



EL EC

A00622B

A00630B

A00855B

A00856B

A00878B

A01016B

EARTH LEAKAGE

&

EARTH CONTINUITY

RELAY

Operation Manual

## **ELEC Operation Manual**

Part numbers:

A00622B	500mA	500mS	110vAC
A00630B	500mA	500mS	24-48vAC/DC
A00855B	100mA	100mS	110vAC
A00856B	100mA	100mS	24-48vAC/DC
A00878B	100mA	100mS	240vAC
A01016B	500mA	500mS	240VAC

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# OVERVIEW

The ELEC relay is designed to provide dual and complimentary protection functions.

**EL:** The monitoring and detection of Earth Fault Currents in a power system,

**EC:** The monitoring of the Earth Continuity of a supply cable, using the pilot core and grounding/earthing the load end of the pilot via a termination diode. Remote Start is also available via the pilot circuit.

## 1.1 PHYSICAL LAYOUT

The ELEC relay enclosure provides facilities for either DIN rail mounting or screw mounting. A diagram of the relay front facia is on next page.

An outline drawing along with dimensions as also provided.

See Appendix A for the typical external connection diagram.

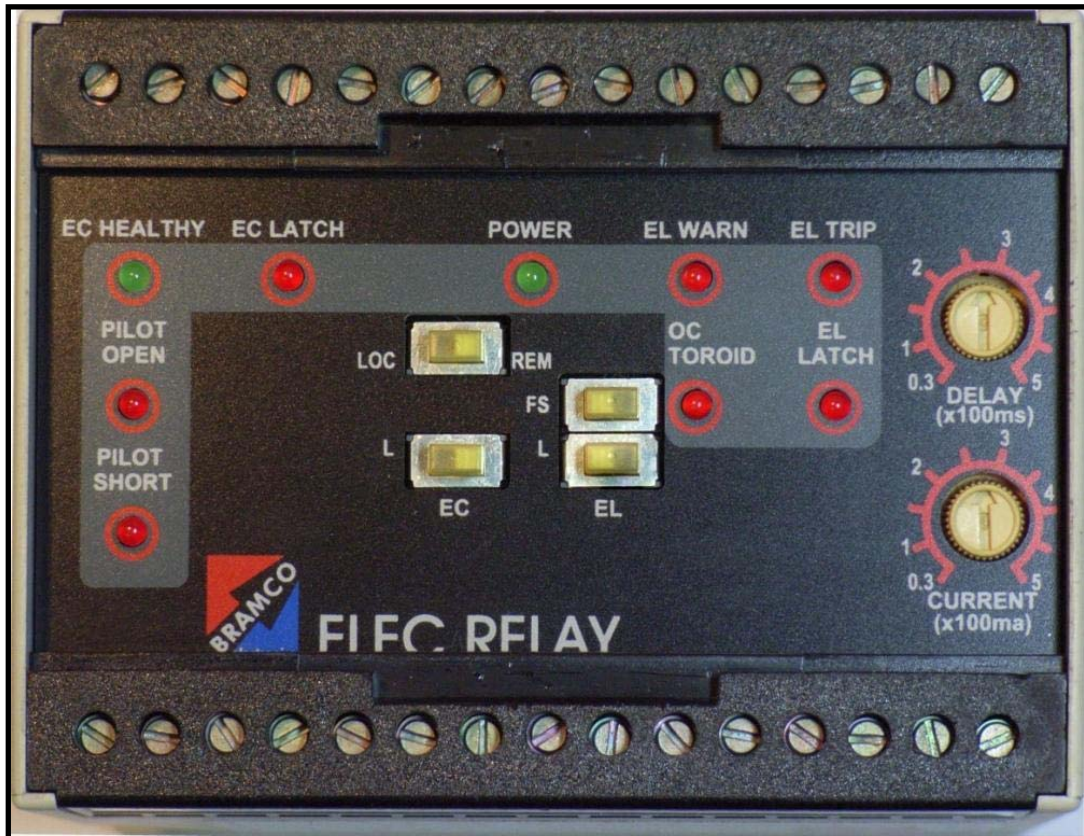
See Section 4.3 for Specifications and important power supply information.

See Section 4.0 for Installation Recommendations.

