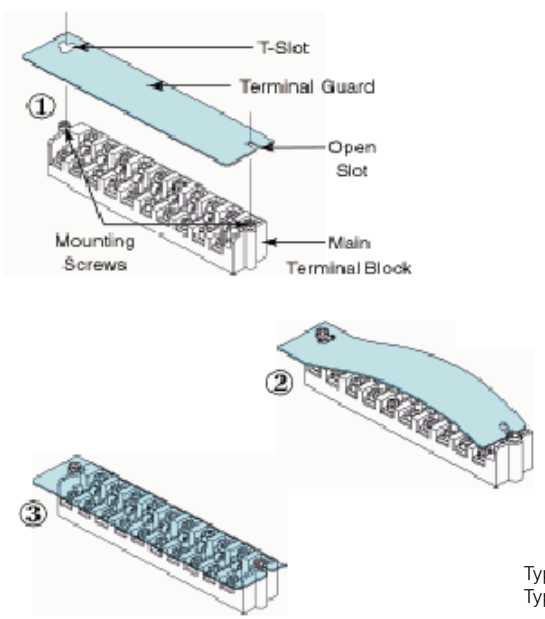
Base Unit
Installing Terminal Guard

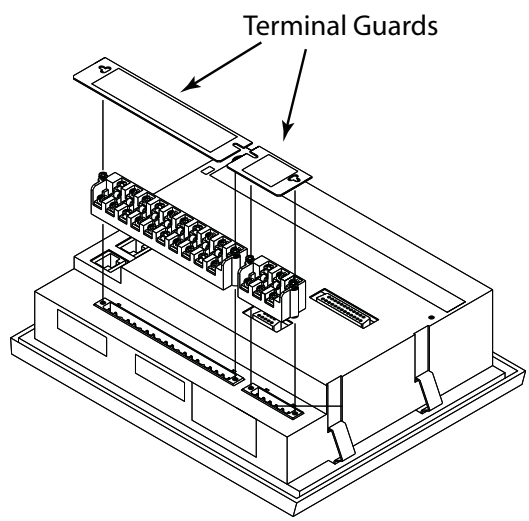
Terminal guards are shipped with each ring-lug type main and VT terminal block. These guards must be installed after the terminal block is wired, but before the Sepam™ Series 80 and equipment wired to the module are energized. (See preceding DANGER notice.) These terminal guards are designed to prevent accidental contact with terminals once they are energized.

To install the terminal guards, follow these steps while referring to the illustrations below:

1 Slightly loosen the two module mounting screws on the ends of one of the blocks.
2 Place the T-slot in the terminal guard over one of the mounting screws and pull it toward the center of the module until the mounting screw is in the narrow portion of the T-slot. Tighten the mounting screw.
3 Gently flex the terminal guard as shown and slide the open slot on the terminal guard under the head of the mounting screw so the screw secures it in place. Release the terminal guard so it lies flat over the terminals. Tighten the mounting screw.

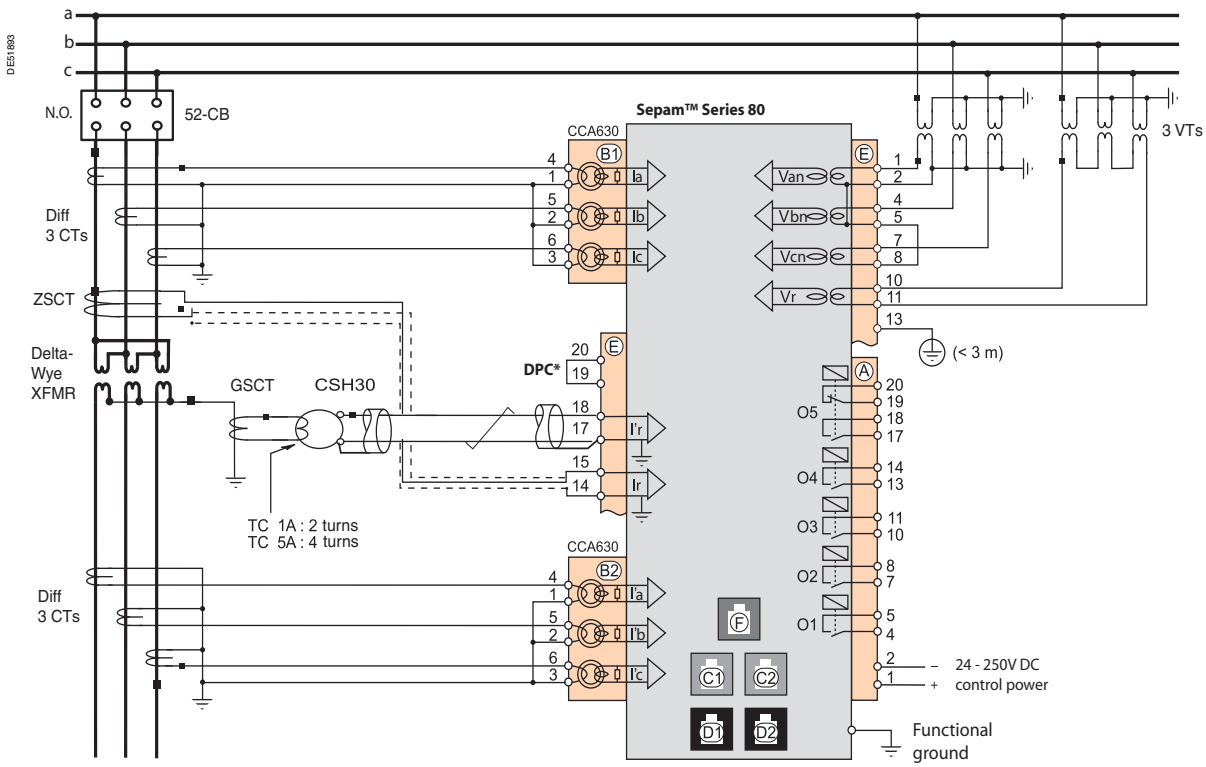
Repeat steps 1 and 2 to install the other terminal guard.
The terminal guards should now be firmly in place, preventing accidental contact with the terminals they cover.





Typical Terminal Block Mounting (Shown for Sepam™ Series 20/40)
Typical for Series 80

Base Unit
Sepam™ Series 80 AC Connection Diagram



Note: *See Connection Characteristics, page 17*

** Detection of Plugged Connector (required for proper operation. Installed manually)*

⚠ CAUTION

LOSS OF PROTECTION OR RISK OF NUISANCE TRIPPING

If Sepam™ loses power or is in fail-safe position, the protection functions are inactive and all Sepam™ output relays drop out. Check to ensure this operating mode and the watchdog relay wiring are compatible with your installation.

Failure to follow this instruction can result in equipment damage and unwanted shutdown of the electrical installation.

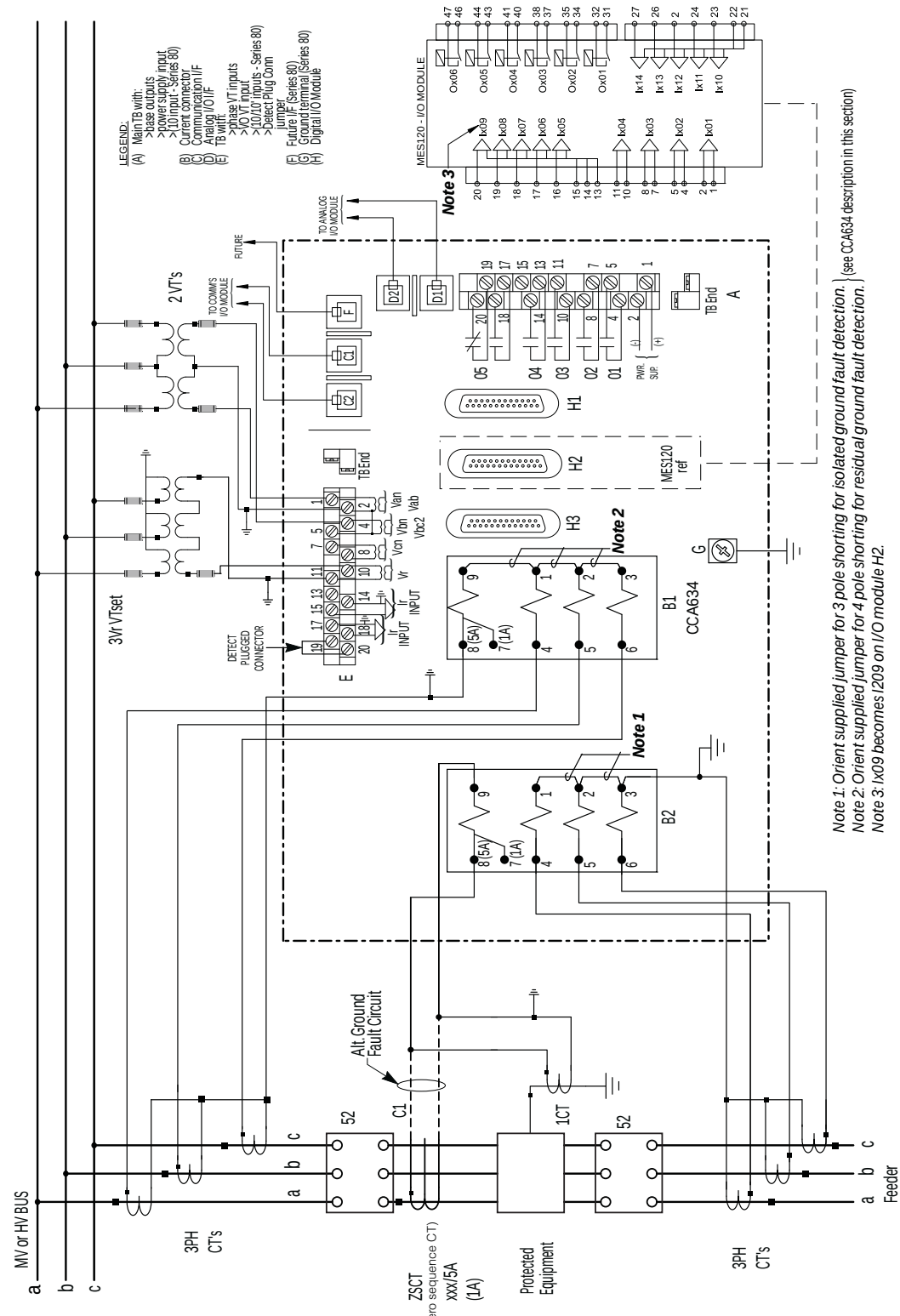
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electrical power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Start by connecting the device to the protective ground and to the functional ground.
- Screw tight all terminals, even those not in use.

