EFL

EARTH FAULT LOCKOUT PROTECTION RELAY

User Manual

Version: 1, JUL 2015

Designed and manufactured in Australia by Ampcontrol Pty Ltd

AMPCONTROL®

WARNING! 	**This safety alert symbol identifies important safety messages in this manual and indicates a potential risk of injury or even death to personnel. When you see this symbol, be alert, your safety is involved, carefully read the message that follows, and inform other operators.**

CAUTION! 	**This safety alert symbol identifies important information to be read in order to ensure the correct sequence of work and to avoid damage or even destruction of the equipment, and reduce any potential risk of injury or death to personnel.**

	**Supplementary information not directly affecting safety or damage to equipment. Carefully read the message that follows, and inform other relevant personnel.**

	**Information concerning possible impact on the environment and actions required for prevention and proper response.**

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Before You Begin

We would like to take a moment to thank you for purchasing the Ampcontrol EFL Relay.

WARNING! 	**To become completely familiar with this equipment and to ensure correct operation, we strongly recommend that you take the time to read and thoroughly understand this user manual.**

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1 SAFETY AND OTHER WARNINGS

For safety reasons, the EFL Relay must be installed, operated and serviced only by competent electrical personnel. Read and understand this instruction manual completely before installing, operating or servicing this equipment. Failure to install or operate this instrument in accordance with the instructions contained in this manual may create hazardous operating conditions.

1.1 Safe Use of Equipment

The equipment supplied has been manufactured according to the state of the art, and designed to ensure a safe operation. The equipment may only be used within the design parameters.

The instructions within this manual must be observed as an aid towards achieving maximum safety during operation.

The owner/user is responsible for observing the following instructions:

1.1.1 Changes to Equipment

Changes in the design and modifications to the equipment are not permitted. Unauthorised changes made to the hardware or operating firmware will void the manufacturer's warranty, and may compromise the integrity of the system into which it is installed and other connected equipment.

1.1.2 Equipment Knowledge

Experience with, or understanding of, this equipment is essential for the safe installation and removal of the equipment. Therefore, please read and understand this manual prior to use. Competency based training courses are recommended and are available on request.

1.1.3 Manual Handling

Precautions have been taken to ensure all equipment is safe to handle and free from sharp edges. However care should always be taken when handling enclosures and gloves should be worn.

1.1.4 Installation

Correct operation and safety depend on the EFL Relay and associated equipment being installed correctly. Mechanical and or electrical installation and maintenance of plant and equipment must only be carried out by appropriately qualified personnel and must be tested thoroughly prior to operation.

1.1.5 Operation

As safety depends on the EFL Relay functioning correctly it is highly recommended that all safety functions of the EFL Relay be periodically tested to ensure correct operation.

2 RECEIVING AND STORAGE

2.1 Receiving

All possible precautions are taken to protect the equipment against damage or losses during shipment, however before accepting delivery, check all items against the packing list or bill of loading. If there is evidence of physical damage, notify Ampcontrol immediately.

Notify Ampcontrol immediately in case of any discrepancies to the packing list. Keep a record of any claims and correspondence. Photographs are recommended.

Where practicable do not remove protective covers prior to installation unless there are indications of damage. Boxes opened for inspection and inventory should be carefully repacked to ensure protection of the contents or else the parts should be packaged and stored in a safe place. Examine all packing boxes, wrappings and covers for items attached to them. Retain and store any approval documentation for your safety file as applicable, prior to wrappings being discarded.

2.2 Inspection

Equipment that is found to be damaged or has been modified away from its published specification must not be used. Please contact Ampcontrol if the equipment is suspected to be different than that ordered or if it does not match the published specifications.

2.3 Storage after Delivery

When the equipment is not to be installed immediately, proper storage is important to ensure protection of equipment and validity of warranty.

All equipment should be stored indoors between 0-40˚C, preferably on shelves and protected from moisture and sunlight.

2.4 Unpacking of Equipment

The method of packing used will depend on the size and quantity of the equipment. The following cautions should be interpreted as appropriate.

CAUTION! 	**Take care when unpacking crates as the contents may have shifted during transport.**

	**The disposal of packaging materials, replaced parts, or components must comply with environmental restrictions without polluting the soil, air or water.** **Ensure that any timber and cardboard used as packaging is disposed of in a safe and environmentally responsible manner.** **Where possible, dispose of all waste products i.e. oils, metals, plastic and rubber products by using an approved recycling service centre.**

3 PRODUCT OVERVIEW

3.1 Product Description

The Ampcontrol EFL Protection Relay provides earth fault lockout (EFLO) and frozen contactor (FC) protection that is compliant to AS/NZS 2081:2011 sections 7 & 9.

While the outlet's main contactor is open, the EFL will continually monitor the resistance of the phase conductors to earth, on the load side of the contactor. If this resistance falls below an acceptable level, then the EFL will initiate an EFLO trip, preventing the outlet from being started.

The EFL will also monitor the state of the outlet's main contactor. If voltage appears on the line when the contactor is open a Frozen Contactor electrical trip will occur, opening the circuit breaker. If the main contactor is either open when it should be closed or closed when it should be open a Frozen Contactor logical trip will occur, opening the circuit breaker. A back EMF timer is also provided to inhibit the frozen contactor electrical trip function for a short period after the main contactor is open.

The EFL also has an undervoltage protection function which, if activated, will open the main contactor if the voltage on the load side of the contactor falls below 50% of the selected system voltage.

The EFL is available in two configurations, an internal barrier configuration and an external barrier configuration. If using the internal barrier unit, the high voltage connection leads will extend directly from the EFL Relay. If using the external barrier version, the high voltage connection circuitry is stored inside a separate enclosure, allowing this barrier to be installed closer to the phase conductors if required. This external barrier is supplied with 'flying leads' for connection to the phase conductors. The external barrier is then required to be wired to a stand-alone EFL Relay (no internal barrier).

Key Features

- AS/NZS 2081:2011 compliant
- Earth Fault Lock-out (EFLO) protection
- Frozen Contactor (FC) protection
- Selectable Undervoltage (UV) protection
- Compatible with a wide range of system voltages
- Internal or external barriers available

3.2 Applications

The Ampcontrol EFL is compliant to AS/NZS 2081:2011 sections 7 & 9, and has been designed for installation on mining outlets that require earth fault lockout and frozen contactor protection. The EFL is capable of being installed on a wide range of system voltages from 110V up to 3.3kV (barrier dependent). In addition to EFLO and FC protection, the EFL also offers a selectable undervoltage protection function.

