EFL-IS

INTRINSICALLY SAFE EFL RELAY

User Manual

Version: 6, May 2021

Designed and manufactured in Australia by Ampcontrol Pty Ltd

AMPCONTROL®

WARNING!

The **warning** symbol highlights a potential risk of **injury or death**.

Please share these warnings with other operators.

CAUTION!

The **caution** symbol highlights a potential risk of **damage to equipment**.

Please share these cautions with other operators.

NOTE

The **note** symbol highlights **key information**.

Please share these notes with other operators.

ENVIRO

The **enviro** (environmental) symbol highlights areas which may have an impact on the surrounding **fauna and/or flora**.

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Before You Begin

Thank you for purchasing the Ampcontrol EFL-IS relay.

WARNING!

In the interests of **safety and correct equipment operation**, please take the time to read and understand the content in this manual.

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TABLE OF CONTENTS

TABLE OF FIGURES

1 SAFETY AND OTHER WARNINGS

For safety reasons, the EFL-IS relay must be installed, operated and serviced only by competent personnel. Please 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.

WARNING!

To comply with the Conditions of Certification, ensure full serviceable life of the product, and avoid nullifying the warranty, it is essential to exercise great care with the installation, use and storage of the system components. Failure to comply with the Conditions of Certification may seriously compromise the integrity of the system and/or its components, and the consequence could be fatal. The user must ensure that the "Conditions of Certification" outlined in the certificate are met or the certificate (and the IS rating) will not be valid.

1.1 Safe Use of Equipment

The equipment supplied has been designed and manufactured to ensure safe operation. The equipment must only be used within the design parameters.

The instructions within this manual must be observed as an aid towards achieving the safest possible installation.

Persons responsible for installation, maintenance, or operation, must observe 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-IS 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-IS relay functioning correctly it is highly recommended that all safety functions of the relay be periodically tested to ensure correct operation.

1.2 Intrinsic Safety Considerations

- See the IECEx certificate for conditions of use.
- See Appendix A for IS critical information.
- The EFL-IS Relay and the EFL-IS Barrier must be installed in a non-hazardous (safe) area.
- The installation is to be in accordance with the relevant installation Standards/Codes of Practice.
- There are no user-replaceable or user-adjustable parts in the EFL-IS system's components. **DO NOT OPEN** the EFL-IS Relay or Barrier enclosure. Return to Ampcontrol for service & repair.

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 wrapping 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**.

ENVIRO

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-IS Protection Relay provides earth fault lockout (EFLO) and frozen contact (FC) protection that is compliant to AS/NZS 2081:2011 sections 7 & 9. The EFL-IS Relay and EFL-IS Barrier are IECEx certified as Ex ia, provided that the conditions of use in the certification are adhered to.

While the outlet's main contactor is open, the EFL-IS relay will use an intrinsically safe signal to 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 the EFL-IS relay will initiate an EFLO trip, preventing the outlet from being started.

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

The EFL-IS relay also has an undervoltage protection function which, if activated, will open the main contactor if the outlet voltage falls below 50% of the selected system voltage.

The EFL-IS relay monitors the line voltage via the externally connected EFL-IS barrier. The external barrier is supplied with high voltage flying lead connections to allow the high voltage terminations to be made.

Key Features

- AS/NZS 2081:2011* compliant
- IECEx Ex ia I Ma certification (U_m 132V_{rms} withdrawn)
- Earth Fault Lock-out (EFLO) protection
- Frozen Contact (FC) protection
- Selectable Undervoltage (UV) protection
- Compatible with a wide range of system voltages

3.2 Applications

The Ampcontrol EFL-IS relay is IECEx Ex ia certified and is compliant to AS/NZS 2081:2011 sections 7 & 9. It has been designed for installation on mining outlets supplying hazardous area equipment that require earth fault lockout and frozen contact protection. The EFL-IS is capable of being installed on a wide range of system voltages from 110V up to 1.1kV. In addition to EFLO and FC protection, the EFL-IS also offers a selectable undervoltage protection function.

For a typical electrical installation diagram, refer to Figure 4.4.

WARNING!

The EFL-IS Relay and EFL-IS Barrier must be installed in accordance with the conditions of use stated on the certificate. **Failure to do so will void the Ex ia certification of the product.**

4 INSTALLATION

4.1 General Warnings

These instructions have been designed to assist users of the EFL-IS relay with installation.

Before the 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 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 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-IS 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-IS relay will properly perform the required functions within the system design.

