Base unit
Connection

1 Base unit.
2 8 fixing points for 4 spring clips.
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
- ■ 5 relay outputs.

(B1) Connector for 3 phase current I1, I2, I3 inputs.

(B2) ■ Sepam T87, M87, M88, G87, G88: connector for 3 phase current I'1, I'2, I'3 inputs
- ■ Sepam B83: connector for
- □ 3 phase voltage V'1, V'2, V'3 inputs
- □ 1 residual voltage V'0 input.
- ■ Sepam C86: connector for capacitor unbalance current inputs.

(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 V1, V2, V3 inputs
- ■ 1 residual voltage V0 input.
- ■ 2 residual current I0, I'0 inputs.

(F) Communication port 3 for ACE850 communication interfaces only.

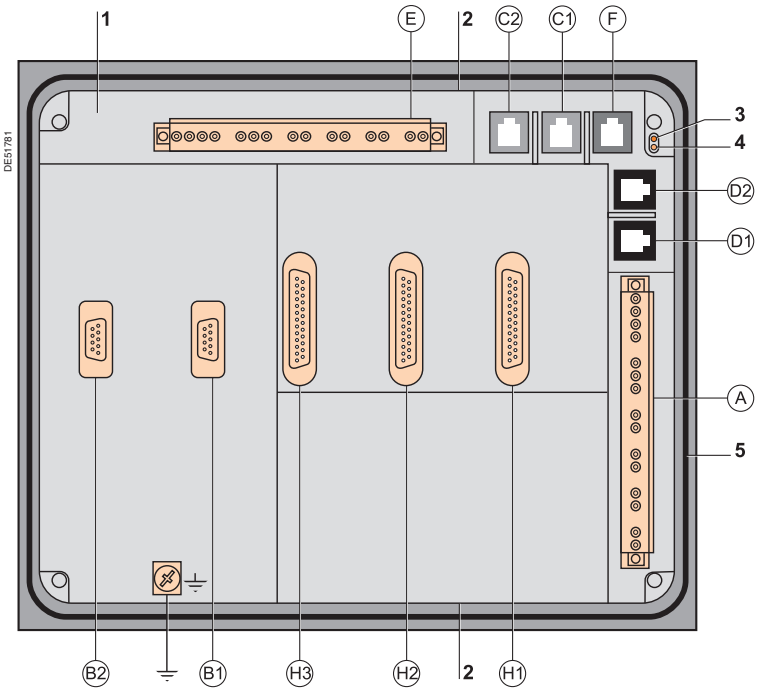
(H1) Connector for 1st MES120 input/output module.

(H2) Connector for 2nd MES120 input/output module.

(H3) Connector for 3rd MES120 input/output module.

⏚ Functional earth.