## 1.2 TERMINAL CONNECTIONS

Terminal Number	Description	Terminal Number	Description
1	AC power /DC POS	16	EARTH
2	AC power/DC NEG	17	PILOT
3		18	
4		19	
5	EARTH	20	
6	EL N/C	21	EC LATCH RESET
7	EL COM	22	EC LATCH RESET
8	EL N/O	23	SCREEN EC RESET
9	EL N/O	24	4 – 20mA Neg OUTPUT
10	EL COM	25	4 – 20mA Pos OUTPUT
11	EC N/C	26	EL LATCH RESET
12	EC COM	27	EL LATCH RESET
13	EC N/C	28	EARTH + SCREEN EL TOROID/ EL RESET CONTACT
14	EC N/O	29	EL TOROID
15	EC COM	30	EL TOROID

## ELEC Front Panel



## 2 EL OPERATION

### 2.1 EARTH LEAKAGE FEATURES

Standard Bramco EL toroid.  
Failsafe/Non-Failsafe operation.  
Latch/No Latch operation.  
EL Toroid open circuit monitoring.  
Adjustable Trip Current.  
Adjustable Trip Time.  
Status Leds for –  
    EL Warn  
    EL Trip  
    EL Latched  
    External EL Latch reset

May be used on limited/unlimited neutral systems.

In-built **EL noise filter** for improved HF noise rejection of pulse earth currents from variable speed drives  
Separate EL contacts are provided.

Optional: EL leakage monitoring 4 – 20mA output into 400 ohms.

### 2.2 FAILSAFE/NON-FAILSAFE MODE

These modes are selected via the **FAILSAFE/NON-FAILSAFE** slide switches on the front facia of the unit.

**NON-FAILSAFE** - the EL relay is de-energised (open) when relay is un-powered, and is energised (closed) with a fault.

**FAILSAFE** – the EL relay is de-energised (open) when relay is un-powered, and energised (closed) when the EL circuit is unlatched and healthy, and is de-energised (open) with an EL fault.

### 2.3 LATCHING/NON-LATCHING MODES

These modes are selected via the **LATCH/NON-LATCH** slide switch on the front of the unit. Any EL trip in **Latch** mode causes the relay to latch the EL Relay contacts in the fault position.

A manual reset (momentary shorting of TERM 14 and 15) is required to allow the EL Relay contacts to return to the state before the fault.

## 3 EC OPERATION

### EARTH CONTINUITY FEATURES

- Better tolerance to cable capacitance, allowing long cable runs.
- Termination using 1A diode and/or operates transparently with a Node.
- Local/Remote mode of pilot operation.
- Fixed Failsafe operation.
- Latch/Non-Latch operation.
- External EC latch reset.
- Separate EC contacts are provided.
- Status Leds for –
  - EC Healthy
  - EC Latch
  - Pilot Open
  - Pilot Short

### 3.1 LOCAL/REMOTE MODE.

These modes are selected via the LOC/REM slide switch on the front facia of the unit.  
**See:** ELEC Typical Connection and Pilot Termination Drawings.

#### ***LOCAL CONTROL MODE -***

Pilot termination uses a 1A diode at the external machine with the cathode end (Bar end) connected to Earth.

When the Pilot resistance is less than 45 ohms, no pilot short, and the pilot diode termination is healthy, then the EC relay is closed, healthy failsafe condition.

#### ***REMOTE START MODE -***

Remote Start Mode enables the EC relay to Start and Stop a load circuit connected to the ELEC.

The Remote Start pilot circuit has a N/C stop button, in series with a 100R Start resistor, with a N/O Start button across it, in series with a pilot termination diode with the cathode connected to earth.

When the pilot loop resistance is less than 145R and the Start button is pressed, shorting the 100R resistor, then the EC relay should close.

When the pilot loop resistance becomes larger than 145 ohms, the EC relay will open.

### 3.2 FAILSAFE MODE

***FAILSAFE*** – the EC relay is de-energised (open) when relay is un-powered, and energised (closed) when the EC circuit is unlatched and healthy, and is de-energised (open) with an EC fault. Only available in Local Mode.

### 3.3 LATCHING/NON-LATCHING MODES

These modes are selected via the *LATCH/NON-LATCH* slide switch on the front of the unit.

