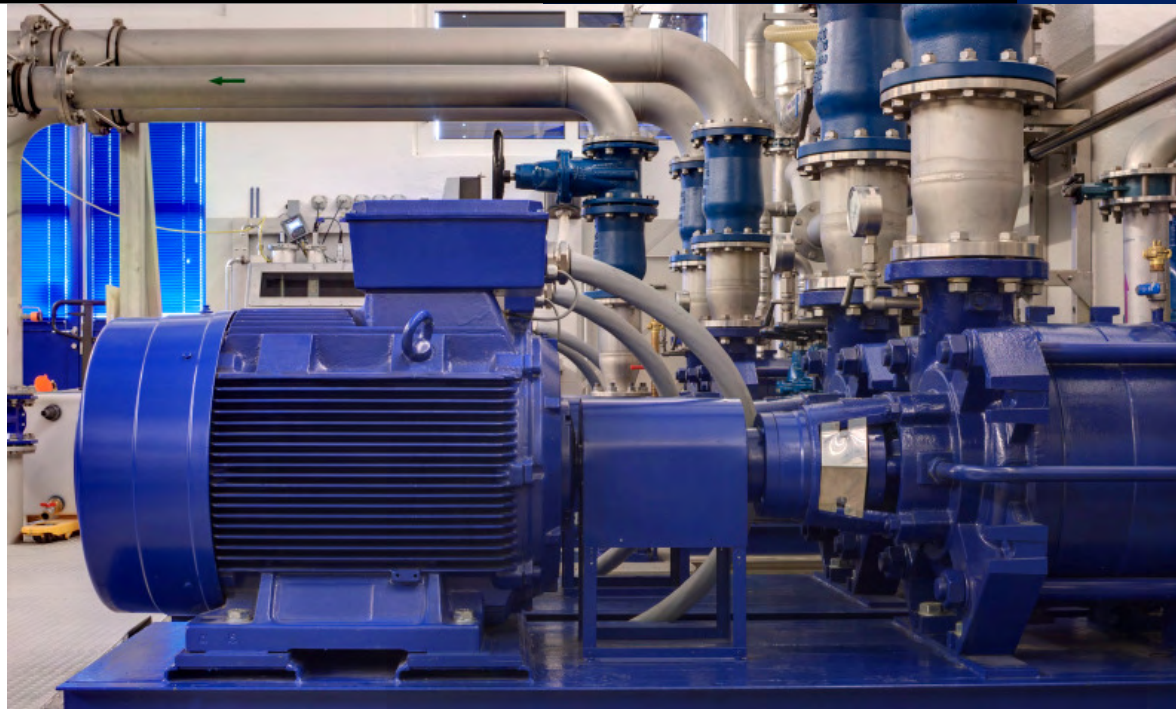


EARTH LEAKAGE

Product FOCUS Information and Application Handout



ELRM44V-30

Earth Leakage Relay
Type A

November 2015



Overview

The **ELRM44V-30** is a DIN Rail mount, True R.M.S. Earth Leakage Relay with an adjustable Trip Level and Time Delay. It can be set from 30mA up to 30A for the Trip Level and Time Delay¹ from instantaneous² up to 10 seconds. It is always used in conjunction with an external Toroid (also known as a Core Balance Current Transformer, *CBCT for short*). Classified as a “Type A” Relay it will detect both sinusoidal and pulsed DC leakage currents.

A Test button allows the user to manually “Trip” the Earth Leakage Relay in order to test and confirm correct operation. A Reset button then allows the user to “Reset” the Relay after a Tripped condition. Both buttons are placed on the front of the Earth Leakage Relay. As an option, the user may also wire external buttons that provide a “Remote” Test and Reset facility.

Various LED’s are used to indicate power is present, the amount of leakage currently being detected and whether the ELR is tripped or not. Indication to the user is also provided to say if the external Toroid has been disconnected.

Two isolated relay outputs are used to switch auxiliary devices and are offered in SPNO (Positive Safety Output) and SPDT (Standard Output) formats.

What’s it used for?

The **ELRM44V-30** is used for protection against electric shock and fires. It is used in both single or 3-phase circuits and monitors when a current imbalance occurs in the conductors that are passing through the externally connected Toroid. This could happen for numerous reasons – for example where an operator comes in to contact with a live cable or where a cable overheats and comes in to contact with a conductive part of a piece of equipment.

More often than not, this type of product will be used in conjunction with a switching device used to isolate the circuit of which it is protecting. This can be in the form of a standard contactor, shunt trip or other similar switching device.



