



# 1S20 User Guide

## Arc Fault Monitor

RMS Mors Smitt

### Advanced Protection Devices



User Guide

# 1S20 User Guide

## About This Manual

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This User Guide covers all 1S20 relays manufactured from July 2023. Earlier relays do not necessarily incorporate all the features described. Our policy of continuous development means that extra features & functionality may have been added.

The 1S20 User Guide is designed as a generic document to describe the common operating parameters for all relays built on this platform.

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## Documentation

### Technical Bulletin

The detailed technical attributes, functional description & performance specifications for the 1S20 are described in the product Technical Bulletin.

The order of precedence for product information is as follows:

- Technical Bulletin
- User Guide

### User Guide

This User Guide covers all 1S20 relay versions & describes the generic features & attributes common across all versions.

Different relay versions are required to cater for varying customer requirements such as auxiliary voltage range, I/O configuration, case style, relay functionality etc.

## Introduction

The 1S20 monitors either one, two or three 1S30 optical sensors to detect the presence of an arcing fault within Metal Clad air insulated switchgear.

The 1S20 provides 2 zones or common Arc Fault trip outputs and continuously supervises the optical sensors to ensure maximum availability of the Arc Fault Protection scheme.

Upon detection of an arc the 1S20 can either initiate or directly trip circuit breakers to affect fault clearance.

## 1S20 Variants

The 1S20 is available in several voltage ranges, mounting arrangements and either 2 or 3 optical point sensor variants.

### Mounting Arrangements

1S20 - #A#	Panel mount or surface mount
1S20 - #C#	Panel mount or surface mount with DIN rail kit supplied
1S20 - #B#	Surface mount only
1S20 - #D#	Surface mount only with DIN rail kit supplied

### Sensor Variants

1S20 - ##A	Maximum of two 1S30 sensors connected
1S20 - ##B	Maximum of three 1S30 sensors connected

## 1S20 Indications

### Front Layout

The pictures below depict the two styles of user interface:

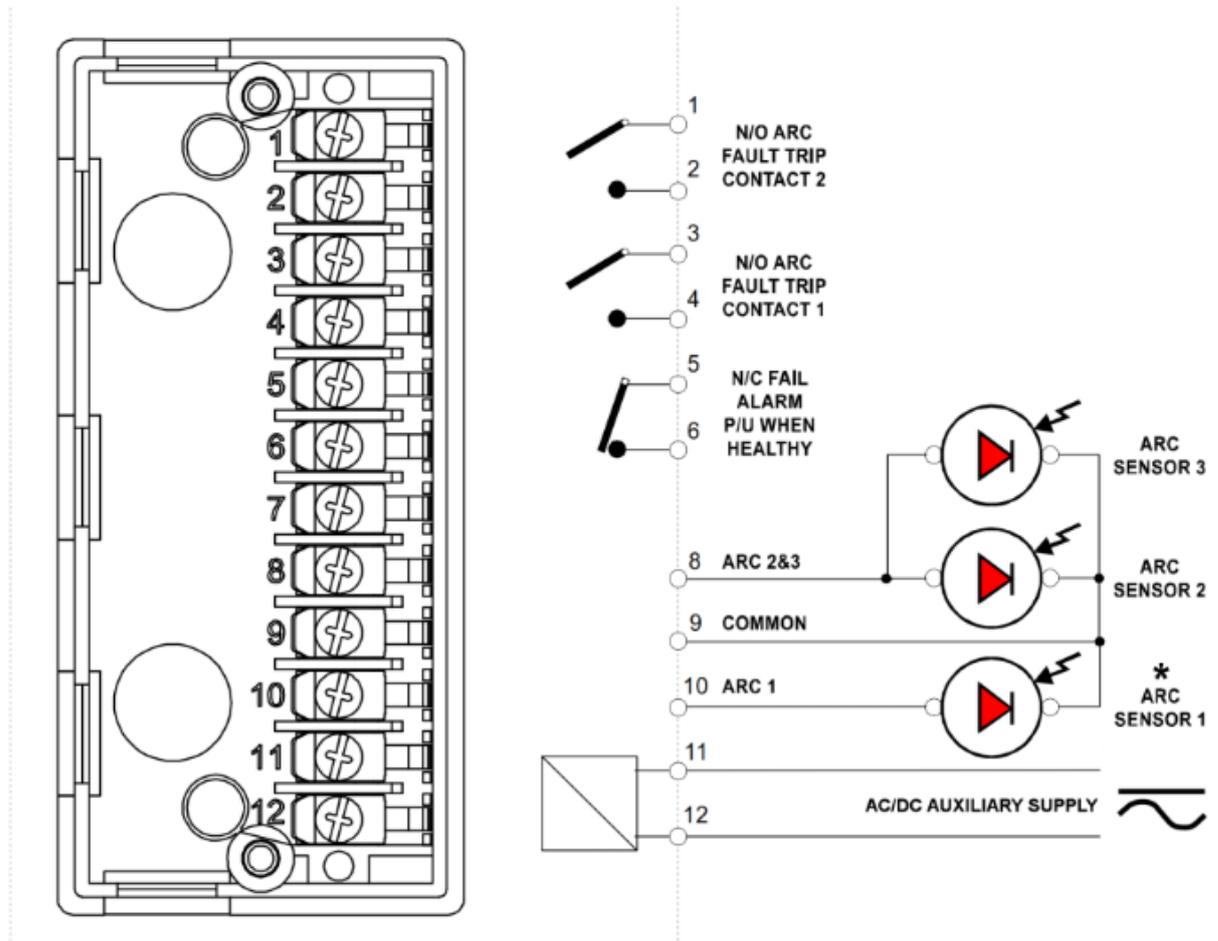


A single tri colour LED provides the following status indications:



