

TRIPPING | SUPERVISION

Trip Circuit Management Relay

The TCM relay is a modular and cost-effective high-performance tripping relay with integrated supervision functions designed for power utility protection and control applications.

- > Modular construction
- > 4, 8, 12 or 16 heavy duty contacts
- > High speed tripping function <10ms
- > Integrated trip supply supervision
- > Integrated trip relay supervision
- > Optional trip circuit supervision
- > Self-reset or latching trip contacts
- > Magnetic arc blowout trip contacts
- > High burden trip operation
- > Made in Australia

Overview

Low-voltage auxiliary power systems for electric power plants and substations continue to evolve. In addition to traditional schemes, new technologies such as IEC61850 and a trend to lower cost components has resulted in a growing number of diverse tripping and supervision schemes.

The TCM relay is the latest device to be released by RMS Mors Smitt to address these changing market requirements and to meet specific customer design standards.



Description

The TCM relay is a modular and cost-effective high-performance tripping relay with integrated supervision functions designed for power utility protection and control applications.

The TCM relay provides both tripping and supervision functions integrated in a single relay. This provides enhanced system security and flexibility in the number of output contacts.

Highly reliable heavy-duty relay output modules are employed with integrated coil supervision. A simplified ordering scheme allows exact model definition to suit specific requirements for an extensive array of functions and applications.

High Speed Trip Functions

Three high speed trip functions:

- > TCM-1 SR Contacts + HR Flag button + ER Flag input
- > TCM-2 ER Contacts and Flag + HR Contacts and Flag button
- > TCM-3 ER Contacts + HR Contacts and Flag button

Integrated Supervision Functions

The TCM relay integrates several supervision functions to monitor and signal abnormal system events.

- > TSS Trip supply supervision
- > TRS Trip relay supervision
- > TCS Trip circuit supervision - Optional

Application

The TCM relay provides a robust and reliable high-speed interface between the main protection relay and the circuit breaker.

A more economical alternative to traditional tripping relays, the TCM relay provides a compact, flexible and high-performance solution meeting applicable IEC standards.

A wide voltage range, high burden operation and standard hand reset flag reduces the number of model variations. The TCM relay is packaged in a modular 4U high case that may be flush panel or rack mounted.

Features

Supervision

- > Trip supply supervision
- > Trip relay supervision
- > Supervision healthy LED
- > 2 C/O alarm contacts
- > Optional 1-3 trip circuit supervision elements

Tripping

- > Less than 10ms operate time
- > High burden operation to comply with capacitor discharge test requirements
- > Optional low burden specification
- > 4, 8, 12 or 16 heavy duty C/O contacts
- > Self-reset contact version
- > Latching contact version with hand and electrical reset
- > Trip Initiate LED indicator
- > Latching Trip LED indicator
- > Front panel Reset button
- > Magnetic arc blowouts standard

Installation

- > Rated operate voltages available for 110/125 and 220/250 V dc
- > Simplified installation and wiring
- > A custom text window is provided on the front cover to allow information printed on a slip in card to be visible

Mounting

- > Panel or rack mounting
- > Size 4 high – S4 or S6 wide case versions
- > Plug-in relay modules
- > M4 screw terminals

Standards Compliance

- > IEC 60255
- > ENA TS 48-4

Modular System

Trip Circuit Control Module

The Trip Circuit Control (TCC), module is the core of the system providing the supervision functions and managing the trip relay command signals. Individual 4 C/O Trip Circuit Relay (TCR), modules are incorporated to provide the number of trip contacts required. One, two or three Trip Circuit Supervision (TCS), modules may be specified.



TCC Module

Supervision Healthy LED

A front panel green LED is provided to indicate the supervision status is healthy. Loss of this LED will be accompanied by the alarm contacts dropping out to signal an abnormal condition.

Initiate LED

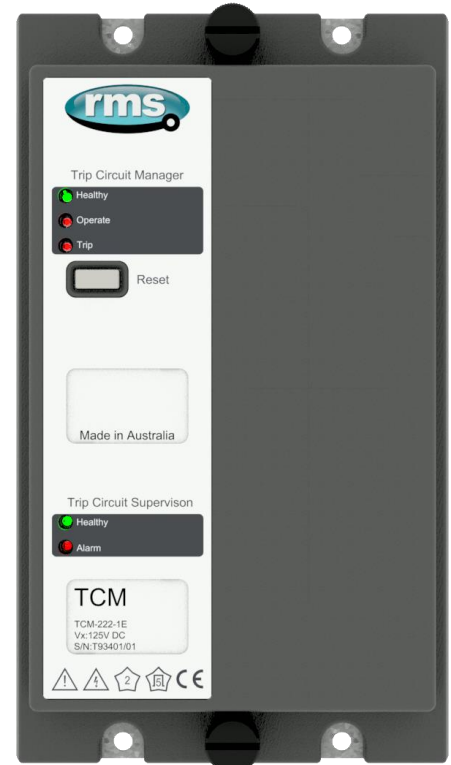
A front panel red LED is provided to indicate when a voltage is applied to the operate input.

- > For the TCM-1 self-reset version, Illumination of this LED also indicates that the trip output contacts are picked up.

Tripped LED

A front panel red LED is provided to indicate that a trip condition has occurred. Once the relay has operated this LED will remain illuminated until reset.

- > For the TCM-2 latching version, Illumination of this LED also indicates that the trip output contacts are picked up.



TCM relay depicted in a size 4 format case LED's visible and reset accessible through cover



TCM relay depicted in a size 4 format case Cover removed to show internal plug-in modules

Trip Supply Supervision (TSS)

The TSS function allows the supervision of the DC auxiliary supply employed on high security protection and tripping circuits employed in high voltage power systems. If the supply voltage drops below a pre-defined level, the healthy logic status is reset causing the alarm relay to drop out after a short time delay.

Trip Relay Supervision (TRS)

The TRS function provides internal monitoring of the trip relay coils and wiring to ensure the system is available to operate when a suitable trip signal is applied. This is achieved by injecting a supervision current through the internal trip circuit and trip relay coils. Provided the monitored current remains within pre-defined limits, the alarm contacts will be held closed in the healthy condition. If a trip initiate pulse is applied to the TCM Relay under a TRS fault condition, any TCR modules not effected by the fault will provide a 50ms trip output pulse.

Normal Operating Conditions

NORMAL CONDITION:

Normal operating condition is indicated on the front panel via the green Trip Supply LED. Under healthy conditions, the alarm relay coil is energized and the 2 C/O alarm contacts are picked up.

Abnormal Operating Condition

ALARM CONDITIONS: Auxiliary supply fail or
 Trip relay coil open circuit or
 Trip relay wiring open circuit

The green healthy LED is extinguished, and the 2 C/O alarm contacts drop out. A time delay is incorporated to avoid nuisance tripping due to switching transients. These conditions will self-reset after the supervision fail condition is corrected.

Alarm Contact Ratings

Contact material	AgNi	
Maximum switching voltage	250 V / 440 V AC	
Minimum switching voltage	5 V	
Minimum switching current	5 mA	
Contact resistance	< 100 mΩ (initial)	
Rated Load (capacity)	AC1	8 A / 250 V AC
	DC1	8 A / 24 V DC
	AC15 (B300)	3 A/120 V 1.5 A/240 V
	AC3	550 W (single phase motor)
	DC13 (R300)	0.22 A/120 V 0.1 A/250 V
Max AC breaking capacity	2,000 VA	

Supervision Logic

Both the TSS and TRS function must be healthy for the alarm contacts to remain picked up.

TSS and TRS Operating Range

PICK-UP VOLTAGE:

The alarm relay contacts are guaranteed to be picked up and the green healthy LED illuminated.

DROP-OUT VOLTAGE:

The alarm relay contacts are guaranteed to be dropped out and the green healthy LED extinguished.

Rated V dc	Pick-up	Drop-out	Maximum
110/125	88	70	150
220/250	176	150	300

Dips and Interruptions

Minimum period required to activate alarm condition:

Trip circuit fail: 300-600 ms

Loss of dc supply: 300-600 ms

Reset

When the supervision fault is rectified, the alarm contacts will self-reset to the picked up healthy state and the green Trip Supply Healthy LED illuminated.

Supervision Burden – TSS + TRS

The TSS and TRS circuit designs are optimized to minimize the supervision currents and burden on the DC supply.

Maximum burdens at 23 degrees Celsius:

Rated V dc	Healthy	Alarmed
110/125	2.1W	1.0W
220/250	3.2W	1.5W

High Speed Trip Functions

Contact Configuration

Number: 4, 8, 12 or 16 C/O contacts

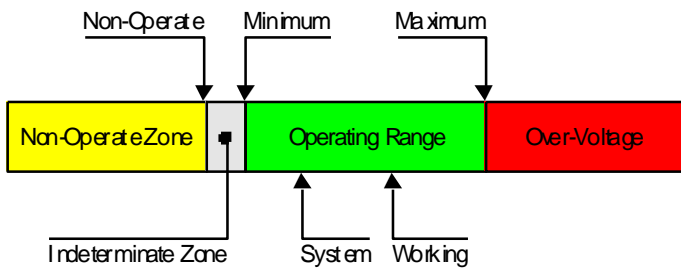
Operating Time

Make contacts: <10 ms to first touch at the rated voltage

Break contacts: <7 ms transition

Voltage Rating Definitions

The following definitions apply to the specification of relay voltage ratings. The terms highlighted in bold are used in this document when specifying voltage operating parameters.



- > The nominal **System** voltage is used to describe the DC system voltage.
- > The relay **Rated** voltage is the value assigned by the manufacturer as the reference voltage used to energize the relay for the declaration of the relay characteristics and is displayed on the TCM relay rating plate.
- > The normal **Working** voltage is the voltage at which the DC system battery is float charged to maintain it in a healthy condition.
- > The **Maximum** Operating voltage is also known as the Thermal Withstand Voltage and is the elevated voltage that may occur under boost charge conditions.
- > The **Minimum** Operating voltage is the minimum energizing voltage required to guarantee the relay will pick-up. This ensures correct operation in the event of the loss of the charger supply for considerable periods on battery fed DC systems.
- > The **Non-Operate** voltage is the maximum voltage level that may be applied, and the relay will not operate.
- > The **Indeterminate Zone** is the voltage window between the **Non-Operate** voltage and **Minimum** Operating voltage. In this zone the relay status (D/O or P/U), is not defined. There are several factors that affect the performance of the relay in this zone such as mechanical adjustment, coil resistance tolerance, ambient temperature and if the energizing voltage is applied as a step or a ramp.
- > Continuous application of an **Over-Voltage** condition may result in thermal damage.