	**The EFL Relay is not for use in hazardous areas. Customers should select the EFL-IS (available in 2016) or OMA products for applications requiring intrinsic safety.**

For a typical electrical installation diagram, refer to Figure 4.6.

4 INSTALLATION

4.1 General Warnings

These instructions have been designed to assist users of the EFL Relay with installation.

Before the EFL Relay can be installed, there are a number of things that need to be considered and understood to prevent incorrect or unsafe operation of the EFL Relay or the system into which it is installed.

Along with relevant competence, and an understanding of the target application, the following points should be considered:

4.1.1 Ensure that the information provided in this user manual is fully understood.

It is extremely important that the limitations and functionality of the EFL Relay are understood to prevent incorrect installation and use from creating a potentially dangerous risk. If in doubt as to the nature of the limitations or their implication, consult a competent authority such as a supervisor or Ampcontrol technical representative.

4.1.2 Ensure that the application into which the EFL Relay is being installed has been properly defined, designed and approved.

Any system intended to mitigate the risk of injury needs to be properly designed and implemented. Such a system must be the result of structured risk analysis with the outcomes used to define the system requirements. These requirements, in turn, will guide the choice of instrumentation, logic solvers and actuators needed to implement the system. Understanding the needs of the system will ensure proper selection of equipment.

4.1.3 Ensure that the EFL Relay will properly perform the required functions within the system design.

It is important to understand how the EFL Relay is intended to interact with other equipment within a system. For safe and reliable use, it is crucial that neither the EFL Relay logical operation nor its signalling be compromised by incompatibilities with connected equipment.

4.1.4 Modifications of any form to the EFL Relay are prohibited.

The EFL Relay, as supplied, has been designed and manufactured to comply with the requirements of protection standards. If modifications of any form are made to the EFL Relay, the equipment may no longer be fit for use. If any modifications or damage to the EFL Relay is evident, do not use the equipment and contact Ampcontrol for advice.

4.2 Mandatory Installation Practices

The following information must be adhered to when installing the EFL Relay. Failure to adhere to this information may give rise to unsafe operation.

Using the EFL Relay in a manner that exceeds its electrical, functional or physical specifications, or in a way that is contrary to its operating restrictions, may create risks to personnel and/or equipment resulting in injury or death.

- The EFL Relay must be powered within the specified voltage range.
- The installation of the EFL Relay must be carried out by suitably trained and qualified personnel.
- Identification labels fixed to the EFL Relay must not be damaged, removed or covered before, during or after installation.
- The installation is to be in accordance with the relevant installation Standards/Codes of Practice.
- Modifications must not be made to any part of the EFL Relay. As supplied, the unit is built to, and complies with the relevant standards. Modifications to its construction will render the unit non-compliant.
- Complete and accurate records of the installation must be kept as part of the site installation.

4.3 Mechanical Installation Information

The EFL Relay is available in two configurations – the EFL Relay with Internal Barrier version, or the Stand-Alone EFL Relay with External Barrier.

4.3.1 Mounting Arrangements

The EFL Relay with Internal Barrier, the Stand-Alone EFL Relay and the External Barrier are all DIN Rail mounted.

CAUTION! 	**The EFL Relay and Barrier MUST be mounted in such a manner that allows unrestricted air flow through the upper and lower air vents.**

