ECD – Earth Continuity Protection Relay

User Manual

[Ex ia] I   -20°C ≤ Ta ≤ 65 °C

IECEx TSA13.0004X

Part Number: 166351

Revision: 3 – March 2020

Designed and manufactured in Australia by Ampcontrol CSM Pty Ltd

WARNING!	This safety alert symbol identifies important safety messages in this manual and indicates a potential risk of injury or even death to the 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 the personnel.
NOTE	Supplementary information not directly affecting safety or damage to equipment. Carefully read the message that follows, and inform other relevant personnel.
ENVIRONMENTAL ALERT	Information concerning possible impact on the environment and actions required for prevention and proper response.

Copyright Notice

The Ampcontrol ECD described in this document is the property of AMPCONTROL PTY LTD. It is furnished under a license agreement and is to be used only in accordance with the terms of the agreement.

No part of the hardware or documentation may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, without prior written permission of AMPCONTROL PTY LTD.

Disclaimer

While every effort has been made to assure the accuracy and clarity of this document, AMPCONTROL PTY LTD assumes no liability resulting from any omissions in this document, or from misuse of the information obtained herein. The information in this document has been carefully checked and is believed to be entirely reliable with all of the necessary information included. AMPCONTROL PTY LTD reserves the right to make changes to any products described herein to improve reliability, function, or design, and reserves the right to revise this document and make changes from time to time in content hereof with no obligation to notify any persons of revisions or changes. AMPCONTROL PTY LTD does not assume any liability arising out of the application or any use of any product or circuit described herein; neither does it convey license under its patent rights or the rights of others.

Before You Begin

We would like to take a moment to thank you for purchasing the ECD Earth Continuity 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.**

Ampcontrol CSM Contact Details

7 Billbrooke Close, Cameron Park, NSW, 2285

P +61 2 4903 4800 | F +61 2 4903 4888

EMAIL: electronicsorders@ampcontrolgroup.com

WEB: www.ampcontrolgroup.com

TABLE OF CONTENTS

1 SAFETY AND OTHER WARNINGS

For safety reasons, the ECD must be installed, operated and serviced only by competent 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 result in non-conformance to the conditions of certification and 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 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 conditions of certification, 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, in case of a question on how to safely proceed, contact Ampcontrol immediately.

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 ECD 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 ECD functioning correctly it is highly recommended that all safety functions of the ECD be periodically tested to ensure correct operation.

1.2 Intrinsic Safety Considerations

- The ECD relay's IS Pilot Terminal is protected by an internal IS barrier. In the event of a phase to pilot fault, this barrier will clamp the voltage at the pilot terminal to a safe level and protect the relay from damage. However this barrier can only withstand 5.25A for 1s. The ECD relay must, therefore, be installed in a system with earth fault current limitation of 5A or less and an earth fault clearance time of less than 1s. Alternatively a 3A external fuse rated to system voltage can be installed between the relay's pilot terminal and the pilot conductor.
- The ECD relay must be located in a non-hazardous (safe) area.
- The ECD IS earth connection is critical to the IS protection and must be infallibly connected to the system earth. This must be done with a minimum of 3 conductors, each of $1.5mm^2$ as per the IS installation standards.
- 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 ECD system's components.
  DO NOT OPEN the ECD 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 are shortages or evidence of physical damage, notify Ampcontrol immediately.

Notify Ampcontrol within 7 days (maximum) in case of shortages or discrepancies, according to the packing list. This action will help ensure a speedy resolution to any perceived problems. Keep a record of all 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, especially if the wrappings are to be 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, preferably on shelves and protected from the elements.

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.**

 ENVIRONMENTAL ALERT	**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 INSTALLATION

These instructions have been designed to assist users of the ECD Relay with installation and special wiring techniques required to maintain the integrity of the intrinsically safe circuits.

3.1 General Warnings

Before the ECD can be installed, there are a number of things that need to be considered and understood to prevent incorrect or unsafe operation of the ECD 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:

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

It is extremely important that the limitations and functionality of the ECD 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.

3.1.2 Ensure that the application into which the ECD 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.

3.1.3 Ensure that the ECD relay will properly perform the required functions within the system design.

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

3.1.4 Modifications of any form to the ECD relay are prohibited.

The ECD as supplied has been designed and manufactured to comply with the requirements of certification standards. If modifications of any form are made to the ECD, the conditions of certification will no longer be valid and the equipment will no longer be fit for use in a hazardous area. If any modifications or damage to the ECD is evident, do not use the equipment and contact Ampcontrol for advice.

3.2 Mandatory Installation Practices

The following information must be adhered to when installing the ECD. Failure to adhere to this information may give rise to unsafe operation and could render the product invalid against its certificate.

Using the ECD 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 ECD must be powered within the specified voltage range.
- The installation of the ECD must be carried out by suitably trained and qualified personnel.
- Certification and identification labels fixed to the ECD 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 ECD. As supplied, the unit is built to, and complies with standards against which it has been certified. Modification to its construction will render the unit incompatible with its certification.
- Complete and accurate records of the installation must be kept as part of the site installation.