## Scheme Wiring

### 1S20 Connection diagram



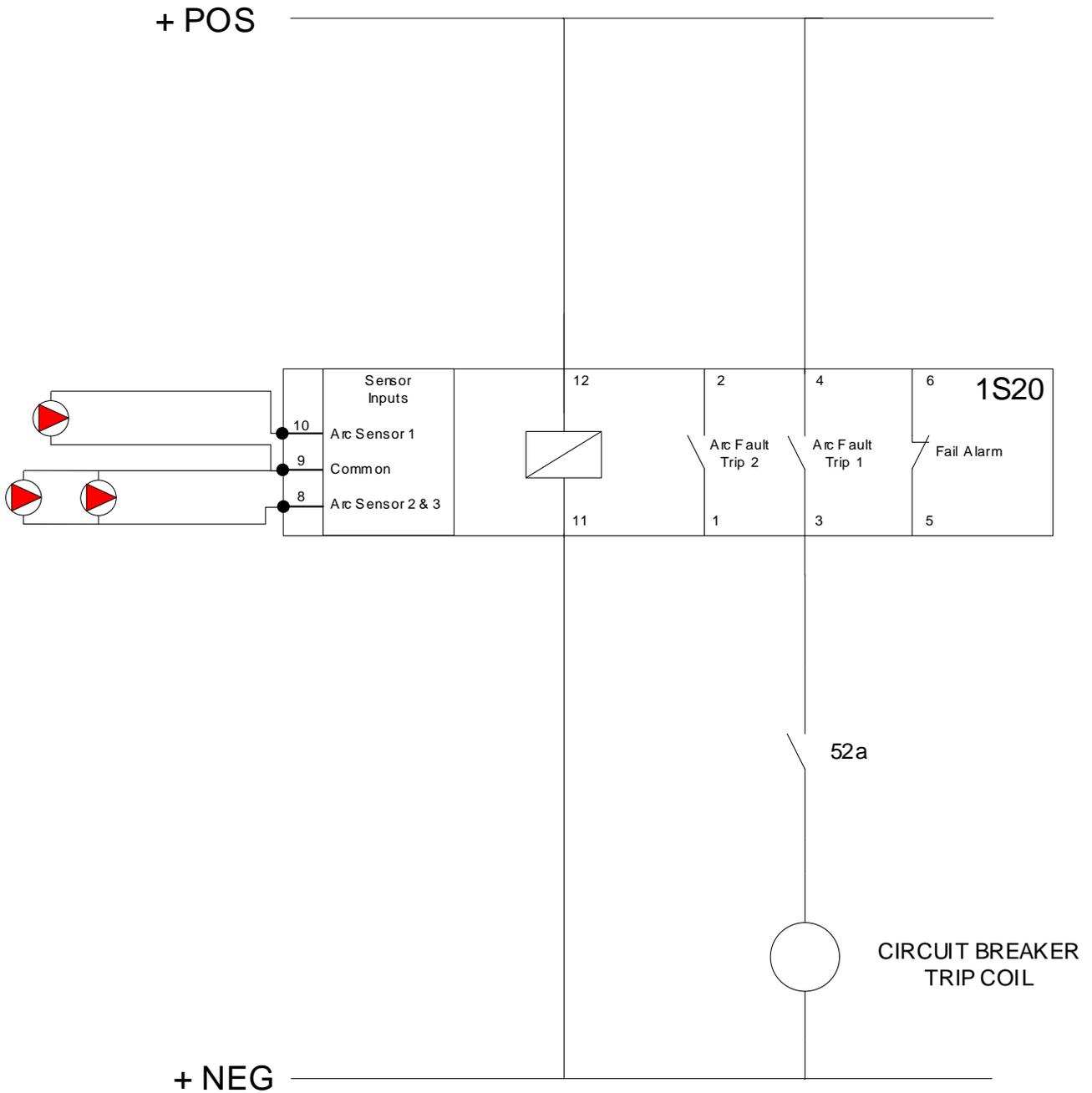
The above diagram shows the 1S20 connections.

The 1S20 is ordered as either a 2 or 3 sensor version.

Sensor connection is not polarity sensitive.

**Example Schematic**

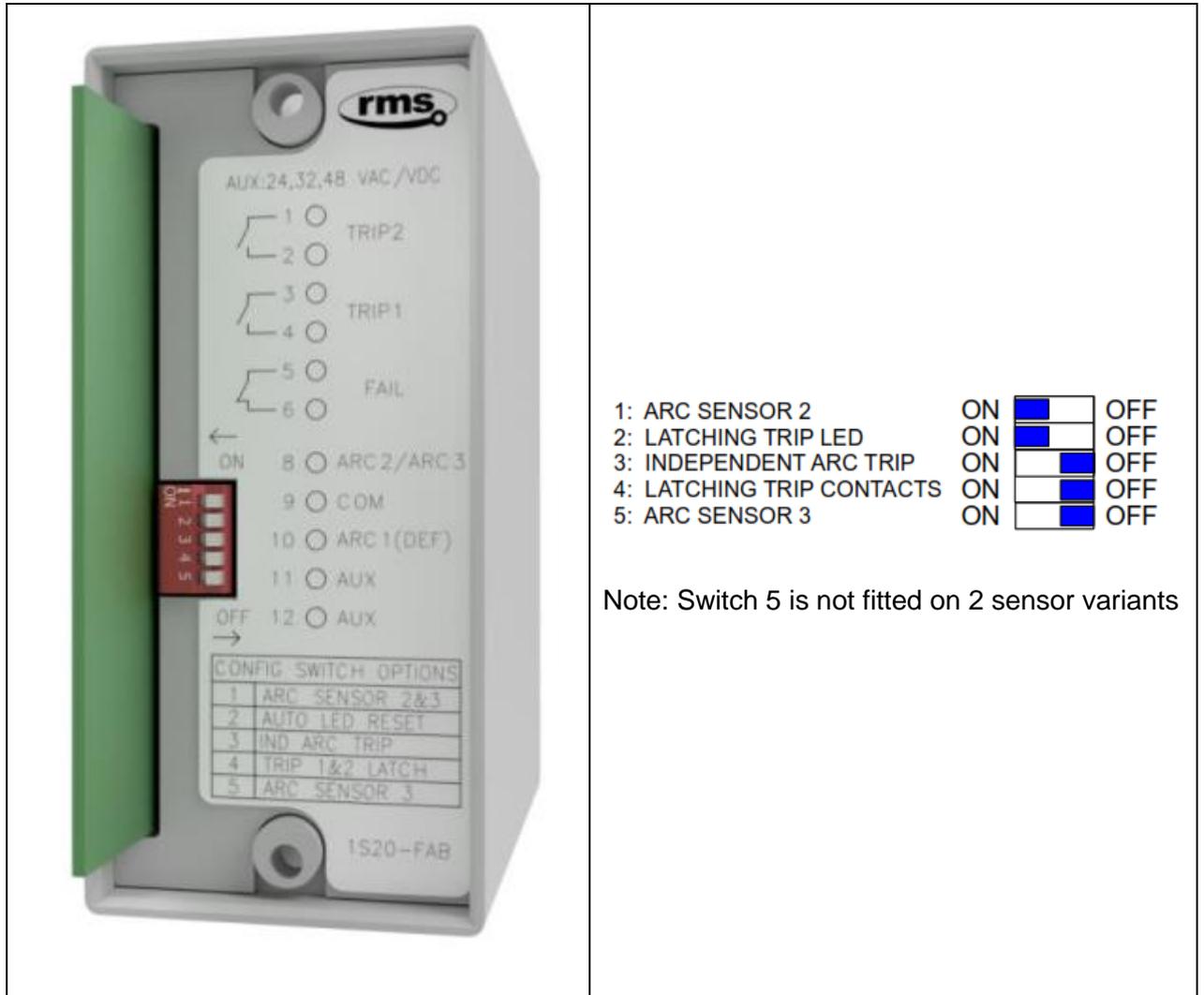
The following typical schematic shows how the 1S20 may be wired to direct trip a circuit breaker tripping.



