

RESISTANCE GROUNDING/NGR MONITORING

Continuously monitor the integrity of the ground conductor to protect portable equipment from hazardous voltages caused by ground faults

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Neutral-Grounding-Resistor Sizing Chart

System Voltage (Line-to-line)	NGR Let-Through Current and Resistance	Time Rating
208 V	5 A/24 Ohms	Continuous
480 V	5 A/55 Ohms	Continuous
600 V	5 A/69 Ohms	Continuous
2,400 V	5 A/277 Ohms or 10 A/139 Ohms	Continuous or 10 sec
4,160 V	5 A/480 Ohms or 10 A/240 Ohms	Continuous or 10 sec
13,800 V	10 A/798 Ohms or 200 A/40 Ohms	10 seconds
25,000 V	200 A/72 Ohms or 400 A/36 Ohms	10 seconds
34,500 V	200 A/100 Ohms or 400 A/50 Ohms	10 seconds

Note: The values shown are for any size transformer and are typical.

Note: The above table is for illustrative purposes only. Actual values may differ based on a variety of individual system considerations, such as capacitive charging current and co-ordination study results.



For More Information...
and to download our White Paper
Why NGRs Need Continuous
Monitoring, visit
Littelfuse.com/TechnicalCenter

SE-325 SERIES (PGM-8325)

Neutral-Grounding-Resistor Monitor



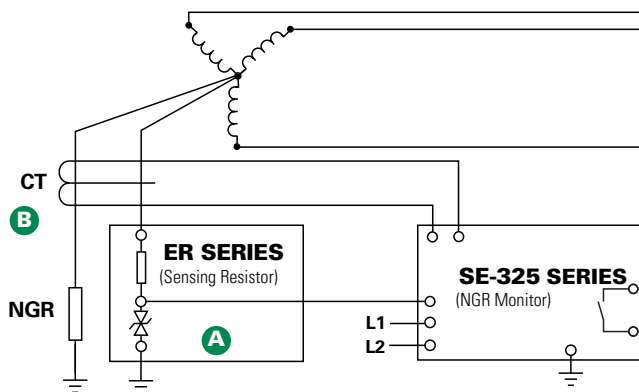
Description

The SE-325 Neutral-Grounding-Resistor Monitor is used on resistance-grounded systems up to 25 kV to monitor the integrity of the neutral-to-ground path and to detect ground faults. It measures current and voltage in a transformer or generator neutral-to-ground connection and continuity of the neutral-grounding resistor (NGR). The SE-325 coordinates these three measurements to detect a loose connection, corrosion, ground fault, or NGR failure, and provides one alarm or trip output contact.




Features & Benefits

FEATURES	BENEFITS
Continuous NGR monitoring	Detects resistor failure within seconds, reduces transient-overvoltage risk, removes risk of ground-fault-detection failure
Ground-fault Detection	Main or backup protection to detect a ground fault anywhere on the monitored system
Adjustable pickup (0.5-4 A)	Select greatest sensitivity without false operation
Adjustable time delay (0.1-2 s)	Adjustable trip delay allows system coordination
Output contacts	Form A output contact
Selectable contact operating mode	Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil or alarm system

Simplified Circuit Diagram



Accessories

- A**  **ER Series Sensing Resistor**
Required interface between the power system and the SE-325. Eliminates hazardous voltage levels at the monitor.
- B**  **CT200 Series Current Transformer**
Required CT detects ground-fault current.
-  **RK Series Remote Indication and Reset**
Optional panel-mounted remote indication and reset assemblies. Available in NEMA 1 or NEMA 4 configurations.

Ordering Information

ORDERING NUMBER	CONTROL POWER
SE-325	120 Vac
SE-325D	120 Vac/Vdc
SE-325E	240 Vac

Consult manual online for additional ordering options.