4.3.2 Enclosure Dimensions

Figure 4.1: Enclosure Dimensions – Stand Alone EFL Relay

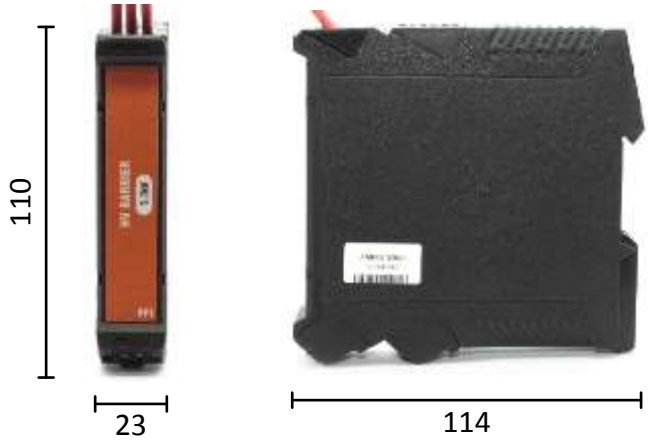

Figure 4.2: Enclosure Dimensions – External Barrier

Figure 4.3: Enclosure Dimensions – EFL Relay with Internal Barrier

4.3.3 Terminal Layouts

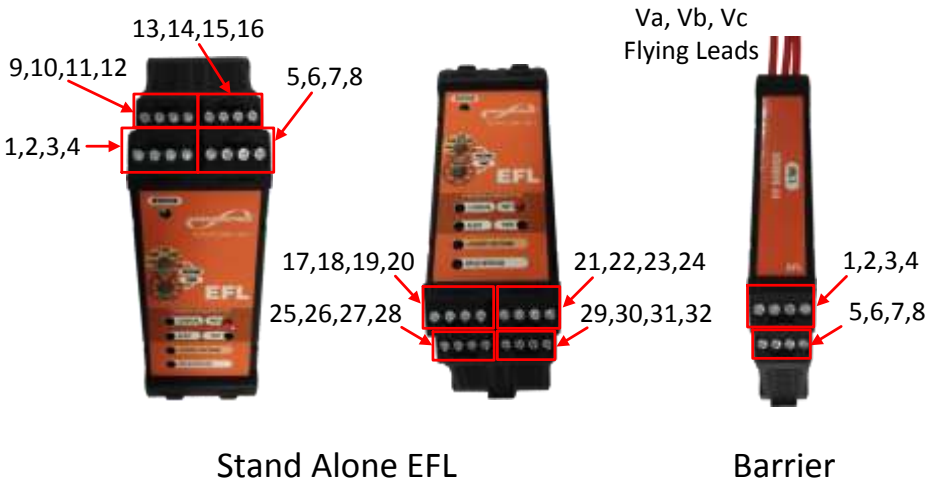

Figure 4.4: Terminal Numbering Arrangements for EFL Relay with External Barrier

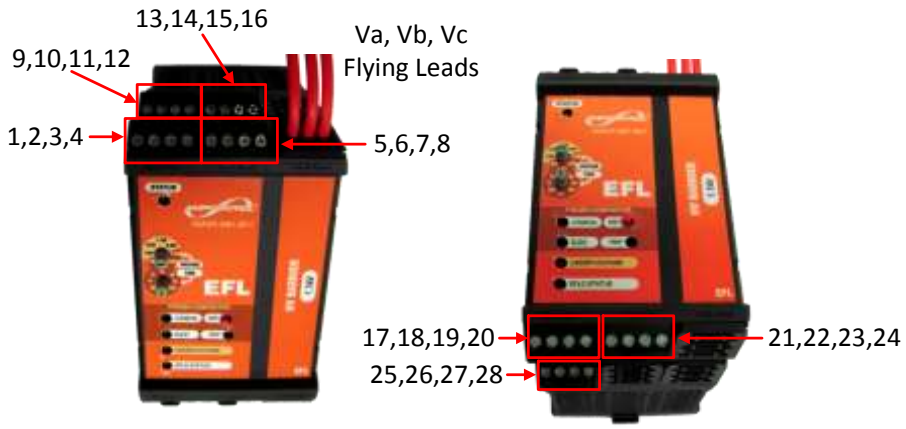

Figure 4.5: Terminal Numbering Arrangement for EFL Relay with Internal Barrier

4.4 Electrical Installation Information

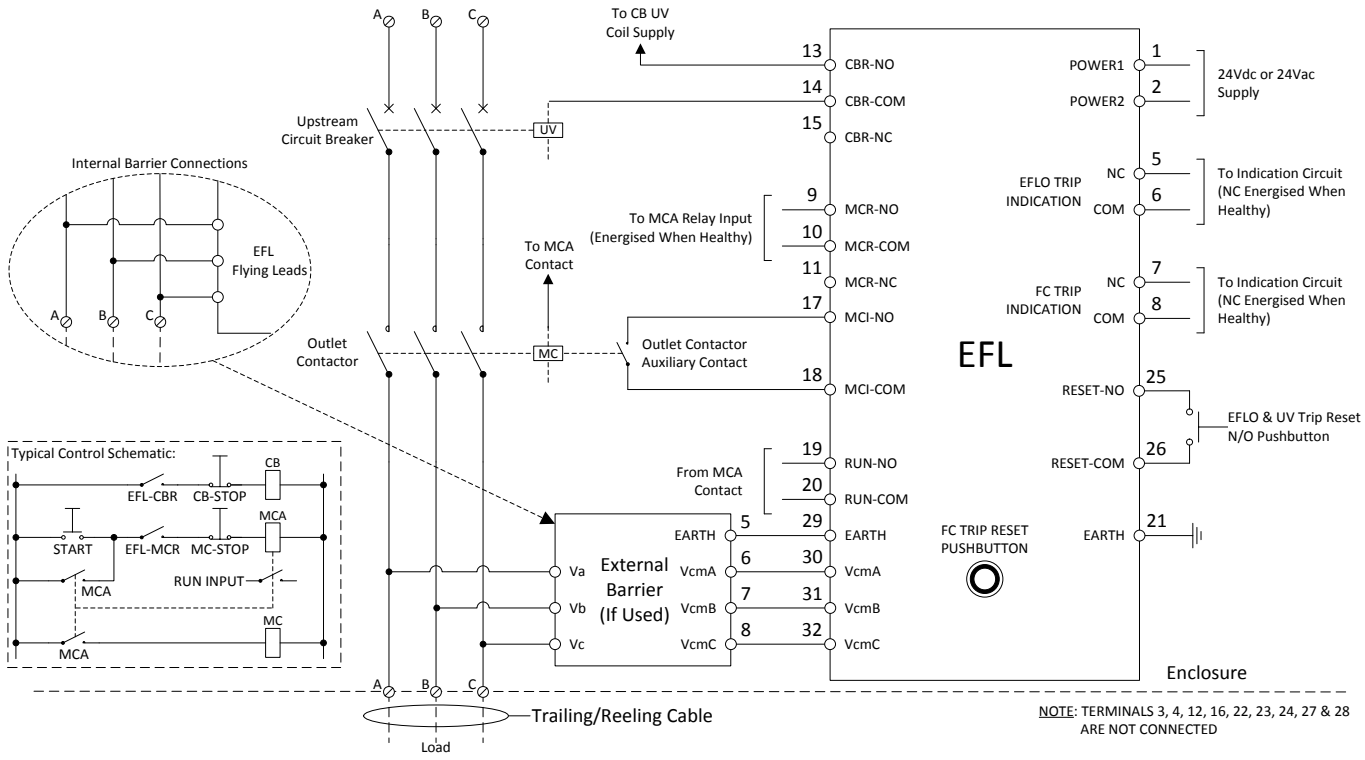

Figure 4.6: Typical Electrical Application

4.4.1 Power Supply (Terminals 1 & 2)

The EFL relay is supplied by either 24Vdc ± 20% or 24Vac ± 20%. The power consumption of the relay is less than 5W.

4.4.2 Earth Fault Lockout (EFLO) Trip Indication (Terminals 5 & 6)

The EFLO Trip Indication Contact is a normally closed (NC) contact that is used to provide external indication that an EFLO trip has occurred. The contact is energised when the system is healthy and will de-energise (close) when an EFLO trip is active.

4.4.3 Frozen Contactor (FC) Trip Indication (Terminals 7 & 8)

The FC Trip Indication Contact is a normally closed (NC) contact that is used to provide external indication that an FC trip has occurred. The contact is energised when the system is healthy and will de-energise (close) when an FC trip is active.

4.4.4 Main Contactor Relay (MCR) (Terminals 9, 10 & 11)

The MCR relay is the EFL's control relay for the main contactor. The relay is a change-over, allowing the control circuit to be implemented with either normally open or normally closed MCR.

