bramco ELECTRONICS

el3

Earth Leakage Relay

A00867 (Generic Reference Number)
(all models covered in this document)

User Manual

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1. Document Versions

Version	Description	Date
1.30	Updated to reflect latest models and features	22-03-2009
1.40	Minor updates	28-05-2009
1.54	Minor updates	12-06-2009
1.55	Added further installation info (artificial fault creation)	05-01-2010
1.56	Corrected statement under installation-mounting, where terminal 15 was referred to as earth, Instead of 16.	29-01-2010
1.57	Part Numbering Changed	13-08-2010

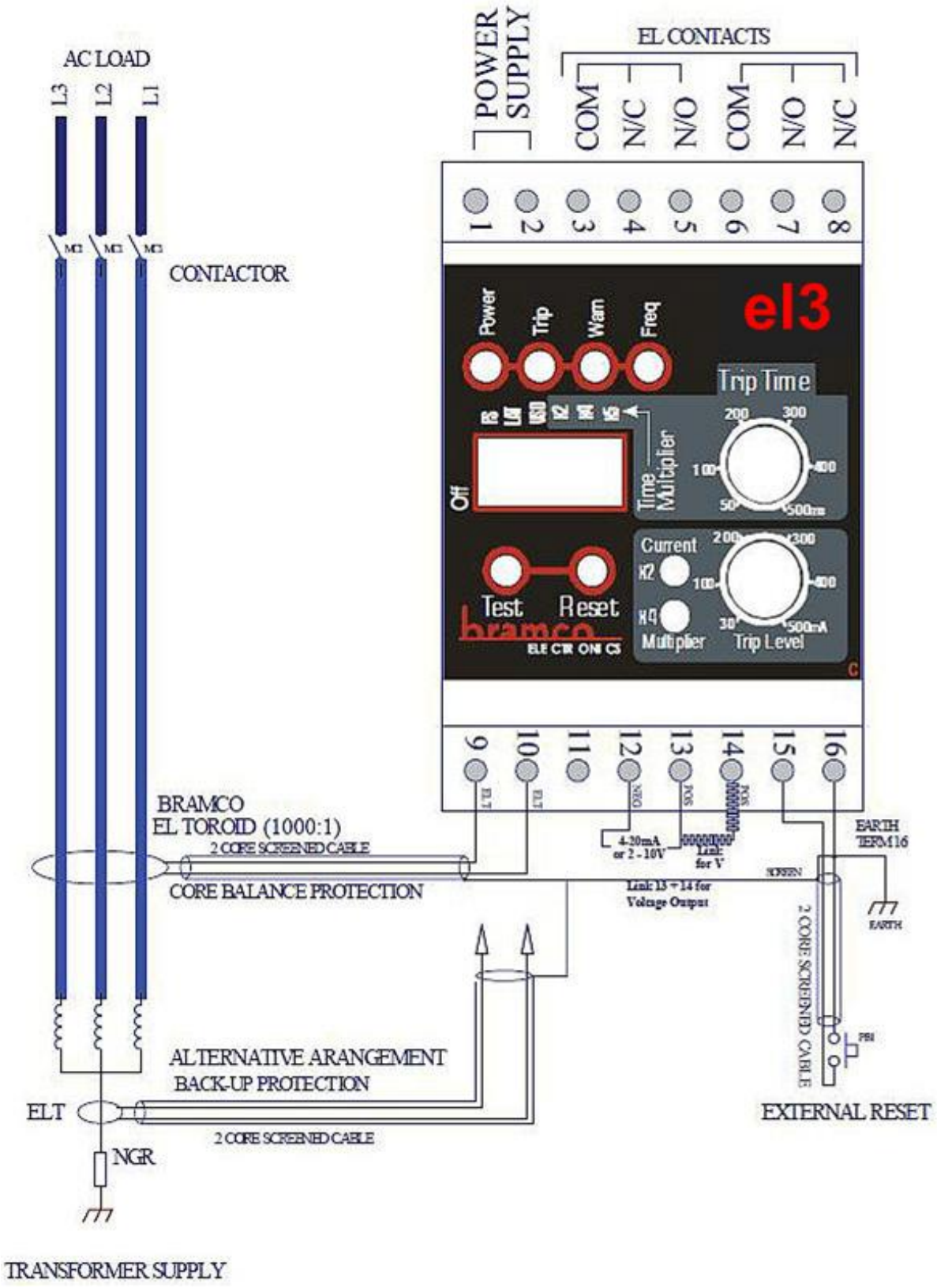
2. Terminology and Abbreviations

EL Earth Leakage

3. Overview

The EL3 Earth Leakage relay is a microprocessor based, versatile, earth-fault protection module. It has been designed to detect earth current faults flowing in a power system, and provide a timed tripping mechanism.