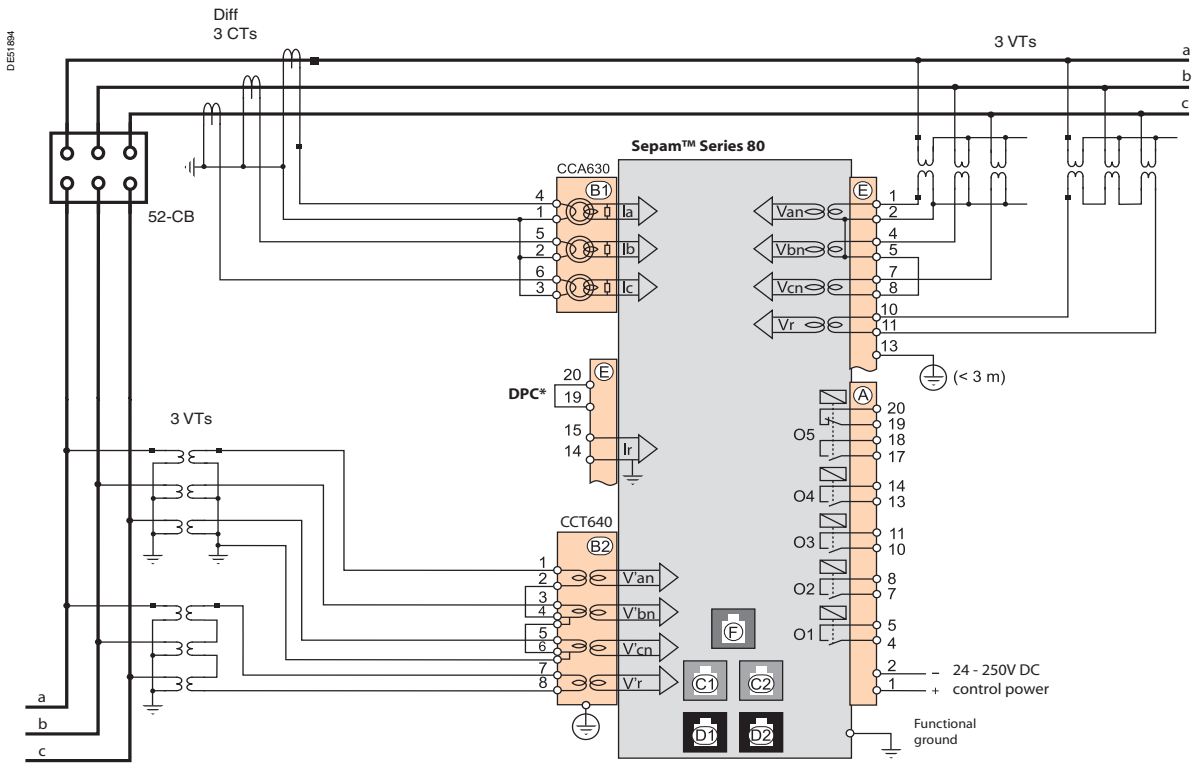
Failure to follow these instructions will result in death or serious injury.

Base Unit
Sepam™ Series 80 AC Connection Diagram



63230-216-229-B1

Base Unit
Sepam™ B83 Connection Diagram



** Detection of Plugged Connector (required for proper operation. Installed manually)*

Connector	Type	Reference	Wiring
B1	0.15 in (4 mm) ring lugs	CCA630 or CCA634, for connection of 1 A or 5 A ZSCTs	1.5 to 6 mm² (AWG 16-10)
B2	Screw type	CCT640	VT wiring: same as wiring for the CCA620 Ground connection is by a 4 mm ring lug
DE51845 Functional ground	Ring lug		Connect the grounding braid to cubicle ground: ■ Flat copper braid with cross-section ≥ 9 mm² (> AWG 8) ■ Maximum length: 11.8 in (300 mm) ■ Tightening torque: 6.1 - 8.8 in-lb (0.7 to 1.0 Nm)

Connection characteristics of connectors A, E, C1, C2, D1, D2 : see page 20

⚠ CAUTION

LOSS OF PROTECTION OR RISK OF NUISANCE TRIPPING

If Sepam™ loses power or is in fail-safe position, the protection functions are inactive and all the Sepam™ output relays drop out. Check to ensure that this operating mode and the watchdog relay wiring are compatible with your installation.

Failure to follow this instruction can result in equipment damage and unwanted shutdown of the electrical installation.

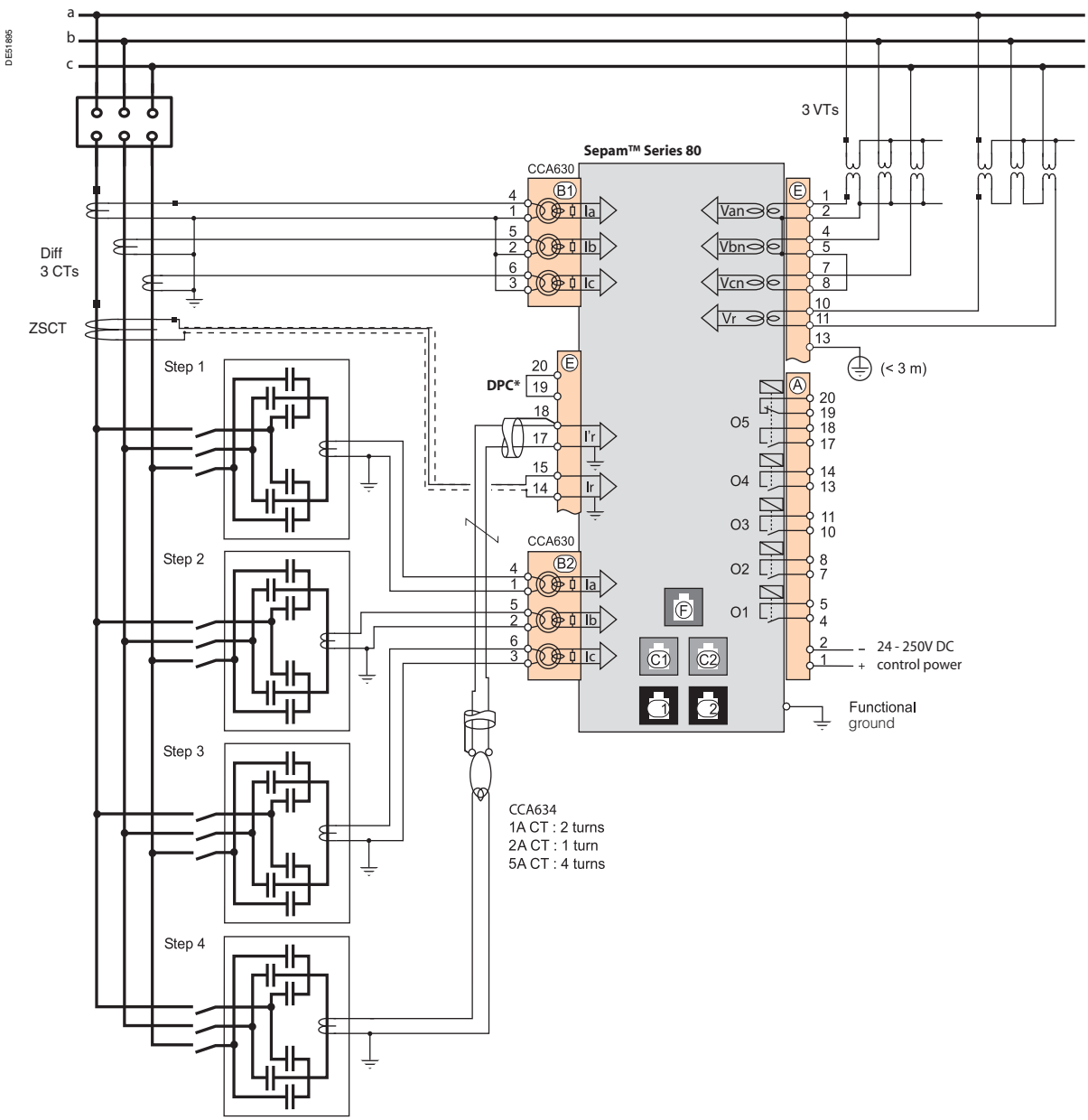
⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electrical power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that power is off.
- Start by connecting the device to the protective ground and to the functional ground.
- Screw tight all terminals, even those not in use.

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

Base Unit
Sepam™ C86 Connection Diagram



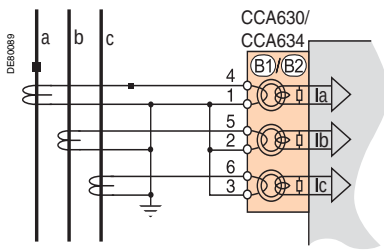
** Detection of Plugged Connector (required for proper operation. Installed manually)*

Connector	Type	Reference	Wiring
(B1)	0.15 in (4 mm) ring lugs	CCA630 or CCA634, for connecting 1A or 5A CTs	1.5 to 6 mm² (AWG 16-10)
	RJ45 plug	CCA671, for connecting three LPCT sensors	Integrated with LPCT sensor
(B2)	0.15 in (4 mm) ring lugs	CCA630 or CCA634, for connecting 1A, 2A or 5A CTs	1.5 to 6 mm² (AWG 16-10)
DE51845 Functional ground	Ring lugs		Connect the grounding braid to the cubicle ground: ■ Flat copper braid with cross-section ≥ 9 mm² (>AWG 8) ■ Maximum length: 11.8 in (300 mm) ■ Tightening torque: 6.1 - 8.8 in-lb (0.7 to 1.0 Nm)

Connection characteristics of connectors (A), (E), (C1), (C2), (D1), (D2) : see page 20

Base Unit
Connecting Phase Current Inputs

Variant 1: Measuring Phase Current by three - 1A or 5A CTs (Standard Connection)



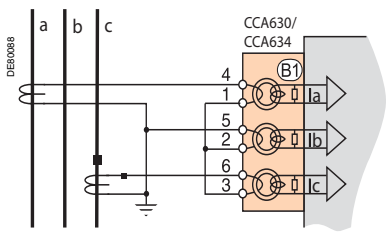
Description
Connecting three - 1A or 5A sensors to the CCA630 or CCA634 connector.