Trip Voltage – Pick-up

All contacts pick-up when a voltage in the specified range is applied to the relay coil. The red LED flag is illuminated when the contacts are first operated and will remain visible until reset to indicate that a trip event has occurred.

Rated V dc	Non-Operate	Operating Range	
		Minimum	Maximum
110/125	<68	84	150
220/250	<137	168	300

Reset Voltage – Drop-out

The trip initiate command will drop-out when the input voltage is reduced in accordance with the following table.

Rated V dc	Guaranteed Drop-out
110/125	50
220/250	100

Electrical Reset

Reset voltage: As per the rated trip voltage pickup.

Coil Thermal Rating

All operate, reset and time delayed circuits are designed to withstand continuous application of maximum operating voltage at 55 degrees Celsius.

The high-speed operating coil elements are automatically economized in <60 ms to provide thermal protection.

High Speed Trip Functions

Trip Contacts and Flag Operation

The following tables describe the actions required to change the state of the TCM relay trip contacts and flag.

SR – Self reset

HR – Hand reset button

ER – Electrical reset input

N/C indicates no change of state.

Reset actions will only function after the trip initiate signal has been removed. Refer reset voltage drop-out.

TCM-1 SR Contacts + HR and ER Flag

Action	Contacts	Flag
Apply trip initiate signal	Pick-up	Operates
Remove trip initiate signal	Drop-out	N/C
Press reset button	N/C	Resets
Apply electrical reset signal	N/C	Resets

TCM-2 ER Contacts and Flag + HR Contacts and Flag

Action	Contacts	Flag
Apply trip initiate signal	Pick-up	Operates
Remove trip initiate signal	N/C	N/C
Press reset button	Drop-out	Resets
Apply electrical reset signal	Drop-out	Resets

TCM-3 ER Contacts + HR Contacts and Flag

Action	Contacts	Flag
Apply trip initiate signal	Pick-up	Operates
Remove trip initiate signal	N/C	N/C
Press reset button	Drop-out	Resets
Apply electrical reset signal	Drop-out	N/C

Fail-Safe Trip Function

In the event of loss of auxiliary supply to the TCM relay, the trip contacts will continue to operate in response to signals applied to the trip input. Under these conditions the TCM relay will function as a self-reset trip relay with an increased operated burden of ~1W. The LED trip indication and latching high burden contacts are automatically recovered when the auxiliary supply is restored. Should the electrical reset be energised during an auxiliary supply outage, the trip status will be reset.

Electrical Reset Interlock

In traditionally designed tripping relays, if the reset circuit is held energized while the relay operate input is energized, the relay may oscillate between the operated and reset states. The reset interlock feature incorporated in the TCM relay eliminates this condition and protects the relay from thermal damage by locking out the reset command when a relay operate voltage is present.

Refer reset voltage drop-out.

This feature operates in accordance with the requirements of ENA TS 48-4 2016 4.10.2 - Simultaneous energisation of the operate and reset coils.

Trip Contact Ratings

Contact material	Ag	
Isolation across open contacts	1 kV rms	
Make and carry	7 A all contacts 10 A any two contacts	
Peak inrush current (make and carry)	200 A for 10 ms 40 A for 0.5 s 30 A for 1 s	
DC break capacity (rated load)	Resistive (DC1)	7 A / 110 V 3 A / 220 V
	Inductive (L/R = 40 ms)	0.5 A / 110 V 0.15 A / 220 V
Maximum switching voltage	250 VDC / 440 VAC	
Minimum switching voltage	12 V	
Minimum switching current	10 mA	

Magnetic Arc Blowouts

Magnetic arc blowouts are a standard feature on all TCR modules. Their fitment provides greatly enhanced switching capabilities for inductive DC loads by extinguishing the electrical arcs initiated when the load is broken.

High Speed Trip Functions

High Burden Versions

High burden TCM relay versions are suitable for application in high security circuit breaker tripping circuits and specifically where the initiating contact may be remote from the trip relay. The high burden characteristic can also be used to facilitate satisfactory operation of current operated series relay elements - Refer to the section 'Operation of Series Elements'.

The high burden configuration provides maximum immunity to electrical disturbance and noise.

Capacitor Discharge Test

High burden TCM relay versions comply with the capacitor discharge test as defined in ENA TS 48-4. The relay will not operate when a 10uF capacitor charged to a specified test voltage is applied across the operate input of the relay.

Rated V dc	Test Voltage
110/125	150V dc
220/250	275V dc

Operating Burden

ENA TS 48-4 Issue 5 2016 Table 1

Operate burden during pick-up at rated voltage	
High burden	<150 W
Low burden	<100 W

Operated Burden

Maximum burden after pick-up at 23 degrees Celsius:

Rated V dc	Number of C/O Contacts	
	4 or 8	12 or 16
110/125	7.0W	10.5W
220/250	7.0W	12.5W

The total burden borne by the auxiliary supply after pick-up is equal to the Operated Burden tabulated above plus the Supervision Burden (TSS + TRS + one pole TCS).

Minimum Operate Current

Rated V dc	Low burden	High burden
110/125	>25 mA	>50 mA
220/250	>25 mA	>50 mA

Electrical Reset Burden

Electrical reset burden during drop-out at rated voltage	
Low / high burden models	<50 W (20W typical)

Time Delayed Cut Off

Economizing delay - Operate	>40 ms and <60 ms
- Reset	>40 ms and <60 ms

Operation of Series Elements

To provide additional or remote flagging and alarm functions, external current operated relay elements may be wired in series with the TCM trip operate input. A 50 ms time delayed cut off is incorporated in the TCC to ensure reliable operation of the current operated series relay elements. High burden specification TCM relays are recommended for this application. Care must be taken to ensure that the wiring and current coil burden does not drop the trip input signal below the TCM minimum operate voltage.

Low Burden Versions

Low burden TCM relay versions are suitable for application where wiring to the circuit breaker is short and specifically where the initiating contact is in the same panel. For small DC battery systems where power capacity is limited, the application of low burden tripping relays may offer an advantage.

Trip Circuit Supervision (TCS)

The trip circuit supervision function is available as an option and requires the addition of a TCS module for each CB circuit to be monitored.

Each TCS module provides two supervision elements to monitor the trip circuit, circuit breaker trip coil and the circuit breaker trip supply.

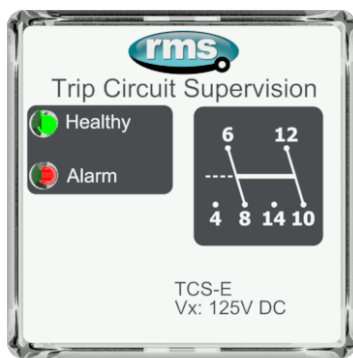
Supervision is active with the circuit breaker in the open or closed position via the “-a” and “-b” CB auxiliary contacts.

Supervision also remains active during tripping operations irrespective of the status of the tripping relay contact.

An important characteristic of the design is the low level of current required to flow through the CB coil for correct operation of the supervision scheme. A constant low supervision current is maintained irrespective of the circuit breaker open or closed position. This results in low power dissipation in the supervision circuit and the circuit breaker coil which reduces the possibility of nuisance tripping.

Under healthy conditions, the alarm relay coil is energized and if a fault is detected, the relay will drop out to initiate a supervision fail alarm. A time delay is incorporated to avoid nuisance tripping due to switching transients.

- > Option Code 1: 1x TCS Module
- > Option Code 2: 2x TCS Modules
- > Option Code 3: 3x TCS Modules



TCS Module

Functional Diagrams

Figures 1 to 6 depict how the supervision elements A and B monitor circuit continuity under all conditions:

Figure 1	CB open	Trip contact open	Auxiliary supply available
Figure 2	CB closing	Trip contact open	
Figure 3	CB closed	Trip contact open	
Figure 4	CB opening	Trip contact closed	
Figure 5	CB open	Trip contact closed	
Figure 6	Alarm condition		

Normal Operating Conditions

TRIP CIRCUIT AND CB TRIP SUPPLY HEALTHY

Normal operating condition is indicated on the front panel via a green LED and the alarm contact being picked up.

Supervision with Circuit De-energized

CIRCUIT BREAKER OPEN AND TRIP CONTACT OPEN

Figure 1 shows a typical tripping circuit with the TCS employed to supervise the circuit continuity, the circuit breaker coil and the auxiliary supply.

The blue lines depict the supervised circuits and red arrows the path of the supervision current through supervision element A with the auxiliary supply applied and the circuit breaker open.

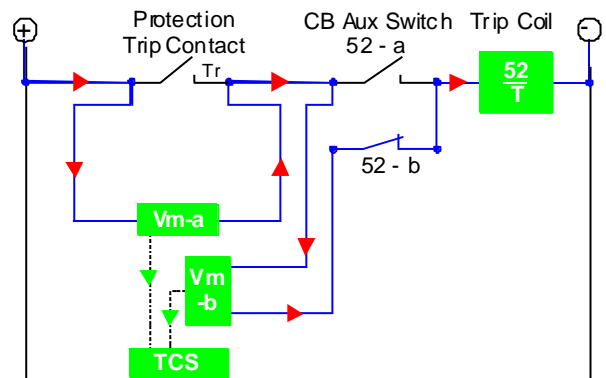


Figure 1

Supervision during Circuit Breaker Closure

CIRCUIT BREAKER CLOSING AND TRIP CONTACT OPEN

Closure of the circuit breaker could cause the supervision circuits to be interrupted for the duration of the circuit breaker operate time. During this interval, a >400 ms time delay holds in the alarm relay contacts.

Figure 2 shows the loss of supervision current through both the A and B supervision elements for the duration of the circuit breaker operating period.

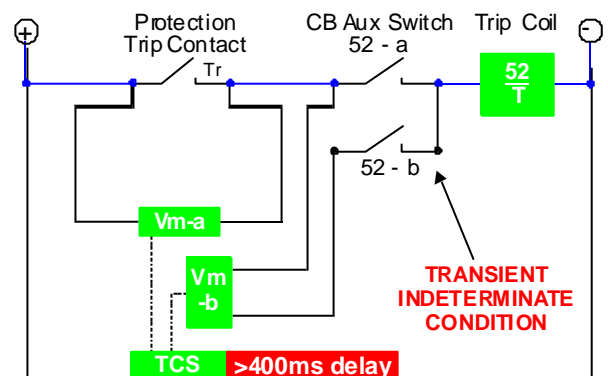


Figure 2

Supervision with Circuit Energized

CIRCUIT BREAKER CLOSED AND TRIP CONTACT OPEN

Figure 3 shows a typical tripping circuit with the TCS employed to supervise the circuit continuity, the circuit breaker coil and the auxiliary supply.

