



# 2V76 User Guide

## Single Phase Voltage / Neutral Displacement Relay

relay monitoring systems Pty Ltd

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**Advanced Protection Devices**



User Guide



Test Manual

# 2V76 User Guide

## About This Manual

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This User Guide covers all 2V76 relays manufactured from May 2007. Earlier relays do not necessarily incorporate all the features described. Our policy of continuous may means that extra features & functionality may have been added.

The 2V76 User Guide is designed as a generic document to describe the common operating parameters for all relays built on this platform. Some relay applications are described but for specific model information the individual “K” number Product / Test manuals should be consulted.

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## Contact Us

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To download a PDF version of this guide:  
[http://www.rmspl.com.au/userguide/2v76\\_user\\_guide.pdf](http://www.rmspl.com.au/userguide/2v76_user_guide.pdf)

To download the model specific Test Manual:  
<http://www.rmspl.com.au/search.asp>

## How this guide is organised

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*This guide is divided into five parts:*

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Part

1

## Test Manual

This User Guide covers all 2V76 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.

The product ordering code described in the Technical Bulletin is used to generate a unique version of the relay specification & is called a type number. The type number takes the form 2V76Kxx where the Kxx is the “K” or version number.

Refer to: [www.rmspl.com.au/handbook/parta3.pdf](http://www.rmspl.com.au/handbook/parta3.pdf)  
for a complete description of the RMS “K” number system.

Each 2V76 version has a specific Test Manual which provides details on the unique attributes of the relay. Each Test Manual includes the following information:

- Test Certificate
- Specific technical variations from the standard model if applicable
- Test & calibration record
- Wiring diagram

A Test Manual is provided with each relay shipped.

If you require a copy of the Test Manual for an RMS product the following options are available:

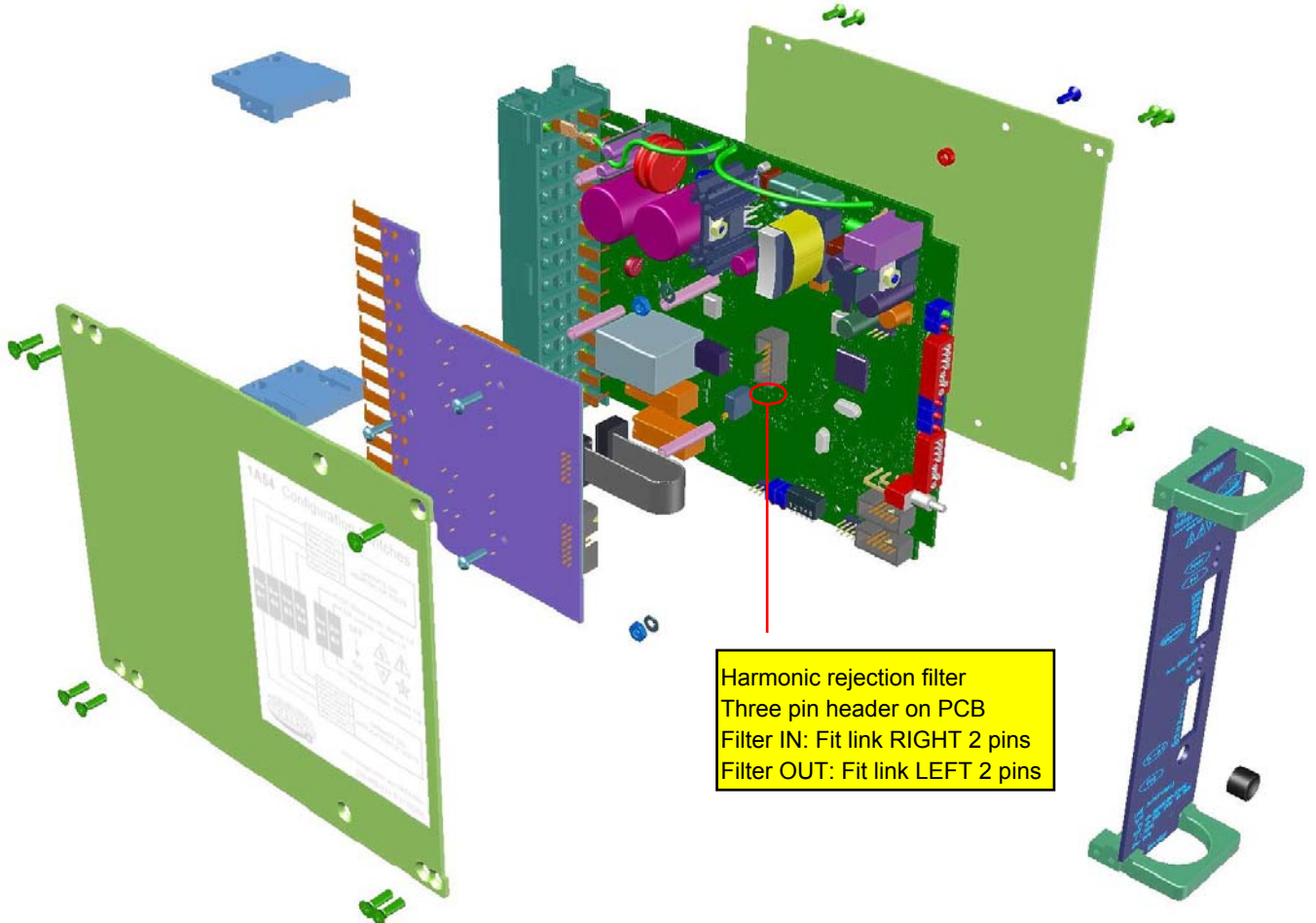
- Check the RMS web site at: [www.rmspl.com.au/search.asp](http://www.rmspl.com.au/search.asp)
- RMS CD catalogue select: [List all Product/Test Manuals](#) under [Technical Library](#)
- Contact RMS or a representative & request a hard copy or PDF by email.



Visit [www.rmspl.com.au](http://www.rmspl.com.au) for the latest product information.