ACCESSORIES	REQUIREMENT
CT200 Series	Required
ER Series	Required
SE-MRE-600	Optional
RK-325, RK-325I, RK-302	Optional
RK-13	Optional
NGRM-ENC	Optional

Specifications

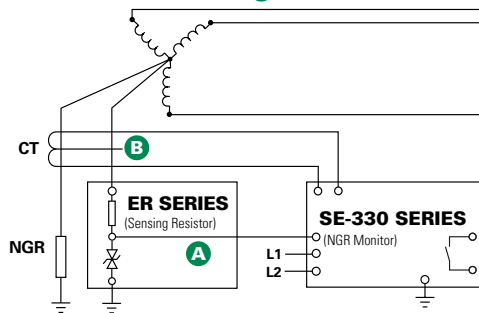
IEEE Device Numbers	Ground Fault (50G/N, 51G/N), Overvoltage (59N), Lockout Relay (86), Checking Relay (3)
Input Voltage	See ordering information
Dimensions	H 150 mm (5.9"); W 109 mm (4.3"); D 100 mm (4.0")
GF Trip Level Settings	0.5-4.0 A
GF Trip Time Settings	0.1-2.0 s
RF Trip-Level Settings	20-400 Vac (≤ 5 kV systems) 100-2,000 Vac (> 5 kV systems)
Contact Operating Mode	Selectable fail-safe or non-fail-safe
Reset Button	Standard feature
Output Contacts	Form A
Approvals	CSA certified, UL Listed (E340889), C-Tick (Australian)
Conformally coated	Standard feature
Warranty	5 years
Mounting	Surface

SE-330, SE-330HV SERIES

Neutral-Grounding-Resistor Monitor



Simplified Circuit Diagram



For detailed wiring diagram, see adjacent page.

Ordering Information

ORDERING NUMBER	POWER SUPPLY	COMM		K4 UNIT HEALTHY CONTACT
SE-330	-	X	X	- 0 X
SE-330 for all apps. 35 kV or less SE-330HV for 72 kV apps.	0=120/240 Vac/Vdc 2=48 Vdc	0=USB Only 1=DeviceNet 3=EtherNet (Dual RJ45) 4=EtherNet (SC Fiber & RJ45) 5=EtherNet (Dual SC Fiber) 6=IEC61850 Dual RJ45) 7=IEC61850 (SC Fiber & RJ45) 8=IEC61850 (Dual SC Fiber)		0=Normally Open 1=Normally Closed

NOTE: For Australian applications, see the SE-330AU.

ACCESSORIES	REQUIREMENT
ER Series Sensing Resistor	Required
Current Transformer	Required
SE-IP65CVR-G	Optional
SE-MRE-600	Optional
RK-332	Optional
NGRM-ENC	Optional
PGA-0520	Optional
SE-330-SMA	Optional

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Description

The SE-330 Series is an advanced ground-fault and neutral-grounding-resistor monitoring relay. It measures neutral current, neutral-to-ground voltage, and neutral-to-ground resistance. It provides continuous monitoring of the neutral-to-ground path to verify that the neutral-grounding resistor (NGR) is intact. This is of utmost importance—an open NGR renders current-sensing ground-fault protection inoperative and could result in a false belief that the system is functioning properly. The SE-330 can be used with low- and medium-voltage transformers and generators with low- or high-resistance grounding used in processing, manufacturing, chemical, pulp and paper, petroleum, and water-treatment facilities. For high-voltage applications, use the SE-330HV Series. For applications that require conformance to Australian standard AS/NZS 2081.3:2002, see the SE-330AU Series.

Resistor Monitoring

The SE-330 combines the measured values of resistance, current, and voltage to continuously determine that an NGR is intact. It is able to detect a resistor failure with or without a ground fault present. Sensing resistors are matched to the system voltage and are used to monitor NGRs on systems up to 72 kV.