3.3 Installation Orientation

The ECD relay may be installed upside down without any degradation to the performance of the relay. The orientation of the relay will depend upon the wiring requirements as some installations require the Pilot terminal to be positioned at the top while others require the Pilot terminal to be positioned at the bottom. For this reason the ECD relay is supplied with a second loose label with inverted text. This allows for easier identification and reading of the Relay's status when installed upside down. To install, apply the new label directly over the existing label.

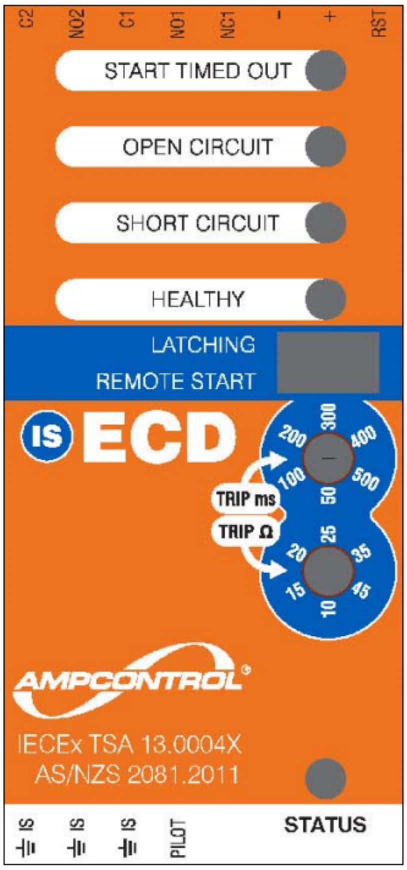


Figure 1: Inverted ECD label

	**Ensure the existing label is clean by wiping all dirt and oils off. This will ensure that the new label does not fall off.**

4 ECD RELAY OVERVIEW

The ECD is an intrinsically safe electrical protection relay designed for operation in underground coal mining applications. It provides earth continuity protection in accordance with AS/NZS 2081:2011 ensuring the integrity of the earth connection through a trailing or reeling cable is maintained. Earth Continuity protection is another layer of protection that, along with earth leakage protection, can help keep step and touch voltage potentials at a safe level by ensuring the earth resistance is below a determined safe level.

The ECD relay is based on microprocessor digital logic, and features a user friendly LED and switch interface. It is installed within a compact, DIN rail mounted unit with pluggable connectors that can easily be changed out in the event of a problem with the relay.

The relay contains an internal IS barrier.

Key Features

- Compact size
- DIN rail mounted
- Simple wiring and installation
- 6 settings for trip time
- 6 settings for trip level
- AS/NZS 2081:2011 Compliant
- IEC 60079 Certification
- SIL2 Capable (See appendix B)

Typically the ECD relay will be connected to the pilot conductor of a trailing or reeling cable. With the pilot conductor terminated to earth through a diode, the relay measures the resistance of the pilot-earth loop (series resistance), to ensure the integrity of the earth conductors, and the pilot to earth resistance (shunt resistance), to ensure the integrity of the pilot-earth loop. If these tests fail the ECD will trip, de-energising its output relay which can be used to switch a contactor, circuit breaker or for signalling.

The ECD can be configured for latching or non-latching operation and has a remote start option.

The ECD relay can also be used as an IS interlock with the pilot terminal connected to a circuit that passes through interlocks and switches.

CAUTION!	**A safe resistance level for the pilot-earth loop should be determined by risk assessment and analysis of the system.**

4.1 Mechanical Arrangement

4.1.1 Enclosure

The ECD is housed in a plastic enclosure and is rated IP20.

The dimensions are shown in Figure 2 below (117x45x114mm):

Figure 2: ECD enclosure dimensions

4.1.2 Mounting arrangement

The ECD enclosure is designed be mounted on a standard 35mm DIN rail.

The IS connections are located at the top of the enclosure and the non-IS connections (power and user inputs and outputs) are located at the bottom of the enclosure.

The fascia of the relay includes two (2) adjustable DIP switches and two (2) rotary switches for configuration of relay settings and five (5) indication LEDs to assist in fault finding.

4.2 Electrical Connections

Once the ECD relay has been mounted at a suitable location, it is necessary to wire it correctly.

Figure 3 shows a typical wiring diagram for the application of the ECD relay. Also refer to drawing ECDM003 for installation information.