CIRCUIT BREAKER SHOWN IN THE OPEN POSITION AND RELAY SHOWN IN THE DE-ENERGISED STATE

## Function Configuration

The 1S20 configuration switches are accessible to the user by unplugging the electronic module from the terminal base as shown below:



- |                           |    |                          |     |
|---------------------------|----|--------------------------|-----|
| 1: ARC SENSOR 2           | ON | <input type="checkbox"/> | OFF |
| 2: LATCHING TRIP LED      | ON | <input type="checkbox"/> | OFF |
| 3: INDEPENDENT ARC TRIP   | ON | <input type="checkbox"/> | OFF |
| 4: LATCHING TRIP CONTACTS | ON | <input type="checkbox"/> | OFF |
| 5: ARC SENSOR 3           | ON | <input type="checkbox"/> | OFF |

Note: Switch 5 is not fitted on 2 sensor variants

### Available Configuration Settings

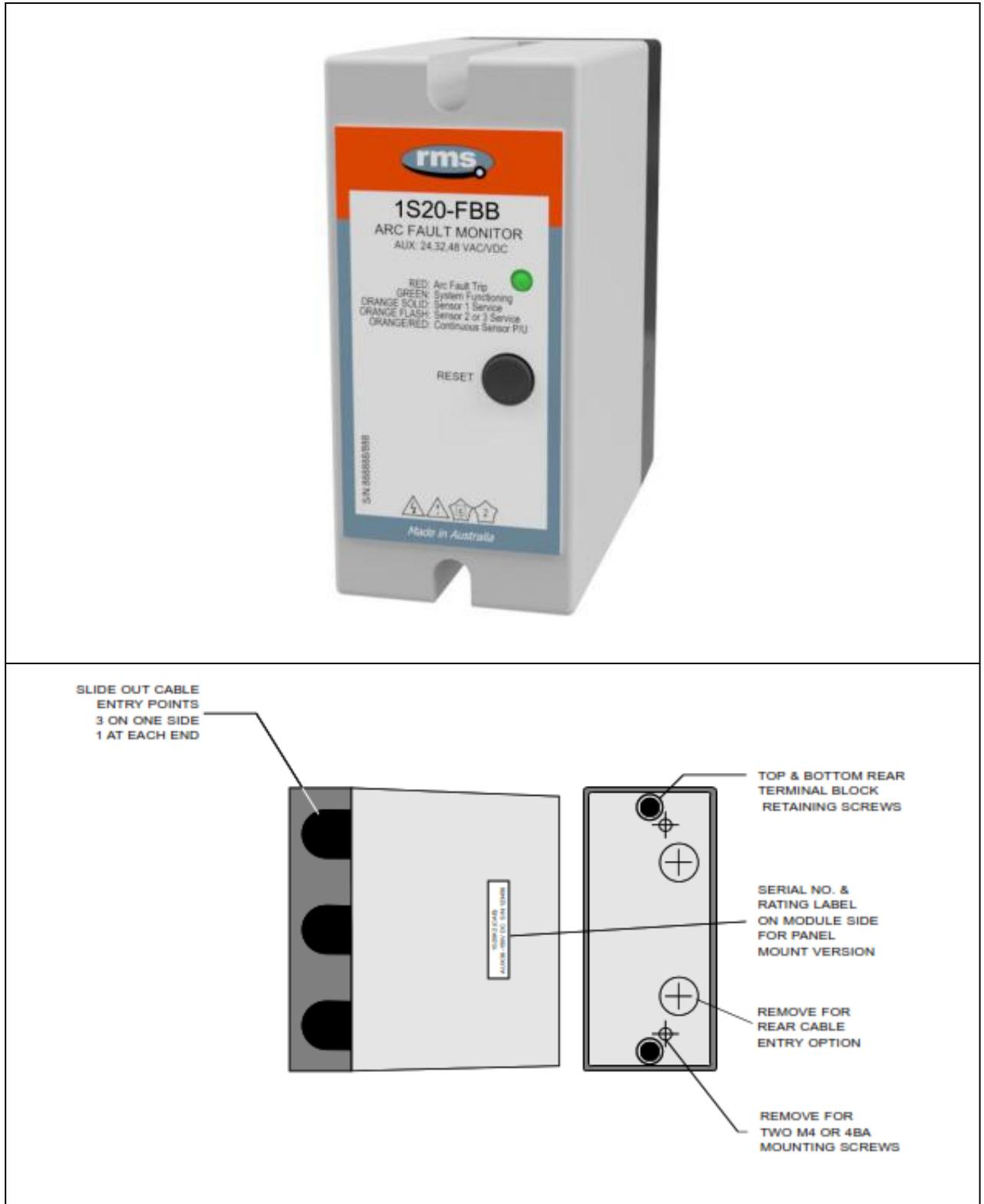
- Switch 1: Arc sensor 2  
ON - Arc Sensor 2 fitted  
OFF - Arc Sensor 2 not fitted
- Switch 2: Arc fault trip indication LED reset  
ON - Latching until manually reset  
OFF - Automatic self-reset (Extinguish) after 4 hours Will also reset contacts set for latching function
- Switch 3: Independent arc trip output contacts  
ON - Arc Sensor 1 activates trip output contact 1 & Arc sensor 2 or 3 activates trip output contact 2  
OFF - Arc Sensor 1, 2 or 3 activate both trip outputs
- Switch 4: Arc fault trip output contact reset  
ON - Latching – Reset with trip LED  
OFF - Self-reset after 2s
- Switch 5: Arc sensor 3  
ON - Arc Sensor 3 fitted  
OFF - Arc Sensor 3 not fitted

Note: Switch 5 is not fitted on 2 sensor variants

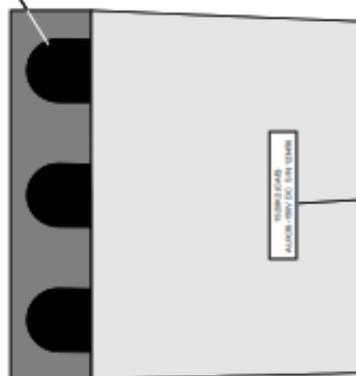
On all variants Arc sensor 1 must be connected otherwise a sensor supervision alarm will assert.