Ground-Fault Monitoring

The SE-330 uses an application-appropriate current transformer to reliably detect ground-fault currents as small as 100 mA. DFT filtering ensures that false trips due to harmonic noise from adjustable-speed drives do not occur. Should the resistor open and a ground fault subsequently occur, the SE-330 will detect the fault through voltage measurement, while other current-only sensing relays would be ineffective.

Pulsing Ground-Fault Location

The SE-330 is capable of controlling a pulsing contactor, which is used to switch the NGR resistance in a pulsing-compatible NGR package. The resulting ground-fault current is distinguishable from charging currents and noise and will only appear upstream of the ground fault, making fault location fast and easy, even without isolating feeders or interrupting loads.

Accessories

A



ER Series Sensing Resistor

Required interface between the power system and the SE-330/SE-330HV. Eliminates hazardous voltage levels at the relay.

B



EFCT Series Ground-Fault Current Transformer

Sensitive ground-fault current detection (5 A primary).



SE-CS30 Series Ground-Fault Current Transformer

Sensitive ground-fault current detection (30 A primary).



Other Current Transformer

For low-resistance NGRs choose a CT primary approximately equal to the NGR rating. Inputs are provided for 1- and 5- A- secondary CTs.



SE-IP65CVR-G Hinged Transparent Cover

Watertight cover, tamper resistant, IP65 protection.

SE-330, SE-330HV SERIES

Features & Benefits

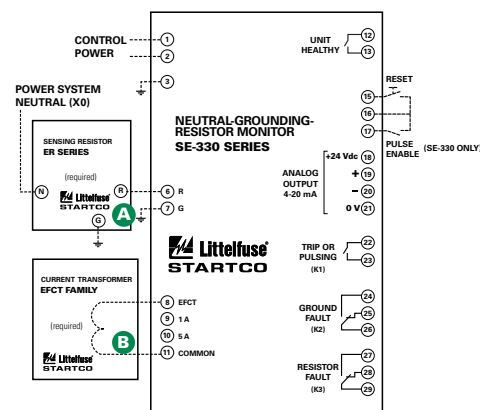
FEATURES	IEEE #	BENEFITS
Continuous NGR monitoring	3	Detects resistor failure within seconds, reduces transient-overvoltage risk, removes risk of ground-fault-detection failure
Ground-fault detection	50G/N, 51G/N, 59N	Main or backup protection to detect a ground fault anywhere on the monitored system
Adjustable pickup (2-100%)		Select greatest sensitivity without false operation, adjustable in 1% increments (MEM setting)
Adjustable time delay (0.1-10 s)		Adjustable trip delay allows quick protection and system coordination
Universal CT compatibility		Allows the use of a CT that gives required ground-fault settings
Output contacts		Two Form C (Ground Fault, Resistor Fault), Two Form A (Trip/Pulse, Healthy)
Analog output (4-20 mA)		Connect an optional PGA-0520 meter or control system
Pulsing output (SE-330 only)		Control the operation of a pulsing ground-fault-location circuit
Trip records		On-board 100-event (with date and time) recorder helps with system diagnostics
Harmonic filtering (DFT)		Eliminate false trips due to harmonic noise from ASDs
Local communications		Mini USB port to view measured values, configure settings, and check event records
Data Logging		On-board microSD card (included) can be used for long-term data logging
Network communications		Remotely view measured values and event records, reset trips, and cause a remote trip Available Protocol Options: IEC 61850 - with dual RJ45, SC Fiber and RJ45, or Dual SC Fiber Interface Modbus TCP and Ethernet/IP - with dual RJ45, SC Fiber and RJ45, or Dual SC Fiber Interface DeviceNet - with CAN interface
Software		PC-interface software (SE-MON330) is available at Littelfuse.com/RelaySoftware
Selectable contact operating mode		Selectable fail-safe or non-fail-safe operating modes allows connection to shunt or undervoltage breaker coil or alarm circuit (Trip, Ground Fault, Resistor Fault relays)
Selectable reset mode		Selectable latching or auto-reset operation
Calibrate push button		Ensures resistor-failure sensitivity is correct
Unit-healthy output		Verifies SE-330 is operating correctly
Conformal coating		Internal circuits are conformally coated to protect against corrosion and moisture