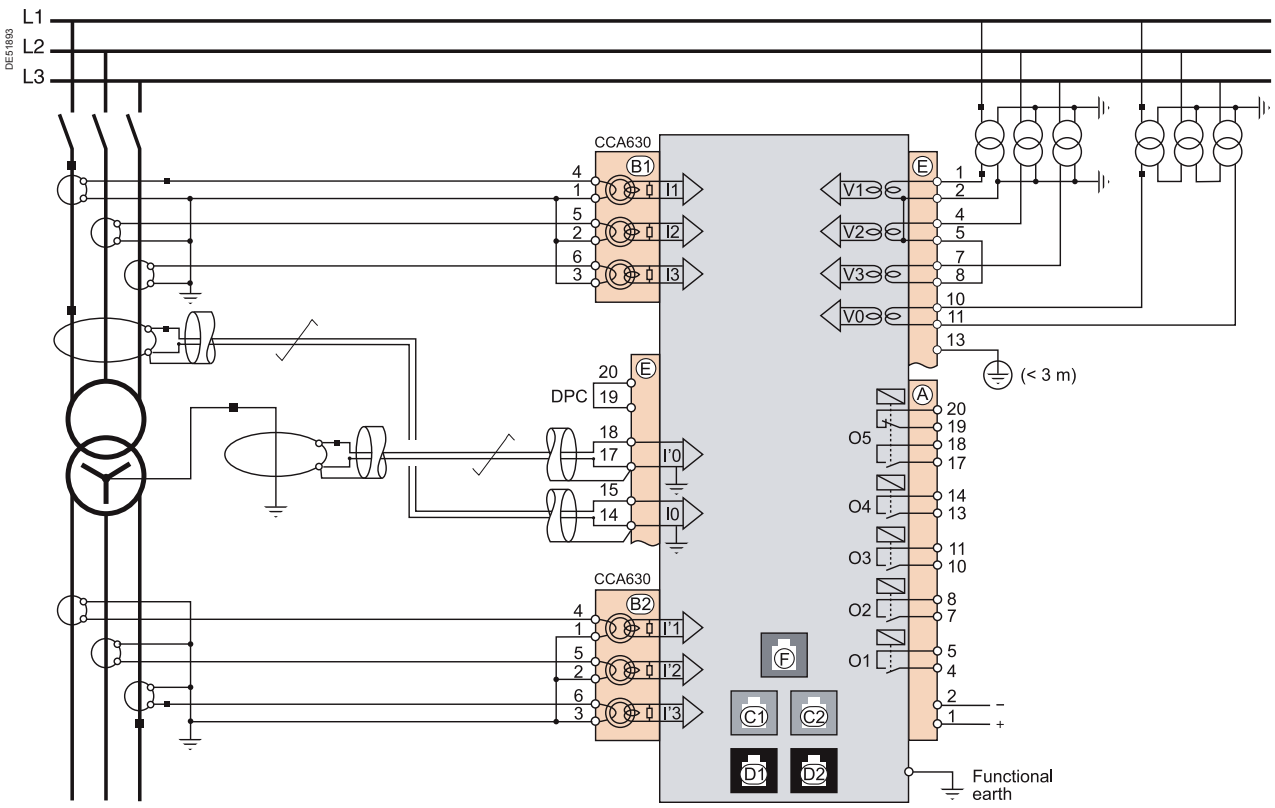
Rear panel description



Connection characteristics

Connector	Type	Reference	Wiring
(A), (E)	Screw-type	CCA620	■ Wiring without fittings: □ 1 wire with max. cross-section 0.5 to 2.5 mm² (≥ AWG 20-12) or 2 wires with max. cross-section 0.5 to 1 mm² (≥ AWG 20-16) □ Stripped length: 8 to 10 mm (0.31 to 0.39 in) ■ Wiring with fittings: □ Recommended wiring with Schneider Electric fitting: - DZ5CE015D for 1 wire 1.5 mm² (AWG 16) - DZ5CE025D for 1 wire 2.5 mm² (AWG 12) - AZ5DE010D for 2 wires 1 mm² (AWG 18) □ Tube length: 8.2 mm (0.32 in) □ Stripped length: 8 mm (0.31 in)
	6.35 mm (0.25 in) ring lugs	CCA622	■ 6.35 mm ring or spade lugs (0.25 in) (1/4") ■ Wire with max. cross-section 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: 0.7 to 1 Nm (8.85 lb-in)
(B1), (B2)	4 mm (0.15 in) ring lugs	CCA630 or CCA634, for connection of 1 A or 5 A CTs	■ Wire with cross-section 1.5 to 6 mm² (AWG 16-10) ■ Stripped length: 6 mm (0.23 in) ■ Use an appropriate tool to crimp the lugs on the wires ■ Tightening torque: 1.2 N.m (11 lb-in)
	RJ45 connector	CCA671, for connection of 3 LPCT sensors	Integrated with LPCT sensor
(C1), (C2)	White RJ45 connector		CCA612
(D1), (D2)	Black RJ45 connector		CCA770: L = 0.6 m (2 ft) CCA772: L = 2 m (6.6 ft) CCA774: L = 4 m (13.1 ft) CCA785 for MCS025 module: L = 2 m (6.6 ft)
(F)	Blue RJ45 connector		CCA614
DE51845 Functional earth	Ring lug		Earthing braid, to be connected to cubicle grounding ■ Flat copper braid with cross-section ≥ 9 mm² (> AWG 8) ■ Maximum length:500 mm (19.68 in)

Base unit
Connection



Note: *See connection characteristics page 16*

NOTICE

LOSS OF PROTECTION OR RISK OF NUISANCE TRIPPING

If the Sepam is no longer supplied with power or is in fail-safe position, the protection functions are no longer active and all the Sepam output relays are dropped out. Check that this operating mode and the watchdog relay wiring are compatible with your installation.

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

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, ELECTRIC ARC OR BURNS

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

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

NOTICE

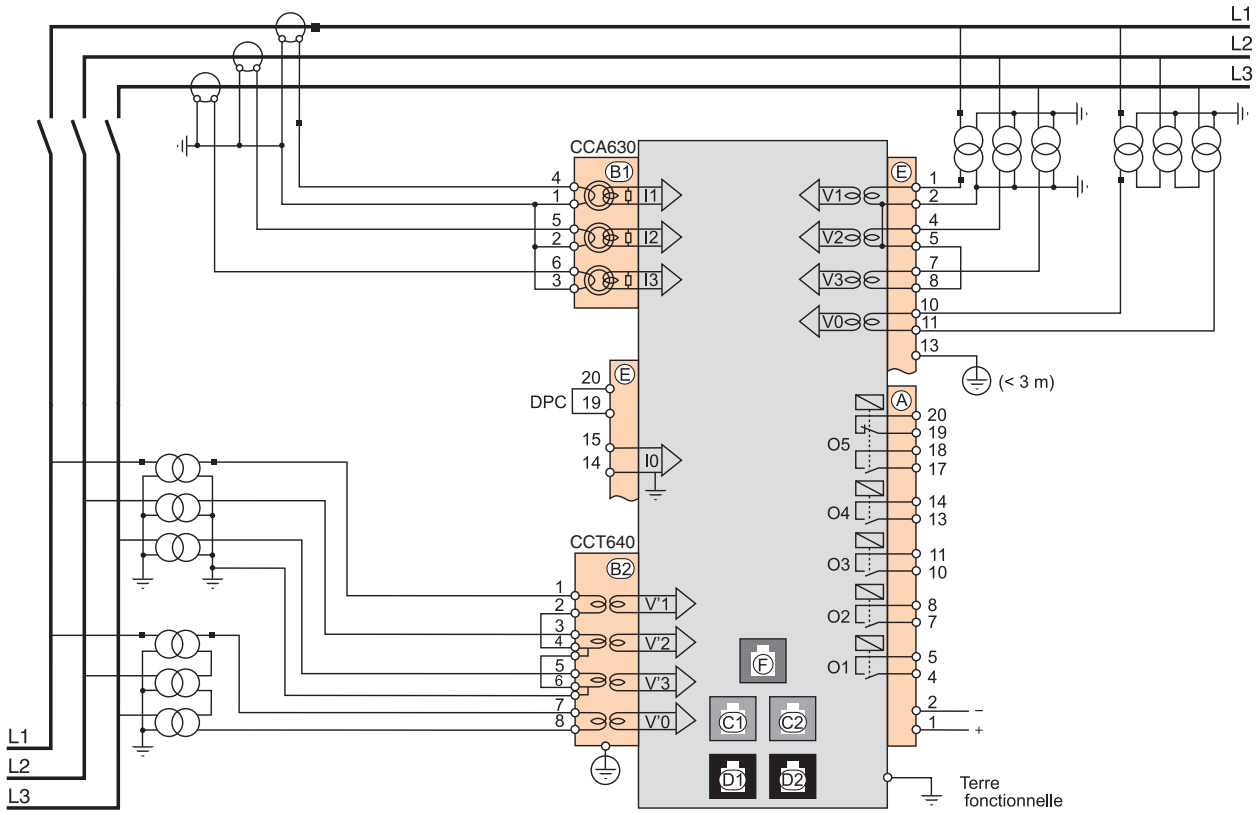
RISK OF DESTRUCTION OF THE SEPAM

Do not invert the connectors (A) and (E).

Failure to follow these instructions can result in equipment damage.