3.1. Typical application



4. EL3 Features

- Wide adjustable trip current and trip time options (model dependant)
- Failsafe / Non-Failsafe operation
- Latched / Non-latched operation
- Variable VSD (8-200Hz) / Fixed (50-60Hz) frequency operation
- LED indication of power, open toroid, trip, warning and frequency
- Reset a latched trip, both locally and/or externally (local can be locked out)
- Test button for unit trip audit.
- Dual isolated output tripping relay contacts, each with N/O and N/C contacts.
- Fault current is measured via a 1000:1 external toroid (must be Bramco approved)
- Open toroid protection
- Can be used with limited/unlimited neutral systems
- Instrumentation output, either current loop (4-20mA) or voltage (2-10V)

5. EL3 Model Information

Model number format

A00867-(Generic Reference Number)

A01312 -	110-240VAC	30 - 500mA
A01313 -	24-48VAC/DC	30 - 500mA
A01314 -	110 -240VAC	30mA - 2A
A01315 -	24-48VAC/DC	30mA - 2A
A01316 -	110-240VAC	0.3A – 20A
A01317 -	24-48VAC/DC	0.3A – 20A

Supply voltage rating options

		Min	Max
	24-48V AC/DC (50/60Hz)	18	72
	110-240V AC/DC (50/60Hz)	80	264

Earth Leakage Toroid

Use the New 1000:1

See the installation section at the end of this document, for more detail about ELT connection.

6. User Interface

6.1. Mode Settings

(front panel dip switches)
Bramco recommends using the default modes, as this will ensure the highest degree of safety.

Failsafe / Non-Failsafe mode

Mode	Healthy condition	Trip condition
Failsafe (FS) [default]	Trip relay Energized	Trip relay De-energized
Non-failsafe	Trip relay De-energized	Trip relay Energized

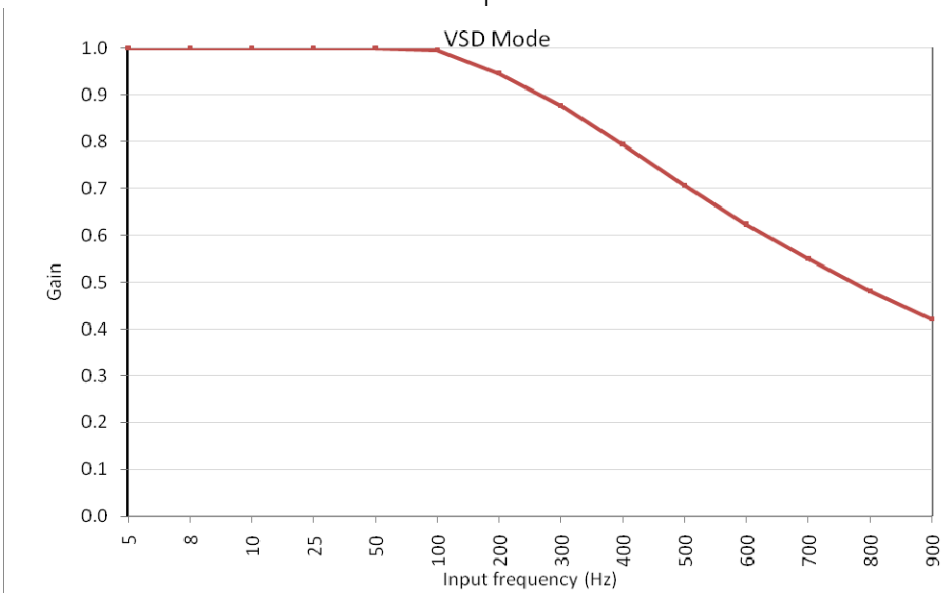
Latched / Non-latched mode

Mode	Result
Latched (LAT) [default]	A trip condition will be latched until the user resets it (even if the fault is removed) *Latched mode should be used if you have the compliant* ***model***
Non-latched	A trip condition will only remain so long as the fault current is above the set trip level.