The MCR relay is intended to be wired into the control circuit for the main contactor's auxiliary relay (MCA). The MCR will energise when the system is deemed healthy, allowing power to be applied to the interposing relay when required. When the system cannot be deemed healthy, either when the EFL is starting, in a tripped state or immediately after the contactor has opened (prior to EFLO test being performed), the MCR relay will be de-energised, preventing the interposing relay from energising and hence preventing the main contactor from closing.

4.4.5 Circuit Breaker Relay (CBR) (Terminals 13, 14 & 15)

The CBR relay is the EFL's control relay for the upstream circuit breaker. The relay is a change-over, allowing the control circuit to be implemented with either normally open or normally closed CBR.

The CBR relay is intended to be wired into the control circuit for the upstream circuit breaker. The CBR will energise when the FC is in a healthy state. If an FC trip occurs, the CBR will be de-energised, tripping the upstream circuit breaker and removing power from the frozen contactor.

4.4.6 Main Contactor Input (MCI) (Terminals 17 & 18)

The main contactor indication terminals should be wired to one of the main contactors normally open (NO) auxiliary contacts. This provides indication on whether the main contactor is open or closed.

4.4.7 Run Input (RUN) (Terminals 19 & 20)

The run indication terminals should be wired to the contacts of the interposing relay that drives the main contactor. This provides indication on whether the interposing relay is open or closed and hence whether the main contactor should be open or closed. The RUN input tells the EFL what the main contactor should be doing and the MCI input tells the EFL what the main contactor is doing.

4.4.8 Earth Connection (Terminals 21, 22, 23 & 24)

The EFL Relay is to be earthed to the main earth using at least one 1.5mm^2 earth cable.

4.4.9 Reset (Terminals 25 & 26)

The EFL Relay's Reset terminals allow a normally open pushbutton or contact to be wired to the EFL Relay to provide a reset function. Provided that a fault condition is not still present, shorting these two terminals will reset any EFLO or UV trips on the relay (all FC trips must be reset using the push button on the fascia of the relay).

4.4.10 Phase Conductor Connections (Flying Leads)

The EFL Relay interfaces with the phase conductors of the protected outlet via a high voltage barrier. The EFL can be purchased with an internal barrier, or the EFL Relay and barrier can be purchased as separate "stand-alone" units. The connection to the phase conductors is made using the three flying leads (A, B & C phase) that extend from the EFL Relay/Barrier. These leads are each 1.2m long.

If the EFL Relay is purchased with the external barrier configuration, the EFL Relay and the external barrier will need to be wired together as per Figure 4.6.

5 COMMISSIONING AND CALIBRATION

Prior to being put into service, the electrical protection system must be correctly commissioned. This manual does not cover system commissioning; the full scope of commissioning tests should be determined during the risk assessment or FMEA covering the design of the electrical protection system.

The following tests can provide guidance on checking the correct operation of the EFL Relay during commissioning. This is not intended to provide an exhaustive commissioning checklist, but should be considered to be a minimum set of tests.

5.1 Earth Fault Lockout Test

In order to ensure that the EFL Relay's earth fault lockout protection is operating correctly, performing the following test:

1. Open the main contactor that the EFL Relay is protecting.
2. Connect a 0.9MΩ resistor between each phase conductor on the load side of the main contactor. **WARNING:** if the outlet is attempted to be started while these resistors are connected, and the EFL Relay fails during EFLO test, the full system voltage will be applied to the resistors.
3. Ensure that the EFL initiates an EFLO trip when each the resistors are placed on the phase conductors.
4. Confirm that an EFLO trip prevents the main contactor from being closed.

5.2 Frozen Contactor Test

In order to ensure that the EFL Relay's frozen contactor protection is operating correctly, perform the following test:

1. Open the main contactor that the EFL Relay is protecting.
2. Apply a 25Vac or 60Vdc voltage to the load side of the contactor and wait until the EFL Relay's back emf timer has expired.
3. Ensure that the EFL Relay's CBR output de-energises, tripping the upstream circuit breaker.

5.3 Undervoltage Test

In order to ensure that the EFL Relay's under voltage protection is operating correctly, perform the following test:

1. Open the main contactor that the EFL Relay is protecting.
2. Using a double poled switch, close the RUN and MCI inputs to the EFL Relay at the same time. This will indicate to the EFL Relay that the main contactor is closed. As the main contactor remains open, the relay should see no voltage on the load side of the contactor.
3. Confirm that the EFL Relay initiates an undervoltage trip.
4. After an undervoltage trip occurs (which should result in the main contactor opening), if the MCI input to the EFL does not open within 1 second, a Frozen Contactor (FC) trip will occur.

6 PRODUCT OPERATION

6.1 Logical Operation of the EFL Relay

The following flow chart provides an insight into the logical operation of the EFL Relay. Individual test functions are presented as sub-processes and the functionality of these tests can be seen in the individual test flow charts.