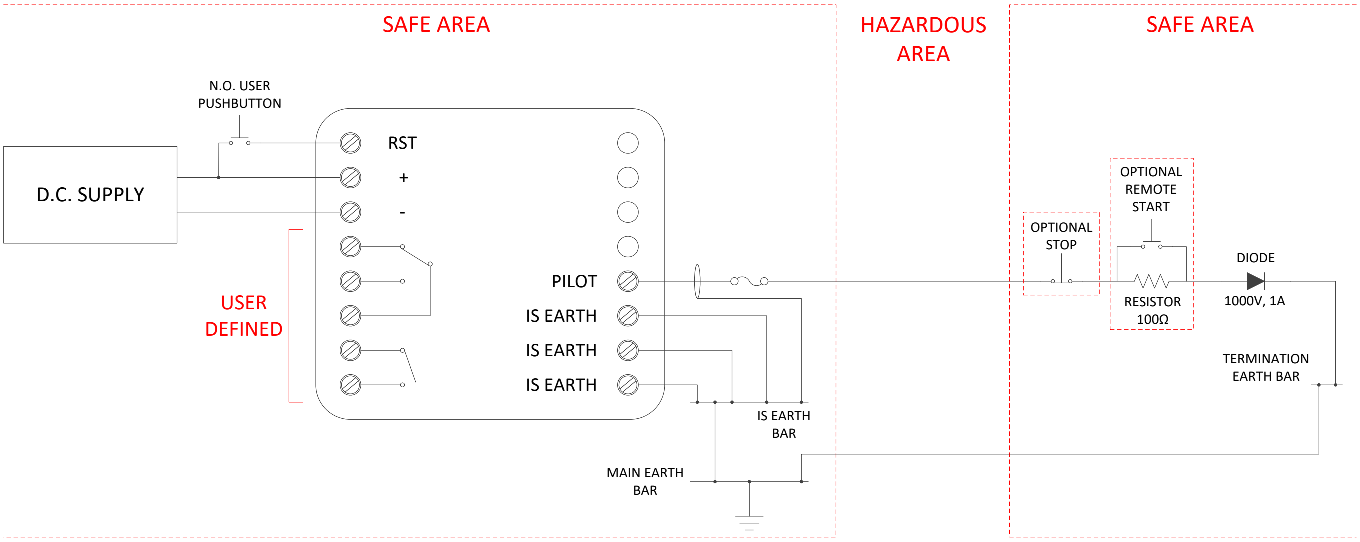


Figure 3: ECD Typical Electrical Application

The table below lists the terminal connections into the ECD relay.

Terminal	***Label***	***Description***
1	RST	Reset
2	+	Power Supply Positive
3	-	Power Supply Negative
4	NC1	Relay Output Normally Closed Contact 1
5	NO1	Relay Output Normally Open Contact 1
6	COM1	Relay Output Common Contact 1
7	NO2	Relay Output Normally Open Contact 2
8	COM2	Relay Output Common Contact 2
9	NC	Not connected
10	NC	Not connected
11	NC	Not connected
12	NC	Not connected
13	Pilot	IS Pilot connection (protected by internal IS barrier) (Single core screened, screen connected to earth at ECD end)
14	IS Earth	IS Earth
15	IS Earth	IS Earth
16	IS Earth	IS Earth

NOTE	**Using a screened cable helps in reducing the induced / coupled voltages. This noise can cause spurious trips.**

NOTE	**Wherever a screened cable is to be connected to Earth, ensure that the screen is earthed at ONE END ONLY, as near to the ECD as practicable.**

4.2.1 Supply

The appropriate power supply is dependent on the ECD model. The ECD relay is available as either a 24Vdc ±20% or as a 48Vdc ±20% model.

4.2.2 Pilot Terminal

The pilot terminal is an IS terminal (protected by an internal IS barrier) through which the ECD performs resistance measurements.

Typically the pilot terminal will be connected to the pilot conductor of a trailing or reeling cable. The load end of the pilot conductor will then be terminated with a diode to earth, creating a return path through the earth conductors of the cable to the main earth point of the outlet and then to the ECD's IS earth terminals. The primary function of the ECD relay is to verify the resistance of this pilot earth-loop is below a selectable level.

4.2.3 IS Earth Terminals

The IS earth terminals provide the earth connection for the ECD's internal IS barrier as well as the earth reference for the pilot resistance measurement. These terminals must be connected directly to the outlet's main earth point by 3 x 1.5mm2 cables. No other connections are permitted.

4.2.4 Reset - Optional

This is an active high input that allows ECD trips to be reset in latching mode, after the fault has been cleared. The reset input has no affect in non-latching mode.

The Reset input should be connected to the ECD's '+' terminal via a normally open switch with a minimum rating of the supply voltage.

4.2.5 Relay Contacts

The default position of the relay contacts (Normally Open or Normally Closed) is described on the ECD front label and Figure 3. The relay contacts will change state when the ECD is started (Status LED flashing) and will return to the default state when the ECD "trips".

The relay contacts are rated for 1A @ 110Vac and 1A @ 30Vdc (Resistive).

4.2.6 External Fuse

The ECD's IS Pilot Terminal is protected by an internal IS barrier. In the event of a phase to pilot fault this barrier will clamp the voltage at the pilot terminal to a safe level and protect the relay from damage. However this barrier can only withstand 5.25A for 1s. The ECD relay must, therefore, be installed in a system with earth fault current limitation of 5A or less and an earth fault clearance time of less than 1s. Alternatively a 3A external fuse rated to system voltage can be installed between the ECD's pilot terminal and the pilot conductor.

4.2.7 Stop Button - Optional

The stop button should be a normally closed switch installed in the pilot conductor. When opened, the ECD will detect an open circuit pilot and trip on open circuit.

4.2.8 Start Button and Resistor - Optional

When remote start mode is selected a 100Ω, 1%, 5W resistor must be installed in series with the pilot conductor. The start button is then installed in parallel to this resistor. The start button should be a normally open switch.