The blue lines depict the supervised circuits and red arrows the path of the supervision current through supervision element A with the auxiliary supply applied and the circuit breaker closed.

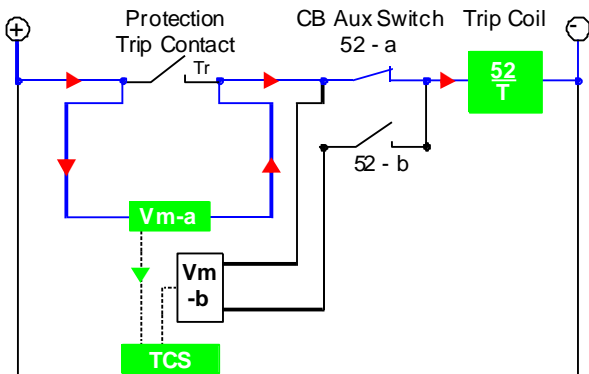


Figure 3

Supervision with Circuit Tripped

CIRCUIT BREAKER OPEN AND TRIP CONTACT CLOSED

Figure 5 shows the path of the supervision current with the auxiliary supply applied and the circuit breaker in the open condition. The blue lines depict the supervised circuits and red arrows the path of the supervision current through supervision element B. Note that the supervision element A is shorted out by the closed trip relay contact. Supervision will also function with the trip relay contact reset (Open), as shown in figure 5.

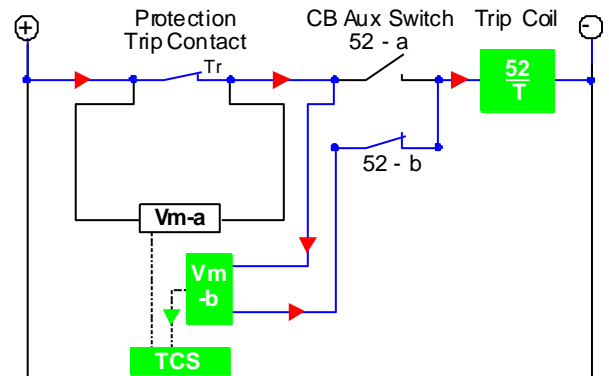


Figure 5

Supervision during Circuit Breaker Operation

CIRCUIT BREAKER OPENING AND TRIP CONTACT CLOSED

Operation of the protection relay trip contact will cause the supervision circuits to be interrupted for the duration of the circuit breaker operate time. During this interval a >400ms time delay holds in the TCS alarm relay contacts.

Figure 4 shows the loss of supervision current through both the A and B supervision elements for the duration of the circuit breaker operating period.

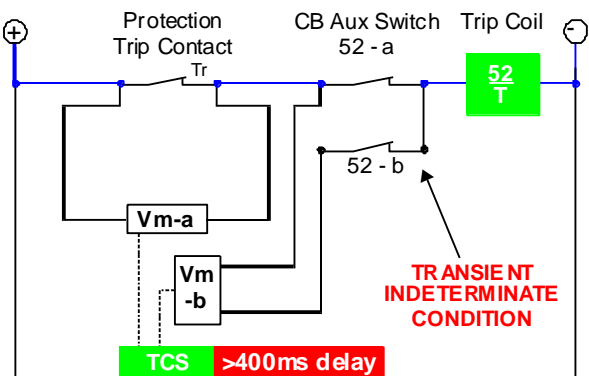


Figure 4

Abnormal Conditions

- > CB TRIP CIRCUIT FAIL
- > CB TRIP COIL FAIL
- > CB TRIP SUPPLY FAIL

Under abnormal trip circuit or CB trip coil conditions, supervision elements A and B will be unable to detect supervision current. After a time delay of 400-550 ms the TCS auxiliary alarm relay will drop out and the hand reset flag activated as per Figure 6. Under abnormal CB trip supply conditions, the TCS auxiliary alarm relay will drop out after a time delay of >400-550 ms. Loss of CB trip supply will cause the green healthy LED to be extinguished.

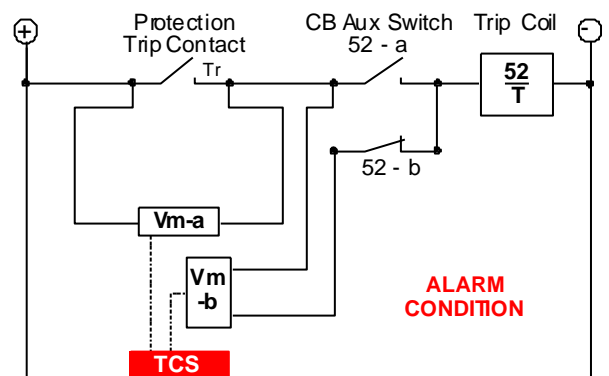


Figure 6

Trip Circuit Supervision Option

Trip Circuit Resistance & Supervision Current

The TCS circuit design is optimized to minimize the supervision current in the CB trip coil to avoid the possibility of nuisance tripping. Resistance of the CB trip coil must be less than the maximum tabulated below to ensure adequate supervision current flows through the TCS.

CB Open (52a Open and 52b Closed)			
Rated V dc	Maximum CB Trip Coil Resistance (ohms)	Supervision Channel Impedance (ohms)	Supervision Current* (mA)
110/125	21K	126K	<0.9
220/250	44K	248K	

CB Closed (52a Closed and 52b Open)			
Rated V dc	Maximum CB Trip Coil Resistance (ohms)	Supervision Channel Impedance (ohms)	Supervision Current* (mA)
110/125	21K	63K	<1.5
220/250	44K	124K	

* Based on maximum CB trip coil resistance.

TCS Module Supervision Connections

Wire across the N/O protection trip contact to be supervised.

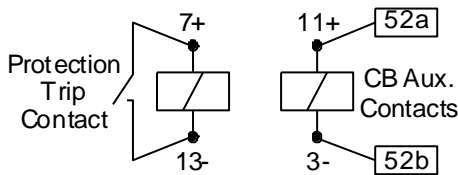


Figure 7

Auxiliary Supply Positive: Terminal 7

Auxiliary Supply Negative: Terminal 3

TCS Operating Range

PICK-UP VOLTAGE:

The alarm relay is guaranteed to be picked up, the green healthy LED illuminated and the red fail LED extinguished.

DROP-OUT VOLTAGE:

The alarm relay is guaranteed to be dropped out, the green healthy LED extinguished and the red fail LED illuminated.

Rated V dc	Pick-up	Drop-out	Maximum
110/125	88	70	150
220/250	176	150	300

Dips and Interruptions

Minimum period required to activate alarm condition:

Trip circuit fail: 400-550 ms

Loss of supply: 400-550 ms

TCS Circuit Burdens

Maximum TCS module burdens at 23 degrees Celsius:

Rated V dc	Auxiliary Supply		Supervision Channels	
	Healthy	Alarmed	52a open 52b closed	52a closed 52b open
110/125	2.7W	0.8W	0.13W	0.26W
220/250	3.2W	1.0W	0.26W	0.52W

TCS Alarm Contact Ratings

Contact material	AgNi	
Maximum switching voltage	250 V / 440 V AC	
Minimum switching voltage	5 V	
Minimum switching current	5 mA	
Contact resistance	< 100 mΩ (initial)	
Rated Load (capacity)	AC1	8 A / 250 V AC
	DC1	8 A / 24 V DC
	AC15 (B300)	3 A/120 V 1.5 A/240 V
	AC3	550 W (single phase motor)
	DC13 (R300)	0.22 A/120 V 0.1 A/250 V
Max AC breaking capacity	2,000 VA	

TCM Relay Configuration

Chassis Size and Wiring Diagrams – Refer TCM Relay Order Code Generator on page 28

Trip Function	Supervision Code*	Trip Contacts		Module Positions - Figure 8						Chassis Size	Wiring Diagram	TCM Relay Order Code		
				TCC Module	TCR Modules			TCS Modules						
TCM-1 Self-Reset Contacts Hand and Electrical Reset Flag	1	1	4 C/O	A	C	-	-	-	B	-	-	4	2	TCM-111
	0	2	8 C/O	A	C	D	-	-	-	-	-	4	3	TCM-102
	1			A	C	D	-	-	B	-	-	4	4	TCM-112
	3	3	8 C/O	A	C	E	-	-	B	D	F	6	10	TCM-132
	0			A	B	C	D	-	-	-	-	4	5	TCM-103
	1	3	12 C/O	A	C	D	E	-	B	-	-	6	6	TCM-113
				2	A	C	D	E	-	B	F	-	6	7
	0	4	16 C/O	A	C	D	E	F	-	-	-	6	8	TCM-104
	1			A	C	D	E	F	B	-	-	6	9	TCM-114
TCM-2 Latching Contacts Hand and Electrical Reset Contacts and Flag	1	1	4 C/O	A	C	-	-	-	B	-	-	4	2	TCM-211
	0	2	8 C/O	A	C	D	-	-	-	-	-	4	3	TCM-202
	1			A	C	D	-	-	B	-	-	4	4	TCM-212
	3	3	8 C/O	A	C	E	-	-	B	D	F	6	10	TCM-232
	0			A	B	C	D	-	-	-	-	4	5	TCM-203
	1	3	12 C/O	A	C	D	E	-	B	-	-	6	6	TCM-213
				2	A	C	D	E	-	B	F	-	6	7
	0	4	16 C/O	A	C	D	E	F	-	-	-	6	8	TCM-204
	1			A	C	D	E	F	B	-	-	6	9	TCM-214
TCM-3 Latching Contacts Electrical Reset Contacts Hand Reset Contacts and Flag	1	1	4 C/O	A	C	-	-	-	B	-	-	4	2	TCM-311
	0	2	8 C/O	A	C	D	-	-	-	-	-	4	3	TCM-302
	1			A	C	D	-	-	B	-	-	4	4	TCM-312
	3	3	8 C/O	A	C	E	-	-	B	D	F	6	10	TCM-332
	0			A	B	C	D	-	-	-	-	4	5	TCM-303
	1	3	12 C/O	A	C	D	E	-	B	-	-	6	6	TCM-313
				2	A	C	D	E	-	B	F	-	6	7
	0	4	16 C/O	A	C	D	E	F	-	-	-	6	8	TCM-304
	1			A	C	D	E	F	B	-	-	6	9	TCM-314

Notes: *
 Supervision Code 0 = Trip supply + trip relay supervision
 Supervision Code 1 = Trip supply + trip relay + 1x TCS Module
 Supervision Code 2 = Trip supply + trip relay + 2x TCS Modules
 Supervision Code 3 = Trip supply + trip relay + 3x TCS Modules

TCC = Trip Circuit Control Module
 TCR = Trip Circuit Relay Module
 TCS = Trip Circuit Supervision Module

TCM Relay Configuration

Module Identification Panel

A Module Identification label is fitted to the TCM Chassis to identify the TCM Modules required and the correct mounting position. Examples for each TCM chassis size are shown in Figure 8.