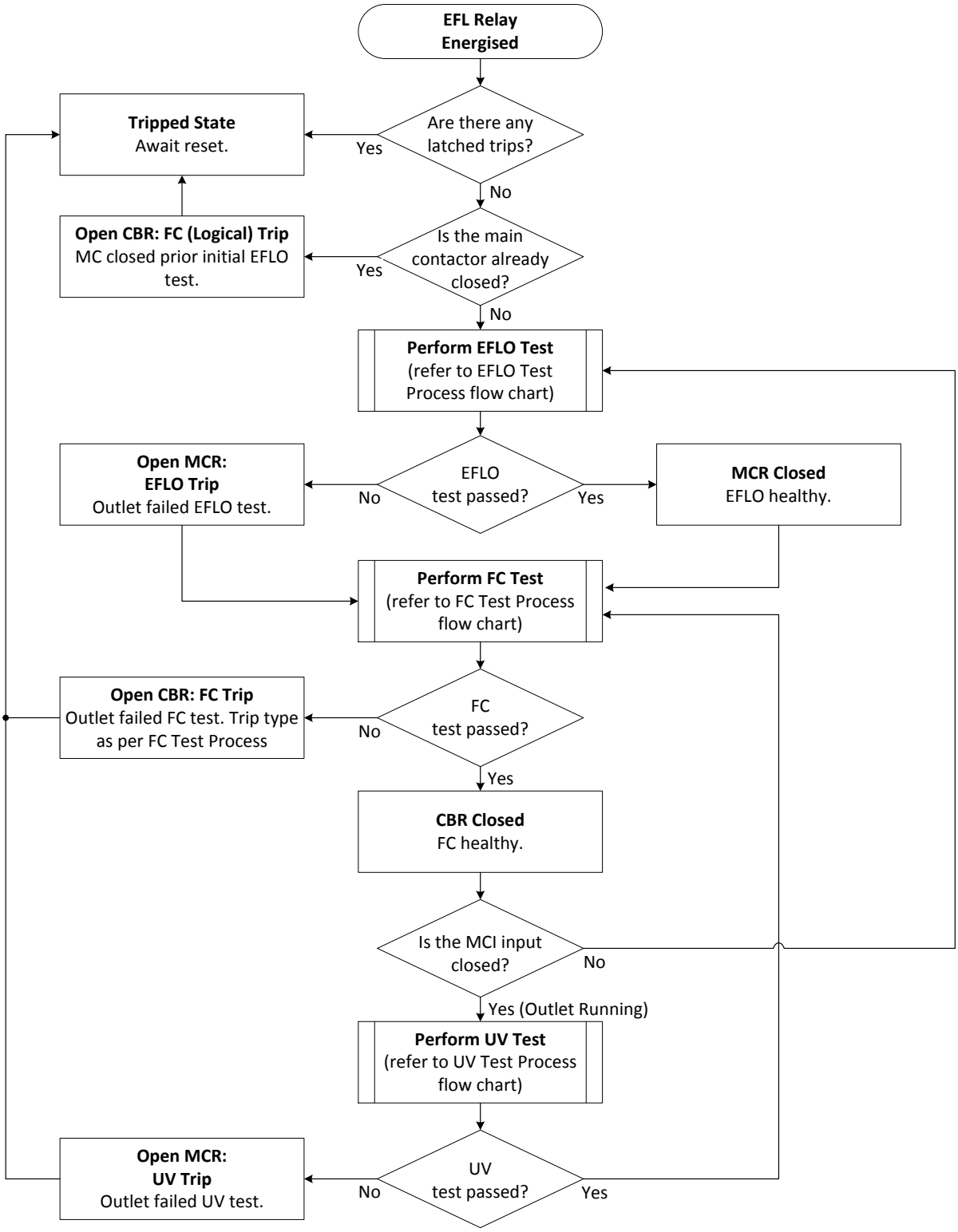

Figure 6.1: Logical Operation of the EFL Relay – General Overview

6.2 Earth Fault Lockout (EFLO) Protection Function

The EFL's EFLO Protection Function provides earth fault lockout protection for the connected outlet as per AS/NZS 2081:2011 requirements. Whilst the outlet's main contactor is open, the EFL Relay will continually monitor the impedance of each of the phase conductors to earth. When the impedance of any of the phase conductors falls below the tripping threshold of 1MΩ, then the EFL Relay with initiate an EFLO trip by opening the MCR output relay.

When the EFL Relay first energises, an EFLO test will be performed before the MCR output relay can close. The initial EFLO test can take up to 10 seconds to complete, as the EFL Relay must first charge the cable before the measurements can be taken. If the EFLO test is successful, the EFL Relay will then energise the MCR output relay – provided that there are no latched FC, EFLO or UV trips.

If an EFLO trip occurs, this trip will be latched in the memory of the EFL Relay. In order to clear an EFLO trip, the External Reset terminals must be shorted together. This is typically achieved through the use of an externally wired normally open push button.

	**To reset an EFLO trip, the External Reset terminals of the EFL Relay must be shorted together using an externally wired pushbutton or relay. An EFLO trip cannot be cleared whilst the EFL Relay is de-energised.**

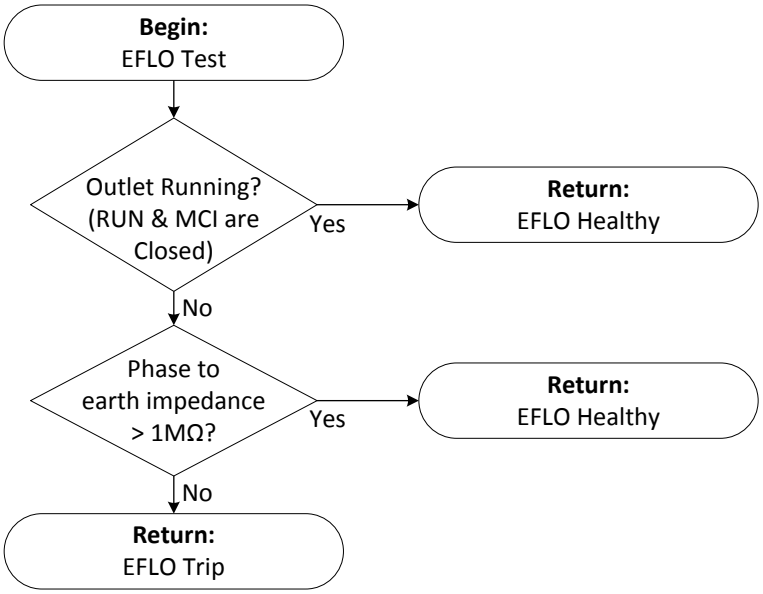

Figure 6.2: Logical Operation of the EFL Relay – EFLO Test Process

6.3 Frozen Contactor (FC) Protection Function

The EFL's FC Protection Function provides frozen contactor and contactor loss of vacuum protection for the connected outlet as per AS/NZS 2081:2011 requirements. The EFL Relay provides this protection in two forms: logical protection and electrical protection.

The FC (Logical) Protection Function is initiated when a discrepancy is observed between the positon of the main contactor and the position of the main contactor's interposing relay. A discrepancy between the positon of these two devices will indicate that the main contactor is either welded shut or frozen open. The position of the main contactor is monitored by the EFL Relay by wiring an auxiliary contact of the main contactor to the MCI input of the EFL Relay. The position of the main contactor's interposing relay is monitored by the EFL Relay by wiring an auxiliary contact to the RUN input of the relay.

