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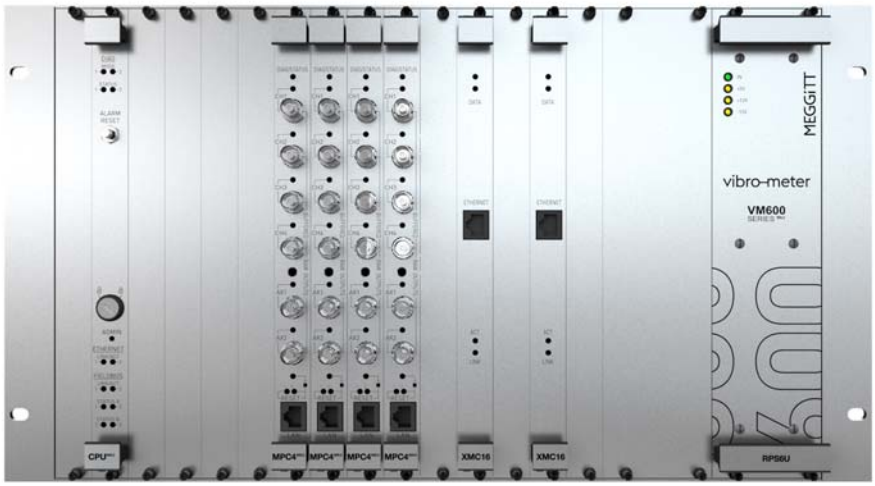
QUICK START MANUAL

vibro-meter®

VM600^{Mk2}
machinery protection system (MPS)



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REVISION RECORD SHEET

Edition	Date of issue	Written by / modified by	Description	Signature
1	19.01.2021	Peter Ward	Original edition.	PW
2	17.02.2021	Peter Ward	Updated information on the MPC4^{Mk2} + IOC4^{Mk2} module's LEDs. See 2.2.1 MPC4^{Mk2} module LEDs. Added additional information on the MPC4^{Mk2} + IOC4^{Mk2} module's buttons. See 2.2.2 MPC4^{Mk2} module buttons.	PW
3	12.11.2021	Peter Ward	Added information on configuration storage and the live insertion and removal of modules (hot-swapping). See 1.9.3 Configuration storage and hot-swapping. Added additional information on VM600^{Mk2} module relays. See 2.3.2 IOC4^{Mk2} module relays and 2.4.2 RLC16^{Mk2} module relays. Added additional information on the MPC4^{Mk2} + IOC4^{Mk2} module's common circuit-fault relay (FAULT) and its fuse. See 2.3.2.2 Common circuit-fault relay and 2.3.2.3 Common circuit-fault relay fuse. Added information on the CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module. See 2.5 CPUM^{Mk2} rack controller and communications interface module, 2.6 IOCN^{Mk2} input/output module and 5 CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module. Clarified the behaviour of the MPC4^{Mk2} + IOC4^{Mk2} module and its common circuit-fault relay (FAULT) in Operational mode. See 4.4.2 Operational mode. Clarified the behaviour of the MPC4^{Mk2} + IOC4^{Mk2} module, its common circuit-fault relay (FAULT), the system-wide VM600^{Mk2} MPS safety-line control signal, and the display of diagnostic fault codes (VibroSight System Manager) in Fail-safe mode. See 4.4.3 Fail-safe mode. Added information on the diagnostic fault codes displayed by the VibroSight System Manager software for a VM600^{Mk2} system. See Appendix A: Diagnostic fault codes. Clarified that sensor/measurement chain OK checks are not part of the MPC4^{Mk2} module's internal diagnostics (built-in self-test (BIST)) and will not result in a VM600^{Mk2} system entering the Fail-safe mode. See A.3 Sensor/measurement chain OK checks. Added information on Modbus fieldbus configuration files, including file structure and command/function syntax. See Appendix B: Modbus fieldbus. Added information on PROFIBUS fieldbus configuration files, including file structure and command/function syntax. See Appendix C: PROFIBUS fieldbus. Updated all module images to use the latest version of panel drawings.	PW

Edition	Date of issue	Written by / modified by	Description	Signature
4	17.05.2022	Peter Ward	Added information on the MPC4^{Mk2} + IOC4^{Mk2} module's support for condition monitoring, since the release of the VibroSight 7.0 software and MPC4^{Mk2} condition monitoring firmware (see 1.2 VibroSight / VM600^{Mk2} systems, 3.3.3 Displaying information about a MPC4^{Mk2} module, 4.1 VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring and 4.3 MPC4^{Mk2} module firmware). Updated Table 4-1 to include separate machinery firmware and condition monitoring firmware. (Previously, there was only one firmware called "operational firmware" that provided machinery protection only). Updated Figure 4-1 to clarify MPC4^{Mk2} module operating modes and highlight important operating features and relationships. Added additional information on VM600^{Mk2}/VM600 racks (see 2.1 VM600^{Mk2}/VM600 racks). Added information on slot number coding for VM600^{Mk2} racks and modules (see 2.1.3 Slot number coding for VM600Mk2 modules in the rear of a VM600^{Mk2}/VM600 rack). Added notes to clarify that the CPUM^{Mk2} + IOCN^{Mk2} module does not currently support Modbus RTU. For example, see 2.6 IOCN^{Mk2} input/output module, B.1 VM600^{Mk2} CPUM^{Mk2} Modbus features and B.4 Modbus RTU communications. Added notes to clarify that the CPUM^{Mk2} + IOCN^{Mk2} module currently supports Modbus TCP via its system Ethernet interfaces (ports) – not via its fieldbus interfaces (ports). See 2.6 IOCN^{Mk2} input/output module and B.1 VM600^{Mk2} CPUM^{Mk2} Modbus features. Added information on condition monitoring licensing for MPC4^{Mk2} + IOC4^{Mk2} modules (see 3.3.3 Displaying information about a MPC4^{Mk2} module, 3.3.7 Checking the condition monitoring license for a MPC4^{Mk2} module, 3.3.8 Managing the condition monitoring license for a MPC4^{Mk2} module and 4.2 VibroSight / VM600^{Mk2} MPC4^{Mk2} condition monitoring licensing). MPC4^{Mk2} module boot / power-on self-test (POST) time corrected to be 30 seconds (was incorrectly given as 20 s). For example, see Table 2-1 and 4.4 MPC4^{Mk2} module operating modes. MPC4^{Mk2} module button behaviour updated to more clearly describe how to enter the Recovery mode. For example, see Table 2-2 and 4.4 MPC4^{Mk2} module operating modes. Added information on MPC4^{Mk2} + IOC4^{Mk2} module data update rates (see 4.7 MPC4^{Mk2} + IOC4^{Mk2} module data update rates). Added information on MPC4^{Mk2} + IOC4^{Mk2} module output behaviour after a reset (see 4.6 MPC4^{Mk2} + IOC4^{Mk2} module output behaviour after a reset and during power up).	PW

Edition	Date of issue	Written by / modified by	Description	Signature
5	27.03.2023	Peter Ward	Added information on module diagnostic log files and how to download them. See 1.13 Diagnostic log files, 1.14 VibroSight software diagnostic logs and 3.3.11 Saving diagnostic logs from a VM600^{Mk2} module. Added information on VM600^{Mk2}/VM600 rack backplanes (see 2.1.1.1 VM600^{Mk2}/VM600 system rack backplane and 2.1.2.1 VM600^{Mk2}/VM600 slimline rack backplane). Corrected and updated information on slot number coding for the slimline rack (see 2.1.3.2 Slot number coding for VM600Mk2 modules in the rear of a slimline rack and 2.1.3.3 Changing the slot number for a VM600Mk2/^{VM600} slimline rack). Added clamping range and tightening torque information for the screw-terminal connectors used by modules. See 2.3 IOC4^{Mk2} input/output module, 2.4 RLC16^{Mk2} relay module and 2.6 IOCN^{Mk2} input/output module. Updated information on the MPC4^{Mk2} + IOC4^{Mk2} module's LEDs in accordance with the latest version of machinery protection firmware (version 640-025-006-xxx corresponding to VibroSight 7.1 or earlier). See 2.2.1 MPC4^{Mk2} module LEDs. Added rack compatibility information for the CPUM^{Mk2} module. See 2.5.4 CPUM^{Mk2} module and rack compatibility. Added that a VM600^{Mk2} module automatically resets when its IP settings change (see 3.3.1 Configuring the network interface for a MPC4^{Mk2} module). Added a CPUM^{Mk2} Modbus tip and trick for float to integer conversion using the scaling function. See B.10.1 Float to integer conversion using the scaling function. Updated information on the diagnostic fault codes, notably, fault codes 5, 6, 31 to 34 and 67. See Appendix A: Diagnostic fault codes. Added end-of-life product disposal information (see 6 End-of-life product disposal).	PW

	Department	Name	Signature	Date
Technical content of original issue approved by	Engineering	---	---	---
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The duly signed master copy of this page is stored by the Technical publications department of Meggitt SA and can be obtained by writing to Technical publications.

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PREFACE

About this manual

This manual provides summary information on the VM600^{Mk2} machinery protection system (MPS) consisting of the MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module, RLC16^{Mk2} relay module, and CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module, from Meggitt's vibro-meter® product line.

It also offers some general information concerning the installation, configuration and general use of the system.

This manual SHOULD be read in conjunction with a *VM600 machinery protection system (MPS) hardware manual*, which is the reference installation manual (see Related publications and documentation).

This manual SHOULD NOT be used as a replacement for the reference installation manual, since the installation instructions in this manual are incomplete.

About Meggitt and vibro-meter®

Meggitt PLC is a global engineering group, headquartered in the UK, specialising in the design and manufacture of high-performance components and systems for aerospace and energy markets.

The Meggitt facility in Fribourg, Switzerland, operates as the legal entity Meggitt SA (formerly Vibro-Meter SA). vibro-meter® is a product line of Meggitt that applies our core sensing and monitoring technologies to power generation, oil & gas and other industrial markets.

Meggitt SA produces a wide range of vibration, dynamic pressure, proximity, air-gap and other sensors capable of operation in extreme environments, electronic monitoring and protection systems, and innovative software for aerospace and land-based turbomachinery.

vibro-meter® products and solutions have been at the forefront of sensing and monitoring for more than 65 years and help keep machinery and equipment working safely, reliably and efficiently. This includes the VM600^{Mk2} machinery protection system (MPS) produced for the Meggitt vibro-meter® product line.

To learn more about Meggitt Switzerland, our proud tradition of innovation and excellence, and our solutions for energy markets and applications, visit the Meggitt vibro-meter® Energy website at www.meggittsensing.com/energy

Who should use this manual?

The manual is intended for use by qualified personnel, such as operators of process monitoring/control systems using a VM600^{Mk2} machinery protection system (MPS).

NOTE: Personnel involved in the installation, operation and maintenance of Meggitt vibro-meter® systems are assumed to have the necessary technical training in electronics and/or mechanical engineering (professional certificate/diploma or equivalent) to enable them to install, configure, use and/or maintain the system correctly and safely.

Applicability of the manual

The manual is applicable to the VM600^{Mk2} machinery protection system (MPS) using MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring modules, optional RLC16^{Mk2} relay modules, and optional CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module, that is, the evolution of the VM600 MPS based on existing VM600 rack infrastructure (that is, the first-generation VM600 cards/systems (VM600^{Mk1})).

Different versions of VM600^{Mk2}/VM600 MPS racks and modules can be visually identified from the front panels of the rack and modules. For each module, the lower handle on the front panel includes the module's name.

For a VM600^{Mk2} MPS, the main modules are:

- MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module
- RLC16^{Mk2} relay module
- CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module.

NOTE: Only later versions of the VM600^{Mk2}/VM600 system rack (ABE04x) with an I^{2}C interface (VME utility bus) are compatible with the CPUM^{Mk2} + IOCN^{Mk2} module. See 2.5.4 CPUM^{Mk2} module and rack compatibility.

Users of a VM600^{Mk2} MPS should use this *VM600^{Mk2} machinery protection system (MPS) quick start manual* and refer to a *VM600 machinery protection system (MPS) hardware manual*, as required.

The MPC4^{Mk2} module LED behaviour described in this version (edition 5) of the manual applies to systems having MPC4^{Mk2} modules running machinery protection firmware version 640-025-007-xxx or later (corresponding to VibroSight 7.2 or later).
Users of systems having MPC4^{Mk2} modules running machinery protection firmware version 640-025-006-xxx or earlier (corresponding to VibroSight 7.1 or earlier) should refer to edition 4 of this manual.

For reference, for a VM600 MPS, the main equivalent cards (modules) are:

- MPC4/IOC4T machinery protection card pair
- RLC16 relay card
- CPUx/IOCx (CPUM) rack controller and communications interface module.

Users of a VM600 MPS should refer to the *VM600 machinery protection system (MPS) quick start manual* and refer to a *VM600 machinery protection system (MPS) hardware manual*, as required.

Terminology

To distinguish between the different generations of VM600^{Mk2}/VM600 MPS racks and modules/cards from the Meggitt vibro-meter® product line, the following terminology is used in this document.

Hardware

VM600^{Mk2} MPS, rack or system – used to refer to a VM600^{Mk2}/VM600 rack containing one or more of the following machinery protection system (MPS) modules: MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module, RLC16^{Mk2} relay module, and CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module, (that is, a second-generation VM600^{Mk2} system).

VM600 MPS, rack or system – used to refer to a VM600 rack containing one or more of the following machinery protection system (MPS) cards (modules): MPC4/IOC4T machinery protection card pair, RLC16 relay card, AMC8/IOC8T analog monitoring card pair, and CPUx/IOCx (CPUM) rack controller and communications interface module (that is, first-generation VM600 systems (VM600^{Mk1})).

Software

VibroSight® is proprietary software from Meggitt vibro-meter® for the configuration, operation and management of VM600^{Mk2}/VM600 rack-based systems and VibroSmart® distributed monitoring system (DMSs).

VibroSight Protect is a separate VibroSight® software module used for the configuration and operation of a VM600^{Mk2} MPS. This helps ensure complete separation (“segregation”) of machinery protection system (MPS) and condition monitoring system (CMS) in a single VM600^{Mk2}/VM600 rack.

Related publications and documentation

Further information on products can be found in their corresponding data sheets, which are available from our website at www.meggittsensing.com/energy or can be obtained from your local Meggitt representative.

For further information on the use of a VM600^{Mk2} machinery protection system (MPS), refer to the following Meggitt vibro-meter® documentation:

- *VM600 machinery protection system (MPS) hardware manual – standard version* (document reference MAMPS-HW/E)
- *VM600 machinery protection system (MPS) hardware manual – CSA version* (document reference MAMPS-HW/E-CSA)
- *VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module data sheet* (document reference DS 268-121).
- *VM600^{Mk2} RLC16^{Mk2} relay module data sheet* (document reference DS 268-125).
- *VM600^{Mk2} CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module data sheet* (document reference DS 268-035).
- *VibroSight® machinery monitoring system software data sheet* (document reference DS 660-020-005-2xxA).

For further information on the use of the VibroSight® software, refer to the *Getting started with VibroSight installation guide*, the *VibroSight software release notes* and/or the *VibroSight help*.

NOTE: To ensure that the latest version of documentation is being used, visit the Meggitt vibro-meter® Energy website at www.meggittsensing.com/energy and check for any updates. Alternatively, contact your local Meggitt representative.

SAFETY

Symbols and styles used in this manual

The following symbols are used in this manual where appropriate:

The WARNING safety symbol

THIS INTRODUCES DIRECTIVES, PROCEDURES OR PRECAUTIONARY MEASURES WHICH MUST BE EXECUTED OR FOLLOWED. FAILURE TO OBEY A WARNING MIGHT RESULT IN INJURY TO THE OPERATOR AND/OR THIRD PARTIES, AND/OR RESULT IN DAMAGE TO EQUIPMENT.

The CAUTION safety symbol

This draws the operator's attention to information, directives or procedures which must be executed or followed. Failure to obey a caution can result in damage to equipment.

The ELECTROSTATIC SENSITIVE DEVICE symbol

This indicates that the device or system being handled can be damaged by electrostatic discharges. For further information, see **Handling precautions for electrostatic sensitive devices on page xiv****.**

NOTE: This is an example of the NOTE paragraph style. This draws the operator's attention to complementary information or advice relating to the subject being treated.


Direct current


Alternating current


Direct and alternating current


Earth (ground) terminal


Protective conductor (ground) terminal


Frame or chassis (ground) terminal


Signal 0 V (ground) terminal


Class II equipment


Caution, general danger


Caution, possibility of electric shock


Caution, hot surface

Important remarks on safety

FAILURE TO FOLLOW THE INSTRUCTIONS AND IMPLEMENT THE RECOMMENDATIONS IN THIS MANUAL MIGHT RESULT IN INJURY TO THE OPERATOR AND/OR THIRD PARTIES, AND/OR RESULT IN DAMAGE TO EQUIPMENT AND WILL INVALIDATE ANY WARRANTY.

Read this manual carefully and observe the safety instructions before installing and using the equipment described.

By doing this, you will be aware of the potential hazards and be able to work safely, ensuring your own protection and also that of the equipment.

Every effort has been made to include specific safety-related procedures in this manual using the symbols described above. However, operating personnel are expected to follow all generally accepted safety procedures.

All personnel who are liable to operate the equipment described in this manual should be trained in the correct safety procedures.

Meggitt does not accept any liability for injury or material damage caused by failure to obey any safety-related instructions or due to any modification, transformation or repair carried out on the equipment without written permission from Meggitt SA. Any modification, transformation or repair carried out on the equipment without written permission from Meggitt SA will invalidate any warranty.

Electrical safety and installation

WHEN INSTALLING A VM600^{Mk2}/VM600 RACK, OBSERVE ALL SAFETY (WARNING AND CAUTION) STATEMENTS IN THIS MANUAL AND FOLLOW ALL NATIONAL AND LOCAL ELECTRICAL CODES.

ONLY TRAINED AND QUALIFIED PERSONNEL (SUCH AS A QUALIFIED/LICENSED ELECTRICIAN) SHOULD BE ALLOWED TO INSTALL OR REPLACE THIS EQUIPMENT.

CHECK NATIONAL AND LOCAL ELECTRICAL CODES, REGULATIONS AND DIRECTIVES BEFORE WIRING.

A VM600^{Mk2}/VM600 RACK MUST BE DIRECTLY AND PERMANENTLY CONNECTED TO LIVE EARTH (PE), KNOWN AS AN EQUIPMENT GROUNDING CONDUCTOR IN THE US NATIONAL ELECTRICAL CODE, USING THE EARTH CONDUCTOR OF THE EXTERNAL MAINS POWER SUPPLY LEAD (POWER CORD), IN ORDER TO HELP PREVENT THE RISK OF ELECTRIC SHOCK.

SELECT CABLE WIRE SIZES AND CONNECTORS (CURRENT-CARRYING CAPACITY), INCLUDING THE EXTERNAL MAINS POWER SUPPLY LEAD (POWER CORD), TO MEET THE REQUIREMENTS OF THE APPLICATION IN ACCORDANCE WITH THE APPLICABLE NATIONAL AND LOCAL ELECTRICAL CODES.

CHECKS TO ENSURE ELECTRICAL SAFETY SHOULD BE CARRIED OUT BY A COMPETENT PERSON.

DEFLECTION PLATES (BARRIERS) CAN BE INSTALLED ABOVE AND BELOW A VM600^{Mk2}/VM600 RACK IN ORDER TO HELP REDUCE THE RISK OF ELECTRICAL SHOCK AND IN THE CASE OF THE BARRIER INSTALLED BELOW THE RACK, IN ORDER TO HELP PREVENT THE SPREAD OF FIRE TOO.

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN DEATH, SERIOUS INJURY, AND/OR EQUIPMENT DAMAGE.

Hazardous voltages and the risk of electric shock

HAZARDOUS VOLTAGES EXIST WITHIN A VM600^{Mk2}/VM600 RACK.

WHEN A MODULE/CARD, PANEL OR POWER SUPPLY IS REMOVED FROM A VM600^{Mk2}/VM600 RACK, THE RACK BACKPLANE – CONTAINING HAZARDOUS VOLTAGES – IS EXPOSED AND THERE IS THE RISK OF ELECTRIC SHOCK, AS INDICATED BY THE USE OF THE FOLLOWING WARNING LABEL ON THE EQUIPMENT:

REGARD ANY EXPOSED COMPONENT, CONNECTOR OR PRINTED CIRCUIT BOARD (PCB) AS A POSSIBLE SHOCK HAZARD AND DO NOT TOUCH WHEN ENERGISED.

FOR SAFETY REASONS, ANY VM600^{Mk2}/VM600 RACK SLOT (MODULE POSITION) NOT POPULATED BY A MODULE MUST BE COVERED BY A BLANK PANEL.

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN DEATH, SERIOUS INJURY, AND/OR EQUIPMENT DAMAGE.

Hot surfaces and the risk of burning

HOT SURFACES CAN EXIST WITHIN AND ON A VM600^{Mk2}/VM600 RACK.

DEPENDING ON THE AMBIENT OPERATING TEMPERATURE AND POWER CONSUMPTION, AND THE INSTALLATION AND COOLING OF A VM600^{Mk2}/VM600 RACK, THE TOP OF THE RACK CAN BECOME HOT TO TOUCH AND THERE IS THE RISK OF BURNING WHEN HANDLING THE RACK, AS INDICATED BY THE USE OF THE FOLLOWING WARNING LABEL ON THE EQUIPMENT:

REGARD THE TOP OF A VM600^{Mk2}/VM600 RACK AS A HOT SURFACE AND DO NOT TOUCH UNLESS COOL.

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN INJURY.

Heavy objects and the risk of injury

A FULLY POPULATED VM600^{Mk2}/VM600 SYSTEM RACK (ABE04X) WITH RPS6U RACK POWER SUPPLIES AND MODULES INSTALLED IS A HEAVY OBJECT.

DEPENDING ON THE NUMBER OF RPS6U RACK POWER SUPPLIES AND MODULES INSTALLED, A VM600^{Mk2}/VM600 SYSTEM RACK CAN BE TOO HEAVY TO HANDLE MANUALLY BY ONE PERSON AND THERE IS THE RISK OF INJURY DURING INSTALLATION OR REMOVAL. ACCORDINGLY, A FULLY POPULATED VM600^{Mk2}/VM600 SYSTEM RACK SHOULD BE CONSIDERED AS A HEAVY OBJECT THAT REQUIRES TWO PEOPLE TO LIFT, LOWER OR OTHERWISE HANDLE MANUALLY.

ALTERNATIVELY, THE RPS6U RACK POWER SUPPLIES (THE HEAVIEST SYSTEM COMPONENTS AND EASILY REMOVABLE), AND THEN THE MODULES AS NECESSARY, CAN BE REMOVED FROM THE RACK IN ORDER TO REDUCE THE WEIGHT AND ALLOW ONE PERSON TO SAFELY HANDLE MANUALLY.

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN INJURY.

Handling precautions for electrostatic sensitive devices

Certain devices used in electronic equipment can be damaged by electrostatic discharges resulting from built-up static electricity. Because of this, special precautions must be taken to minimise or eliminate the possibility of these electrostatic discharges occurring.

Read the following recommendations carefully before handling electronic circuits, printed circuit boards or modules containing electronic components.

- Before handling VM600^{Mk2} modules (cards) and other electronic circuits, discharge the static electricity from your body by touching and momentarily holding a grounded metal object (such as a pipe or cabinet).
- Avoid the build-up of static electricity on your body by not wearing synthetic clothing material, as these tend to generate and store static electric charges. Cotton or cotton blend materials are preferred because they do not store static electric charges.
- Do not handle VM600^{Mk2} modules (cards) and other electronic circuits unless it is absolutely necessary. Only hold modules/cards by their handles or panels.
- Do not touch printed circuit boards, their connectors or their components with conductive devices or with your hands.
- Put the any module (card), printed circuit board or other electronic circuit containing electronic components into an antistatic protective bag immediately after removing it from a VM600^{Mk2}/VM600 rack.

Replacement parts and accessories

Use only approved replacement parts and accessories.

Do not connect with incompatible products or accessories.

Only use replacement parts and accessories intended for use with VM600^{Mk2}/VM600 racks that have been approved by Meggitt SA.

Using incompatible replacement parts and accessories could be dangerous and may damage the equipment or result in injury.

For information on replacement parts and accessories:

- Visit the Meggitt vibro-meter® Energy website at www.meggittsensing.com/energy
- Contact your local Meggitt representative.

TABLE OF CONTENTS

1 INTRODUCTION TO THE VM600Mk2 MACHINERY PROTECTION SYSTEM (MPS)

This chapter provides a brief overview of the installation of a VM600Mk2 machinery protection system (MPS), that is, the second-generation VM600Mk2 system. Information is provided on installing a VM600Mk2/VM600 rack, connecting power, handling and connecting modules, communicating with the rack and software configuration.

NOTE: For further information on installing a VM600Mk2 machinery protection system (MPS), refer to a *VM600 machinery protection system (MPS) hardware manual*.

1.1 System overview

The VM600Mk2 machinery protection system (MPS) uses MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring modules, optional RLC16Mk2 relay modules, and an optional CPUMMk2 + IOCNMk2 rack controller and communications interface module, and is an evolution of the VM600 MPS based on existing VM600 rack infrastructure (that is, the first-generation VM600 cards/systems (VM600Mk1)). The VM600Mk2 MPS is a digital machinery protection system designed for use in industrial applications. It is intended primarily for vibration monitoring in order to assure the protection of rotating machinery as used in, for example, the power generation, petro-chemical and petroleum industries as well as in marine related applications.

The VM600Mk2 series of machinery protection and condition monitoring systems from Meggitt's vibro-meter® product line are based around a 19″ rack containing various types of modules, depending on the application.

There are basically two types of system:

- VM600Mk2 machinery protection system (MPS in a 6U (ABE04x) or 1U (ABE056) rack).
- VM600Mk2 condition monitoring system (CMS in a 6U (ABE04x) or 1U (ABE056) rack).

It is also possible to integrate MPS and CMS hardware into the same VM600Mk2 rack (6U – ABE04x).

NOTE: This manual describes the VM600Mk2 machinery protection system (MPS) only.

In its most basic configuration, a VM600Mk2 machinery protection system (MPS) consists of the following system components (hardware):

1- VM600Mk2/VM600 rack: 19″ system rack × 6U (ABE04x) or 19″ slimline rack × 1U (ABE056)

NOTE: ABE04x refers to both the ABE040 and ABE042, which are identical apart from the position of the rack mounting brackets.

2- RPS6U rack power supply (ABE04x only)

When an AC-input version of the RPS6U is installed in a VM600 rack, the optional ASPS auxiliary sensor power supply can be used to replace external power supplies such as the APFxxx 24 V_{DC} power supplies.

3- MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module.

The MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module provides 4 dynamic channels and 2 auxiliary channels configurable as either tachometer inputs or DC inputs. The MPC4^{Mk2} module is always used with an associated IOC4^{Mk2} module as a set/pair of modules. These modules are used primarily to monitor vibration for the purposes of machinery protection and condition monitoring.

In general, a VM600^{Mk2}/VM600 rack used for machinery protection and condition monitoring contains:

- One or more MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring modules.

Depending on the application, the following type of modules can also be installed in the VM600^{Mk2}/VM600 rack (ABE04x or ABE056):

4- RLC16^{Mk2} relay module.

The RLC16^{Mk2} relay module provides an additional 16 relays for when the 4 relays of a MPC4^{Mk2} + IOC4^{Mk2} module are not enough. Accordingly, the RLC16^{Mk2} is an optional module.

The system components listed above can be used to make a stand-alone VM600^{Mk2} machinery protection system (MPS), that is, a VM600^{Mk2} MPS providing machinery protection that is not required to be permanently connected to a network. Although such a VM600^{Mk2} system can be connected to a network, as required.

Further, a VM600^{Mk2} machinery protection system (MPS) that requires additional system-level functionality is typically permanently connected to a network using the following module in the VM600^{Mk2}/VM600 rack (6U – ABE04x only):

5- CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module.

Depending on the application (and irrespective of whether the rack is used in a stand-alone or a networked configuration), one or more of the following power supplies can be used outside a VM600^{Mk2}/VM600 rack (ABE04x):

- APFxxx 24 V_{DC} power supplies
- Any equivalent low-noise power supply provided by the customer.

These devices must be used for GSI1xx galvanic separation units, GSV safety barriers and other sensor/measurement chains having a current requirement greater than 25 mA. They will often be mounted in the cubicle in which the rack is installed.

NOTE: Auxiliary sensor power supplies (ASPSs) installed in a VM600^{Mk2}/VM600 rack (ABE04x) perform the same function as external power supplies such as the APFxxx 24 V_{DC} power supplies. That is, they are used to power external hardware such as GSI galvanic separation units or signal conditioners that require more power than can be provided by a MPC4^{Mk2} + IOC4^{Mk2} module.

NOTE: Refer to individual data sheets for full technical specifications of the VM600Mk2 MPS hardware.

Finally, a combined machinery protection and condition monitoring system can integrate the following condition monitoring hardware in the VM600Mk2/VM600 rack (ABE04x):

- XMx16 + XIO16T extended condition monitoring modules.

Figure 1-2 shows front, rear and side views of a typical VM600Mk2 system rack (ABE040) containing machinery protection system (MPS) hardware. VM600Mk2 solutions can also be installed in a slimline rack (see Figure 1-3).

NOTE: VM600 slimline racks (1U – ABE056) do not support the CPUMMk2 + IOCNMk2 rack controller and communications interface module (or any CPUx/IOCx (CPUM) card pairs) due to rack slot limitations.

NOTE: Refer to individual data sheets for full technical specifications of the VM600Mk2 MPS hardware.