The response time of the external switching device should be considered carefully as the overall response time will be the switching device + the set Time Delay (Δt) on the Earth Leakage Relay!

Where’s it used?

Although not exhaustive, Control Panels, Distribution Boards, Consumer Units, Motor Control Centres, Motors, and Generating Sets.

¹ Time Delay is fixed to instantaneous when 30mA selected

² <25ms @ 5 x I Δ n

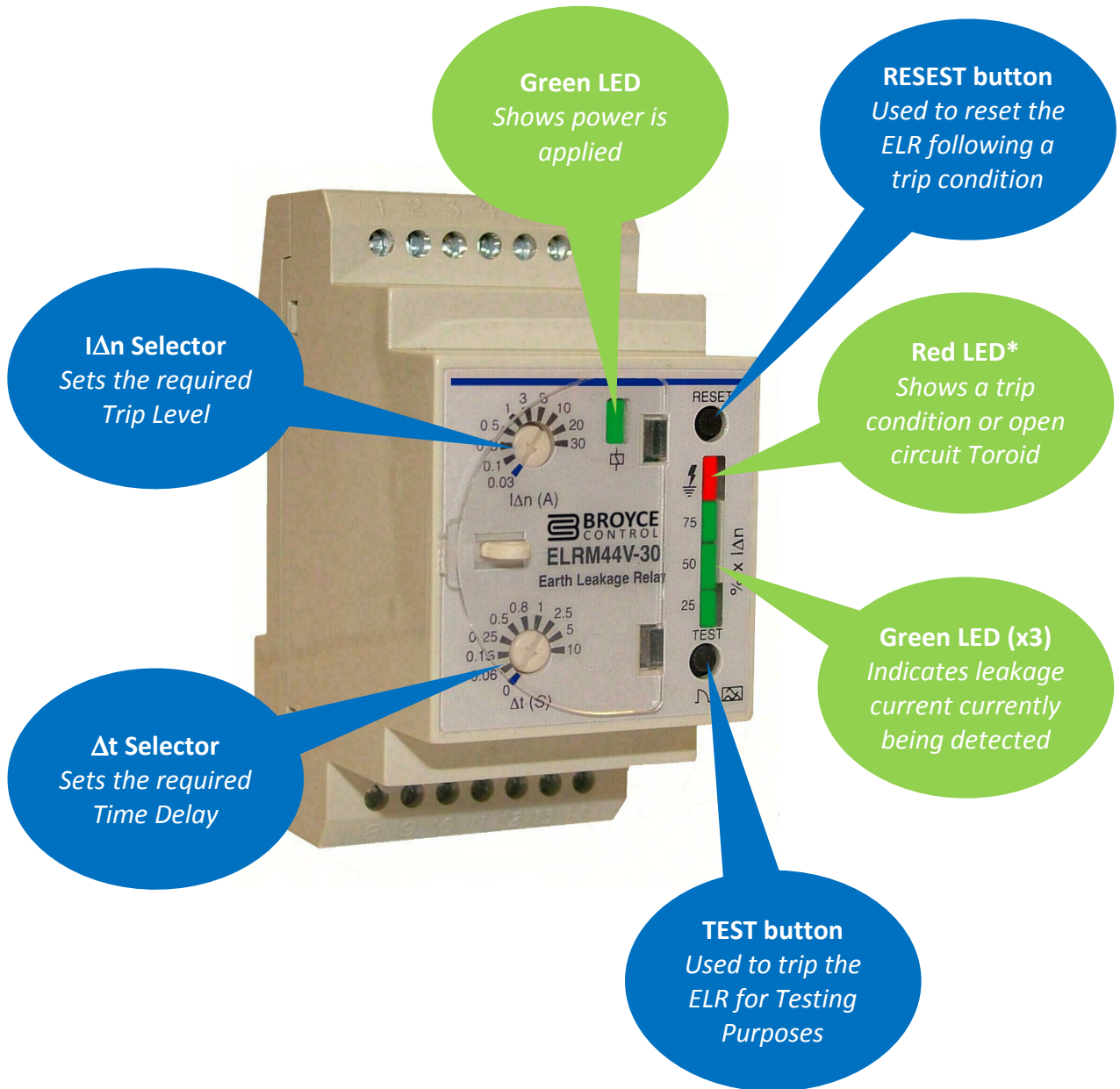


Clicking on a Product part number shown in bold/italic will take you to a Technical Data Sheet





User Adjustments and Indicators



* LED flashes during open circuit condition



User Settings and Controls

Trip Level ($I\Delta n$)

There are 10 selectable Trip Levels on the **ELRM44V-30**. They range from 30mA up to 30A and set the point at which the Earth Leakage Relay will trip once the leakage current has exceeded this level.