The FC (Electrical) Protection Function monitors the voltage on the load side of the main contactor via the HV barrier. When the contactor is opened, the EFL Relay will wait a period of time for the back emf of the supplied motor to subside (determined by the back emf time setting) before applying the test conditions to the voltage measured on the outlet. After the back emf timer has expired, if the measured voltage exceeds the test conditions of 25Vac or 60Vdc, then the EFL Relay will initiate an FC (Electrical) trip.

Both the FC (Logical) trip and FC (Electrical) trip will result in the EFL Relay opening its CBR output relay, which should be wired into the tripping circuit of the upstream device (e.g. circuit breaker).

An FC trip will be latched in the memory of the EFL Relay and can be reset by pressing the FC Trip Reset Button on the fascia of the EFL Relay (after the fault condition has been investigated and rectified). FC trips cannot be reset via the externally wired remote reset.

NOTE	**To reset an FC trip, the button on the fascia of the EFL Relay must be pressed. A FC trip is not able to be reset unless the EFL Relay's super capacitor is charged (refer to Section 6.6).**

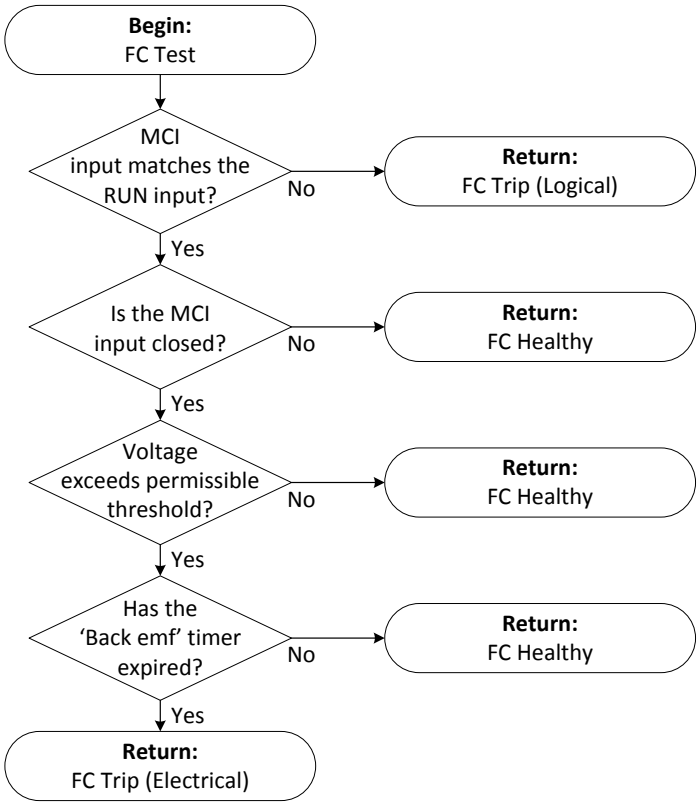

Figure 6.3: Logical Operation of the EFL Relay – FC Test Process

6.4 Undervoltage (UV) Protection Function

In addition to the EFLO and FC protection functions provided by the EFL Relay, the EFL Relay also offers a selectable Undervoltage Protection Function. This function will monitor the voltage on the outlet via the relay's HV Barrier and initiate an UV trip if the measured voltage falls below 50% of the selected system voltage.

The UV Protection Function can be activated and deactivated via the Voltage Selector Switch on the fascia of the EFL Relay.

If a UV trip occurs, this trip will be latched in the memory of the EFL Relay. In order to clear a UV trip, the External Reset terminals must be shorted together. This is typically achieved through the use of an externally wired normally open push button.

NOTE	**To reset a UV trip, the External Reset terminals of the EFL Relay must be shorted together using an externally wired pushbutton or relay. A UV trip cannot be cleared whilst the EFL Relay is de-energised.**