#### *LOCAL CONTROL MODE -*

In **Non-Latch** mode, the EC Relay contacts will operate as soon as the fault is cleared and the pilot circuit is healthy.

*In Latch* mode, an Open or Shorted pilot will cause the relay to latch the EC Relay contacts in the fault position, which depends on the Failsafe/Non-Failsafe mode selection.

**PLEASE NOTE: When the Latch Mode is selected, the EC will fault and latch on power down, requiring a latch reset on power up.**

#### *REMOTE START MODE -*

*Select NON-LATCH* with slide switch on the front of the unit.  
This is required to allow Remote Start to operate normally.

## 4 INSTALLATION

### 4.1 GENERAL RECOMMENDATIONS

Following are some key recommendations for installation and wiring to help achieve successful operation.

A typical connection diagram is included in Section 7 Appendix A.

### 4.2 ELEC RELAY

The ELEC relay may be DIN rail, or foot mounted to panel.

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

Use shielded, 2 core cable for the following inputs,

EL Toroid,

EL LATCH RESET, (voltage free contact)

EC LATCH RESET, (voltage free contact)

Each individual cable screen should be connected to the ELEC relay *to its allocated terminal*. **Do Not EARTH SCREEN ELSEWHERE.**

**DO NOT earth the non-relay end of these screened cables.**

It is recommended that these 3 screened cables are run by a direct route to the ELEC 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.

## 4.3 EL TOROIDS

**IMPORTANT:** Match the EL Toroid Scaling with ELEC model.

I.E. **500mA STANDARD TOROID WITH 500mA ELEC RELAY**  
**100mA SENSITIVE TOROID WITH 100mA ELEC RELAY.**

ELT's have a powder coated mild steel enclosure which acts as a shield to stray flux. For this to be effective the open side of the ELT should face away from stray flux sources such as transformers, relays and contactors, and for best effect, facing but not touching the steel enclosure body.

## 4.4 PILOT AND EARTH

Wire from Pilot Terminal 17 direct to the pilot pin on the restrained receptical.

**Do not pass the Pilot wire through the EL Toroid.**

Wire from Earth Terminal 16 direct to the physical Earth.

## 4.4 PILOT TERMINATION

Use a 1A 1000V diode 1N4007 for pilot to earth termination.

The ELEC relay will operate correctly with a Node installed on the Pilot circuit, in addition to the Pilot termination diode.

## 5 SPECIFICATIONS

Supply Voltage	<b>A00622A</b> – 110V (240V optional) 50/60Hz 2VA <b>A00630</b> 24 – 48VAC/DC 2VA OPTIONAL See other models Page 2 of this manual.
NOTE:	ELEC has a common power supply input. ELEC relay is powered by 2 x isolated DC supplies.
Latch Resets	Separate External voltage free contacts, 20mS Typical <b>NOTE: <i>Must use separate reset contacts for EL and EC reset.</i></b>
<b>EL - EARTH LEAKAGE</b>	
Trip Current Range	50 – 500mA or 30 – 100mA AC (Inbuilt EL noise filter to reduce HF pulse noise from variable speed drives).
Trip Delay Range	50 – 500mS or 30 – 100mS
Current Monitor Output	4 – 20mA ( F.S @ 500mADC ) into 400 ohms maximum <b>NOTE: <i>Do NOT Earth Pos or Neg.</i></b>
Relay Function	Failsafe (preferred) or Non-Failsafe. (Switchable) Latching (preferred) or Non-Latching. (Switchable)
EL Contact ratings	1 x C/O, 1 x N/O - 5A 250VAC, 100VA max
<b>EC - PILOT CIRCUIT</b>	
Local Mode Pilot/Earth Resistance	Relay trips at more than 45 ohms.
Remote Mode (NFS Mode) Pilot Control	EC Relay is open initially, closes if pilot resistance drops by 100R, (remote start initiate), and if resistance is less than 145R, opens when pilot resistance becomes greater than 145R.
Pilot Termination	1A 1000V diode and/or Smart Pilot Node.
Pilot/Earth Shunt leakage tolerance	Greater than 500 ohms. Greater than 1000 ohms when Smart Pilot Node installed.
Pilot/Earth capacitance tolerance	2 uF maximum (lumped)
Drop out delay	500mS typical
Relay Function	Failsafe Latching (preferred) or Non-Latching. (Switchable)
EC Contact ratings	250VAC, 100VA max

## 6 FAULT DIAGNOSIS

To assist in fault diagnosis, a variety of typical faults are shown, with possible solutions given.