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

4.1.4 Modifications of any form to the EFL-IS relay or barrier are prohibited.

The EFL-IS 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 relay or barrier, the equipment may no longer be fit for use. If any modifications or damage to the relay or barrier 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-IS relay. Failure to adhere to this information may give rise to unsafe operation.

Using the EFL-IS 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-IS relay must be powered within the specified voltage range.
- The installation of the relay and barrier must be carried out by suitably trained and qualified personnel.
- The Conditions of Use in the certification must be adhered to.
- Identification labels fixed to the relay and barrier 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 relay or barrier. 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-IS system consists of both the EFL-IS Relay and the EFL-IS Barrier.

4.3.1 Mounting Arrangements

The EFL-IS Relay and the EFL-IS Barrier are both DIN Rail mounted.

CAUTION!

The EFL-IS Relay and EFL-IS 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: EFL-IS Relay Dimensions

Figure 4.2: EFL-IS Barrier Dimensions

4.3.3 Terminal Layout

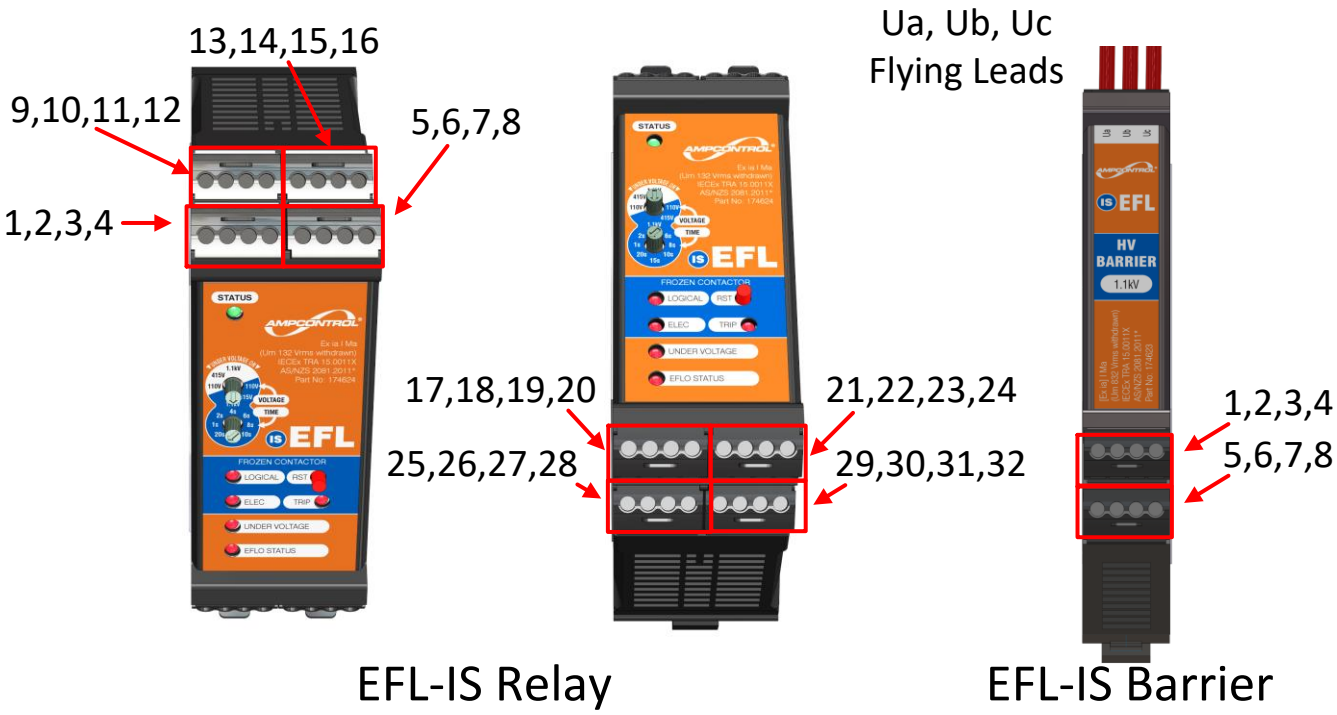

Figure 4.3: EFL-IS Relay and Barrier Terminal Arrangements

4.4 Electrical Installation Information

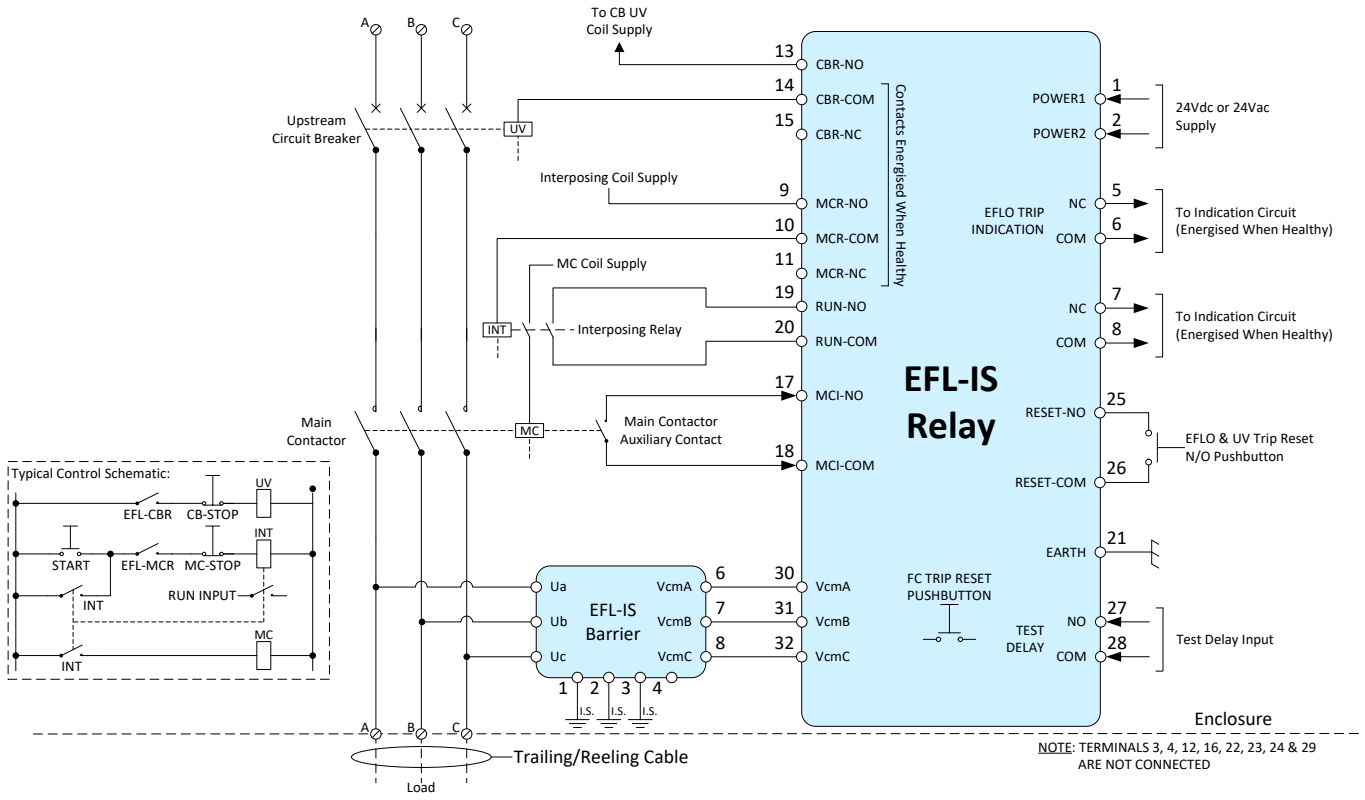

Figure 4.4: EFL-IS Typical Application Wiring Diagram

4.4.1 Power Supply (Terminals 1 & 2)

The EFL-IS 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 Contact (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-IS Relay'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 interposing circuit relay (INT), see Figure 4.4. 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 Relay 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-IS'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 contact.

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, see Figure 4.4. 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-IS Relay what the main contactor should be doing and the MCI input tells the EFL-IS Relay what the main contactor is actually doing.

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

The EFL-IS 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-IS Relay's Reset terminals allow a normally open pushbutton or contact to be wired to the EFL-IS 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 Test-Delay Input (Terminals 27 & 28)

This input should be shorted to enable the test delay operation. This typically applies to the use in a fan starter utilising a Burp sequence. Shorting terminals will inhibit the EFL-IS performing checks during the burp sequences.

4.4.11 Relay – Barrier Inter-Connections (Terminals 30, 31, & 32)

The EFL-IS Relay and EFL-IS Barrier are wired together as per Figure 4.4.

In typical installations these connecting cables are short and noise interference will not be an issue. If problems occur, an earth screened cable can be used. The screen should be connected to terminal 5 on the barrier.

4.4.12 EFL-IS Barrier Earthing (Barrier Terminals 1, 2, 3 & 4)

The EFL-IS Barrier requires an I.S. earth connection using at least three (3) conductors, each with a minimal cross-sectional area of 1.5mm^2.