## 1S20 Dimensions and Mounting Arrangements

### Surface Mount Only Variant



SLIDE OUT CABLE  
ENTRY POINTS  
3 ON ONE SIDE  
1 AT EACH END



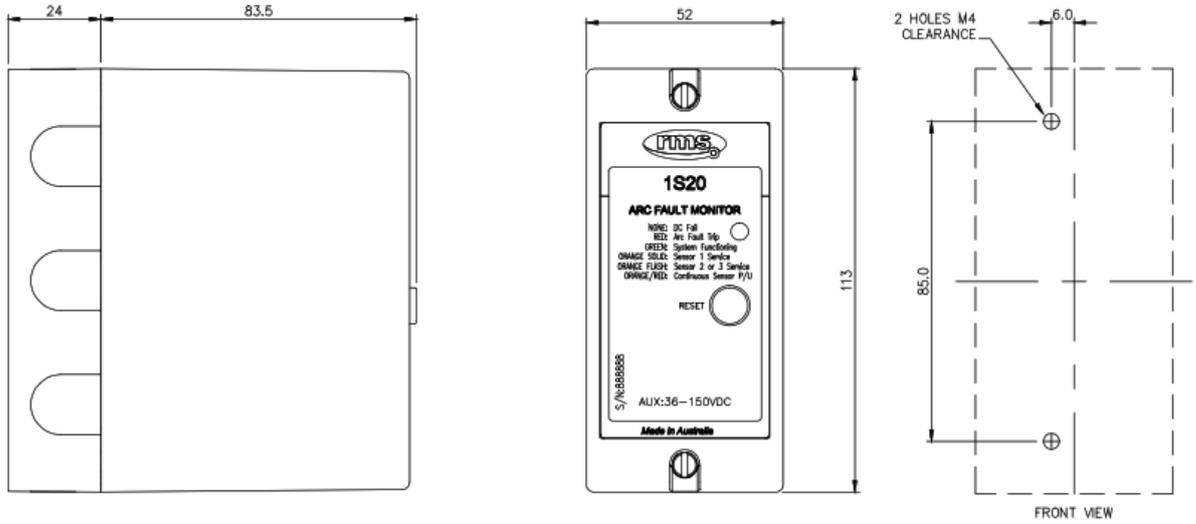
TOP & BOTTOM REAR  
TERMINAL BLOCK  
RETAINING SCREWS

SERIAL NO. &  
RATING LABEL  
ON MODULE SIDE  
FOR PANEL  
MOUNT VERSION

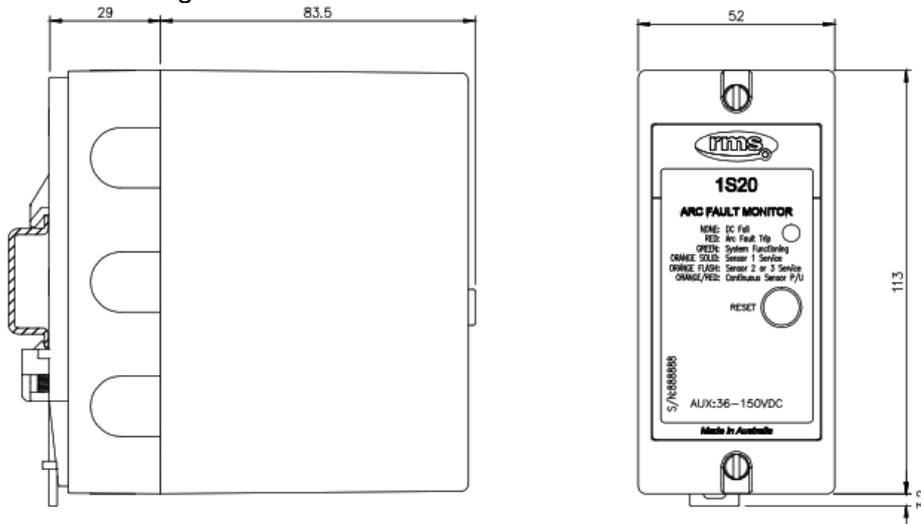
REMOVE FOR  
REAR CABLE  
ENTRY OPTION

REMOVE FOR  
TWO M4 OR 4BA  