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 ECD during commissioning. This is not intended to provide an exhaustive commissioning checklist, but should be considered to be a minimum set of tests.

The Earth Continuity function performs two measurements to ensure the integrity of the pilot-earth loop; Series resistance measurement and shunt resistance measurement.

5.1 Earth Continuity Test – Series Resistance

The series resistance measurement can be verified by installing a resistor which is a minimum of 3Ω above the selected trip level, or creating an open circuit, in series with the pilot conductor and verifying that the ECD relay trips within the selected trip time and indicates an open circuit fault.

5.2 Earth Continuity Test – Shunt Resistance

The shunt resistance measurement can be verified by installing a resistor which is 1kΩ or less, or creating a short circuit, between the pilot conductor and earth, and verifying that the ECD relay trips within the selected trip time and indicates a short circuit fault.

5.3 Remote Start Function

The remote start function can be verified by repeating the two previous tests in the remote start mode with the remote start resistor installed.

6 AS/NZS 2081 PROTECTION FUNCTION: EARTH CONTINUITY

The primary function of the ECD relay is to provide Earth Continuity protection in accordance with AS/NZS 2081: 2011. This protection ensures the integrity of the earth connection between an outlet and a load via the pilot conductor in the cable.

In a typical installation the ECD's pilot terminal will be connected to the pilot conductor of a trailing or reeling cable. The load end of the pilot conductor will then be terminated with a diode to earth, creating a return path through the earth conductors of the cable to the main earth point of the outlet and then to the ECD's IS earth terminals. The ECD measures the resistance of this pilot-earth loop (series resistance) and the pilot resistance to earth (shunt resistance). If the pilot-earth loop is not healthy (series resistance greater than the selected trip value or shunt resistance lower than 1.25kΩ), a trip occurs which de-energises the output relay within the selected trip time.

The trip can be configured as latching or non-latching. This allows the user to choose if the trip is manually or automatically reset once the pilot - earth loop is healthy.

CAUTION!	**Cable parameters are important to the correct operation of the Pilot E/C function. Resistance & capacitance values limit the length of cable that the relay can drive.**

6.1 Series Resistance

The ECD relay measure the series resistance of the pilot-earth loop by applying a positive voltage to the pilot conductor and measuring the pilot current. If the series resistance is detected to be above the user selected level, the ECD de-energises its output relay and the LEDs on the front panel will indicate an open circuit fault. The pilot-earth loop resistance will still continuously be monitored even in the event of a trip.

The ECD cannot be re-started until the fault has been cleared.

A power cycle will not reset the trip.

In non-latching mode, the ECD will automatically reset after the fault has been cleared.

In latching mode, a manual reset is needed after the fault has been cleared.

The trip level and time can be selected using the rotary switch on the front panel.

6.2 Shunt Resistance

The ECD measures the shunt resistance (pilot to earth) by applying a negative voltage to the pilot conductor and measuring the pilot current. If the shunt resistance is detected to be below 1.25kΩ, the ECD's output relay will be de-energised and the LEDs on the front panel will indicate a short circuit fault. The shunt resistance will still continuously be monitored even in the event of a trip.

The ECD cannot be re-started until the fault has been cleared.

A power cycle will not reset the relay.

In non-latching mode, the ECD will automatically reset after the fault has been cleared.

In latching mode, a manual reset is needed after the fault has been cleared.

The trip time can be selected using the rotary switch on the front panel.

6.3 Remote Start

Remote start mode can be selected via the DIP switches at the front of the panel.

Switching to or from remote start mode while the power is applied will cause a trip (the relay will de-energise and the Start Timed Out LED will come ON).

In remote start mode, a 100Ω resistor (1%, 5W) must be connected in series with the pilot circuit and a normally open button connected in parallel to this resistor. The loop resistance of the circuit will then be 100Ω plus the resistance of the cable.

To start the ECD in remote start mode the following sequence must be followed:

1. All trips must be clear.
2. The start resistor must be detected in the pilot circuit.
3. The start button must be pressed for a minimum of 500ms.
4. The start button must be released within 15s or “Start Button timed out” trip will occur.

The start timed out fault is automatically reset once the start resistor is detected (A manual reset is not required).

6.4 Latching mode

Latching mode can be selected via the DIP switches at the front panel.

When a fault occurs in latching mode the trip will be latched, preventing the ECD from starting (even if the fault is cleared), until a manual reset occurs.

In latching mode, if a fault occurs, the corresponding LED will be turned on and the trip will be latched. If another fault occurs, while the previous trip is still latched, the LED corresponding to that fault will flash.

6.5 Manual reset procedure

To use the reset function, the user must connect a switch (typically a NO momentary pushbutton) between the RST input and the positive of the supply (see ‘Electrical Connections’ section 4.3 for more information).

