RMS Mors Smitt
A Wabtec company

4M400 / 4M420 User Guide

Test Block System

RMS Mors Smitt

Advanced Protection Devices

User Guide

4M400 User Guide

About This Manual

This User Guide covers all 4M400 test blocks manufactured from January 2025. Earlier test blockss do not necessarily incorporate all the features described. Our policy of continuous development means that extra features & functionality may have been added.

The 4M400 User Guide is designed as a generic document to describe the common operating parameters for all test blocks built on this platform.

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Contents

Documentation

Technical Bulletin

The detailed technical attributes, functional description & performance specifications for the 4M400 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 4M400 test block versions & describes the generic features & attributes common across all versions.

Introduction

4M400 Test blocks enable test technicians to quickly and safely isolate protection relays so that test signals may be injected and system performance verified.

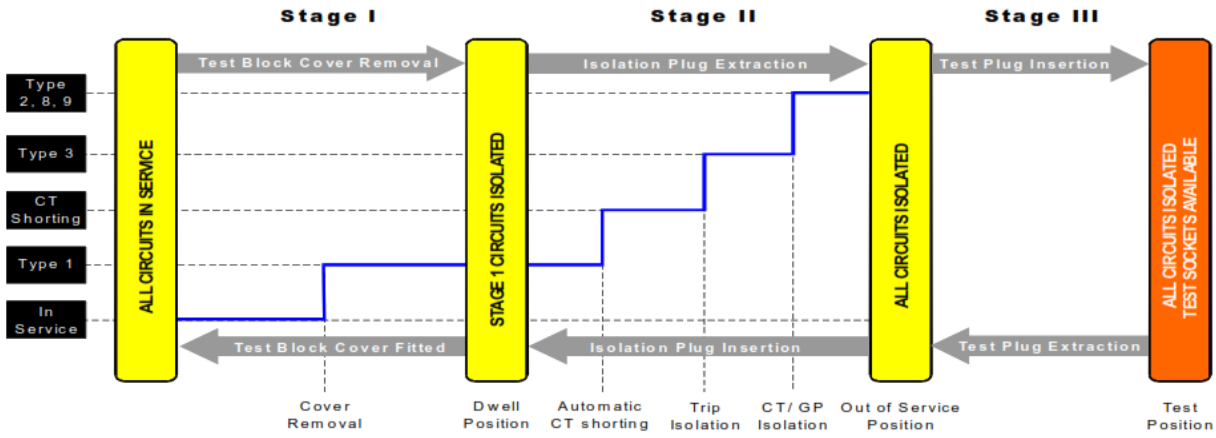
The 4M400 Test Block system is designed as a general-purpose isolation and test signal injection point.

A safety feature of the 4M400 test block is the inbuilt automated CT shorting located within the test block. The test block operator has no need to install manual CT shorting links which can often be omitted or installed in the wrong position.

'Finger safe' sockets are employed to improve operator safety and suit 4mm shrouded 'finger safe' type banana plugs.

Equipment under test need only be removed for servicing if problems are detected or for routine maintenance.

The 4M400 Test Block achieves staged isolations for the different circuit types according to the following timing diagram:



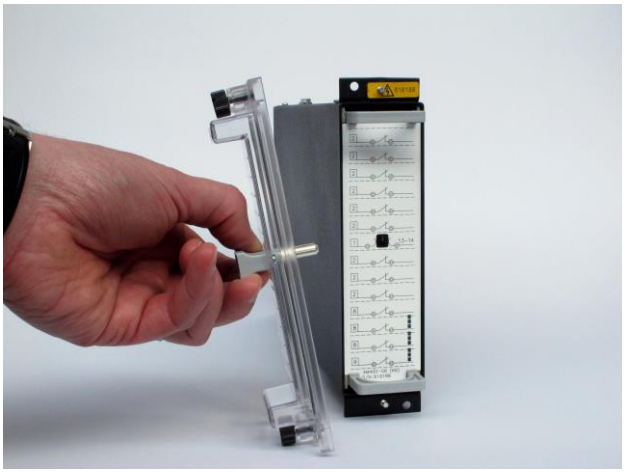
Test Block System

Test Block Components

The 4M400 Test Block system is made up of 4 main components.