4.4.13 Phase Conductor Connections (Flying Leads)

The EFL-IS Relay interfaces with the phase conductors of the protected outlet via the EFL-IS Barrier. The connection to the phase conductors is made using the three flying leads (A, B & C phase) that extend from the EFL-IS Barrier. These leads are each 1.2m long.

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 test can provide guidance on checking the correct operation of the EFL-IS Relay and Barrier 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-IS 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 separate 2.9MΩ resistor between each outlet phase conductor and earth, on load side of the Main Contactor.
3. Ensure that the EFL initiates an EFLO trip when each of the resistors are placed on the phase conductors individually.
4. Confirm that an EFLO trip prevents the main contactor from being closed.

WARNING: if the outlet is attempted to be started while these resistors are connected, and the EFL Relay fails, the full system voltage will be applied to the resistors.

NOTE: If preforming an EFLO test with a load connected, a single 0.9MΩ resistor can be connected between any phase and earth.

5.2 Frozen Contact Test

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

1. Open the main contactor that the EFL-IS Relay is protecting.
2. Apply a 25Vac or 60Vdc voltage to the load side of the contactor
3. Wait for the Back EMF timer to end.
4. Ensure that the CBR output de-energises from an Electrical Frozen Contactor (FC) trip, tripping the upstream circuit breaker.

5.3 Undervoltage Test

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

1. Open the main contactor that the EFL-IS Relay is protecting.
2. Using a double poled switch, close the RUN and MCI inputs to the EFL-IS Relay at the same time. This will indicate to the EFL-IS Relay that the main contactor is closed and is required to be. As the main contactor remains open, the relay should see no voltage on the load side of the contactor.
3. Confirm that the EFL-IS 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-IS Relay does not open within 1 second, a Frozen Contact (FC) trip will occur.