NOTE: Further information on installing VM600Mk2 machinery protection system (MPS) hardware (racks and modules/cards) can be found in a *VM600 machinery protection system (MPS) hardware manual* and in the corresponding data sheets.

1.2 VibroSight / VM600Mk2 systems

In VibroSight / VM600Mk2 systems, the MPC4Mk2 + IOC4Mk2 module can provide machinery protection system (MPS) functionality and/or condition monitoring system (CMS) functionality, depending on the requirements of the application.

As shown in Figure 1-1, the VibroSight® software uses completely separate software modules for the configuration and operation of VM600Mk2 systems depending on the functionality required:

- VibroSight Protect supports the configuration and operation of the machinery protection (MPS) functionality for a VM600Mk2 system.
- VibroSight Capture supports the configuration and operation of the condition monitoring (CMS) functionality for a VM600Mk2 system.

Using separate software modules – VibroSight Protect and VibroSight Capture – for the configuration and operation of VM600Mk2 functionality/systems helps ensure complete separation (“segregation”) of MPS and CMS in a single VM600Mk2/VM600 rack.

See also 4.1 VM600Mk2 MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring.

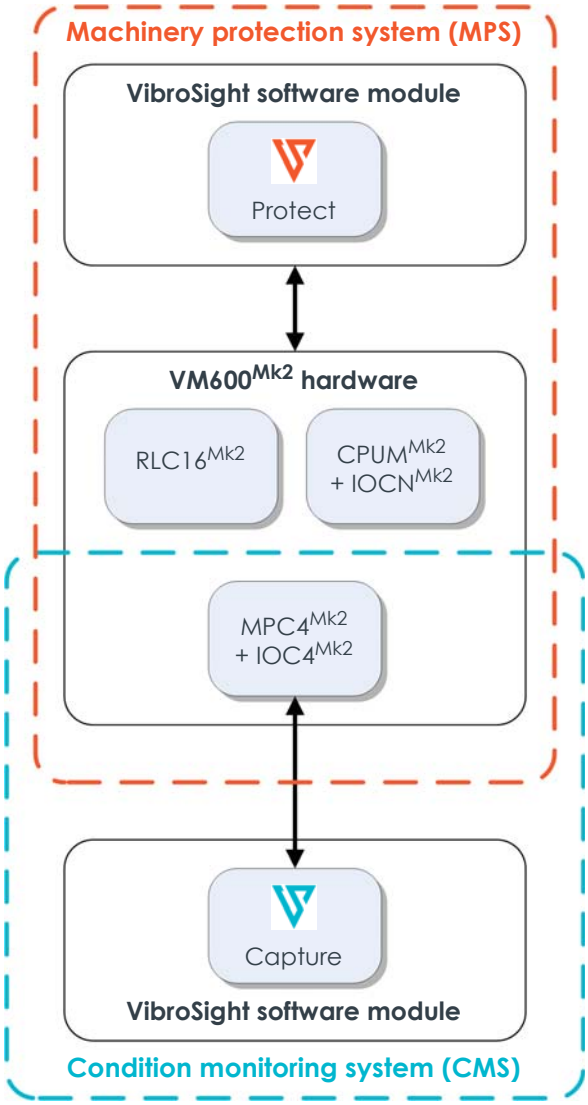


Figure 1-1: Separation (“segregation”) of MPS and CMS in a VM600Mk2/VM600 rack

1.3 Installing a rack

A typical VM600Mk2 machinery protection system (MPS), consisting of multiple VM600Mk2 modules, is housed in a VM600Mk2/VM600 system rack (ABE04x), that is, a standard 19″ inch rack (84TE) with a height of 6U (6HE). Two types of this rack exist: the ABE040 and the ABE042. These are identical, except for the position of the rack mounting brackets.

Smaller VM600Mk2 machinery protection systems (MPSs), consisting of a single processing modules, can be housed in the smaller VM600Mk2/VM600 slimline rack (ABE056), that is, a standard 19″ inch rack (84TE) with a height of 1U (6HE).

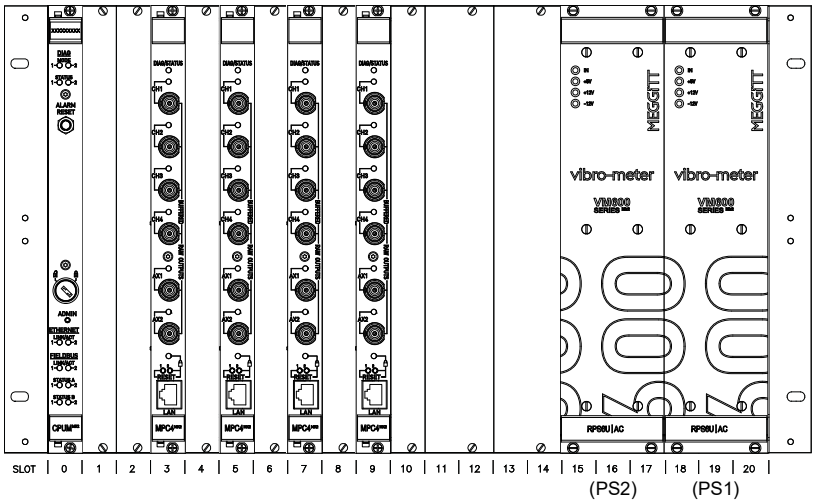
The appearance of the front panel and rear panel of a rack depends on the types of modules/cards installed in the two cages.

An example of a VM600Mk2 MPS housed in a VM600 system rack (ABE040) is shown in Figure 1-2.

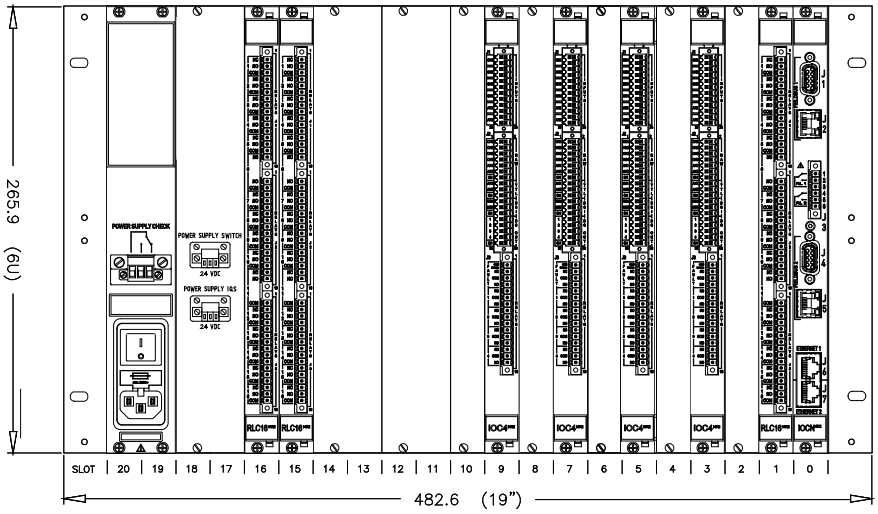
An example of a VM600Mk2 MPS housed in a VM600 slimline rack (ABE056) is shown in Figure 1-3.

See also 2.1 VM600Mk2/VM600 racks.

Front view



Rear view



Side view

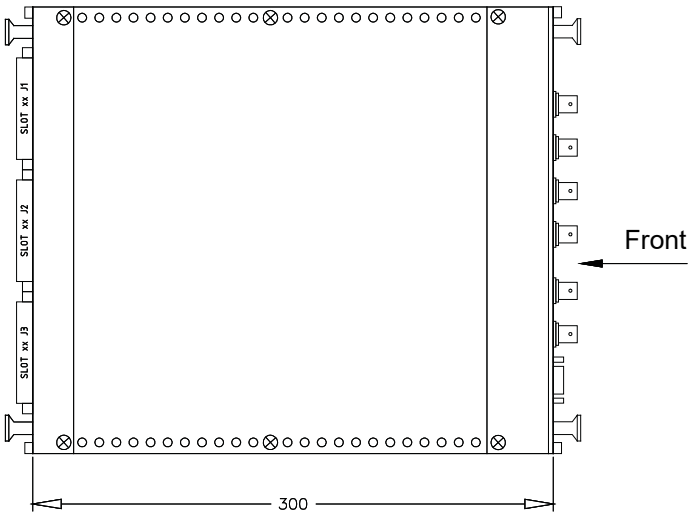


Figure 1-2: Views of a typical VM600Mk2/VM600 system rack (ABE040) with VM600Mk2 modules installed

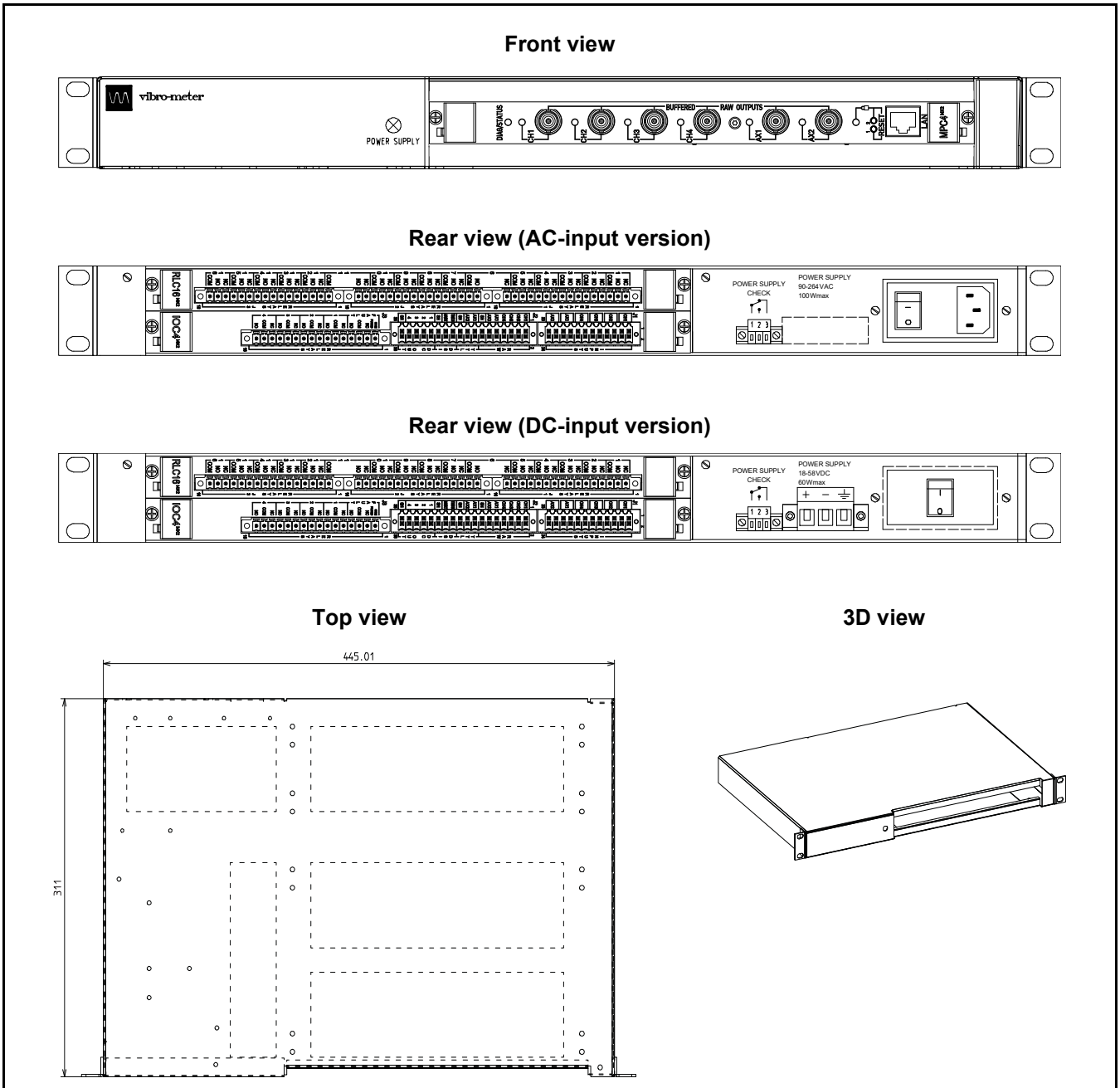


Figure 1-3: Views of a typical VM600Mk2/VM600 slimline rack (ABE056) with VM600Mk2 modules installed

1.3.1 Ventilation

VM600Mk2/VM600 racks do not contain any ventilation units (fans). They therefore rely on either forced ventilation by fans in the cabinet or on natural ventilation (convection) for their cooling. All require the free flow of air in an upward direction, with air entering the rack through the vents in the base of the rack and leaving it through the vents on the top of the rack.

When VM600Mk2/VM600 racks are installed in a cabinet or enclosure in which natural ventilation is used, a space of at least 50 mm should be present below and above each rack for a ABE04x system rack (see Figure 1-4, Case A) and 20 mm for a ABE056 slimline rack (see Figure 1-5, Case A).

It is possible to prevent warm air flowing from one rack to another, by placing inclined plates between them in order to deflect the airflow (see Figure 1-4, Case B for a ABE04x system rack and Figure 1-5, Case B for a ABE056 slimline rack). When inclined plates are used with VM600Mk2/VM600 racks, an inclined plate can also function as a non-flammable separation barrier, if required (see 1.3.4 Instructions for locating and mounting). In addition, the space of 50 mm should be present below and above system racks (ABE04x).

Always ensure adequate spacing (minimum 50 mm for ABE04x racks) is provided below and above a VM600Mk2/VM600 rack to allow proper natural ventilation.

Failure to adhere to this requirement will cause overheating of the rack and as a consequence will affect the correct operation of the system.

If a ABE04x rack is assembled without empty slots between the MPS and/or CMS processing modules/cards, it is recommended to use forced ventilation if the temperature of the air flowing through the rack exceeds 40 °C (104 °F). If a 19″ × 6U rack has at least one empty slot between each processing module/card, it is recommended to use forced ventilation if the temperature of the air flowing through the rack exceeds 55 °C (131 °F).

In a case where forced ventilation by fan units is used, the spacing above, below and between racks can be reduced to zero, providing that the airflow to/from neighbouring racks is ensured.

HAZARDOUS TEMPERATURES CAN EXIST WITHIN AND ON VM600Mk2/VM600 SYSTEM RACKS (ABE04X).

DEPENDING ON THE AMBIENT OPERATING TEMPERATURE, NUMBER OF MODULES/CARDS AND POWER SUPPLIES INSTALLED (AND THEIR CONFIGURATION AND OPERATION), THE INSTALLATION AND COOLING (FORCED OR NATURAL VENTILATION), THE TOP OF A VM600Mk2/VM600 RACK CAN BECOME HOT AND THERE IS THE RISK OF BURNING WHEN HANDLING THE RACK.

SEE ALSO HOT SURFACES AND THE RISK OF BURNING ON PAGE XVII.

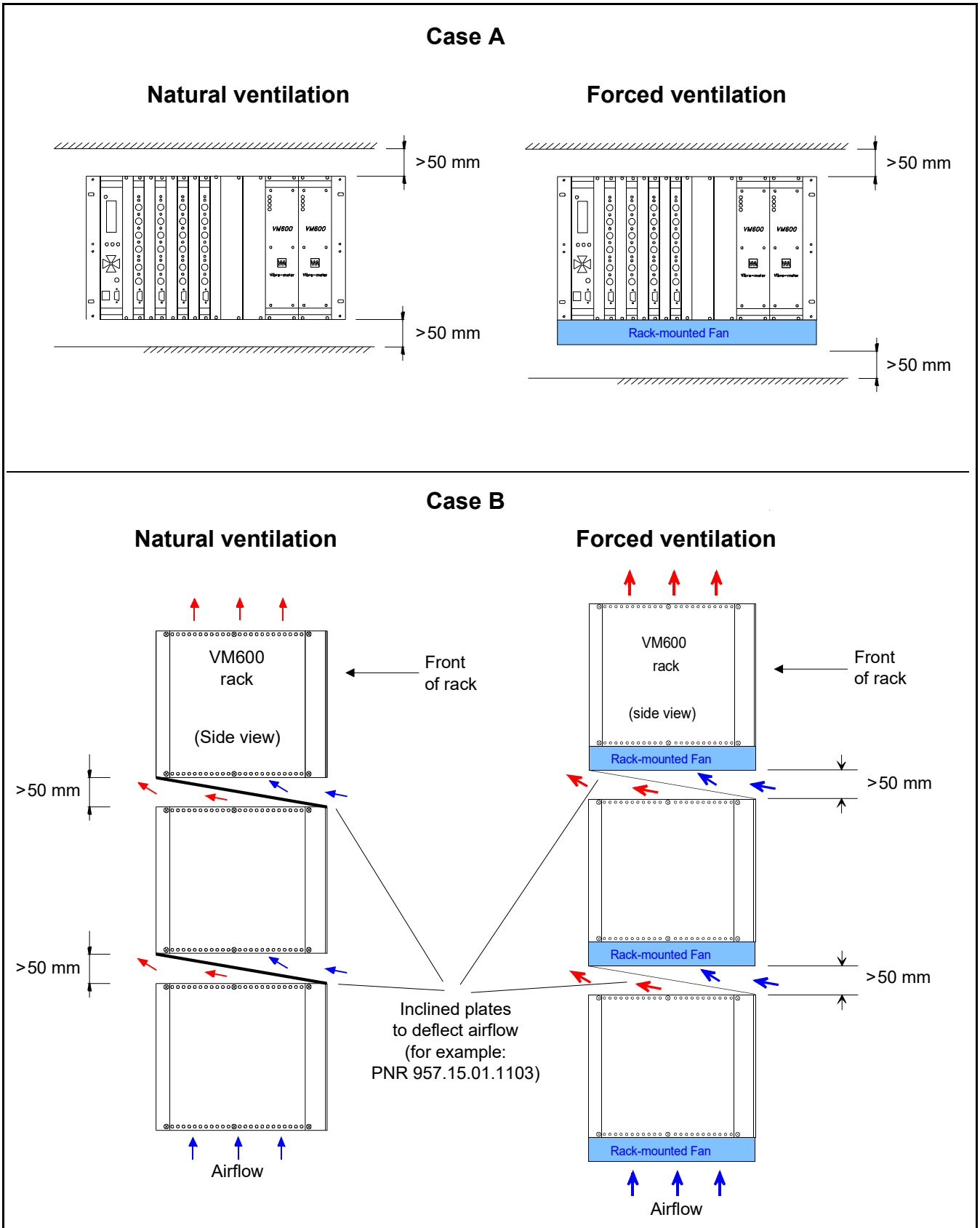


Figure 1-4: Minimum required spacing above, below and between VM600Mk2/VM600 system racks (ABE04x) in an enclosure using natural or forced ventilation

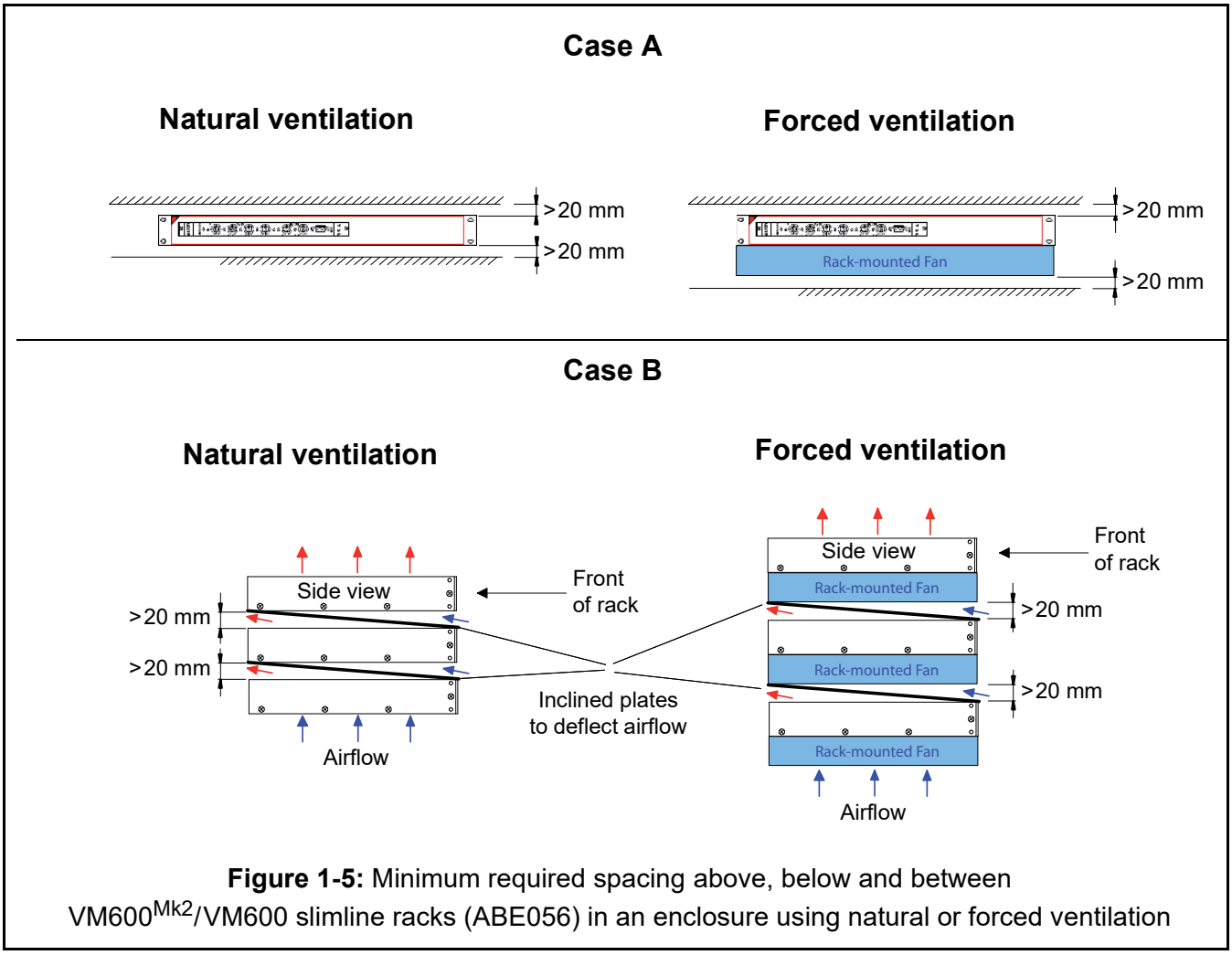


Figure 1-5: Minimum required spacing above, below and between VM600Mk2/VM600 slimline racks (ABE056) in an enclosure using natural or forced ventilation

1.3.2 Circuit breaker

In some circumstances the operator must ensure a switch or circuit breaker is provided in order to comply with the IEC/EN 61010-1 standard. This standard stipulates that permanently connected equipment, such as a VM600Mk2/VM600 system rack (ABE04x), must employ a switch or circuit breaker as a means of disconnection from the mains supply.

A VM600Mk2/VM600 system rack using the AC-input version of the RPS6U rack power supply already have an ON/OFF switch or switches (and a fuse or fuses) at the rear of the rack. However, this is not the case for the DC-input versions of the RPS6U rack power supply, so an appropriately rated external circuit breaker or equivalent must be used.

For a VM600Mk2/VM600 system rack using a DC-input version of the RPS6U rack power supply, the mains power supply lead (power cord) linking the rack to the mains supply must pass through an external switch or circuit breaker.

The switch or circuit breaker must be installed and used in accordance with the manufacturer's instructions in order to ensure the correct and reliable protection of the VM600Mk2/VM600 rack.

The switch or circuit breaker must be chosen in accordance with the version of the DC-input RPS6U rack power supply used, and in particular the maximum permitted input current and output power.

The operator must have easy access to the switch or circuit breaker at all times.

For further information, refer to a *VM600 machinery protection system (MPS) hardware manual*.

1.3.3 Supply wiring

A VM600Mk2/VM600 system rack (ABE04x) using the AC-input version of the RPS6U rack power supply is supplied with a mains power supply lead (power cord). Power supply rear panels with two AC inputs for independent mains supplies are supplied with two mains cables. However, no lead (cable) is supplied with a VM600Mk2/VM600 system rack using the DC-input version of the RPS6U.

NOTE: For further information on the mains power supply lead (power cord) supplied with a VM600 rack, refer to the *VM600 RPS6U rack power supply data sheet* and *VM600 system rack (ABE04x) data sheet*.

In general, for a VM600Mk2/VM600 system rack, the mains power supply lead (power cord) used must be of sufficient cross-section to meet the power requirements of the connected equipment.

In addition, the power supply lead (power cord) must meet certain requirements depending on whether it is used with an AC-input version or a DC-input version of the RPS6U rack power supply.

For further information, refer to a *VM600 machinery protection system (MPS) hardware manual*.

The AC-input rear panels with mains sockets used by VM600Mk2/VM600 system racks have a power entry module that requires temperature derating when a rack operates in environments with temperatures greater than 50°C (122°F).

NOTE: For further information on the temperature derating required for AC-input rear panels, refer to a *VM600 machinery protection system (MPS) hardware manual*.

1.3.4 Instructions for locating and mounting

A POPULATED VM600Mk2/VM600 SYSTEM RACK (ABE04X) WITH MODULES/CARDS AND RACK POWER SUPPLIES INSTALLED IS A HEAVY OBJECT.

DEPENDING ON THE NUMBER OF MODULES/CARDS AND RPS6U RACK POWER SUPPLIES INSTALLED, A VM600 SYSTEM RACK CAN BE TOO HEAVY TO LIFT, LOWER OR OTHERWISE HANDLE MANUALLY BY A SINGLE PERSON AND THERE IS THE RISK OF INJURY DURING INSTALLATION OR REMOVAL.

SEE ALSO HEAVY OBJECTS AND THE RISK OF INJURY ON PAGE XIII.

The positioning of the VM600Mk2/VM600 rack shall allow easy access to the on/off switch for the main supply.

A fully equipped VM600Mk2/VM600 rack can weigh 23 kg, so the following instructions apply:

- **Two people are required to carry or mount the rack in its cabinet.**
- **Shelves, guide rails and other devices used to support the rack must be strong enough to bear the weight of the rack.**

For the standard version (PNR: 204-040-100-0xx), separate-circuits version (PNR: 204-040-100-1xx) and rear-mounting version (PNR: 204-042-100-0xx) of the VM600Mk2/VM600 rack, deflection plates (barriers) must be installed both above and below the rack.

The barriers installed above and below a VM600Mk2/VM600 rack are required to prevent unintentional access to the equipment in order to help reduce the risk of electrical shock.

In addition, the barrier installed below a VM600Mk2/VM600 rack is also required in order to help prevent the spread of fire in the unlikely event that one should occur. Accordingly, the barrier below the rack must be a non-flammable separation barrier made of metal or a UL94 V-1 rated (or better) material.

See also ELECTRICAL SAFETY AND INSTALLATION ON PAGE XII.

When inclined plates are used with a VM600Mk2/VM600 rack in order to deflect airflow and prevent warm air flowing into a rack, an inclined plate can also function as a required deflection plate (barrier) if it is made from an appropriate material. See 1.3.1 Ventilation.

1.4 Connecting power

For a VM600Mk2 machinery protection system (MPS) housed in a VM600Mk2/VM600 system rack (ABE04x), the following versions of RPS6U rack power supply are available:

- RPS6U power supply for use with an external AC-mains supply.
- RPS6U power supplies for use with different external DC-mains supplies.

The RPS6U rack power supply must be used with an appropriate connection panel mounted at the rear of the VM600Mk2/VM600 rack. Several types of these associated rear panels exist in order to allow the connection of external AC-mains and/or DC-mains power to the rack.

NOTE: For further information, refer to the *VM600 RPS6U rack power supply data sheet* and a *VM600 machinery protection system (MPS) hardware manual*.

HAZARDOUS VOLTAGES EXIST WITHIN VM600Mk2/VM600 SYSTEM RACKS (ABE04X).
SEE HAZARDOUS VOLTAGES AND THE RISK OF ELECTRIC SHOCK ON PAGE XIII.

As shown in Figure 1-2, one or two RPS6U power supplies can be installed in a VM600Mk2/VM600 system rack (ABE04x). When two RPS6Us are installed in a rack, the RPS6U on the right (slots 18 to 20) is power supply 1 (PS1) and the RPS6U on the left (slots 15 to 17) is power supply 2 (PS2).

A rack can have two RPS6U power supplies installed for different reasons:

- In order to support rack power supply redundancy.
- In order to supply power to the modules/cards (non-redundantly).

NOTE: A VM600Mk2/VM600 system rack configuration with two RPS6U power supplies (330 W) operating non-redundantly to supply power to the modules/cards is typically only necessary for a full rack of modules/cards in an application where the operating environment requires RPS6U output power derating.

The number and type of RPS6U power supplies installed in a VM600Mk2/VM600 system rack, together with the number of modules/cards installed and the environmental conditions, helps determine the mode of operation of the RPS6U power supplies as either redundant or non-redundant.

NOTE: For further information on RPS6U power supply configurations, including redundant configurations, refer to a *VM600 machinery protection system (MPS) hardware manual*.

To connect power to a VM600Mk2/VM600 system rack:

- Determine the type of RPS6U rack power supply or supplies used by the rack: DC-input, AC-input or both (that is, 1 × DC-input and 1 × AC-input).
  See 1.4.1 Front panels.
- Connect the external mains power supply to the rack via the DC-input rear panel(s) and/or AC-input rear panel(s), or combined AC-input and DC-input rear panel using appropriate mains power supply leads (power cords).