- Test Block
- Isolation Plug
- Test Block Cover
- 4M420 Test Plug

Complete 4M400 Test Block



4M400 Test Block

Front Cover Removed - Stage 1 Isolation

4M400 Test Block

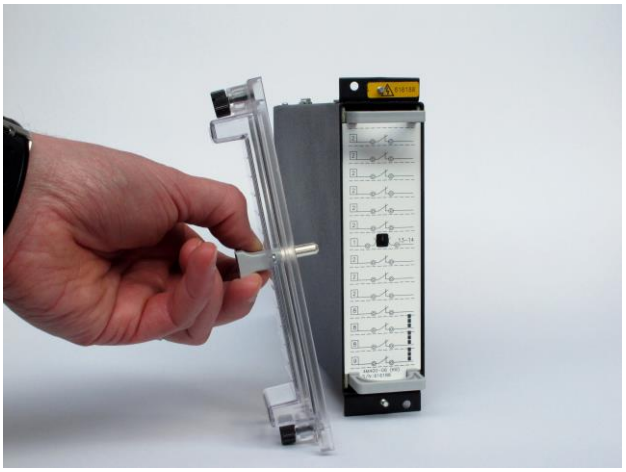
Isolation Plug Removed - Stage 2 Isolation

4M420 Test Plug

Test Block Usage

Placing into the test state

Stage 1 Isolation

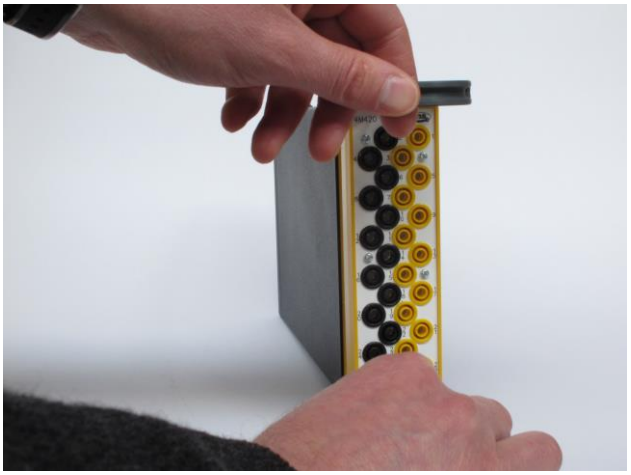
	
Undo Front Cover Thumbscrews to allow Front Cover Removal	Front Cover Removed - Stage 1 Isolation Completed

Stage 2 Isolation Plug Extraction

	
Withdraw Isolation Plug - to Automatically short CT circuits and then isolate remaining circuits	Isolation Plug Removed - Stage 2 Isolation Completed