Base unit
Connection of Sepam B83

DE80993



Connector	Type	Reference	Wiring
(B1)	4 mm (0.15 in) ring lugs	CCA630 or CCA634, for connection of 1 A or 5 A CTs	■ wire with cross-section 1.5 to 6 mm² (AWG 16-10) ■ stripped length: 6 mm (0.236 in) ■ use an appropriate tool to crimp the lugs on the wires ■ tightening torque: 1.2 N.m (11 lb-in)
(B2)	Screw type	CCT640	■ VT wiring: identical to the CCA620 wiring ■ Earthing connection: by 4 mm (0.16 in) ring lug ■ tightening torque: 1.2 N.m (11 lb-in)
DE51845 Functional earth	Ring lug		Earthing braid, to be connected to cubicle grounding: ■ flat copper braid with cross-section ≥ 9 mm² (> AWG 8) ■ maximum length: 500 mm (19.68 in)

Connection characteristics of connectors (A), (E), (C1), (C2), (D1), (D2) : see page 14

NOTICE

LOSS OF PROTECTION OR RISK OF NUISANCE TRIPPING

If the Sepam is no longer supplied with power or is in fail-safe position, the protection functions are no longer active and all the Sepam output relays are dropped out. Check that this operating mode and the watchdog relay wiring are compatible with your installation.

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

⚠⚠ DANGER

HAZARD OF ELECTRIC SHOCK, ELECTRIC ARC OR BURNS

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

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

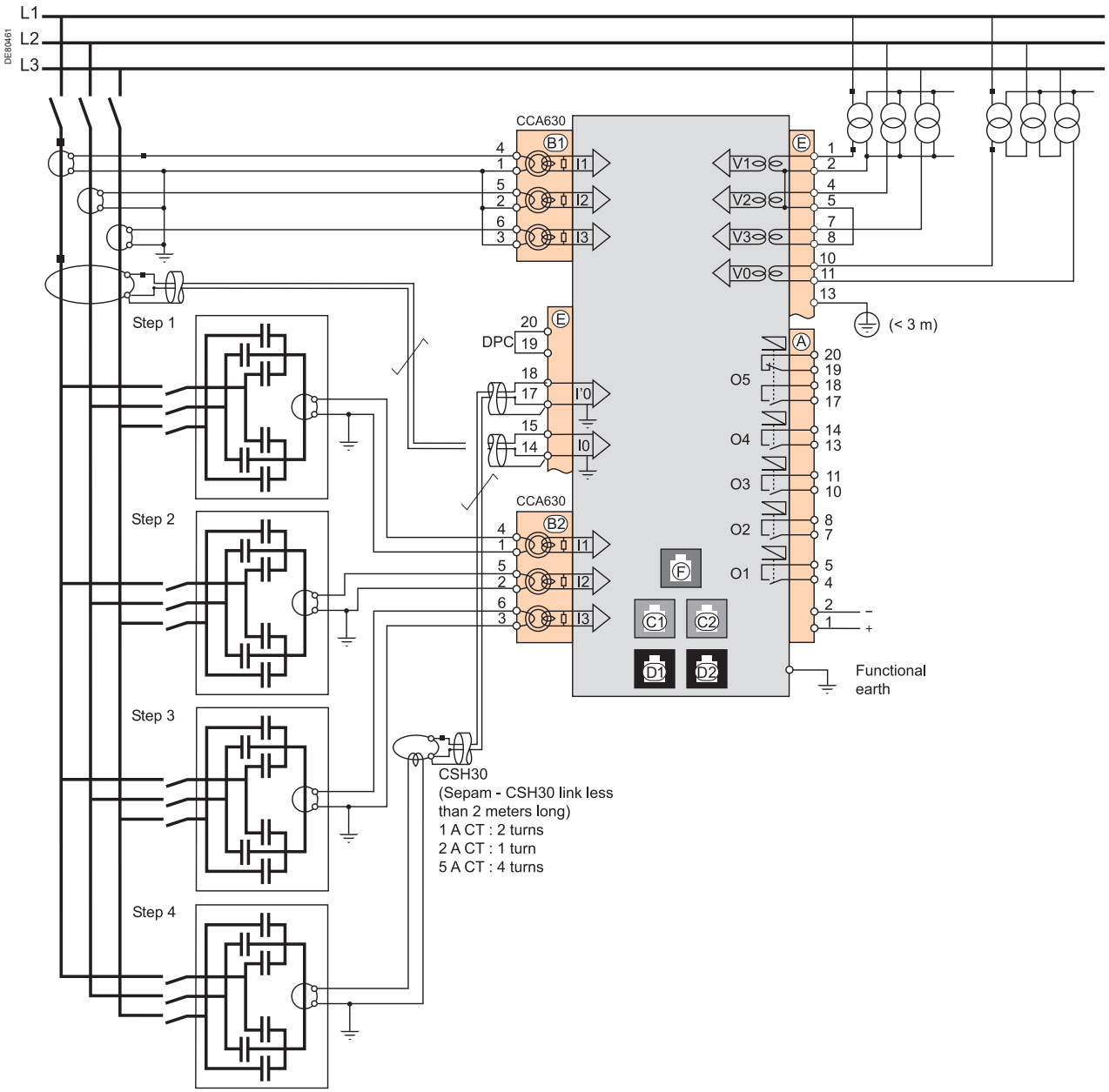
NOTICE

RISK OF DESTRUCTION OF THE SEPAM

Do not invert the connectors (A) and (E).

Failure to follow these instructions can result in equipment damage.