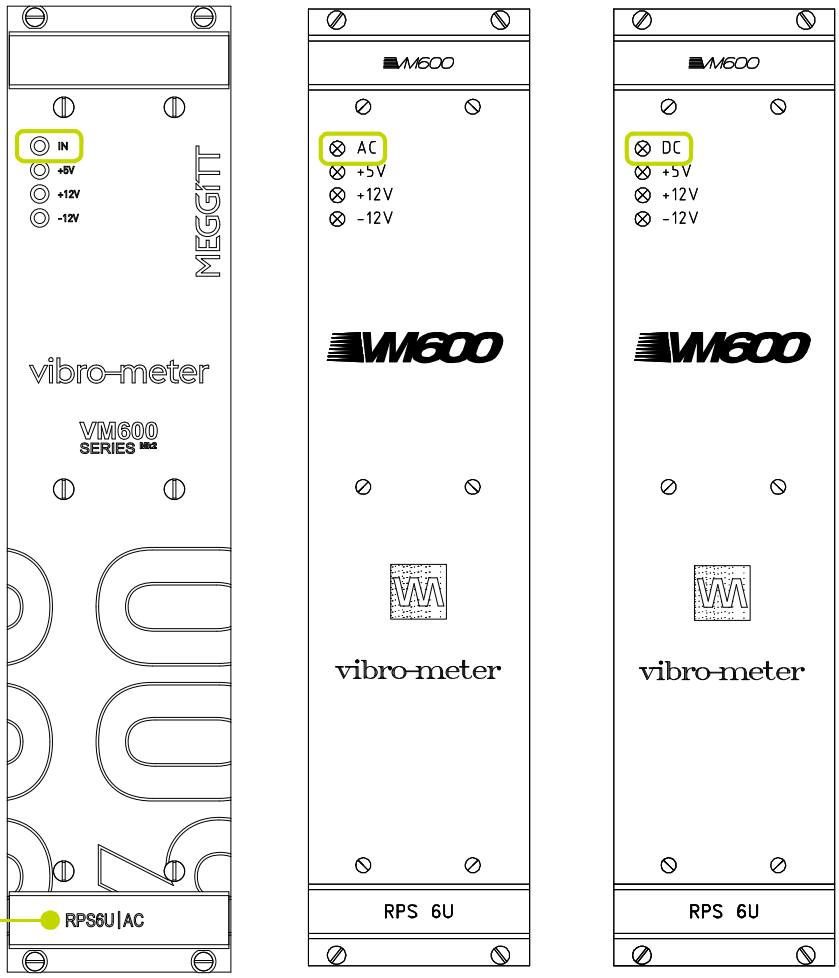
1.4.1 Front panels

Figure 1-6 shows the panels of RPS6U rack power supplies with different inputs: AC or DC.

IN, **AC** or **DC** LED:
Green indicates that the external mains supply is present and is within the normal range.
This LED is on when the RPS6U is operating normally.

+5V, **+12V** and **−12V** LEDs:
Yellow indicates that the corresponding internal supply voltage is being generated and is within the normal range.
These LEDs are on when the RPS6U is operating normally.

Note: The lower handle on the front panel indicates the VM600Mk2 RPS6U version: AC, 24VDC or 110VDC.



(AC-input version) (DC-input version)

(a) Panel of later (higher-power) version of the RPS6U rack power supply

(b) Panels of earlier (original) version of the RPS6U rack power supply: AC-input version (left) and DC-input version (right)

Figure 1-6: Front panels for the different versions of the RPS6U rack power supply

NOTE: For a VM600Mk2/VM600 system rack (ABE04x) with two RPS6U rack power supplies connected to two external mains supplies, if one of the external mains supplies is not connected/operating, the **+5V** LED on the RPS6U connected to that (non-operating) external mains supply can still show yellow even though that particular RPS6U's +5 V output is not operating normally.
(This incorrect **5V** LED indication is due to reverse/leakage current across an ORing diode used to connect the +5 V outputs from both RPS6U power supplies.)

1.4.2 Associated rear panels

NOTE: For further information on RPS6U power supply configurations, including associated rear panels, refer to a *VM600 machinery protection system (MPS) hardware manual*.

1.4.3 Power supply check relay

For a VM600Mk2/VM600 rack, the power supply check relay provides an indication that the +5 V, +12 V and −12 V supplies are being correctly generated and delivered by the rack's power supply and/or rack backplane. The connector for the power supply check relay is available at the rear of the rack, for example, on the rear panel associated with a RPS6U power supply or supplies.

THE POWER SUPPLY CHECK RELAY IS SPECIFIED FOR OPERATION WITH SEPARATED OR SAFETY EXTRA-LOW VOLTAGE (SELV) SYSTEM VOLTAGE LEVELS:

• MAXIMUM SWITCHING VOLTAGE OF ±30 V_{RMS} / ±42.4 $V_{AC(PEAK)}$ OR 60 V_{DC}.

NOTE: For further information, refer to the *VM600 system rack (ABE040 and ABE042) data sheet* or *VM600 slimline rack (ABE056) data sheet*, as appropriate, and a *VM600 machinery protection system (MPS) hardware manual*.

1.5 Handling VM600Mk2 modules

Operating personnel should remember to observe the handling precautions mentioned in Handling precautions for electrostatic sensitive devices on page xiv when handling modules/cards.

Failure to do this may result in modules/cards becoming damaged by electrostatic discharges.

Before inserting a module/card in a rack, visually check that none of the connector pins are bent.

1.6 Installing VM600Mk2 modules

Before installing VM600Mk2 modules/cards or otherwise working with a VM600Mk2/VM600 rack, it is important to refer to the information given in the safety section of this manual (see Safety).

FOR SAFETY REASONS, ANY VM600Mk2 /VM600 RACK SLOT (MODULE POSITION) NOT POPULATED BY A MODULE/CARD MUST BE COVERED BY A BLANK PANEL.

1.6.1 VM600Mk2/VM600 rack slots / module positions

VM600Mk2/VM600 racks are modular systems with different rack slots / module positions as follows:

- VM600Mk2/VM600 system rack

  The VM600Mk2/VM600 system rack (ABE04x) is a 19″ × 6U rack with 21 × VME slots in the front and the rear of the rack. The rack slots are designated slot 00 to slot 20 (left to right, as seen from the front). See Figure 1-2.

- VM600Mk2/VM600 slimline rack

  The VM600Mk2/VM600 slimline rack (ABE056) is a 19″ × 1U rack with 1 × VME slot in the front of the rack and 2 × slots on the rear. The rack slots are designated slot 01 and slot *n*, since it can be set to any slot number from slot 03 to 14. See Figure 1-3.

The front and rear module/card cages of a VM600Mk2/VM600 rack are partitioned by a backplane. Each side of the backplane is equipped with connectors allowing modules/cards to be quickly and easily installed. See also 2.1 VM600Mk2/VM600 racks.

The following VM600Mk2 modules are connected to the backplane by installing them from the front of the VM600Mk2/VM600 rack:

- MPC4Mk2 machinery protection and condition monitoring module
- CPUMMk2 rack controller and communications interface module.

The following VM600Mk2 modules are connected to the backplane by installing them from the rear of the VM600Mk2/VM600 rack:

- IOC4Mk2 input/output module (for the MPC4Mk2 module)
- RLC16Mk2 relay module
- IOCNMk2 input/output module (for the CPUMMk2 module).

NOTE: Information on other VM600 MPS hardware can be found in a *VM600 machinery protection system (MPS) hardware manual*.

1.6.2 Installation restrictions

Table 1-1 shows the installation restrictions that apply to MPS modules/cards in a VM600Mk2/VM600 system rack (ABE04x).

Table 1-1: Attribution of slots in a VM600Mk2/VM600 system rack (ABE04x)

Rack (VME) slot no.	Module/card or system component accepted in front module/card cage	Module/card or system component accepted in rear module/card cage
00	CPUMMk2 (Reserved for CPUx)	IOCNMk2 (Reserved for IOCx)
01		IOCNMk2 or RLC16Mk2 (RLC16 or IRC4)
02	(Reserved)	(Reserved)
03 to 14	MPC4Mk2 (AMC8, MPC4 or XMx16)	IOC4Mk2 or RLC16Mk2 (Associated IOC8T, IOC4T or XIO16T, or RLC16 or IRC4)
15	(Reserved for RPS6U as PS2 (Power supply 2, PS2) (Width of RPS6U = 3 slots))	RLC16Mk2 (RLC16 or IRC4)
16		RLC16Mk2 (RLC16)
17		RLC16Mk2 (RLC16)
18	(Reserved for RPS6U as PS1 (Power supply 1, PS1) (Width of RPS6U = 3 slots))	RLC16Mk2 (RLC16)
19		(Reserved for rear panel associated with the rack power supply (one or two RPS6Us))
20		

Notes

A CPUMMk2 module can be installed in rack slot 00 or 01. The CPUMMk2 module must have a IOCNMk2 module installed directly behind it in the rack.

MPC4Mk2 modules can be installed in rack slots 03 to 14. A MPC4Mk2 module must have a IOC4Mk2 module installed directly behind it in the rack.

In a VM600Mk2/VM600 system rack (ABE04x), one or two RPS6U rack power supplies can be installed. The rack can have two RPS6U rack power supplies installed for different reasons: in order to support rack power supply redundancy or in order to supply power to the modules/cards. For further information, refer to a *VM600 machinery protection system (MPS) hardware manual*.

NOTE: VM600Mk2 system racks (ABE04x) can contain up to 12 × MPC4Mk2 + IOC4Mk2 modules, associated RLC16Mk2 relay modules (optional) and a maximum of 1 × CPUMMk2 + IOCNMk2 module (optional), as defined by the system configuration created in VibroSight Protect.

Table 1-2 shows the installation restrictions that apply to MPS modules/cards in a VM600Mk2/VM600 slimline rack (ABE056).

Table 1-2: Attribution of slots in a VM600Mk2/VM600 slimline rack (ABE056)

Rack slot no.	Module/card or system component accepted in front module/card cage	Module/card or system component accepted in rear module/card cage
01 (default)	MPC4Mk2 (AMC8, MPC4 or XMx16)	IOC4Mk2 (associated IOC8T, IOC4T or XIO16T)
00	(None)	RLC16Mk2 (RLC16)

Notes

A MPC4Mk2 module can be installed in rack slot 01. A MPC4Mk2 module must have a IOC4Mk2 module installed directly behind it in the rack.

A VM600Mk2/VM600 slimline rack (ABE056) has one rack slot / module position in the front and two rack slots / module positions in the rear. In the Rack slot no. column, the factory assigned default values are shown. See also 2.1.3.2 Slot number coding for VM600Mk2 modules in the rear of a slimline rack.

NOTE: VM600Mk2 system racks (ABE04x) can contain 1 × MPC4Mk2 + IOC4Mk2 module in rack slot 01, and an associated RLC16Mk2 relay module (optional) in rack slot 00, as defined by the system configuration created in VibroSight Protect.

When a VM600Mk2 machinery protection system (MPS) is installed for the first time, the MPC4Mk2 + IOC4Mk2 modules, RLC16Mk2 modules, and CPUMMk2 + IOCNMk2 module, within it must be configured according to their intended application.

MPC4Mk2 + IOC4Mk2 modules are software configured using the VibroSight Protect software, while RLC16Mk2 modules are configured and controlled by the MPC4Mk2 module that they are associated with.

CPUMMk2 + IOCNMk2 modules are also software configured using the VibroSight Protect software.

In addition, jumpers must be manually configured to match the VibroSight Protect configuration for the modules, as follows:

- For MPC4Mk2 + IOC4Mk2 modules, jumpers on the IOC4Mk2 are manually configured to select the VM600Mk2/VM600 rack's Open Collector (OC) bus and/or Raw bus lines that are used to share signals/lines between the MPC4Mk2 + IOC4Mk2 and other modules in the rack, for example, to control and monitor RLC16Mk2 module relays, to share status information between logical functions, and distribute the system-wide VM600Mk2 MPS safety-line control signal.
- For RLC16Mk2 modules, jumpers on the RLC16Mk2 are manually configured to select the VM600Mk2/VM600 rack's Open Collector (OC) bus and/or Raw bus lines that are used to share signals/lines between the RLC16Mk2 and other modules in the rack, for example, to control and monitor RLC16Mk2 module relays, to share status information between logical functions, and distribute the system-wide VM600Mk2 MPS safety-line control signal.

In general, all configurable elements (module/card configurations (software) and jumpers (hardware)) are normally configured in the factory before delivery of the system.

See also 1.9 System configuration and 1.9.2 Hardware configuration.

1.7 Communicating with a VM600Mk2 MPS

The various possibilities for communicating with a VM600Mk2 machinery protection system (MPS) are shown in Figure 1-7. In all cases, a computer running the VibroSight® software is required for the configuration, operation and management of the system.

NOTE: Once configured, a VM600Mk2 MPS can operate stand-alone, that is, without a computer permanently connected.

To configure a VM600Mk2 MPS:

- For a VM600Mk2/VM600 system rack (ABE04x) or VM600Mk2/VM600 slimline rack (ABE056) with a VM600Mk2 MPS consisting of a single MPC4Mk2 + IOC4Mk2 module

  In this case, a computer running the VibroSight® software is typically connected to the MPC4Mk2 + IOC4Mk2 module using the “LAN” connector available on the front panel of the MPC4Mk2 module, either directly or via a network switch. This is shown in Figure 1-7 (a).
- For a VM600Mk2/VM600 system rack (ABE04x) with a VM600Mk2 MPS consisting of multiple MPC4Mk2 + IOC4Mk2 modules

  In this case, a computer running the VibroSight® software is typically connected to the MPC4Mk2 + IOC4Mk2 modules using the “LAN” connectors connector available on the front panel of the MPC4Mk2 modules, via one or more network switches. This is shown in Figure 1-7 (b).

In addition:

- For a VM600Mk2/VM600 system rack (ABE04x) with a VM600Mk2 MPS that also contains a CPUMMk2 + IOCNMk2 module

  In this case, the CPUMMk2 + IOCNMk2 module can act as communications interface by obtaining data from the MPC4Mk2 + IOC4Mk2 module(s) via the rack’s VME bus and subsequently sharing this information with external third-party systems such as a DCS or PLC. This is shown in Figure 1-7 (c).

  NOTE: As a fieldbus communications interface for a VM600Mk2 monitoring system, the CPUMMk2 module communicates with other VM600Mk2 modules in the rack (such as the MPC4Mk2) via the VM600Mk2/VM600 rack’s VME bus and with XMx16 modules via a system Ethernet link in order to obtain measurement data and then share this information with third-party systems such as a DCS or PLC.

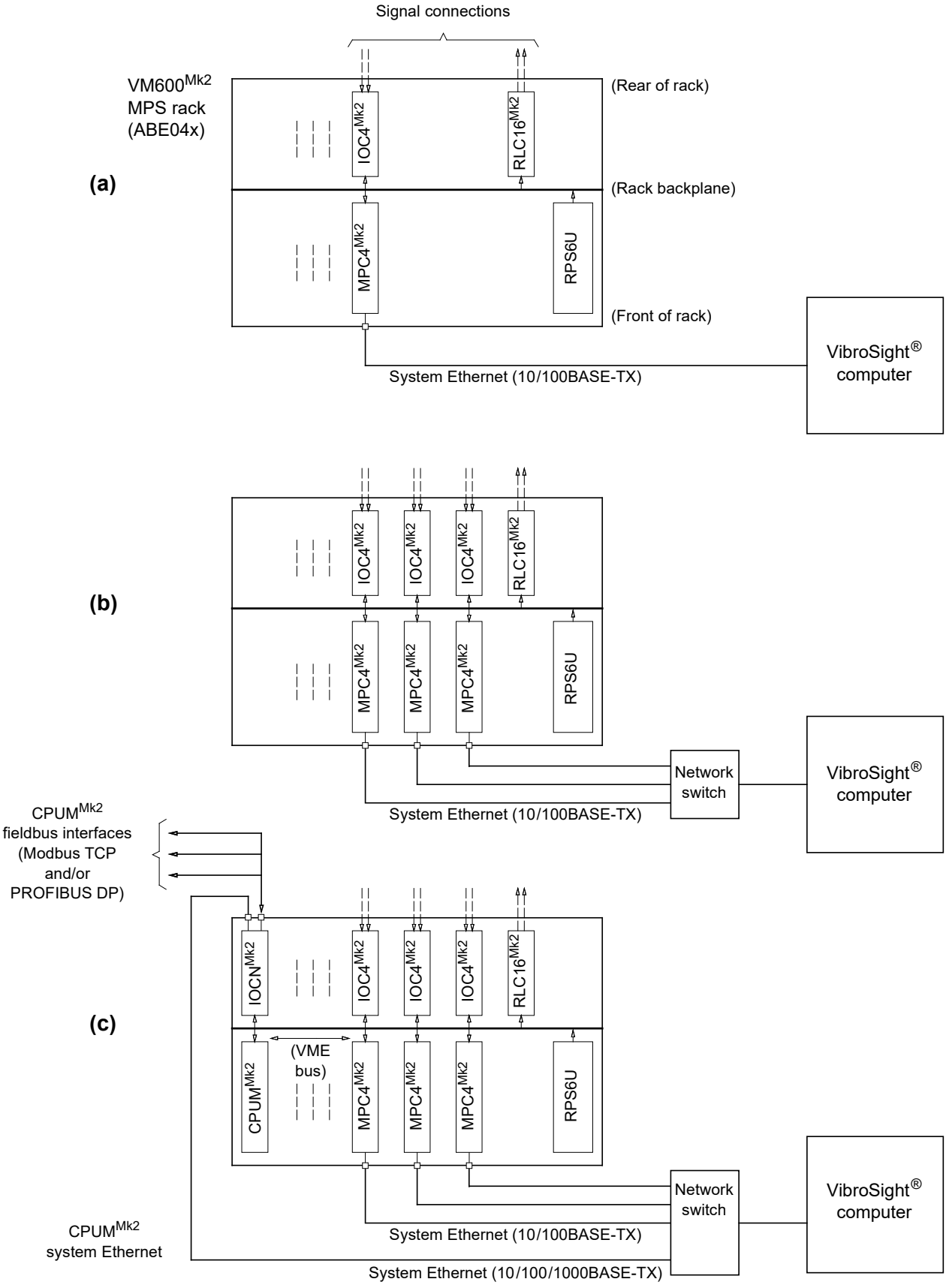


Figure 1-7: Communicating with a VM600Mk2 machinery protection system (MPS) in a VM600Mk2/VM600 system rack (ABE04x)

1.8 Connecting to a computer

The MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring module has one system communication interface available via the “LAN” connector on the front panel of the MPC4Mk2 module (front of rack). See Figure 2-3.

This system communication interface is a Ethernet interface (10/100BASE-TX (up to 100 Mbps)) that is used for all system communications with the MPC4Mk2 + IOC4Mk2 module. The MPC4Mk2 module supports a proprietary TCP/IP-based protocol that communicates with the VibroSight® and VibroSight Protect software running on a computer.

The CPUMMk2 + IOCNMk2 rack controller and communications interface module has two system communication interfaces available via the “ETHERNET1” and “ETHERNET2” connectors on the front panel of the IOCNMk2 module (rear of rack). See Figure 2-9.

These system communication interfaces are Ethernet interfaces (10/1000/1000BASE-TX (up to 1000 Mbps (1 Gbps))) that are used for all system communications with the CPUMMk2 + IOCNMk2 module. The CPUMMk2 module supports a proprietary TCP/IP-based protocol that communicates with the VibroSight® and VibroSight Protect software running on a computer.

NOTE: The CPUMMk2 module communicates with other VM600Mk2 modules in the VM600Mk2/VM600 rack (such as MPC4Mk2 modules) via the rack’s VME bus and with XMx16 modules via a system Ethernet link.

Standard Ethernet cables (Cat 5 or better) can be used for networking between a VM600Mk2 machinery protection system (MPS) and network switches or computers.

For a VM600Mk2 machinery protection system (MPS) consisting of a single MPC4Mk2 + IOC4Mk2 module, or when working with a single MPC4Mk2 + IOC4Mk2 module, the MPC4Mk2 module can be connected directly to a VibroSight computer or connected indirectly via a network switch (see Figure 1-7 (a) or (b)).

For a VM600Mk2 machinery protection system (MPS) consisting of multiple MPC4Mk2 + IOC4Mk2 modules, the MPC4Mk2 modules are connected together using one or more network switches (or equivalent) before being connected to a VibroSight computer (see Figure 1-7 (b)).

In addition, for a VM600Mk2 machinery protection system (MPS) that also contains a CPUMMk2 + IOCNMk2 module, the CPUMMk2 module can use the same network switches (or equivalent) as the MPC4Mk2 modules before being connected to a VibroSight computer (see Figure 1-7 (c)).

1.9 System configuration

1.9.1 Software configuration

The modules in a VM600Mk2 machinery protection system (MPS) must be software configured before the system can be used.

NOTE: A VibroSight / VM600Mk2 MPS must be configured as a whole, that is, the VibroSight Protect software requires concurrent access to all modules in the VM600Mk2/VM600 rack in order to configure the system (see 1.7 Communicating with a VM600Mk2 MPS and 1.8 Connecting to a computer).

While the majority of settings are normally configured in the factory before delivery, the user is nevertheless able to modify certain parameters using the VibroSight Protect software and any associated hardware jumpers on the IOC4Mk2 and RLC16Mk2 modules, if required.

NOTE: For further information on the VibroSight® software, refer to the *VibroSight software release notes* and/or the *VibroSight help*.

In general, the VibroSight Protect software is used for software configuration as follows:

- To configure the system properties for the VM600Mk2/VM600 rack.

  For example, type of rack (system rack (ABE04x) or slimline rack (ABE056)); type and organisation of power supplies (AC and/or DC input, rack power supply redundancy); type (MPC4Mk2 + IOC4Mk2 or RLC16Mk2), number (up to 12) and location (rack slot number/position) of VM600Mk2 modules.

  Global system properties are configured and summarised on the Layout tab/page of VibroSight Protect.

  To configure the settings for the VM600 Mk2 modules (MPC4Mk2 + IOC4Mk2, RLC16Mk2, and CPUMMk2 + IOCNMk2) in the VM600Mk2/VM600 rack.

  For example, for a MPC4Mk2 + IOC4Mk2 module, enabled or disabled, network settings (IP address); sensor/measurement chain, processing and alarms for each channel (dynamic and auxiliary); logical functions; relays (user-configurable and common circuit-fault); analog outputs.

  For example, for a RLC16Mk2 module, enabled or disabled, mode (normally energised (NE) or normally de-energised (NDE)), input (logical function), latched or not, for each relay.

  For example, for a CPUMMk2 + IOCNMk2 module, enabled or disabled, network settings (IP address), and fieldbus configuration.

  Individual module settings are configured and summarised on the Configure tab/page of VibroSight Protect.

- To upload the configuration to the VM600Mk2 machinery protection system (MPS) in the VM600Mk2/VM600 rack.

  Once a configuration has been completed and passed all of the automatic consistency and error checking (Consistency check window), it can be uploaded to the VM600Mk2 machinery protection system (MPS), that is, to the MPC4Mk2 + IOC4Mk2, RLC16Mk2, and CPUMMk2 + IOCNMk2 modules.

In VibroSight Protect, the Dashboard tab/page is used to upload a valid configuration to a connected the VM600Mk2 machinery protection system (MPS).

The configuration of individual channels on MPC4Mk2 + IOC4Mk2 modules must be made using software before the system can be used. The VibroSight Protect software should be used to do this once the rack is powered up. See 1.7 Communicating with a VM600Mk2 MPS.

In addition, the VibroSight System Manager software is used for other infrequent system maintenance and operation tasks, such as module firmware upgrades or accessing module diagnostic log files. See 3 Overview of VM600Mk2 machinery protection system (MPS) software.

NOTE: In general, VibroSight Protect is used for the configuration/operation of a VM600Mk2 MPS, while VibroSight System Manager is used more for supporting operation/management tasks (see 3 Overview of VM600Mk2 machinery protection system (MPS) software).

1.9.2 Hardware configuration

The modules in a VM600Mk2 machinery protection system (MPS) must be hardware configured before the system can be used.

While the majority of settings are normally configured in the factory before delivery, the user is nevertheless able to modify certain parameters if required using the VibroSight Protect software (see 1.9 System configuration) and jumpers on the IOC4Mk2 and RLC16Mk2 modules.

NOTE: For further information on the VibroSight® software, refer to the *VibroSight software release notes* and/or the *VibroSight help*.

While the vast majority of settings are software configured using VibroSight Protect (see 1.9 System configuration), jumpers on the modules in a VM600Mk2 machinery protection system (MPS) must be manually configured to match the VibroSight Protect configuration as follows:

- For a MPC4Mk2 + IOC4Mk2 module, jumpers on the IOC4Mk2 module are used to manually configure the VM600Mk2/VM600 rack's Open Collector (OC) bus and/or Raw bus lines that control and monitor the module's relays, and distribute the system-wide VM600Mk2 MPS safety line control signal.
- For a RLC16Mk2 module, jumpers on the module are used to manually configure the VM600Mk2/VM600 rack's Open Collector (OC) bus and/or Raw bus lines that control and monitor the module's relays, and distribute the system-wide VM600Mk2 safety line control signal.

NOTE: The jumper information is automatically generated and displayed by the VibroSight Protect software.

In VibroSight Protect, on the Configure tab/page, when an individual module (MPC4Mk2 + IOC4Mk2 or RLC16Mk2) is selected, the Jumpers tab for the module displays the module's required jumper settings.

On a Jumpers tab, the Jumpers location displays a photo of the area of the module (IOC4Mk2 or RLC16Mk2) to illustrate where the jumpers are physically located on the module, while the Jumpers configuration highlights the jumpers that must be installed in order to match the VibroSight Protect configuration.

NOTE: When configuring hardware jumpers on IOC4Mk2 and RLC16Mk2 modules, it is important to note that each module can be different and that for each module:
• Jumpers shown as grey in Jumpers configuration (VibroSight Protect) for the module must be removed (not installed).
• Jumpers shown as blue in Jumpers configuration (VibroSight Protect) for the module must be inserted (installed).

1.9.3 Configuration storage and hot-swapping

The modules in a VM600Mk2 machinery protection system (MPS) are software configured using the VibroSight Protect software (see 1.9.1 Software configuration).

When VibroSight Protect is used to activate a configuration on a VM600Mk2 MPS, a copy of the overall system configuration is uploaded to and stored on the module(s), as follows:

- For each MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring module, a copy of the configuration is stored on the MPC4Mk2 module and on the corresponding IOC4Mk2 input/output module.
- For the CPUMMk2 + IOCNMk2 rack controller and communications interface module, a copy of the configuration is stored on the CPUMMk2 module and on the corresponding IOCNMk2 input/output module.

This locally redundant configuration storage enables the live insertion and removal of VM600Mk2 modules (hot-swapping) with automatic reconfiguration, for ease of maintenance and reduced downtime.

NOTE: In a VM600Mk2 machinery protection system (MPS), the live insertion and removal of modules (hot-swapping) with automatic reconfiguration is handled by the MPC4Mk2 + IOC4Mk2 modules themselves, so the CPUMMk2 + IOCNMk2 module is not required for this functionality (unlike first-generation VM600 cards/systems which require a CPUM for equivalent functionality).

1.10 VibroSight networking

VibroSight uses zero-configuration networking (zeroconf) in order to automatically create usable networks of VibroSight-compatible devices with the minimum amount of network administration.

1.10.1 Zero-configuration networking

VibroSight uses a proprietary implementation of the zero-configuration networking (zeroconf) protocols for all required networking operations. This includes the automatic discovery of and communications between VibroSight-system components, such as VibroSight software modules, VM600 modules/cards and VibroSmart® modules.

NOTE: The zero-configuration networking (zeroconf) protocols use multicast domain name system (mDNS) messages on UDP port 5353 for device discovery, so this UDP port number must be added as an allowed UDP port to the exceptions list in Windows Firewall.

If the automatic discovery does not work (for example, due to a network not meeting the requirements of zeroconf), then connections between the VibroSight-system components can be established manually by using the IP addresses of the components.

For example, for VibroSight software to VM600Mk2 machinery protection system (MPS) module communications, it is possible to connect from VibroSight System Manager to a MPC4Mk2 + IOC4Mk2 module (even if the MPC4Mk2 module does not have a valid IP address) when the computer running VibroSight System Manager and the module are on the same network. (If necessary, a direct connection between the computer and the device can be made in order to bypass the network.)

1.10.2 VibroSight network requirements

A network that meets the requirements of zero-configuration networking (zeroconf) is recommended in order to reduce the need to establish connections between VibroSight-system components manually.

Network bandwidth and latency recommendations depend on the monitoring system hardware being used:

For a VM600Mk2 machinery protection system (MPS), a network that supports bandwidth and latency requirements equivalent to 100 Mbps LAN or better is recommended.

For reference, for a a VM600 condition monitoring system using VM600 XMx16 + XIO16T modules, a network that supports bandwidth and latency requirements equivalent to 1000 Mbps (1 Gbps) LAN or better is recommended.

NOTE: The highly configurable nature of the VibroSight software and monitoring system hardware, and the wide variation in machinery monitoring applications makes it impossible to define operating limits for a VibroSight network that are correct under all circumstances.

1.10.3 Wide area networking

It is not recommended to use WANs between VibroSight-system components for reasons of bandwidth, latency and security.

1.11 MPC4Mk2 + IOC4Mk2 module network interface

The configuration of the network interface (IP address) of the MPC4Mk2 must be known in order to establish communications and work with a MPC4Mk2 + IOC4Mk2 module as part of a VM600Mk2 machinery protection system (MPS).