Test Plug Insertion

4M420 Test Plug may be inserted into test block

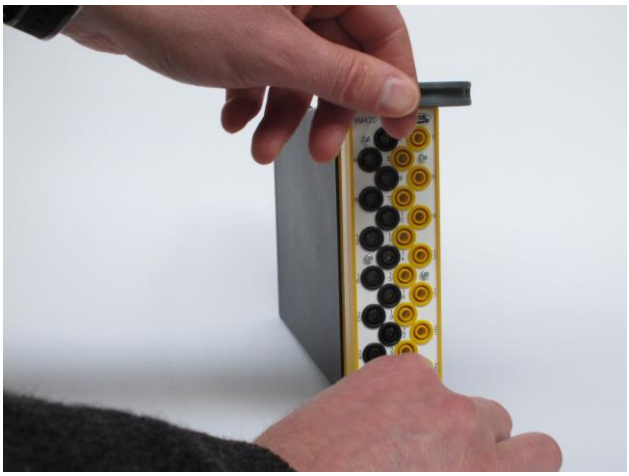


Test Plug inserted into test block, tighten thumb screws to retain in position

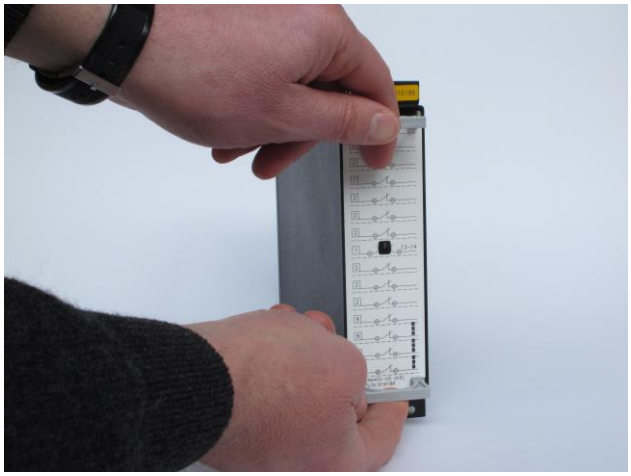
Test Plug ready for testing

Placing into the normal service state

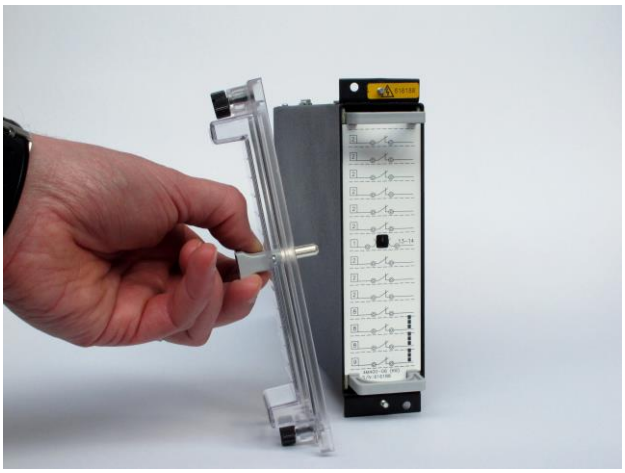
Test Plug Extraction

	
Loosen the thumb screws to enable test plug extraction	Test Plug extracted and test block ready for isolation plug insertion

Stage 2 Isolation Plug Insertion

	
Isolation Plug ready for insertion into the test block	Isolation Plug inserted

Stage 1 Restoration – Test Block Cover Fitted



Test Block Cover restoration

Tighten Test Block Cover screws

Complete 4M400 Test Block all circuits back in service

NOTE

It is imperative that the test block cover is securely fitted to the test block via the cover thumbscrews to ensure that product ingress protection levels are maintained, and the isolation insert is held in the recessed state within the test block to ensure circuit continuity.

To securely fit the test block cover the thumbscrews are tightened to 0.2 – 0.3 Nm but not exceeding 0.5 Nm.

Under no circumstances should the test block be considered 'In Service' if the test block cover is not fitted or loosely fitted with the thumbscrews not tightened to the above recommended torque.

Installation

Test Block Location

The purpose of the 4M400 Test Block is to provide a convenient and safe means of undertaking routine or emergency secondary injection testing of Protection and Metering schemes.

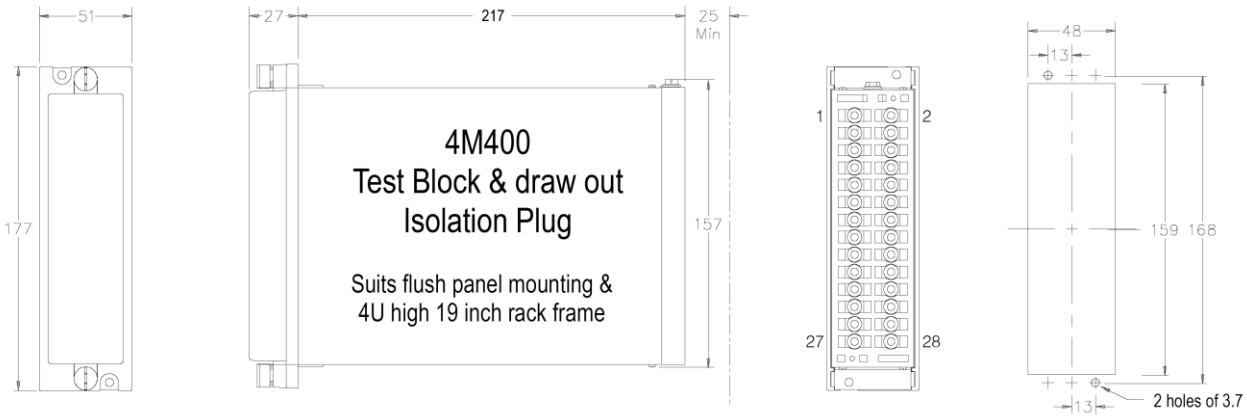
The positioning of the 4M400 Test Block should ideally be on the front of the cubicle or panel and near the equipment to be tested. The Test block needs to be located so that it is readily accessible by Testing personnel.

Test Block Mounting

The 4M400 Test Block is housed in a size 2 case with 28 terminals and provides for either flush panel mounting or 4U high 19 inch rack frame mounting.

Connection to the 4M400 is achieved via 4mm screw terminals.

The case dimensions and Panel cut out details are provided below.



Front view Side view Terminal layout Panel cut out

Required Wiring Layout

The Test Block is wired with connections to the protective relay or protection scheme made to the EVEN numbered equipment side terminals. Connections to CT's, VT's and CB circuitry must be made to the ODD numbered live side terminals on the Test Block.

This arrangement ensures that when the isolation insert is removed that CT's are correctly shorted and when the Test Plug is used, the sockets in the black half of the plug are the isolated relay circuits and sockets on the yellow half are connected to the potentially live supplies as shown in the Applications section.