In latching mode, the user must manually reset the unit after a fault has occurred. The procedure is as follows:

1. Clear the fault.
2. Press the reset button for a minimum of 500ms.

7 OPERATION SUMMARY

7.1 DIP Switches Configuration

7.1.1 Remote Start

Switch Position	*Function*
Off (left)	Remote Start disabled. A remote start button (with a 100Ω resistor) must not be installed
On (right)	Remote Start Enabled. A remote start button (with a 100Ω resistor) must be installed

7.1.2 Latching

Switch Position	*Function*
Off (left)	Latching mode disabled. Trips will be automatically reset after the fault has been cleared.
On (right)	Latching mode enabled. Trips must be manually reset after the fault has been cleared.

7.2 Rotary Switches Configuration

7.2.1 Trip Level selection

The user can select the trip level via one of the rotary switches at the front of the unit. The trip level represents the threshold for the series resistance. If the resistance is measured to be greater than this threshold ±3Ω, a trip will occur. The allowed values for the trip level setting are 10Ω, 15Ω, 20Ω, 25Ω, 35Ω, and 45Ω.

The shunt resistance trip level is fixed at 1.25kΩ. A trip will occur if the pilot to earth resistance is detected to be below this level.

7.2.2 Trip Time Selection

The user can select the trip time via one of the rotary switches at the front of the unit. The trip time represents the delay after which a trip condition has occurred when the ECD relay will de-energise. The allowed settings for the trip time are 50ms, 100ms, 200ms, 300ms, 400ms, and 500ms.

7.3 Indication LEDs

7.3.1 Status (Green)

LED state	*Indication*
Off	Power Off
Flashing	Power is ON and ECD is running (relay contacts switched to the non-default state)
On	Power is ON but ECD is not running (relay contacts in the default state)

7.3.2 Healthy (Green)

LED state	*Indication*
Off	Pilot is not healthy (series resistance above the selected setting or shunt resistance below 1.25kΩ)
Flashing	N/A
On	Pilot is healthy (series resistance below the selected setting and shunt resistance above 1.25kΩ)

7.3.3 Short Circuit (Red)

LED state	***Indication***
Off	Shunt resistance above 1.25kΩ
Flashing	**Non-latch mode:** Shunt resistance is below 1.25kΩ but for less than trip time setting **Latch mode:** ECD has tripped on series resistance and shunt resistance is now below 1.25kΩ
On	Shunt resistance below 1.25kΩ

7.3.4 Open Circuit (Red)

LED state	***Indication***
Off	Series resistance is below trip setting
Flashing	**Non-latch mode:** Series resistance is above trip setting but for less than trip time setting **Latch mode**: ECD has tripped on shunt resistance and series resistance is now above trip setting
On	Series resistance is above trip setting

7.3.5 Start Timed Out (Red)

LED state	***Indication***
Off	Start button not pressed
Flashing	Start button is pressed
On	Start button has timed out (held down for more than 15s)

7.4 Fault Indication

CAUTION!	**When an internal fault occurs, all the LEDs will be flashing together and the measurements can no longer be trusted. A power cycle is needed to reset this state. If this happens repetitively, please contact Ampcontrol as the unit may be damaged.**

The ECD continuously checks the health of its internal circuitry. If these checks fail, the ECD will show an internal fault by flashing all LEDs and returning the relay contacts to the default position.

7.5 Starting the ECD

When first powered, the ECD will begin checking its internal circuitry as well as the pilot circuit. If no faults are detected within 1.7s the ECD will be ready to start.

- If remote start mode is not selected the ECD will automatically start, energising its output relay.
- If remote start mode is selected the ECD will wait for the start button to be pressed.

After a trip has occurred and the fault cleared, the ECD can be reset and re-started depending on the configured modes:

Latching Mode	**Remote Start Mode**	**Starting the ECD**
No	No	Automatic re-start 1s after the fault has been cleared.
No	Yes	Press the start button a minimum of 1s after the fault has been cleared.
Yes	No	Automatic re-start immediately after manual reset
Yes	Yes	Press the start button after manual reset

8 SERVICE, MAINTENANCE & DISPOSAL

8.1 Equipment Service

The ECD requires no internal servicing during its normal operating life. A number of external system based checks should however be completed on a regular basis. These 'routine inspections' must be carried out by suitably trained people with knowledge of the ECD 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.

8.1.1 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 ECD 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.

8.1.2 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.

8.2 Equipment Maintenance

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

It is recommended that the electrical protection system incorporating the ECD 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 earth continuity tests.

8.3 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.**

9 SPECIFICATIONS

Certificates/Approvals	
Type	[Ex ia] I - for use in non-hazardous area only
Certificate Number	IECEx TSA 13.0004X

IS Parameters – Non-IS Terminals	
Um	132V rms phase to earth
IS Parameters – On the blue coloured terminals providing the output for the Pilot/Earth Line	
When Pilot/Earth Line is considered intrinsically safe	
Uo	28V
Io	184mA
Po	1.28W
Co	2.0uF*
Lo	10.0mH*
	** The load can have the above Co as a lumped value provided the Lo is < 1%, or it can have the above Lo as a lumped value provided the Co is <1%.* *Optionally, the load can have the full value of Co and Lo if distributed as in a cable.*
When Pilot/Earth Line is not considered intrinsically safe	
Im	5.25A for 1s