MOUNTING SCREWS

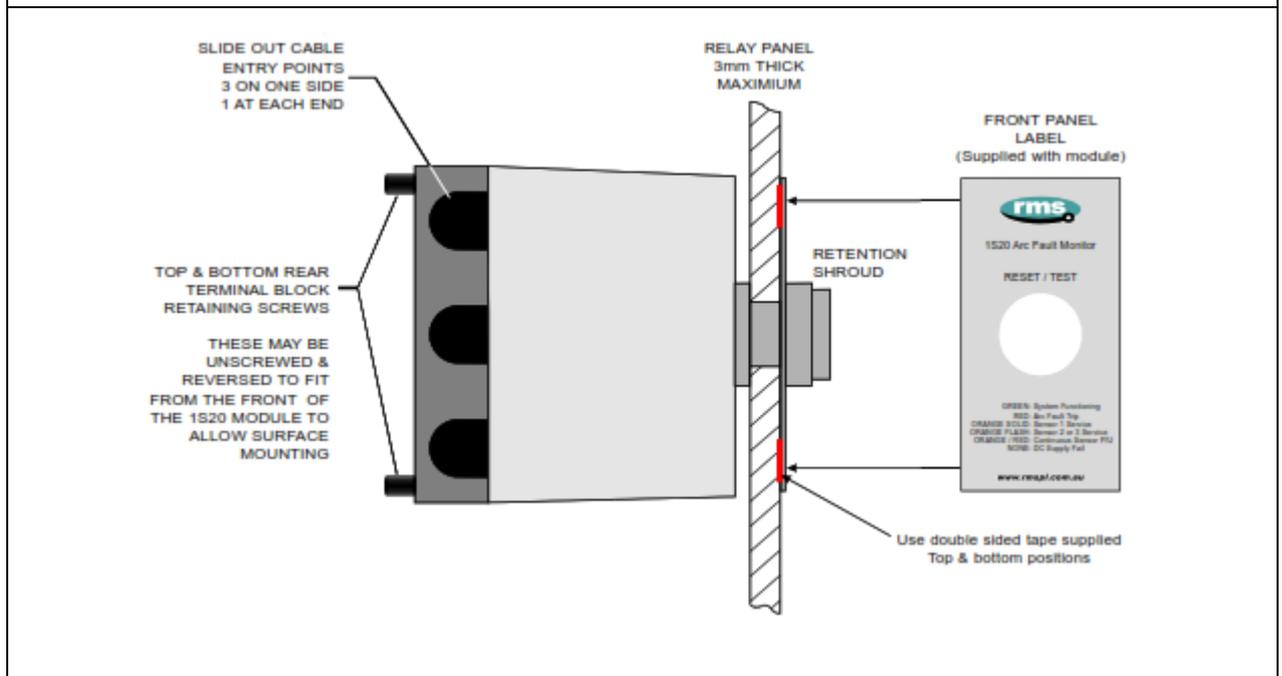
Surface mounting detail



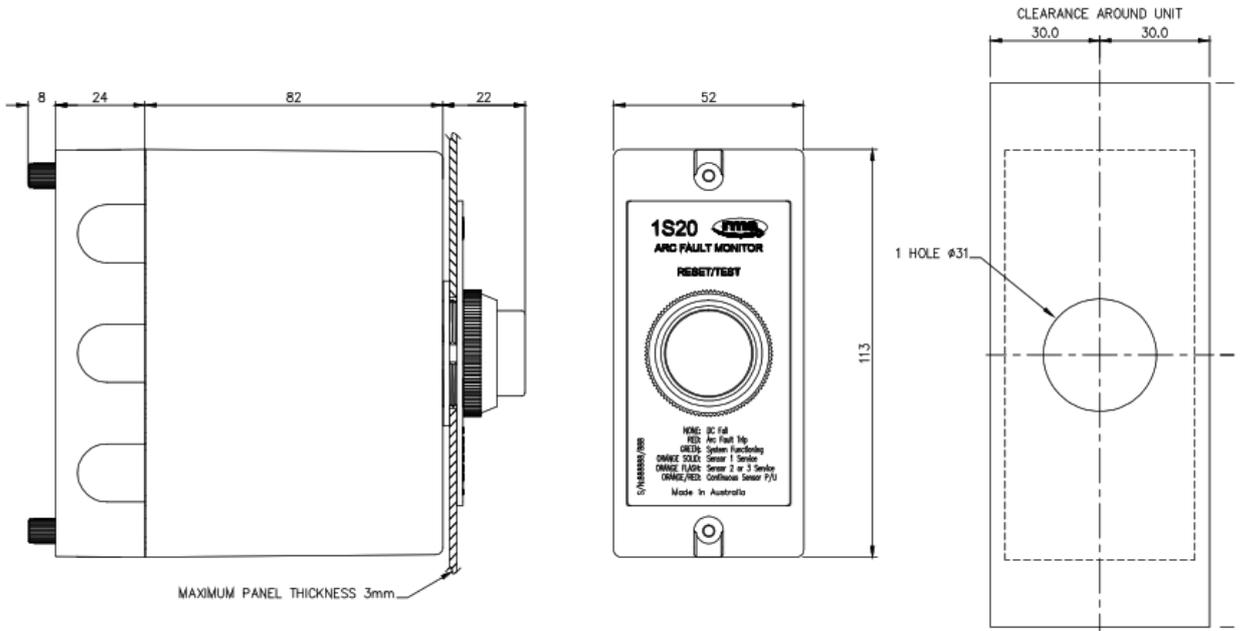
DIN rail mounting detail



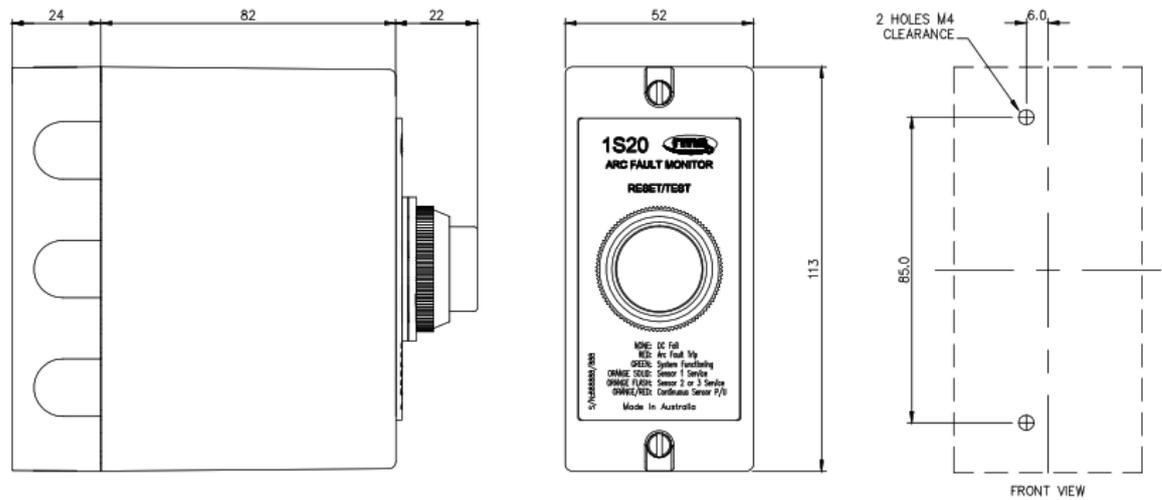
**Panel Mount or Surface Mount Variant**



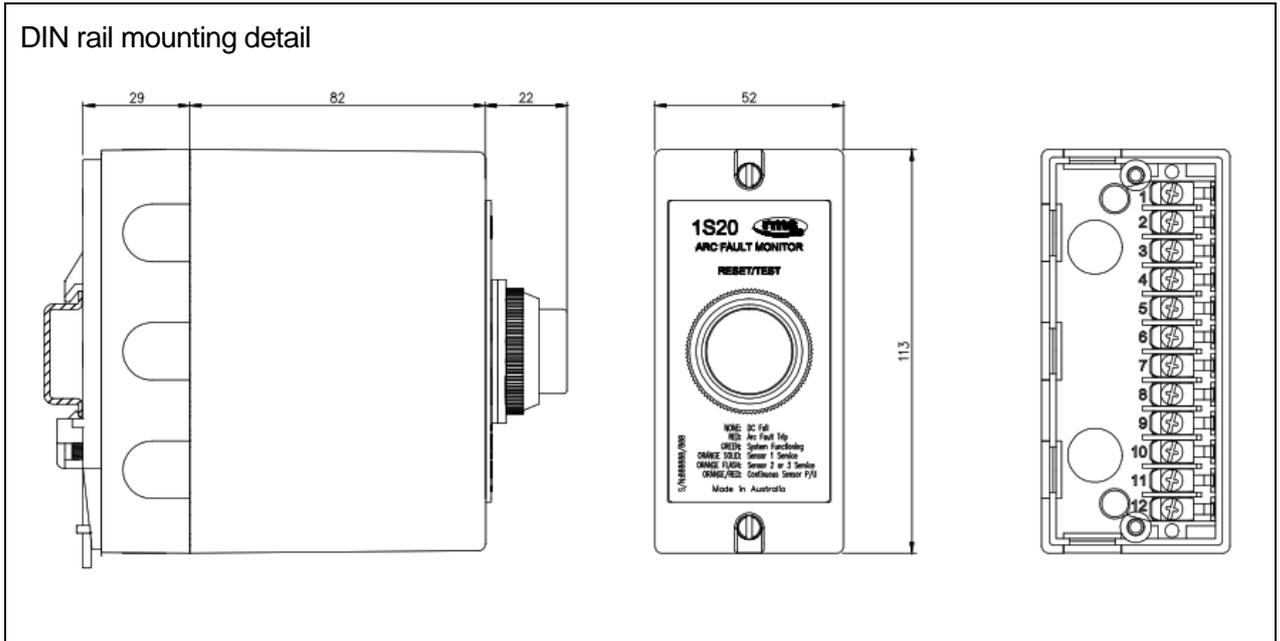
Panel mounting cut out detail



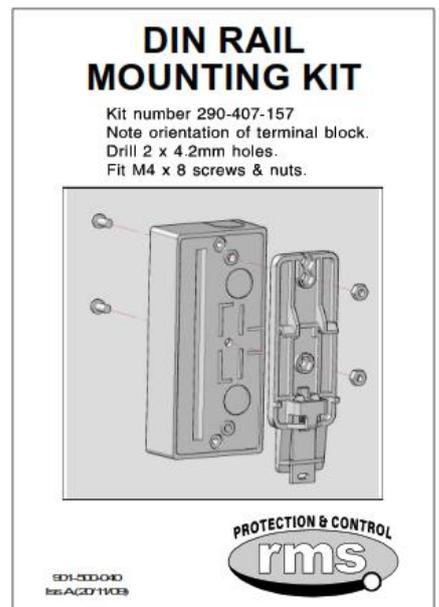
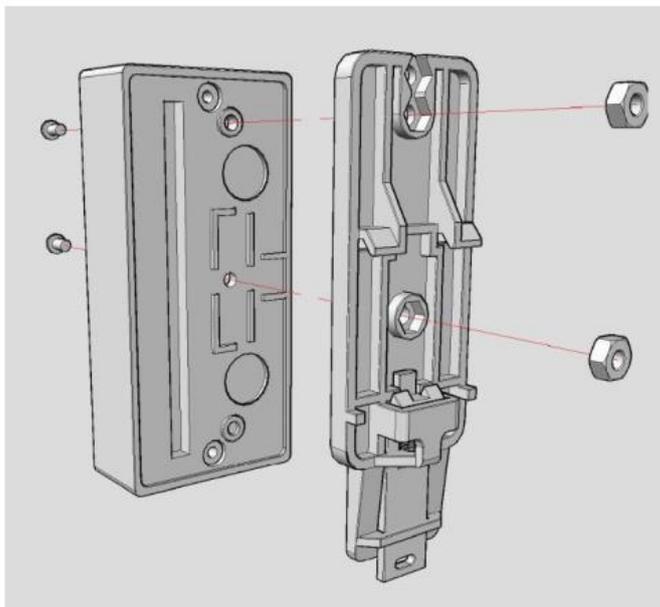
Surface mounting detail