Variable / Fixed frequency mode

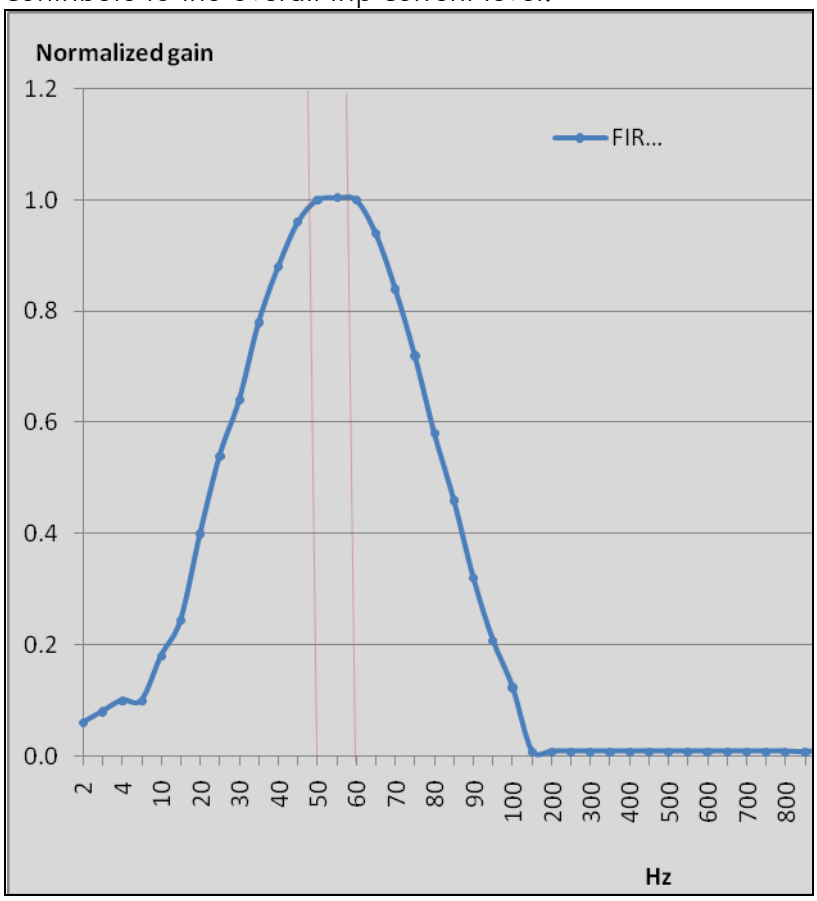
Mode	Fault current frequency range
Variable (VSD) [default]	<8Hz (latched mode is recommended) 8-200Hz
Fixed (filtered)	50-60Hz (rejects unwanted harmonic currents)

Variable frequency mode response
Indicates how much each frequency component of a sinusoidal fault current will be allowed to contribute to the overall trip current level.



Fixed frequency mode response

Indicates how much each frequency component of a sinusoidal fault current will be allowed to contribute to the overall trip current level.



Important Note

A condition can arise, where for example, a 150Hz current is flowing, of such a magnitude that it exceeds the hardware's maximum dynamic range. At this point, the relay will automatically trip, even though it is in fixed frequency mode. This is a failsafe feature.

The equation to calculate this failsafe trip limit is :

Failsafe Trip point (min) = (1.8 x Maximum Trip level setting) - (Trip level setting)

Example

Relay	A01313	30-500mA (2A)
Current multiplier	x2	
Trip level setting	100mA (already includes x2)	

Failsafe Trip point = (2 x 500mA x 1.8) - (100mA)
= (1.8A) - (100mA)
= 1.7A

Regardless of the above feature, Bramco recommends that having large standing imbalance/EF currents should be avoided.

6.2. Trip Time Setting

Trip Time

(front panel knob)
Range : 50-500ms (see below for effect of trip time multiplier)
Effect : A fault current (RMS) equal to or above the trip level must exist for this period of time, before a trip will occur.
NB - this time starts at the moment the fault current begins to flow, and includes all hardware latencies of the unit, up to and including the output relay operating time.