Selectable levels allow the installer to set the Relay according to the requirements of the application.

Note that the lowest permissible setting is also governed by the type of Toroid installed. Typically, the settings are:

Toroid style	Toroid size	Minimum $I\Delta n$ setting
Circular	30, 50, 70mm \varnothing	30mA
	120mm \varnothing	100mA
	160, 210mm \varnothing	300mA
Rectangular	305, 350, 470mm	1A



Time Delay (Δt)

There are 10 selectable Time Delay positions which range from instantaneous³ up to 10 seconds. The delay allows the user to prevent the Relay from tripping unless the fault persists for greater than the set delay. Primarily, the delay is used as a means of “discriminating” between several Relays in the installation and so prevents all Relays tripping simultaneously.

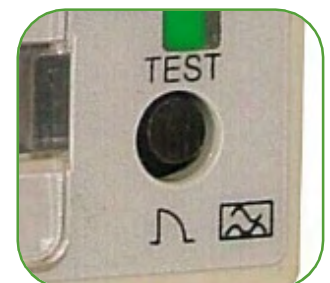
In accordance with the product standard(s), the delay must be instantaneous if the Trip Level is set to 30mA. The blue coloured graduation marker on the scale for the Trip Level (0.03A) and Time Delay (0S) are used to show these are related.



TEST button

A requirement for all Earth Leakage relays is the provision to manually Test the integrity of the Relay using this button. Pressing the button “simulates” a fault current and hence causes a tripped condition. There is the option also for the user to install a “remote” Test button that can be wired remotely from the Relay.

If any Time delay has been set, the Relay will only trip after that delay has elapsed and assuming the button is still pressed. During this, the LED bargraph will also flash.



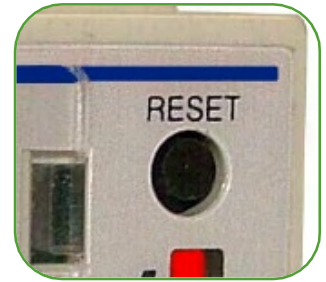
³ <25ms @ 5 x $I\Delta n$



RESET button

The Reset button is used to reset the Relay after a trip event has occurred and assuming the fault has cleared. As with the Test button, this function can also be triggered remotely by connecting a button to the relevant terminals.

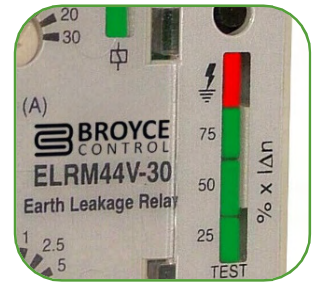
The Relay can also be reset by momentarily interrupting the Power Supply.



LED Bargraph

The LED bargraph is used to give the user a visual indication of the leakage current being measured in the monitored circuit(s). As the leakage current increases, the LED's illuminate accordingly. If a trip condition then occurs these LED's extinguish (leaving just the red "tripped" LED illuminated) because the faulty circuit(s) would have been isolated and hence leakage current removed.

As mentioned on the previous page, the LED bargraph also illuminates when the "Test" button is pressed and held.



Output Relays

Two output switching relays offer the user the option to choose the logic they require depending on how the Earth Leakage Relay is to be utilized. In normal operation (un-tripped), the "Positive Safety Output" output is normally in the energised state and "Standard Output" de-energised. When the unit trips, the relays change to the opposite state. The Positive Safety Output relay can be classed as the "fail-safe" output because in normal operation, this will de-energise should the Auxiliary Supply be removed.

Both relay outputs are isolated from the internal electronics and have voltage free contacts.

Toroid

A Toroid is always connected to the Earth Leakage Relay. The cables of the circuit to be monitored (whether single phase or three-phase) are passed through the Toroid but exclude the Earth connection. Toroids of various sizes can be specified and are chosen based on the size and number of cables to be passed through as well as the rating of the circuits.

Any fault in the Toroid or connection between the Toroid and Earth Leakage Relay will be seen as a fault and cause the Earth Leakage Relay to trip!



Examples of typical faults

The following list is not exhaustive but provides an overview of typical faults that can occur and what causes them. In most cases, an Earth Leakage Relay that has been installed and set correctly will help to prevent these from becoming a serious problem.