For a MPC4Mk2 module delivered as part of a VM600Mk2 solution, the module's IP address is normally configured as specified at the time of ordering. For a MPC4Mk2 module delivered as a spare part, the module's IP address is normally configured to used dynamic addressing (that is, DHCP). See 2.2.3 MPC4Mk2 module factory assigned defaults.

1.11.1 Configuring the network interface (IP address) for a MPC4Mk2 + IOC4Mk2 module

VibroSight System Manager is used to configure the network interface (IP address) of a MPC4Mk2 + IOC4Mk2 module. See 3.3.1 Configuring the network interface for a MPC4Mk2 module.

1.11.2 Identifying a MPC4Mk2 + IOC4Mk2 module in a configuration

VibroSight Protect is used to identify a MPC4Mk2 + IOC4Mk2 module in a VibroSight Protect configuration. See 3.4.1 Identifying a MPC4Mk2 module in a VibroSight Protect (MPS) configuration.

1.12 CPUMMk2 + IOCNMk2 module network interface

The configuration of the network interface (IP address) of the CPUMMk2 must be known in order to establish communications and work with a CPUMMk2 + IOCNMk2 module as part of a VM600Mk2 machinery protection system (MPS).

For a CPUMMk2 module delivered as part of a VM600Mk2 solution, the module's IP address is normally configured as specified at the time of ordering. For a CPUMMk2 module delivered as a spare part, the module's IP address is normally configured to used dynamic addressing (that is, DHCP). See 2.5.3 CPUMMk2 module factory assigned defaults.

1.12.1 Configuring the network interface (IP address) for a CPUMMk2 + IOCNMk2 module

VibroSight System Manager is used to configure the network interface (IP address) of a CPUMMk2 + IOCNMk2 module. See 3.3.9 Configuring the network interface for a CPUMMk2 module.

1.12.2 Identifying a CPUMMk2 + IOCNMk2 module in a configuration

VibroSight Protect is used to identify a CPUMMk2 + IOCNMk2 module in a VibroSight Protect configuration. See 3.4.3 Identifying a CPUMMk2 module in a VM600Mk2/VM600 rack using VibroSight Protect.

1.13 Diagnostic log files

During normal operation, the VM600Mk2 modules record operating information in a diagnostic log file, known as a *module* debug log (`*.ddbgl`).

Although not of any utility to the end user, VM600Mk2 module diagnostic log files contain information that can be useful to Meggitt Customer support when investigating certain issues.

You can download and save diagnostic logs from a VM600Mk2 module using a Diagnostics command in the VibroSight System Manager software. See 3.3.11 Saving diagnostic logs from a VM600Mk2 module.

1.14 VibroSight software diagnostic logs

During normal operation, the VibroSight software records operating information in a diagnostic log file, known as a VibroSight diagnostic information file (`*.zip`)

Although not of any utility to the end user, VibroSight diagnostic log files contain information that can be useful to Meggitt Customer support when investigating certain issues.

You can download and save the diagnostic logs for the VibroSight software using a Help menu command in any VibroSight software module.

In any VibroSight software module, click Help > Save Diagnostic information and use the resultant Save as dialog box to indicate in which folder and under what name the diagnostic information file should be saved. Then click Save.

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2 OVERVIEW OF VM600Mk2 MACHINERY PROTECTION SYSTEM (MPS) HARDWARE

This chapter provides a brief overview of the VM600Mk2 machinery protection system (MPS) hardware.

This includes an introduction to the features and basic functionality of the VM600Mk2 machinery protection system (MPS) modules:

- MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring module
- RLC16Mk2 relay module
- CPUMMk2 + IOCNMk2 rack controller and communications interface module.

For information on the VibroSight® software used with the VM600Mk2 machinery protection system (MPS) hardware, see 3 Overview of VM600Mk2 machinery protection system (MPS) software.

NOTE: For further information on VM600 racks in general, refer to a *VM600 machinery protection system (MPS) hardware manual*.

2.1 VM600Mk2/VM600 racks

The VM600Mk2/VM600 system racks (ABE040 and ABE042) and slimline rack (ABE056) are used to house hardware (modules (cards), power supplies) for the VM600Mk2/VM600 series of machinery protection and/or condition monitoring systems.

VM600Mk2/VM600 racks contain a front module/card cage and a rear module/card cage, separated by the rack backplane. Processing modules (cards) are installed in the front of the rack and the associated input/output modules (cards) are installed in the rear.

These racks are particularly suitable for industrial environments, where equipment must be permanently installed in 19″ cabinets or panels.

See also 1.3 Installing a rack.

2.1.1 VM600Mk2/VM600 system racks (6U – ABE04x)

Two types of VM600Mk2/VM600 ABE04x system rack are available: the ABE040 and the ABE042. These are very similar, differing only in the position of the mounting brackets. Both racks have a standard height of 6U and provide mounting space (rack slots) for up to 12 single-width VM600Mk2/VM600 modules (card pairs), or a combination of single-width and multiple-width modules (cards).

The different versions of ABE04x system rack enable different mounting options to support various markets and applications. Either one or two RPS6U rack power supplies can be installed in a VM600Mk2/VM600 ABE04x system rack, supporting rack power supply redundancy.

2.1.1.1 VM600Mk2/VM600 system rack backplane

The VM600Mk2/VM600 ABE04x system racks use a custom-designed backplane that combines features of a VME backplane with other special features in order to support modules (cards) from the Meggitt vibro-meter® product line.

The VM600Mk2/VM600 ABE04x rack backplane consists of various different systems such as a VME bus, an analogue bus and through connections.

For the VM600Mk2/VM600 ABE04x rack, the analogue bus is used to implement three dedicated VM600Mk2/VM600 rack buses as follows:

- Tacho bus
- Open Collector (OC) bus
- Raw bus.

2.1.2 VM600Mk2/VM600 slimline racks (1U – ABE056)

The VM600Mk2/VM600 ABE056 slimline rack has a standard height of 1U and provides mounting space (rack slots) for one single-width VM600Mk2/VM600 processing module (card pair) and an optional relay module (card).

Different versions of the integrated RPS1U power supply enable a VM600Mk2/VM600 ABE056 slimline rack to be powered using either an external AC or DC mains supply. Both the power supplies support a wide input voltage range.

2.1.2.1 VM600Mk2/VM600 slimline rack backplane

The VM600Mk2/VM600 ABE056 slimline racks use a custom-designed backplane that combines features of a VME backplane with other special features in order to support modules (cards) from the Meggitt vibro-meter® product line.

The VM600Mk2/VM600 ABE056 slimline backplane consists of various different systems such as a VME power supply, a discrete bus and through connections (similar to the VM600Mk2/VM600 ABE04x rack backplane described in 2.1.1.1 VM600Mk2/VM600 system rack backplane).

For the VM600Mk2/VM600 ABE056 rack, the discrete bus is used to implement one dedicated VM600Mk2/VM600 rack bus as follows:

- Open collector (OC) bus.

2.1.3 Slot number coding for VM600Mk2 modules in the rear of a VM600Mk2/VM600 rack

For VM600Mk2 modules (cards) installed in the rear of a VM600Mk2/VM600 rack, an electronic keying mechanism, known as slot number coding, is used to help ensure that the module (card) is installed in the correct slot (in the slot directly behind the associated processing module (card) in the front of the rack), as defined by the configuration.

For VM600Mk2 modules such as the MPC4Mk2 + IOC4Mk2, the slot number is defined using the VibroSight Protect software and automatically stored on the module as part of its configuration.

(For reference, for VM600 cards such as the MPC4 and IOC4T, the slot number is defined using the VM600 MPSx software and set on the IOC4T module using a DIP switch.)

2.1.3.1 Slot number coding for VM600Mk2 modules in the rear of a system rack

For VM600Mk2/VM600 system racks (ABE04x), the rack's slot numbers are fixed (hard-wired) for each rack slot (module (card) position) and cannot be changed. Accordingly, system rack slot number coding requires that a module's slot number is set to match the rack slot where it is installed.

As a result, a VM600Mk2 module can only be used in a VM600Mk2/VM600 system rack slot for which it has been configured.

NOTE: For a VM600Mk2/VM600 system rack (ABE04x), the slot number coding range is 3 to 14.
The fixed (hard-wired) values for slot number coding are as follows:
- Slot 03 = 3 (0011 binary)
- Slot 04 = 4 (0100 binary)

…
- Slot 13 = 13 (1101 binary)
- Slot 14 = 14 (1110 binary).

For example, a VM600Mk2 MPC4Mk2 + IOC4Mk2 module configured for slot 03 (VibroSight Protect software) must be installed in slot 03 of a system rack (ABE04x).

In order to be used in a different rack slot, the module's rack slot must be reconfigured using VibroSight Protect.

2.1.3.2 Slot number coding for VM600Mk2 modules in the rear of a slimline rack

For VM600Mk2/VM600 slimline racks (ABE056), the rack's slot number is configurable by DIP switch and slot number coding requires that the rack's slot number matches the slot number used by the module. Accordingly, VM600Mk2/VM600 slimline rack slot number coding requires that the rack's slot is set to match the module's slot number.

As a result, a VM600Mk2 module can only be used in a VM600Mk2/VM600 slimline rack in which the rack slot number matches the slot number configured on the module.

NOTE: For a VM600Mk2/VM600 slimline rack (ABE056), the slot number coding range is 0 to 12.
The factory assigned default values for slot number coding are as follows:
- Slot = 01 (0001 binary) for a slimline rack configured for use by a VM600Mk2 system such as a MPC4Mk2 + IOC4Mk2.

(For reference, Slot = 03 (0011 binary) for a slimline rack configured for use by a VM600 system such as a MPC4 and IOC4T.)

For example, a VibroSight / MPC4Mk2 + IOC4Mk2 system always uses slot 01 in a VM600Mk2/VM600 slimline rack, so the rack's DIP switch must be set to 01. (This is because the VibroSight Protect configuration software uses 01 as the default slot number, and other slot numbers cannot be used.)

(For reference, the equivalent default slot number used by a VM600 MPSx / MPC4/IOC4T system is slot 03).

NOTE: It is important to note that for a VibroSight / MPC4Mk2 + IOC4Mk2 system in a VM600Mk2/VM600 slimline rack, the VibroSight Protect configuration always uses rack slot 01.

(For reference, for a VM600 MPSx / VM600 MPC4 and IOC4T system, the ABE056 rack DIP switch is typically set to 03, as this is the default slot number used by the VM600 MPSx configuration software for this type of rack.)

2.1.3.3 Changing the slot number for a VM600Mk2/VM600 slimline rack

To configure slot number coding for a VM600Mk2/VM600 slimline rack (ABE056), a DIP switch on the rack's backplane must be set in order to match the slot number used for the input/output module by the configuration software (for example, VibroSight Protect for a VM600Mk2 MPC4Mk2 + IOC4Mk2 module).

As shown in Figure 2-1 (a), the DIP switch is accessible from the rear of the VM600Mk2/VM600 slimline rack, when the modules (cards) are removed.

On most VM600Mk2/VM600 slimline racks, the DIP switch is installed with its "ON" text marking towards the top. Although some have the DIP switch installed with its "ON" text marking towards the bottom. This upside-down orientation is shown in Figure 2-1.

Accordingly, it is important to note that the operation of the DIP switch depends on its assembled/installed orientation. That is, the ON positions of the individual switches are always towards the "ON" text marking, which can be on top (up) or bottom (down).

More specifically:

- For a DIP switch with "ON" on top: the switches ON positions are up (and OFF is down).
- For a DIP switch with "ON" on bottom: the switches ON positions are down (and OFF is up). This upside-down orientation is shown in Figure 2-1.

Irrespective of the orientation of the DIP switch, when looking into the rear of the rack with the DIP switch located to the top left (see Figure 2-1 (a)), the least significant bit (LSB) is always to the left and the most significant bit (MSB) is always to the right. It is also always the case that the ON position (that is, with the raised part of an individual switch pushed towards ON) corresponds to a logic 0, while OFF corresponds to a logic 1.

For a VibroSight / VM600Mk2 MPC4Mk2 + IOC4Mk2 system, the ABE056 rack DIP switch must always be set to 01, as this is the slot number used by the VibroSight Protect configuration software for this type of rack. See 2.1.3.2 Slot number coding for VM600Mk2 modules in the rear of a slimline rack.

For the VM600Mk2/VM600 slimline rack DIP switch, this translates as follows:

Slot 01 => 0001 in binary

=> (MSB) 0 0 0 1 (LSB) in significant bits

=> (LSB) 1 0 0 0 (MSB) as per switch orientation (reversed)

=> 1 0 0 0 in logic terms

=> OFF ON ON ON in switch positions.

For a DIP switch with "ON" on top: this corresponds to DN UP UP UP.

For a DIP switch with "ON" on bottom: this corresponds to UP DN DN DN.

(a) Location of DIP switch on the rack's backplane – rear of rack, top left (accessible when the modules are removed)

(b) DIP switch for a system configured as slot 01

Figure 2-1: VM600Mk2/VM600 slimline rack (ABE056) DIP switch

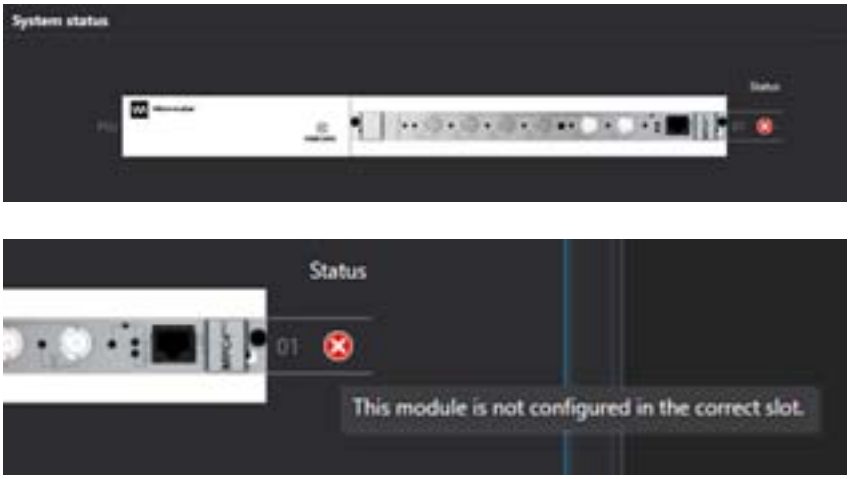
Figure 2-1 (b) shows a VM600Mk2/VM600 slimline rack DIP switch with "ON" on bottom configured for a VibroSight / VM600Mk2 MPC4Mk2 + IOC4Mk2 system in slot 01.

NOTE: For a VibroSight / VM600Mk2 MPC4Mk2 + IOC4Mk2 system in a VM600Mk2/VM600 slimline rack (ABE056), the VibroSight Protect configuration always uses rack slot 01, which requires that a rack DIP switch with "ON" on top must always be set to DN UP UP UP, and that a rack DIP switch with "ON" on bottom must always be set to UP DN DN DN (see Figure 2-1 (b)).

When the VM600Mk2/VM600 slimline rack (ABE056) DIP switch is set correctly, VibroSight Protect is able to activate the configuration on the MPC4Mk2 + IOC4Mk2 module and work with the system. This is shown in Figure 2-2 (a).

However, if the VM600Mk2/VM600 slimline rack (ABE056) DIP switch is set incorrectly, VibroSight Protect will detect this as a problem. It will not activate the configuration on the MPC4Mk2 + IOC4Mk2 module and will not work with the system until the problem is corrected. This is shown in Figure 2-2 (b).

(a) System status OK – rack's slot number matches the module's slot number (system (configuration) can be activated on the module by VibroSight Protect)



(b) System status not OK – rack's slot number does not match the module's slot number (system (configuration) cannot be activated on the module by VibroSight Protect)

Figure 2-2: VibroSight Protect software system status

2.2 MPC4Mk2 machinery protection and condition monitoring module

The MPC4Mk2 machinery protection and condition monitoring module panel is shown in Figure 2-3.

NOTE: The MPC4Mk2 machinery protection and condition monitoring module is always used with an associated IOC4Mk2 input/output module as a set/pair of modules (see 2.3 IOC4Mk2 input/output module).

Figure 2-3 illustrates the main components found on the MPC4Mk2 module's panel and briefly explains their function.

It also summarises the behaviour and meaning of the MPC4Mk2 module's LEDs. A more detailed explanation of the MPC4Mk2 LEDs is given in Table 2-1.

As shown in Figure 2-3, the MPC4Mk2 module has the following connectors:

- CH*n* connectors – CH1, C2, CH3 and CH4

  These BNC connectors make the buffered outputs ("raw" analog signals) corresponding to the dynamic channel inputs available at the front of the VM600Mk2/VM600 rack.

  NOTE: The buffered outputs corresponding to dynamic channel inputs are also available on the J2 connector of the MPC4Mk2 module's corresponding IOC4Mk2 module, as "raw" analog signals.

- AX*n* connectors – AX1 and AX2

  These BNC connectors make the buffered outputs ("raw" analog signals) corresponding to the auxiliary channel inputs available at the front of the VM600Mk2/VM600 rack.

  NOTE: The buffered outputs corresponding to auxiliary channel inputs are also available on the J2 connector of the MPC4Mk2 module's corresponding IOC4Mk2 module, as "raw" analog and as TTL-level signals.

- LAN connector

  This Ethernet (8P8C (RJ45)) connector is used to connect the MPC4Mk2 module (VM600Mk2 MPS) to a computer running the VibroSight® software – in order to support configuration, operation and management.

  NOTE: Once configured, a VM600Mk2 MPS can operate stand-alone, that is, without a computer permanently connected.

As shown in Figure 2-3, a MPC4Mk2 module has the following LED indicators:

- DIAG/STATUS LED
  In general, this LED is a system/module-level indicator used to indicate the status of the VM600Mk2 MPS (MPC4Mk2 + IOC4Mk2 module).
- CH*n* (dynamic channel) LEDs – CH1, C2, CH3 and CH4
  In general, these LEDs are channel-level indicators used to indicate the status of the MPC4Mk2 module's dynamic channels and measurements.
- AX*n* (auxiliary channel) LEDs – AX1 and AX2
  In general, these LEDs are channel-level indicators used to indicate the status of the MPC4Mk2 module's auxiliary channels and measurements.
- LOCK LED
  This LED is a security-level indicator used to indicate the main operating mode (security status) of the VM600Mk2 MPS (MPC4Mk2 + IOC4Mk2 module): Locked (safety/secure operating mode) or Unlocked (maintenance operating mode).

For further information on the MPC4Mk2 module's LEDs, see 2.2.1 MPC4Mk2 module LEDs.

As shown in Figure 2-3, a MPC4Mk2 module has the following buttons (control inputs):

- Button 1
- Button 2
- RESET (buttons 1 and 2 together).

These buttons are used to change/control the operation and behaviour of the VM600Mk2 MPS (MPC4Mk2 + IOC4Mk2 module).

For further information on the MPC4Mk2 module's buttons, see 2.2.2 MPC4Mk2 module buttons.

For information on communicating with a MPC4Mk2 module, see 1.7 Communicating with a VM600Mk2 MPS and 1.8 Connecting to a computer.

CH*n* (dynamic channel) BNC connectors

Buffered outputs ("raw" analog signals) corresponding to dynamic channel inputs.

Transfer ratios:
- For a voltage input signal: 1 V/V.
- For a current input signal: 0.2 V/mA.

AX*n* (auxiliary channel) BNC connectors

Buffered outputs ("raw" analog signals) corresponding to auxiliary channel inputs.

Transfer ratios:
- For a channel configured as a tachometer input:
  0 to 5 V TTL-compatible (digital pulse train) signal.
- For a channel configured as a DC input:
  1 V/V for a voltage input signal or
  0.2 V/mA for a current input signal.

LOCK LED indicator:
- Green (continuous): VM600Mk2 MPS (MPC4Mk2 + IOC4Mk2 and RLC16Mk2s) locked (safety/secure operating mode).
- Red (continuous): VM600Mk2 MPS (MPC4Mk2 + IOC4Mk2 and RLC16Mk2s) unlocked (maintenance operating mode).

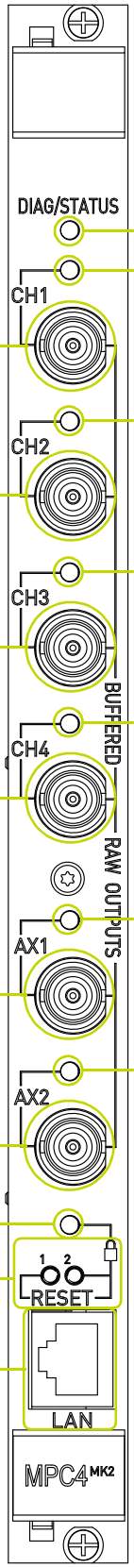
1, 2, RESET buttons

Used to change/control the operation and behaviour of a VM600Mk2 MPS (MPC4Mk2 + IOC4Mk2 and RLC16Mk2).
In general:
- Button 1 (left) is used to help change the operating mode of the MPC4Mk2 module.
- Button 2 (right) is used to switch the main Operational mode of the MPC4Mk2 module between Locked (safety/secure operating mode) and Unlocked (maintenance operating mode).
- RESET (both buttons) is used to reset the MPC4Mk2 + IOC4Mk2 module, that is, reboot the VM600Mk2 MPS.

LAN connector
(with Link and Activity LEDs)

8P8C (RJ45) modular jack, female.

System Ethernet communications between the MPC4Mk2 + IOC4Mk2 module and a computer running the VibroSight® software.



DIAG/STATUS LED indicator:
- Off: MPC4Mk2 + IOC4Mk2 module/system booting.
- Green blinking: no configuration or being configured.
- Green (continuous): normal operation.
- Orange blinking slowly: trip multiply (TM).
- Orange blinking quickly: alarm bypass (AB).
- Orange (continuous): data acquisition stopped.
- Red blinking slowly: Fail-safe due to internal diagnostics (BIST, Error class 2 error-level problem detected).
- Red (continuous): Fail-safe due to internal diagnostics (BIST, Error class 1 fatal-level problem detected), typically a hardware fault/problem.

CH*n* (dynamic channel) LED indicators and AX*n* (auxiliary channel) LED indicators:
- Off: channel not configured.
- Green blinking slowly: sensor / measurement chain not OK (NOK).
- Green blinking quickly: channel not stabilized.
- Green (continuous): normal operation.
- Orange blinking slowly: alert alarm (dual-channel).
- Orange blinking quickly: alert alarm (first-out).
- Orange (continuous): alert alarm (not first-out).
- Red blinking slowly: danger alarm (dual-channel).
- Red blinking quickly: danger alarm (first-out).
- Red (continuous): danger alarm (not first-out).

Notes

See Table 2-1 and Figure 2-4 for more detailed information on the MPC4Mk2 module's LED indicators.

See Table 2-2 for more detailed information on the MPC4Mk2 module's buttons.

Figure 2-3: MPC4Mk2 panel (front of rack)

2.2.1 MPC4Mk2 module LEDs

LEDs on the front panel of the MPC4Mk2 module (front of rack) are used to indicate the status and behaviour of a VM600Mk2 MPS (MPC4Mk2 + IOC4Mk2 module and any associated RLC16Mk2 modules).

In general:

- The DIAG/STATUS LED indicates the status and behaviour of the VM600Mk2 MPS:
  - DIAG/STATUS ○ indicates module/system booting.
  - DIAG/STATUS ● indicates module/system not configured or being configured when blinking and normal operation when on continuously.
  - DIAG/STATUS ● indicates trip multiply (TM) when blinking slowly, alarm bypass (AB) when blinking quickly and data acquisition stopped when on continuously.
  - DIAG/STATUS ● indicates fail-safe, that is, the VM600Mk2 MPS is in a safe state due to the MPC4Mk2 module's internal diagnostics (BIST).

NOTE: In Fail-safe mode, the MPC4Mk2 module activates the system-wide VM600Mk2 MPS safety-line control signal in order to automatically drive all system relays and analog outputs to a safe state.

- The CH*n* and AX*n* LEDs indicate the status and behaviour of the dynamic and auxiliary channels respectively:
  - AX*n* or CH*n* ○ indicates channel not configured.
  - AX*n* or CH*n* ● indicates sensor / measurement chain not OK (NOK) when blinking slowly, channel not stabilized when blinking quickly, and normal operation when on continuously.
  - AX*n* or CH*n* ● indicates alert alarm (dual-channel) when blinking slowly, alert alarm (first-out) when blinking quickly, and alert alarm (not first-out) when on continuously.
  - AX*n* or CH*n* ● indicates danger alarm (dual-channel) when blinking slowly, danger alarm (first-out) when blinking quickly, and danger alarm (not first-out) when on continuously.
- The LOCK LED indicates the security status of the VM600Mk2 MPS:
  - LOCK ● indicates that the VM600Mk2 MPS is Locked (safety/secure operating mode).
  - LOCK ● indicates that the VM600Mk2 MPS is Unlocked (maintenance mode).

Table 2-1 provides detailed information on the behaviour of the MPC4Mk2 LEDs corresponding to the machinery protection firmware running on the module.

Figure 2-4 provide some examples of MPC4Mk2 LED activity for typical VM600Mk2 MPS situations.

NOTE: The MPC4Mk2 module LED behaviour described in Table 2-1 and Figure 2-4 applies to MPC4Mk2 modules running machinery protection firmware version 640-025-007-xxx or later (corresponding to VibroSight 7.2 or later).
For MPC4Mk2 modules running machinery protection firmware version 640-025-006-xxx or earlier (corresponding to VibroSight 7.1 or earlier), refer to edition 4 of this manual.

Table 2-1: Behaviour of MPC4Mk2 module LEDs corresponding to machinery protection firmware (version 640-025-007-001 or later)

MPC4Mk2 LEDs			Module/ system status	Channel status – description
DIAG/STATUS (top)	**LOCK** (bottom)	**CH*n* and AX*n*** (center)		
Operating mode: Power-up				
○	○	○	Booting	Booting (start up). A MPC4Mk2 module takes approximately 30 seconds to boot and complete its power-on self-test (POST).
Note: For further information on the Power-up mode, see 4.4.1 Power-up mode.				
Operating mode: Operational – Unlocked				
● ○ ● ○ ●	●	○	Not configured	Not configured
●	●	○	Data acquisition stopped	Data acquisition stopped. Data acquisition stops when a module/system is being reconfigured or during a firmware upgrade.
●	●	○	Configured	Channel not configured
		● ○ ● ○ ●		Channel not stabilized. LED blinking quickly.
		● ○ ○ ● ○ ○ ●		Sensor / measurement chain not OK (NOK). LED blinking slowly.
		● ○ ● ○ ●		Danger (first-out). LED blinking quickly.
		●		Danger (not first-out)
		● ○ ○ ● ○ ○ ●		Danger (dual-channel). LED blinking slowly.
		● ○ ● ○ ●		Alert (first-out). LED blinking quickly.
		●		Alert (not first-out)
		● ○ ○ ● ○ ○ ●		Alert (dual-channel). LED blinking slowly.
		● ○ ● ○ ● ○ ●		Sensor/channel bypass is active
		●		Normal operation
● ○ ○ ● ○ ○ ●	●	Same as for "Configured" module/ system status	Trip multiply (TM)	Trip multiply (TM) is active. LED blinking slowly.

Table 2-1: Behaviour of MPC4Mk2 module LEDs corresponding to machinery protection firmware (version 640-025-007-001 or later) *(continued)*

MPC4Mk2 LEDs			Module/ system status	Channel status – description
DIAG/STATUS (top)	**LOCK** (bottom)	**CH*n* and AX*n*** (center)		
Operating mode: Operational – Unlocked *(continued)*				
● ○ ● ○ ●	●	Same as for "Configured" module/ system status	Alarm bypass (AB)	Alarm bypass (AB) is active. LED blinking quickly.
● ○ ● ○ ● ● ○ ● ○ ●	● ○ ● ○ ● ● ○ ● ○ ●	● ○ ● ○ ● ● ○ ● ○ ●	LED test / MPC4Mk2 module identification	LED test / MPC4Mk2 module identification is active. The VibroSight Protect software is used to test (blink) all of a MPC4Mk2 module's LEDs. This can be used to verify communications with and/or identify a MPC4Mk2 module in a VM600Mk2/VM600 rack.
Operating mode: Operational – Locked				
●	●	○	Configured	Channel not configured
		● ○ ● ○ ●		Channel not stabilized. LED blinking quickly.
		● ○ ○ ● ○ ○ ●		Sensor / measurement chain not OK (NOK). LED blinking slowly.
		● ○ ● ○ ●		Danger (first-out). LED blinking quickly.
		●		Danger (not first-out)
		● ○ ○ ● ○ ○ ●		Danger (dual-channel). LED blinking slowly.
		● ○ ● ○ ●		Alert (first-out). LED blinking quickly.
		●		Alert (not first-out)
		● ○ ○ ● ○ ○ ●		Alert (dual-channel). LED blinking slowly.
		● ○ ● ○ ● ○ ●		Sensor/channel bypass is active
		●		Normal operation
● ○ ○ ● ○ ○ ●	●	Same as for "Configured" module/ system status	Trip multiply (TM)	Trip multiply (TM) is active. LED blinking slowly.

Notes:
In Operating mode: Operational – Locked, Alarm bypass (AB) and LED test / MPC4Mk2 module identification are not possible.
Note: For further information on the Operational mode, see 4.4.2 Operational mode.