Typical Values

SYSTEM VOLTAGE (VOLTS)	NEUTRAL-GROUNDING RESISTOR		SENSING RESISTOR		GROUND-FAULT PICKUP LEVEL (AMPERES)	V _N PICKUP LEVEL (VOLTS)
	CURRENT (AMPERES)	RESISTANCE (OHMS)	MODEL	RESISTANCE (SWITCH S5 SETTING)		
480	5	55	ER-600VC	20 kΩ	2.5	170
600	5	69	ER-600VC	20 kΩ	2.5	200
2,400	5	277	ER-5KV	20 kΩ	2.5	800
4,160	5	480	ER-5KV	20 kΩ	3	1,700
7,200	10	416	ER-15KV	100 kΩ	2	170 x 5 = 850
14,400	15	554	ER-15KV	100 kΩ	3	340 x 5 = 1,700

DISCLAIMER: The above table is for illustrative purposes only. Actual values may differ based on a variety of individual system considerations, such as capacitive charging current and coordination study results.

Wiring Diagram



Specifications

IEEE Device Numbers
Input Voltage
Dimensions
GF Trip-Level Settings
GF Trip-Time Settings
V_N Trip-Level Settings
Contact Operating Mode
Harmonic Filtering
Reset Button
Output Contacts
Pulsing Circuit
Approvals

Communications

Analog Output
Conformally Coated
Warranty
Mounting

Ground Fault (50G/N, 51G/N, 59N), Checking Relay (3), Lockout Relay (86)
See ordering information
H 213 mm (8.4"); **W** 98 mm (3.9"); **D** 132 mm (5.2")
2-100% of CT-Primary Rating in 1% increments
0.1-10 s
20-2,000 Vac (≤5 kV systems) 100-10,000 Vac (>5 kV systems)
Selectable fail-safe or non-fail-safe (K1, K2, K3)
Standard feature
Standard feature
Two Form A and two Form C
1.0-3.0 s in 0.2 s increments (SE-330 only)
CSA certified, UL Listed (E340889),
CE (European Union), C-Tick (Australian)
Mini USB (standard); DeviceNet (optional), IEC 61850 (optional),
Modbus TCP and EtherNet/IP (optional)
4-20 mA, self or loop powered
Standard feature
5 years
Panel and Surface (optional)

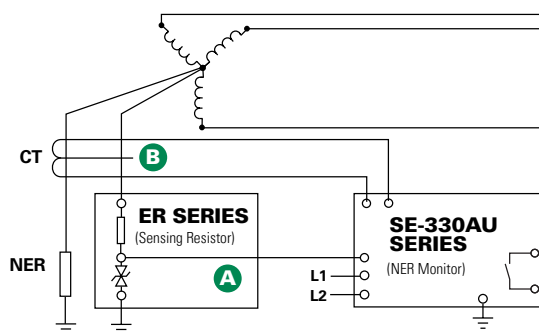
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SE-330AU SERIES

Neutral-Earthing-Resistor Monitor



Simplified Circuit Diagram



Ordering Information

ORDERING NUMBER	POWER SUPPLY	COMM		K4 UNIT HEALTHY CONTACT
SE-330AU	- X	X	- 0	X
SE-330AU for all apps. 35 kV or less SE-330HV for 72 kV apps.	0=120/240 Vac/Vdc 2=48 Vdc	0=USB Only 1=DeviceNet 3=EtherNet (Dual RJ45) 4=EtherNet (SC Fiber & RJ45) 5=EtherNet (Dual SC Fiber) 6=IEC61850 (Dual RJ45) 7=IEC61850 (SC Fiber & RJ45) 8=IEC61850 (Dual SC Fiber)		0=Normally Open 1=Normally Closed