Trip Time Multiplier

(front panel dip switches - not available on all models)
Effect : Scale up the trip time setting range.

x2	x4	x5	Resultant multiplier	Trip Time Range	
				Minimum	Maximum
OFF	OFF	OFF	1 (default)	50ms	500ms
ON	OFF	OFF	2	100ms	1s
OFF	ON	OFF	4	200ms	2s
OFF	OFF	ON	5	250ms	2.5s
ON	ON	OFF	8	400ms	4s
ON	OFF	ON	10	500ms	5s
OFF	ON	ON	20	1s	10s
ON	ON	ON	40	2s	20s

6.3. Trip Level Setting

Trip Level

(front panel knob)
Range : AS2081.3 and Low current model : 30-500mA
High current model : 0.3-5A
Effect : A fault current (RMS) equal to or above this trip level must exist for the trip time period before a trip will occur.

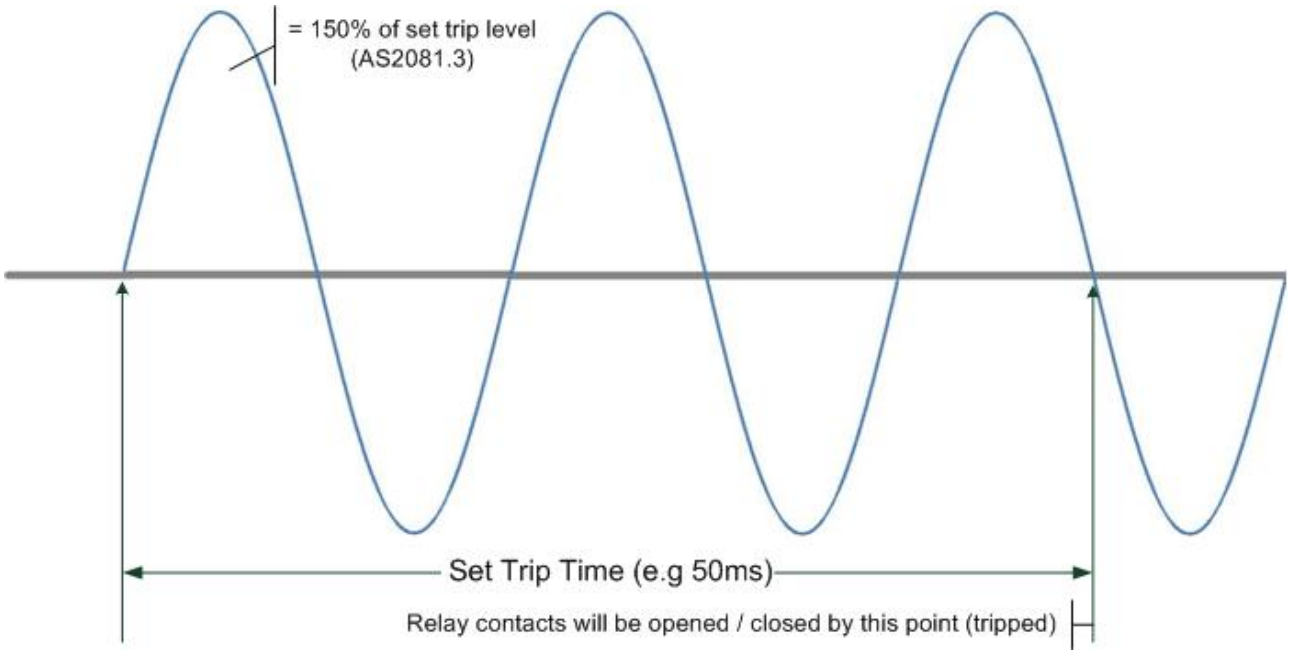
Trip Level Multiplier

(internal switches - not available on all models)
Effect : Scale up the trip level setting range.