Table 2-1: Behaviour of MPC4Mk2 module LEDs corresponding to machinery protection firmware (version 640-025-007-001 or later) *(continued)*

MPC4Mk2 LEDs			Module/ system status	Channel status – description
DIAG/STATUS (top)	**LOCK** (bottom)	**CH*n* and AX*n*** (center)		
Operating mode: Fail-safe				
●	●	○	Fail-safe	Error class 1 fatal-level problem detected.
● ○ ● ○ ●	●	○		Error class 2 error-level problem detected. LED blinking slowly.
Note: For further information on the Fail-safe mode and diagnostic faults (problems) detected, see 4.4.3 Fail-safe mode and Appendix A: Diagnostic fault codes.				
Operating mode: Recovery				
● ○ ○ ● ○ ○ ● ○ ○ ●	○	○	Recovery	Recovery firmware running. LED blinking slowly.
Note: For further information on the Recovery mode, see 4.4.4 Recovery mode.				

Notes:

○ indicates a continuously off LED.

● indicates a continuously on LED (green ●, orange ● or red ●).

● ○ ● ○ ● indicates a quickly blinking LED (green ●, orange ● or red ●), that is, 0.5 s on / 0.5 s off approx.

● ○ ○ ● ○ ○ ● indicates a slowly blinking LED (green ●, orange ● or red ●), that is, 1 s on / 1 s off approx.

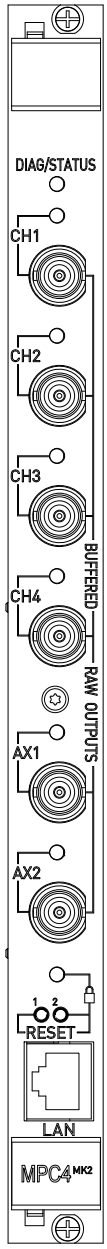
--- indicates N/A.

For channels configured for dual-channel processing, the LEDs for both channels (CHn or AXn) exhibit the same behaviour.

The MPC4Mk2 module LED behaviour described here (Table 2-1) is listed in priority order and applies to modules running machinery protection firmware version 640-025-007-xxx or later (corresponding to VibroSight 7.2 or later). For modules running machinery protection firmware version 640-025-006-xxx or earlier (corresponding to VibroSight 7.1 or earlier), refer to edition 4 of this manual.

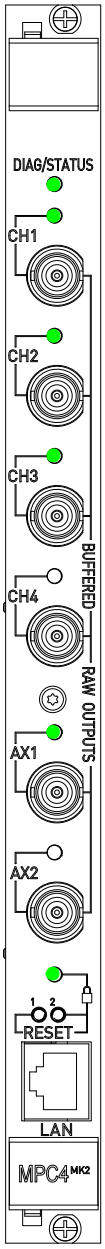
Alarm bypass (AB) and/or Trip-multiply (TM) can be activated by a DSI control signal, the VibroSight software (XNP) or a fieldbus command (VME via a CPUMMk2 module). Sensor/channel bypass does not have a corresponding DSI control signal and so can only be activated by the VibroSight software or a fieldbus command (via a CPUMMk2 module) only.

For further information on the MPC4Mk2 module's firmware, see 4.3 MPC4Mk2 module firmware.



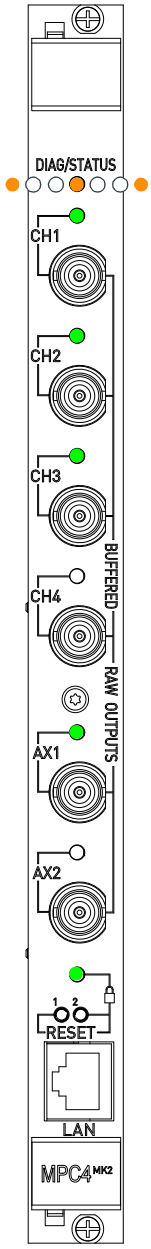
(a)

Module/system booting (start up).
Note: All LEDS off.



(b)

Module/system operating normally:
CH1, CH2, CH3 and AX1 configured and operating normally (CH1 and CH2 configured for dual-channel processing).
CH4 and AX2 not configured.
Note: Module/system locked.

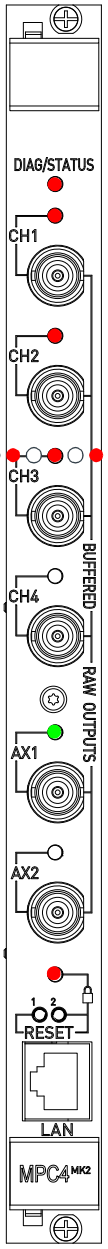


(c)

Configuration as per (b) with
Trip multiply (TM) active.
Note: Module/system locked.

Figure 2-4: MPC4Mk2 LED activity for typical VM600Mk2 MPS situations

Note: LED blinking quickly.



Note: LED blinking quickly.

(d)

Configuration as per (b)
with
Alarm bypass (AB) active.
Note: Module/system unlocked.

(e)

Configuration as per (b)
with
danger alarms for CH1 and CH2 (dual-channel processing) and CH3, where CH3 is the first-out alarm and CH1 and CH2 is not first-out alarm.
Note: Module/system unlocked.

(f)

Configuration as per (b)
with
module/system in safe state (that is, Fail-safe mode).
Note: Module/system unlocked.

Figure 2-4 (*continued*): MPC4Mk2 LED activity for typical VM600Mk2 MPS situations

2.2.2 MPC4Mk2 module buttons

Buttons on the front panel of the MPC4Mk2 module are used to change/control the operation and behaviour of a VM600Mk2 MPS (MPC4Mk2 + IOC4Mk2 module and any associated RLC16Mk2 modules).

In general:

- Button 1 (left) is used to help change the operating mode of the MPC4Mk2 module.
- Button 2 (right) is used to control/toggle the MPC4Mk2 + IOC4Mk2 module (VM600Mk2 MPS) between its main operating modes:
  - Locked (safety/secure operating mode)

    When locked, a VM600Mk2 MPS performs its machinery protection functions while ensuring the security of the system (modules) and it's configuration. That is, the configuration cannot be changed and maintenance activities cannot be performed.
  - Unlocked (maintenance operating mode)

    When unlocked, a VM600Mk2 MPS performs its machinery protection functions without ensuring the security of the system (modules) and it's configuration. That is, the configuration can be changed and maintenance activities can be performed.

NOTE: The LOCK LED indicates the status of the VM600Mk2 MPS, as follows:
• LOCK ● indicates that the MPC4Mk2 module is Locked.
• LOCK ● indicates that the MPC4Mk2 module is Unlocked.

- RESET – button 1 (left) and button 2 (right) together – is used to reset the VM600Mk2 MPS (MPC4Mk2 + IOC4Mk2 module), that is, to reboot the module, forcing it into the Power-up mode.

Table 2-2 provides detailed information on the behaviour and functionality of the MPC4Mk2 buttons, which vary depending on the operating mode of the MPC4Mk2 module.

Table 2-2: Behaviour of MPC4Mk2 module buttons

MPC4Mk2 buttons		Description
1 (left)	**2** (right)	
Power-up mode		
When a MPC4Mk2 module resets, it temporarily enters the Power-up mode where it takes approximately 30 seconds to boot and complete its power-on self-test (POST). After a successful POST, the module automatically enters the Operational mode if machinery protection firmware is available or enters the Recovery mode if machinery protection firmware is not available. But if the POST is not successful, then the module will enter the Fail-safe mode.		
X … X	X … ---	Press and hold both button 1 and button 2 for at least 2 seconds to reset (reboot) the module, then release button 2 while keeping button 1 pressed for a further 5 seconds (approx.) in order to force the module into the Recovery mode
Operational mode		
---	X	When Locked (safety/secure operating mode), press button 2 5 times within 5 seconds to switch Operational mode to Unlocked (maintenance operating mode)
---	X	When Unlocked (maintenance operating mode), press and hold button 2 for at least 1 second to switch Operational mode to Locked (safety/secure operating mode)
X	X	Press and hold both button 1 and button 2 for at least 2 seconds to reset (reboot) the module
Fail-safe mode		
---	X	For an error-level problem (as displayed by VibroSight System Manager), press and hold button 2 for at least 1 second to force the module into Operational mode
X	X	For a fatal-level problem (as displayed by VibroSight System Manager), press and hold both button 1 and button 2 for at least 2 seconds to reset (reboot) the module
X … X	X … ---	Press and hold both button 1 and button 2 for at least 2 seconds to reset (reboot) the module, then release button 2 while keeping button 1 pressed for a further 5 seconds (approx.) in order to force the module into the Recovery mode
Recovery mode		
The Recovery mode allows the end-user/operator to change/upload MPC4Mk2 module firmware, which is required for a module delivered as a spare part. The Recovery mode also allows a module to be recovered in the unlikely event of a problem such as corrupted operational firmware (machinery protection and/or condition monitoring) or a corrupted configuration. Note: It is important to note that entering the Recovery mode clears the modules configuration.		
X	X	Press and hold both button 1 and button 2 for at least 2 seconds to reset (reboot) the module

For further information on the MPC4Mk2 module's firmware and its various operating modes, see 4.3 MPC4Mk2 module firmware and 4.4 MPC4Mk2 module operating modes.

For further information on the diagnostic fault codes (fatal-level, error-level and warning-level) displayed by the VibroSight System Manager software for VM600Mk2 machinery protection system (MPS) hardware, see Appendix A: Diagnostic fault codes.

2.2.3 MPC4Mk2 module factory assigned defaults

2.2.3.1 MPC4Mk2 module as part of a VM600Mk2 solution

For a MPC4Mk2 module delivered as part of a VM600Mk2 solution, the module normally runs the latest version of the "standard" operating firmware and is pre-configured in the factory for the application before delivery of the system. See 4.3 MPC4Mk2 module firmware.

2.2.3.2 MPC4Mk2 module as a spare part

For a MPC4Mk2 module delivered as a spare part, the module normally runs the latest version of the recovery firmware only and therefore cannot be pre-configured before delivery. See 4.3 MPC4Mk2 module firmware.

NOTE: The MPC4Mk2 module recovery firmware allows the end-user/operator to change/upload the MPC4Mk2 module firmware to the "standard" operating firmware or the proof test firmware.

So the end-user/operator must change/upload the required version of the required firmware, typically the latest version of the "standard" module operating firmware, and then must (re-)configure the VM600Mk2 MPS containing the MPC4Mk2, so that the MPC4Mk2 module is configured as required by the application.

NOTE: For a MPC4Mk2 module delivered as a spare part, the required "standard" operating firmware must be uploaded to the module, and the module must then be configured using VibroSight Protect, before the module can be used in an application.

NOTE: In general, it is strongly recommended to use the most recent version of MPC4Mk2 "standard" operating firmware. Of course, the version of MPC4Mk2 module firmware running on a module can be changed if necessary, for example, so that all modules of the same type in a VM600Mk2 MPS solution are running the same version of firmware.

See 3.3.5 Checking the firmware for a MPC4Mk2 module and 3.3.6 Changing the firmware for a MPC4Mk2 module.

For a MPC4Mk2 module delivered as a spare part, the module's LAN (Ethernet) connector/port has the following factory assigned defaults:

- Configured as Enabled using dynamic addressing (Use DHCP).

  That is, the Static IP settings (IP address, Subnet mask and Default gateway) are not configured (fields left empty).

When dynamic addressing using the dynamic host configuration protocol (DHCP) is used, a DHCP server must be available on the same network as the VM600Mk2 MPS, in order for the MPC4Mk2 module(s) to be automatically assigned an IP address.

NOTE: Contact your IT department or network administrator for information on whether a DHCP server is available on your network.

It is important to consider a MPC4Mk2 module's LAN (Ethernet) port settings when connecting a MPC4Mk2 module to a computer/network for the first time and/or when reconfiguring or replacing a module in an application.

Using VibroSight System Manager, the Ethernet port settings for a MPC4Mk2 module can be changed as required using the IP settings command. For example, to use static addressing instead of dynamic addressing (that is, to use fixed IP addresses).

See 3.3.1 Configuring the network interface for a MPC4Mk2 module.

2.3 IOC4Mk2 input/output module

The IOC4Mk2 input/output module panel is shown in Figure 2-5.

NOTE: The IOC4Mk2 input/output module is always used with an associated MPC4Mk2 machinery protection and condition monitoring module as a set/pair of modules (see 2.2 MPC4Mk2 machinery protection and condition monitoring module).

Figure 2-5 illustrates the main components found on the IOC4Mk2 panel and briefly explains their function.

As shown in Figure 2-5, the IOC4Mk2 module has the following connectors:

- J1 connector

  This 24-pin connector is used to connect:

  - Inputs (analog signals) for the dynamic channels (CH1 to CH4) and the auxiliary channels (AX1 and AX2).

  NOTE: The J1 connector is a 24-pin S2L connector (male) that is compatible with 24-pin B2CF plug-in connectors (female) with PUSH IN spring connections and B2L plug-in connectors (female) with tension clamp spring connections.

- J2 connector

  This 36-pin connector is used to connect:

  - Inputs and ground reference (digital signals) for the DSI control signals (AB, AR and TM).
  - Outputs (buffered “raw” analog signals) for the dynamic channels (CH1 to CH4) and the auxiliary channels (AX1 and AX2).
  - Outputs (digital (pulse train) signals (TTL-level)) for the auxiliary channels (AX1 and AX2).
  - Outputs (analog signals) for the analog DC outputs.

  NOTE: The J2 connector is a 36-pin S2L connector (male) that is compatible with 36-pin B2CF plug-in connectors (female) with PUSH IN spring connections and B2L plug-in connectors (female) with tension clamp spring connections.

- J3 connector

  This 16-pin connector is used to connect:

  - Outputs (contacts) for the common circuit-fault relay (FAULT) and the user-configurable relays (RL1 to RL4).

  NOTE: The J3 connector is a 16-pin connector (male) that is compatible with 16-pin MC/STF plug-in connectors (female) with screw-terminal connections.

The IOC4Mk2 module’s J1, J2 and J3 connectors are removable to simplify installation and mounting.

For the J1 and J2 connectors:

- Clamping range (min. to max.): 0.2 to 1 mm^2 (28 to 18 AWG)
- Tightening torque (min. to max.): 0.15 to 0.2 N•m (0.11 to 0.15 lb-ft).

For the J3 connector:

- Clamping range (min. to max.): 0.14 to 1.5 mm^2 (28 to 16 AWG).
- Tightening torques (min. to max.):
  - 0.2 to 0.25 N•m (0.15 to 0.18 lb-ft) for conductor screws
  - 0.2 to 0.3 N•m (0.15 to 0.22 lb-ft) for mounting-flange screws.

The J3 connector provides 1 × COM, 1 × NC and 1 × NO contact per user-configurable relay (RL1 to RL4) and 1 × COM, 1 × COM FUSED, 1 × NC and 1 × NO contact for the common circuit-fault relay (FAULT).

J1 connector

24-pin S2L connector (male).
Compatible with 24-pin B2CF/B2L plug-in connectors (female) with spring connections.

Connections:

- Inputs (analog signals) for the dynamic channels (CH1 to CH4) and the auxiliary channels (AX1 and AX2).

J2 connector

36-pin S2L connector (male).
Compatible with 36-pin B2CF/B2L plug-in connectors (female) with spring connections.

Connections:

- Inputs and ground reference (digital signals) for the DSI control signals (AB, AR and TM).
- Outputs (buffered "raw" analog signals) for the dynamic channels (CH1 to CH4) and the auxiliary channels (AX1 and AX2).
- Outputs (digital (pulse train) signals (TTL-level)) for the auxiliary channels (AX1 and AX2).
- Outputs (analog signals) for the analog DC outputs.

J3 connector

16-pin connector (male).
Compatible with 16-pin MC/SCF plug-in connectors (female) with screw-terminal connections.

Connections:

- Outputs (contacts) for the common circuit-fault relay (FAULT) and the user-configurable relays (RL1 to RL4).

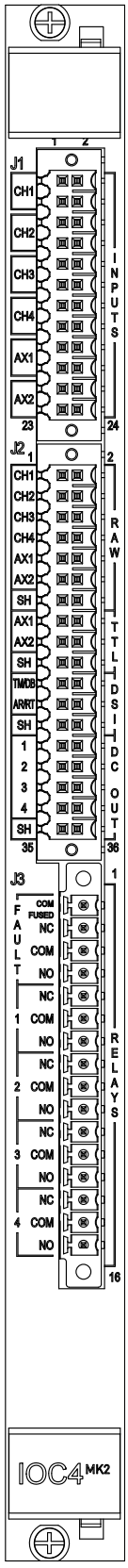


Figure 2-5: IOC4Mk2 panel (rear of rack)

2.3.1 IOC4Mk2 module connector pinouts

As shown in Figure 2-5, the IOC4Mk2 panel (rear of rack) contains three connectors, identified as J1, J2 and J3.

Each connector consists of a male connector (socket on the module) and a mating female connector (plug on the wiring):

- J1 (top) is used to connect inputs (analog signals) for the dynamic channels (CH1 to CH4) and the auxiliary channels (AX1 and AX2).
- J2 (middle) is used to connect inputs and ground reference (digital signals) for the DSI control signals (AB, AR and TM), outputs (buffered “raw” signals) for the dynamic channels (CH1 to CH4) and the auxiliary channels (AX1 and AX2), outputs (digital (pulse train) signals (TTL-level)) for the auxiliary channels (AX1 and AX2), and outputs (analog signals) for the analog DC outputs.
- J3 (bottom) is used to connect outputs (contacts) for the common circuit-fault relay (FAULT) and the user-configurable relays (RL1 to RL4).

Detailed information on the IOC4Mk2 module’s connector pinouts (definition of terminals) are given in Table 2-3, Table 2-4 and Table 2-5.

Table 2-3: IOC4Mk2 module J1 connector pinouts

IOC4Mk2 J1 connector: INPUTS				
Label	**Pin**	**Name / function**	**Direction**	**Definition**
CH1	1	CH1_HI	I	Dynamic channel 1 differential input (high)
	2	CH1_SPS	O	Dynamic channel 1 sensor power supply output
	3	CH1_LO	I	Dynamic channel 1 differential input (low)
	4	SHIELD	PG / S	Protective ground / shield (dynamic channel 1)
CH2	5	CH2_HI	I	Dynamic channel 2 differential input (high)
	6	CH2_SPS	O	Dynamic channel 2 sensor power supply output
	7	CH2_LO	I	Dynamic channel 2 differential input (low)
	8	SHIELD	PG / S	Protective ground / shield (dynamic channel 2)
CH3	9	CH3_HI	I	Dynamic channel 3 differential input (high)
	10	CH3_SPS	O	Dynamic channel 3 sensor power supply output
	11	CH3_LO	I	Dynamic channel 3 differential input (low)
	12	SHIELD	PG / S	Protective ground / shield (dynamic channel 3)
CH4	13	CH4_HI	I	Dynamic channel 4 differential input (high)
	14	CH4_SPS	O	Dynamic channel 4 sensor power supply output
	15	CH4_LO	I	Dynamic channel 4 differential input (low)
	16	SHIELD	PG / S	Protective ground / shield (dynamic channel 4)
AX1	17	AX1_HI	I	Auxiliary channel 1 differential input (high)
	18	AX1_SPS	O	Auxiliary channel 1 sensor power supply output
	19	AX1_LO	I	Auxiliary channel 1 differential input (low)
	20	SHIELD	PG / S	Protective ground / shield (auxiliary channel 1)
AX2	21	AX2_HI	I	Auxiliary channel 2 differential input (high)
	22	AX2_SPS	O	Auxiliary channel 2 sensor power supply output
	23	AX2_LO	I	Auxiliary channel 2 differential input (low)
	24	SHIELD	PG / S	Protective ground / shield (auxiliary channel 2)

Notes
COM = common, DSI = discrete signal interface, G = ground, HI = high, I = input, LO = low, NC = normally closed, NO = normally open, O = output, PG = protective ground, R = return, S = shield, SHIELD = shield / protective ground, SPS = sensor/measurement chain power supply

Table 2-4: IOC4Mk2 module J2 connector pinouts

IOC4Mk2 J2 connector: RAW, TTL, DSI, DC OUT				
Label	**Pin**	**Name / function**	**Direction**	**Definition**
CH1	1	RAW_CH1_HI	O	Dynamic channel 1 buffered “raw” output signal
	2	RAW_CH1_R	G	Dynamic channel 1 buffered “raw” return
CH2	3	RAW_CH2_HI	O	Dynamic channel 2 buffered “raw” output signal
	4	RAW_CH2_R	G	Dynamic channel 2 buffered “raw” return
CH3	5	RAW_CH3_HI	O	Dynamic channel 3 buffered “raw” output signal
	6	RAW_CH3_R	G	Dynamic channel 3 buffered “raw” return
CH4	7	RAW_CH4_HI	O	Dynamic channel 4 buffered “raw” output signal
	8	RAW_CH4_R	G	Dynamic channel 4 buffered “raw” return
AX1	9	RAW_AX1_HI	O	Auxiliary channel 1 buffered “raw” analog output signal
	10	RAW_AX1_R	G	Auxiliary channel 1 buffered “raw” analog return
AX2	11	RAW_AX2_HI	O	Auxiliary channel 2 buffered “raw” analog output signal
	12	RAW_AX2_R	G	Auxiliary channel 2 buffered “raw” analog return
SH	13	SHIELD	PG / S	Protective ground / shield (buffered “raw” analog outputs)
	14	SHIELD	PG / S	Protective ground / shield (buffered “raw” analog outputs)
AX1	15	RAW_AX1_HI	O	Auxiliary channel 1 buffered “raw” digital output signal
	16	RAW_AX1_R	G	Auxiliary channel 1 buffered “raw” digital return
AX2	17	RAW_AX2_HI	O	Auxiliary channel 2 buffered “raw” digital output signal
	18	RAW_AX2_R	G	Auxiliary channel 2 buffered “raw” digital return
SH	19	SHIELD	PG / S	Protective ground / shield (buffered “raw” digital outputs)
	20	SHIELD	PG / S	Protective ground / shield (buffered “raw” digital outputs)
TM/DB	21	DSI_TM	I	Discrete signal interface trip multiply (TM) control input
	22	DSI_AB	I	Discrete signal interface alarm bypass (AB) control input
AR/RT	23	DSI_AR	I	Discrete signal interface alarm reset (AR) control input
	24	DSI_R	G	Discrete signal interface return
SH	25	SHIELD	PG / S	Protective ground / shield (DSI)
	26	SHIELD	PG / S	Protective ground / shield (DSI)

Table 2-4: IOC4Mk2 module J2 connector pinouts (continued)

IOC4Mk2 J2 connector: RAW, TTL, DSI, DC OUT				
Label	**Pin**	**Name / function**	**Direction**	**Definition**
CH1	27	ANA_OUT1_HI	O	Analog (processed DC) output 1 signal
	28	ANA_OUT1_R	R	Analog (processed DC) output 1 return
CH2	29	ANA_OUT2_HI	O	Analog (processed DC) output 2 signal
	30	ANA_OUT2_R	R	Analog (processed DC) output 2 return
CH3	31	ANA_OUT3_HI	O	Analog (processed DC) output 3 signal
	32	ANA_OUT3_R	R	Analog (processed DC) output 3 return
CH4	33	ANA_OUT4_HI	O	Analog (processed DC) output 4 signal
	34	ANA_OUT4_R	R	Analog (processed DC) output 4 return
SH	35	SHIELD	PG / S	Protective ground / shield (buffered “raw” analog outputs)
	36	SHIELD	PG / S	Protective ground / shield (buffered “raw” analog outputs)

Notes
COM = common, DSI = discrete signal interface, G = ground, HI = high, I = input, LO = low, NC = normally closed, NO = normally open, O = output, PG = protective ground, R = return, S = shield, SHIELD = shield / protective ground, SPS = sensor/measurement chain power supply

Table 2-5: IOC4Mk2 module J3 connector pinouts

IOC4Mk2 J3 connector: RELAYS				
Label	**Pin**	**Name / function**	**Direction**	**Definition**
FAULT	1	FAULT_RLY_COM_FUSED	O	Common circuit-fault relay fused COM contact
	2	FAULT_RLY_NC	O	Common circuit-fault relay normally closed (NC) contact
	3	FAULT_RLY_COM	O	Common circuit-fault relay common (COM) contact
	4	FAULT_RLY_NO	O	Common circuit-fault relay normally open (NO) contact
1	5	RLY1_NC	O	Relay 1 normally closed (NC) contact
	6	RLY1_COM	O	Relay 1 common (COM) contact
	7	RLY1_NO	O	Relay 1 normally open (NO) contact
2	8	RLY2_NC	O	Relay 2 normally closed (NC) contact
	9	RLY2_COM	O	Relay 2 common (COM) contact
	10	RLY2_NO	O	Relay 2 normally open (NO) contact
3	11	RLY3_NC	O	Relay 3 normally closed (NC) contact
	12	RLY3_COM	O	Relay 3 common (COM) contact
	13	RLY3_NO	O	Relay 3 normally open (NO) contact
4	14	RLY4_NC	O	Relay 4 normally closed (NC) contact
	15	RLY4_COM	O	Relay 4 common (COM) contact
	16	RLY4_NO	O	Relay 4 normally open (NO) contact
Notes COM = common, DSI = discrete signal interface, G = ground, HI = high, I = input, LO = low, NC = normally closed, NO = normally open, O = output, PG = protective ground, R = return, S = shield, SHIELD = shield / protective ground, SPS = sensor/measurement chain power supply				

2.3.2 IOC4Mk2 module relays

2.3.2.1 User-configurable relays

Located on the IOC4Mk2 module, there are four user-configurable relays (RL1 to RL4) available for use by an application. These relays are driven by logical functions which are used to logically combine alarm and status information in order to obtain the required functionality.

These four relays can be configured as required by an application. For example, they can be configured as enabled or disabled, normally energised (NE) or normally de-energised (NDE), and latched or not latched.

As shown in Figure 2-5, all RL1 to RL4 relay contacts (1 × COM, 1 × NC and 1 × NO contact per relay) are available on the IOC4Mk2 panel (rear of rack).

2.3.2.2 Common circuit-fault relay

Located on the IOC4Mk2 module, there is one common circuit-fault relay (FAULT) available for use by an application. This relay is automatically driven by the MPC4Mk2 module in order to indicate the status of the module/system, notably any problems detected by the MPC4Mk2 module's internal diagnostics (that is, built-in self-test (BIST)).

The configuration of this one relay is fixed by the MPC4Mk2 + IOC4Mk2 module (that is, it cannot be configured as required by an application). More specifically, it is configured as enabled, normally energised (NE) and latched.

NOTE: The common circuit-fault relay (FAULT) operates as a normally energised (NE) relay as the "de-energise to trip principle" allows problems to be more easily detected.

During normal operation (that is, MPC4Mk2 module in Operational mode), the common circuit-fault relay (FAULT) indicates the actual operating mode of the module/system, as follows:

- When Locked (safety/secure operating mode), the relay is energised.
- Then Unlocked (maintenance operating mode), the relay is de-energised.

For further information, see 4.4.2 Operational mode.

In Fail-safe mode, the relay is de-energised its common circuit-fault relay (FAULT) in order to indicate that a problem has been detected.

For further information, see 4.4.3 Fail-safe mode.

2.3.2.3 Common circuit-fault relay fuse

For the MPC4Mk2 + IOC4Mk2 module's common circuit-fault relay (FAULT), a fused common (COM_FUSED) contact is provided, in addition to the usual common (COM), normally closed (NC) and normally open (NO) contacts, in order to support "fused" circuits.

Detailed information on the contacts of the common circuit-fault relay (FAULT) are given in Table 2-5.

The specifications for the fuse used for the fused common contact (COM_FUSED) of the common circuit-fault relay (FAULT) are given in Table 2-6.

Table 2-6: Specifications for common circuit-fault relay fuse

Specifications for common circuit-fault relay fuse	
Type	Littelfuse 443 series NANO2® surface-mount fuse (SMD) or equivalent
Characteristic	Time delay (T) / "Slo-Blo®"
Current rating	2 A
Voltage rating	250 V_{AC} max.
Interrupting rating (breaking capacity	50 A (at 250 V_{AC})
Case style	Small rectangular surface-mount fuse (SMD) with square end blocks for insertion into a board-mounted (SMD) metal fuse clip/holder
Note: Replacement common circuit-fault relay fuses (PNR: 957.10.04.0350) are available for order from Meggitt SA.	

NOTE: Refer to the *VM600Mk2 MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring module data sheet* for detailed information on the common circuit-fault relay fuse.

The common circuit-fault relay fuse is a single-use component that must be replaced with a suitable replacement fuse if blown.

A digital multi-meter (DMM) or equivalent is required to confirm the status of the fuse, as the case of the fuse is opaque (not transparent), so a simple visual check is not possible.

The fuse used for the fused COM contact of the common circuit-fault relay (FAULT) is a single-use component and should be replaced if blown.

NOTE: Before replacing a fuse, ensure that the power to the module (board) is turned off. The new fuse must be same specification and size as the one being replaced. Never replace a fuse with one that has a different amperage to the original.

Figure 2-6 highlights the location of the common circuit-fault relay fuse on the IOC4Mk2 module (board).