DIN rail mounting detail



DIN Rail Mounting Kit

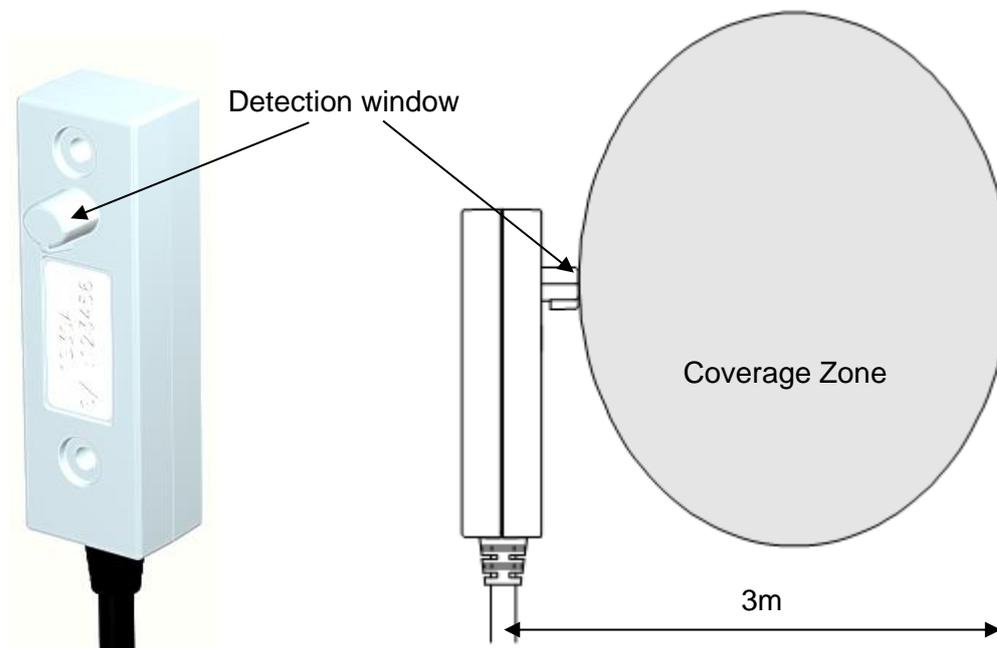


## Sensor Installation

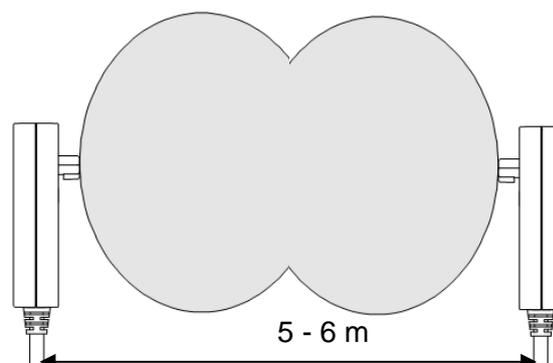
### Sensor Spacing

The 1S30 sensor is available as a single detector or dual detector package.

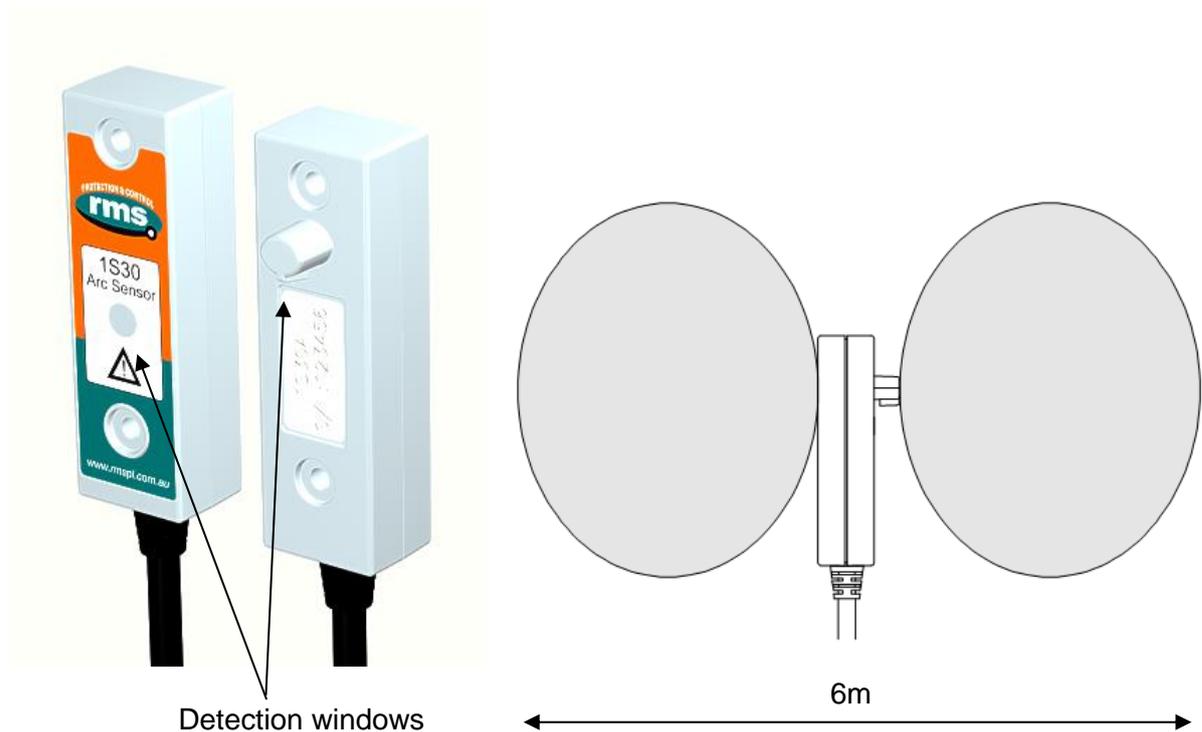
The 1S30A single detector version is depicted below showing the location of the detection window and the approximate coverage zone :



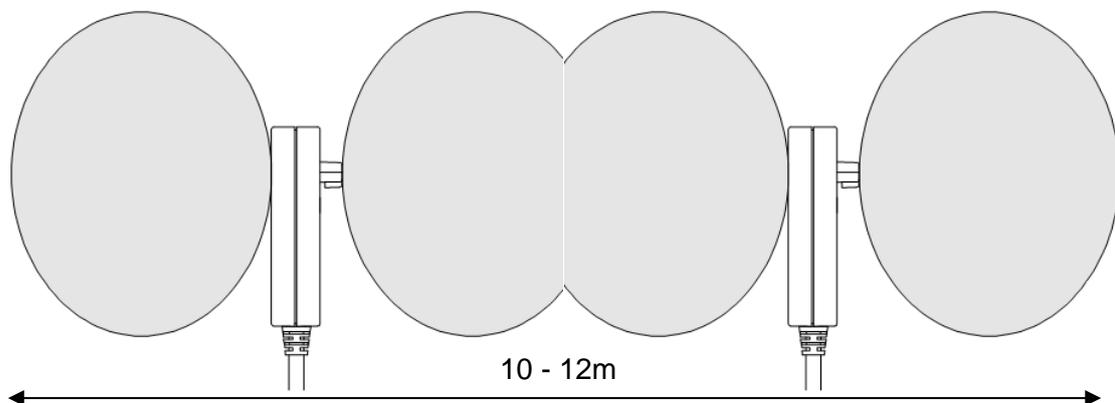
The recommended spacing for the 1S30A single detectors is approximately 5 - 6 m to ensure adequate detection overlap.