Safety Section

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

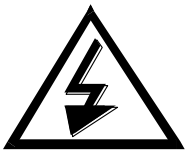
The information in the Safety Section of the product documentation is intended to ensure that products are properly installed and handled in order to maintain them in a safe condition. It is assumed that everyone who will be associated with the equipment will be familiar with the contents of the Safety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

Explanation of Symbols & Labels

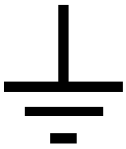
The meaning of symbols and labels which may be used on the equipment or in the product documentation, is given below.

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 system for bulk packaging of ten (10) Test Blocks per carton.

Individual inner packing carton with lid open showing 4M400 Test Block.

Inner packing carton with lid open showing 4M420 Test Plug.

4M400 Isolation Plug shown removed from the 4M400 outer case.

Ac **y**

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 is 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 al 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 downloaded from:

https://www.morssmitt.com/products/400857/m-series-modular-rack-mount-protection-relay-cases

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.

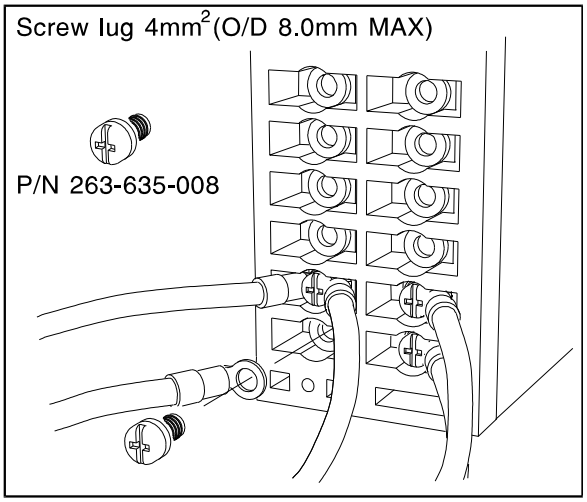
Voltage and current connections should be made using insulated crimp terminations to ensure that terminal block insulation requirements are maintained for safety. To ensure that wires are correctly terminated, the correct crimp terminal and tool for the wire size should be used.

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^2, 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.

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.

4M400 Applications

Order Code Cross Reference Chart

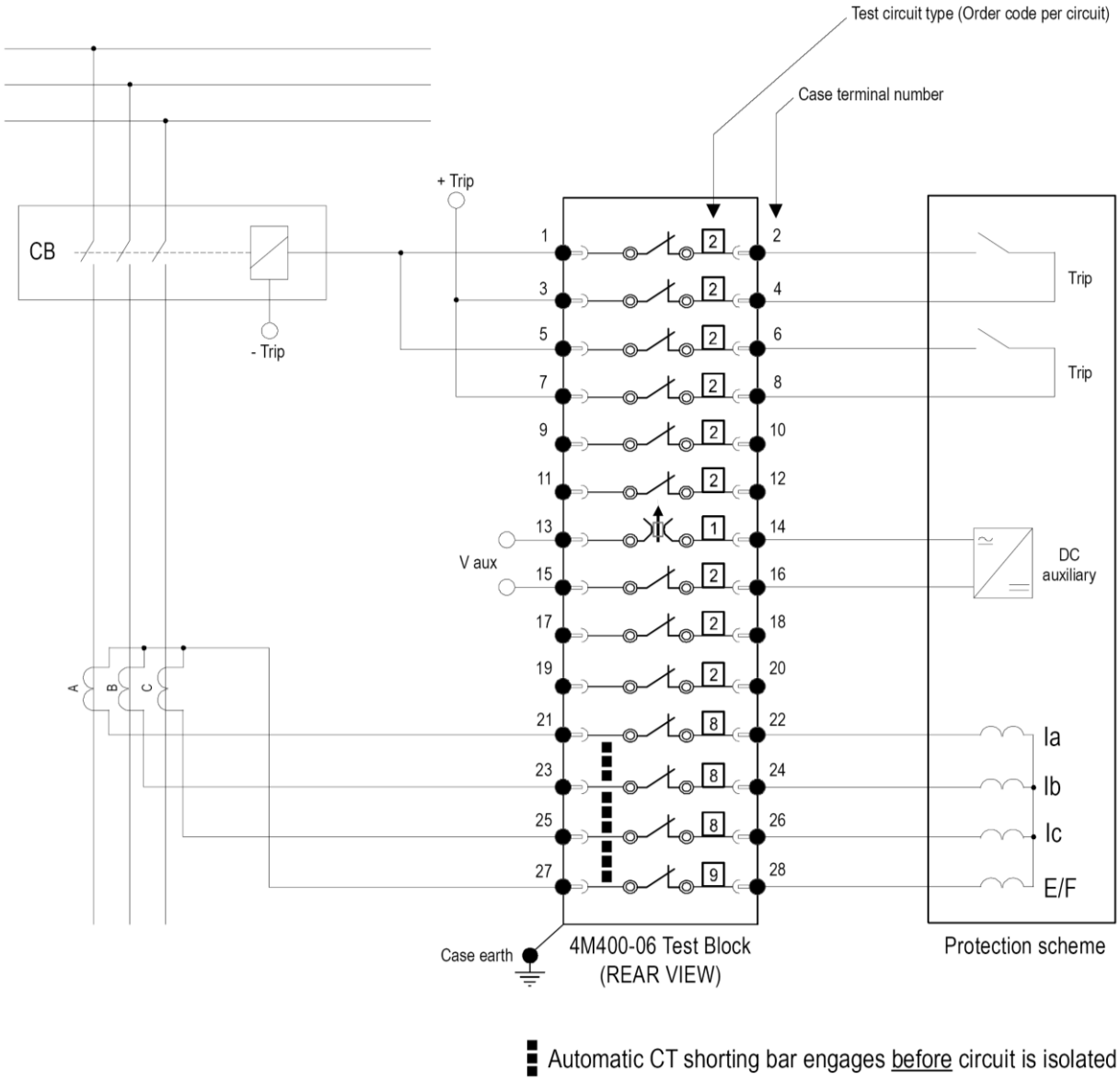
A functionally equivalent 4M400 Test Block solution is available for most common test block systems available on the market.