Calculate residual current by measuring the three-phase currents.

Parameters

Sensor type	5A CT or 1A CT
Number of CTs	Ia, Ib, Ic
Rated Current (IN)	1A to 6250 A

Variant 2: Measuring Phase Current by two - 1A or 5A CTs



Description
Connecting two - 1A or 5A sensors to the CCA630 or CCA634 connector. All protection functions are based on monitoring phase A and phase C currents.

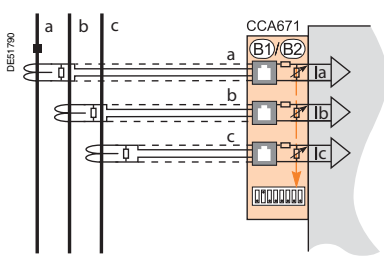
Phase current IB is assessed only for metering functions (assuming Ir = 0).

The user cannot calculate residual current or use ANSI 87T and 87M differential protection functions on the Sepam™ T87, M87, M88, G87 and G88 under this configuration.

Parameters

Sensor type	5A CT or 1A CT
Number of CTs	Ia, Ic
Rated Current (IN)	1A to 6250 A

Variant 3: Measuring Phase Current with three LPCT Type Sensors



Description
The CCA671 Connector uses three Low Power Current Transducer (LPCT) type sensors to keep Sepam™ from going into a fail-safe condition.

There are three sets of Dual In-Line (DIP) switches, shown at the bottom of the CCA671 example to the left, one set for each phase. Each of these is set for the Full Load Amps (FLA) for that phase.

Calculate residual currentby measuring the three phase currents Ia, Ib, and Ic. They are measured by 3 x 1A or 5A CTs or by three LPCT type sensors.

LPCT sensors cannot be used to obtain the following measurements:

- Phase current measurements for Sepam™ T87, M88 and G88 with ANSI 87T transformer differential protection (connectors B1 and B2)
- Phase current measurements for Sepam™ B83 (connector B1)
- Unbalance current measurements for Sepam™ C86 (connector B2).

Parameters

Sensor type	LPCT
Number of CTs	Ia, Ib, Ic
Rated Current (IN)	25, 50, 100, 125, 133, 200, 250, 320, 400, 500, 630, 666, 1000, 1600, 2000 or 3150 A

Note : *Rated Current (IN) must be set twice, because:*

- *The software parameter setting uses the advanced UMI or the SFT2841 software tool.*
- *The hardware parameter setting uses microswitches on the CCA671 connector.*

Base Unit
Connecting Residual Current Inputs

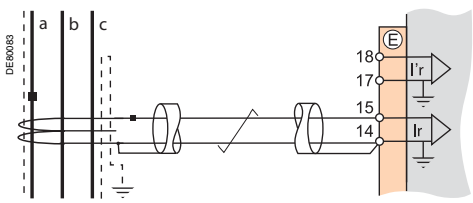
Variant 1: Calculating Residual Current by Sum of Three Phase Currents

Description
Residual current is calculated by vectorially summing the three phase currents Ia, Ib and Ic, which are measured by three x 1A or 5A CTs or by three LPCT type sensors. See the current input connection diagrams for more information.

Parameters

Residual Current	Rated Residual Current	Measuring Range
Sum of the three currents	I_{Nr} = I_N, CT primary current	0.01 to 40 I_{Nr} (minimum 0.1 A)

Variant 2: Measuring Residual Current by CSH120 or CSH200 Zero Sequence CT (Standard Connection)

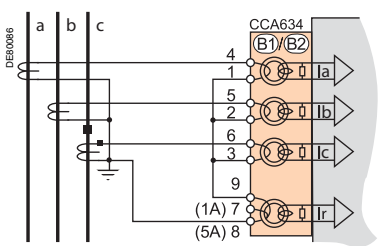


Description
Use this arrangement to protect isolated or compensated neutral systems having very low fault currents that need to be detected.

Parameters

Residual Current	Rated Residual Current	Measuring Range
2 A rating CSH	I_{Nr} = 2 A	0.1 to 40 A
20 A rating CSH	I_{Nr} = 20 A	0.2 to 400 A

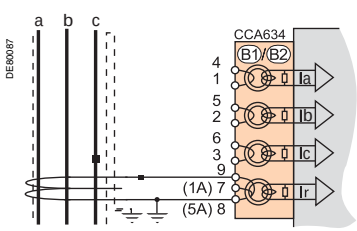
Variant 3: Measuring Residual Current by 1A or 5A CTs and CCA634



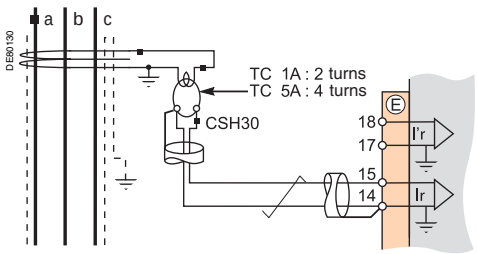
Description
Residual current measurement by 1A or 5A CTs
- Terminal 7: 1A CT
- Terminal 8: 5A CT

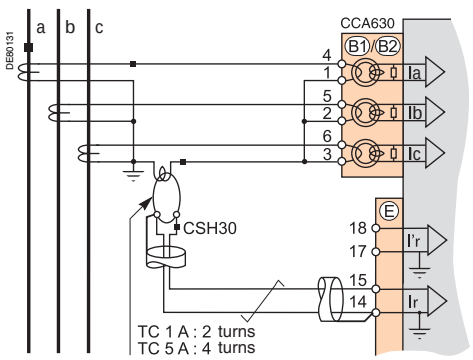
Parameters

Residual Current	Rated Residual Current	Measuring Range
1 A CT	I_{Nr} = I_N, CT primary current	0.01 to 20 I_{Nr} (minimum 0.1 A)
5 A CT	I_{Nr} = I_N, CT primary current	0.01 to 20 I_{Nr} (minimum 0.1 A)



Variant 4: Measuring Residual Current by 1A or 5A CTs and CSH30 Interposing Ring CT





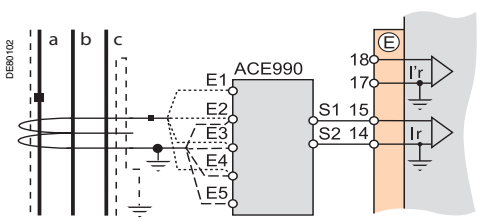
Description
The CSH30 interposing ring CT connects 1A or 5A CTs to Sepam™ to measure residual current:

- CSH30 interposing ring CT connected to 1A CT: make two turns through CSH primary
- CSH30 interposing ring CT connected to 5A CT: make four turns through CSH primary.

Parameters

Residual Current	Rated Residual Current	Measuring Range
1 A CT	I_{Nr} = I_N, CT primary current	0.01 to 20 I_{Nr} (minimum 0.1 A)
5 A CT	I_{Nr} = I_N, CT primary current	0.01 to 20 I_{Nr} (minimum 0.1 A)

Variant 5: Measuring Residual Current by Zero Sequence CT with Ratio of 1/n (n between 50 and 1500)



Description
The ACE990 is an interface between a MV zero sequence CT with a ratio of 1/n (50 ≤ n ≤ 1500) and the Sepam™ residual current input.

This arrangement allows the continued use of existing zero sequence CTs on the installation.

Parameters

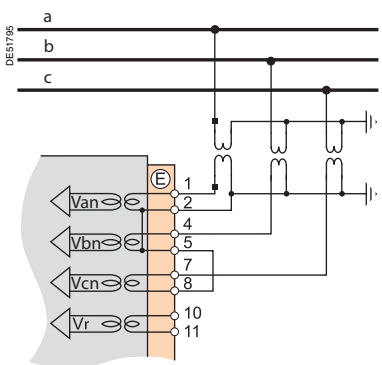
Residual Current	Rated Residual Current	Measuring Range
ACE990 - range 1 (0.00578 ≤ k ≤ 0.04)	I_{Nr} = Ik.n(1)	0.01 to 20 I_{Nr} (minimum 0.1 A)
ACE990 - range 2 (0.0578 ≤ k ≤ 0.26316)	I_{Nr} = Ik.n(1)	0.01 to 20 I_{Nr} (minimum 0.1 A)

(1) *n = number of zero sequence CT turns*
k = factor to be determined according to ACE990 wiring and setting range used by Sepam™

Base Unit
Connecting Main Voltage Inputs

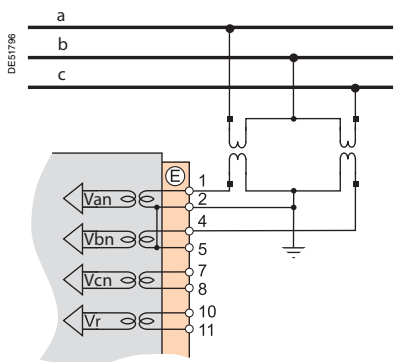
Phase Voltage Input Connection Variants

Variant 1: Measuring Three Phase-to-Neutral Voltages (3 V_{Ln}, Standard Connection)