Application	Protection	Fault example	Caused by
<i>Industrial or Residential</i>	Fire prevention	Insulation failure	Moisture ingress in equipment
		Cable breakdown	Age/General deterioration
		Cable damage	Digging when cables are buried underground, chiselling when cables are within a wall
		Motor starting	Sparks igniting insulation or flammable materials
		Motor overheating	Insufficient cooling or ventilation, overvoltage, age
		Transformer overheating	Primary or secondary short circuits
		Loose connection	Long term vibration
		Contact wear	Frequent switching of heavy loads



Application	Protection	Fault example	Caused by
<i>Industrial or Residential</i>	Shock prevention	Cable breakdown	Age/General deterioration
		Exposed terminals and connections	Poorly maintained equipment
		Live equipment chassis or casings	Moisture ingress. Poor maintenance



Also in the range...

Earth Leakage Relays



The ELRM44 is available with a Fixed Trip Level/Time Delay or with limited maximum Trip Level setting for special applications.

An Auto-Reclosing version of the ELRM44V-30 is ideally suited to applications that don't require any initial user intervention as these products will attempt to restore the tripped circuit automatically up to a point. This is ideal for remote applications where access may be difficult.

A Panel mount version offers the same features as the ELRM44V-30 but in a compact, 48x48mm enclosure.

All products are available with a choice of supply voltages to suit most applications.

Part Number	Description	Options
ELRM44F	Fixed Trip Level and Time Delay ⁴	30mA, 100mA or 300mA ⁵
ELRM44V-3	Maximum Trip Level setting (I Δ n) 3A and Time Delay 0.5s	
ELRM44V-10	Maximum Trip Level setting (I Δ n) 10A and Time Delay 0.5s	
ELRM44V-30AR	Auto-Reclosing output	
ELRP48V-30	Panel mount version of ELRM44V-30	
ELR-IF	Built-in CBCT	30mA, 100mA or 300mA ⁵

Toroids



A range of Circular and Rectangular Toroids used in conjunction with any of the Earth Leakage Relays specified above (except the ELR-IF).

Their size is chosen based on the overall diameter and number of cables to be passed through them and the current rating of the circuit.



It is important that the Earth cable does not pass through the Toroid!

Part Number	Description	Options
BZCT	Circular Toroids	30, 50, 70, 120, 160 or 210mm \varnothing
BZCTR	Rectangular Toroids	305, 350 or 470mm

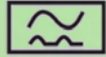
Visit www.broycecontrol.com for product data sheets on the above products

⁴ Fixed at instantaneous time

⁵ Specified at the time of ordering



Glossary

Terminology	Meaning
Earth Leakage Relay	Device used in conjunction with a Core Balance Current Transformer and designed to detect a fault current and “trip” if the current level is exceeded
Residual Current	Algebraic sum of the currents in the live conductors of a circuit at a point in the electrical installation
Type A	<p>Tripping is ensured if any of the following fault currents are detected:</p> <ul style="list-style-type: none"> • Residual sinusoidal alternating currents • Pulsating direct currents • Pulsating direct current superimposed by a smooth direct current of 6mA with or without phase-angle control and irrespective of the polarity <p>A “Type A” Earth Leakage Relay can be identified by the symbol </p>
True R.M.S (Root Mean Square)	The RMS value of an alternating current (also known as its “ <i>heating value</i> ”) which is equivalent to the direct current value that would be required to get the same heating effect
Pulsed D.C.	Leakage current which is either half wave or phase angle controlled and either positive or negative going. The Earth Leakage Relay must detect this current and trip accordingly ⁶
Trip Level (I Δ n)	The level at which the Earth Leakage Relay will trip once the current exceeds this point
Time Delay (Δ t)	The delay in which the Earth Leakage Relay waits before tripping
Test button	Used to trip the Earth Leakage Relay in order to check operation
Reset button	Used to reset the Earth Leakage Relay after a trip condition has occurred
P.S.O.	Abbreviation for “Positive Safety Output”. The relay which is normally energised and de-energises when the Earth Leakage Relay trips
S.O.	Abbreviation for “Standard Output”. The relay which is normally de-energised and energises when the Earth Leakage Relay trips
SPNO	Abbreviation for “Single Pole Normally Open” as used on the P.S.O. Relay
SPDT	Abbreviation for “Single Pole Double Throw” as used on the S.O. Relay
Toroid	Current Transformer used to measure the leakage current in the monitored circuit and send a signal back to the Earth Leakage Relay
CBCT	Core Balance Current Transformer. Alternative description for Toroid
ZCT	Zero Current Transformer. Alternative description for Toroid

⁶Tripping limits are specified differently for Pulsed DC in accordance with the product standard.



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