Base unit
Connection of Sepam C86

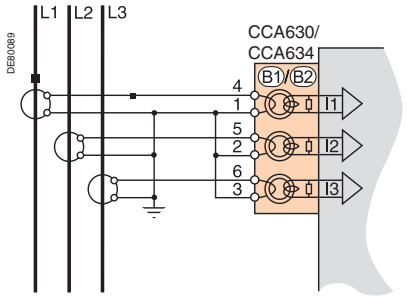


Connector	Type	Reference	Wiring
B1	4 mm (0.15 in) ring lugs	CCA630 or CCA634, for connection of 1 A or 5 A CTs	■ wire with cross-section 1.5 to 6 mm² (AWG 16-10) ■ stripped length: 6 mm (0.236 in) ■ use an appropriate tool to crimp the lugs on the wires ■ tightening torque: 1.2 N.m (11 lb-in)
	RJ45 connector	CCA671, for connection of 3 LPCT sensors	Integrated with LPCT sensor
B2	4 mm (0.15 in) ring lugs	CCA630 or CCA634, for connection of 1 A, 2A or 5 A CTs	■ wire with cross-section 1.5 to 6 mm² (AWG 16-10) ■ stripped length: 6 mm (0.236 in) ■ use an appropriate tool to crimp the lugs on the wires ■ tightening torque: 1.2 N.m (11 lb-in)
DE51845 Functional earth	Ring lugs		Earthing braid, to be connected to cubicle grounding: ■ flat copper braid with cross-section ⩾ 9 mm² (>AWG 8) ■ maximum length: 500 mm (19.68 in)

Connection characteristics of connectors A, E, C1, C2, D1, D2 : see page 14

Base unit
Connection of phase current inputs

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



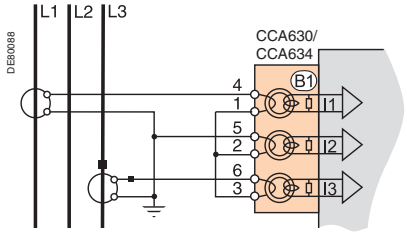
Description
Connection of 3 x 1 A or 5 A sensors to the CCA630 or CCA634 connector.

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

Parameters

Sensor type	5 A CT or 1 A CT
Number of CTs	I1, I2, I3
Rated current (In)	1 A to 15 kA

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



Description
Connection of 2 x 1 A or 5 A sensors to the CCA630 or CCA634 connector.

Measurement of phase 1 and 3 currents is sufficient for all protection functions based on phase current.
The phase current I2 is only assessed for metering functions, assuming that I0 = 0.

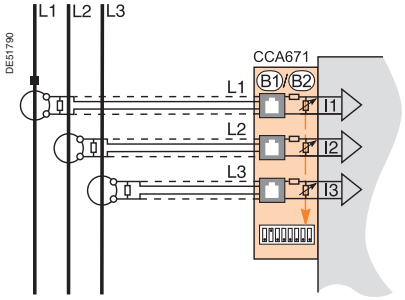
This arrangement does not allow the calculation of residual current, nor use of ANSI 87T and 87M differential protection functions on the Sepam T87, M87, M88, G87 and G88.

Paramètres

Sensor type	5 A CT or 1 A CT
Number of CTs	I1, I3
Rated current (In)	1 A to 15 kA

Base unit
Connection of phase current inputs

Variant 3: phase current measurement by 3 LPCT type sensors



Description

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

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

It is not possible to use LPCT sensors for 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)).

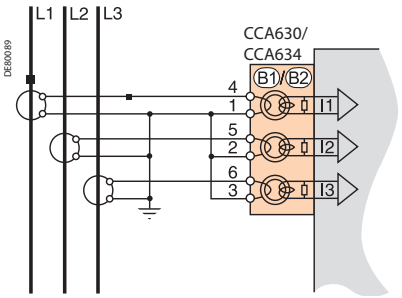
Parameters

Sensor type	LPCT
Number of CTs	I1, I2, I3
Rated current (In)	25, 50, 100, 125, 133, 200, 250, 320, 400, 500, 630, 666, 1000, 1600, 2000 or 3150 A

Note: *Parameter In must be set twice:*
- *Software parameter setting using the advanced UMI or the SFT2841 software tool*
- *Hardware parameter setting using microswitches on the CCA671 connector*

Base unit
Connection of resid ual current inputs

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

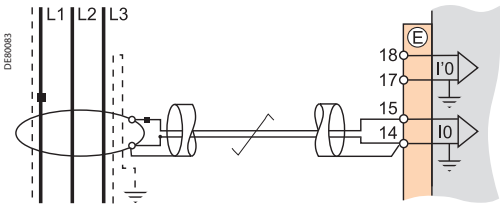


Description
Residual current is calculated by the vector sum of the 3 phase currents I1, I2 and I3, measured by 3 x 1 A or 5 A CTs or by 3 LPCT type sensors.
See current input connection diagrams.

Parameters

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

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

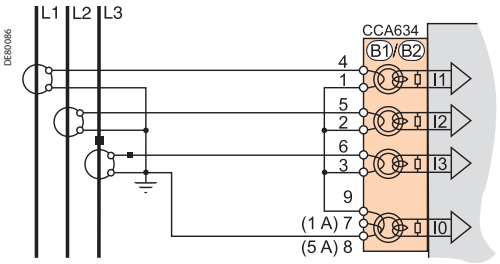


Description
Arrangement recommended for the protection of isolated or compensated neutral systems, in which very low fault currents need to be detected.

Parameters

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

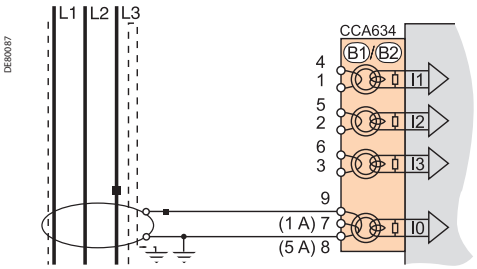
Variant 3: residual current measurement by 1 A or 5 A CTs and CCA634



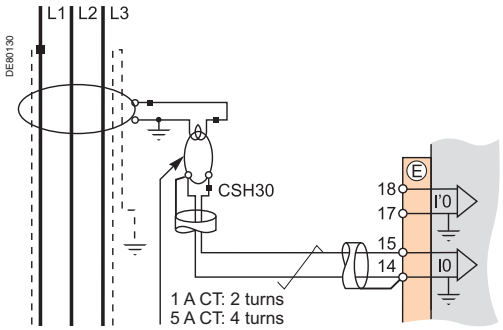
Description
Residual current measurement by 1 A or 5 A CTs
b Terminal 7: 1 A CT
b Terminal 8: 5 A CT