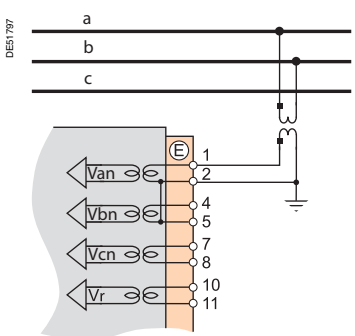
Measuring three phase-to-neutral voltages allows the calculation of residual voltage, VrΣ

Variant 2: Measuring Two Phase-to-Phase Voltages (2 V_{LL})



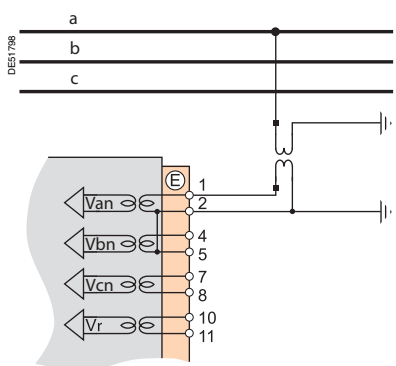
This variant does not allow residual voltage calculation

Variant 3: Measuring One Phase-to-Phase Voltage (1 V_{LL})



This variant does not allow residual voltage calculation

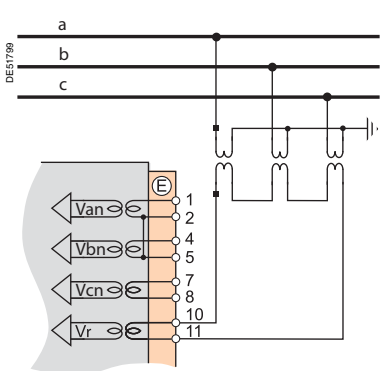
Variant 4: Measuring One Phase-to-Neutral Voltage (1 V_{Ln})



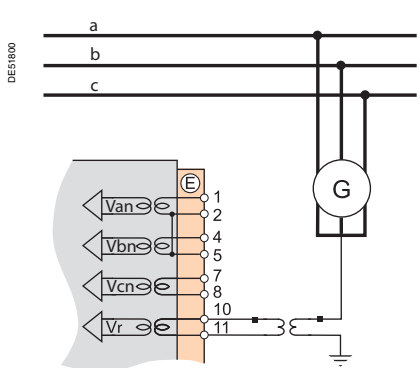
This variant does not allow residual voltage calculation

Residual Voltage Input Connection Variants

Variant 5: Measuring Residual Voltage Vr



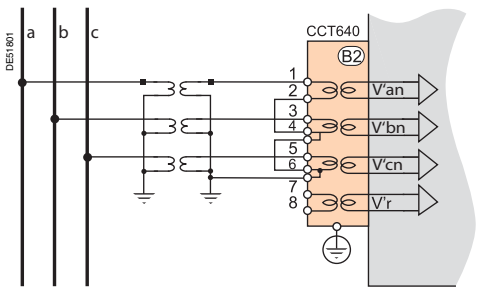
Variant 6: Measuring Residual Voltage VNT in Generator Neutral Point



Base Unit
Connecting Additional Voltage Inputs for Sepam™ B83

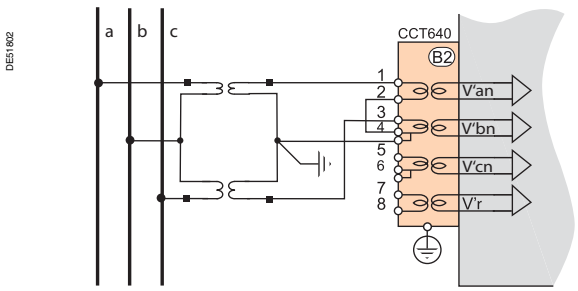
Additional Phase Voltage Input Connection Variants

Variant 1: Measuring Three Phase-to-Neutral Voltages (3 V_{Ln}, Standard Connection)



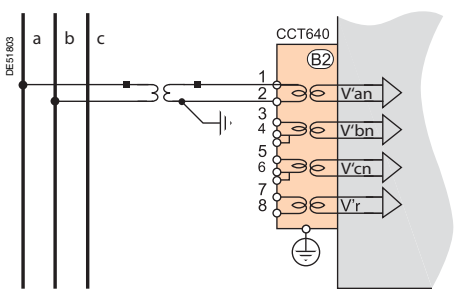
You can calculate residual voltage by measuring the three phase-to-neutral voltages, V'rΣ.

Variant 2: Measuring Two Phase-to-Phase Voltages (2 V_{LL})



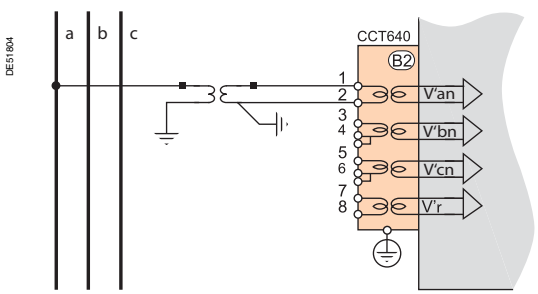
This variant does not allow residual voltage calculation.

Variant 3: Measuring One Phase-to-Phase Voltage (1 V_{LL})



This variant does not allow residual voltage calculation.

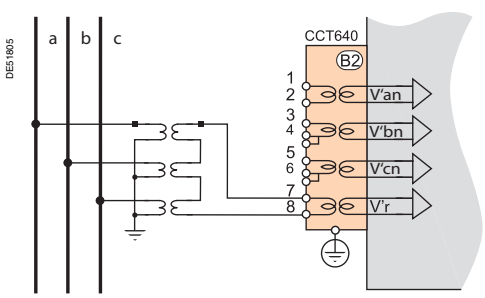
Variant 4: Measuring One Phase-to-Neutral Voltage (1 V_{Ln})



This variant does not allow the calculation of residual voltage.

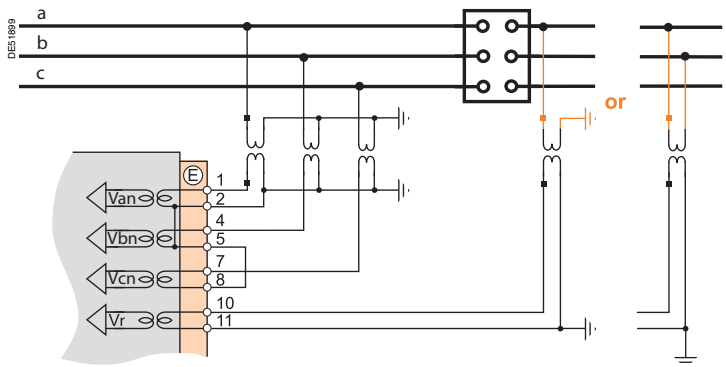
Additional Residual Voltage Input Connection

Variant 5: Measuring Residual Voltage V'r



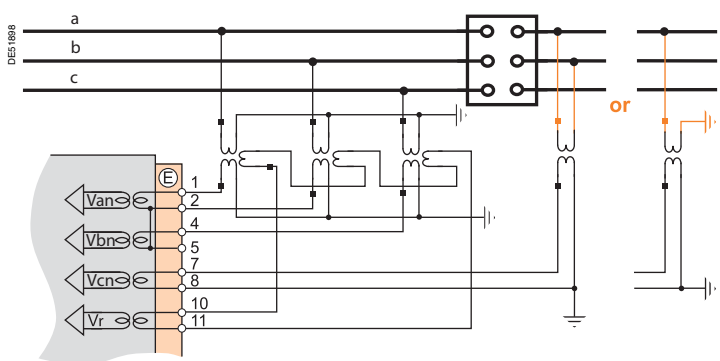
Base Unit
Connecting Additional Phase Voltage Input for Sepam™ B80

Connection to Measure an Additional Voltage



This connection is used to measure:

- three phase-to-neutral voltages Van, Vbn, Vcn on bus no. 1
- one additional phase-to-neutral voltage V'an (or one additional phase-to-phase voltage V_{LL}) on bus no. 2



This connection is used to measure:

- two phase-to-phase voltages Vab, Vbc and one residual voltage Vr on bus no. 1
- one additional phase-to-phase voltage V_{LL} (or one additional phase-to-neutral voltage V'an) on bus no. 2

Base Unit
Functions Available According to Connected Voltage Inputs

The phase and residual voltages that Sepam™ measures determine the availability of some protection and metering functions.

The table below gives the voltage input connection variants for each protection and metering function that depends on measured voltages.

Example:
The directional ground fault protection is ANSI 67N/67NC. It uses residual voltage Vr as a polarization value.
It is operational in the following cases:
- measuring the three phase-to-neutral voltages and calculating the variant, (3 V_{LN} + VrΣ, variant 1)
- measuring residual voltage Vr (variant 5).

Directional ground fault protection is ANSI67N/67NC.
The protection and metering functions not appearing in the table below are available regardless of the voltages measured.