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2V76 relay assembly depicted in a 2M28 case



## Technical Bulletin

The detailed technical attributes, functional description & performance specifications for the 2V76 are described in the attached Technical Bulletin. For the most up to date version go to:

[www.rmspl.com.au/handbook/2v76.htm](http://www.rmspl.com.au/handbook/2v76.htm)

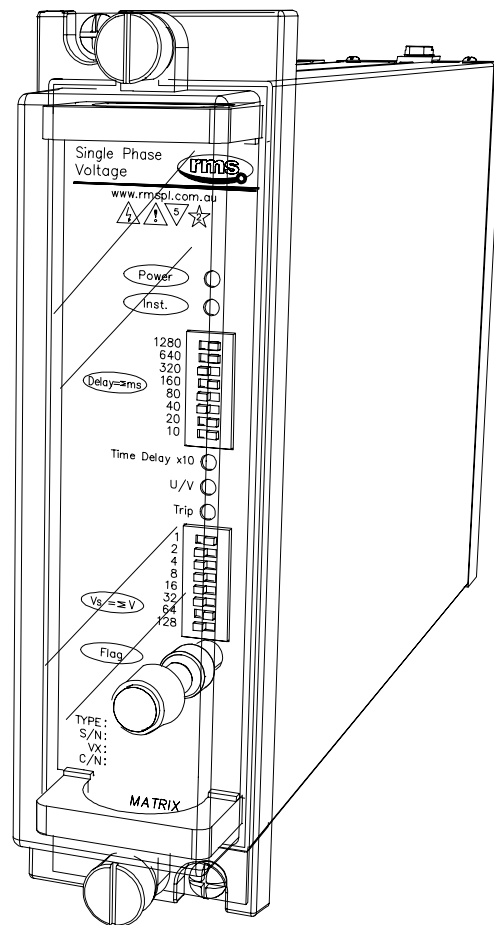
For any specific attributes of a particular version refer to the Test Manual for that type (K) number.

The order of precedence for technical information is as follows:

- Test Manual
- Technical Bulletin
- User Guide

## Features

- Selectable over or under voltage function
- Wide voltage monitoring range: 1-255 V AC in 1V steps
- Selectable 3rd harmonic filtering for neutral displacement applications
- Wide range auxiliary supply 40-275 V AC & 40-300 V DC
- 20-70V DC aux. Optional
- Auxiliary supply fail alarm
- Instantaneous p/u LED
- Undervoltage VT alarm function
- Non-volatile trip indication
- 5 C/O output contacts
- 2 contacts may be configured for instantaneous operation
- Two time delay ranges:
  - 0-2.55 s in 10 ms steps
  - 0-25.5 s in 100 ms steps
- Relay enable status input
- Push button & status input to reset trip LED
- Size 2M draw out case



2V76 depicted in a 2M28 case

## Description

The 2V76 series relay is a single phase protection class AC voltage relay. It may be configured for under or over voltage operation & includes a filter for rejection of third harmonics for neutral displacement applications, which may be switched in or out of circuit.

A definite time delay element is included which is initiated by the voltage detection circuit & drives the time delayed output contacts.

Voltage & time settings are fully adjustable using DIL switches readily accessible on the front panel of the relay & provide a high level of repeatability & accuracy. Visual indication of an output relay operation is provided by a non volatile LED indicator which may be hand or remotely reset.

A configurable status input is provided to ENABLE the operation of the 2V76 on application or removal of a control voltage.

## Application

Made in Australia

The 2V76 series relay can be configured to suit a range of AC voltage protection applications. For example:

### UNDER VOLTAGE

High speed detection of undervoltage in automatic transfer equipment,  
 Protection of induction motors against the restoration of supply following the loss or severe reduction in that supply.  
 Application in under frequency load shedding schemes

### OVER VOLTAGE

Protection of synchronous motors & motors driving high inertia loads.  
 Protection of hydro generators against over speed.

### NEUTRAL DISPLACEMENT

(Third harmonic filter configuration)

When the third harmonic filter is switched into the circuit, the 2V76 may be applied as a neutral displacement relay. In this application the 2V76 may be applied for earth fault protection of alternator stator windings where the neutral is earthed through a voltage transformer or distribution transformer. The relay is designed for this application such that its response to third harmonics is suppressed, thus making it inoperative to the third harmonic load imbalance which normally flows in the generator neutral. The applications of the relay in this configuration also include protection against unbalance conditions in capacitor banks & the detection of earth faults in impedance earthed, solidly earthed or un-earthed systems.

A switchmode power supply provides a very wide auxiliary operating range. A relay fail alarm is provided in the form of a C/O contact which is picked up when the auxiliary supply is healthy.



## AC VOLTAGE INPUT

Nominal input: 110 V AC  
 Maximum withstand: 300 V AC continuous  
 AC Burden: <1 VA over voltage setting range  
 Rated frequency: 50 Hz or 60 Hz  
 Frequency range: Rated frequency +/- 2 Hz  
 Measurement accuracy: +/-1% of setting or +/-0.5 V over the rated frequency range

## AC VOLTAGE SETTING RANGE Vset

1-255V AC in 1V steps

Vset = ΣV switches set to ON (LHS) on the front panel.

## VOLTAGE SENSING FUNCTION

The voltage sensing element is only active when the initiate input is enabled.

**Overvoltage mode:** Set configuration switch 5 to **ON**

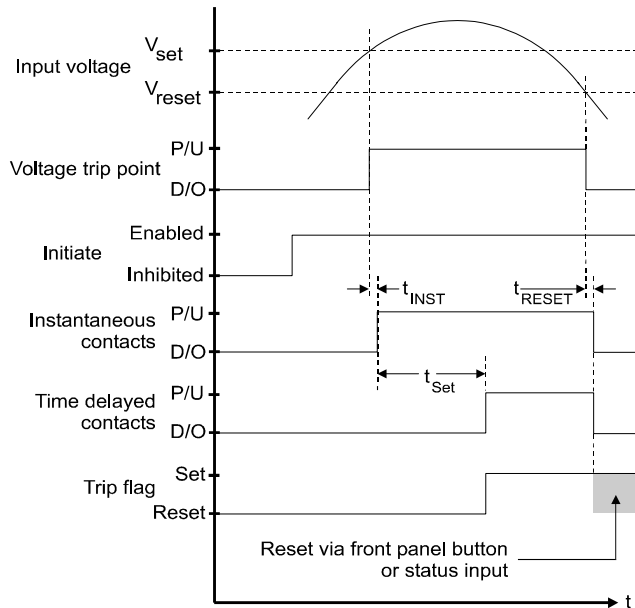


Figure 1:

**Undervoltage mode:** Set configuration switch 5 to **OFF**

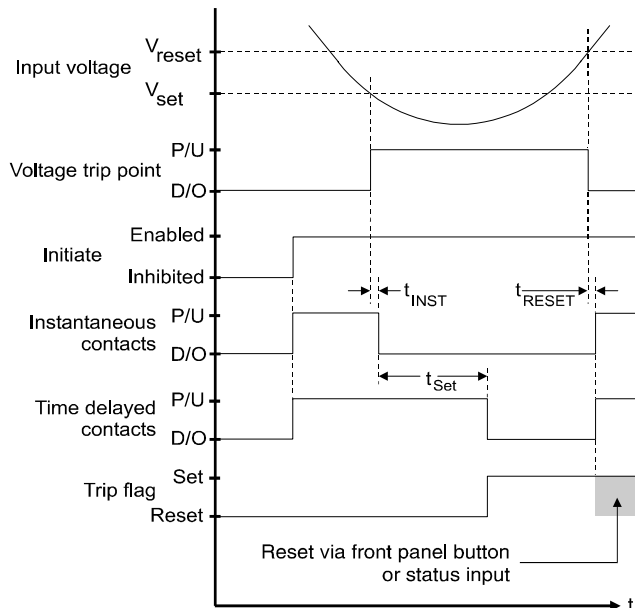


Figure 2:

## HARMONIC REJECTION

Harmonic filter rejection: >20x setting at >100 Hz

The harmonic rejection filter is selected by fitting a PCB jumper link to the appropriate position in a similar manner depicted in figure 3 (Refer 2V76 User Guide for details). Relays are shipped with the harmonic rejection filter OUT. The stated voltage measurement accuracy is maintained with the harmonic rejection filter selected IN or OUT.

## DROPOUT PICKUP RATIO OF VOLTAGE ELEMENT

HIGH 90% setting: PCB jumper J118 fitted left – Factory default  
 LOW 80% setting: PCB jumper J118 fitted right as per figure 3.

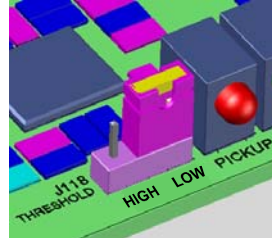


Figure 3:

To change the dropout / pickup ratio remove the relay module from the case, locate the three pin jumper header position J118 & fit jumper for HIGH or LOW dropout pickup ratio.

## UNDERVOLTAGE ALARM FUNCTION

The 2V76 provides a dedicated undervoltage alarm function for application as a VT fail alarm & is active when the initiate input is enabled.

The undervoltage alarm set point U/Vset, is a fixed percentage of Vset. When the input voltage falls below this level, C/O contact 1 & the front panel LED will operate after a short time delay to avoid spurious operation due to transients.

The U/V alarm LED & output contact are self reset when the voltage level is restored above U/Vreset.

Set point: U/Vset 0.2 x Vset  
 Reset point: U/Vreset 0.3 x Vset  
 Voltage measurement accuracy: +/-3V  
 Fixed time delay setting: ~500 ms

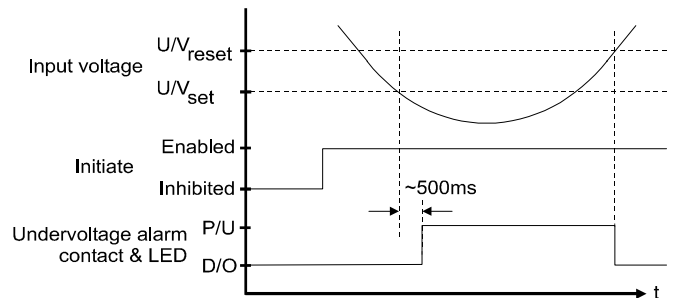


Figure 4:

When the AC sensing voltage input is ramped up from below the undervoltage alarm set point as depicted in figure 5, a short time delay (tUVM), is applied to mask spurious pick up of the voltage element. This time delay will result in an additional time delay to the instantaneous contacts when the 2V76 is configured to operate in overvoltage mode as described in the following sections.

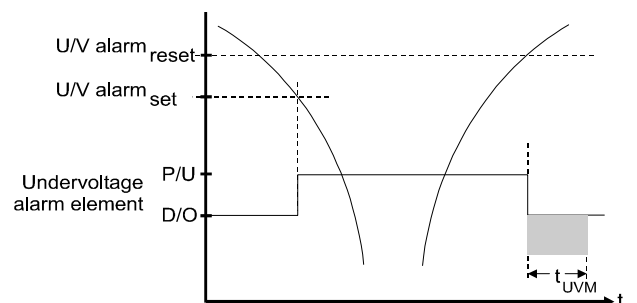


Figure 5:

### OPERATE TIMING – INSTANTANEOUS

The overall operate time of the instantaneous output contacts,  $t_{INSTANTANEOUS}$ , depends on the mode of operation & varies as a function of the scale of the input voltage change and the position on the waveform of the input change.

Harmonic filter switched **OUT**  $t_{OP} = 45ms^{***}$

When configured for neutral displacement applications the stiff 3<sup>rd</sup> harmonic filter results in an instantaneous pick up time of:

Harmonic filter switched **IN**  $t_{OP} = 50ms^{***}$

\* Times specified are for AC input voltage steps applied synchronous with the zero point crossing of  $V_{IN}$

\*\* Worst case for voltage step applied on falling point on wave add 5ms

#### Overvoltage mode:

When the input voltage rises from below the undervoltage alarm set point level, an undervoltage mask time delay is imposed:

$$t_{UVM} = 30ms$$

Overall Pick Up operate times are extended for this period where the input voltage is initiated from less than the Undervoltage Set Point.