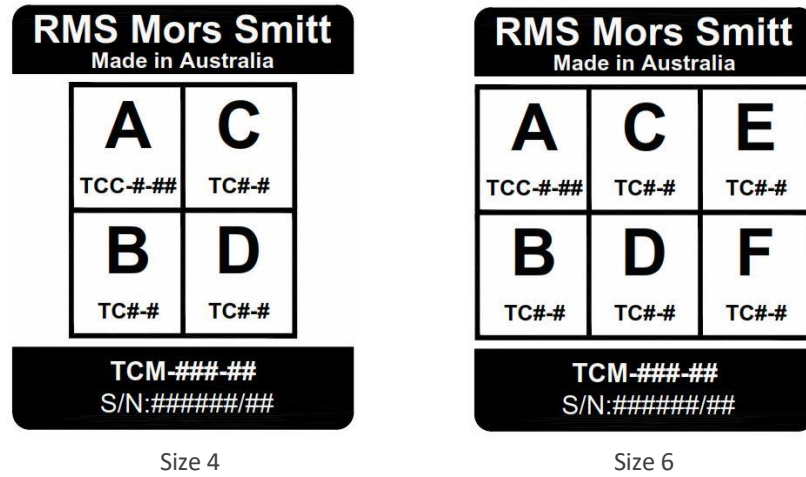


Figure 8: Module identification labels

Connection Diagrams

Connection diagrams are displayed on the front and top surfaces of each TCM Module. Refer to Figure 12 for terminal positions.

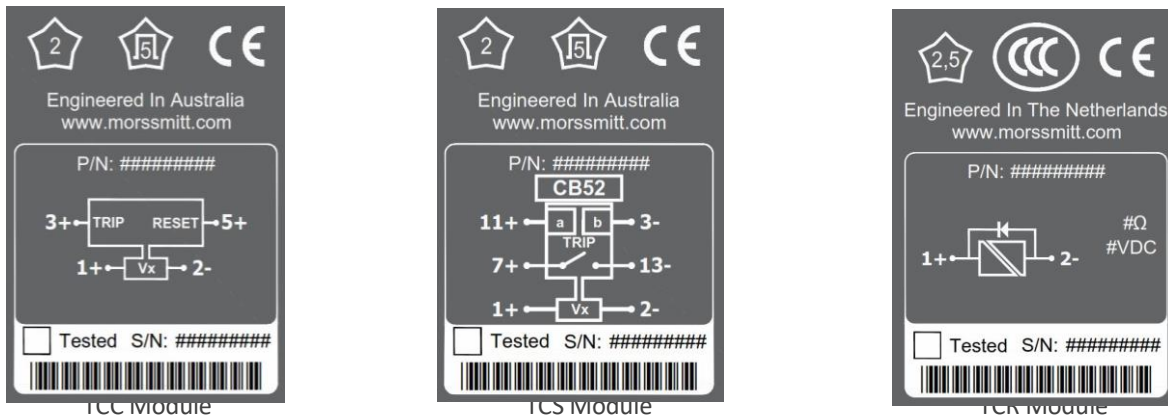


Figure 9: Auxiliary connection diagram printed on the top surface of each TCM Module

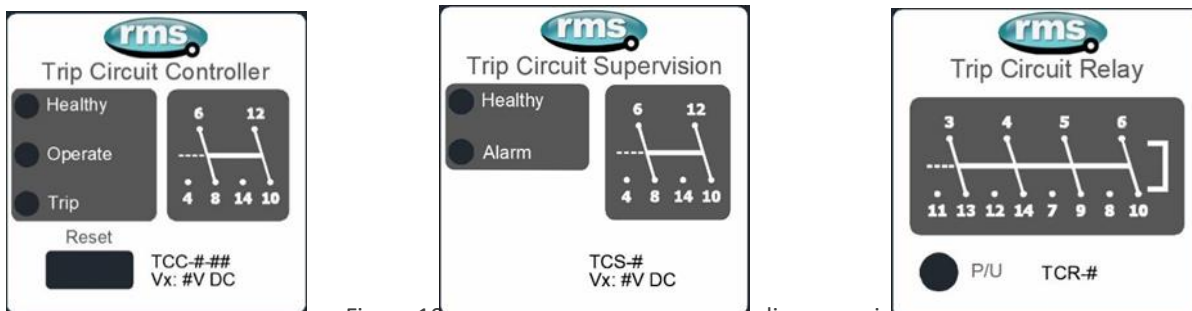


Figure 10: Output contact connection diagram printed on the front surface of each TCM Module

TCM Relay Configuration

Product Identification

Typical identification positions for all TCM chassis. Size 4 chassis depicted with cover removed.

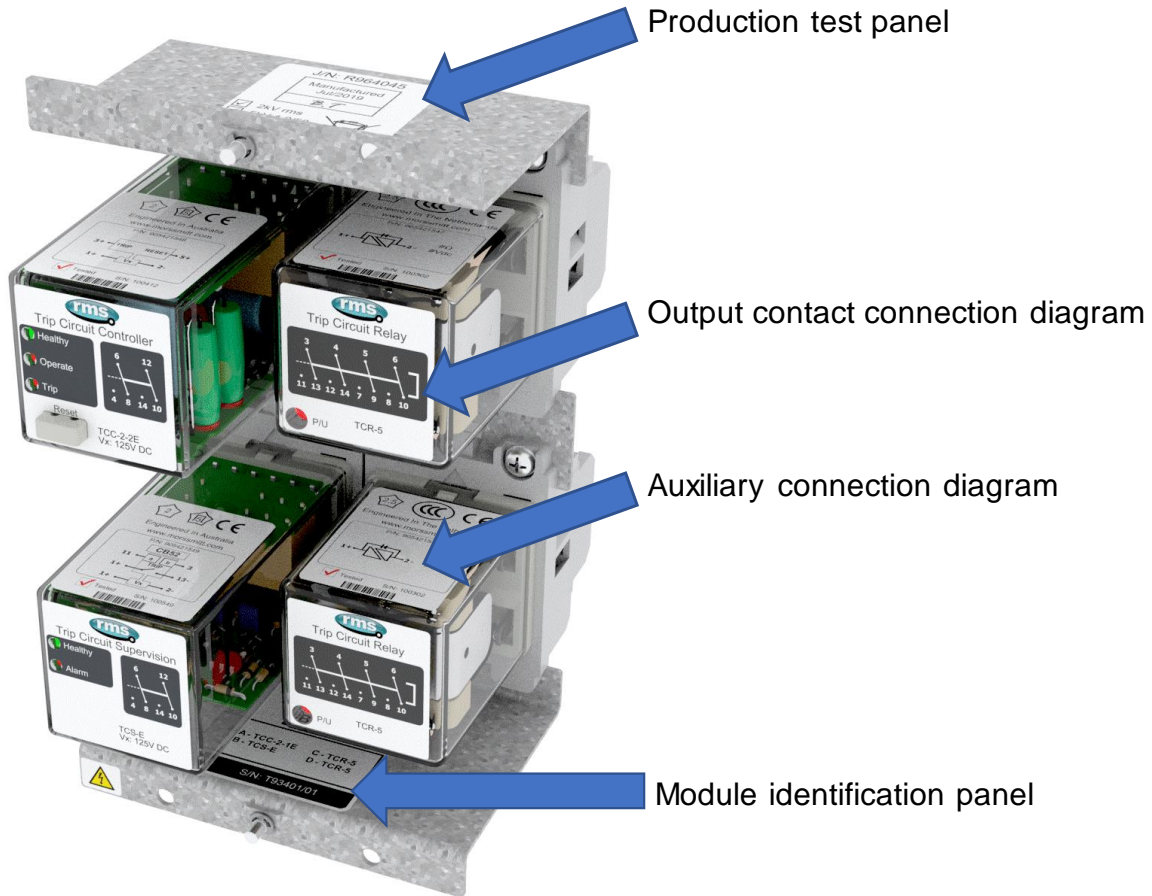


Figure 11

TBD Terminal Block Layout

Common terminal block layout for all TCM Relay Module positions A to F.
 M4 screws with integrated lock washers suitable for ring lug terminals.
 Two ring lugs may be fitted per screw point back to back.
 Each ring lug can accommodate up to 2.5 square mm copper conductors.