Phase Voltages Measured (connection variant)		**3 V_{LN} + VrΣ** (var. 1)			**2 V_{LL}** (var. 2)			**1 V_{LL}** (var. 3)			**1 V_{LN}** (var. 4)		
Residual Voltage Measured (connection variant)		**–**	**Vr** (v. 5)	**VNT** (v. 6)	**–**	**Vr** (v. 5)	**VNT** (v. 6)	**–**	**Vr** (v. 5)	**VNT** (v. 6)	**–**	**Vr** (v. 5)	**VNT** (v. 6)
Protection Functions Dependent on Voltages Measured													
Directional phase overcurrent	67	■	■	■	■	■	■						
Directional ground fault	67N/67NC	■	■	■		■			■			■	
Directional active overpower	32P	■	■	■	■	■	■						
Directional reactive active overpower	32Q	■	■	■	■	■	■						
Directional active underpower	37P	■	■	■	■	■	■						
Field loss (underimpedance)	40	■	■	■	■	■	■						
Pole slip, phase shift	78PS	■	■	■	■	■	■						
Voltage-restrained overcurrent	50V/51V	■	■	■	■	■	■						
Underimpedance	21B	■	■	■	■	■	■						
Inadvertent energization	50/27	■	■	■	■	■	■						
100 % stator ground fault	64G2/27TN			■			■						
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	■ □	■ □	■	■ □	■ □	■	■ □ ☑	■ □	■	■ □ ☑	■ □	■
Rate of change of frequency	81R	■	■	■	■	■	■						
Measurements Dependent on Voltages Measured													
Phase-to-phase voltage Vab, Vbc, Vca or V'ab, V'bc, V'ca		■ □	■ □	■	■ □	■ □	■ □	Vab, V'ab	Vab	Vab			
Phase-to-neutral voltage Van, Vbn, Vcn or V'an, V'bn, V'cn		■ □	■ □	■		■					Van, V'an	Van, V'an	Van
Residual voltage Vr or V'r		■ □	■ □	■		■ □			■ □			■ □	
Neutral point voltage Vnt				■			■			■			■
Third harmonic neutral point or residual voltage				■			■			■			■
Positive sequence voltage V1 or V'1 / negative sequence voltage V2 or V'2		■ □	■ □	■	■ □	■ □	■						
Frequency (f)		■ □	■ □	■ □	■ □	■ □	■ □	■ □ ☑	■ □	■ □	■ □ ☑	■ □	■ □
Active / reactive / apparent power: P, Q, S		■	■	■	■	■	■	■	■	■			
Peak demand power PM, QM		■	■	■	■	■	■	■	■	■			
Active / reactive / apparent power per phase: Pa/Pb/Pc, Qa/Qb/Qc, Sa/Sb/Sc		■ (1)	■ (1)	■ (1)		■ (1)					Pa/ Qa/Sa	Pa/ Qa/Sa	Pa/ Qa/Sa
Power factor (pf)		■	■	■	■	■	■	■	■	■			
Calculated active and reactive energy (±Wh, ±VARh)		■	■	■	■	■	■	■	■	■			
Total harmonic distortion, voltage Vthd		■	■	■	■	■	■	■	■	■			
Phase displacement φr, φ'r		■	■	■		■			■			■	
Phase displacement φa, φb, φc		■	■	■	■	■	■						
Apparent positive sequence impedance Z1		■	■	■	■	■	■						
Apparent phase-to-phase impedances Zab, Zbc, Zac		■	■	■	■	■	■						

■ *Function available on main voltage channels.*
□ *Function available on Sepam™ B83 additional voltage channels.*
☑ *Function available on Sepam™ B80 additional voltage channel, according to the type of the additional voltage measured.*
(1) *If all three phase currents are measured.*

1

Function

Connect Sepam™ to any standard 1A or 5A CT. Schneider Electric offers a range of current transformers to measure primary currents from 50 A to 2500 A. Contact a Schneider Electric representative for more information.

Current Transformer Sizing

Current transformers should be large enough to minimize saturation. CTs should be selected per ANSI C37.110. This can be critical for high X/R systems with generators larger than 2MW.

		Normal Performance			Higher Performance		
Rated Secondary Current (I_N)	**CT Ratio(1)**	**Burden Designation**	**ANSI Class(2)**	**IEC Class(3)**	**Burden Designation**	**ANSI Class(4)**	**IEC Class(3)**
5	100/5	B-0.1	C10	2.5VA 5P20	B-0.2	C20	5VA 5P20
5	500/5	B-0.5	C50	15VA 5P20	B-1.0	C100	30VA 5P20
5	1200/5	B-2.0	C200	50VA 5P20	B-4.0	C400	100VA 5P20
1	100/1	B-0.1	C50	2.5VA 5P20	B-0.2	C100	5VA 5P20
1	500/1	B-0.5	C200	10VA 5P20	B-1.0	C400	30VA 5P20
1	1200/1	B-2.0	C1000(5)	40VA 5P20	B-4.0	C2000(5)	80VA 5P20

Transformer and Transformer-Machine Unit Differential Protection (ANSI 87T)
The phase CT primary currents must adhere to the following rule:

$$0.1\left(\frac{S}{\sqrt{3}\,V_{LLn1}}\right) \le I_N \le 2.5\left(\frac{S}{\sqrt{3}\,V_{LLn1}}\right)$$ for winding 1.

$$0.1\left(\frac{S}{\sqrt{3}\,V_{LLn2}}\right) \le I'_N \le 2.5\left(\frac{S}{\sqrt{3}\,V_{LLn2}}\right)$$ for winding 2.

where:

S is the transformer's rated power.
I_N and **I'_N** are the phase CT primary currents of winding 1 and 2 respectively.
V_{LLn1} and **V_{LLn2}** are winding 1 and 2 phase-to-phase voltages.

The rule of thumb is to size the primary and secondary CTR to 1.5XFLA. While the relay can accept substantially smaller CTR's, care should be taken when the CTR is below the rated FLA. Smaller CTR's generally result in a higher probability of saturation.

The current transformers should be defined by the knee-point voltage **$V_k \ge (R_{CT} + R_w)\ (20)\ I_N$**.

The equation applies to the phase current transformer windings 1 and 2, where:
I_N and **I'_N** are the CT rated primary and secondary currents respectively.
R_{CT} is the CT internal resistance.
R_w is the resistance of the CT load and wiring.

Machine Differential (ANSI 87M)

Current transformers should be defined by a minimum knee-point voltage
$V_k \ge (R_{CT} + R_w)\ (20) I_N$.
The equations apply to the phase current transformers placed on either side of the machine.
I_N is the CT rated secondary current
R_{CT} is the CT internal resistance.
R_w is the resistance of the CT load and wiring.

Generators are characterized by large X/R ratio's. The rule of thumb is to use the highest possible accuracy class. A completely offset short circuit current requires the ct to support (1+X/R) times the calculated voltage. In many applications it is not possible to completely avoid saturation. Under these conditions it is helpful to have machine differential ct's with the same knee point voltage

(1) *CT ratio rule of thumb is to size primary to be 1.5 x connected load.*
Example: 600/5. CT for 400A load.
(2) *Typical usual product offering from switchgear manufacturers in North Americe for 50/51 products.*
(3) *Highest listed VA in IEC 60044 is 30VA*
(4) *Suitable for systems with X/R=15, or small generator connected to bus. Minimum for 87 protection.*
(5) *Not listed in C57.13*

Restricted Ground Fault Differential Protection (ANSI 64REF)

- The primary current of the neutral point current transformer used must comply with the following rule:
  0.1 I_N ≤ Neutral Point CT Primary Current ≤ 2 I_N
  where **I_N** = primary current of phase CTs on the same winding

Current transformers should be defined by the equation below that produces the highest knee-point voltage:

$Vk \geq (R_{CT} + Rw) \times 20\ I_N$
$Vk \geq (R_{CT} + Rw)\ (1.6\ I_{3P}/I_N) \times I_N$
$Vk \geq (R_{CT} + Rw)\ (2.4\ I_{1P}/I_N) \times I_N$

The equations apply to the phase current transformers and the neutral-point current tranformer, where

I_N is the CT rated secondary current.
R_{CT} is the CT internal resistance.
Rw is the resistance of the CT load and wiring.
I_{3P} is the maximum current value for a three-phase short circuit.
I_{1P} is the maximum current value for a phase-to-ground short circuit.

CCA630/CCA634 Connector

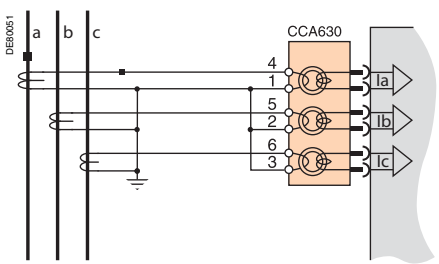
Function

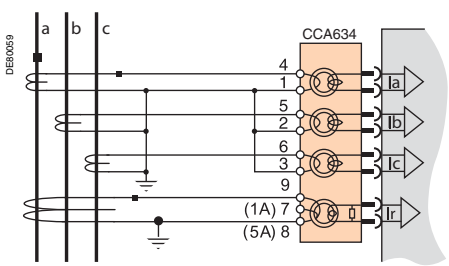
The current transformers (1A or 5A) are connected to the CCA630 or CCA634 connector on the rear panel of Sepam™:

- The CCA630 connector connects three phase current transformers to Sepam™.
- The CCA634 connector connects three phase current transformers and one zero sequence current transformer to Sepam™.

The CCA630 and CCA634 connectors contain interposing ring CTs with through primaries. When measuring phase and zero sequence currents, these primaries provide impedance matching and isolation between the 1A or 5A circuits and Sepam™.

The connectors can be disconnected with the power on since disconnection does not open the CT secondary circuit.





⚠ DANGER

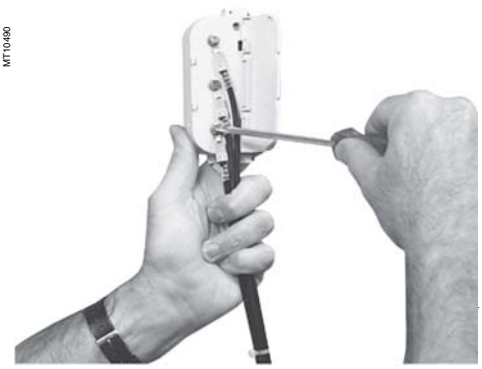
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should only be performed after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Disconnect the Sepam™ unit current inputs by unplugging the CCA630 or CCA634 connector. Do not disconnect the wires from it. The CCA630 and CCA634 connectors ensure continuity of the current transformer secondary circuits.
- Short-circuit the current transformer secondary circuits before disconnecting the wires connected to the CCA630 or CCA634 connector.