Where the input voltage is initiated from above the Undervoltage Set point there is no delay:

$$t_{UVM} = 0ms$$

Where the 2V76 is configured to operate in overvoltage mode the instantaneous operate time is defined in Figure 6:

$$t_{INSTANTANEOUS} = t_{UVM} + t_{OP}$$

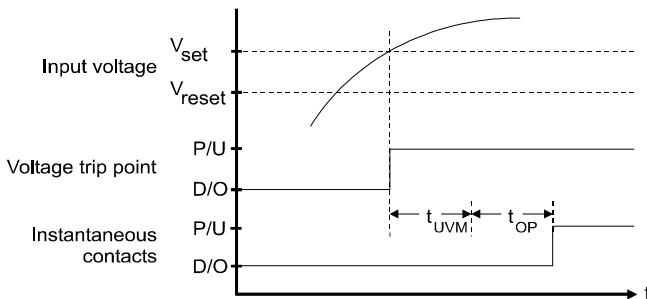


Figure 6:

In this mode the voltage element will always be reset from above the Undervoltage Set point such that  $t_{RESET} = t_{OP}$

#### Undervoltage mode:

Where the 2V76 is configured to operate in undervoltage mode the instantaneous operate time is defined in Figure 7:

As the input voltage is starting from above the Undervoltage set point  $t_{UVM} = 0ms$ .

$$t_{INSTANTANEOUS} = t_{OP}$$

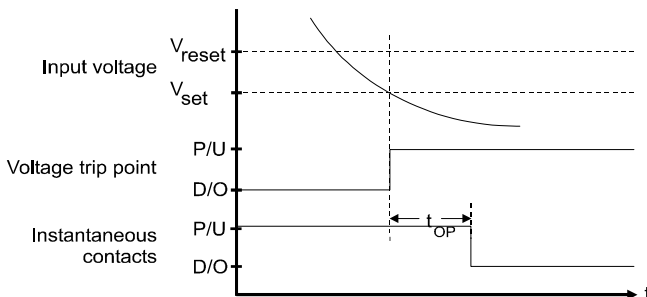


Figure 7:

If the voltage element is reset from a voltage which starts from above the Undervoltage Set point then  $t_{RESET} = t_{OP}$

If the voltage element is reset from a voltage which starts from below the Undervoltage Set point then  $t_{RESET} = t_{OP} + 30ms$

### INSTANTANEOUS OUTPUT CONTACTS

When output contacts 4 & 5 are configured for Instantaneous operation they will pick up when the relay is enabled and  $V_s$  is above / below the voltage pick up set point.

Refer to timing shown in Figures 6 & 7.

Set configuration switch 3 to **ON** to select Instantaneous operation for output contacts 4 & 5.

### TIME DELAYED OUTPUT CONTACTS

Output contact 1 has a fixed time delay for U/V alarm. The contact will automatically and independently reset after ~500ms

Output contacts 2 & 3 **always** operate in time delayed mode.

Output contact 4 & 5 will also operate in time delayed mode provided configuration switch 3 is set to **OFF**.

#### Time Delay Setting Ranges

$t_{set} = \sum$  ms switches set to ON (LHS) on front panel.

0 to 2.5 sec in 10 ms steps; or

0 to 25 sec in 100ms steps (when x10 time range selected)

Where all switches are set to OFF (RHS), the time delay set point is instantaneous.

The 10x setting multiplier is activated when configuration switch 4 is set to **OFF** to extend the timer range to 25 sec.

#### Time Delay Setting Changes

The time delay & function settings should only be changed when the timing initiate LED is extinguished. Time delay settings are read at the beginning of each timing sequence.

#### Time Delay - Accuracy

Nominal  $t_{set} \pm 0.5\%$

Note: The accuracy of the delay timer does not include output contact operate or reset times.

### TIMER RESET

If the input voltage is restored to above / below the voltage trip level before the preset time delay  $t_{set}$  has expired, the time delay trip output contacts will not operate provided the timer has adequate time to reset.

The timer reset time is dependant on the harmonic filter setting as follows:

#### Harmonic filter switched **OUT**

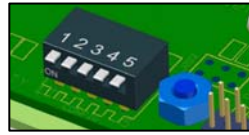
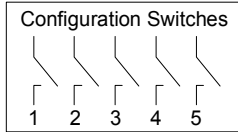
If the voltage element drops out before the pre set time delay is reached the timing element will reset in <40 ms at 2x  $V_s$ .

#### Harmonic filter switched **IN**

If the voltage element drops out before the pre set time delay is reached the timing element will reset in <60 ms at 2x  $V_s$ .

### CONFIGURATION SWITCHES

Configuration switches are accessible to the user & can be set by withdrawing the relay module & following the instructions on the side plate label. A bank of 5 switches are provided as depicted below & are read each time the 2V76 is powered up:



While the function of the configuration switches may vary for special custom models, the standard functions & default settings are described in the Ordering Information section.

### FRONT PANEL INDICATORS

Five LED indicators are provided on the front panel:

Power	On solid when auxiliary supply healthy	Green
U/V Alarm	On solid when input below threshold	Red
Timing	Flashing during timing	Amber
Trip	On solid when output relay operated	Red
Range x10	On when the x10 time range selected	Green

The U/V alarm & trip LED's status is stored in non volatile memory & will be restored when the 2V76 is powered up after loss of the auxiliary supply. The preserved trip LED state is reset using the front panel trip LED reset button or status input.

### STATUS INPUT OPERATING VOLTAGE (AC rejection filter)

The operating range of the status inputs are set using internal configuration switch 1. This setting may be pre defined when ordering.

**18 - 300V DC** Set Configuration Switch to **ON**  
In this mode the universal status input will reject AC signals that may be induced on the control wiring. Suitable for high security applications where a DC battery supply is available.

**18 - 300V DC & 18 - 275V AC** Set Configuration Switch to **OFF**  
In this mode the universal status input is designed to operate on both AC & DC input voltages. Suitable for applications where an AC auxiliary voltage is available such as transformer or generator control panels.

### STATUS INPUT MINIMUM OPERATING CURRENT

10 mA P/U for 1 ms then reducing to 1.5 mA after 4 ms.

While the function of the configuration switches may vary for special custom models, the standard functions & default settings are described in the Ordering Information section.