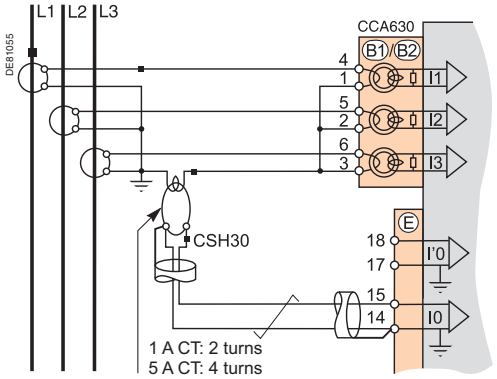
Parameters

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



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



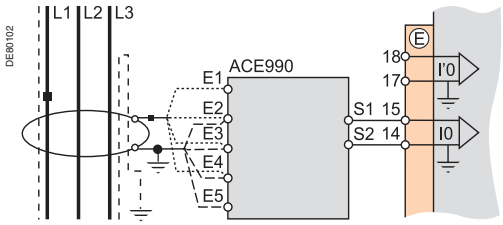


Description
The CSH30 interposing ring CT is used to connect 1 A or 5 A CTs to Sepam to measure residual current:
- CSH30 interposing ring CT connected to 1 A CT: make 2 turns through CSH primary
- CSH30 interposing ring CT connected to 5 A CT: make 4 turns through CSH primary.

Parameters

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

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



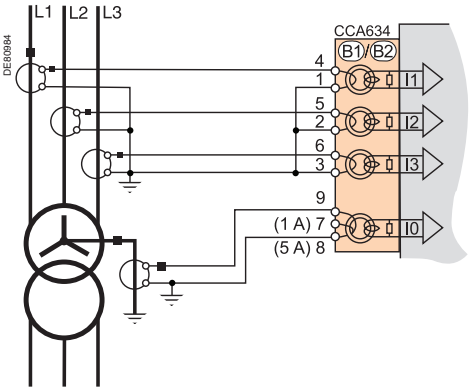
Description
The ACE990 is used as an interface between a MV core balance CT with a ratio of 1/n (50 ⩽ n ⩽ 1500) and the Sepam residual current input.
This arrangement allows the continued use of existing core balance CTs on the installation.

Parameters

Residual current	Rated residual current	Measuring range
ACE990 - range 1 (0.00578 ⩽ k ⩽ 0.04)	In0 = Ik.n(1)	0.01 to 20 In0 (minimum 0.1 A)
ACE990 - range 2 (0.0578 ⩽ k ⩽ 0.26316)	In0 = Ik.n(1)	0.01 to 20 In0 (minimum 0.1 A)

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

Variant 6: neutral point current measurement for the restricted earth protection (ANSI 64REF) and for a network where the neutral is not distributed



Description
The residual current is measured by taking the sum of the 3 phase currents using the CT whose secondary current is 1 A or 5 A.
The neutral point current is measured using the CT whose secondary current is 1 A or 5 A:
- Terminal 7: 1 A CT
- Terminal 8: 5 A CT

Parameters

Secondary current	Rated residual current	Measuring range
1 A CT	In0 = phase CT primary current In	0.01 to 20 In0 (0.1 A minimum)
5 A CT	In0 = phase CT primary current In	0.01 to 20 In0 (0.1 A minimum)

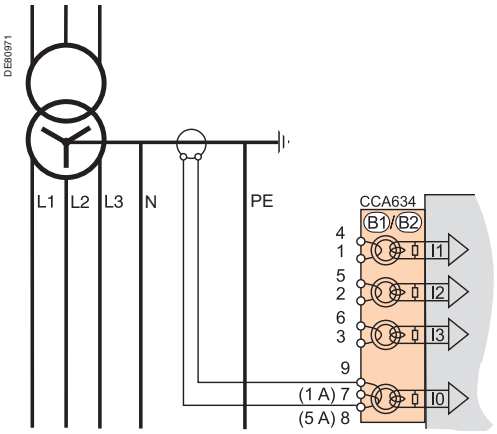
Base unit
Connection of low voltage residual current inputs

Variant 1: residual current measurement by CTs on the neutral earthing link (with or without CSH30 interposing ring CT)

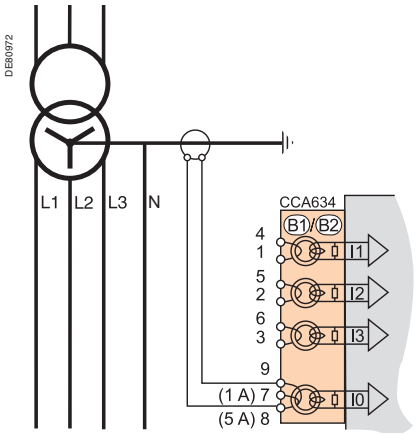
Description
Residual current is measured with a 1 A or 5 A CT on the neutral point.
These connection diagrams are incompatible with those for the ANSI 64REF function.

Parameters

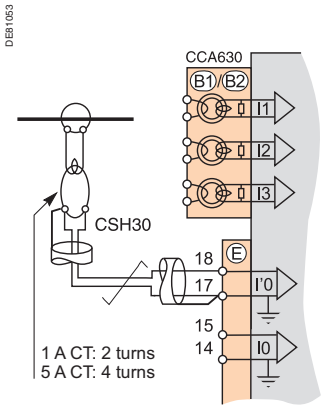
Residual current	Rated residual current	Measuring range
1 A CT	In0 = neutral point CT In	0.01 to 20 In0
5 A CT	In0 = neutral point CT In	0.01 to 20 In0



Connection on TN-S network.



Connection on TT network.



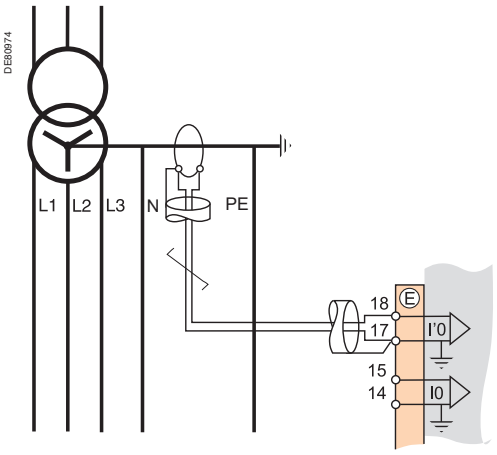
Connection with CSH30.