SW2	SW1	Resultant multiplier	Trip Level Range	
			Minimum	Maximum
UP	UP	1 (default)	30mA / 0.5A	300mA / 5A
UP	DOWN	2	60mA / 1A	0.6A / 10A
DOWN	DOWN	4	120mA / 2A	1.2A / 20A
DOWN	UP	Invalid	Invalid	Invalid

(*An invalid setting will force the unit to trip and remain tripped until it is corrected, and the power is cycled. This is a failsafe*)

6.4. Trip Event Example



As can be seen from the example, all latencies are compensated for.

6.5. Test button

(front panel pushbutton)
This can be used for auditing purposes.
Pressing the test button for a time longer than the set trip time, will cause the relay to trip.
This test only verifies the internal operation of the unit, it is not a replacement for injecting a fault test current via the toroid.

6.6. Reset button

Two reset inputs are provided to reset a latched trip. Local and external.

The following conditions must be met, before a reset will occur:

a) Any fault current must be below the trip level.
b) The reset button/contact must be opened, and then closed, this provides protection against a jammed or shorted reset.

Local

(front panel pushbutton)
If the external reset terminals are closed, the local reset is disabled.

External

(see terminal connections)
Use a N/C pushbutton if the local reset is required to be locked out.
The external contact must be voltage free.

7. User Indication

7.1. LED's

(F - flashing ; blank implies a don't care item)

Power (green)	Trip (red)	Warn (orange)	Freq (orange)	x2 Current* (green)	x4 Current* (green)	Description
On	On	On	On	On	On	Power-up sequence (held for 2s after power-up) or Test button has been pressed for a period longer than the trip time setting, and is still being pressed.
On	**Off**	**Off**	**Off**			**Unit is powered and healthy**
On	On	On	On/F			A trip has occurred, but there is still a fault current present which is above the set point.
On	On	Off				A trip has occurred, which has been latched
			F			[Fixed frequency mode] Harmonic currents exist which are >5% of the 50-60Hz current.
	On		On			[Fixed frequency + latched modes] A harmonic current existed of such a magnitude, that the dynamic range of the relay was exceeded. This caused a trip, which was latched.
				On	Off	x2 current multiplication has been selected (internal switches)
				Off	On	x4 current multiplication has been selected (internal switches)
On	On	On		On	On	Invalid current multiplication has been selected (internal switches) Setting must be corrected and units power cycled.
F	On	Off	Off			Open toroid has been detected, which has caused a trip (toroid is disconnected or damaged)
F	Off					Internal voltage monitoring has detected a fault
Off	Off	Off	Off	Off	Off	Incorrect supply voltage, or internal fuse has blown.

(*not present on all models)

8. Instrumentation Output

A non-isolated, 4-20mA / 2-10V analog output provides a value with a magnitude determined by ; the fault current, proportional to the maximum current range (for the given model) plus trip level multiplier.

Example :
A High current model (0.3-5A) has a multiplier of 4, which takes it to a range of 1.2A to 20A.
Thus