### STATUS INPUT OPERATING TIME

Initiate input	Minimum	AC Rejection Filter	
		ON	OFF
DC	P/U	<16 ms	<4 ms
	D/O	<4 ms	<16 ms
AC	P/U	N/A	<23 ms
	D/O		<33 ms

Table 1

### RELAY ENABLE INPUT

Apply volts to enable: Set configuration switch 2 **ON**  
Remove volts to enable: Set configuration switch 2 **OFF**

### REMOTE RESET INPUT

Application of a control voltage to remote flag reset input will cause the trip LED to be reset.

### AUXILIARY SUPPLY

40-275 V AC / 40-300 V DC or 20-70 V DC switchmode supply.

### RELAY FAIL ALARM

A C/O alarm contact is maintained in the energized state when all of the following conditions are met:

- The auxiliary supply is applied
- The internal 24 V DC rail is within acceptable limits
- The CPU hardware watchdog maintains a pulsing output

A CPU software watchdog records "suspect" events to an assert register & if necessary performs a soft restart.

### OUTPUT RELAY CONTACT CONFIGURATION

- 1 C/O undervoltage alarm contact
- 4 C/O time delayed contacts or
- 2 C/O time delayed + 2 C/O instantaneous contacts

### OUTPUT CONTACT DWELL TIME

Once operated all time delayed output contacts have a minimum dwell time of 100ms.

### OUTPUT CONTACT RATINGS

Carry continuously	5A AC or DC	<b>IEC60255-0-2</b>
Make & carry	0.5 s 20 A AC or DC	
L/R ≤ 40ms & V ≤ 300V	0.2 s 30 A AC or DC	
	AC resistive	1,250 VA
Break capacity	AC inductive	250 VA @ PF ≤ 0.4
I ≤ 5A & V ≤ 300V	DC resistive	75 W
	DC inductive	30 W @ L/R ≤ 40 ms
		50 W @ L/R ≤ 10 ms
Minimum number of operations		10 <sup>6</sup> at maximum load
Minimum recommended load		0.5W limit 10mA / 5 V

### TRANSIENT OVERVOLTAGE

Between all terminals & earth	<b>IEC60255-5 CLASS III</b>
Between independent circuits without damage or flashover	5 kV 1.2/50 us 0.5 J
	5 kV 1.2/50 us 0.5 J

### INSULATION COORDINATION

Between all terminals & earth	<b>IEC60255-5 CLASS III</b>
Between independent circuits	2.0 kV rms for 1 min.
Across normally open contacts	2.0 kV rms for 1 min.
	1.0 kV rms for 1 min.

### AUXILIARY SUPPLY

Allowable breaks / dips in supply	<b>IEC60255-11</b>
Collapse to zero from nominal voltage	

### HIGH FREQUENCY DISTURBANCE

2.5 kV 1MHz common mode	<b>IEC60255-22-1 CLASS III</b>
1.0 kV 1MHz differential mode	≤ 3% variation