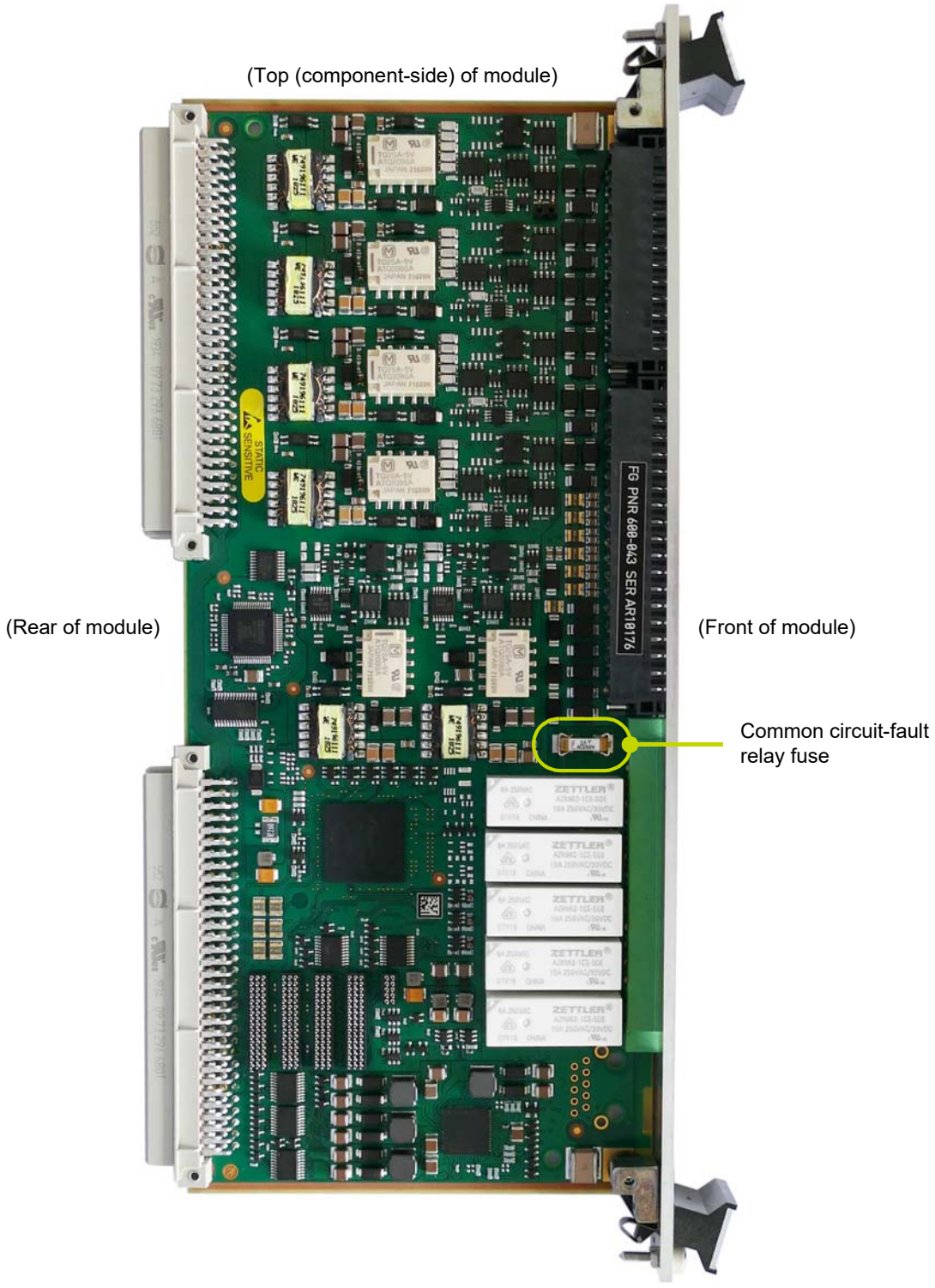


Figure 2-6: Location of the common circuit-fault relay fuse on the IOC4Mk2 module (board)

2.3.3 IOC4Mk2 module factory assigned defaults

2.3.3.1 IOC4Mk2 module as part of a VM600Mk2 solution

For a IOC4Mk2 module delivered as part of a VM600Mk2 solution, the module and its hardware jumpers are normally pre-configured in the factory for the application before delivery of the system.

2.3.3.2 IOC4Mk2 module as a spare part

For a IOC4Mk2 module delivered as a spare part, the module is not pre-configured before delivery. So the end-user/operator must (re-)configure the VM600Mk2 MPS containing the MPC4Mk2 + IOC4Mk2, so that the IOC4Mk2 module will automatically be configured as required by its associated MPC4Mk2.

In addition, for a IOC4Mk2 module delivered as a spare part, the end-user/operator must configure the IOC4Mk2 module's hardware jumpers as required for the application (see 1.9.2 Hardware configuration).

2.4 RLC16Mk2 relay module

The RLC16Mk2 relay module panel is shown in Figure 2-7.

The RLC16Mk2 module is an optional module that can be used with a MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring module in order to add additional relays to a system (see 2.2 MPC4Mk2 machinery protection and condition monitoring module).

Figure 2-7 illustrates the main components found on the RLC16Mk2 module's panel and briefly explains their function.

As shown in Figure 2-7, the RLC16Mk2 module has the following connectors:

- J1 connector

  This 16-pin screw-terminal connector is used to connect:
  - Outputs (contacts) for relays RL1 to RL6.

  NOTE: The J1 connector is a 16-pin connector (male) that is compatible with 16-pin MC/STF plug-in connectors (female) with screw-terminal connections.

- J2 connector

  This 16-pin screw-terminal connector is used to connect:
  - Outputs (contacts) for relays RL6 to RL11.

  NOTE: The J2 connector is a 16-pin connector (male) that is compatible with 16-pin MC/STF plug-in connectors (female) with screw-terminal connections.

- J3 connector

  This 16-pin screw-terminal connector is used to connect:
  - Outputs (contacts) for relays RL11 to RL16.

  NOTE: The J3 connector is a 16-pin connector (male) that is compatible with 16-pin MC/STF plug-in connectors (female) with screw-terminal connections.

For each RLC16Mk2 module relay (RL1 to RL16), 1 × COM, 1 × NC and 1 × NO contact is available on the J1, J2 and J3 connectors.

The RLC16Mk2 module's J1, J2 and J3 connectors are removable to simplify installation and mounting.

For the J1, J2 and J3 connectors:

- Clamping range (min. to max.): 0.14 to 1.5 mm^2 (28 to 16 AWG).
- Tightening torques (min. to max.):
  - 0.2 to 0.25 N•m (0.15 to 0.18 lb-ft) for conductor screws
  - 0.2 to 0.3 N•m (0.15 to 0.22 lb-ft) for mounting-flange screws.

The J1, J2 and J3 connectors provide 1 × COM, 1 × NC and 1 × NO contact per relay (RL1 to RL16).

J1 connector

16-pin connector (male).
Compatible with 16-pin MC/SCF plug-in connectors (female) with screw-terminal connections.

Connections:
• Outputs (contacts) for relays RL1 to RL6.

J2 connector

16-pin connector (male).
Compatible with 16-pin MC/SCF plug-in connectors (female) with screw-terminal connections.

Connections:
• Outputs (contacts) for relays RL6 to RL11.

J3 connector

16-pin connector (male).
Compatible with 16-pin MC/SCF plug-in connectors (female) with screw-terminal connections.

Connections:
• Outputs (contacts) for relays RL11 to RL16.

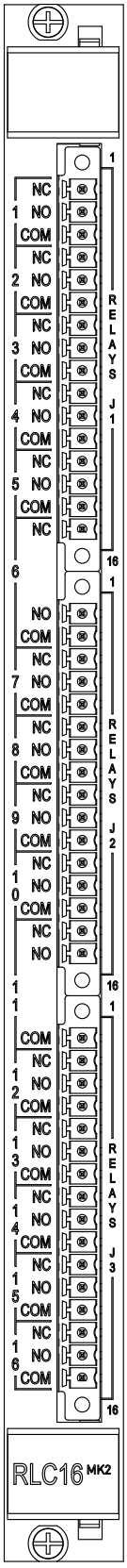


Figure 2-7: RLC16Mk2 panel (rear of rack)

2.4.1 RLC16Mk2 module connector pinouts

As shown in Figure 2-7, the RLC16Mk2 panel (rear of rack) contains three connectors, identified as J1, J2 and J3.

Each connector consists of a male connector (socket on the module) and a mating female connector (plug on the wiring):

- J1 (top) is used to connect outputs (contacts) for relays RL1 to RL6.
- J2 (middle) is a used to connect outputs (contacts) for relays RL6 to RL11.
- J3 (bottom) is used to connect outputs (contacts) for relays RL11 to RL16.

Detailed information on the RLC16Mk2 module's connector pinouts (definition of terminals) are given in Table 2-7, Table 2-8 and Table 2-9.

Table 2-7: RLC16Mk2 module J1 connector pinouts

RLC16Mk2 J1 connector: RELAYS				
Label	**Pin**	**Name / function**	**Direction**	**Definition**
1	1	RLY1_NC	O	Relay 1 normally closed (NC) contact
	2	RLY1_NO	O	Relay 1 normally open (NO) contact
	3	RLY1_COM	O	Relay 1 common (COM) contact
2	4	RLY2_NC	O	Relay 2 normally closed (NC) contact
	5	RLY2_NO	O	Relay 2 normally open (NO) contact
	6	RLY2_COM	O	Relay 2 common (COM) contact
3	7	RLY3_NC	O	Relay 3 normally closed (NC) contact
	8	RLY3_NO	O	Relay 3 normally open (NO) contact
	9	RLY3_COM	O	Relay 3 common (COM) contact
4	10	RLY4_NC	O	Relay 4 normally closed (NC) contact
	11	RLY4_NO	O	Relay 4 normally open (NO) contact
	12	RLY4_COM	O	Relay 4 common (COM) contact
5	13	RLY5_NC	O	Relay 5 normally closed (NC) contact
	14	RLY5_NO	O	Relay 5 normally open (NO) contact
	15	RLY5_COM	O	Relay 5 common (COM) contact
6	16	RLY6_NC	O	Relay 6 normally closed (NC) contact

Notes
COM = common, DSI = discrete signal interface, G = ground, HI = high, I = input, LO = low, NC = normally closed, NO = normally open, O = output, PG = protective ground, R = return, S = shield, SHIELD = shield / protective ground, SPS = sensor/measurement chain power supply

Table 2-8: RLC16Mk2 module J2 connector pinouts

RLC16Mk2 J2 connector: RELAYS				
Label	**Pin**	**Name / function**	**Direction**	**Definition**
6	1	RLY6_NO	O	Relay 6 normally open (NO) contact
	2	RLY6_COM	O	Relay 6 common (COM) contact
7	3	RLY7_NC	O	Relay 7 normally closed (NC) contact
	4	RLY7_NO	O	Relay 7 normally open (NO) contact
	5	RLY7_COM	O	Relay 7 common (COM) contact
8	6	RLY8_NC	O	Relay 8 normally closed (NC) contact
	7	RLY8_NO	O	Relay 8 normally open (NO) contact
	8	RLY8_COM	O	Relay 8 common (COM) contact
9	9	RLY9_NC	O	Relay 9 normally closed (NC) contact
	10	RLY9_NO	O	Relay 9 normally open (NO) contact
	11	RLY9_COM	O	Relay common (COM) contact
10	12	RLY10_NC	O	Relay 10 normally closed (NC) contact
	13	RLY10_NO	O	Relay 10 normally open (NO) contact
	14	RLY10_COM	O	Relay 10 common (COM) contact
11	15	RLY11_NC	O	Relay 11 normally closed (NC) contact
	16	RLY11_NO	O	Relay 11 normally open (NO) contact
Notes COM = common, DSI = discrete signal interface, G = ground, HI = high, I = input, LO = low, NC = normally closed, NO = normally open, O = output, PG = protective ground, R = return, S = shield, SHIELD = shield / protective ground, SPS = sensor/measurement chain power supply				

Table 2-9: RLC16Mk2 module J3 connector pinouts

RLC16Mk2 J3 connector: RELAYS				
Label	**Pin**	**Name / function**	**Direction**	**Definition**
11	1	RLY11_COM	O	Relay 11 common (COM) contact
12	2	RLY12_NC	O	Relay 12 normally closed (NC) contact
	3	RLY12_NO	O	Relay 12 normally open (NO) contact
	4	RLY12_COM	O	Relay 12 common (COM) contact
13	5	RLY13_NC	O	Relay 13 normally closed (NC) contact
	6	RLY13_NO	O	Relay 13 normally open (NO) contact
	7	RLY13_COM	O	Relay 13 common (COM) contact
14	8	RLY14_NC	O	Relay 14 normally closed (NC) contact
	9	RLY14_NO	O	Relay 14 normally open (NO) contact
	10	RLY14_COM	O	Relay 14 common (COM) contact
15	11	RLY15_NC	O	Relay 15 normally closed (NC) contact
	12	RLY15_NO	O	Relay 15 normally open (NO) contact
	13	RLY15_COM	O	Relay 15 common (COM) contact
16	14	RLY16_NC	O	Relay 16 normally closed (NC) contact
	15	RLY16_NO	O	Relay 16 normally open (NO) contact
	16	RLY16_COM	O	Relay 16 common (COM) contact
Notes COM = common, DSI = discrete signal interface, G = ground, HI = high, I = input, LO = low, NC = normally closed, NO = normally open, O = output, PG = protective ground, R = return, S = shield, SHIELD = shield / protective ground, SPS = sensor/measurement chain power supply				

2.4.2 RLC16Mk2 module relays

2.4.2.1 User-configurable relays

Located on the RLC16Mk2 module, there are sixteen user-configurable relays (RL1 to RL16) available for use by an application. These relays are driven by logical functions which are used to logically combine alarm and status information in order to obtain the required functionality.

These sixteen relays can be configured as required by an application. For example, they can be configured as enabled or disabled, normally energised (NE) or normally de-energised (NDE), and latched or not latched.

As shown in Figure 2-7, all RL1 to RL16 relay contacts (1 × COM, 1 × NC and 1 × NO contact per relay) are available on the RLC16Mk2 panel (rear of rack).

2.4.3 RLC16Mk2 module factory assigned defaults

2.4.3.1 RLC16Mk2 module as part of a VM600Mk2 solution

For a RLC16Mk2 module delivered as part of a VM600Mk2 solution, the module and its hardware jumpers are normally pre-configured in the factory for the application before delivery of the system.

2.4.3.2 RLC16Mk2 module as a spare part

For a RLC16Mk2 module delivered as a spare part, the module is not pre-configured before delivery. So the end-user/operator must (re-)configure the VM600Mk2 MPS containing the MPC4Mk2 + IOC4Mk2 and RLC16Mk2, so that the RLC16Mk2 module will automatically be configured as required by its associated MPC4Mk2.

In addition, for a RLC16Mk2 module delivered as a spare part, the end-user/operator must configure the RLC16Mk2 module's hardware jumpers as required for the application (see 1.9.2 Hardware configuration).

2.5 CPUMMk2 rack controller and communications interface module

The CPUMMk2 rack controller and communications interface module panel is shown in Figure 2-8.

NOTE: The CPUMMk2 rack controller and communications interface module is always used with an associated IOCNMk2 input/output module as a set/pair of modules (see 2.6 IOCNMk2 input/output module).

Figure 2-8 illustrates the main components found on the CPUMMk2 module's panel and briefly explains their function.

It also summarises the behaviour and meaning of the CPUMMk2 module's LEDs. A more detailed explanation of the CPUMMk2 LEDs is given in Table 2-10 to Table 2-13.

As shown in Figure 2-8, a CPUMMk2 module has the following LED indicators:

- DIAG MODE 1 / 2 LEDs
  In general, these LEDs are used to indicate the operating mode of the CPUMMk2 + IOCNMk2 module.
- DIAG STATUS 1 / 2 LEDs
  In general, these LEDs are used to indicate the status of the CPUMMk2 + IOCNMk2 module.
- ETHERNET LINK/ACT 1 / 2 LEDs
  In general, these LEDs are used to indicate the status of the system Ethernet interfaces (ports) available on the IOCNMk2 module.
- FIELDBUS LINK/ACT 1 / 2 LEDs
  In general, these LEDs are used to indicate the status of the fieldbus Ethernet interfaces (ports) available on the IOCNMk2 module.
- FIELDBUS STATUS A 1 / 2 LEDs
  In general, these LEDs are used to help indicate the status of the fieldbus interfaces available on the IOCNMk2 module.
- FIELDBUS STATUS B 1 / 2 LEDs
  In general, these LEDs are used to help indicate the status of the fieldbus interfaces available on the IOCNMk2 module.

For further information on the CPUMMk2 module's LEDs, see 2.5.1 CPUMMk2 module LEDs.

As shown in Figure 2-8, a CPUMMk2 module has the following buttons and control inputs:

- ALARM RESET
- Security key lock
- ADMIN.

These controls are used to change/control the operation and behaviour of the VM600Mk2 MPS (CPUMMk2 + IOCNMk2 module and/or MPC4Mk2 + IOC4Mk2 modules).

For further information on the MPC4Mk2 module's buttons, see 2.5.2 CPUMMk2 module buttons.

For information on communicating with a CPUMMk2 module, see 1.7 Communicating with a VM600Mk2 MPS and 1.8 Connecting to a computer.

Notes

See Table 2-10 to Table 2-13 for more detailed information on the CPUM^{Mk2} module's LED indicators.

See Table 2-14 for more detailed information on the CPUM^{Mk2} module's buttons.

ALARM RESET button

Used to reset the latched alarms (and associated relays) for all VM600^{Mk2} MPS modules in the rack (MPC4^{Mk2}).

Security key lock

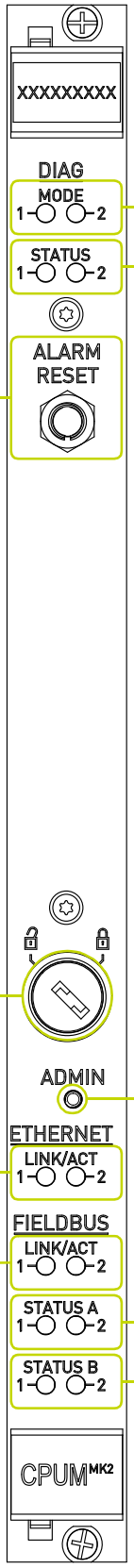
Used to enable or disable VM600^{Mk2} rack (CPUM^{Mk2}) security, that is, limit any connections, such as VibroSight® software, to read-only operations.

ETHERNET LINK/ACT 1 / 2 LED indicators

Used to indicate the status of the system Ethernet interfaces (ports) available on the IOCN^{Mk2} module (see Table 2-11).

FIELDBUS LINK/ACT 1 / 2 LED indicators

Used to indicate the status of the fieldbus Ethernet interfaces (ports) available on the IOCN^{Mk2} module (see Table 2-12).



DIAG MODE 1 / 2 LED indicators:

- 1: Off, 2: Off: CPUM^{Mk2} + IOCN^{Mk2} not powered or external power supply out of normal range.
- 1: Green, 2: Green: CPUM^{Mk2} is operating as a VME bus master.
- 1: Green, 2: Off: CPUM^{Mk2} is operating as a VME bus slave.
- 1: Off, 2: Green: CPUM^{Mk2} does not have a VME bus interface.

DIAG STATUS 1 / 2 LED indicators:

- 1: Off, 2: Off: CPUM^{Mk2} + IOCN^{Mk2} not powered or external power supply out of normal range.
- 1: Green, 2: ---: CPUM^{Mk2} has started and is operating normally (booted and firmware is running).
- 1: Green (blinking for 5 s), 2: ---: CPUM^{Mk2} is resetting to its default security settings. That is, VM600^{Mk2} MPS rack (CPUM^{Mk2}) security will not be used.
- 1: Orange, 2: ---: CPUM^{Mk2} is starting (second phase of booting).
- 1: Red, 2: ---: Hardware fault/problem, such as an internal power supply failure.
- 1: Red (blinking), 2: ---: CPUM^{Mk2} is either starting (first phase of booting) or it is being held in reset.
- 1: ---, 2: Green: All of the XMx16 cards whose configurations are managed by the CPUM^{Mk2} are running.
- 1: ---, 2: Green: One or more of the XMx16 cards whose configurations are managed by the CPUM^{Mk2} are not running.

ADMIN button (recessed)

Reserved for future use.

FIELDBUS STATUS A 1 / 2 LED indicators

Used to help indicate the status of the fieldbus interfaces available on the IOCN^{Mk2} module (see Table 2-13).

FIELDBUS STATUS B 1 / 2 LED indicators

Used to help indicate the status of the fieldbus interfaces available on the IOCN^{Mk2} module (see Table 2-13).

Figure 2-8: CPUM^{Mk2} panel (front of rack)

2.5.1 CPUMMk2 module LEDs

LEDs on the front panel of the CPUMMk2 module (front of rack) are used to indicate the status and behaviour of the CPUMMk2 + IOCNMk2 module and interfaces (and any associated modules such as MPC4Mk2 modules and/or XMx16 modules).

Table 2-10 provides detailed information on the behaviour of the CPUMMk2 modules DIAG MODE 1 / 2 and DIAG STATUS 1 / 2 LEDs, which indicate the operating mode and status of the module.

Table 2-11 provides detailed information on the behaviour of the CPUMMk2 modules ETHERNET LINK/ACT 1 / 2 LEDs, which indicate the status of the system Ethernet interfaces (ports) available on the IOCNMk2 module.

Table 2-12 provides detailed information on the behaviour of the CPUMMk2 modules FIELDBUS LINK/ACT 1 / 2 LEDs, which indicate the status of the fieldbus Ethernet interfaces (ports) available on the IOCNMk2 module.

Table 2-13 provides detailed information on the behaviour of the CPUMMk2 modules FIELDBUS STATUS A and STATUS B 1 / 2 LEDs, which help indicate the status of the fieldbus interfaces available on the IOCNMk2 module.

Table 2-10: Behaviour of CPUM^{Mk2} module DIAG MODE 1 / 2 and DIAG STATSUS 1 / 2 LEDs

CPUM^{Mk2} LEDs				Description
DIAG MODE 1	DIAG MODE 2	DIAG STATUS 1	DIAG STATUS 2	
○	○	○	○	CPUM^{Mk2} not powered
●	●	---	---	CPUM^{Mk2} operating as a VME bus master
●	○	---	---	CPUM^{Mk2} operating as a VME bus slave
○	●	---	---	CPUM^{Mk2} does not have a VME bus interface. The firmware has booted (started up) and is now operational or ready to become operational.
○	○	● ○ ● ○ ●	○	CPUM^{Mk2} is either starting (first phase of booting) or is being held in reset
○	○	●	○	CPUM^{Mk2} is starting (second phase of booting) or is being held in reset
---	---	●	---	CPUM^{Mk2} has started and is operating normally (booted and firmware is running)
---	---	---	●	CPUM^{Mk2} has a valid configuration for all of the MPC4^{Mk2} modules in the rack and all of the XMx16 cards whose configuration it is managing are running
---	---	● ○ ● ○ ● (for 5 seconds)	---	CPUM^{Mk2} is resetting to its default VM600^{Mk2} rack (CPUM^{Mk2}) security settings. That is, CPUM^{Mk2} MPS rack (CPUM^{Mk2}) security will not be used. Note: After 5 seconds, the LED reverts to its previous state.
---	---	---	●	CPUM^{Mk2} does not have a valid configuration for one or more of the MPC4^{Mk2} modules in the rack or one or more of the XMx16 cards whose configuration it is managing is not running
○	○	●	● ○ ● ○ ●	CPUM^{Mk2} has detected another CPUM^{Mk2} in the VM600 rack so there might be a I^2C interface (VME utility bus) conflict
○	○	●	○	CPUM^{Mk2} has a hardware problem such as an internal power supply failure

Notes

○ indicates a continuously off LED.

● indicates a continuously on LED (green ●, orange ● or red ●).

● ○ ● ○ ● indicates a blinking LED (green ●, orange ● or red ●).

--- indicates no change to the LED.

Table 2-11: Behaviour of CPUM^{Mk2} module ETHERNET LINK/ACT 1 / 2 LEDs

CPUM^{Mk2} LEDs ETHERNET LINK/ACT *n*	Description
○	No link established
●	Link established at 1 Gbps – with no activity (data communications) on the link
● ○ ● ○ ●	Link established at 1 Gbps – with activity (data communications) on the link
●	Link established at 100 Mbps – with no activity (data communications) on the link
● ○ ● ○ ●	Link established at 100 Mbps – with activity (data communications) on the link
●	Link established at 10 Mbps – with no activity (data communications) on the link
● ○ ● ○ ●	Link established at 10 Mbps – with activity (data communications) on the link

Notes

○ indicates a continuously off LED.

● indicates a continuously on LED (green ●, yellow ● or red ●).

● ○ ● ○ ● indicates a blinking LED (green ●, yellow ● or red ●).

Table 2-12: Behaviour of CPUM^{Mk2} module FIELDBUS LINK/ACT 1 / 2 LEDs

CPUM^{Mk2} LEDs FIELDBUS LINK/ACT *n*	Description
---	To be determined (TBD)

Table 2-13: Behaviour of CPUM^{Mk2} module FIELDBUS STATUS A / B 1 / 2 LEDs

MPC4^{Mk2} LEDs		Description
FIELDBUS STATUS A *n*	**FIELDBUS STATUS B *n***	
○	○	Fieldbus not configured
●	○	Fieldbus server (slave) has started and is operating normally – communication with all PROFIBUS slaves is established
● ○ ● ○ ● (cyclical	○	PROFIBUS – PROFIBUS is configured but bus communication is not yet released from the application
● ○ ○ ● ○ ○ ● (acyclical)	○	PROFIBUS – PROFIBUS is not configured or stack error
●	○	PROFIBUS – Communication to at least one slave is disconnected
● ○ ● ○ ●	○	PROFIBUS – Communication to one/all slaves is disconnected or other serious error has occurred

Notes

○ indicates a continuously off LED.

● indicates a continuously on LED (green ● or red ●).

● ○ ● ○ ● indicates a cyclically blinking LED (green ● or red ●).

● ○ ○ ● ○ ○ ● indicates an acyclically blinking LED (green ● or red ●).

2.5.2 CPUMMk2 module buttons

Buttons on the front panel of the CPUMMk2 module are used to change/control the operation and behaviour of the CPUMMk2 + IOCNMk2 module (and any associated MPC4Mk2 modules).

In general:

- ALARM RESET (top) is used to reset the alarms for all VM600Mk2 modules in the rack.
- Security key lock (middle) is used to enable or disable VM600Mk2 rack (CPUMMk2) security, that is, limit any connections, such as VibroSight® software, to read-only operations.
- ADMIN (bottom) is reserved for future use.

Table 2-14 provides detailed information on the behaviour and functionality of the CPUMMk2 buttons.

Table 2-14: Behaviour of CPUMMk2 module buttons

CPUMMk2 buttons	Description
ALARM RESET	A momentary push-button switch. Press and release the ALARM RESET button to cause the CPUMMk2 module to generate a rack-wide alarm reset that is communicated to other VM600Mk2 modules in the rack (such as the MPC4Mk2).
Security key lock	A key-operated switch, with a removable key. With the key inserted, turn the switch to the left to disable VM600Mk2 MPS rack (CPUMMk2) security. With the key inserted, turn the switch to the right to enable VM600Mk2 MPS rack (CPUMMk2) security. Note: The key can be inserted/removed with the switch in either position.
ADMIN	Reserved for future use

For further information on the rack-wide VM600Mk2 alarm reset signal, see 5.3 CPUMMk2 alarm reset.

For further information on VM600Mk2 rack (CPUMMk2) security, see 5.2 VM600Mk2 rack (CPUMMk2) security.

2.5.3 CPUMMk2 module factory assigned defaults

2.5.3.1 CPUMMk2 module as part of a VM600Mk2 solution

For a CPUMMk2 module delivered as part of a VM600Mk2 solution, the module normally runs the latest version of firmware and is pre-configured in the factory for the application before delivery of the system. See 5.5 CPUMMk2 module firmware.

2.5.3.2 CPUMMk2 module as a spare part

For a CPUMMk2 module delivered as a spare part, the module normally runs a recent version of firmware but is not pre-configured for the application. See 5.5 CPUMMk2 module firmware.

So the end-user/operator must typically change/upload the CPUMMk2 module firmware to the latest version of firmware, and then must (re-)configure the VM600Mk2 MPS containing the CPUMMk2, including the upload of a fieldbus configuration file for the module's fieldbus interfaces (ports), so that the CPUMMk2 module is configured as required by the application. See 5.4 CPUMMk2 fieldbus configuration.

NOTE: For a CPUMMk2 module delivered as a spare part, the required firmware must be uploaded to the module, and the module must then be configured using VibroSight Protect, before the module can be used in an application.

NOTE: In general, it is strongly recommended to use the most recent version of CPUMMk2 firmware.

See 3.3.10 Checking and/or changing the firmware for a CPUMMk2 module.

For a CPUMMk2 module delivered as a spare part, the module's LAN (Ethernet) connectors/ports have the following factory assigned defaults:

- Configured as Enabled using dynamic addressing (Use DHCP).
  That is, the Static IP settings (IP address, Subnet mask and Default gateway) are not configured (fields left empty).

When dynamic addressing using the dynamic host configuration protocol (DHCP) is used, a DHCP server must be available on the same network as the VM600Mk2 MPS, in order for the CPUMMk2 module(s) to be automatically assigned an IP address.

NOTE: Contact your IT department or network administrator for information on whether a DHCP server is available on your network.

It is important to consider a CPUMMk2 module's LAN (Ethernet) port settings when connecting a CPUMMk2 module to a computer/network for the first time and/or when reconfiguring or replacing a module in an application.

Using VibroSight System Manager, the Ethernet port settings for a CPUMMk2 module can be changed as required using the IP settings command. For example, to use static addressing instead of dynamic addressing (that is, to use fixed IP addresses).

See 3.3.9 Configuring the network interface for a CPUMMk2 module.

2.5.4 CPUMMk2 module and rack compatibility

The CPUMMk2 module requires an I2C interface (part of the VM600Mk2/VM600 system rack's VME utility bus on the rack backplane) in order to detect other modules in the rack. Accordingly, the CPUMMk2 can only be used with later versions of the VM600Mk2/VM600 system rack (ABE04x) that contain the I2C interface (VME utility bus).