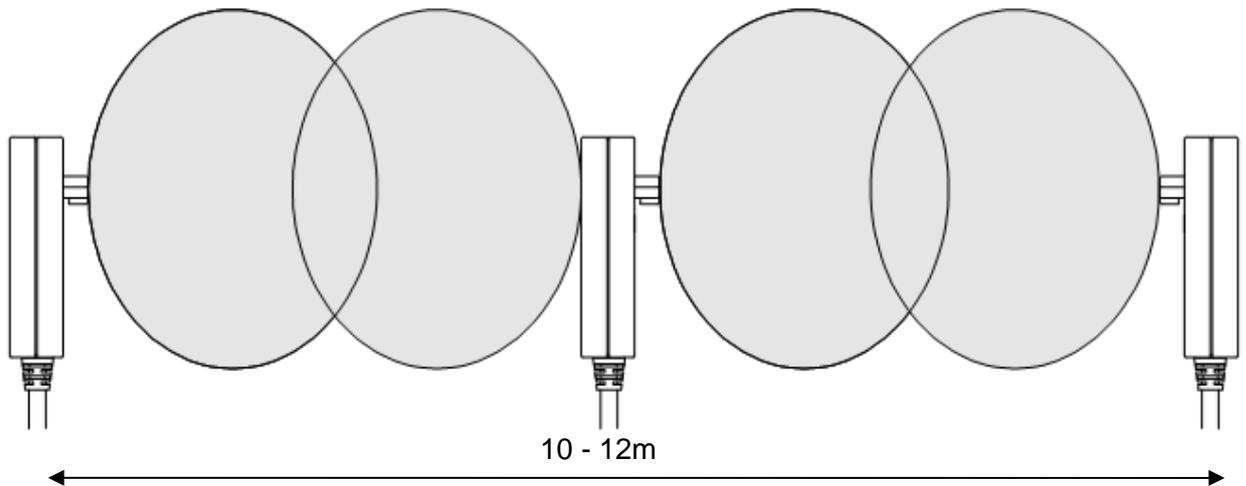
The 1S30B Dual detector version provides an additional detection window for dual zones of coverage as depicted below :



The recommended spacing for the 1S30B single detectors is approximately 5 - 6 m to ensure adequate detection overlap, this combination provides an overall coverage zone of approximately 10 - 12 m.



The 1S30A and 1S30B sensors may also be mixed to provide various coverage combinations, again spacings of approximately 5 - 6 m should be observed to ensure adequate detection overlap.



### Sensor Placement

Sensors need to be mounted to provide full coverage of the switchgear cubicles to be protected. Where the protected zone is larger than the sensor coverage then the use of multiple sensors is required.

Precise positioning of the sensors is generally not required as the light caused by the arc is reflected from the switchgear walls.

### Sensor Mounting

The 1S30 is suitable for flush panel mounting in a number of configurations, for further information on mounting arrangements and mounting hardware refer to the 1S30 Technical Bulletin.

### Example Sensor Placement

The following are some typical examples of sensor placement.



Sensor placement inside the CB racking chamber



Sensor placement inside the busbar chamber



Sensor placement inside the cable termination chamber



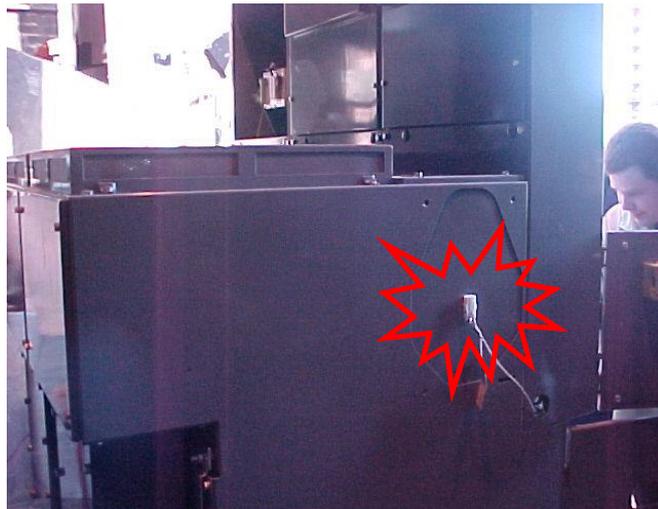
Sensor placement for switchgear Busbar coverage (External through Hole Detector)



Sensor placement near a Low Voltage Contactor for a Variable Speed Drive



Sensor placement for a Switchgear cable termination chamber (External through Hole Detector)



Sensor placement for an end of Bus chamber (External through Hole Detector)



Sensor placement for a Switchgear cable termination chamber (External through Hole Detector)

## Commissioning

### Commissioning Preliminaries

Carefully examine the module to ensure that no damage has occurred during transit. Check that the model number and rating information are correct.

#### Insulation

The relay, and its associated wiring, may be insulation tested between:

- all electrically isolated circuits
- all circuits and earth

An electronic or brushless insulation tester should be used, having a dc voltage not exceeding 1000V. Accessible terminals of the same circuit should first be strapped together. Deliberate circuit earthing links, removed for the tests, subsequently must be replaced.

#### ARC Trip Verification

ARC Trip Verification will require a flash source to initiate sensor operation.

A high powered photographic flash is the most convenient means of initiating a positive sensor operation.

Note that mobile phone or small compact camera flashes may not have sufficient power to cause sensor operation.

The RMS 'Arc Flash Timing Test Guide' outlines a suggested test setup to provide a flash source and determine ARC Trip times. The 'Arc Flash Timing Test Guide' is available on the Mors Smitt website :

[https://www.morssmitt.com/uploads/files/catalog/products/arc-flash-timing-test-guide\(1\).pdf](https://www.morssmitt.com/uploads/files/catalog/products/arc-flash-timing-test-guide(1).pdf)

## Site Commissioning Verification Checklist

Observe all site specific standard safety procedures.

The following tests are undertaken following the completion of all 1S20 ARC Monitor scheme wiring and the wiring of all 1S30 sensors.

### System Power Up

Item	Description	Complete
1	Confirm all necessary primary equipment isolations	
2	Confirm all necessary secondary equipment isolations (including trip outputs)	
3	Check fitment of 1S30 optical sensors and cable condition	
4	Check panel installation of the 1S20 ARC Fault Monitor	
5	Check the 1S20 is wired to the protection design schematic	
6	Confirm Fail alarm relay is closed (Terminals 5 and 6)	
7	Withdraw the 1S20 module from the base and confirm configuration switches match protection setting specifications and the number of connected sensors and reinsert module into the case Note: Arc sensor 1 must be connected at all times	
8	Apply correct auxiliary voltage to power up the 1S20 and observe the LED flashes green 3 times and then stays on solid green to indicate system healthy	
9	Confirm Fail alarm relay is open (Terminals 5 and 6)	
10	Confirm that the LED indicates no sensor fail conditions (Refer to the status indications to aid in troubleshooting if sensor failure is indicated)	
11	Confirm that no ARC fault trips are indicated	

### SUPERVISION Output Verification

Item	Description	Complete
1	In turn disconnect each sensor from the associated 1S20 sensor input	
2	Confirm that the status indications correspond to the disconnected sensor/s	
3	Reconnect all sensors back to the associated 1S20 sensor inputs	
4	Confirm that the LED returns to solid green to indicate system healthy	

## Arc Trip Testing

Item	Description	Complete
1	Initiate the operation of each sensor by the use of a suitable high power camera flash * If a current check interlock is employed in your ARC Fault protection scheme ensure that current is injected into the associated Overcurrent relay to cause operation of the current check element at the same time the sensor is flashed	
2	Check for correct operation of the 1S20 LED to indicate a trip operation (Solid red for approx. 2 sec and then alternating red and green until reset)	
3	Confirm operation of the 1S20 ARC fault outputs corresponds to the flashed sensor and in accordance with setting switch 3	

Upon satisfactory completion of scheme testing the scheme may be placed into service per established asset owner commissioning and operational procedures.