Variant 2: residual current measurement by CSH120 or CSH200 core balance CT on the neutral earthing link

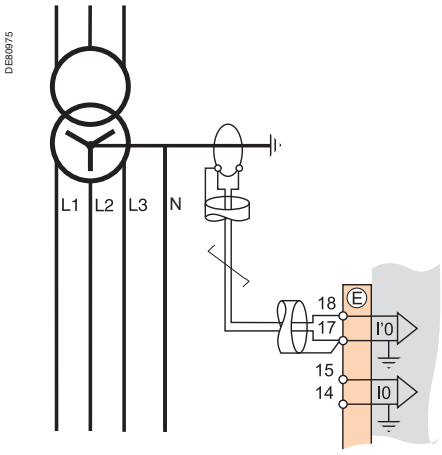
Description
Residual current is measured with a core balance CT on the neutral point. Core balance CTs are recommended for measuring very low fault currents provided that the earth fault current remains below 2 kA. Above this value it is advisable to use the standard variant 1.

Parameters

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

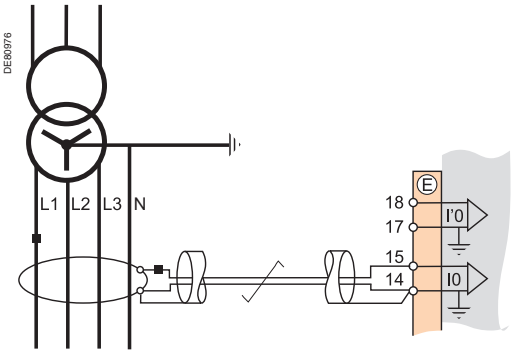


Connection on TN-S network.



Connection on TT network.

Variant 3: residual current measurement by sum of 3 phase currents and neutral current measurement by CSH120 or CSH200 core balance CT



Connection on TN-S and TT networks.

Description

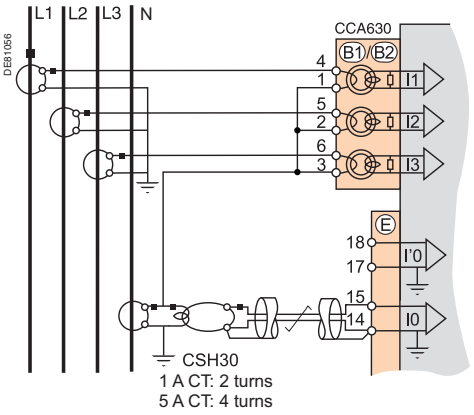
Measurement by core balance CT is recommended for measuring very low fault currents.

This connection diagram is incompatible with the ANSI 64REF function.

Parameters

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

Variant 4: residual current measurement by sum of 3 phase currents and neutral current measurement by 1 A or 5 A CTs and CSH30 interposing ring CT



Connection on TN-S and TT networks.

Description

The phase and neutral CTs should have the same primary and secondary currents.

The CSH30 interposing ring CT is used to connect 1 A or 5 A CTs to Sepam to measure residual current:

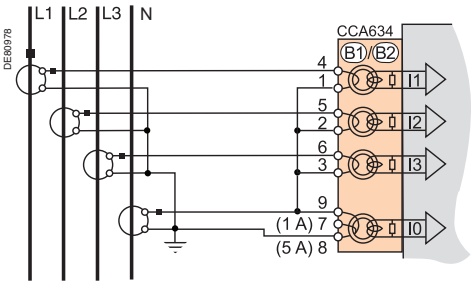
- Connection of CSH30 interposing ring CT to 1 A CT: make 2 turns through CSH primary
- Connection of CSH30 interposing ring CT to 5 A CT: make 4 turns through CSH primary.

According to the connection between the neutral point and earth, this connection diagram is incompatible with the ANSI 64REF function.

Parameters

Residual current	Rated residual current	Measuring range
1 A CT	In0 = phase CT primary current In	0.01 to 20 In0
5 A CT	In0 = phase CT primary current In	0.01 to 20 In0

Variant 5: residual current measurement by sum of 3 phase currents and neutral current measurement by 1 A or 5 A CTs and CCA634 connector



Connection on TN-S and TT networks.

Description

The phase and neutral CTs should have the same primary and secondary currents.

Residual current measurement by 1 A or 5 A CTs.

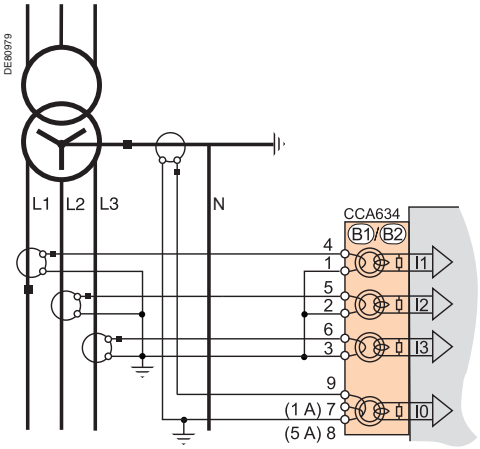
- Terminal 7: 1 A CT
- Terminal 8: 5 A CT

According to the connection between the neutral point and earth, this connection diagram is incompatible with the ANSI 64REF function.

Parameters

Residual current	Rated residual current	Measuring range
1 A CT	In0 = phase CT primary current In	0.01 to 20 In0
5 A CT	In0 = phase CT primary current In	0.01 to 20 In0

Base unit
Connection of low voltage current inputs for restricted earth protection (ANSI 64REF)



Connection on TT network.

Description

These 3 diagrams correspond to the connections as found in the various low voltage diagrams where the neutral is distributed.

They are used to work out the residual current (taking the sum of the 3 phase currents) and the transformer neutral point current for operation of the restricted earth protection function (ANSI 64 REF).

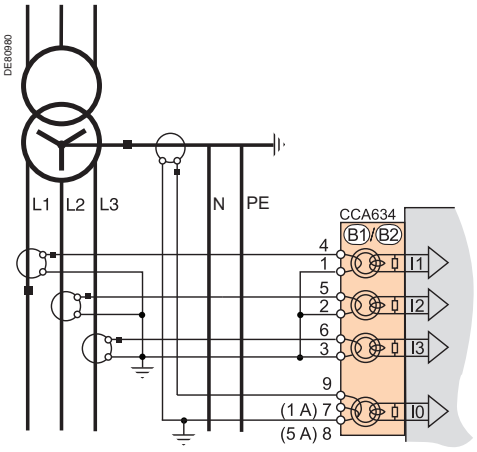
The residual current is measured by taking the sum of the 3 phase currents using the CT whose secondary current is 1 A or 5 A.