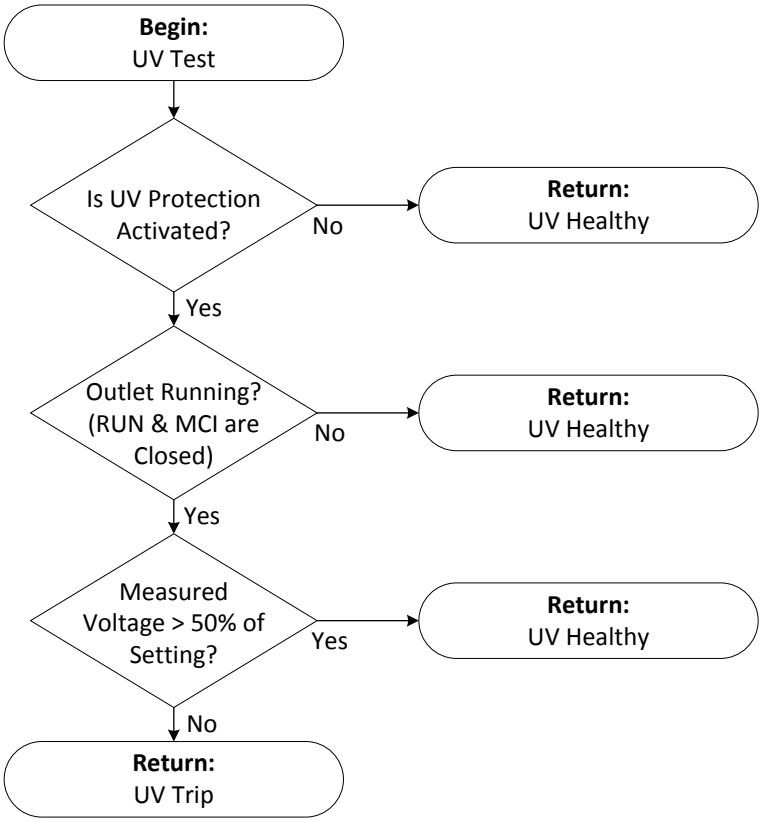

Figure 6.4: Logical Operation of the EFL Relay – UV Test Process

6.5 User Interface

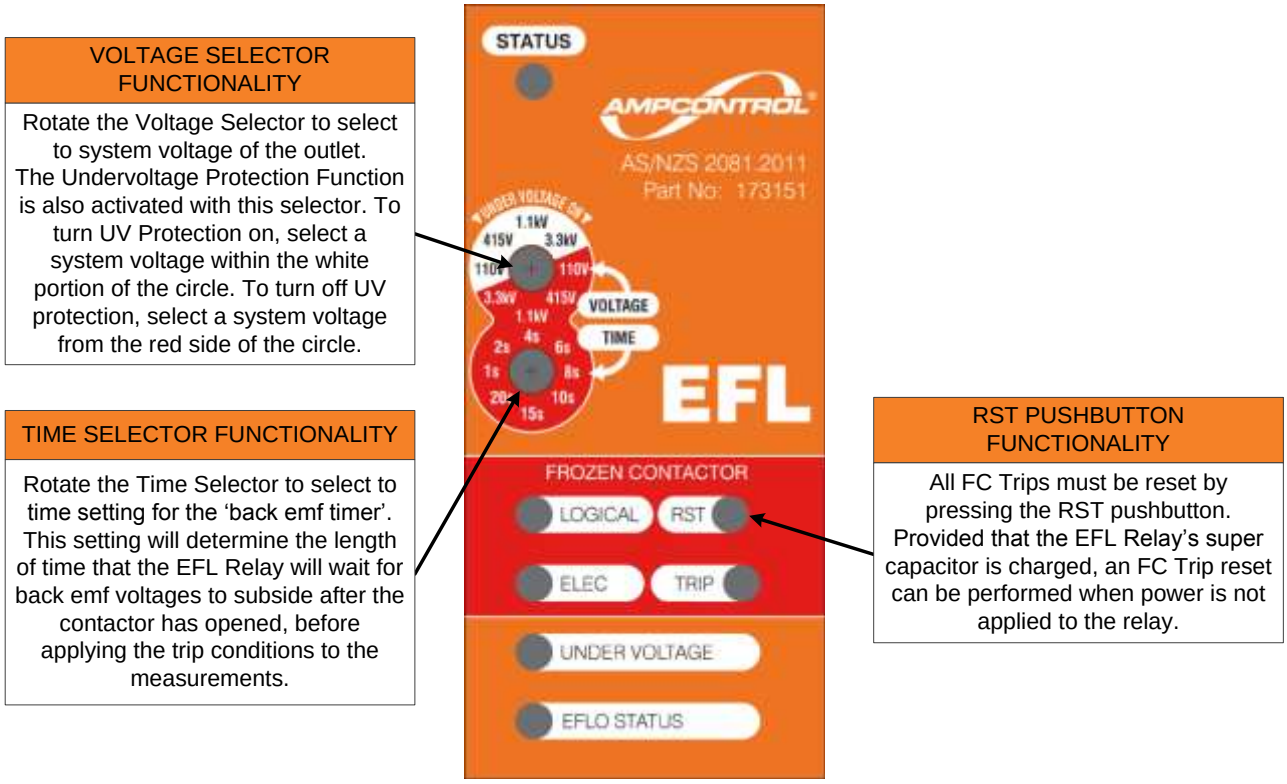

Figure 6.5: EFL Relay User Interface: Functionality of Operators

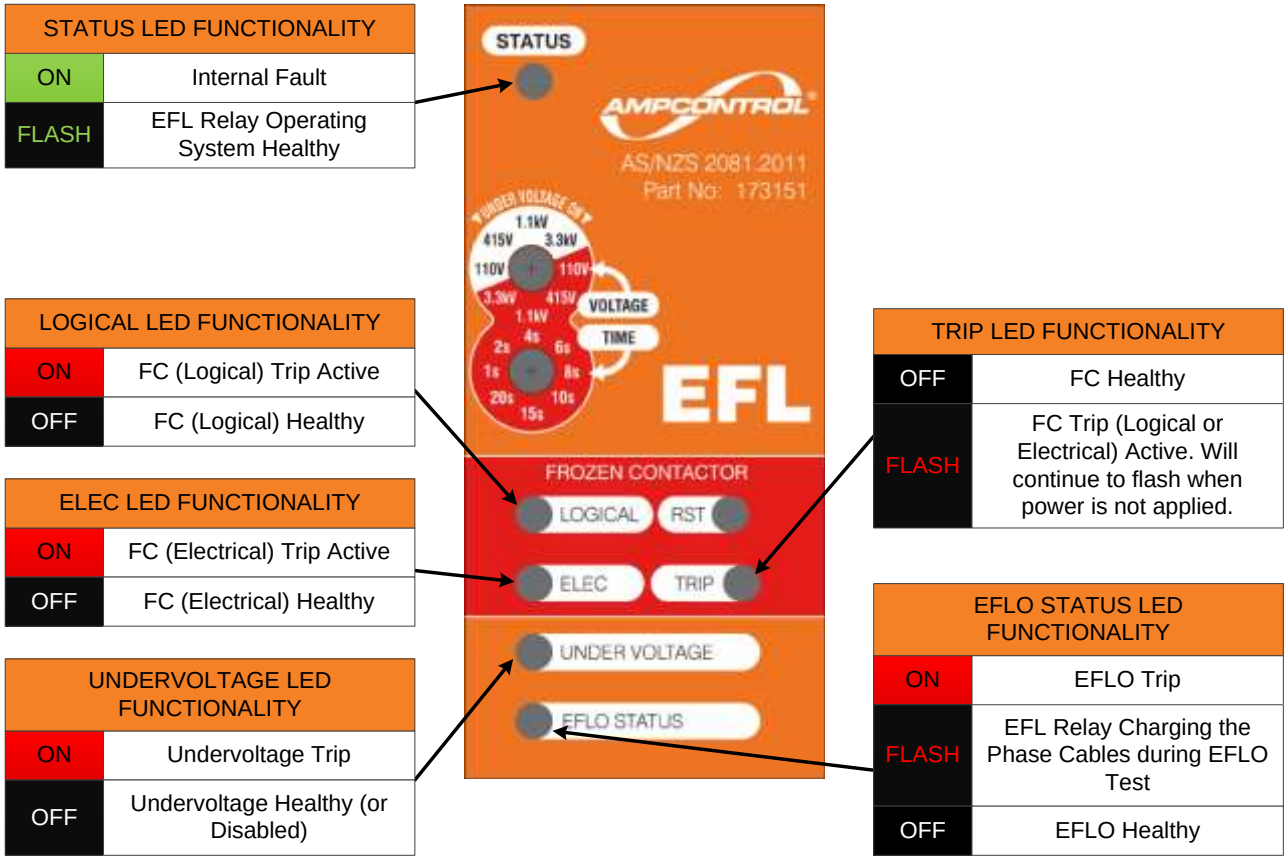

Figure 6.6: EFL Relay User Interface: Functionality of LEDs

6.6 First Time Use / Use after Extended Storage

The EFL Relay uses an internal super-capacitor to provide long term energy storage; however, after long periods of storage time, the energy stored in the super-capacitor will dissipate.