		RMS Codes
MMLG-01	2RMLG-01	4M400-06
MMLG-02	2RMLG-02	4M400-07
MMLG-07	2RMLG-07	4M400-07
MMLG-08	2RMLG-08	4M400-08
	2RMLG-09	4M400-09

The above 4M400 variants provide internal CT shorting as standard.

The common 4M420 Test Plug is compatible with all RMS coded 4M400 test blocks.

Application for a 3 Phase Overcurrent and EF Protection Scheme



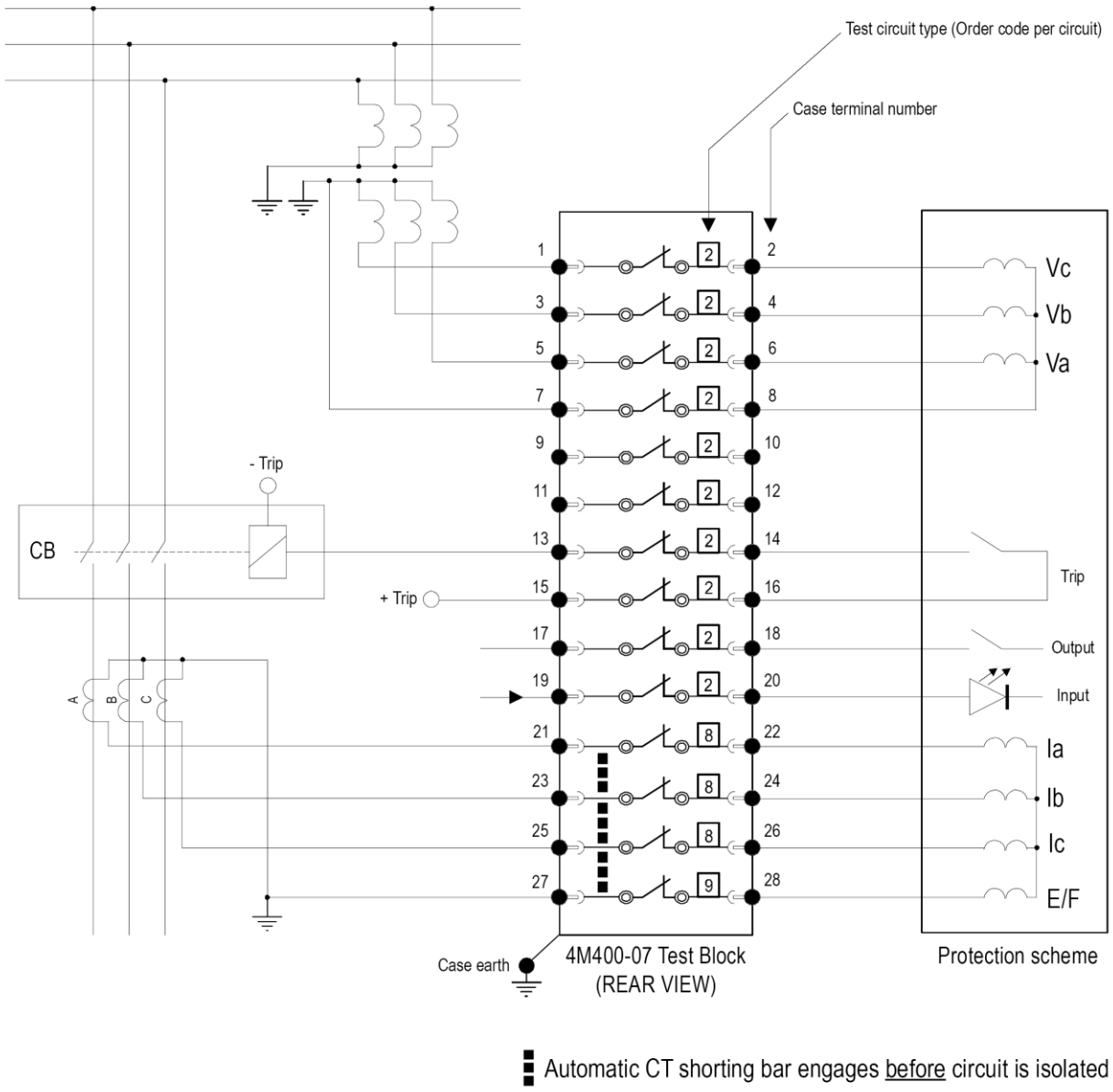
RMS Order Code 4M400-06

The Even Numbered terminals of the 4M400 Test Block correspond to the BLACK coloured Even Numbered sockets of the 4M320 Test Plug (access to the Protection scheme).