ACCESSORIES	REQUIREMENT
ER Series Sensing Resistor	Required
Current Transformer	Required
SE-IP65CVR-G	Optional
SE-MRE-600	Optional
RK-332	Optional

Description

The SE-330AU Series is an advanced earth-fault and earthing-resistor monitoring relay for low- and medium-voltage transformers and generators. It monitors neutral current, neutral-to-earth voltage, and neutral-to-earth resistance. It provides continuous monitoring of the neutral-to-earth path to verify that the neutral-earthing resistor (NER) is intact. This is of utmost importance—an open NER renders current-sensing earth-fault protection inoperative and could result in a false belief that the system is functioning properly. The SE-330AU earth-fault function complies with AS/NZS 2081.3:2002. Outputs include four relay outputs, and an analog output. A mini USB port is included to view measured values, configure settings, and check event records. An on-board micro SD card can be used for long-term data logging. Network communications options are available. For non-AS/NZS 2081 applications, see the SE-330 or SE-330HV Series.

Resistor Monitoring

The SE-330AU combines the measured values of resistance, current, and voltage to continuously determine that the NER is intact. It is able to detect a resistor failure with or without an earth fault present. Sensing resistors are matched to the system voltage and are used to monitor NGRs on systems up to 35 kV.

Earth-Fault Monitoring

The SE-330AU uses a 5- or 30-A-primary current transformer to provide a pickup-setting range of 0.125 to 5 A or 0.75 to 30 A to comply with AS/NZS 2081.3:2002. DFT filtering ensures that false trips due to harmonic noise from adjustable-speed drives do not occur. Open-CT detection is provided.

Accessories

A



ER Series Sensing Resistor

Required interface between the power system and the SE-330AU. Eliminates hazardous voltage levels at the relay.

B



EFCT Series Earth-Fault Current Transformer

Sensitive earth-fault current detection (5 A primary).



SE-CS30 Series Earth-Fault Current Transformer

Sensitive earth-fault current detection (30 A primary).

Specifications

Input Voltage

See ordering information

Dimensions

H 213 mm (8.4"); **W** 98 mm (3.9"); **D** 132 mm (5.2")

GF Trip-Level Settings

0.125 to 30 A

GF Trip-Time Settings

0.1 to 0.5 s

Vn Trip-Level Settings

20-2,000 Vac (≤ 5 kV systems)
100-10,000 Vac (> 5 kV systems)

Output Contacts

Two Form A, Two Form C

Operating Mode

Fail-Safe

Harmonic Filtering

Standard feature

Reset

Front panel push button and remote input

Approvals

C-Tick (Australian), CE

Communications

Mini USB (standard); DeviceNet (optional), IEC 61850 (optional), Modbus TCP and EtherNet/IP (optional)

Analog Output

4-20 mA, self or loop powered

Conformal Coating

Standard feature

Warranty

5 years

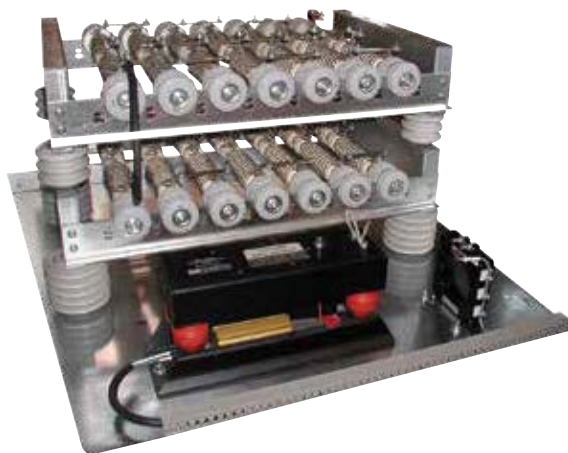
Mounting

Panel, Surface (optional)

NGR SERIES

Neutral-Grounding-Resistor System

3
RESISTANCE GROUNDING/NGR MONITORING



For information about the NGRM-ENC NGR Monitor Control Panel, see Accessories.