6 PRODUCT OPERATION

6.1 Logical Operation of the EFL-IS Relay

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

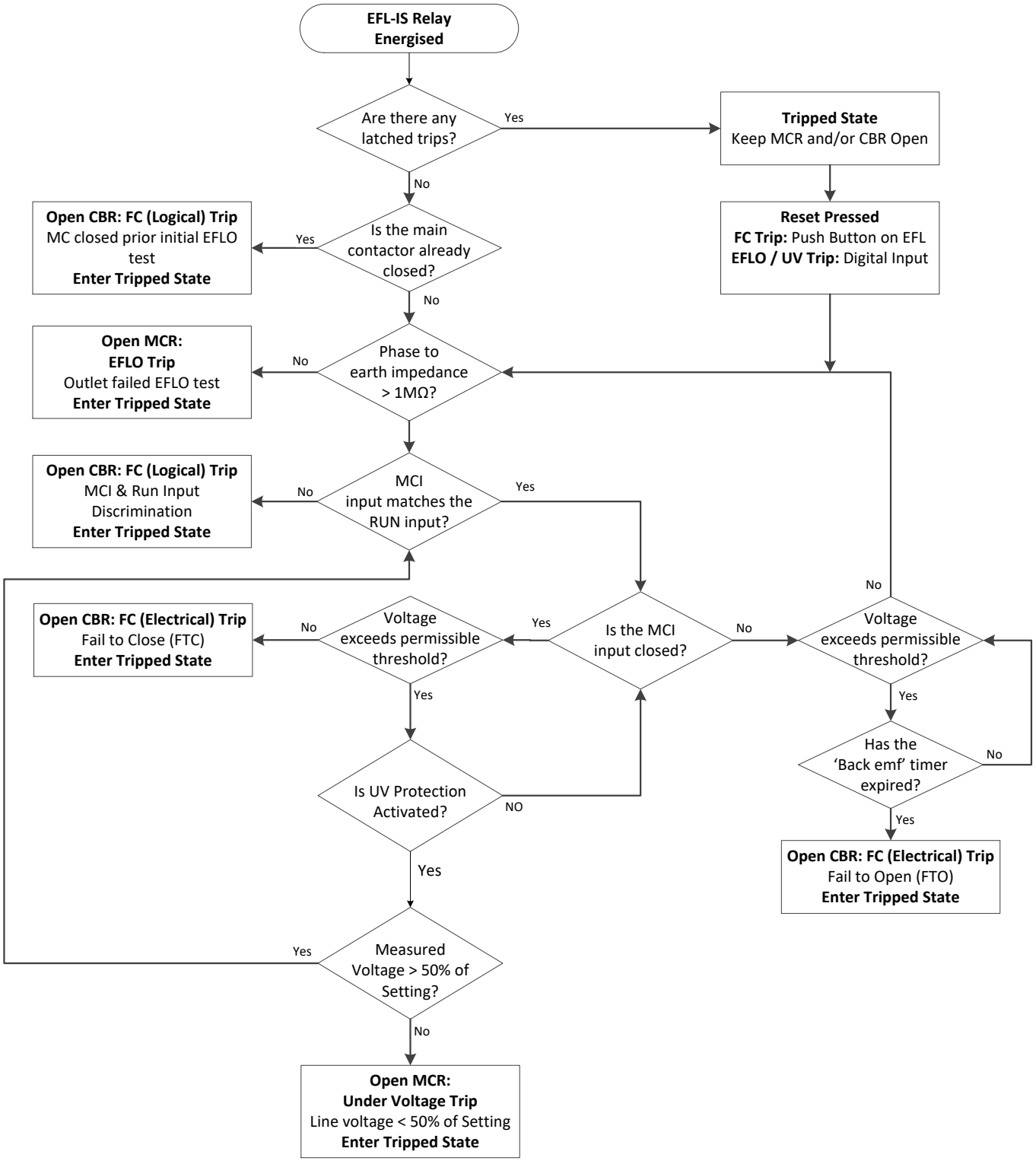

Figure 6.1: Logical Operation of the EFL-IS Relay – General Overview

6.2 Earth Fault Lockout (EFLO) Protection Function

The EFL-IS Relay'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-IS Relay will continually preform an LV test to 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, defined below, the EFL-IS Relay with initiate an EFLO trip by opening the MCR output relay.

When the EFL-IS 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-IS Relay must first charge the cable before the measurements can be taken. If the EFLO test is successful, the EFL-IS 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-IS 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.

NOTE

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

The EFL trip point has been chosen to ensure compliance to the worst case scenario as defined in AS/NZS 2081:2011 section 7.2.

"Earth fault lockout protection devices shall be designed to prevent energization of the circuit interrupting device when the insulation resistance of any active conductor to earth is below 1 MΩ. This requirement shall apply to any combination of active conductors to earth"

To ensure compliance with AS/NZS 2081 2011, the EFL set point is influenced by the configuration that reduces the impedance to earth the greatest. This being all three phases shorted together through a Load or connected motor, essentially causing all three phase leakage impedance's to be paralleled. An electric motor or load can be treated as a short circuit for the applied DC test voltage. Under this circumstance the EFL needs to trip before it detects 1MΩ to ensure compliance.

The individual leakage impedances for each phase in a un-shorted configuration (due to load or motor) is then required to be greater than 3MΩ to ensure the minimum level of safety is maintained.

Table 1: EFL Trip Threshold

EFL Trip Threshold	Outlet Configuration	Example
1Meg	Load on Outlet	Outlet cable terminated by Motor
3Meg	Open Circuit Outlet	Shuttle car with incomer contactor

6.2.1 Test Delay Input

This input should only be utilised when the EFL-IS has been installed in an outlet configured as a Fan starter implementing a burp sequence. When shorted, this input will prevent the EFL-IS initiating the EFLO checks when the Main Contactor opens. This test delay is limited to 16 seconds after the MCI has indicated the Main Contactor has opened.

Burp sequences should not be greater than 15 seconds when this mode is used. Once the Main Contactor has been closed for greater than 25 seconds the EFL-IS will operate as per normal. This indicates that the burp sequence has ended and will then initiate an EFLO check after Main contactor has opened (and the Back EMF Timer has ended).

If the MCI remains open for >15 seconds before the relay believes the burp sequence has ended, the relay will operate as per normal operation. That being, the Back EFM timer will initiate and then the relay will perform the standard EFLO tests upon completion.

6.3 Frozen Contact (FC) Protection Function

The EFL-IS Relay's FC Protection Function provides frozen contact and contactor loss of vacuum protection for the connected outlet as per AS/NZS 2081:2011 requirements. The EFL-IS 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 (MC) and the position of the Main Contactor's interposing relay. . A discrepancy will indicate that the MC is either welded shut (Failed to Open) or frozen open (Failed to Close). The position of the MC is monitored by the EFL-IS Relay by wiring an auxiliary contact of the MC to the MCI input. The position of the MC interposing relay is monitored by the EFL-IS 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-IS 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-IS Relay will initiate an FC (Electrical) trip.

Both the FC (Logical) trip and FC (Electrical) trip will result in the EFL-IS 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-IS Relay and can be reset by pressing the FC Trip Reset Button on the fascia of the EFL-IS 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-IS Relay must be pressed. A FC trip is not able to be reset unless the EFL-IS Relay's super capacitor is charged (refer to Section 6.6).