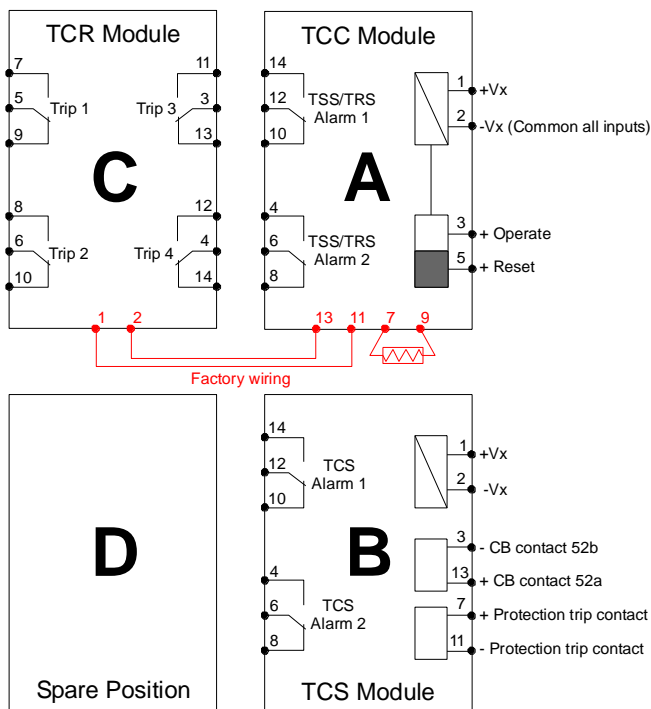
Figure 12

Wiring Diagrams

All diagrams viewed from rear terminal side – No auxiliary supply and all contacts dropped out

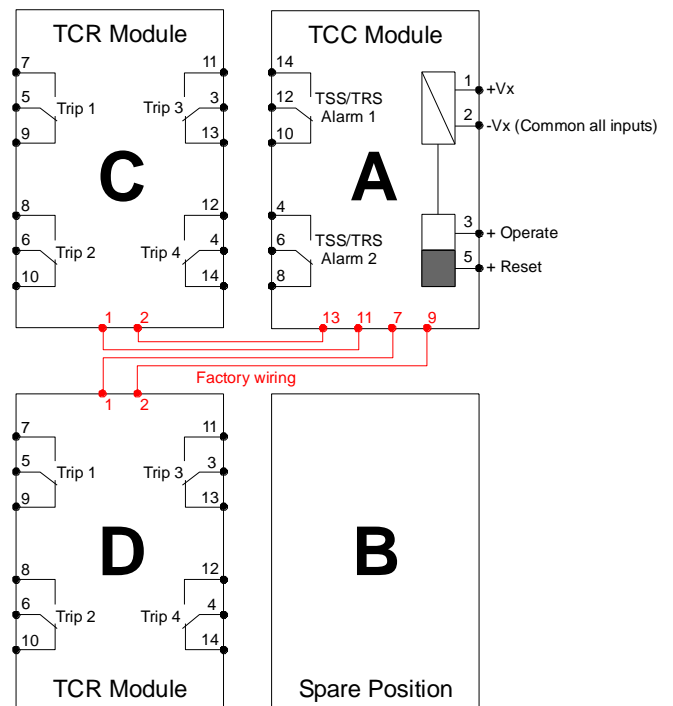
Note that connection diagrams are displayed on the front and top surfaces of each TCM Module – Refer Figures 9 and 10.

TCM-111 / TCM-211 / TCM-311



Wiring Diagram 2

TCM-102 / TCM-202 / TCM-302



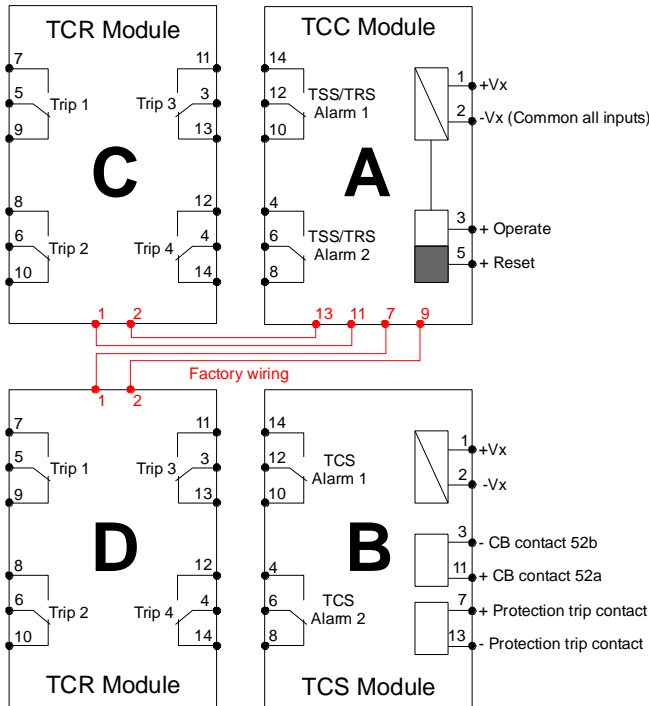
Wiring Diagram 3

Wiring Diagrams

All diagrams viewed from rear terminal side – No auxiliary supply and all contacts dropped out

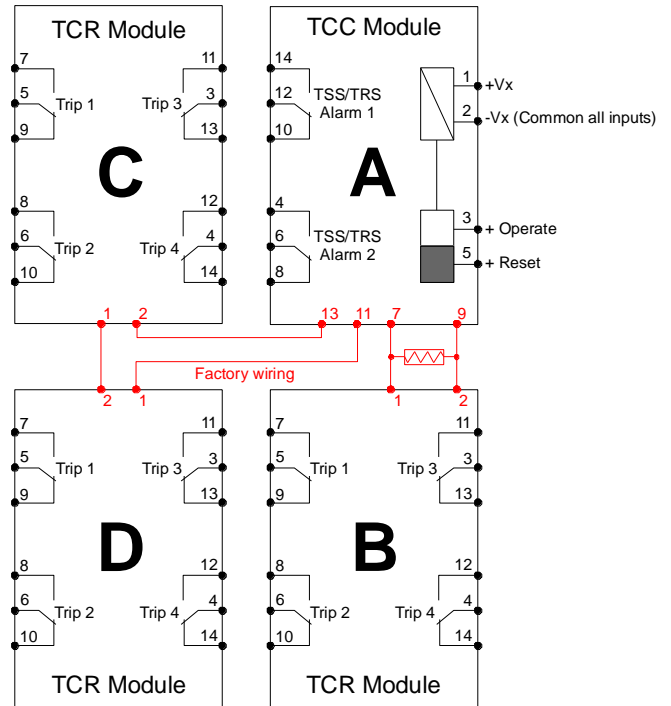
Note that connection diagrams are displayed on the front and top surfaces of each TCM Module – Refer Figures 9 and 10.

TCM-112 / TCM-212 / TCM-312



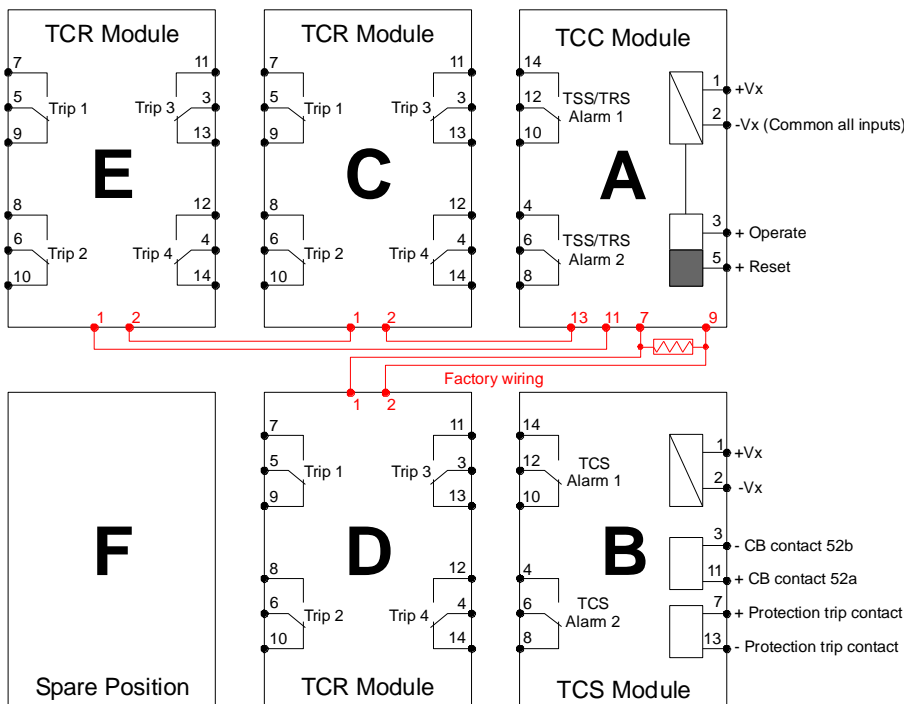
Wiring Diagram 4

TCM-103 / TCM-203 / TCM-303



Wiring Diagram 5

TCM-113 / TCM-213 / TCM-313



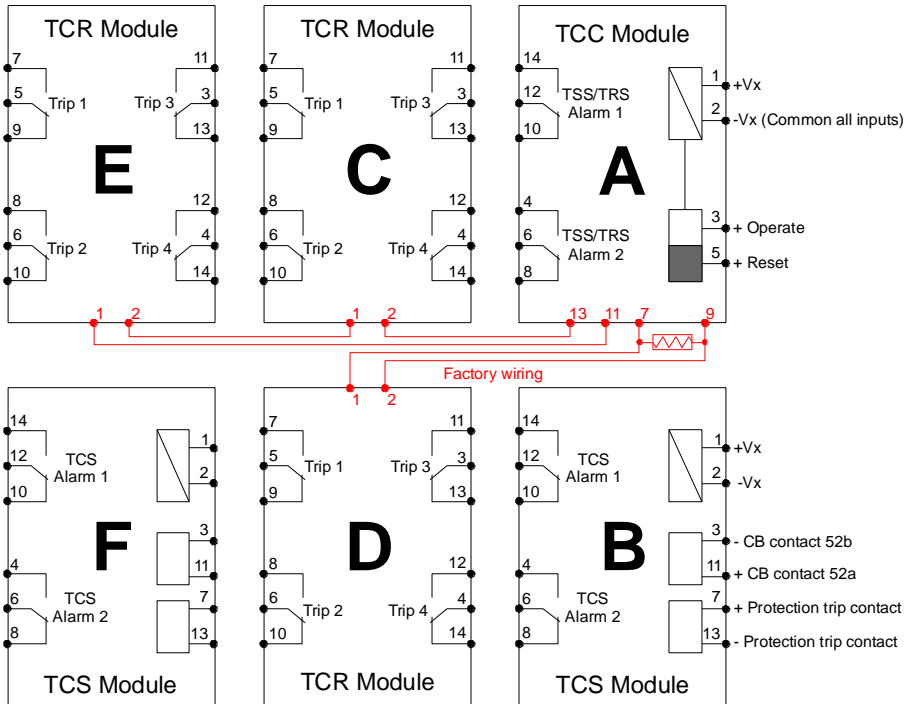
Wiring Diagram 6

Wiring Diagrams

All diagrams viewed from rear terminal side – No auxiliary supply and all contacts dropped out