Ordering Information

For information regarding a tailored NGR package, please fill out and submit the form at www.littelfuse.com/NGR-Quote

Description

Neutral-Grounding Resistors (NGRs) are used to ground power systems by inserting a resistor between the system neutral and ground. This reduces the prospective ground-fault current to a predetermined value.

A properly designed resistance-grounded system provides benefits over both ungrounded and solidly grounded systems. Because the system is grounded, transient overvoltages do not occur and ground-fault current can flow allowing it to be detected and measured. They also significantly reduce damage caused by ground faults on solidly grounded systems. Limiting ground-fault current eliminates the arc-flash hazards associated with the first ground fault. The hazards associated with phase-to-phase electrical faults must still be mitigated by using arc-flash relays, feeder-protection relays, current-limiting fuses, and other methods. Ground-fault relays (such as the SE-701) can be used on feeders to provide selective coordination and the ability to quickly locate or isolate the fault. Pulsing systems are also available as they are another popular fault-location method.

Applications

Resistance grounding is typically applied on transformers and generators where safety and continuity of service are paramount. A faulted feeder may remain in operation until it is safe to repair the fault, where allowed by the local electrical code.

Benefits

- Eliminate phase-to-ground arc-flash incidents
- Eliminate transient overvoltages
- Reduced point-of-fault damage
- Can provide continuity of service during a ground fault
- Optional pulsing ground-fault current to aid in fault location

Features

- ER-series Sensing Resistor and Current Transformer required for NGR monitoring come pre-installed inside the enclosure
- Can be packaged with a zigzag transformer to resistance ground an ungrounded delta system, a system bus fed by generators, or a system with an inaccessible neutral
- SE-325 or SE-330 NGR Monitor can provide continuous NGR monitoring and ground-fault protection; NGR failure will render all downstream current-sensing ground-fault protection inoperative
- Stainless steel resistor elements prevent corrosion
- Short-time and continuous-rated duty resistors are available

NGRM-ENC SERIES

NGRM-ENC



Description

The NGRM-ENC Enclosed Neutral-Grounding-Resistor (NGR) Monitor series is a Type 4X enclosure housing a Littelfuse Startco SE-325 or SE-330 Neutral-Grounding-Resistor Monitor and optional accessories that include a 480/600-V control power transformer (CPT), faulted-phase indication (FPI; implemented with an EL3100 Ground-Fault & Phase-Voltage Indicator), earth-leakage panel meter, pulse-enable control, and mounting options. Appropriate fusing is included and field wiring is to terminal blocks.

Options



SE-325 Neutral-Grounding-Resistor Monitor

Measures current and voltage in a transformer or generator neutral-to-ground connection and continuity of the neutral-grounding resistor.



SE-330 Neutral-Grounding-Resistor Monitor

Advanced ground-fault and neutral-grounding resistor monitoring relay that measures neutral current, neutral-to-ground voltage, and neutral-to-ground resistance.



EL3100 Ground-Fault & Phase-Voltage Indicator

Three panel-mounted LEDs indicate the ground-faulted phase.



Panel Meter

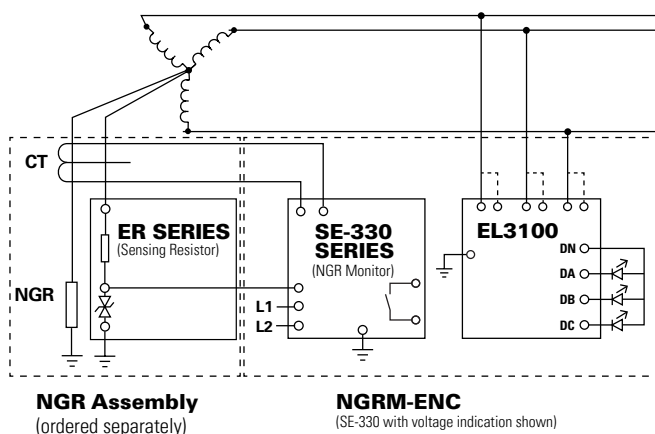
Panel-mounted meter displays earth leakage current as a percentage of the ground-fault-CT-primary rating.