Environmental Conditions	
Temperature Range	-20°C ≤ Ta ≤ 65°C

Supply Voltage	
24V Model	24Vdc ± 20%, 5W
48V Model	48Vdc ± 20%, 5W

Relay Contacts	
Contacts	2 x NO / 1 x NC / 2 x COM
Ratings	1A @ 110Vac – 1A @ 30Vdc (Resistive)

Earth Continuity Protection: AS/NZS 2081: 2011	
Series Resistance Trip Settings (± 3Ω)	10Ω, 15Ω, 20Ω, 25Ω, 35Ω, 45Ω
Shunt Resistance	1.25kΩ
Trip Time Settings	50ms, 100ms, 200ms, 300ms, 400ms, 500ms
Pilot Measurement Voltage	±24Vdc
Optional Start Button	100Ω, 1%, 5W

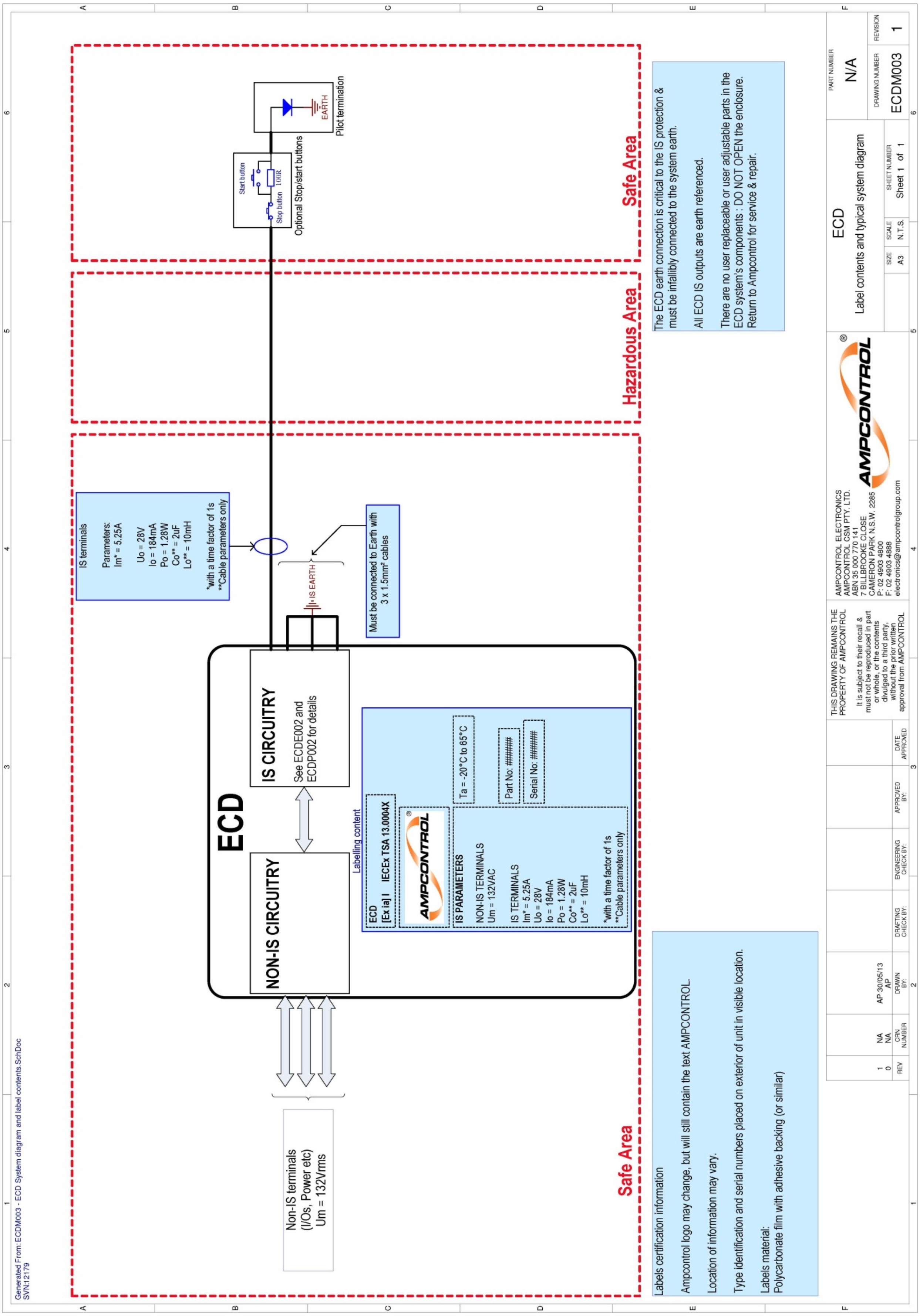
Mechanical	
Dimensions	117x45x114mm
Weight	503g
IP Rating	IP20

10 EQUIPMENT LIST

Part Number	Description
163554	ECD 24VDC IS
163555	ECD 48VDC IS

Accessories	
141479	P/SUPPLY 24V 1A DIN MOUNT
115119	MODULE PTB PILOT TERMINATION FOR ECB/D/M
169732	RES 100R 5W 1%
NA	Normally Open Reset Button - Contact Ampcontrol