Fault current	2-10V output	4-20mA output
0A	2V	4mA
10A	6V	12mA
20A	10V	20mA

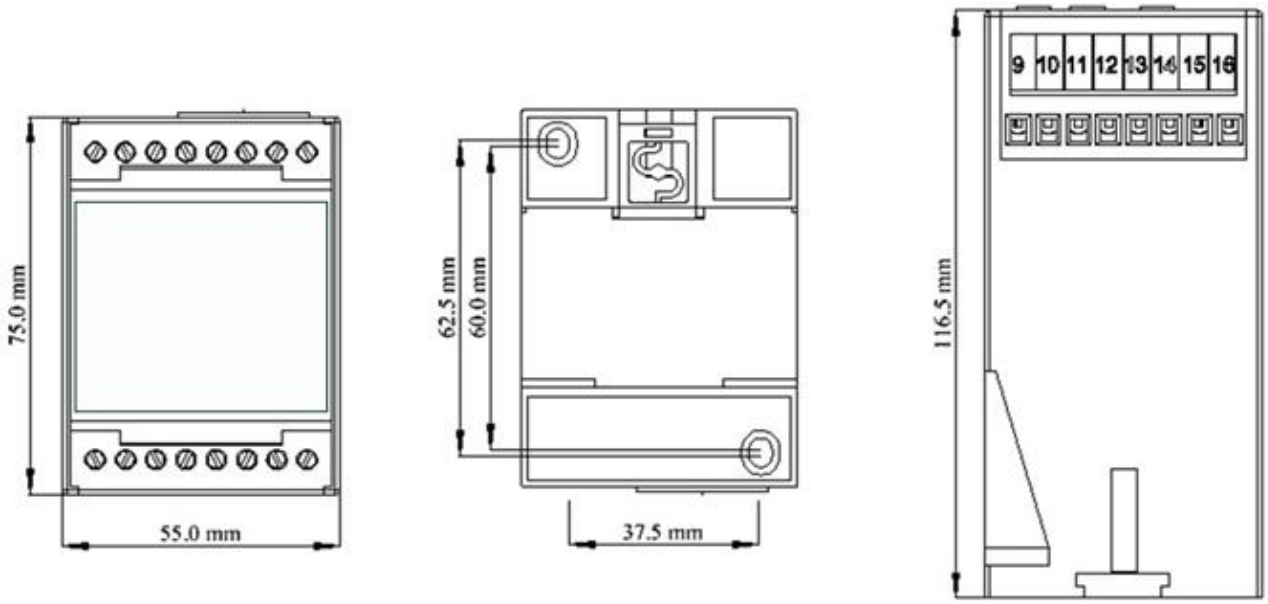
9. Installation

9.1. Panel

It is recommended that the unit be installed in an IP53 panel.

9.2. Mounting

The relay is supplied in a 16 terminal poly style enclosure with provision for Din rail or foot mounting.



The relay and Toroid should be mounted away from stray flux sources such as power supplies, transformers, control relays and contactors and cables carrying load currents.

Use 2 core screened cable for the following inputs, Toroid, External Reset
Each individual cable screen should be connected to the relay **Earth Terminal (16).**
DO NOT earth the *non-relay end* of these screened cables.

It is recommended that these 2 screened cables are run by a direct route to the EL3 relay, **BUT,** are not to run with, or in cable harness or ducting with control or power cabling. Where necessary, cross other cables at 90 degrees and provide maximum clearance from high voltage/current circuits as much as practically possible.

9.3. Supply Voltage

This is model dependant. (see specifications)

9.4. Artificial Fault

It is recommended that the installation include a method of creating an artificial fault condition.
This to fully test the entire protection loop, ideally acting on the conductor which runs thru the toroid.

9.5. Toroid

Standard el3

- ✓ Your el3 part number is A01312 110-240VAC 30-500mA
- ✓ Bramco certified 1000:1 ELT must be used.

Load cable orientation

The three phase load power cables should be arranged to pass symmetrically through the centre of the EL toroid center.

9.6. Terminal Connections

Terminal Number	Description	
1	Power supply input	(model dependant)
2		
3	Trip Relay output 1	Common
4		N/C
5		N/O
6	Trip Relay output 2	Common
7		N/O
8		N/C
9	Earth fault Toroid (ELT)	(no external burden resistor)
10		
11	No Connection (not used)	
12	Instrumentation output (do not earth any of these contacts)	Common
13		4 - 20mA (default) or 2 - 10V output
14		Link to 13 for 2-10V
15	External Reset	
16	Earth	(solid earthing is essential)

10. Specifications

Dimensions	
Height	75mm (3.0″)
Width	55mm (2.2″)
Depth	117mm (4.5″)
Standard Accuracy	
Trip level	3% at nominal trip current (10% for P model) (over-read for safety)
Trip time	Within 0 to -10ms of set time
Standard Toroid	(see datasheet for size options)
Ratio	1000:1 (must be Bramco approved)
Distance between toroid and relay (max)	20m
Toroid secondary wire type	2 core, screened to earth at both ends
Current (max continuous)	1kA
External burden resistor	None required
Supply voltage	
Minimum	See model information
Maximum	See model information
Frequency	DC/50-60Hz
Consumption (max)	2VA
Output relay	
Contact configuration	1x DPDT
Contacts rating	250V, 5A (100VA max)
Switching load (min)	300mW
Operations at 100VA (absolute max)	80,000
Instrumentation output	
4-20mA load (max)	500R
2-10V load (min)	50kΩ
Environmental	
Operating temperature	0-60°C

11. Troubleshooting

Symptom	Cause
Front Reset button does not work	External reset may be locking it out
Test button does not work	Button has not been pressed for a period of time equal to or longer than the trip level setting.