More specifically, the CPUMMk2 + IOCNMk2 module can only be used with the VM600Mk2/VM600 system racks (ABE04x) listed in Table 2-15.

Table 2-15: CPUMMk2 module and rack compatibility

VM600Mk2/VM600 system rack	Part numbers (PNRs)
ABE040	204-040-100-013 or later. 204-040-100-115 or later. 204-040-100-212 or later.
ABE042	204-040-100-013 or later

Notes

The part number (PNR) of a VM600Mk2/VM600 system rack can be found from a label (sticker) on the side of the rack, which can be seen when the rack is removed from any cabinet/enclosure.

NOTE: It is especially important to consider CPUMMk2 + IOCNMk2 module and VM600Mk2/VM600 system rack (ABE04x) compatibility when updating an existing system that may use an earlier version of the rack and/or replacing a CPUM / IOCN card pair.

2.6 IOCN^{Mk2} input/output module

The IOCN^{Mk2} input/output module panel is shown in Figure 2-9.

NOTE: The IOCN^{Mk2} input/output module is always used with an associated CPUM^{Mk2} rack controller and communications interface module as a set/pair of modules (see 2.2 MPC4^{Mk2} machinery protection and condition monitoring module).

Figure 2-9 illustrates the main components found on the IOCN^{Mk2} panel and briefly explains their function.

As shown in Figure 2-9, the IOCN^{Mk2} module has the following connectors:

- J1 and J2 connectors (FIELDBUS1)

  These serial (D-sub) and Ethernet (8P8C (RJ45)) connectors are used to connect:

  - The fieldbus 1 interface (port) of the CPUM^{Mk2} + IOCN^{Mk2} module (fieldbus server) to fieldbus clients (master devices).

  NOTE: The J1 connector is a 9-pin D-sub connector (female) that is compatible with 9-pin D-sub connectors (male), such as industry standard PROFIUBUS DP connectors.

  NOTE: The J2 connector is a 8P8C (RJ45) modular jack (female) that is compatible with 8P8C (RJ45) modular jack connectors (male), such as industry standard Ethernet connectors.

- J3 connector (RL1 and RL2)

  This 6-pin screw-terminal connector is used to connect:

  - Outputs (contacts) for relays RL1 and RL2.

  NOTE: The J3 connector is a 6-pin connector (male) that is compatible with 6-pin MC/STF plug-in connectors (female) with screw-terminal connections.

- J4 and J5 connectors (FIELDBUS2)

  These serial (D-sub) and Ethernet (8P8C (RJ45)) connectors are used to connect:

  - The fieldbus 2 interface (port) of the CPUM^{Mk2} + IOCN^{Mk2} module (fieldbus server) to fieldbus clients (master devices).

  NOTE: The J3 connector is a 9-pin D-sub connector (female) that is compatible with 9-pin D-sub connectors (male), such as industry standard PROFIUBUS DP connectors.

  NOTE: The J4 connector is a 8P8C (RJ45) modular jack (female) that is compatible with 8P8C (RJ45) modular jack connectors (male), such as industry standard Ethernet connectors.

NOTE: It is important to note that the CPUMMk2 + IOCNMk2 module does not currently support Modbus RTU.

- J6 and J7 connectors (ETHERNET1 and ETHERNET2)
  These Ethernet (8P8C (RJ45)) connectors are used to connect:
  - The system Ethernet interface (port) of the CPUMMk2 + IOCNMk2 module to a computer running the VibroSight® software and/or XMx16 + XIO16T modules via external Ethernet cabling (not via VME as used by MPC4Mk2 + IOC4Mk2 modules).

  NOTE: The J6 and J7 connectors are 8P8C (RJ45) modular jacks (female) that are compatible with 8P8C (RJ45) modular jack connectors (male), such as industry standard Ethernet connectors.

  Both system Ethernet ports provide the same functionality so one port is typically allocated for communications with the VibroSight® software while the other port is allocated for communications with monitoring modules such as the XMx16 + XIO16T.
  In addition, the system Ethernet ports support Modbus TCP, which also allow the CPUMMk2 module to share data from the other modules in the VM600Mk2 rack.

NOTE: It is important to note that the CPUMMk2 + IOCNMk2 module currently supports Modbus TCP via its system Ethernet interfaces (ports) – not via its fieldbus interfaces (ports).

The IOCNMk2 module's J1 to J7 connectors are removable to simplify installation and mounting.

For the J3 connector:

- Clamping range (min. to max.): 0.14 to 1.5 mm^2 (28 to 16 AWG).
- Tightening torques (min. to max.):
  - 0.2 to 0.25 N•m (0.15 to 0.18 lb-ft) for conductor screws
  - 0.2 to 0.3 N•m (0.15 to 0.22 lb-ft) for mounting-flange screws.

The J3 connector provides 1 × COM, 1 × NC and 1 × NO contact per relay (RL1 and RL2).

J1 connector (FIELDBUS1)

9-pin D-sub connector (DCE), female.
Serial-based fieldbus 1 for communication between the CPUMMk2 + IOCNMk2 module (fieldbus server) and a fieldbus client (master).

J2 connector (FIELDBUS1)

8P8C (RJ45) modular jack, female.
Ethernet-based fieldbus 1 for communication between the CPUMMk2 + IOCNMk2 module (fieldbus server) and a fieldbus client (master).

J3 connector (RL1 and RL2)

6-contact screw-terminal connector, male
1 × COM, 1 × NC and 1 × NO contact per relay.
Note: Relays are configurable via Modbus using the fieldbus configuration.

J4 connector (FIELDBUS2)

9-pin D-sub connector (DCE), female.
Serial-based fieldbus 1 for communication between the CPUMMk2 + IOCNMk2 module (fieldbus server) and a fieldbus client (master).

J5 connector (FIELDBUS2)

8P8C (RJ45) modular jack, female.
Ethernet-based fieldbus 1 for communication between the CPUMMk2 + IOCNMk2 module (fieldbus server) and a fieldbus client (master).

J6 connector (ETHERNET1)

8P8C (RJ45) modular jack, female.
System Ethernet 1 for communication between the CPUMMk2 + IOCNMk2 module and either a computer or XMx16 + XIO16T modules.

J7 connector (ETHERNET2)

8P8C (RJ45) modular jack, female.
System Ethernet 2 for communication between the CPUMMk2 + IOCNMk2 module and either a computer or XMx16 + XIO16T modules.

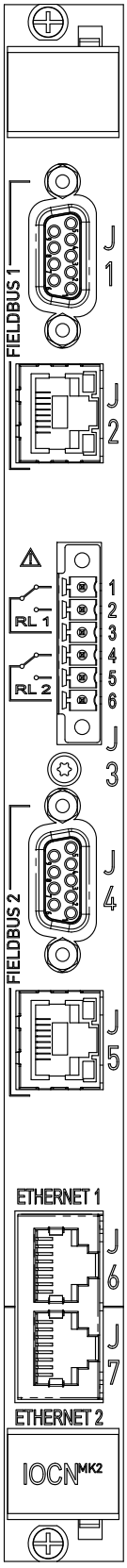


Figure 2-9: IOCNMk2 panel (rear of rack)

2.6.1 IOCNMk2 module LEDs

LEDs on the front panel of the IOCNMk2 module (rear of rack) are used to indicate the status and behaviour of the CPUMMk2 + IOCNMk2 module and interfaces.

Table 2-16 provides detailed information on the behaviour of the IOCNMk2 modules J2 (FIELDBUS1) and J5 (FIELDBUS2) LEDs, indicate the status of the fieldbus Ethernet interfaces available on the IOCNMk2 module.

Table 2-17 provides detailed information on the behaviour of the IOCNMk2 modules J6 and J7 (ETHERNET1 and ETHERNET2) LEDs, which indicate the status of the system Ethernet interfaces (ports) available on the IOCNMk2 module.

Table 2-16: Behaviour of IOCNMk2 module J2 and J5 (FIELDBUS1, FIELDBUS2) LEDs

IOCNMk2 LEDs	**Description**
FIELDBUS*n* LINK/ACT	
---	To be determined (TBD)

Table 2-17: Behaviour of IOCNMk2 module J6 and J7 (ETHERNET1, ETHERNET2) LEDs

IOCNMk2 LEDs		**Description**
ETHERNET*n* LINK/ACT		
○	○	No link established
●	●	Link established at 1 Gbps, 100 Mbps or 10 Mbps – with no activity (data communications) on the link
● ○ ● ○ ●	● ○ ● ○ ●	Link established at 1 Gbps, 100 Mbps or 10 Mbps – with activity (data communications) on the link

Notes

○ indicates a continuously off LED.

● indicates a continuously on LED (green ● or yellow ●).

● ○ ● ○ ● indicates a blinking LED (green ● or yellow ●).

2.6.2 IOCN^{Mk2} module connector pinouts

As shown in Figure 2-9, the IOCN^{Mk2} panel (rear of rack) contains seven connectors, identified as J1 to J7.

Each connector consists of a connector (socket on the module) and a mating connector (plug on the wiring):

- J1 and J2 (top) are used to connect devices to fieldbus 1.
- J3 (upper middle) is used to connect outputs (contacts) for relays RL1 and RL2.
- J4 and J5 (lower middle) are used to connect devices to fieldbus 2.
- J6 and J7 (bottom) are used to connect to a computer running the VibroSight® software and/or XMx16 + XIO16T modules.

Detailed information on the IOCN^{Mk2} module's J1 and J4 connector pinouts (definition of terminals) are given in Table 2-18.

Detailed information on the IOCN^{Mk2} module's J3 connector pinouts (definition of terminals) are given in Table 2-19.

Table 2-18: IOCN^{Mk2} module J1 and J4 connector pinouts

IOCN^{Mk2} J1 and J4 connectors: FIELDBUS*n*				
Label	**Pin**	**Name / function**	**Direction**	**Definition**
J1 / J4	1	---	---	
	2	---	---	
	3	RxD/TxD-P	B	RS-485 differential receive/transmit signal (+), also known as B line
	4	---	---	
	5	GND	G	Ground (data) – isolated
	6	+5 V_{DC}	O	+5 V_{DC} power supply – isolated, also known as VP. Note: Used for terminating resistors (active termination), if required
	7	---	---	
	8	RxD/TxD-N	B	RS-485 differential receive/transmit signal (−), also known as A line
	9	---	---	
Notes The J1 (FIELDBUS1) and J4 (FIELDBUS2) connectors provide a RS-485 (half-duplex (2-wire)) fieldbus interface. B = bidirectional, G = ground, O = output.				

Table 2-19: IOCNMk2 module J3 connector pinouts

IOCNMk2 J3 connector: RL1 and RL2				
Label	**Pin**	**Name / function**	**Direction**	**Definition**
RL1	1	RL1_NC	O	Relay 1 normally closed (NC) contact
	2	RL1_NO	O	Relay 1 normally open (NO) contact
	3	RL1_COM	O	Relay 1 common (COM) contact
RL2	4	RL2_NC	O	Relay 2 normally closed (NC) contact
	5	RL2_NO	O	Relay 2 normally open (NO) contact
	6	RL2_COM	O	Relay 2 common (COM) contact
Notes COM = common, NC = normally closed, NO = normally open, O = output.				

2.6.3 IOCNMk2 module relays

2.6.3.1 User-configurable relays

Located on the IOCNMk2 module, there are two user-configurable relays (RL1 and RL2) available for use by an application. These relays are driven by Modbus bits (bit variables) as defined by the Modbus fieldbus configuration file in order to obtain the required functionality (see 5.4 CPUMMk2 fieldbus configuration).

For example, they can be used to signal a fault or a problem detected by a common alarm, such as communication status or rack status.

As shown in Figure 2-9, all RL1 to RL2 relay contacts (1 × COM, 1 × NC and 1 × NO contact per relay) are available on the IOCNMk2 panel (rear of rack).

2.6.4 IOCNMk2 module factory assigned defaults

2.6.4.1 IOCNMk2 module as part of a VM600Mk2 solution

For a IOCNMk2 module delivered as part of a VM600Mk2 solution, the module is normally pre-configured in the factory for the application before delivery of the system.

2.6.4.2 IOCNMk2 module as a spare part

For a IOCNMk2 module delivered as a spare part, the module is not pre-configured before delivery. So the end-user/operator must (re-)configure the VM600Mk2 MPS containing the CPUMMk2 + IOCNMk2, so that the IOCNMk2 module will automatically be configured as required by its associated CPUMMk2.

2.7 Connecting sensors/measurement chains to a VM600Mk2 MPS

Sensors/measurement chains are connected to a VM600Mk2 machinery protection system (MPS) via the IOC4Mk2 input/output module of MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring modules.

2.7.1 Interfacing to a IOC4Mk2 module

Detailed information on the IOC4Mk2 module's connector pinouts (definition of terminals) are given in Table 2-3, Table 2-4 and Table 2-5.

Each connector consists of a male connector (socket on module) and a mating female connector (plug on wiring):

- J1 (top) is a 24-pin connector used to connect inputs (analog signals) for the dynamic channels (CH1 to CH4) and the auxiliary channels (AX1 and AX2).
- J2 (middle) connector is a 36-pin connector used to connect inputs and ground reference (digital signals) for the DSI control signals (AB, AR and TM), outputs (buffered "raw" signals) for the dynamic channels (CH1 to CH4) and the auxiliary channels (AX1 and AX2), outputs (digital (pulse train) signals (TTL-level)) for the auxiliary channels (AX1 and AX2), and outputs (analog signals) for the analog DC outputs.
- J3 (bottom) connector is a 16-pin connector used to connect outputs (contacts) for the common circuit-fault relay (FAULT) and the user-configurable relays (RL1 to RL4).

NOTE: For further information on connecting sensors/measurement chains to a IOC4Mk2 module, refer to section 9.2 Connecting vibration and pressure sensors in a *VM600 machinery protection system (MPS) hardware manual*.

3 OVERVIEW OF VM600Mk2 MACHINERY PROTECTION SYSTEM (MPS) SOFTWARE

This chapter provides a brief overview of the software used with the VM600Mk2 machinery protection system (MPS) hardware, that is, the VibroSight® software.

NOTE: The VibroSight® machinery monitoring system software, from Meggitt's vibro-meter® product line, is a highly-integrated software suite that supports the effective monitoring of all rotating machinery.

This includes an introduction to the relevant VibroSight® software modules and the basic tasks required to configure and manage a VM600Mk2 MPS.

In general:

- VibroSight System Manager is the software used to manage VM600Mk2 MPS hardware/systems in general.
- VibroSight Protect is the software used to configure and work with VM600Mk2 MPS hardware for specific applications/solutions.

For information on the VM600Mk2 machinery protection system (MPS) hardware, see 2 Overview of VM600Mk2 machinery protection system (MPS) hardware.

NOTE: For further information on the VibroSight® software in general, refer to the *VibroSight software release notes* and/or the *VibroSight help*.

3.1 VibroSight System Manager

VibroSight System Manager is the VibroSight client application software module that provides the tools to manage VibroSight-compatible machinery monitoring system hardware, such as VM600Mk2 machinery protection system (MPS) hardware.

For example, VibroSight System Manager is used to manage the VibroSight software (activate and/or upgrade software licenses), configure VM600 module/card IP addresses and upgrade VM600 module/card firmware.

3.2 VibroSight Protect

VibroSight Protect is the VibroSight client application software module used for the configuration and operation of VM600Mk2 machinery protection system (MPS) hardware, that is, the second generation of VM600 rack-based machinery protection system (MPS) hardware.

More specifically, it is used to configure the following modules:

- MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring module
- RLC16Mk2 relay module
- CPUMMk2 + IOCNMk2 rack controller and communications interface module.

NOTE: The VibroSight® software uses VibroSight Protect, a completely separate software module, for the configuration and operation of VM600Mk2 machinery protection system (MPS) hardware.
This helps ensure complete separation ("segregation") of machinery protection system (MPS) and condition monitoring system (CMS) functionality in a VM600Mk2/VM600 rack.

3.3 Common VibroSight System Manager tasks

3.3.1 Configuring the network interface for a MPC4Mk2 module

VibroSight System Manager is used to configure the network interface for a MPC4Mk2 module, that is, IP address, subnet mask, etc.

In order to communicate with a network device such as a MPC4Mk2 module, it has to be in the correct subnet. If the predefined IP address of the network device does not belong to the same subnet as the computer running VibroSight, it must be changed.

The IP address of a device can be changed using either:

- A DHCP server (automatically)
- Static IP addresses (manually).

A DHCP server will usually assign IP addresses that are automatically in the correct subnet for a network. However, static IP addressees should be assigned carefully, with consideration for the subnet.

NOTE: It is possible, and quite typical, for a network to use a combination of DHCP assigned, auto IP assigned and/or manually assigned addresses for its attached devices. However, good network administration is necessary to ensure that an IP address that has already been allocated in one way is not reused elsewhere in the network.
For example, an IP address that has already been allocated to a DHCP server must not manually reused (assigned) elsewhere in the network. Therefore, it is always recommended to contact your IT department or network administrator before manually assigning an IP address.

1- Start VibroSight System Manager.

2- In the System Explorer window (left), select the Devices view (bottom).
The System Explorer window updates to display all of the VibroSight-compatible devices that System Manager can see on the network.

3- In the System Explorer window, under MPC4 modules, select the MPC4Mk2 module.
In the System Explorer window, VibroSight compatible devices are listed in a serial number (IP address) format. For example: xxxxxxx (xxx.xxx.xxx.xxx in dot-decimal notation) for a VM600Mk2 module such as a MPC4Mk2.

NOTE: It is recommended that VibroSight compatible devices such as a MPC4Mk2 module are identified by their serial number (for example, APxxxxx), as an IP address (xxx.xxx.xxx.xxx in dot-decimal notation) can be easily changed.
The product's serial number is assigned in the factory during manufacture and cannot be changed, but the product's IP address (xxx.xxx.xxx.xxx in dot-decimal notation) can be changed to meet the requirements of a network.

The main window (centre) updates to display information for the MPC4Mk2 module.

In the main window, Network (centre) displays the information about the network interface for the MPC4Mk2 module.

4- In the Actions window (right), under Configuration, click IP settings.

The MPC4 module(s) IP settings window is displayed.

NOTE: If the MPC4 module(s) IP settings window does not display correctly and, for example, a timeout message is displayed, then the IP (TCP and UDP) port numbers required by the VibroSight software have probably not been added as allowed ports to the exceptions list in Windows Firewall.
For further information, refer to the *Getting started with VibroSight installation guide*.

5- To configure the IP settings for the MPC4Mk2 module using a DHCP server:
Select the Use DHCP server option. Click Finish.

The MPC4Mk2 module will communicate with the DHCP server in the background and a unique IP address for the module will automatically be assigned.

To configure the IP settings for the MPC4Mk2 module using a static IP address:
Select the Use static IP option, then enter the new IP address and Subnet mask (and Default gateway, if used), in dot-decimal notation (xxx.xxx.xxx.xxx), for the MPC4Mk2 module in the appropriate fields. Click Finish.

NOTE: When the IP settings for a MPC4Mk2 module are changed, the module automatically resets (reboots) in order to start using the new IP settings (IP address). See 3.3.1.1 Notes on configuring the IP settings for a MPC4Mk2 module.

After the MPC4Mk2 module restarts, the System Explorer will update to show the new IP configuration information in the Devices structure view. However, this does not necessarily mean that the module is accessible in your subnet.

6- To test if the MPC4Mk2 module is accessible, at a Windows command prompt, type `ping xxx.xxx.xxx.xxx` replacing `xxx.xxx.xxx.xxx` with the IP address just configured.

If the module replies, this means it is in the same subnet as your computer and that it is ready to be used.

NOTE: The fact that the MPC4Mk2 module appears in the Devices tree structure of the System Explorer does not mean that the module is in your subnet, as zeroconf (the network discovery protocols implemented in VibroSight) can find VibroSight-compatible devices all over a network. To be able to communicate with the device, configure an IP address belonging to the same subnet as the computer used for this communication.

3.3.1.1 Notes on configuring the IP settings for a MPC4Mk2 module

When the IP settings for a MPC4Mk2 module are changed, the module must automatically reset (reboot) in order to start using and broadcast the new IP settings (IP address).

NOTE: When a MPC4Mk2 module is locked (safety/secure operating mode), its IP settings cannot be changed. See also 4.4.2 Operational mode.

Following the reset (reboot) of a MPC4Mk2 module, it temporarily enters the Power-up mode where it takes approximately 30 seconds to boot and complete its power-on self-test (POST). While in the Power-up mode, the module's outputs are held in their default states. See also 4.4.1 Power-up mode and 4.6 MPC4Mk2 + IOC4Mk2 module output behaviour after a reset and during power up.

NOTE: During the reset (reboot) of a MPC4Mk2 module, the module cannot provide its normal machinery monitoring functions because its outputs (alarms and relays) are held in their default states, irrespective of how they have been configured.

It is highly recommended that the IP settings (IP address) of a MPC4Mk2 module are only changed in accordance with the operating procedures for the machinery being monitored with appropriate precautions are taken at the control system level (such as DCS or PLC).

For example, alarms and relay outputs should be ignored (bypassed or inhibited) in order to avoid false trips of the machinery being monitored.

To check that a MPC4Mk2 module (or any other VibroSight-compatible device) is connected to your subnet, type `ping xxx.xxx.xxx.xxx` at a Windows command prompt and then press ENTER (where `xxx.xxx.xxx.xxx` is replaced by the actual IP address of the device, in dot-decimal notation, as displayed by VibroSight System Manager).

If the module or device replies, it is ready to communicate in your subnet. If the device does not reply, this is probably because its IP address does not belong to the correct subnet, in which case it must be changed.

NOTE: VibroSight System Manager displays all of the VibroSight compatible hardware (modules and other devices) that the computer can see on the network.
Although a module/device does not need to be in the same subnet as the computer running VibroSight in order to be detected and displayed by VibroSight System Manager, a device does need to be in the same subnet as the computer running VibroSight for a deployed VibroSight system.
That is, it is necessary for a VibroSight-compatible device and the computer running VibroSight to be in the same subnet for normal system operation.

The fact that a MPC4Mk2 module (or any other VibroSight-compatible device) appears in the Devices tree structure of the System Explorer does not mean that the module (or device) is in your subnet, as zeroconf (the network discovery protocols implemented in VibroSight) can find VibroSight-compatible devices all over a network. To be able to communicate with the device, configure an IP address belonging to the same subnet as the computer used for this communication.

3.3.2 Identifying a MPC4Mk2 module in a VM600Mk2/VM600 rack using VibroSight System Manager

VibroSight System Manager can be used to identify a MPC4Mk2 module in a VM600Mk2/VM600 rack by making the LEDs on the front panel of the module blink (flash).

This can be used to help physically identify a module in a rack, which can be useful, for example, to identify a module before removing it from the rack or adding connections to the corresponding input/output module in the rear of the rack.

1- Start VibroSight System Manager.

2- In the System Explorer window (left), select the Devices view (bottom).

The System Explorer window updates to display all of the VibroSight-compatible devices that System Manager can see on the network.

3- In the System Explorer window, under MPC4 modules, select the MPC4Mk2 module.

In the System Explorer window, VibroSight compatible devices are listed in a serial number (IP address) format. For example: xxxxxxx (xxx.xxx.xxx.xxx) for a VM600Mk2 module such as a MPC4Mk2.

NOTE: It is recommended that VibroSight compatible devices such as a MPC4Mk2 module are identified by their serial number (for example, APxxxxx), as an IP address (xxx.xxx.xxx.xxx in dot-decimal notation) can be easily changed.

The main window (centre) updates to display information for the MPC4Mk2 module.

4- In the Actions window (right), under Maintenance, click Test LED.

VibroSight System Manager will display a window to confirm LED test done successfully and all LEDs on the front panel of the MPC4Mk2 module will blink ● ○ ● ○ ● ○, holding each LED state for approximately 2 seconds.

After the LED test is finished, which takes a total of approximately 20 seconds, the LEDs on the front panel of the MPC4Mk2 module will resume normal LED operation (see 2.2.1 MPC4Mk2 module LEDs).

See also 3.4.2 Identifying a MPC4Mk2 module in a VM600Mk2/VM600 rack using VibroSight Protect.

3.3.3 Displaying information about a MPC4Mk2 module

VibroSight System Manager is used to display information about a MPC4Mk2 module.

NOTE: The main window (centre) in VibroSight System Manager displays lots of information for the selected MPC4Mk2 module, such as General information, Time synchronisation, Network, Diagnostics and Firmware versions.

1- Start VibroSight System Manager.

2- In the System Explorer window (left), select the Devices view (bottom).

The System Explorer window updates to display all of the VibroSight-compatible devices that System Manager can see on the network.

3- In the System Explorer window, under MPC4 modules, select the MPC4^{Mk2} module.

In the System Explorer window, VibroSight-compatible devices are listed in a serial number (IP address) format. For example: xxxxxxx (xxx.xxx.xxx.xxx in dot-decimal notation) for a VM600^{Mk2} module such as a MPC4^{Mk2}.

NOTE: It is recommended that VibroSight-compatible devices such as a MPC4^{Mk2} module are identified by their serial number (for example, APxxxxx), as an IP address (xxx.xxx.xxx.xxx in dot-decimal notation) can be easily changed.
The product's serial number is assigned in the factory during manufacture and cannot be changed, but the product's IP address (xxx.xxx.xxx.xxx in dot-decimal notation) can be changed to meet the requirements of a network.

The main window (centre) updates to display information for the MPC4^{Mk2} module, grouped in sections such as General information, Time synchronisation, Network, Diagnostics and Firmware versions.

See also A.1 Displaying diagnostic fault code information for a VM600^{Mk2} machinery protection system (MPS).

3.3.3.1 Notes on displaying information about a MPC4^{Mk2} module

For example, the information displayed under General information (top) includes:

- Machinery protection status: Running, Locked *or* Running, Unlocked is typically displayed during normal operation.
- Condition monitoring status: Running *or* Not Configured *or* There is no condition monitoring license is typically displayed.
- Firmware compatibility with VibroSight: Compatible is typically displayed.
- Condition monitoring licensing status: Valid license *or* No license (*or* Invalid license) can be displayed.

If the main window (centre) does not display much information for the MPC4^{Mk2} module and, for example, mostly displaying Not available, then under General information, check the information displayed for Firmware compatibility with VibroSight.

If Firmware compatibility with VibroSight: Too old is displayed, then it is necessary to either change the MPC4^{Mk2} module to a later version of firmware (or change the VibroSight software to an earlier version) in order to display information about the MPC4^{Mk2} module.
(Firmware compatibility with VibroSight: Compatible is displayed when the VibroSight software and module firmware are compatible.)

NOTE: The information in the main window (centre) is updated every 10 seconds (approx.). The time of the last update is displayed to the bottom right of the main window. For example, Update time: 05.04.2022 08:05:16.

3.3.4 Checking the status / operating mode for a MPC4Mk2 module

VibroSight System Manager is used to display the status / operating mode for a MPC4Mk2 module.

Follow the procedure in 3.3.3 Displaying information about a MPC4Mk2 module and when the main window (centre) updates to display information for the MPC4Mk2 module, under General Information (top), check the information displayed for Machinery protection status and Condition monitoring status, if licensed.

For the MPC4Mk2 module, the Machinery protection status can be:

- Power-up – which corresponds to the Power-up mode.
  Note: When a MPC4Mk2 module resets, it enters the Power-up mode only temporarily.
- Running, Locked *or* Running, Unlocked – which corresponds to the Operational mode and is displayed during normal operation.
- Fail-safe – which corresponds to the Fail-safe mode.
- Recovery – which corresponds to the Recovery mode.

For further information, see 4.4 MPC4Mk2 module operating modes.

For the MPC4Mk2 module, the Condition monitoring status can be:

- Running *or* Not Configured (if licensed)
- There is no condition monitoring license (if not licensed).

3.3.5 Checking the firmware for a MPC4Mk2 module

VibroSight System Manager is used to display information about the firmware on a MPC4Mk2 module.

Follow the procedure in 3.3.3 Displaying information about a MPC4Mk2 module and when the main window (centre) updates to display information for the MPC4Mk2 module, check the firmware information displayed under Firmware versions (bottom).

If a particular firmware has been uploaded to and is available for use by the MPC4Mk2 module, then the PNR for the firmware is listed by System Manager, under Firmware versions (bottom). For example, 640-025-vvv-ppp for the Machinery protection firmware.

If a particular firmware has not been uploaded to and is not available for use by the MPC4Mk2 module, then the PNR for that firmware is not listed (that is, left blank) by System Manager, under Firmware versions (bottom).

However, the PNR for the Recovery firmware should always be listed as the Recovery mode is always available in order to allow other firmware to be upgraded. For example, 640-031-vvv-ppp for the Recovery firmware.

For further information, see 4.3 MPC4Mk2 module firmware.

See also 3.3.6 Changing the firmware for a MPC4Mk2 module.

3.3.6 Changing the firmware for a MPC4Mk2 module

VibroSight System Manager is used to upgrade or otherwise change the firmware on a MPC4Mk2 module.

For information on the different firmware used by a MPC4Mk2 module (machinery protection, condition monitoring (if licensed), recovery and proof test), see 4.3 MPC4Mk2 module firmware.

1- Start VibroSight System Manager.

2- In the System Explorer window (left), select the Devices view (bottom).
The System Explorer window updates to display all of the VibroSight-compatible devices that System Manager can see on the network.

3- In the System Explorer window, under MPC4 modules, select the MPC4Mk2 module.

NOTE: As an IP address can be easily changed, a VM600Mk2 module such as a MPC4Mk2 should be identified by its serial number (for example, APxxxxx).