The neutral point current is measured using the CT whose secondary current is 1 A or 5 A:

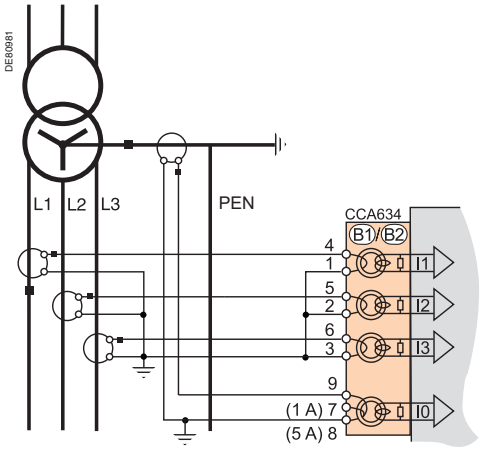
- Terminal 7: 1 A CT
- Terminal 8: 5 A CT

Parameters

Secondary current	Rated residual current	Measuring range
1 A CT	In0 = phase CT primary current In	0.01 to 20 In0
5 A CT	In0 = phase CT primary current In	0.01 to 20 In0



Connection on TN-S network.

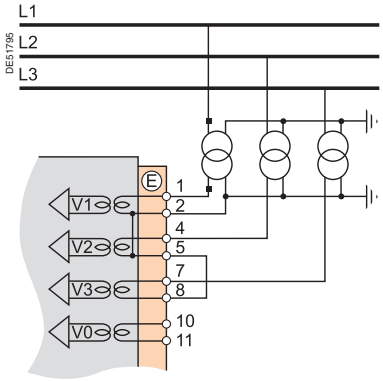


Connection on TN-C network.

Base unit
Connection of main voltage inputs

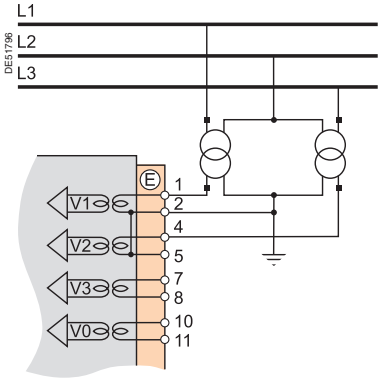
Phase voltage input connection variants

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



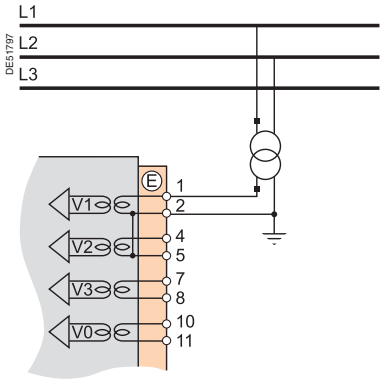
Measurement of the 3 phase-to-neutral voltages allows the calculation of residual voltage, V0Σ.

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



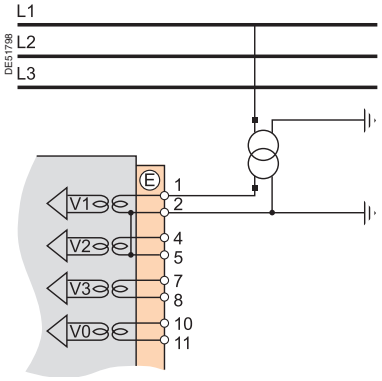
This variant does not allow the calculation of residual voltage.

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



This variant does not allow the calculation of residual voltage.

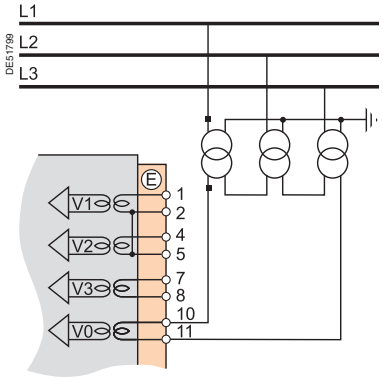
Variant 4: measurement of 1 phase-to-neutral voltage (1 V)



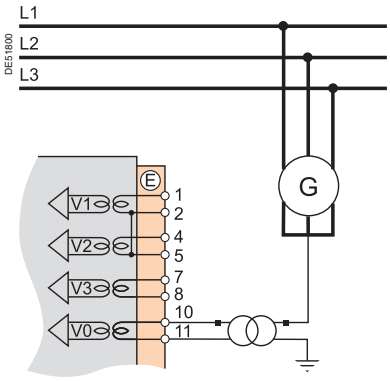
This variant does not allow the calculation of residual voltage.

Residual voltage input connection variants

Variant 5: measurement of residual voltage V0



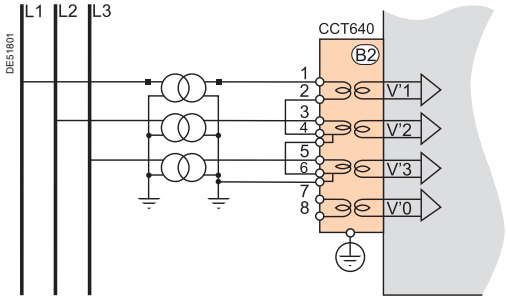
Variant 6: measurement of residual voltage Vnt in generator neutral point



Base unit
Connection of additional voltage inputs for Sepam B83

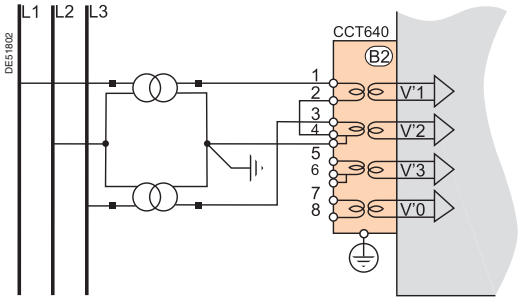
Additional phase voltage input connection variants

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



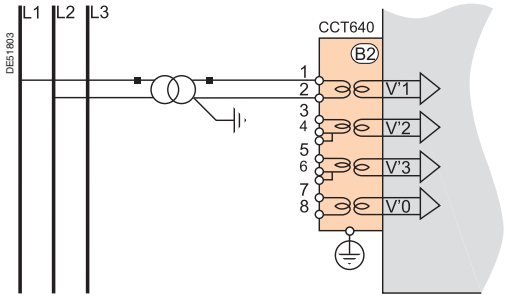
Measurement of the 3 phase-to-neutral voltages allows the calculation of residual voltage, V'0Σ.