RK-332/RK-302 Remote Indication and Reset

Panel-mounted remote indication and reset assemblies are included with SE-325 and surface-mounted SE-330 configurations.

Simplified Circuit Diagram



Ordering Information

The following options are available with a faster shipping time:

ORDERING NUMBER	PROTECTION RELAY OPTION	NGR MONITOR MOUNTING OPTION	AMMETER & PULSE CONTROL OPTION	COMMS	CONTROL-POWER TRANSFORMER OPTION
NGRM-ENC-000-01	SE-325	Surface mounted	None	None	CPT
NGRM-ENC-200-01	SE-330 (K4=NO)	Surface mounted	None	None	CPT
NGRM-ENC-201-01	SE-330 (K4=NO)	Panel mounted	None	None	CPT
NGRM-ENC-201-11	SE-330 (K4=NO)	Panel mounted	Ammeter	None	CPT
NGRM-ENC-230-01	SE-330 (K4=NO)	Surface mounted	None	Ethernet/2 RJ45 ports	CPT
NGRM-ENC-231-01	SE-330 (K4=NO)	Panel mounted	None	Ethernet/2 RJ45 ports	CPT

NGRM-ENC SERIES

Ordering Information

	PROTECTION RELAY OPTION	NETWORK COMMUNICATIONS OPTION	NGR MONITOR MOUNTING OPTION		AMMETER & PULSE CONTROL OPTION	CONTROL-POWER TRANSFORMER OPTION
NGRM-ENC-	X	X	X	—	X	X
3	0=SE-325 1=SE-325 & voltage indication ⁽¹⁾ 2=SE-330 (N.O. K4) 3=SE-330 (N.O. K4) & voltage indication ⁽¹⁾ 4=SE-330 (N.C. K4) 5=SE-330 (N.C. K4) & voltage indication ⁽¹⁾ 6=SE-330HV (N.O. K4) 7=SE-330HV (N.O. K4) & voltage indication ⁽¹⁾ 8=SE-330HV (N.C. K4) 9=SE-330HV (N.C. K4) & voltage indication ⁽¹⁾	0=No network communications 1=DeviceNet ⁽²⁾ 3=Ethernet, dual RJ45 ⁽²⁾ 4=Ethernet, 1 RJ45 & 1 fiber ⁽²⁾ 5=Ethernet, dual fiber ⁽²⁾ 6=IEC 61850, dual RJ45 ⁽²⁾ 7=IEC 61850, 1 RJ45 & 1 fiber ⁽²⁾ 8=IEC 61850, dual fiber ⁽²⁾	0=Surface-mounted NGR monitor ⁽⁴⁾ 1=Panel-mounted NGR monitor ⁽⁵⁾		0=No ammeter 1=Earth-leakage panel meter ⁽²⁾ 2=Earth-leakage panel meter & pulse-enable switch ⁽³⁾	0=No CPT 1=480/600-V CPT ⁽¹⁾

Note (1) - Includes fuses, (2) - SE-330 models only, (3) - SE-330 models only, excluding SE-330HV models, (4) - Includes panel-mounted indication & reset, and USB connector for SE-330 models, (5) - SE-330 models only; includes IP65 hinged transparent cover

Specifications

Enclosure	Polyester, Lockable. SE-330 panel-mount options are rated to IP65. All other options are rated to Type 4X.
Dimensions	H 454 mm (17.9"); W 406 mm (16"); D 264 mm (10.4") Clearance required to open SE-IP65CVR-G 112 mm (4.4")
Approvals	cCSAus
Warranty	1 year