### ELECTROSTATIC DISCHARGE

6 kV contact discharge	<b>IEC60255-22-2 CLASS III</b>
	≤ 5% variation

### FAST TRANSIENT

4 kV, 5/50 ns, 100 KHz repetitive	<b>IEC60255-22-4</b>
	≤ 5% variation

### TEMPERATURE RANGE

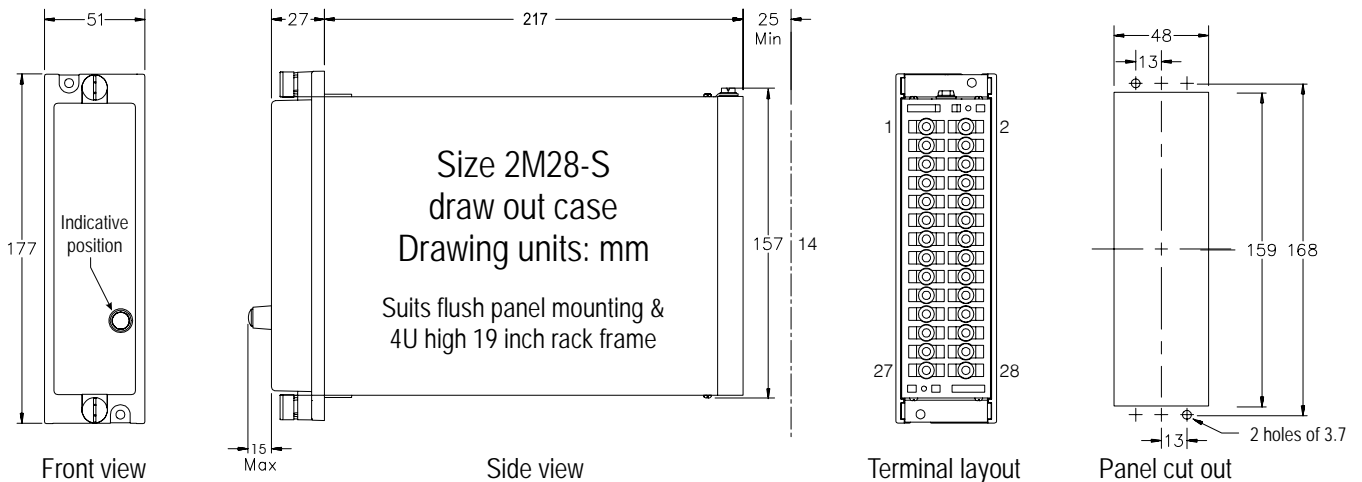
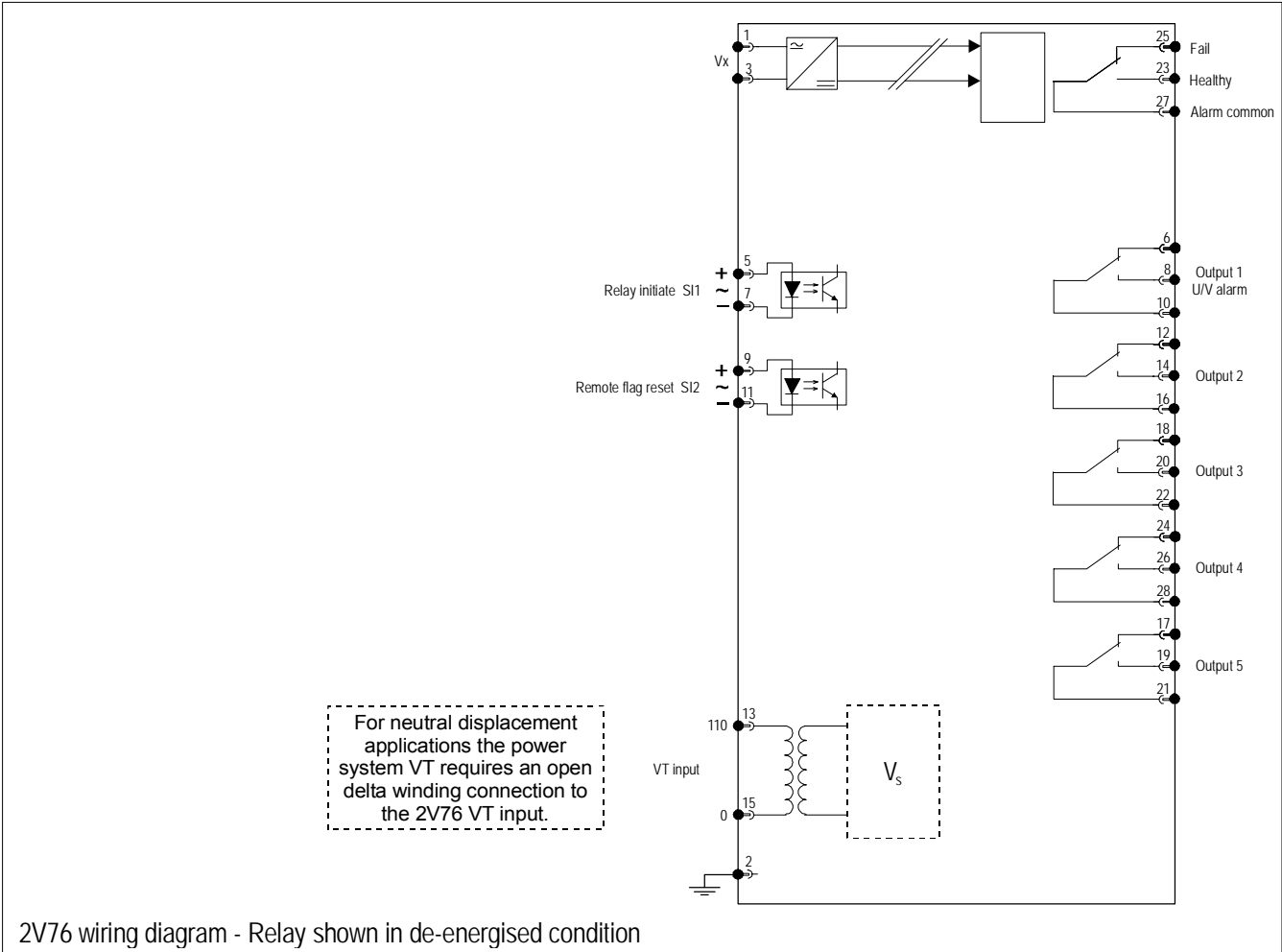
Operating:	<b>IEC68-2-1/2</b>
Storage:	-5 to +55°C
	-25 to +75°C

### HUMIDITY

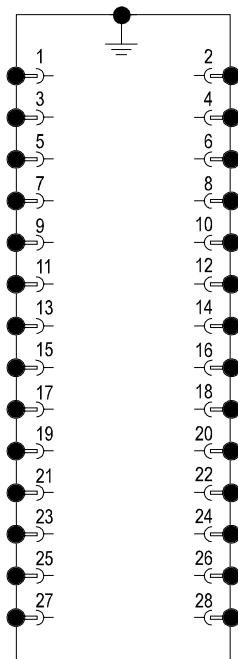
40°C & 95% RH non condensing	<b>IEC68-2-78</b>
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### CASE

Size 2M28-S draw out  
28 M4 screw terminals  
Flush panel mount or 4U high 1/8 width 19 inch rack mount



Case Earth



2M28 Case terminations (REAR VIEW)

# Ordering Information

## ORDER CODE

The order code determines the production build in the factory & cannot be changed in the field.

Generate the required order code as follows: e.g. 2V76-BA

General Type	Order Code	
	1	2
2V76	-	

### 1 AUXILIARY SUPPLY RANGE

- A 20-70 V DC
- B 40-275 V AC & 40-300 V DC

### 2 SYSTEM FREQUENCY

- A 50 Hz
- B 60 Hz

### CONFIGURATION CODE (Optional specification)

The configuration code can be set in the field by withdrawing the relay module & following the instructions on the side plate label.

The configuration code may be specified at time of order so that the relay will be shipped from the factory pre-set to meet customer requirements. e.g. CONFIG-01011

If a configuration code is not specified the factory default will be set as indicated below. i.e. CONFIG-11111

Specify factory Configuration	Configuration Switches				
	1	2	3	4	5
CONFIG	-				

### 1 STATUS INPUT OPERATION

- 1 ON DC operation only - AC rejection ON (Default)
- 0 OFF AC / DC operation - AC rejection OFF

### 2 RELAY ENABLE INPUT

- 1 ON Apply volts to enable (Default)
- 0 OFF Remove volts to enable

### 3 OUTPUT RELAY FUNCTION

- 1 ON Output contacts 4 & 5 will operate instantaneously when  $V_s$  is beyond the voltage pick up threshold irrespective of the front panel time delay settings while output contacts 2 & 3 are time delayed (Default)
- 0 OFF Outputs contact 2 to 5 are time delayed

### 4 TIME RANGE MULTIPLIER

- 1 ON Selected time range x1 (Default)
- 0 OFF Selected time range x10

### 5 RELAY MODE

- 1 ON Overvoltage mode (Default)
- 0 OFF Undervoltage mode

## 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 yourself.
6. Store or transport the module in a conductive bag.

If you are making measurements on the internal electronic circuitry of an 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

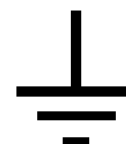


**Caution:** risk of electric shock



### 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 eg. power supply.







## Unpacking

Upon receipt inspect the outer shipping carton or pallet for obvious damage.