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

1

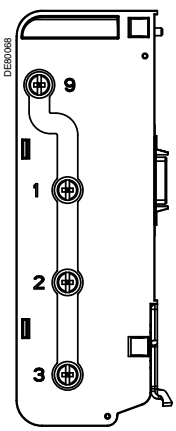
MT10490



Connecting and Assembling the CCA630 Connector

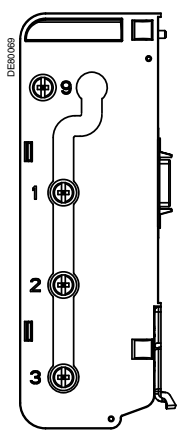
1 Open the two side shields for access to the connection terminals. The shields can be removed to make wiring easier. If removed, replace them after wiring.
2 Remove the bridging strap linking terminals 1, 2, and 3. This strap is supplied with the CCA630.
3 Connect the wires using 4 mm (0.16 in) ring lugs and check the tightness of the six screws that guarantee the continuity of the CT secondary circuits. The connector accommodates wires with cross-sections of 1.5 to 6 mm² (AWG 16-10).
4 Close the side shields.
5 Plug the connector into the 9-pin inlet on the rear panel (item (B)).
6 Tighten the two CCA630 connector fastening screws on the rear panel of Sepam™.

DE90068



Bridging terminals 1, 2, 3, and 9

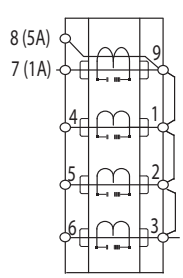
DE90069



Bridging terminals 1, 2, and 3

Connecting and Assembling the CCA634 Connector

1 Open the two side shields for access to the connection terminals. The shields can be removed, if necessary, to make wiring easier. If removed, replaced them after wiring.
2 According to the wiring required, remove or reverse the bridging strap. This is used to link either terminals 1, 2, and 3, or terminals 1, 2, 3, and 9 (see picture opposite).
3 Use terminal 7 (1A) or 8 (5A) to measure the residual current according to the CT secondary.
4 Connect the wires using 4 mm (0.16 in) ring lugs and check the tightness of the six screws that guarantee the continuity of the CT secondary circuits. The connector accommodates wires with cross-sections of 1.5 to 6 mm² (AWG 16-10). The wires only exit from the base.
5 Close the side shields.
6 Insert the retaining tabs into the slots on the base unit.
7 Pivot the connector toward the unit to plug it into the 9-pin SUB-D connector (principle similar to that of the MES module).
8 Tighten the mounting screw.



CCA634

⚠ CAUTION

HAZARD OF IMPROPER OPERATION

Do not use a CCA634 on connector B1 and residual current input Ir on connector E (terminals 14 and 15) simultaneously.

- Though unconnected to a sensor, a CCA634 on connector B1 will disturb input Ir on connector E.

Do not use a CCA634 on connector B2 and residual current input I'r on connector E (terminals 17 and 18) simultaneously.

- Though unconnected to a sensor, a CCA634 on connector B2 will disturb input I'0 on connector E.

Failure to follow this instruction can cause equipment damage.

Function

Low Power Current Transducer (LPCT) type sensors are voltage-output sensors that comply with IEC 60044-8.

The Square D range of LPCTs includes the following sensors:

CLP1
CLP2
CLP3
TLP160
TLP190.

CCA671 Connector

Function

Three LPCT sensors connect to the CCA671 on the rear panel of Sepam™. The CCA671 changes inputs from the LPCTs into a low level signal scale based on the Full Load Amps (FLA) for each phase.

Description

1 There are three blocks of microswitches that set the CCA671 to the rated phase current value.
2 Microswitch setting/selected rated current equivalency table (two In values per position).
3 There are three RJ45 radial plugs to connect the LPCT sensors.
4 9-pin sub-D connector to connect test equipment (ACE917 for direct connector or via CCA613).

Rating

The CCA671 connector is rated according by the rated primary current **IN**, and measured by the LPCT sensors. **IN** is the current value that corresponds to the rated secondary current of 22.5 mV. The possible settings for IN (in amps) are: 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

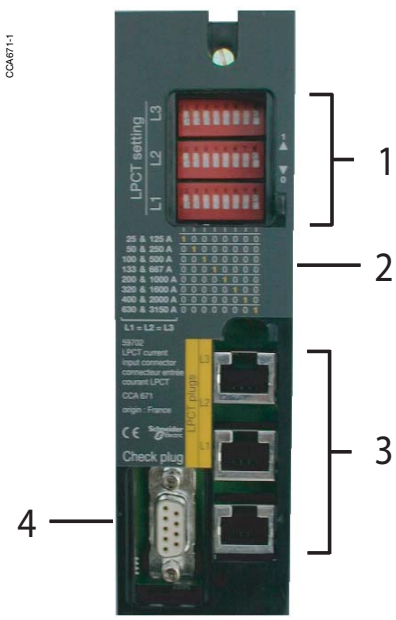
  and

- configured by microswitch on the CCA670/CCA671 connector.

Operating Mode:

1 Use a screwdriver to remove the shield located in the "LPCT settings" zone; the shield protects three blocks of eight microswitches marked L1, L2, L3.
2 On the L1 block, set the microswitch for the selected rated current to "1" (two 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 other microswitches set to "0"
3 Set the other two blocks of switches L2 and L3 to the same position as the L1 block and close the shield.

CCA671-1



Radial plugs for Sepam™ Series 80 (item 3)

CAUTION

HAZARD OF NON-OPERATION

- Set the microswitches for the CCA671 connector before commissioning the device.
- Check that only one microswitch is in position 1 for each block L1, L2, L3, and that no microswitch is in the center position.
- Check that the microswitch settings on all three blocks are identical.

Sepam™ will go into a fail-safe mode if all three LPCT sensors are not connected. Failure to follow these instructions can cause incorrect operation.

LPCT Type Current Sensors
Test Accessories

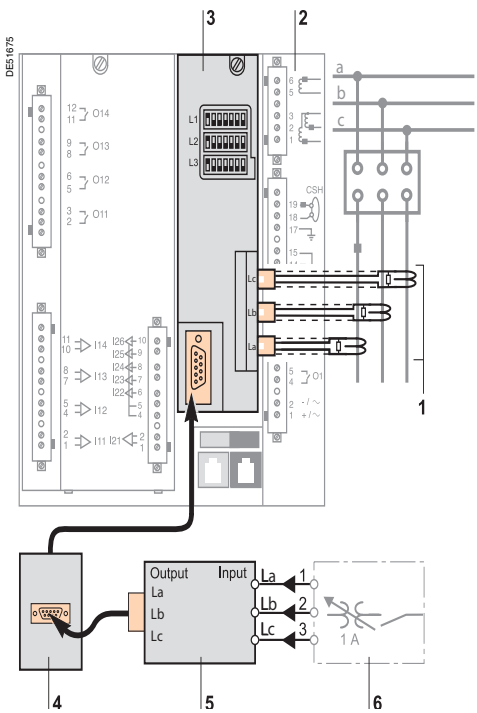
Accessory Connection Principle

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.

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



The following describes the connections shown at left:

1 The LPCT sensor is equipped with a shielded cable fitted with a yellow RJ45 radial plug that is plugged directly into the CCA671 connector.

2 Sepam™ protection unit.

3 CCA671 connector, LPCT voltage interface, with microswitch setting of rated current.[1]

4 CCA613 remote test plug, flush-mounted on the front of the cubicle and equipped with a 3-meter (9.8 ft) cord to be plugged into the test plug of the CCA670/CCA671 interface connector (9-pin sub-D).

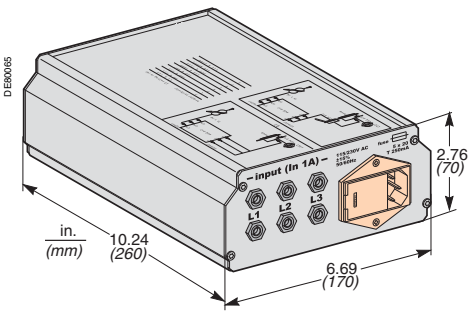
5 ACE917 injection adapter, to test the LPCT protection chain with a standard injection box.

6 Standard injection box.

Note :

1 ***Radial plugs for Sepam™ Series 80***

LPCT Type Current Sensors
Test Accessories



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 is either:
  - integrated in the Sepam™ CCA671 interface connector
  - transferred by means of the CCA613 accessory

The following are supplied with the ACE917 injection adapter:

- power supply cord
- 3-meter (9.8 ft) cord to connect the ACE917 to the LPCT test plug on CCA671 or CCA613

Characteristics

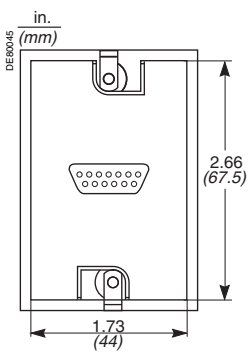
Power supply	115/230 V AC
Protection by time-delayed fuse 5 mm x 20 mm (0.2 x 0.79 in)	0.25 A rating

CCA613 Remote Test Plug

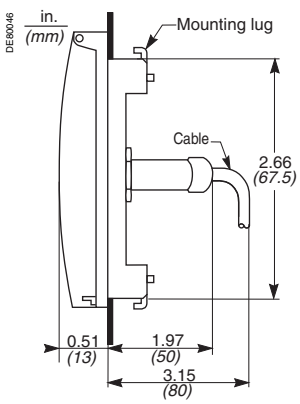
Function

The CCA613 test plug flush-mounts on the front of the cubicle. It has a 3-meter (9.8 ft) cord that transfers data from the test plug integrated in the CCA671 interface connector on the rear panel of Sepam™.

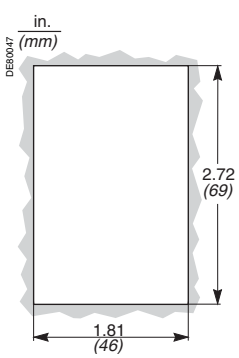
Dimensions



Front view with cover lifted



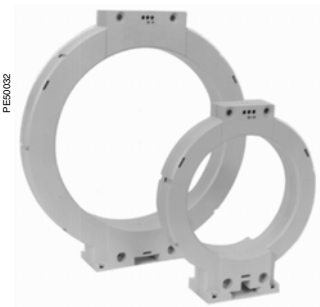
Right side view



Cut-out

CSH120 & CSH200
Zero Sequence CT

PE50032



CSH120 and CSH200 Zero Sequence CTs.