The consequence of the EFL Relay having a discharged super-capacitor is that latched FC trips will not be able to be reset until the super-capacitor has been recharged.

Recharging the super-capacitor requires the unit to be connected to an external power source for a period of 5min. This charging can occur when the unit is installed in its service enclosure by energising the control supply to the relay or, when the relay is not installed, by connecting the EFL relay to a standard car battery.

7 SERVICE, MAINTENANCE & DISPOSAL

7.1 Equipment Inspections

A number of external system based checks should be completed on a regular basis. These 'routine inspections' must be carried out by suitably trained people with knowledge of the EFL Relay and the systems into which it is fitted. Routine inspections may take the form of either visual-only checks, or visual and 'hands-on' checks.

7.1.1 Visual Only Inspections

A basic visual inspection focuses on looking at the installation for signs of physical damage, water or dust ingress and the condition of cables and labels. This type of inspection may involve opening cabinets to gain access to the EFL Relay and other equipment. This level of inspection may also include cleaning display windows that have become obscured by dirt.

Observations would typically be:

- Check that equipment enclosures, cable trays, conduits, etc. are in good order with no physical damage.
- Check that sealed wall boxes are free from water and dust ingress internally. Door seals are in good condition.
- Check that connected cables are free from cuts, abrasions and obvious signs of damage. Cable restraints are in good order and correctly fitted.
- Check that labels on equipment, wall boxes and cables are present and in good condition (especially certification labels).
- Check that no modifications have been carried out to installed equipment.

7.1.2 Hands-On (Detailed) Inspections

A more detailed inspection would include all of the elements of a visual inspection, plus some checks that cover the integrity of connections, fixtures and fittings.

In addition to basic visual observations, more detailed integrity checks would involve:

- Verify that equipment housings, wall boxes and other mechanical fixtures are secured in place. This includes terminal box lids, tightness of cable glands, integrity of wall-box mountings, security of equipment fixing to walls/DIN rails etc.
- Verify all electrical connections are secure with no loose screw terminals or DIN rail terminals not fitted to rails etc.

7.2 Equipment Maintenance

WARNING! 	**The EFL Relay has no user-serviceable parts. All repairs must be carried out by Ampcontrol only. If a fault develops, return the EFL Relay to Ampcontrol for repair. It is essential that no attempt be made to repair the EFL Relay as any attempt to dismantle or repair the EFL Relay can seriously compromise the safety performance of the unit and voids any product warranty.**

It is recommended that the electrical protection system incorporating the EFL Relay be subject to regular functional tests at intervals determined by risk assessment or FMEA. These intervals typically coincide with periodic maintenance checks and will cover (but not limited to) tests such as:

- Functional testing of the Earth Fault Lockout (EFLO) protection function.
- Functional testing of the Frozen Contactor (FC) protection function.
- Functional testing of the Undervoltage (UV) protection function.

7.3 Equipment Service

To ensure the continuing safe operation of the EFL Relay, Ampcontrol recommends that the EFL Relay and associated barriers be returned to an Ampcontrol registered repair facility for service and inspection every 5 years.

7.4 Disposal

	**The electronic equipment discussed in this manual must not be treated as general waste. By ensuring that this product is disposed of correctly you will be helping to prevent potentially negative consequences for the environment and human health which could otherwise be caused by incorrect waste handling of this product.**

8 SPECIFICATIONS

Supply Voltage			
Voltage	24Vd.c ± 20% or, 24Va.c ± 20%, 50Hz		
Power Consumption	< 5W		
Relay Contacts			
Group	*Type*	*Rating*	
MCR Trip Contacts	1 x CO (NO-COM-NC)	250V a.c., 6A, 300VA (AC1), 60VA (AC15) 30V d.c., 1.2A (DC1)	
CBR Trip Contacts	1 x CO (NO-COM-NC)	250V a.c., 6A, 300VA (AC1), 60VA (AC15) 30V d.c., 1.2A (DC1)	
EFLO Indication Contacts	1 x NC	250V a.c., 6A, 300VA (AC1), 60VA (AC15) 30V d.c., 1.2A (DC1)	
FC Indication Contacts	1 x NC	250V a.c., 6A, 300VA (AC1), 60VA (AC15) 30V d.c., 1.2A (DC1)	
Mechanical & Environment			
Dimensions (HxWxD)	111 x 45 x 114mm (EFL) 111 x 22 x 114mm (Barrier) 111 x 75 x 114mm (EFL with Internal Barrier)		
Terminal Max. Wire Gauge	2.5mm^2		
IP Rating	IP20		
Operating Temperature	-20°C to 60°C		
Humidity	Between 10% relative humidity and the dew point, non-condensing		
Air Flow	The EFL is to be mounted in a position that allows unrestriced air flow through the upper and lower air vents.		
LED Indication			
LED	***ON***	***OFF***	***FLASHING***
Status	Internal Fault	-	OK
Trip (FC)	-	FC Healthy	FC Trip
Logical (FC)	Logical FC Trip	-	-
Elec (FC)	Electrical FC Trip	-	-
Undervoltage	UV Trip	System Healthy or UV Not Activated	-
EFLO Status	EFLO Trip	EFLO Healthy	EFLO Test Underway
Find Out More			
For more information on this product, contact Ampcontrol Customer Service on +61 1300 267 373 or *customerservice@ampcontrolgroup.com* or visit the Ampcontrol website: ampcontrolgroup.com			

9 EQUIPMENT LIST

Part Number	Description
173151	EFL Protection Relay
173175	EFL Protection Relay with Internal 415V-1100V Barrier
173176	External 415V-1100V Barrier suit EFL Protection Relay