Remove the individually packaged relays and inspect the cartons for obvious damage.

To prevent the possible ingress of dirt the carton should not be opened until the relay is to be used. Refer to the following images for unpacking the relay:



Outer packing carton showing shipping documentation pouch.  
Address label on top of carton.



Inner packing carton showing front label detailing the customer name, order number, relay part number & description, the relay job number & packing date. (Size 2 inner packing carton depicted)



Visit [www.rmspl.com.au](http://www.rmspl.com.au) for the latest product information.

Due to RMS continuous product improvement policy this information is subject to change without notice. User\_Guide-4/lss E/25/08/08



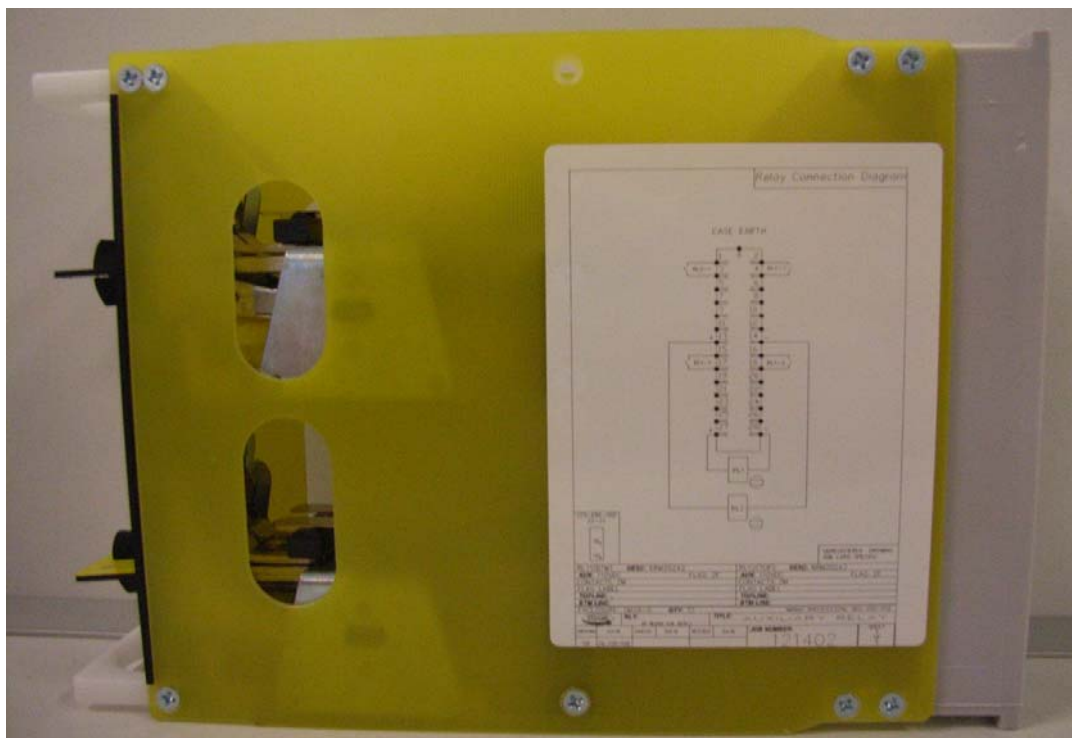




### Relay Module Side Label Depicting Product Details



### Relay Module Side Label Depicting Wiring Diagram (6R MATRIX relays only)



Visit [www.rmspl.com.au](http://www.rmspl.com.au) for the latest product information.

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## Accessories Supplied With Each Relay



Self threading M4 mounting screws



M4 terminal screws with captured lock washers

## Storage & Handling

If damage has been sustained a claim should immediately be made against the carrier, also inform Relay Monitoring Systems Pty Ltd and the nearest RMS agent

When not required for immediate use, the relay should be returned to its original carton and stored in a clean, dry place.

Relays which have been removed from their cases should not be left in situations where they are exposed to dust or damp. This particularly applies to installations which are being carried out at the same time as constructional work.

If relays are not installed immediately upon receipt they should be stored in a place free from dust and moisture in their original cartons.

Dust which collects on a carton may, on subsequent unpacking, find its way into the relay; in damp conditions the carton and packing may become impregnated with moisture and the de-humidifying agent will lose its efficiency.



### **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 at all times 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.

### **Relay Dimensions & Other Mounting Accessories**

Refer drawing in Technical Bulletin. Relevant Auto Cad files & details on other accessories such as 19 inch sub rack frames, semi projection mount kits & stud terminal kits may be down loaded from:

<http://www.rmspl.com.au/mseries.htm>



Visit [www.rmspl.com.au](http://www.rmspl.com.au) for the latest product information.

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## 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.

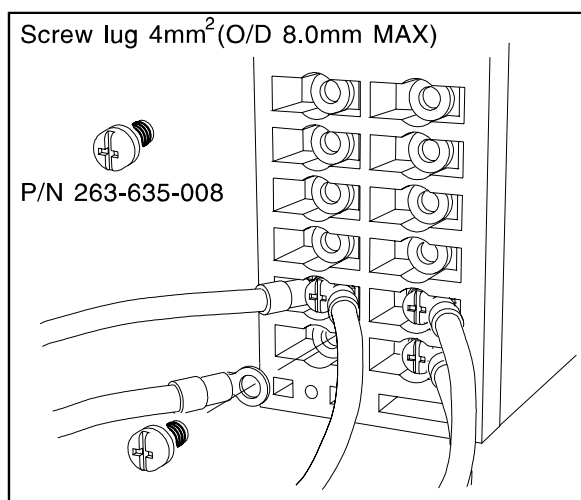
Voltage and current connections should be made using insulated crimp terminations to ensure that terminal block insulation requirements are maintained for safety. To ensure that wires are correctly terminated, the correct crimp terminal and tool for the wire size should be used.

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)







### **Current Transformer Circuits**

Do not open the secondary circuit of a live CT since the high voltage produced may be lethal to personnel and could damage insulation.

### **External Resistors**

Where external resistors are fitted to relays, these may present a risk of electric shock or burns, if touched.