The Odd Numbered terminals of the 4M400 Test Block correspond to the YELLOW coloured Odd Numbered sockets of the 4M320 Test Plug (access to the potentially live supplies).

In this application removal of the front cover disconnects terminals 13 and 14 and removes the DC auxiliary supply to the protection scheme. When the 4M420 Test Plug is inserted, sockets 13 and 14 need to be connected to restore the auxiliary supply to the protection scheme.

Application for a Directional 3 Phase Overcurrent and EF Protection Scheme



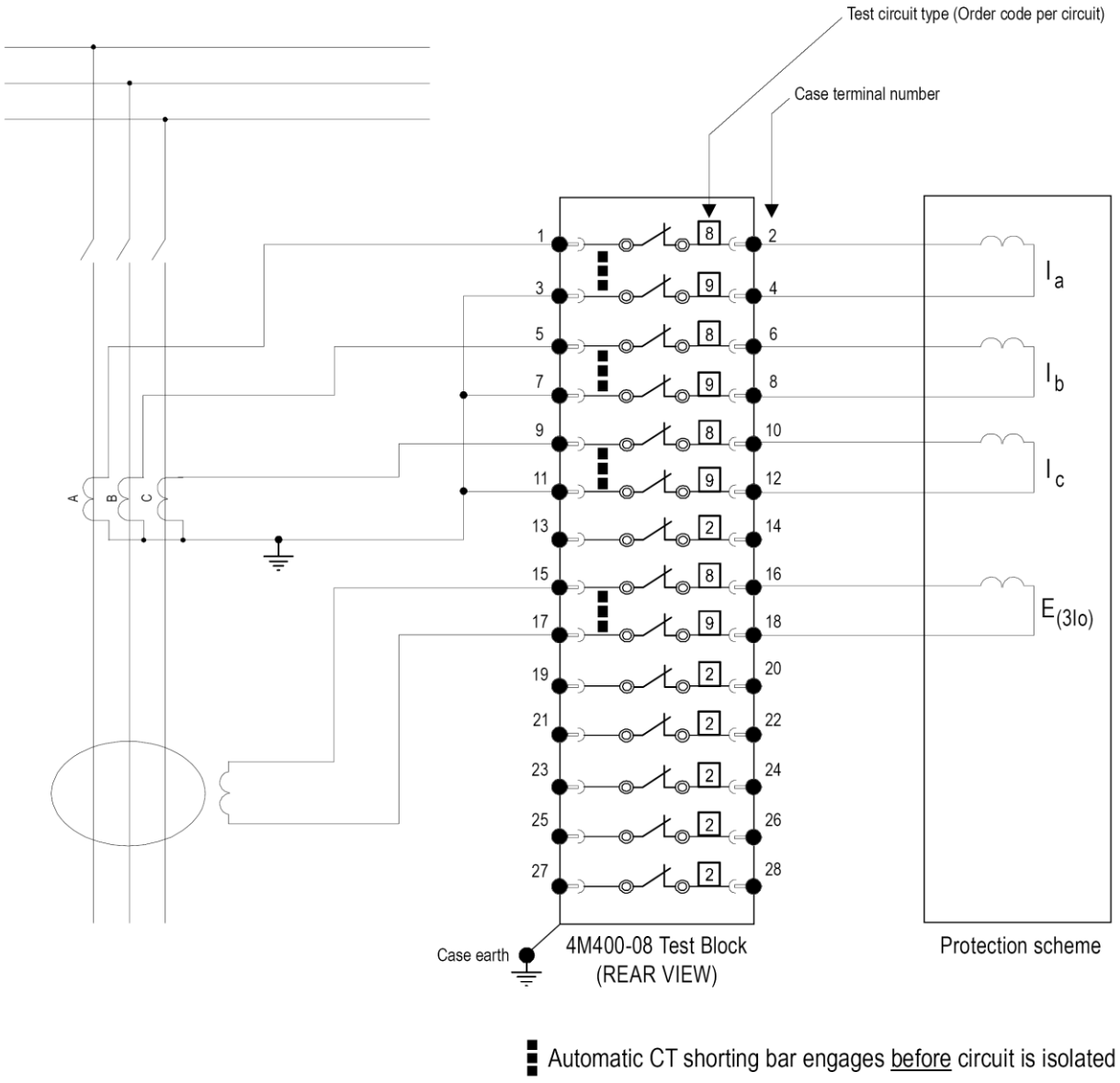
Scheme is also applicable for Distance Protection Schemes.