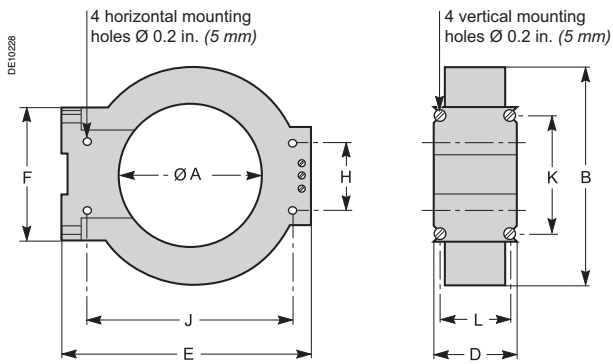
Function

The specifically designed CSH120 and CSH200 zero sequence CTs measure direct residual current. The only difference between them is the diameter. Due to their low voltage insulation, they are used only on cables.

Characteristics

	CSH120	CSH200
Inner diameter	120 mm (4.7 in)	200 mm (7.9 in)
Weight	0.6 kg (1.32 lb)	1.4 kg (3.09 lb)
Accuracy	±5% at 20°C (68°F)	
	±6% max. from –25°C to 70°C (–13°F to +158°F)	
Transformation ratio	1/470	
Maximum permissible current	20 kA - 1 s	
Operating temperature	–25°C to +70°C (–13°F to +158°F)	
Storage temperature	–40°C to +85°C (–40°F to +185°F)	

Dimensions



Dimensions	A	B	D	E	F	H	J	K	L
CSH120	120	164	44	190	76	40	166	62	35
(in)	(4.75)	(6.46)	(1.73)	(7.48)	(2.99)	(1.57)	(6.54)	(2.44)	(1.38)
CSH200	200	256	46	274	120	60	257	104	37
(in)	(7.87)	(10.1)	(1.81)	(10.8)	(4.72)	(2.36)	(10.1)	(4.09)	(1.46)

CSH120 & CSH200 Zero Sequence CT

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Only CSH120, CSH200, and CSH280 zero sequence CTs are used for direct residual current measurement. Other residual current sensors require the use of an intermediate device, CSH30, ACE990 or CCA634.
- Install the zero sequence CTs on insulated cables.
- Cables with a rated voltage of more than 1000 V must also have a grounded shielding.

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

CAUTION

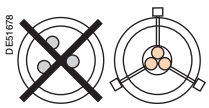
HAZARD OF NON-OPERATION

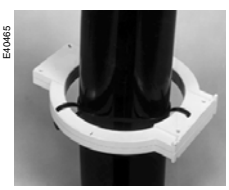
Do not connect the secondary circuit of the CSH zero sequence CTs to ground.
This connection is made in Sepam™.

Failure to follow this instruction can cause Sepam™ to operate incorrectly.

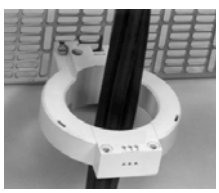
Assembly

1 Group the MV cable(s) in the middle of the zero sequence CT.
2 Use non-conductive binding to hold the cables.
3 Insert the three medium voltage cable shielded grounding cables through the zero sequence CT.





Assembly on MV cables.



Assembly on mounting plate.

Connection

Connection to Sepam™ Series 80

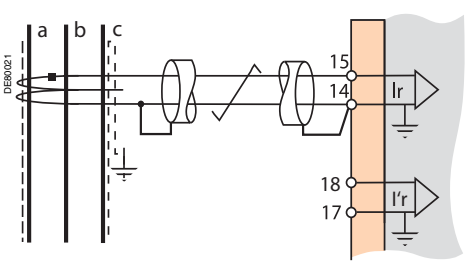
- To residual current Ir input, on connector (E), terminals 15 and 14 (shielding)
- To residual current I'r input, on connector (E), terminals 18 and 17 (shielding)

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 (30.5 mΩ/ft)
- Minimum dielectric strength: 1000 V (700 Vrms)
- Connect the cable shielding in the shortest manner possible to Sepam™
- Flatten the connection cable against the metal frames of the cubicle.

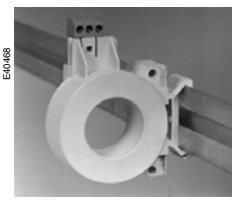
The connection cable shielding is grounded in Sepam™. Do not ground the cable by any other means.

The maximum resistance of the Sepam™ connection wiring must not exceed 4 Ω (20 m maximum for 100 mΩ/m or 66 ft maximum for 30.5 mΩ/ft).



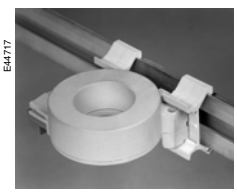
CSH30 Interposing Ring CT

E40468



Vertical assembly of CSH30 interposing ring CT

E44717



Horizontal assembly of CSH30 interposing ring CT

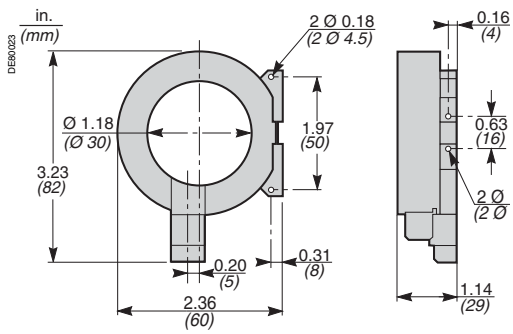
Function

The CSH30 interposing ring CT serves as an interface when measuring residual current using 1A or 5A current transformers.

Characteristics

Weight	0.12 kg (0.265 lb)
Assembly	On symmetrical DIN rail In vertical or horizontal position

Dimensions



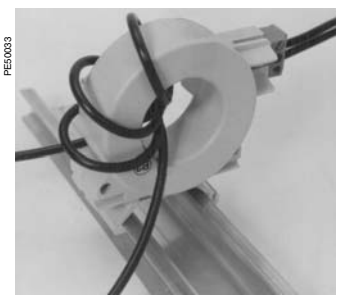
63230-216-229-B1

Connection

The CSH30 is adapted for the type of current transformer by the number of turns of the secondary wiring through the CSH30 interposing ring CT:

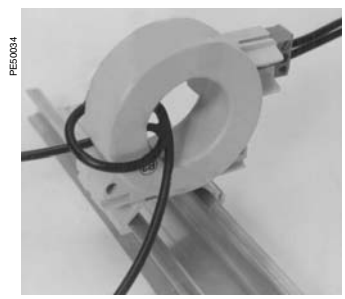
- 5A rating: 4 turns
- 1A rating: 2 turns

5A secondary circuit connection

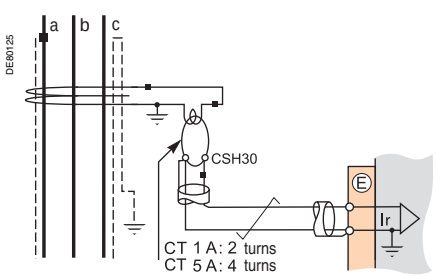


1 Plug into the connector.
2 Insert the transformer secondary wire through the CSH30 interposing ring CT four times.

1A secondary circuit connection



1 Plug into the connector.
2 Insert the transformer secondary wire through the CSH30 interposing ring CT two times.



Connection to Sepam™ Series 80

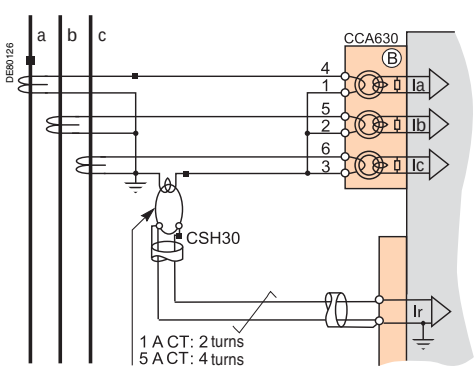
- To residual current Ir input, on connector (E), terminals 14 and 15 (shielding)
- To residual current I'r input, on connector (E), terminals 17 and 18 (shielding)

Recommended Cable

- Sheathed cable, shielded by tinned copper braid
- Minimum cable cross-section: 0.93 mm² (AWG 18) (max. 2.5 mm², AWG 12)
- Resistance per unit length: less than 100 mΩ/m (30.5 mΩ/ft)
- Minimum dielectric strength: 1000 V (700 Vrms)
- Maximum length: 2 m (6.6 ft).

The CSH30 interposing ring CT must be installed near Sepam™ (Sepam™ - CSH30 link less than two meters (6.6 ft) 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.



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PE50037

ACE990 zero sequence CT interface

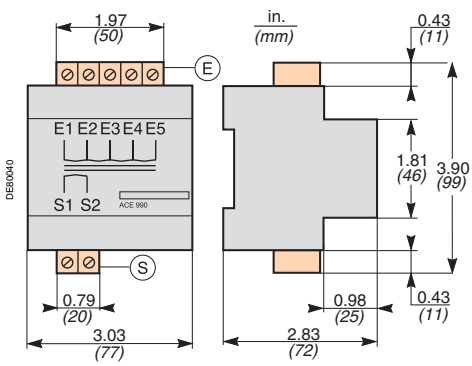
Function

The ACE990 adapts measurements between an MV zero sequence CT with a ratio of 1/n (50 ≤ n ≤ 1500), and the Sepam™ residual current input.

Characteristics

Weight	0.64 kg (1.41 lb)
Assembly	Mounted on symmetrical DIN rail
Amplitude accuracy	±1%
Phase accuracy	< 2°
Maximum permissible current	20 kA - 1 s (on the primary winding of an MV zero sequence CT with a ratio of 1/50 that does not saturate)
Operating temperature	–5°C to +55°C (+23°F to +131°F)
Storage temperature	–25°C to +70°C (–13°F to +158°F)

DE80040

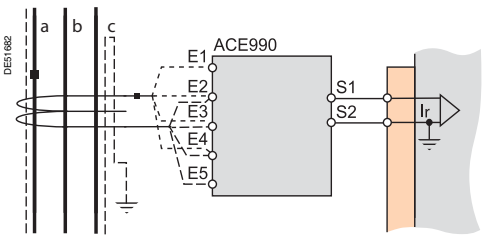


Description and Dimensions

(E) ACE990 input terminal block, for connection of the zero sequence CT.