### 6.1 EL FUNCTION

INDICATION	POSSIBLE CONDITION/SUGGESTION
<i>Power</i> Led is Off	<ul style="list-style-type: none"> <li>- This is powered from the EL portion of the dual isolated power supply.</li> <li>- Check the module incoming supply voltage.</li> </ul>
<i>Power</i> Led is On <i>O/C Toroid</i> Off <i>EL Warn</i> Off <i>EL Trip</i> Off <i>EL Latch</i> Off	<ul style="list-style-type: none"> <li>- EL relay will be open or closed dependant on Failsafe/Non Failsafe mode.</li> </ul>
<i>O/C Toroid</i> Led is On	<ul style="list-style-type: none"> <li>- Check that EL toroid is connected. Test EL relay function by placing a temporary short across ELEC relay terminals 29 – 30. Reset Latch if necessary.</li> <li>- If EL relay comes healthy, the cable to EL toroid is open circuit.</li> </ul>
<i>EL Latch</i> Led is On	<ul style="list-style-type: none"> <li>- Indicating that an EL trip has occurred.</li> <li>- Clear fault, if necessary and reset EL latch.</li> </ul>
<i>EL Warn</i> Led flickers On	<ul style="list-style-type: none"> <li>- Indicates current peaks above trip EL current of a short duration, which do not exceed the trip delay commit time.</li> <li>- Increase the Trip Current setting and /or increase the trip Delay time.</li> </ul>
<i>EL Trip</i> Led is On	<ul style="list-style-type: none"> <li>- Indicates an EL fault is in progress. The EL current has exceeded the EL trip level and the Trip Delay time has expired. ie, the EL fault is still there. Check the external wiring to the EL contacts.</li> </ul>

## 6.2 EC Function

INDICATION	POSSIBLE CONDITION/SUGGESTION
<i>EC Healthy</i> Led is On	- The pilot circuit is healthy. EC relay will be closed.
<i>Pilot Open</i> Led is On	<ul style="list-style-type: none"> <li>- Measurable resistance in the pilot is above the 45 Ohms.</li> <li>- Ensure that there are no "stop" or safety circuits in operation that may be holding the pilot circuit open.</li> <li>- Perform a complete continuity and resistance test on the pilot circuit.</li> <li>- If a new machine, ensure that the termination diode is wired with the correct polarity.</li> <li>- The Diode termination may be faulty.</li> </ul>
<i>EC Latch</i> Led is On	<ul style="list-style-type: none"> <li>- Indicating that an EC trip has occurred.</li> <li>- Clear fault, if necessary and reset EC latch.</li> </ul>
<i>Pilot Short</i> Led is On	<p>A pilot resistance below 500 ohms has been detected.</p> <ul style="list-style-type: none"> <li>- Perform a complete short circuit test on the pilot circuit.</li> <li>- If a new machine, ensure that the termination diode is wired with the correct polarity.</li> <li>- Inspect panel wiring and termination wiring for obvious shorts due to poor connections etc.</li> <li>- Inspect the trailing cable for damage. Replace cable if necessary.</li> <li>- The Diode termination may be faulty.</li> </ul>
<i>EC Latch</i> occurs on power up	<p>This is a design feature when you choose Latch mode.</p> <ul style="list-style-type: none"> <li>- Reset EC Latch.</li> </ul>
Both <i>Pilot Open</i> and <i>Pilot Short</i> Leds are On	<ul style="list-style-type: none"> <li>- The pilot circuit is above 45 ohms.</li> <li>- The pilot has a leakage of less than 500 ohms.</li> </ul>
<i>Pilot Open</i> and <i>Pilot Short</i> Leds are Off, <i>EC Healthy</i> LED is Off, EC Latch is On	<p>The Pilot circuit is Healthy but the tripped EC Latch is preventing EC relay from resetting.</p> <ul style="list-style-type: none"> <li>- Reset the EC Latch.</li> </ul>