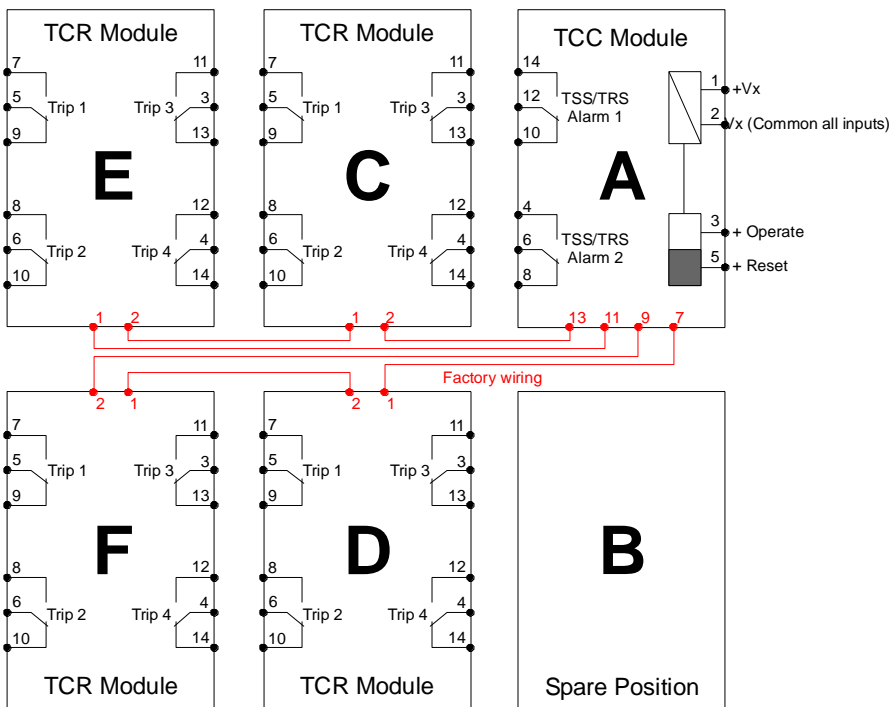
Note that connection diagrams are displayed on the front and top surfaces of each TCM Module – Refer Figures 9 and 10.

TCM-123 / TCM-223 / TCM-323



Wiring Diagram 7

TCM-104 / TCM-204 / TCM-304



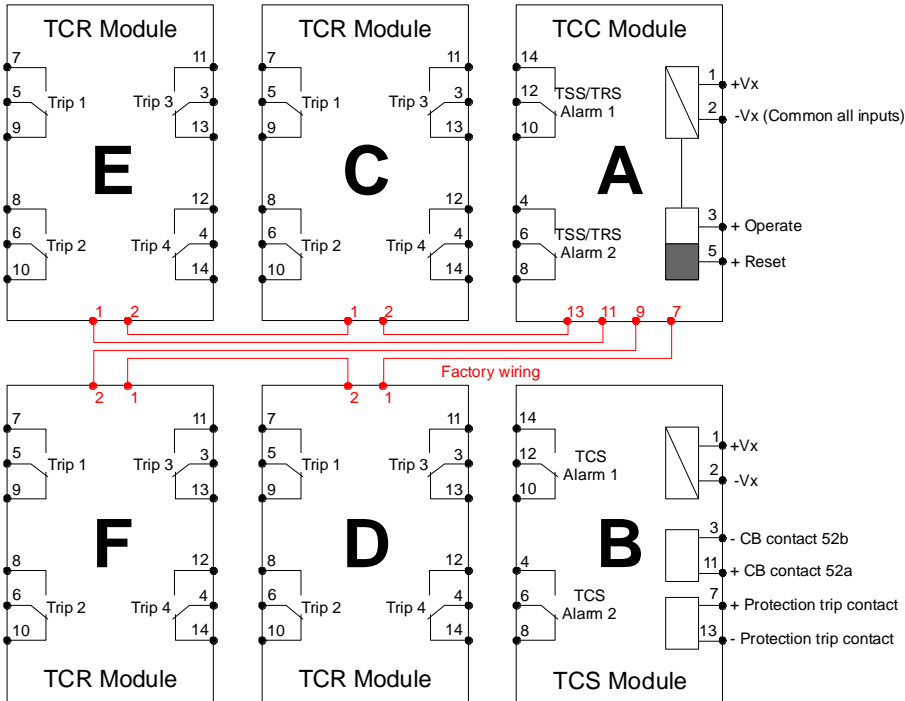
Wiring Diagram 8

Wiring Diagrams

All diagrams viewed from rear terminal side – No auxiliary supply and all contacts dropped out

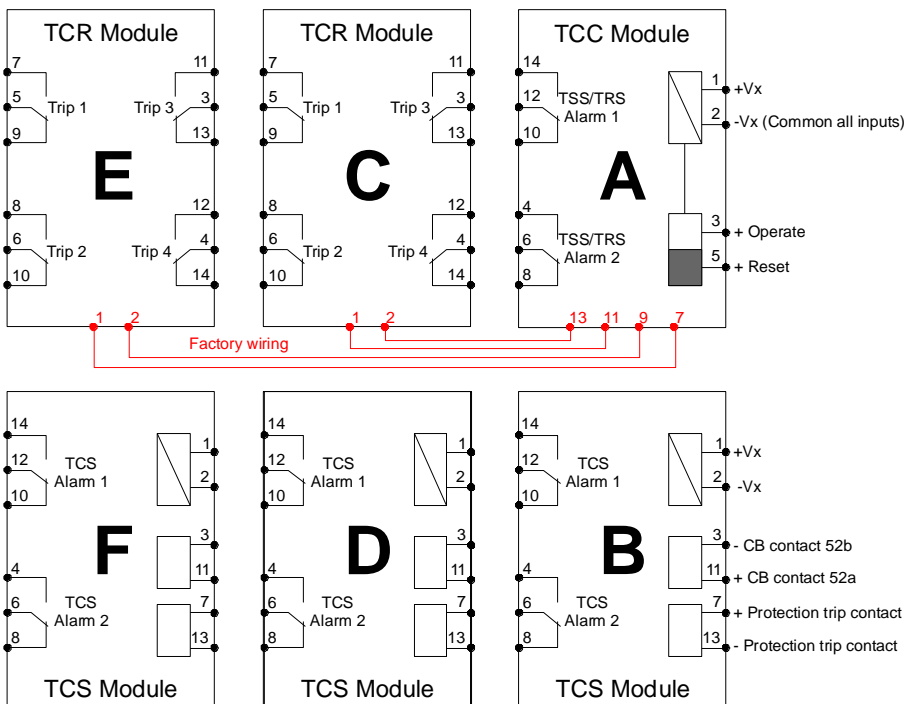
Note that connection diagrams are displayed on the front and top surfaces of each TCM Module – Refer Figures 9 and 10.

TCM-114 / TCM-214 / TCM-314



Wiring Diagram 9

TCM-132 / TCM-232 / TCM-332



Wiring Diagram 10

TCM Chassis Configuration

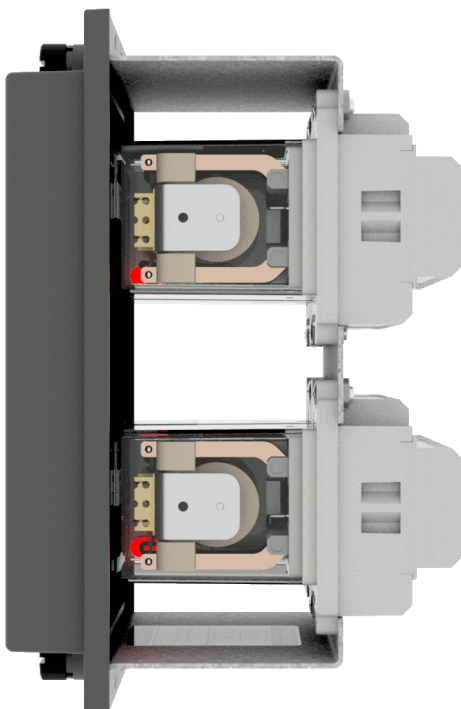
TCM Chassis Configuration

Size 4 Chassis

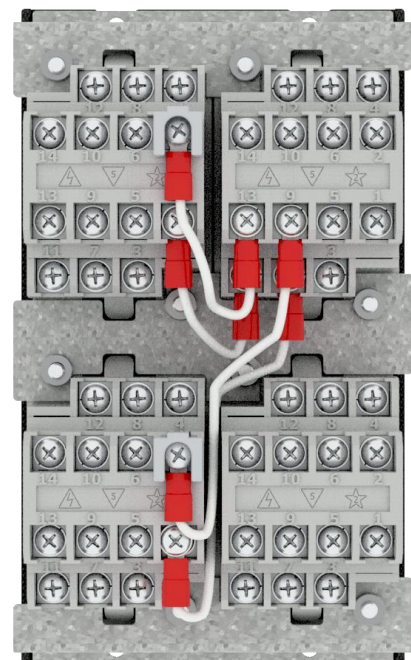
TCM relay example with TCC module + two TCR modules + one optional TCS module - Wiring Diagram 4.



3D view – 4U high and 4U wide



Side view – Cover ON



Rear terminal view
(Note factory wiring)

TCM Chassis Configuration

Size 6 Chassis

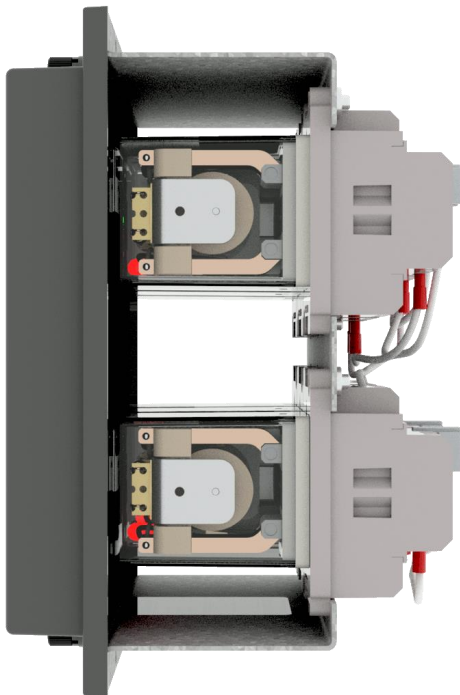
TCM relay example with TCC module + four TCR modules + one optional TCS module - Wiring Diagram 9.