### **Insulation & Dielectric Strength Testing**

Insulation testing may leave capacitors charged up to a hazardous voltage. At the end of each part of the test, the voltage should be gradually reduced to zero, to discharge capacitors, before the test leads are disconnected.

### **Insertion of Modules**

These must not be inserted into or withdrawn from equipment whilst it is energised, since this may result in damage.

### **Electrical Adjustments**

Pieces of equipment which require direct physical adjustments to their operating mechanism to change current or voltage settings, should have the electrical power removed before making the change, to avoid any risk of electric shock.

### **Mechanical Adjustments**

The electrical power to the relay contacts should be removed before checking any mechanical settings, to avoid any risk of electric shock.

### **Draw Out Case Relays**

Removal of the cover on equipment incorporating electromechanical operating elements, may expose hazardous live parts such as relay contacts.

### **Insertion & Withdrawal of Heavy Current Test Plugs**

When using a heavy current test plug, CT shorting links must be in place before insertion or removal, to avoid potentially lethal voltages.



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### **Commissioning Preliminaries**

Carefully examine the module and case to see that no damage has occurred during transit. Check that the relay serial number on the module, case and cover are identical, and that the model number and rating information are correct.

Carefully remove any elastic bands/packing fitting for transportation purposes.

Check that the external wiring is correct to the relevant relay diagram or scheme diagram. The relay diagram number appears inside the case.

Particular attention should be paid to the correct wiring and value of any external resistors indicated on the wiring diagram/relay rating information.

Note that shorting switches shown on the relay diagram are fitted internally across the relevant case terminals and close when the module is withdrawn. It is essential that such switches are fitted across all CT circuits.

If a test block system is to be employed, the connections should be checked to the scheme diagram, particularly that the supply connections are to the 'live' side of the test block.

### **Earthing**

Ensure that the case earthing connection above the rear terminal block, is used to connect the relay to a local earth bar.

### **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.



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## Commissioning Tests

If the relay is wired through a test block it is recommended that all secondary injection tests should be carried out using this block.

Ensure that the main system current transformers are shorted before isolating the relay from the current transformers in preparation for secondary injection tests.

### DANGER

DO NOT OPEN CIRCUIT THE SECONDARY CIRCUIT OF A CURRENT TRANSFORMER SINCE THE HIGH VOLTAGE PRODUCED MAY BE LETHAL AND COULD DAMAGE INSULATION.

It is assumed that the initial preliminary checks have been carried out.

### Relay CT shorting switches

With the relay removed from its case, check electrically that the CT shorting switch is closed.

### Primary injection testings

It is essential that primary injection testing is carried out to prove the correct polarity of current transformers.

Before commencing any primary injection testing it is essential to ensure that the circuit is dead, isolated from the remainder of the system and that only those earth connections associated with the primary test equipment are in position.

## 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

### 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 the front cover & carefully withdraw the relay module from the case.

Care must be taken to avoid subjecting the relay element to static discharge which may damage or degrade sensitive electronic components.

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

Inspect the VT & CT stages for degradation of insulation on the terminal wiring & transformer windings.



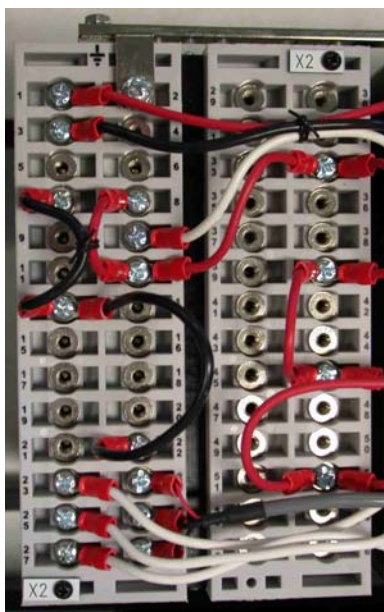
Remove cover by unscrewing black thumb screws & withdraw the relay module from the case.

## Relay Case

Inspect the outer terminals checking insulation integrity & tightness.

Inspect inside the case and use a blower to remove dust.

Inspect the inner terminals for worn, distorted or tarnished contacts and if necessary clean the contacts using a brush dipped in a suitable substance.



Case outer terminals



Case inner terminals



Module plug in terminals

## **Test Intervals**

The maintenance tests required will largely depend upon experience and site conditions, but as a general rule it is recommended that the following inspection and tests are performed every twelve months.

- ◆ Mechanical Inspection
- ◆ Check of Connections
- ◆ Insulation Resistance Test
- ◆ Fault Setting Tests by Secondary Injection
- ◆ Tests using Load Current
- ◆ Check the continuity of the neutral CT loop with a bell test set or an ohmmeter



### 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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## **Australian Content**

Unless otherwise stated the product(s) quoted are manufactured by RMS at our production facility in Melbourne Australia. Approximately 60% of our sales volume is derived from equipment manufactured in house with a local content close to 90%. Imported components such as semi-conductors are sourced from local suppliers & preference is given for reasonable stock holding to support our build requirements.

## **Quality Assurance**

RMS holds NCSI (NATA Certification Services International), registration number 6869 for the certification of a quality assurance system to AS/NZS ISO9001-2008. Quality plans for all products involve 100% inspection and testing carried out before despatch. Further details on specific test plans, quality policy & procedures may be found in section A4 of the RMS product catalogue.

## **Product Packaging**

Protection relays are supplied in secure individual packing cardboard boxes with moulded styrene inserts suitable for recycling. Each product & packing box is labeled with the product part number, customer name & order details.

## **Design References**

The products & components produced by RMS are based on many years of field experience since Relays Pty Ltd was formed in 1955. A large population of equipment is in service throughout Australia, New Zealand, South Africa & South East Asia attesting to this fact. Specific product & customer reference sites may be provided on application.

## **Product Warranty**

All utility grade protection & auxiliary relay products, unless otherwise stated, are warranted for a period of 24 months from shipment for materials & labour on a return to factory basis. Repair of products damaged through poor application or circumstances outside the product ratings will be carried out at the customer's expense.

## **Standard Conditions of Sale**

Unless otherwise agreed RMS Standard Terms & Conditions (QF 907) shall apply to all sales. These are available on request or from our web site.



## **Relay Monitoring Systems Pty Ltd**

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