Refer also to the RMS 'Arc Flash Timing Test Guide' for a suggested test setup to provide a flash source and determine ARC Trip times. The 'Arc Flash Timing Test Guide' is available on the Mors Smitt website :

[https://www.morssmitt.com/uploads/files/catalog/products/arc-flash-timing-test-guide\(1\).pdf](https://www.morssmitt.com/uploads/files/catalog/products/arc-flash-timing-test-guide(1).pdf)

## ARC Sensor Service Trouble Shooting

Item	Description	Complete
1	If there is an arc sensor service indication re-check the 1S30 wiring integrity	
2	Check that the correct number of sensors are wired to the arc sensor inputs according to the ARC Monitor order code and switch settings	
3	Check for high ambient lighting conditions for all the sensors	

Refer to the status indications to aid in troubleshooting.

### ARC Trip Trouble Shooting

If an arc trip occurs without an ARC being present this indicates either:

- a very high ambient light condition is triggering a sensor

or

- short circuit wiring of a 1S30 sensor

In both cases if the condition persists the Fail alarm output will operate.

Item	Description	Complete
1	Check the 1S30 wiring integrity of the sensors	
2	Check for high ambient lighting conditions for all the sensors	

Refer to the status indications to aid in troubleshooting.

## Installation

### Handling of Electronic Equipment

A person's normal movements can easily generate electrostatic potentials of several thousand volts. Discharge of these voltages into semiconductor devices when handling electronic circuits can cause serious damage, which often may not be immediately apparent, but the reliability of the circuit will have been reduced.

The electronic circuits of Relay Monitoring Systems Pty Ltd products are immune to the relevant levels of electrostatic discharge when housed in the case. Do not expose them to the risk of damage by withdrawing modules unnecessarily.

Each module incorporates the highest practicable protection for its semiconductor devices. However, if it becomes necessary to withdraw a module, the following precautions should be taken to preserve the high reliability and long life for which the equipment has been designed and manufactured.

1. Before removing a module, ensure that you are at the same electrostatic potential as the equipment by touching the case.
2. Handle the module by its front-plate, frame, or edges of the printed circuit board.
3. Avoid touching the electronic components, printed circuit track or connectors.
4. Do not pass the module to any person without first ensuring that you are both at the same electrostatic potential. Shaking hands achieves equipotential.
5. Place the module on an antistatic surface, or on a conducting surface which is at the same potential as you.
6. Store or transport the module in a conductive bag.

If you are making measurements on the internal electronic circuitry of equipment in service, it is preferable that you are earthed to the case with a conductive wrist strap.

Wrist straps should have a resistance to ground between 500k – 10M ohms. If a wrist strap is not available, you should maintain regular contact with the case to prevent the build-up of static.

Instrumentation which may be used for making measurements should be earthed to the case whenever possible.

## Safety Section

This Safety Section should be read before commencing any work on the equipment.

The information in the Safety Section of the product documentation is intended to ensure that products are properly installed and handled in order to maintain them in a safe condition. It is assumed that everyone who will be associated with the equipment will be familiar with the contents of the Safety Section.

### Explanation of Symbols & Labels

The meaning of symbols and labels which may be used on the equipment or in the product documentation is given below.

**Caution:** refer to product information

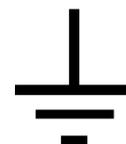


**Caution:** risk of electric shock



### Functional earth terminal

**Note:** this symbol may also be used for a Protective/safety earth terminal if that terminal is part of a terminal block or sub-assembly e.g. power supply.



### **Equipment Operating Conditions**

The equipment should be operated within the specified electrical and environmental limits.

Protective relays, although generally of robust construction, require careful treatment prior to installation and a wise selection of site. By observing a few simple rules, the possibility of premature failure is eliminated, and a high degree of performance can be expected.

Care must be taken when unpacking and installing the relays so that none of the parts are damaged or their settings altered and must always be handled by skilled persons only.

Relays should be examined for any wedges, clamps, or rubber bands necessary to secure moving parts to prevent damage during transit and these should be removed after installation and before commissioning.

The relay should be mounted on the circuit breaker or panel to allow the operator the best access to the relay functions.

### **Equipment Connections**

Personnel undertaking installation, commissioning or servicing work on this equipment should be aware of the correct working procedures to ensure safety. The product documentation should be consulted before installing, commissioning or servicing the equipment.

Terminals exposed during installation, commissioning and maintenance may present hazardous voltage unless the equipment is electrically isolated.

If there is unlocked access to the rear of the equipment, care should be taken by all personnel to avoid electric shock or energy hazards.

Voltage and current connections should be made using insulated crimp terminations to ensure that terminal block insulation requirements are maintained for safety. To ensure that wires are correctly terminated, the correct crimp terminal and tool for the wire size should be used.

Before energising the equipment, it must be earthed using the protective earth terminal, or the appropriate termination of the supply plug in the case of plug connected equipment. Omitting or disconnecting the equipment earth may cause a safety hazard.

The recommended minimum earth wire size is 2.5mm<sup>2</sup>, unless otherwise stated in the technical data section of the product documentation.

Before energising the equipment, the following should be checked:

1. Voltage rating and polarity;
2. CT circuit rating and integrity of connections;
3. Protective fuse rating;
4. Integrity of earth connection (where applicable)

### **Decommissioning & Disposal**

**Decommissioning:** The auxiliary supply circuit in the relay may include capacitors across the supply or to earth. To avoid electric shock or energy hazards, after completely isolating the supplies to the relay (both poles of any dc supply), the capacitors should be safely discharged via the external terminals prior to decommissioning.

**Disposal:** It is recommended that incineration and disposal to water courses is avoided. The product should be disposed of in a safe manner.

## Maintenance

The 1S20 is equipped with a relay self checking watchdog and sensor supervision output alarm contact, this contact should be monitored by a system control and data acquisition system.

The Arc Fault system requires attention should the output alarm contact operates.

As with any protection system, routine checks of the trip wiring should be performed at intervals as determined by local experience and site conditions and as documented in local asset management philosophy and plans.

In the absence of local asset management philosophy or plans, a twelve month maintenance interval may be adopted incorporating the following regime:

### Mechanical Inspection

#### Relay Assembly

Inspect the relay for obvious signs of damage or ingress of moisture or other contamination.

#### Relay Module

Isolate the relay, remove any securing screws where fitted and unplug the relay from the terminal base.

Inspect the relay for signs of any overheating or burn marks which may have been caused by overvoltage surge or transient conditions on the power supply.

### Trip Check

Trip Check (via high powered photo flash of 1S30 sensors), to confirm the integrity of the trip circuit and ensure the circuit breaker trips.

**Defect Report Form**

Please copy this sheet and use it to report any defect which may occur.

Customers Name & Address:	Contact Name:
	Telephone No:
	Fax No:
Supplied by:	Date when installed:
Site:	Circuit:

*When Defect Found*

Date:	Commissioning?	Maintenance?	Systems Fault?	Other, Please State:
Product Part No:			Serial Number:	
Copy any message displayed by the relay:				
Describe Defect:				
Describe any other action taken:				
Signature:		Please Print Name:		Date:

*For RMS use only*

Date Received:	Contact Name:	Reference No:	Date Acknowledged:	Date of Reply:	Date Cleared:
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