RMS Order Code 4M400-07

The Even Numbered terminals of the 4M400 Test Block correspond to the BLACK coloured Even Numbered sockets of the 4M420 Test Plug (access to the Protection scheme).

The Odd Numbered terminals of the 4M400 Test Block correspond to the YELLOW coloured Odd Numbered sockets of the 4M420 Test Plug (access to the potentially live supplies).

Application for 3 Phase CT's and Core Balance E/F CT

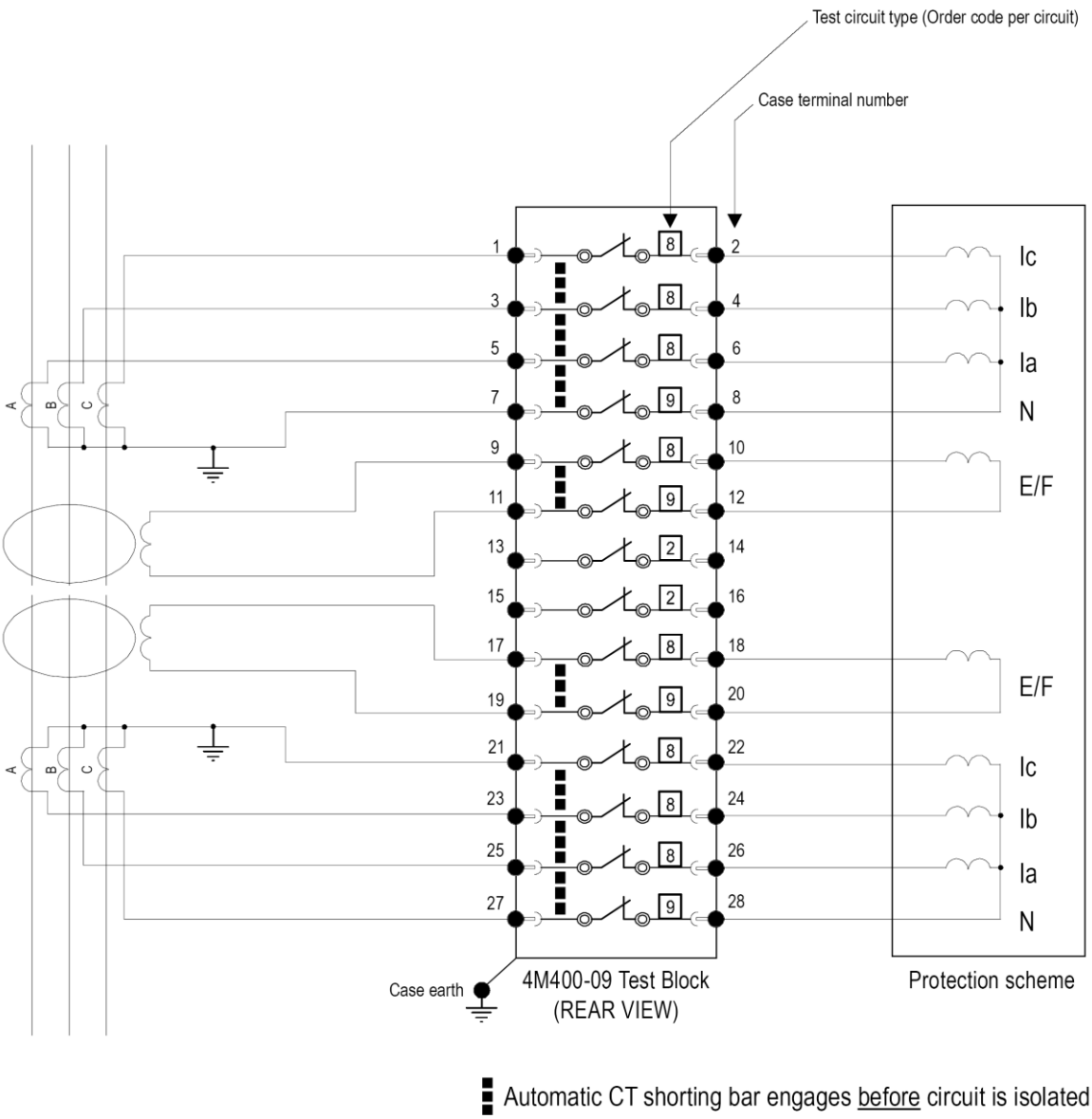


RMS Order Code 4M400-08

The Even Numbered terminals of the 4M400 Test Block correspond to the BLACK coloured Even Numbered sockets of the 4M420 Test Plug (access to the Protection scheme).

The Odd Numbered terminals of the 4M400 Test Block correspond to the YELLOW coloured Odd Numbered sockets of the 4M420 Test Plug (access to the potentially live supplies).

Application for Differential Protection of Transformers



RMS Order Code 4M400-09

The Even Numbered terminals of the 4M400 Test Block correspond to the BLACK coloured Even Numbered sockets of the 4M420 Test Plug (access to the Protection scheme).

The Odd Numbered terminals of the 4M400 Test Block correspond to the YELLOW coloured Odd Numbered sockets of the 4M420 Test Plug (access to the potentially live supplies).

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 test block, 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.

Site Commissioning Verification Checklist

Observe all site specific standard safety procedures.

The following tests are undertaken following the completion of all 4M400 Test Block wiring.

Continuity and Functionality Testing of 4M400 Test Block

Item	Description	Complete
1	Confirm all necessary primary equipment isolations	
2	Confirm all necessary secondary equipment isolations (including trip outputs)	
3	Check the 4M400 is wired to the protection design schematic	
4	Confirm the 4M400 Test Block Isolation Plug and Front Cover are fitted	