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



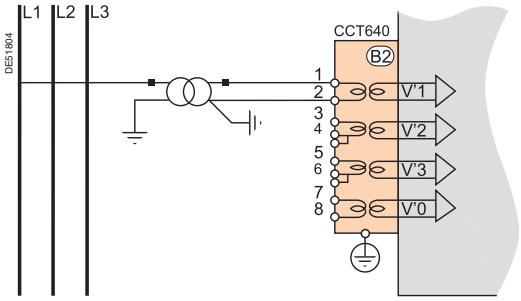
This variant does not allow the calculation of residual voltage.

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



This variant does not allow the calculation of residual voltage.

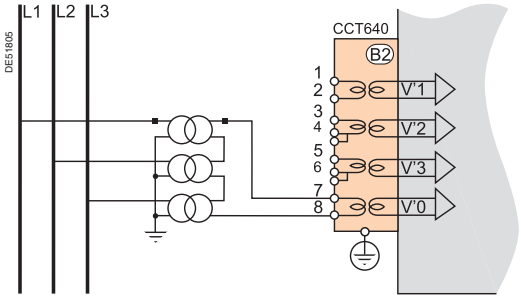
Variant 4: measurement of 1 phase-to-neutral voltage (1 V')



This variant does not allow the calculation of residual voltage.

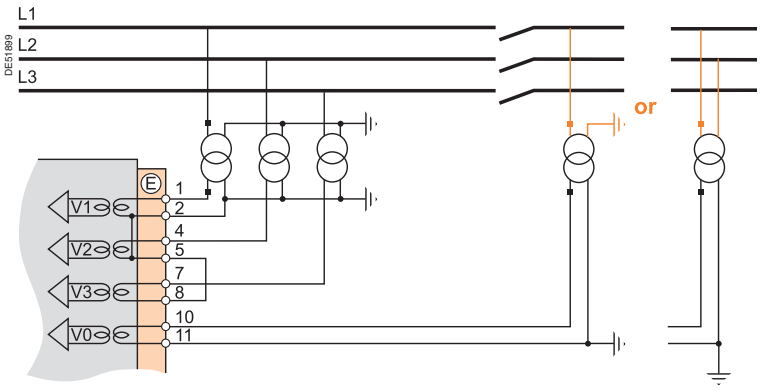
Additional residual voltage input connection

Variant 5: measurement of residual voltage V'0

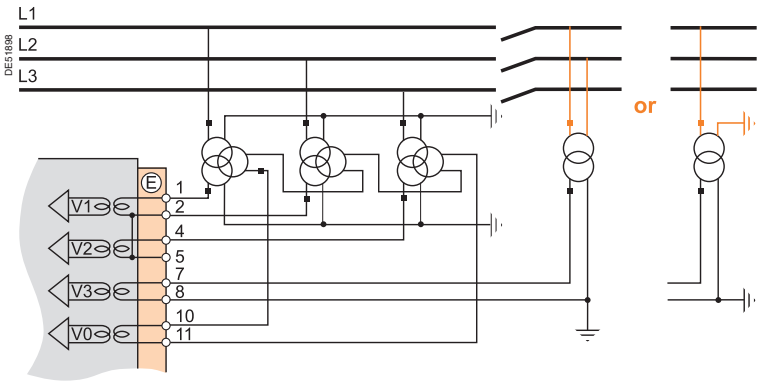


Base unit
Connection of additional phase voltage input for Sepam B80

Connection to measure one additional voltage



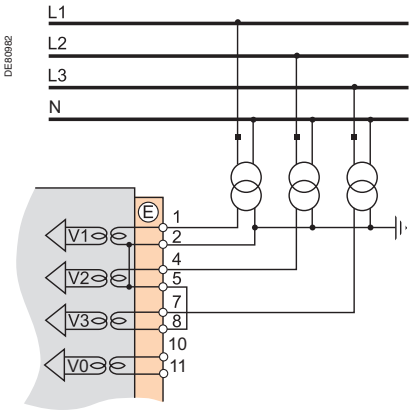
This connection should be used to measure:
- three phase-to-neutral voltages V1, V2, V3 on busbars no. 1
- one additional phase-to-neutral voltage V'1 (or one additional phase-to-phase voltage U'21) on busbars no. 2.



This connection should be used to measure:
- two phase-to-phase voltages U21, U32 and one residual voltage V0 on busbars no. 1
- one additional phase-to-phase voltage U'21 (or one additional phase-to-neutral voltage V'1) on busbars no. 2.

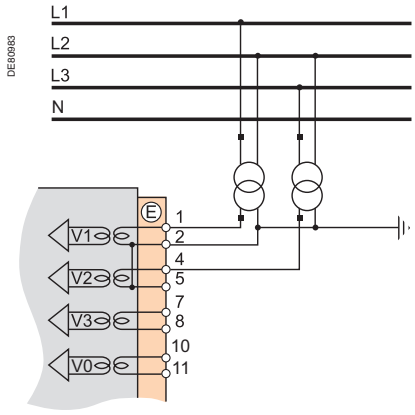
Base unit
Connection of low voltage phase voltage inputs

Variant 1: TN-S and TN-C networks



When a ground fault occurs on a TN-S or TN-C network, the neutral potential is not affected: the neutral can act as a reference for the VTs.

Variant 2: TT and IT networks



When a ground fault occurs on a TT or IT network, the neutral potential is affected: the neutral cannot act as a reference for the VTs, phase-to-phase voltages must be used on both phases.