6.4 Undervoltage (UV) Protection Function

In addition to the EFLO and FC protection functions provided by the EFL-IS Relay, a selectable Undervoltage Protection Function is available. This function will monitor the voltage on the outlet via the 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-IS Relay.

If a UV trip occurs, this trip will be latched in the memory of the EFL-IS 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-IS Relay must be shorted together using an externally wired pushbutton or relay. A UV trip cannot be cleared whilst the EFL-IS Relay is de-energised.

6.5 User Interface

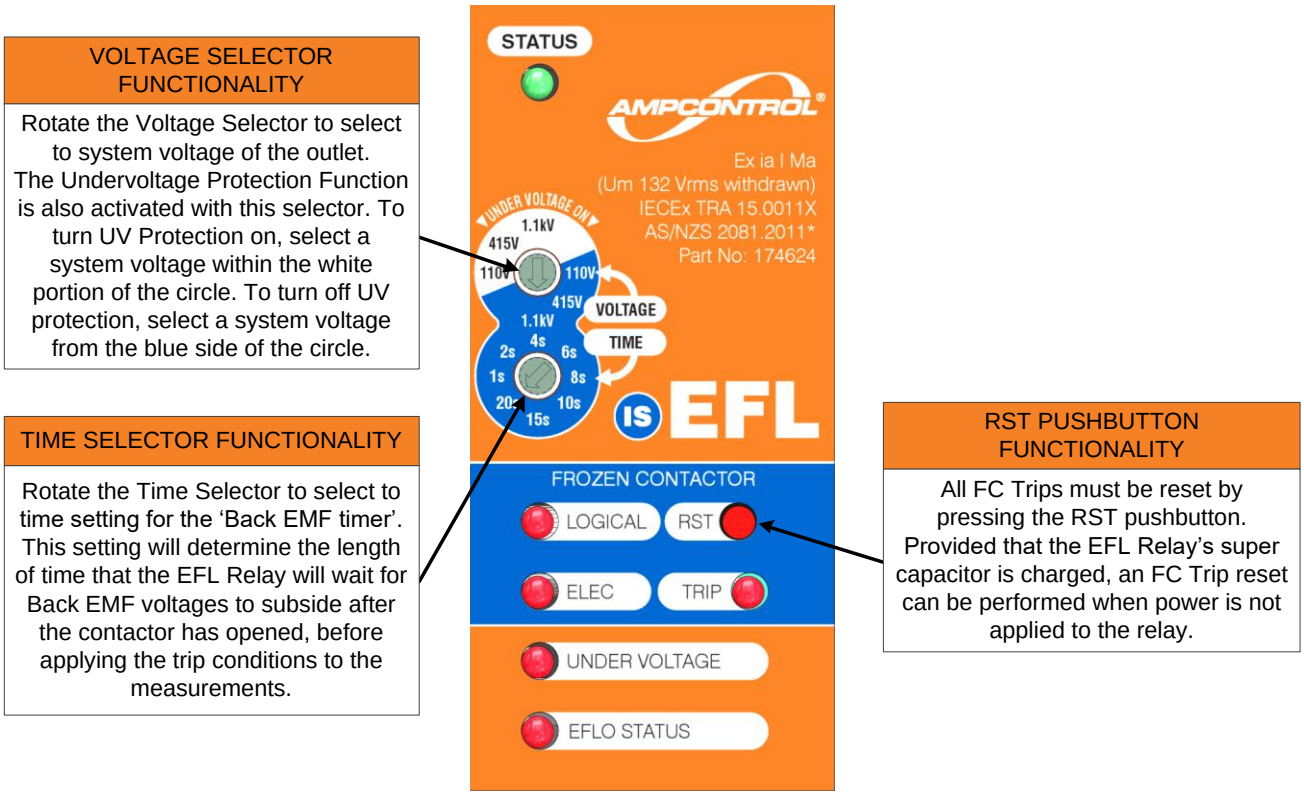

Figure 6.2: EFL-IS Relay User Interface: Functionality of Operators

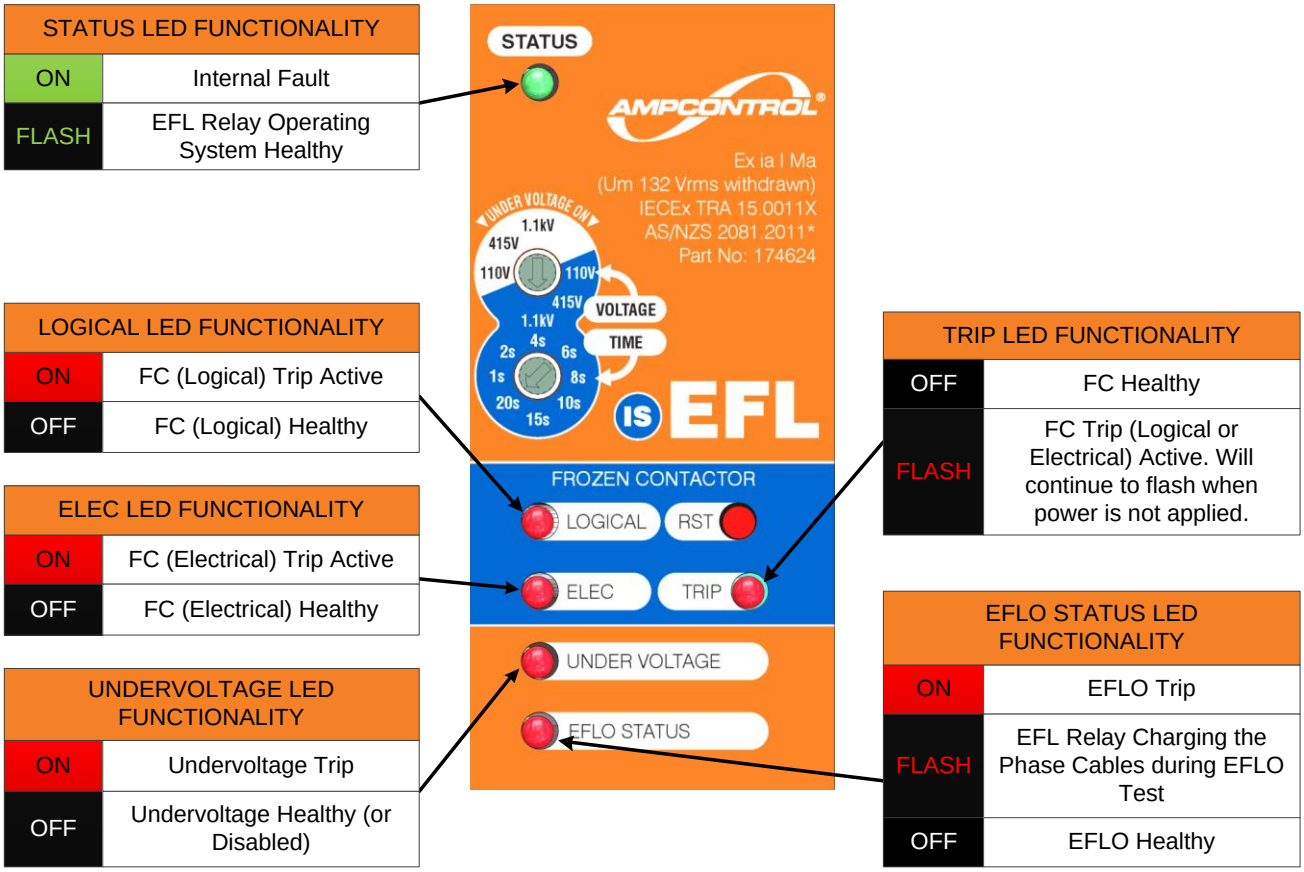

Figure 6.3: EFL-IS Relay User Interface: Functionality of LEDs

6.6 First Time Use / Use after Extended Storage

The EFL-IS 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-IS 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-IS relay to 24Vac or 24Vdc supply.

7 SERVICE, MAINTENANCE & DISPOSAL

7.1 Equipment Service

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-IS 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-IS 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 for physical damage.
- Check that enclosure housing relay is sealed and free from water and dust ingress. Confirming the IP rating has not been compromised.
- 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 such as:

- Verify that the EFL, and Barrier if installed, are secured in place.
- Check wiring against latest signed off schematics
- 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-IS Relay and Barrier have no user-serviceable parts.

All repairs must be carried out by Ampcontrol only.

If a fault develops, return the unit to Ampcontrol for repair. It is essential that **no attempt be made to repair the unit** as any attempt to dismantle or repair the EFL-IS Relay or Barrier can **seriously compromise the safety of the unit and voids product warranty**.

It is recommended that the electrical protection system incorporating the EFL-IS 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 Contact (FC) protection function.
- Functional testing of the Undervoltage (UV) protection function.