APPENDIX A - DRAWINGS


Safe Area
Hazardous Area
Safe Area
Pilot termination
EARTH
Optional Stop/start buttons
Start button
Stop button
100R
IS terminals
Parameters:
Im* = 5.25A
Uo = 28V
Io = 184mA
Po = 1.28W
Co** = 2uF
Lo** = 10mH
*with a time factor of 1s
**Cable parameters only
IS EARTH
Must be connected to Earth with 3 x 1.5mm² cables
ECD
IS CIRCUITRY
See ECDE002 and ECDP002 for details
NON-IS CIRCUITRY
Labelling content
ECD
[Ex ia] I IECEx TSA 13.0004X
AMPCONTROL
IS PARAMETERS
NON-IS TERMINALS
Um = 132VAC
IS TERMINALS
Im* = 5.25A
Uo = 28V
Io = 184mA
Po = 1.28W
Co** = 2uF
Lo** = 10mH
*with a time factor of 1s
**Cable parameters only
Ta = -20°C to 65°C
Part No: ######
Serial No: ######
Non-IS terminals
(I/Os, Power etc)
Um = 132Vrms
The ECD earth connection is critical to the IS protection & must be infallibly connected to the system earth.
All ECD IS outputs are earth referenced.
There are no user replaceable or user adjustable parts in the ECD system's components : DO NOT OPEN the enclosure. Return to Ampcontrol for service & repair.
Labels certification information
Ampcontrol logo may change, but will still contain the text AMPCONTROL.
Location of information may vary.
Type identification and serial numbers placed on exterior of unit in visible location.
Labels material:
Polycarbonate film with adhesive backing (or similar)
PART NUMBER N/A
DRAWING NUMBER ECDM003
REVISION 1
ECD
Label contents and typical system diagram
SIZE A3
SCALE N.T.S.
SHEET NUMBER Sheet 1 of 1
AMPCONTROL ELECTRONICS
AMPCONTROL CSM PTY. LTD.
ABN 35 000 770 141
7 BILLBROOKE CLOSE
CAMERON PARK N.S.W. 2285
P: 02 4903 4800
F: 02 4903 4888
electronics@ampcontrolgroup.com
THIS DRAWING REMAINS THE PROPERTY OF AMPCONTROL
It is subject to their recall & must not be reproduced in part or whole, or the contents divulged to a third party, without the prior written approval from AMPCONTROL
REV
CRN NUMBER
DRAWN BY:
DRAFTING CHECK BY:
ENGINEERING CHECK BY:
APPROVED BY:
DATE APPROVED
1 NA
0 NA AP 30/05/13 AP
Generated From: ECDM003 - ECD System diagram and label contents.SchDoc
SVN:2179

APPENDIX B - APPROVALS

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres

for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.: IECEx TSA 13.0004X issue No.:0

Certificate history:

Status: **Current**

Date of Issue: **2013-06-21** Page 1 of 3

Applicant: **Ampcontrol CSM Pty Ltd**
7 Billbrooke Close
Cameron Park NSW 2285
Australia

Electrical Apparatus: **ECD Earth Continuity Relay**
Optional accessory:

Type of Protection: **[Ex ia] I (when non-I.S. Im not connected)**

Marking:
Ampcontrol
ECD
[Ex ia] I
Ta -20C to +65C
IECEx TSA 13.0004X
S. No.

Approved for issue on behalf of the IECEx Certification Body: Debbie Wouters

Position: Acting Quality & Certification Manager

Signature:
(for printed version)

Date: 21 JUNE 2013

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

TestSafe Australia
919 Londonderry Road
Londonderry NSW 2753
Australia

IECEx Certificate of Conformity

Certificate No.: IECEx TSA 13.0004X

Date of Issue: **2013-06-21**

Issue No.: **0**

Manufacturer:
Ampcontrol CSM Pty Ltd
7 Billbrooke Close
Cameron Park NSW 2285
Australia

Additional Manufacturing location (s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following 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"

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:
AU/TSA/ExTR13.0003/00

Quality Assessment Report:

AU/TSA/QAR06.0007/05

IECEx Certificate of Conformity

Certificate No.: IECEx TSA 13.0004X

Date of Issue: **2013-06-21**

Issue No.: **0**

Page 3 of 3

Schedule

EQUIPMENT:
Equipment and systems covered by this certificate are as follows:

The ECD Earth Continuity Relay is used to measure the continuity of the loop connected at its pilot/earth terminals. This is typically used to measure the continuity of the pilot/earth of a trailing cable. The ECD may also be used as an intrinsically safe interlock relay.

The pilot/earth circuit can be considered intrinsically safe only when the non-intrinsically safe circuits are isolated from the pilot/earth output.

CONDITIONS OF CERTIFICATION: YES as shown below:

See Annexe for details

Annexe: Annex for IECEx TSA 13_0004X.pdf

IECEx Certificate of Conformity Annexe

Annexe for Certificate No.:	IECEx TSA 13.0004X	Issue No.:	0

Conditions of Certification pertaining to Issue 0 of this Certificate:

1. The following parameters shall be taken into account when connecting the ECD Earth Continuity Relay:

   On all the non-i.s. connections of the Relay: Um = 132V rms max.