4	Confirm continuity of isolation circuits	
5	Perform Stage 1 isolation by removing Front Cover	
6	Confirm Stage 1 circuits are isolated	
7	Perform Stage 2 isolation by removing Test Block Isolation Plug	
8	Confirm all CT Circuits are Short Circuited and isolated from equipment to be tested	
9	Confirm Stage 2 circuits are isolated from equipment to be tested	

Functionality Testing of 4M400 Test Block with 4M420 Test Plug

Item	Description	Complete
1	With the Isolation Plug removed insert the 4M420 Test Plug	
2	Confirm continuity from the 4M420 test points to the secondary equipment under test	

Returning the 4M400 to the normal service state

Item	Description	Complete
1	Remove the 4M420 Test Plug	
2	Restore the test block isolation plug	
3	Refit the test block cover and secure with the test block cover thumbscrews*	

*__NOTE__

__It is imperative that the test block cover is securely fitted to the test block via the cover thumbscrews to ensure that product ingress protection levels are maintained, and the isolation insert is held in the recessed state within the test block to ensure circuit continuity.__

__To securely fit the test block cover the thumbscrews are tightened to 0.2 – 0.3 Nm but not exceeding 0.5 Nm.__

__Under no circumstances should the test block be considered ‘In Service’ if the test block cover is not fitted or loosely fitted with the thumbscrews not tightened to the above recommended torque.__

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.

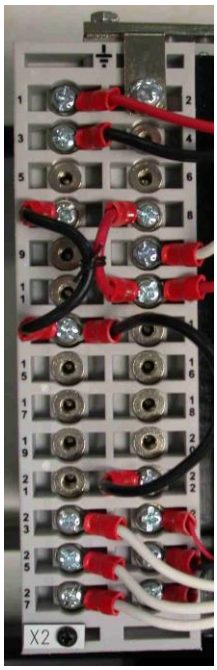
Remove cover by unscrewing black thumb screws & withdraw the relay module from the case.

Relay Case

Inspect the outer terminals checking insulation integrity & tightness.

Inspect inside the case and use a blower to remove any 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 local asset maintenance 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