7.3 Equipment Overhaul

To ensure the continuing safe operation of the EFL-IS Relay, Ampcontrol recommends that the EFL-IS Relay and EFL-IS Barrier are returned to an Ampcontrol registered repair facility for service and inspection every 5 years, or on a timeline corresponding with the overhaul schedule for equipment in which the units are installed.

7.4 Disposal

ENVIRO

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 which could otherwise be caused by incorrect waste handling of this product.

8 SPECIFICATIONS

Supply Voltage			
Regulated Voltage	24Vdc ± 20% or, 24Vac ± 20%, 50Hz		
Power Consumption	< 5W		
System Voltage			
1.1kV Barrier (174623)	110V to 1.1kV		
Certification			
IECEx	IECEx TRA 15.0011X IEC 60079-0:2011 Edition:6.0 IEC 60079-11:2011 Edition:6.0		
EFL-IS Relay Marking	Ex ia I Ma (U_m 132V_{rms} withdrawn)		
EFL-IS Barrier Marking	[Ex ia] I Ma (U_m 832V_{rms} withdrawn)		
EFL Tripping Thresholds			
3PH Load Disconnected	Trip by 3MΩ (Refer to Section 6.2)		
3PH Load Connected	Trip by 1MΩ (Refer to Section 6.2)		
Undervoltage Protection	<50% of Voltage setting (Refer to Section 6.4)		
Relay Contacts			
Group	*Type*	*Rating*	
MCR Trip Contacts	1 x CO (NO-COM-NC)	110Vac, 6A, 300VA (AC1), 60VA (AC15) 30Vdc, 1.2A (DC1)	
CBR Trip Contacts	1 x CO (NO-COM-NC)	110Vac, 6A, 300VA (AC1), 60VA (AC15) 30Vdc, 1.2A (DC1)	
EFLO Indication Contacts	1 x NC	110Vac, 6A, 300VA (AC1), 60VA (AC15) 30Vdc, 1.2A (DC1)	
FC Indication Contacts	1 x NC	110Vac, 6A, 300VA (AC1), 60VA (AC15) 30Vdc, 1.2A (DC1)	
Mechanical & Environment			
Dimensions (HxWxD)	111 x 45 x 114mm (EFL-IS Relay) 111 x 22 x 114mm (EFL-IS 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 Relay and Barrier are 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***
174624	RELAY EFL IS
174623	BARRIER EFL EXT 1.1KV IS
141479	P/SUPPLY 24V 1A DIN MOUNT

APPENDIX A: CERTIFICATION

Certification	
IECEx	IECEx TRA 15.0011X
Applicant	Ampcontrol CSM Pty Ltd 7 Billbrooke Close. Cameron Park, NSW 2285 Australia
EFL-IS Relay Marking	Ex ia I Ma (U_m 132V_{rms} withdrawn)
EFL-IS Barrier Marking	[Ex ia] I Ma (U_m 832V_{rms} withdrawn)
Ambient Temperature	-20˚C to + 60˚C
Standards	
IEC 60079-0:2011 Edition:6.0	Explosive atmospheres – Part 0: General requirements
IEC 60079-11:2011 Edition:6.0	Explosive atmospheres – Part 11: Equipment protection by intrinsic safety “i”
EFL Barrier	
The barrier has a combination of low voltage (Um=132V) and high voltage, the fly leads have a combined Um=832V and Uo=26.7V.	
EFL Relay	
The apparatus is powered from AC mains and powered by a nominal 132VAC.	
Conditions of Certification pertaining to Issue 0 of this Certificate	
1. The EFL equipment is to be installed in a non-hazardous (safe) area. The ambient temperature range is -20˚C to + 60˚C. 2. The EFL is to be housed in a suitable enclosure that provides a degree of protection of not less than IP54. 3. The earth terminals of the EFL Barrier must be connected to a mains earth system via three (3) earth conductors making a combined 4mm². These provide ongoing electrical safety and maintain the intrinsic safety and certification. 4. The electrical parameters in the below table shall be taken into account during installation.	

EFL Relay Entity Parameters

Function	Terminals	Um	Uo	Io	Po	Co	Lo
110V Incoming Power	All Connections	132V	-	-	-	-	-

EFL Barrier Entity Parameters

Function	Terminals	Um	Uo	Io	Po	Co	Lo
High Voltage Leads	Ua, Ub, & Uc	832V	26.7V	176uA	1.2mW	4.25uF	10H
Low Voltage Terminals	5,6,7	132V	-	-	-	-	-

Typical IS System Diagram	
Drawing Number	EFLE005 (See following page)