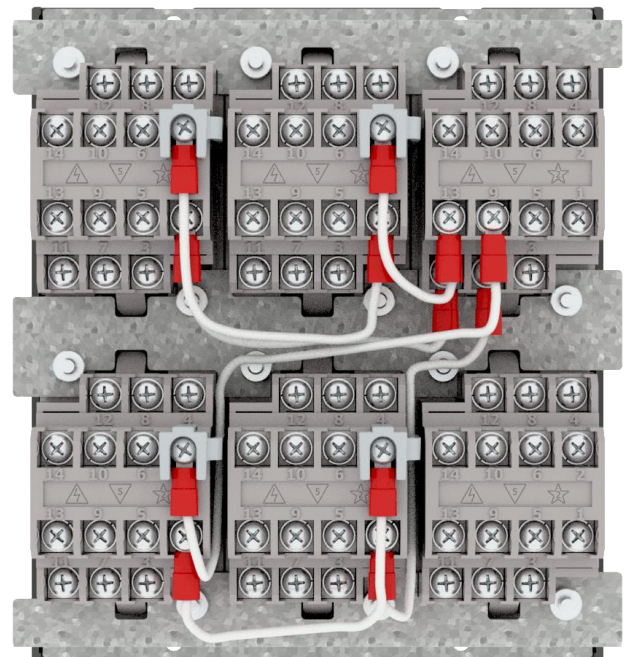
3D view – 4U high and 6U wide



Front view – Cover ON



Side view – Cover ON



Rear terminal view

Dimensional Drawings

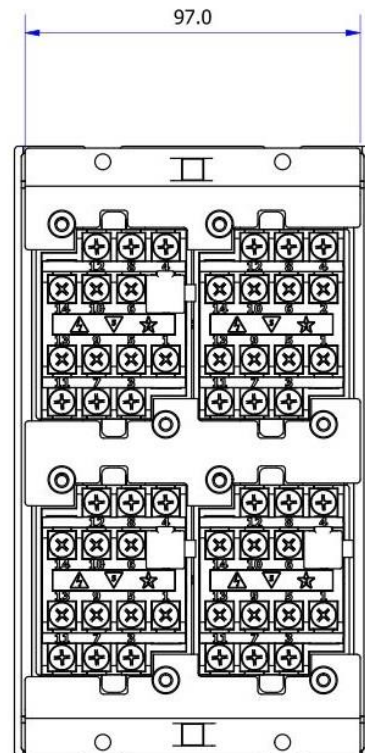
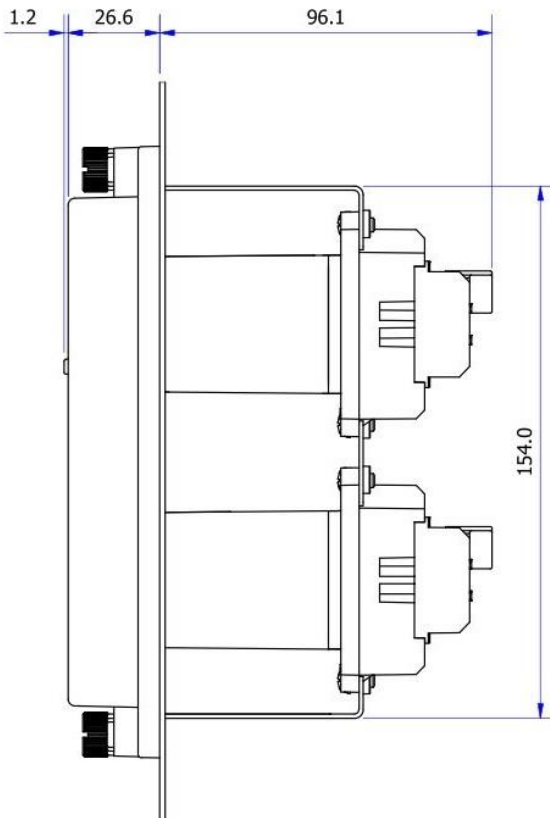
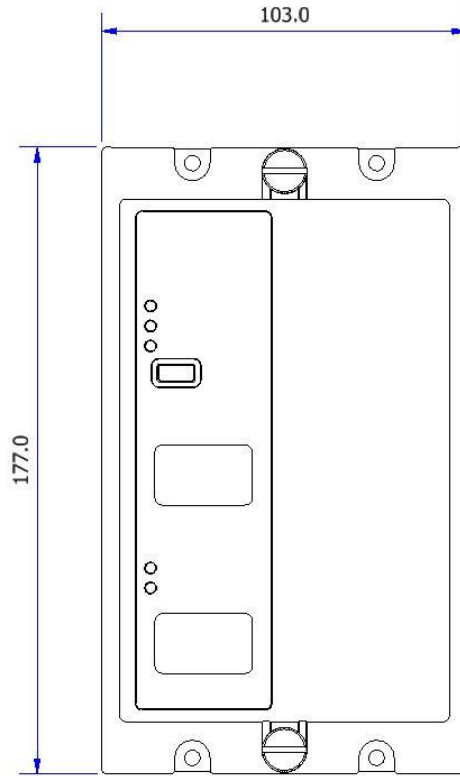
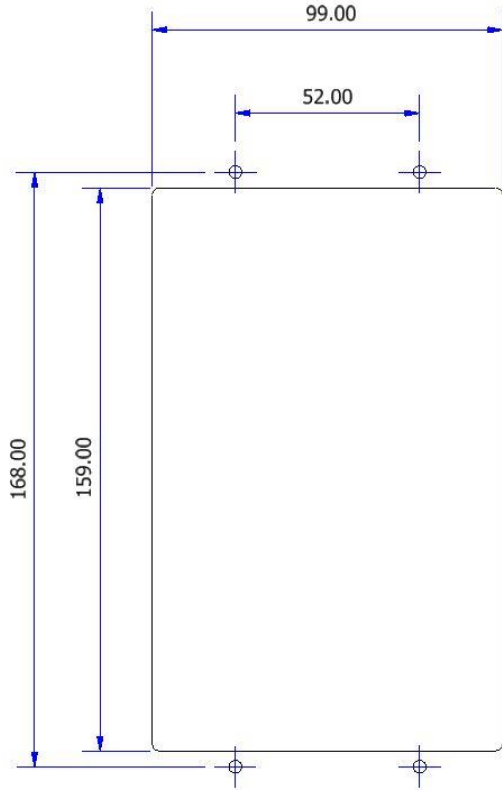


Dimensional Drawings

Size 4 Chassis

Panel cut-out for flush mount
4U wide, 4U high rack mount

PANEL THICKNESS (T)	HOLE DIA (Ø)
1mm < T < 2mm	3.6mm
T > 2mm	3.7mm

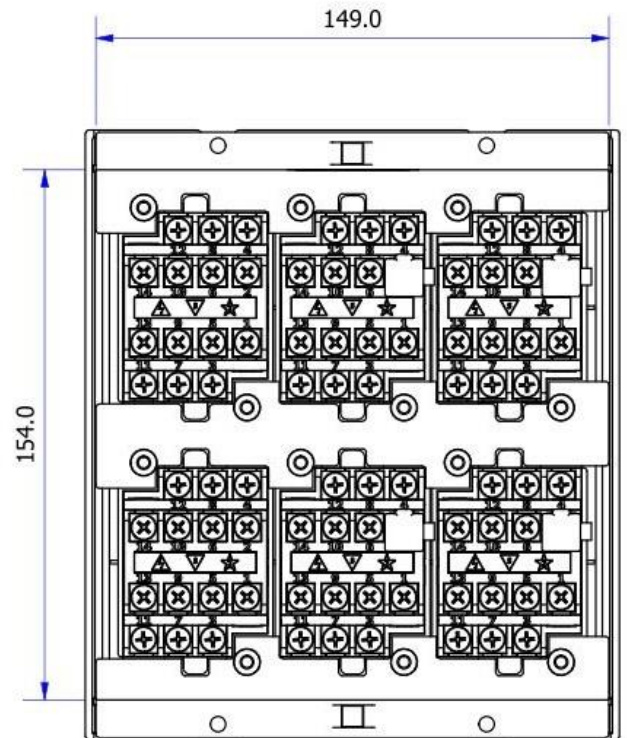
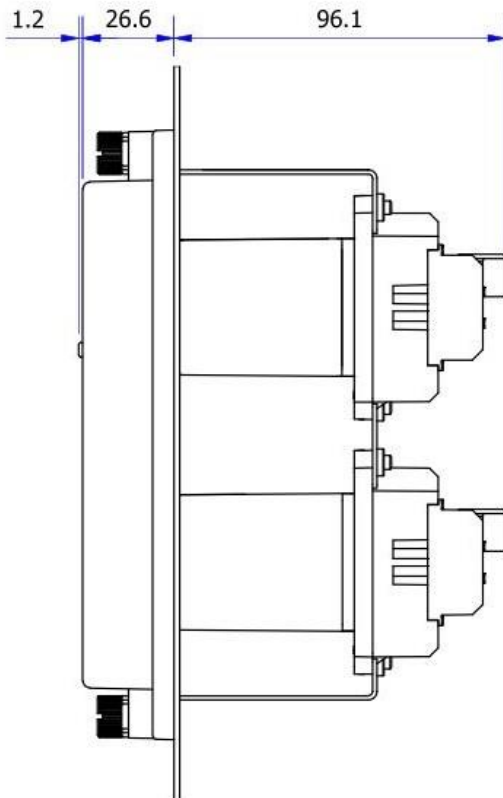
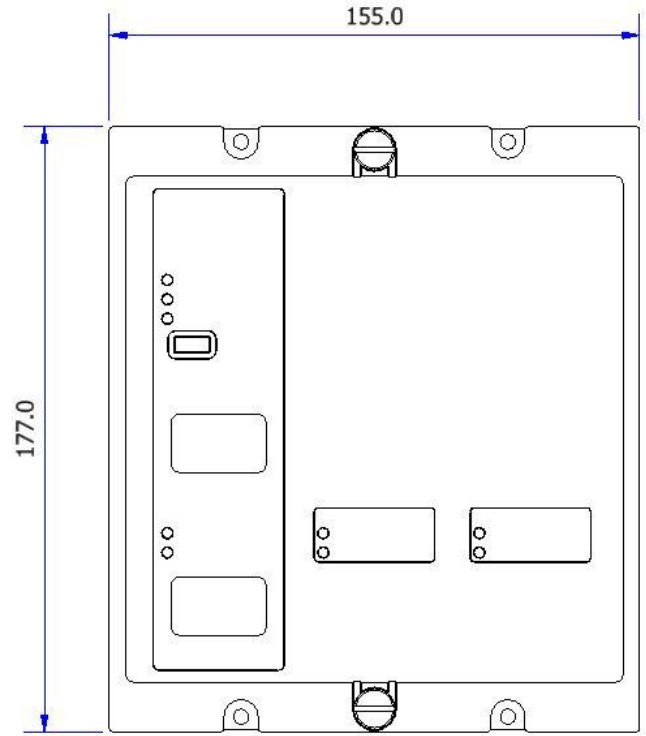
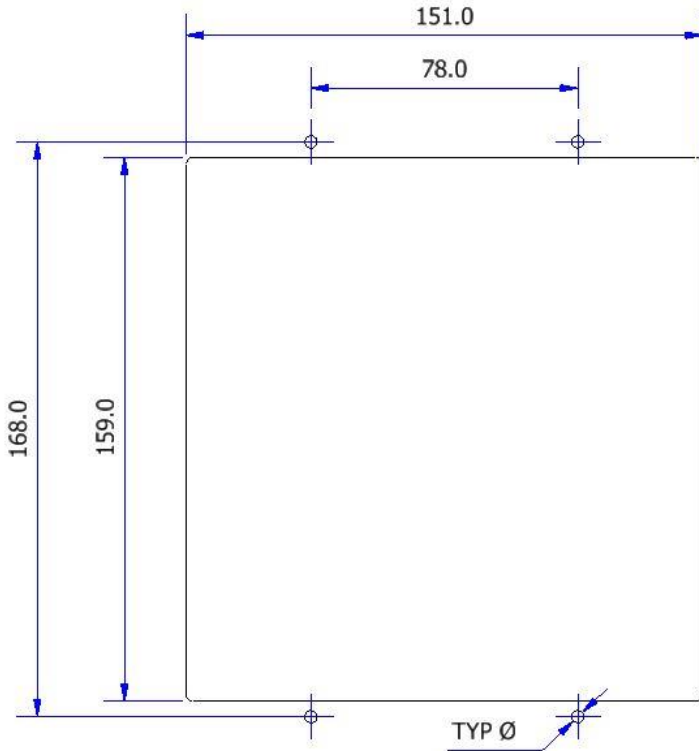