   On the blue coloured terminals providing the output for the Pilot/Earth Line:

	When Pilot/Earth Line is considered intrinsically safe
Uo	28V
Io	184mA
Po	1.28W
Co	2.0uF *
Lo	10.0mH *
	* The load can have the above Co as a lumped value provided the Lo is < 1%, or it can have the above Lo as a lumped value provided the Co is <1%. Optionally, the load can have the full value of Co and Lo if distributed as in a cable
	When Pilot/Earth Line is not considered intrinsically safe
Im	*5.25A for 1 s*

2. The I.S. output is galvanically connected to the system earth. This shall be taken into consideration during installation.

3. A copy of the drawing ECDM003 must be provided to the user.

Drawing list pertaining to Issue 0 of this Certificate:

Drawing/Document Number:	Page/s:	Title:	Revision Level:	Date: (yyyy-mm-dd)
ECDA001	1	ECD Relay Earth Continuity G.A. – Certification	0	-
ECDB002	1	ECD *(Bill of Material)*	1	2013-06-11
ECDE002	1	ECD IS Board *(Schematics)*	1	2013-06-11
ECDM003	1	ECD Label Contents and typical system diagram	1	2013-05-30
ECDP002	4	ECD IS Board *(PCB Layouts)*	1	2013-05-01

Certificate issued by:

Test Safe AUSTRALIA

TestSafe Australia
919 Londonderry Road
Londonderry NSW 2753 Australia

Marcus Punch Pty. Ltd.
Risk and Reliability

Declaration of Conformity (ECD_120613)

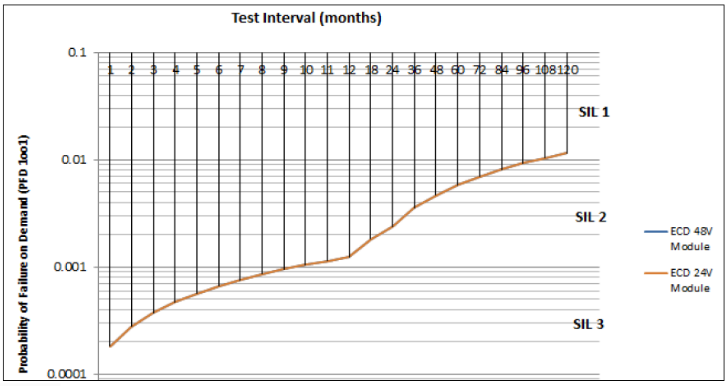
Marcus Punch Pty. Ltd. was engaged by Ampcontrol Group to perform a safety integrity verification on their ECD 24V and ECD 48V Earth Continuity Relays against the requirements of AS61508.2-2011. The verification was conducted according to the ‘traditional’ (probabilistic / deterministic) route.

The details of the analyses and reviews that lead to these findings are provided in our report:

AMP-13-06-A Rev.0, ECD Earth Continuity Relay – Failure Modes and Effects and Diagnostics Analysis (FMEDA) and Safe Failure Fraction (SFF) Report (dated 12th June 2013).

ECD 24V and ECD 48V Earth Continuity Relays
(Drawing No’s. ECDE001 Rev.1, ECDE002Rev.2 and ECDE003 Rev.1)
Earth Continuity Protection

Description	Finding	Conclusion
Hardware Safety Integrity Compliance Approach[1]	Route 1_H	
Architectural Constraints	SFF=98.6%, HWFT=0, Type B	SIL2
Random Hardware Failures (per AS61508.2 Appendix C FMEDA)	λ_{total} = 1.9x10^{-5} / hour, or 19,000 FITS[2] MTTF = 54,046 hours, or 6.1 years λ_{du} = 2.6x10^{-7}/hour, or 260 FITS MTTF$_d$ = 3,797,670 hours, or 433 years	
Probability of Failure on Demand (PFD$_{ave}$)	PFD$_{ave}$ = 1.2x10^{-3} (with proof-test interval = one (1) year) See below for PFD$_{ave}$ V’s proof-test interval.	SIL2
Probability of Dangerous Failure Per Hour (PFH)	PFH = 2.6x10^{-7}	SIL2
Systematic Safety Integrity (Systematic Capability) Compliance Approach[3]	Route 1_S (not assessed).	
Systematic Capability[4]	No assessed.	
Overall SIL Capability[5]	SIL2 (excluding systematic integrity)	



Marcus Punch
TÜV FSExpert (Machinery, ID:154/10), TÜV FSEng (SIS, ID:735/07)
CPEng, NPER, RPEQ
Director

[1] Per AS61508.2-2011 Clauses 7.4.2 and 7.4.4.
[2] 1 FIT = 1 failure per billion hours, or a failure rate of 1x10^{-9} / hour.
[3] Per AS61508.2-2011 Clauses 7.4.2 and 7.4.4.
[4] Per AS61508.2-2011 Clause 7.4.3.
[5] Overall SIL capability is determined by the minimum SIL indicated by the above parameters.