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

ACE990 Zero Sequence CT Interface



Connection

Connecting a Zero Sequence CT

Connect only one zero sequence CT to the ACE990 interface.

The secondary circuit of the MV zero sequence CT connects to two of the five ACE990 interface input terminals. To define the two input terminals, you must know:

- Zero sequence CT ratio (1/n)
- Zero sequence CT power
- Close approximation of rated current INr
  (**INr** is a general setting in Sepam™ and defines the ground fault protection setting
  range between 0.1 and 15 INr)

The table below is used to determine:

- the two ACE990 input terminals to connect to the MV zero sequence CT secondary
- the type of residual current sensor to set
- the exact value of the rated residual current *INr* setting, given by the following formula: **INr = k x number of zero sequence CT turns**
  with k the factor defined in the table below

The zero sequence CT must connect to the interface in the right direction for correct operation. The MV zero sequence CT secondary output terminal S1 must connect to the terminal with the lowest index (Ex).

K Value	ACE990 Input Terminals to be Connected	Residual Current Sensor Setting	Min. MV Zero Sequence 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 zero sequence 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, 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 to k = 0.01136.*
4. *Check the mininum power required for the zero sequence CT:*
   2 VA zero sequence CT > 0.1 VA V OK.
5. *Connect the zero sequence CT secondary to ACE990 input terminals E2 and E4.*
6. *Set Sepam™ up with:*
   INr = 0.0136 x 400 = 4.5 A.

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

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

Connection to Sepam™ Series 80
- To residual current Ir input, on connector (E), terminals 14 and 15 (shielding)
- To residual current I'r input, on connector (E), terminals 17 and 18 (shielding)

Recommended cables
- Cable between zero sequence CT and ACE990: less than 50 m (160 ft) long
- Sheathed cable shielded by tinned copper braid between the ACE990 and Sepam™: maximum length 2 m (6.6 ft)
- Cable cross-section between 0.93 mm² (AWG 18) and 2.5 mm² (AWG 12)
- Resistance per unit length: less than 100 mΩ/m (30.5 mΩ/ft)
- Minimum dielectric strength: 100 Vrms.

Follow these steps to connect the cable.
1 Connect the connection cable shielding in the shortest manner possible (2 cm or 5.08 in maximum) to the shielding terminal on the Sepam™ connector.
2 Flatten the connection cable against the metal frames of the cubicle. The connection cable shielding is already grounded in Sepam™. **Do not ground the cable by any other means**.

Voltage Transformers

Function

Sepam™ connects to any standard voltage transformer with a rated secondary voltage of 100 V to 240 V.

Square D offers a range of voltage transformers

- to measure phase-to-neutral voltages: VT's with one insulated MV terminal
- to measure phase-to-phase voltages: VT's with two insulated MV terminals
- with or without integrated protection fuses

Contact a Square D representative for more information.

Connection

Main Voltage Inputs

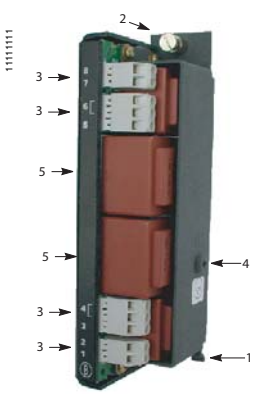
All Sepam™ Series 80 units have four main voltage inputs to measure four voltages (three phase voltages and a residual voltage).

- The main voltage measurement VTs are connected to the Sepam™ connector (E). (see page 20)
- Four transformers integrated in the Sepam™ base unit provide the required impedance matching and isolation between the VTs and the Sepam™ input circuits

Additional Voltage Inputs

Sepam™ B83 units also have four additional voltage inputs to measure the voltages on a second set of bus.

- The additional voltage measurement VTs connect to the CCT640, which is mounted on the Sepam™ port (B2) (see page 20).
- Four transformers in the CCT640 provide impedance matching and isolation between the VTs and the Sepam™ input circuits (port (B2)). (see page 20).



CCT640 Connector

Function

The CCT640 connects the four additional voltages available in Sepam™ B83. It provides impedance matching and isolation between the Voltage Transformers and the Sepam™ input circuits, port (B2) (see page 20).

⚠ DANGER

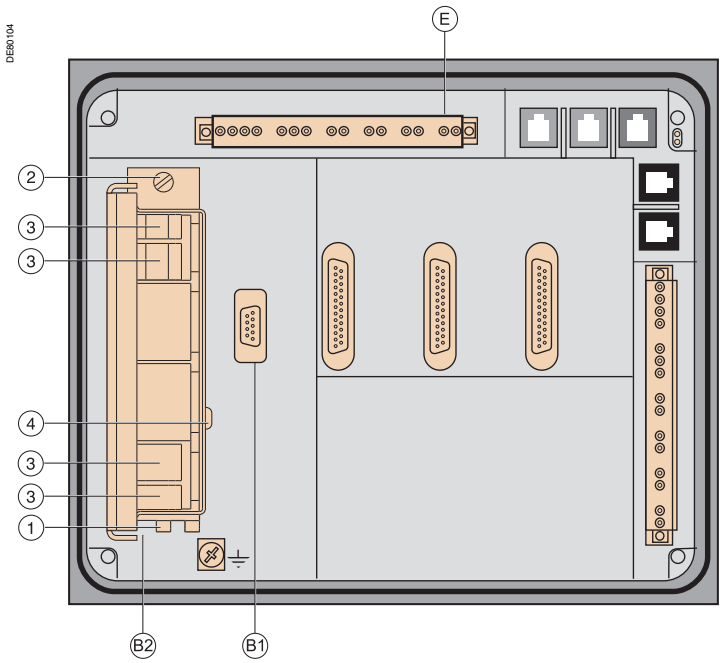
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

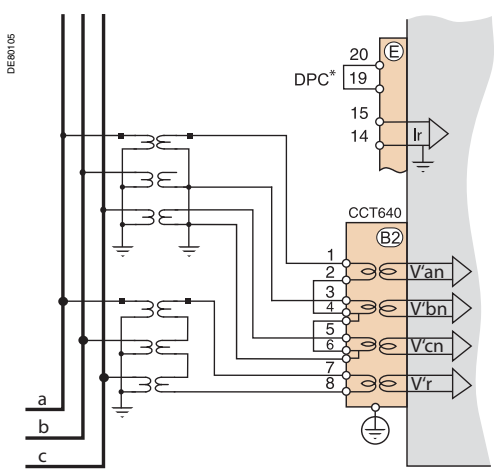
- Only qualified electrical workers should install this equipment. Such work should be performed only after reading this entire set of instructions.
- NEVER work alone.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Start by connecting the device to the protective ground and to the functional ground.
- Tighten all terminal screws, even those not in use.

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

Assembly

1 Insert the three connector pins into the slots ① on the base unit.
2 Rotate connector to plug it into the 9-pin SUB-D connector
3 Tighten the mounting screw ②.





Connection

Make the connections to the screw-type connectors on the rear panel of the CCT640 (item ③ above).

Wiring without Fittings

- One wire with maximum cross-section 0.2 to 2.5 mm² (≤• AWG 24-12) or two wires with maximum cross-section 0.2 to 1 mm² (≥ AWG 24-16)
- Stripped length: 8 to 10 mm (0.31 to 0.39 in)

Wiring with Fittings

Recommended wiring with Telemecanique fittings:

- DZ5CE015D for one 1.5 mm² wire (AWG 16)
- DZ5CE025D for one 2.5 mm² wire (AWG 12)
- AZ5DE010D for two 1 mm² wires (AWG 18)
- Tube length: 8.2 mm (0.32 in)
- Stripped length: 8 mm (0.31 in)
- Tightening torque: 6.1 to 8.8 in-lb (0.7 to 1 Nm)

Grounding

The CCT640 must be grounded by connection (green/yellow wire and ring lug) to the screw ④ This is a safety measure in case the CCT640 disconnects.

** Detection of Plugged Connector (required for proper operation. Installed manually)*

MES120, MES120G, MES120H 14 Input/6 Output Modules

PE50020

MES120 14 input / 6 output module.

Function

You can extend the five output relays included on the Sepam™ Series 80 base unit by adding one, two, or three MES120 modules with 14 DC logic inputs and six output relays, one control relay output, and five annunciation relay outputs.

Three modules are available for the different input supply voltage ranges and offer different switching thresholds:

- MES120, 14 inputs 24 V DC to 250 V DC with a typical switching threshold of 14 V DC
- MES120G, 14 inputs 220 V DC to 250 V DC with a typical switching threshold of 155 V DC
- MES120H, 14 inputs 110 V DC to 125 V DC with a typical switching threshold of 82 V DC

Characteristics

MES120/MES120G/MES120H Modules					
Weight		0.38 kg (0.83 lb)			
Operating temperature		–25°C to +70°C (–13°F to +158°F)			
Environmental characteristics		Same characteristics as Sepam™ base units (see page 21)			
Logic Inputs		**MES120**	**MES120G**	**MES120H**	
Voltage		24 to 250 V DC	220 to 250 V DC	110 to 125 V DC	
Range		19.2 to 275 V DC	170 to 275 V DC	88 to 150 V DC	
Typical burden		3 mA	3 mA	3 mA	
Typical switching threshold		14 V DC	155 V DC	82 V DC	
Input limit voltage	At state 0	< 6 V DC	< 144 V DC	< 75 V DC	
	At state 1	> 19 V DC	> 170 V DC	> 88 V DC	
Isolation of inputs from other isolated groups		Enhanced	Enhanced	Enhanced	
Control Relay Output Ox01*					
Voltage	DC	24/48 V DC	127 V DC	250 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		< 30 A for 200 ms			
Isolation of outputs from other isolated groups		Enhanced			
Annunciation Relay Output Ox02 to Ox06					
Voltage	DC	24/48 V DC	127 V DC	250 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
Isolation of outputs from other isolated groups		Enhanced			

** Ox01 denotes module number of I/O. For example, the first output of module #2 is O201. See page 22 of this manual.*