Dimensional Drawings

Size 6 Chassis

Panel cut-out for flush mount
26 wide, 4U high rack mount

PANEL THICKNESS (T)	HOLE DIA (Ø)
1mm < T < 2mm	3.6mm
T > 2mm	3.7mm



ATMOSPHERIC ENVIRONMENT

Temperature

Standard	IEC 60068-2-1, IEC 60068-2-2	
Test Identification	Test specification	Auxiliary power Supply voltage
Operating Range	-10 to +55°C	Min and Max
Storage Range	-25 to +70°C	Non-energized
Test duration	16 hours at top and bottom temperatures	

Damp Heat (Humidity)

Standard	IEC 680068-2-78	
Test Identification	Test specification	
Operating Range	40°C and 93% RH non-condensing	
Test duration	16 hours	

IP Rating

Standard	IEC 60529	
Test Identification	Test specification	
Installed	IP5x	

MECHANICAL ENVIRONMENT

Vibration - Sinusoidal

Standard	IEC 60255-21-1 Class 1	
Test Identification	Test specification	Variation
Vibration Response in each of 3 axes	0.035 mm/0.5 gn peak 1 sweep cycle 10-150 Hz	≤5%
Vibration Endurance in each of 3 axes	1.0 gn peak 20 sweep cycles 10-150 Hz	Non-energized

Shock and Bump

Standard	IEC 60255-21-2 Class 1	
Test Identification	Test specification	Variation
Shock Response in each of 3 axes	5 gn, 11 ms, 3 pulses in each direction	≤5%
Shock Withstand in each of 3 axes	15 gn, 11 ms, 3 pulses in each direction	Non-energized
Bump Test in each of 3 axes	10 gn, 16 ms, 1,000 bumps in each direction	Non-energized

Seismic

Standard	IEC 60255-21-3 Class 2	
Test Identification	Test specification	Variation
Seismic Response Horizontal, on each axis	7.5 mm/2.0 gn, 1 sweep cycle 1-35Hz	≤5%
Seismic Response Vertical	3.5 mm/1.0 gn, 1 sweep cycle 1-35Hz	≤5%

EMC IMMUNITY

Electrostatic Discharge (ESD)

Standard	IEC 60255-26, #7.2.3, Acceptance criterion B	
Port	Enclosure	
Test Identification	Test specification	Variation
Air Discharge	8 kV	≤5%
Contact discharge	6 kV	≤5%

Radiated Electromagnetic Field

Standard	IEC 60255-26, #7.2.4, Acceptance criterion A	
Port	Enclosure	
Test Identification	Test specification	Variation
Frequency sweep	10 V rms, 80 to 1,000 MHz 1,400 to 2,700 MHz	≤5%
Spot frequencies	10 V rms, 80, 160, 380, 450, 900, 1,850 and 2,150 MHz	≤5%

Fast Transients (EFT)

Standard	IEC 60255-26, #7.2.5, Acceptance criterion B	
Port	Input and Output ports	
Test level	Test specification	Variation
Zone A	4 kV peak, 5/50 ns, 5 kHz	≤5%

Slow Damped Oscillatory Wave (HFD)

Standard	IEC 60255-26, #7.2.6, Acceptance criterion B	
Port	Input and Output ports	
Test Identification	Test specification	Variation
Common Mode	1 MHz 2.5 kV peak	≤5%
Differential Mode	1 MHz 1.0 kV peak	≤5%

Surge

Standard	IEC 60255-26, #7.2.7, Acceptance criterion B	
Port	Input and Output ports	
Test Identification	Test specification	Variation
Line-to-earth	4 kV peak	≤10%
Line-to-line	2 kV peak	≤10%

Conducted Disturbance Induced by RF Fields

Standard	IEC 60255-26, #7.2.8, Acceptance criterion A	
Port	Input and Output ports	
Test Identification	Test specification	Variation
Frequency sweep	10 V rms, 0.15 to 80 MHz	≤5%
Spot frequencies	10 V rms, 27 and 68 MHz	≤5%

Power Frequency Magnetic Field

Standard	IEC 60255-26, #7.2.10	
Port	Enclosure only	
Test Identification	Test specification	
Continuous ≥ 60 s	30 A/m - Acceptance criterion A	
Short time 1 s to 3 s	300 A/m - Acceptance criterion B	

Capacitive Discharge Immunity

Standard	ENA TS 48-4, Issue 4, 2010	
Port	Operate port of a High Burden relay	
Rated Voltage	Test voltage (Vcap)	Criterion
	10 µF capacitor charged to 120% x Vnom	No mal-operation
@ 110/125V dc	150V	
@ 220/250V dc	275V	

EMC EMISSIONS

Emission Enclosure

Standard	IEC 60255-26
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TCM relay is exempt from EMC Emissions testing as there are no frequency sources greater than 9kHz.

ELECTRICAL ENVIRONMENT

Clearances and Creepage Distances

Standard	IEC 60255-26, #10.6.3
Test Identification	Test specification
Pollution degree	2
Overvoltage category	III
Rated insulation voltage	300 V dc
Clearances and Creepage Compliance	CAD drawings assessment

Safety-related Electrical Tests

Standard	IEC 60255-27, #10.6.4
Test Identification	Test specification
Between Independent Circuits	5 kV 1.2/50 μ s 0.5 J 3 pulses of each polarity 2.0 kV ac rms for 1 minute
Any Terminal and Earth	5 kV 1.2/50 μ s 0.5 J 3 pulses of each polarity 2.0 kV ac rms for 1 minute
Across Normally Open Contacts	1 kV ac rms for 1 min

Electrical Environment and Flammability

Standard	IEC 60255-27, #10.6.5
Test Identification	Test specification
Single-fault condition	Assessment for Opened and Closed-circuit cases
Maximum temperature of accessible parts at ambient temperature +40°C	< 80°C
Flammability of insulating materials, components and fire enclosures	Assessment

Reverse Polarity and Slow Ramp Test

Standard	IEC 60255-27, #10.6.6
Test Identification	Test specification
Maximum voltage dc	V start-up + 20%
Minimum voltage dc	V shutdown - 20%
Ramp down/up gradient	1 V/min

AC Component in DC (Ripple)

Standard	IEC 60255-26, #7.2.12
Test Level	Acceptance criterion A
15% of rated DC value	Test specification

Gradual Shut-down/Start-up (DC Power Supply)

Standard	IEC 60255-26, #7.2.13
Test Identification	Acceptance criterion C
Shut-down ramp	Test specification
Power off	60 s
Start-up ramp	5 min

TCM Relay Order Codes

TCM -		-		Trip Circuit Management Relay	
Trip Function	1				SR contacts + HR flag
	2				ER contacts and flag + HR contacts and flag
	3				ER contacts + HR contacts and flag
Supervision Function	0				Trip supply (TSS) + trip relay supervision (TRS) - Standard
	1				Trip supply + trip relay + 1x trip circuit supervision (TCS)
	2				Trip supply + trip relay + 2x trip circuit supervision
	3				Trip supply + trip relay + 3x trip circuit supervision
Trip Contacts		1			4 C/O
		2			8 C/O
		3			12 C/O
		4			16 C/O
Operate Burden			1		High burden operation
			2		Low burden operation
Rated Voltage					
				E	110/125 V dc
				H	220/250 V dc

Note on TCM order codes

Not all TCM order codes are able to be manufactured, confirm your TCM model against the listed models below:

Manufacturable TCM Model Variants				
TCM Model	Number of Contacts	Number of TCS Modules	Total number of Modules	Chassis Size
TCM-102, 202, 302	8	0	3	4
TCM-103, 203, 303	12	0	4	4
TCM-104, 204, 304	16	0	5	6
TCM-111, 211, 311	4	1	3	4
TCM-112, 212, 312	8	1	4	4
TCM-113, 213, 313	12	1	5	6
TCM-114, 214, 314	16	1	6	6
TCM-121, 221, 321	4	2	4	4
TCM-122, 222, 322	8	2	5	6
TCM-123, 223, 323	12	2	6	6
TCM-131, 231, 331	4	3	5	6
TCM-132, 232, 332	8	3	6	6



RMS Mors Smitt
A *Wabtec* Company

RMS Mors Smitt
19 Southern Court
Keysborough, VIC 3173, Australia
Tel: +61 (0)3 8544 1200
sales.rms@wabtec.com



RMS Mors Smitt
A *Wabtec* Company

Wabtec Netherlands B.V.
Darwinstraat 10
6718 XR Ede, Netherlands
Tel: +31 (0)88 600 4500
sales.msbv@wabtec.com



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