The main window (centre) updates to display information for the MPC4Mk2 module.
In the main window, Firmware versions (bottom) displays the information about the firmware currently running on the MPC4Mk2 module.

4- In the Actions window (right), under Maintenance, click Change firmware.
The MPC4 module(s) firmware upgrade window is displayed.

5- In the MPC4 module(s) firmware upgrade window, click the … control (right of Firmware file text box) and use the dialog box that appears to navigate the folders on the computer and select the required firmware file. Then click Open.

NOTE: The default folder for the firmware (embedded software) files used by MPC4Mk2 modules is:
`C:\Program Files\Meggitt\VibroSight\Firmware\VM600\MPC4 Mk2`

The MPC4 module(s) firmware upgrade window, under Firmware status, updates to display the selected firmware changes. For example:

```
Component: Machinery protection firmware PNR
 From version 640-025-vvv-ppp to version 640-025-007-001
  APxxxxx (xxx.xxx.xxx.xxx)
```

6- In the MPC4 module(s) firmware upgrade window, click Next to start the firmware change/upgrade process.
When the firmware upgrade is complete, the MPC4 module(s) firmware upgrade window will display a firmware upgrade finished message.
A firmware upgrade takes approximately 1 minute to upload and install the new firmware on the MPC4Mk2 module. With a further 30 seconds required for the module to automatically reset (reboot) the module and use the new firmware.
Click Finish to continue.

See also 3.3.5 Checking the firmware for a MPC4Mk2 module.

3.3.6.1 Notes on changing the firmware for a MPC4Mk2 module

In order to change/upgrade the operational (machinery protection) firmware, the MPC4Mk2 module must be running either the operational firmware (Unlocked (maintenance operating mode) only), recovery firmware or the proof test firmware.

In order to change/upgrade the recovery firmware, the MPC4Mk2 module must be running the operational firmware (Unlocked (maintenance operating mode) only).

In order to change/upgrade the proof test firmware, the MPC4Mk2 module must be running the recovery firmware.

See Table 4-1 for a description of the different MPC4Mk2 module firmware and the part numbers (PNRs) used to identify them.

3.3.7 Checking the condition monitoring license for a MPC4Mk2 module

VibroSight System Manager is used to display information about the condition monitoring license for a MPC4Mk2 module.

Follow the procedure in 3.3.3 Displaying information about a MPC4Mk2 module and when the main window (centre) updates to display information for the MPC4Mk2 module, under General Information (top), check the information displayed for Condition monitoring licensing status.

If the Condition monitoring licensing status displays Valid license, then the MPC4Mk2 module has a valid condition monitoring license installed (uploaded) and the module can be used for both machinery protection and condition monitoring.

If the Condition monitoring licensing status displays No license or Invalid license, then the MPC4Mk2 module does not have a valid condition monitoring license installed (uploaded) and the module can be used for machinery protection only.

For further information, see 4.2 VibroSight / VM600Mk2 MPC4Mk2 condition monitoring licensing.

See also 3.3.8 Managing the condition monitoring license for a MPC4Mk2 module.

3.3.8 Managing the condition monitoring license for a MPC4Mk2 module

VibroSight System Manager is used to upgrade or otherwise change the condition monitoring license for a MPC4Mk2 module.

For information on the condition monitoring licensing used by a MPC4Mk2 module (MPC4Mk2 CMS license), see 4.2 VibroSight / VM600Mk2 MPC4Mk2 condition monitoring licensing.

1- Start VibroSight System Manager.

2- In the System Explorer window (left), select the Devices view (bottom).

The System Explorer window updates to display all of the VibroSight-compatible devices that System Manager can see on the network.

3- In the System Explorer window, under MPC4 modules, select the MPC4Mk2 module.

NOTE: As an IP address can be easily changed, a VM600Mk2 module such as a MPC4Mk2 should be identified by its serial number (for example, APxxxxx).

The main window (centre) updates to display information for the MPC4Mk2 module.

In the main window, General information (top) displays the information about the current status of condition monitoring licensing for the MPC4Mk2 module, under Condition monitoring licensing status which can be either Valid license *or* No license.

4- For a module does not already have a valid condition monitoring license installed (that is, Condition monitoring licensing status: No license), in the Actions window (right), under Licensing, click Set License.

The License activation window is displayed.

Similarly, for a module that does have a valid condition monitoring license installed (that is, Condition monitoring licensing status: Valid license), in the Actions window (right), under Licensing, the Remove License command can be used to remove the licence.

NOTE: Before removing the condition monitoring license from a MPC4Mk2 module, ensure that a copy of the licence (MPC4Mk2 CMS license) has been backed up / stored and is available elsewhere for future reference. As after the Remove License command is run, it is not possible to obtain a copy of the removed license directly from the module.

5- In the License activation window, click the … control (right of License file text box) and use the dialog box that appears to navigate the folders on the computer and select the required condition monitoring license file. Then click Open.

6- Then click Next to start the license change/upgrade process.

When the license is uploaded to / installed on the MPC4Mk2 module, a license successfully installed message will be displayed.
Click Finish to continue.

When the information in the main window (centre) updates to display information for the MPC4Mk2 module, under General Information (top), the information displayed for Condition monitoring licensing status will be updated, depending on the license.

See also 3.3.7 Checking the condition monitoring license for a MPC4Mk2 module.

3.3.8.1 Notes on managing the condition monitoring license for a MPC4Mk2 module

The condition monitoring license (MPC4Mk2 CMS license) used by a MPC4Mk2 module is “linked/tied” to the module by module-specific parameters such as serial number and MAC address.

Accordingly, when ordering a MPC4Mk2 CMS license for a MPC4Mk2 module without condition monitoring enabled (that is, not pre-licensed), additional information must be provided.

In VibroSight System Manager, with the MPC4Mk2 module selected (System Explorer window, left), in the Actions window (right), under Licensing, the Save device info. command is used to obtain a MPC4 licensing info file (`*.mpc4info`) that contains the information required to generate the condition monitoring license (MPC4Mk2 CMS license) for a MPC4Mk2 module.

Also in VibroSight System Manager, with the MPC4Mk2 module selected (System Explorer window, left), in the Actions window (right), under Licensing, the Remove license command is used to remove the condition monitoring license file from a MPC4Mk2 module.

NOTE: Before removing the condition monitoring license from a MPC4Mk2 module, ensure that a copy of the licence (MPC4Mk2 CMS license) has been backed up / stored and is available elsewhere for future reference. As after the Remove License command is run, it is not possible to obtain a copy of the removed license directly from the module.

3.3.9 Configuring the network interface for a CPUMMk2 module

VibroSight System Manager is used to configure the network interface for a CPUMMk2 module, that is, IP address, subnet mask, etc., just as it is for a MPC4Mk2 module.

The procedure and functionality are the same as described in 3.3.1 Configuring the network interface for a MPC4Mk2 module, except that in VibroSight System Manager, in the System Explorer window (left), the CPUMMk2 module is listed under CPUM modules.

Also, there are two system Ethernet interfaces that can be configured for a CPUMMk2 + IOCNMk2 module (compared to one system Ethernet interface that can be configured for a MPC4Mk2 + IOC4Mk2 module).

NOTE: In VibroSight System Manager, in the System Explorer window, CPUMMk2 modules are listed under CPUM modules and MPC4Mk2 modules are listed under MPC4 modules.

3.3.10 Checking and/or changing the firmware for a CPUMMk2 module

VibroSight System Manager is used to display information about the firmware on a CPUMMk2 module and/or upgrade or otherwise change the firmware on a CPUMMk2 module, just as it is for a MPC4Mk2 module.

The procedure is the same as described in 3.3.5 Checking the firmware for a MPC4Mk2 module and 3.3.6 Changing the firmware for a MPC4Mk2 module, except that in VibroSight System Manager, in the System Explorer window (left), the CPUMMk2 module is listed under CPUM modules and the folder containing the firmware is slightly different.

NOTE: In VibroSight System Manager, in the System Explorer window, CPUMMk2 modules are listed under CPUM modules and MPC4Mk2 modules are listed under MPC4 modules.

NOTE: The default folder for the firmware (embedded software) files used by CPUMMk2 modules is:
`C:\Program Files\Meggitt\VibroSight\Firmware\VM600\CPUM Mk2`

3.3.11 Saving diagnostic logs from a VM600Mk2 module

The information recorded in diagnostic log files by VM600Mk2 modules may be required by Meggitt Customer support in order to help support the investigation of certain issues. Accordingly, VibroSight System Manager is used to download and save diagnostic log files from VM600Mk2 modules.

The VM600Mk2 MPC4Mk2 + IOC4Mk2 module stores its diagnostic log files in local non-volatile memory (that is, in the module itself), so these module's logs are kept even when the power supply to the module is removed.

The VM600Mk2 RLC16Mk2 module has no diagnostic log files of its own, as the MPC4Mk2 module that controls a RLC16Mk2 module also stores information about the RLC16Mk2 in its own diagnostic log files.

The VM600Mk2 CPUMMk2 + IOCNMk2 module stores its diagnostic log files in local volatile memory (that is, in the module itself), so these module's logs are effectively lost whenever:

- The power supply to the module is removed, for example, by turning the power supply to the module off and on, or removing and re-inserting the device.
- The module is rebooted (restarted).

NOTE: Before restarting a module or replacing it with a spare (hot-swapping), it is recommended to use the Save diagnostic logs command in VibroSight System Manager in order to save a copy of the device's diagnostic information to the host computer.
This is especially important for the VM600Mk2 CPUMMk2 + IOCNMk2 module as otherwise this information will be lost.

1- Start VibroSight System Manager.

2- In the System Explorer window (left), select the Devices view (bottom).
The System Explorer window updates to display all of the VibroSight-compatible devices that System Manager can see on the network.

3- In the System Explorer window, select the VM600Mk2 module. For example, under MPC4 modules, select a MPC4Mk2 module.5
In the System Explorer window, VibroSight compatible devices are listed in a serial number (IP address) format. For example: xxxxxxx (xxx.xxx.xxx.xxx in dot-decimal notation) for a VM600 module such as a MPC4Mk2.

NOTE: It is recommended that VibroSight compatible devices such as a MPC4Mk2 module are identified by their serial number (for example, APxxxxx), as an IP address (xxx.xxx.xxx.xxx in dot-decimal notation) can be easily changed.

4- In the Actions window (right), under Diagnostics, click Save diagnostic logs.

5- Use the Save as dialog box that appears to navigate the folders on the computer and select in which folder and under what file name to save the module's diagnostic log file, for example, `*.ddbgl` for a MPC4Mk2 module. Then click Save.
When the diagnostic log file is downloaded from the VM600Mk2 module, a logs successfully saved message will be displayed.
Click OK to continue.

See also 1.13 Diagnostic log files and 1.14 VibroSight software diagnostic logs.

3.4 Common VibroSight Protect tasks

3.4.1 Identifying a MPC4Mk2 module in a VibroSight Protect (MPS) configuration

A VibroSight Protect (MPS) configuration must be able to uniquely identify each MPC4Mk2 module (VM600Mk2 MPS) in a VM600Mk2/VM600 rack using the module's IP address.

This is necessary so that VibroSight Protect can distinguish between different MPC4Mk2 modules in the rack and communicate with the required module(s), as necessary.

1- Start VibroSight Protect.

2- Create a new configuration containing a MPC4Mk2 module (New system – VM600 - 6U or VM600 - 1U) or open and modify an existing one (File > Open Protect file > … (`*.mpscfg`)).

3- For a new configuration, on the Layout tab/page, in the main window (centre), double-click an empty/unpopulated rack slot in the front view of the rack.

Use the Add new device dialog box that appears to add a MPC4Mk2 module (MPC4).

NOTE: For a VM600 - 6U rack (that is, a ABE04x system rack), MPC4Mk2 modules can be installed in rack slots 03 to 14.
For a VM600 - 1U rack (that is, a ABE056 slimline rack), a MPC4Mk2 modules can be installed in rack slot 03.
See 1.6.2 Installation restrictions.

To remove a module in a rack slot, either select the module in the rack view or in the System window (top right), then in the System window, click the − control (Remove item control).

4- On the Configure tab/page, select the MPC4Mk2 rack slot from the view of the rack (top). Alternatively, select the MPC4Mk2 rack slot in the System window (top right).

The main window (centre) updates to display the information for the MPC4Mk2 module.

5- In the main window (centre), on the General tab, under Network settings, the Mode, Serial number and IP address controls/fields are used to identify the MPC4Mk2 in the configuration.

Mode is set to decide how the module will be discovered and identified by VibroSight Protect, as follows:

- For Mode: Manual IP address, the Serial number field is effectively ignored and the IP address for the module must be manually entered in the IP address field.
- For Mode: Automatic discovery from serial number, the serial number for the module must be manually entered in the Serial number field (xxx.xxx.xxx.xxx in dot-decimal notation), after which VibroSight Protect will automatically communicate with the module to obtain its IP address and complete the IP address field.

NOTE: It is recommended that VibroSight compatible devices such as a MPC4Mk2 module are identified by their serial number (for example, APxxxxx), as an IP address (xxx.xxx.xxx.xxx in dot-decimal notation) can be easily changed.

The Serial number and/or IP address for a MPC4Mk2 module can be obtained using VibroSight System Manager (see 3.3.3 Displaying information about a MPC4Mk2 module).

Once the IP address has been configured, the Blink front panel LEDs control can be used to verify communications between VibroSight Protect and the MPC4Mk2 module (see 3.4.2 Identifying a MPC4Mk2 module in a VM600Mk2/VM600 rack using VibroSight Protect).

3.4.2 Identifying a MPC4Mk2 module in a VM600Mk2/VM600 rack using VibroSight Protect

VibroSight Protect can be used to identify a MPC4Mk2 module in a VM600Mk2/VM600 rack by making the LEDs on the front panel of the module blink (flash).

This can be used to help physically identify a module in a rack, which can be useful, for example, to identify a module before removing it from the rack or adding connections to the corresponding input/output module in the rear of the rack.

1- Start VibroSight Protect.

2- On the Configure tab/page, select the MPC4Mk2 rack slot from the view of the rack (top). Alternatively, select the MPC4Mk2 rack slot in the System window (right).

The main window (centre) updates to display the information for the MPC4Mk2 module.

3- In the main window (centre), under Network settings, click the Blink front panel LEDs control.

VibroSight Protect will display a window to confirm LED test done successfully and all LEDs on the front panel of the MPC4Mk2 module will blink ● ○ ● ○ ● ○, holding each LED state for approximately 2 seconds.

After the LED test is finished, which takes a total of approximately 20 seconds, the LEDs on the front panel of the MPC4Mk2 module will resume normal LED operation (see 2.2.1 MPC4Mk2 module LEDs).

See also 3.3.2 Identifying a MPC4Mk2 module in a VM600Mk2/VM600 rack using VibroSight System Manager.

3.4.3 Identifying a CPUMMk2 module in a VM600Mk2/VM600 rack using VibroSight Protect

A VibroSight Protect (MPS) configuration must be able to uniquely identify the CPUMMk2 module (VM600Mk2 MPS) in a VM600Mk2/VM600 rack using the module's IP address.

This is necessary so that VibroSight Protect can distinguish the CPUMMk2 module in the rack and communicate with the module, as necessary.

The procedure is the same as described in 3.4.1 Identifying a MPC4Mk2 module in a VibroSight Protect (MPS) configuration, except that in VibroSight Protect, on the Layout tab/page, when double-clicking an empty/unpopulated rack slot in the front view of the rack:

Use the Add new device dialog box that appears to add a CPUMMk2 module (CPUM).

NOTE: For a VM600 - 6U rack (that is, a ABE04x system rack), a CPUMMk2 module can be installed in rack slots 0 or 1.
For a VM600 - 1U rack (that is, a ABE056 slimline rack), no CPUMMk2 module cannot be installed.
See 1.6.2 Installation restrictions.

Also, for the CPUMMk2 module, there is no Blink front panel LEDs control that can be used to verify communications between VibroSight Protect and the CPUMMk2 module.

3.4.4 Uploading a fieldbus configuration file to a CPUMMk2 module in a VM600Mk2/VM600 rack using VibroSight Protect

A VibroSight Protect (MPS) configuration containing a CPUMMk2 module requires a fieldbus configuration file to be uploaded to the module in order to configure the fieldbus as required by the application (see 5.4 CPUMMk2 fieldbus configuration).

NOTE: Even if the communications interface functionality is not required by the application, a "dummy" fieldbus configuration file (consisting of the initial header section) is still required (see B.8 Dummy fieldbus configuration file).

1- Start VibroSight Protect.

2- On the Configure tab/page, select the CPUMMk2 rack slot from the view of the rack (top). Alternatively, select the CPUMMk2 rack slot in the System window (right).

The main window (centre) updates to display the information for the CPUMMk2 module.

3- In the main window (centre), under Fieldbuses (left), select Fieldbus 1.
The main window (centre) updates to display the existing fieldbus configuration for the CPUMMk2 module. (If no fieldbus configuration file has previously been uploaded to the module, then no fieldbus configuration will be displayed.)

4- In the main window (centre), under Fieldbus 1, click the Load from file … control (bottom of window) and use the dialog box that appears to navigate the folders on the computer and select the required fieldbus configuration file (`*.cfg`). Then click Open.

The fieldbus configuration file will be uploaded to the CPUMMk2 module, then the main window (centre) updates to display the fieldbus configuration.

NOTE: VibroSight Protect can display the contents of a fieldbus configuration file but it cannot be used to edit the contents. That is, VM600Mk2 CPUMMk2 fieldbus configuration files are external files that are currently generated and edited manually using an external text editor.

After the fieldbus configuration file has been uploaded to the CPUMMk2 module, it will take effect on the module after the whole configuration has been activated on the system in the usual way (Tools > System activation).

4 MPC4Mk2 + IOC4Mk2 MACHINERY PROTECTION AND CONDITION MONITORING MODULE

This chapter provides information on the VM600Mk2 MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring module.

NOTE: Refer to the *VM600Mk2 MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring module data sheet* for detailed information on the key features and benefits, and specifications for this module.

This includes an introduction to the different firmware that can run on the MPC4Mk2 module and the different operating modes of the module (firmware).

4.1 VM600Mk2 MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring

The VM600Mk2 MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring module consists of processing and input/output (interface) modules that provide 4 dynamic channels and 2 auxiliary channels of machinery protection and optional condition monitoring in VM600Mk2 systems.

To prioritise machinery protection functionality and help meet stringent cybersecurity and API 670 requirements, the MPC4Mk2 + IOC4Mk2 module segregates machinery protection (MPS) and condition monitoring (CMS) functionality by running separate module firmware using separate configurations from different VibroSight configuration software:

- VibroSight Protect supports the configuration and operation of machinery protection system (MPS) functionality for a VM600Mk2 system (that is, for MPC4Mk2 + IOC4Mk2, RLC16Mk2 and CPUMMk2 + IOCNMk2 modules).
- VibroSight Capture supports the configuration and operation of condition monitoring system (CMS) functionality for a VM600Mk2 system (that is, for MPC4Mk2 + IOC4Mk2 modules).

See also 4.3 MPC4Mk2 module firmware.

Other VibroSight software modules support operations such as data display and analysis (VibroSight Vision), data logging and post-processing (VibroSight Server) system maintenance (VibroSight System Manager), etc.

4.2 VibroSight / VM600Mk2 MPC4Mk2 condition monitoring licensing

In VibroSight / VM600Mk2 systems, the MPC4Mk2 + IOC4Mk2 module can provide machinery protection system (MPS) functionality and/or condition monitoring system (CMS) functionality, depending on the requirements of the application.

For the VM600Mk2 MPC4Mk2 + IOC4Mk2 module, machinery protection functionality is available by default for all versions of the module, while condition monitoring functionality is optional. Accordingly, MPC4Mk2 condition monitoring can be used by either (1) ordering a version of the module with condition monitoring enabled or (2) ordering and uploading a condition monitoring license to a version of the module without condition monitoring enabled (using VibroSight System Manager).

NOTE: For the VM600Mk2 MPC4Mk2 + IOC4Mk2 machinery protection and condition monitoring module, machinery protection functionality is available by default for all versions of the module, while condition monitoring functionality is optional.

NOTE: VM600Mk2 MPC4Mk2 condition monitoring also requires a VibroSight® software edition / license that supports condition monitoring.

For example, a VibroSight / VM600Mk2 system consisting of MPC4Mk2 + IOC4Mk2 modules can initially be installed and used as a MPS only. Then, CMS functionality can be quickly and easily added at any time by upgrading the licenses for the MPC4Mk2 + IOC4Mk2 module(s) and for the VibroSight® software, as required.

See also 3.3.7 Checking the condition monitoring license for a MPC4Mk2 module and 3.3.8 Managing the condition monitoring license for a MPC4Mk2 module.

4.3 MPC4Mk2 module firmware

In a VM600Mk2 machinery monitoring system, it is the MPC4Mk2 module that provides the intelligence and controls the IOC4Mk2 module and any associated/optional RLC16Mk2 modules. Accordingly, only the MPC4Mk2 module runs firmware which can be upgraded or otherwise changed by the end-user/operator as required.

The MPC4Mk2 module can run four different firmwares, as shown in Table 4-1.

For a MPC4Mk2 module delivered as part of a VM600Mk2 solution, the module normally comes with the latest version of each module firmware: machinery protection, condition monitoring (if licensed), recovery and proof test.

For a MPC4Mk2 module delivered as a spare part, the module normally runs the latest version of the recovery firmware only, which allows the other firmware (machinery protection, condition monitoring (if licensed) and proof test) to be changed/uploaded, as required.

See also 2.2.3 MPC4Mk2 module factory assigned defaults.

VibroSight System Manager can be used to display the firmware available on a MPC4Mk2 module and to change/upgrade the module firmware, as required (see 3.3.3 Displaying information about a MPC4Mk2 module, 3.3.5 Checking the firmware for a MPC4Mk2 module and 3.3.6 Changing the firmware for a MPC4Mk2 module).

VibroSight System Manager is also used to display information about and manage condition monitoring licenses (MPC4Mk2 CMS licenses) for MPC4Mk2 modules, as required (see 3.3.3 Displaying information about a MPC4Mk2 module, 3.3.7 Checking the condition monitoring license for a MPC4Mk2 module and 3.3.8 Managing the condition monitoring license for a MPC4Mk2 module).

Table 4-1: MPC4Mk2 module firmware

MPC4Mk2 module firmware	Description
Machinery protection firmware (`640-025-vvv-ppp.Mpc4g2Fw`)	The machinery protection firmware runs on a MPC4Mk2 module in order to provide the machinery protection system (MPS) functionality required by a system. Note: All MPC4Mk2 module's run machinery protection firmware.
Condition monitoring firmware (`640-033-vvv-ppp.VxeFw`)	The condition monitoring firmware runs on a MPC4Mk2 module in order to provide the condition monitoring system (CMS) functionality required by a system. Note: Only MPC4Mk2 module's with a MPC4Mk2 CMS license can run condition monitoring firmware. For further information, see 4.2 VibroSight / VM600Mk2 MPC4Mk2 condition monitoring licensing.
Recovery firmware (`640-031-vvv-ppp.Mpc4g2Fw`)	The recovery firmware allows a MPC4Mk2 module to be recovered in the unlikely event of a problem with the module, such as corrupted operational firmware (machinery protection and/or condition monitoring) or a corrupted configuration. Note: It is important to note that entering the Recovery mode also clears the modules configuration.
Proof test firmware (`640-032-vvv-ppp.VxeFw`)	The proof test firmware is used to run a specific diagnostic proof test on the MPC4Mk2 module in order to verify the status of the module and its components (hardware and firmware). Note: Use of proof testing is primarily intended for safety-related applications.

Notes

The different MPC4Mk2 module firmware is identified by different part numbers (PNRs) as follows:
- The machinery protection firmware is identified by the part number (PNR): `640-025-vvv-ppp` (file name `640-025-vvv-ppp` and file name extension `.Mpc4g2Fw`).
- The condition monitoring firmware is identified by the part number (PNR): `640-033-vvv-ppp` (file name `640-033-vvv-ppp` and file name extension `.VxeFw`).
- The recovery firmware is identified by the part number (PNR): `640-031-vvv-ppp` (file name `640-031-vvv-ppp` and file name extension `.Mpc4g2Fw`).
- The proof test firmware is identified by the part number (PNR): `640-032-vvv-ppp` (file name `640-032-vvv-ppp` and file name extension `.VxeFw`).

In a MPC4Mk2 module firmware part number (PNR):
- `vvv` represents the version number of the firmware.
- `ppp` represents the patch number of the firmware.

For example, PNR `640-025-007-001` is an official release of machinery protection firmware (version 7, patch 1) for the MPC4Mk2 module.

4.4 MPC4Mk2 module operating modes

The MPC4Mk2 module has a number of different operating modes, as shown in Figure 4-1.

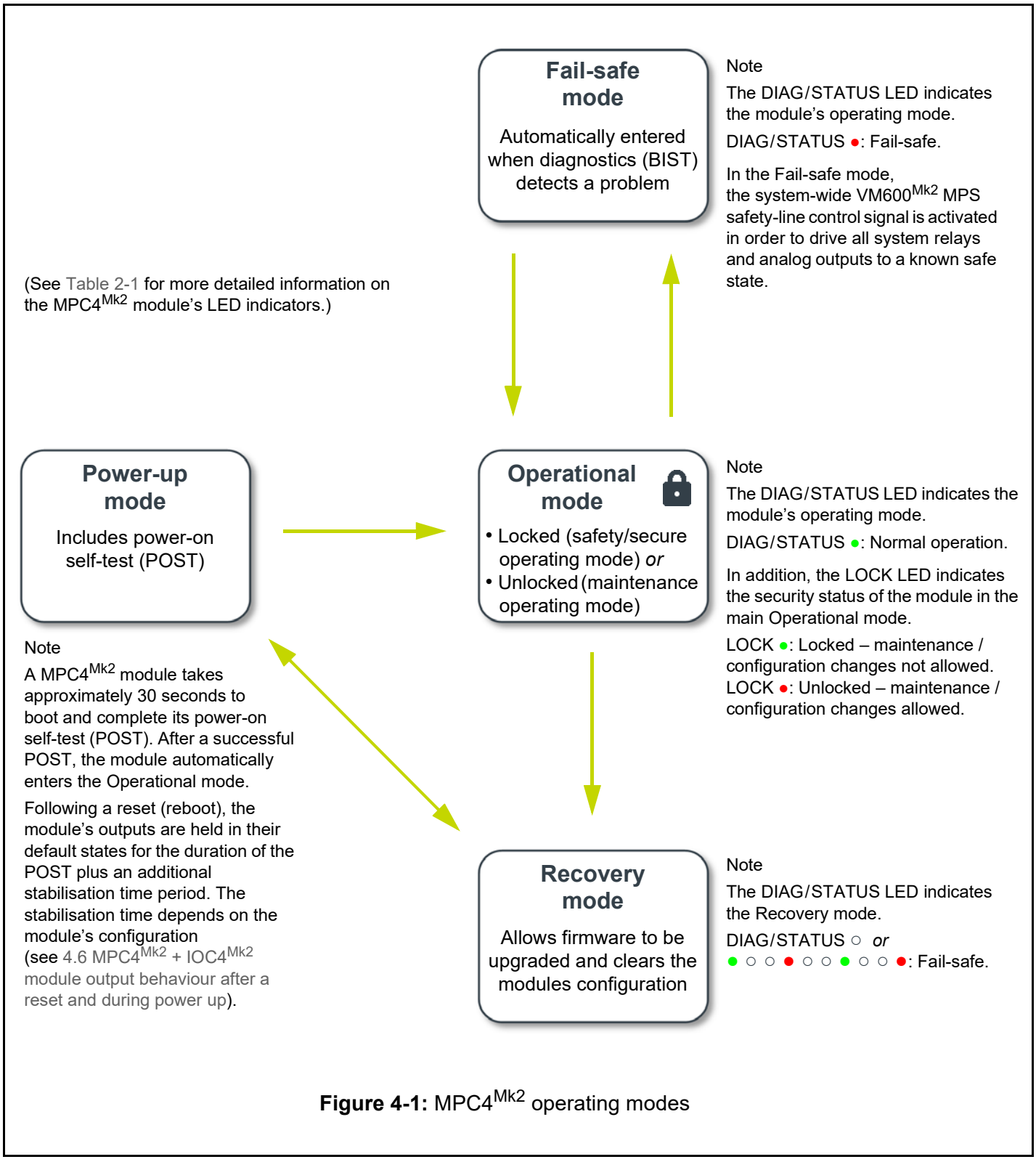


Figure 4-1: MPC4Mk2 operating modes

VibroSight System Manager can be used to display the operating mode of a MPC4Mk2 module (see 3.3.4 Checking the status / operating mode for a MPC4Mk2 module).

See Table 2-1 for information on the behaviour and meaning of the MPC4Mk2 module's LEDs.

4.4.1 Power-up mode

When power is first applied to a MPC4Mk2 module, the module automatically enters the Power-up mode.

In Power-up mode, the MPC4Mk2 module runs a power-on self-test (POST) which takes approximately 30 seconds.

After a successful POST, the module automatically enters the Operational mode if machinery protection firmware is available or enters the Recovery mode if machinery protection firmware is not available.

But if the POST is not successful, then the module will enter the Fail-safe mode.

At any time, a MPC4Mk2 module (VM600Mk2 MPS) can be reset (rebooted) in order to force it temporarily into the Power-up mode (see 4.5 Resetting a VM600Mk2 MPS).

See also 4.6 MPC4Mk2 + IOC4Mk2 module output behaviour after a reset and during power up.

4.4.2 Operational mode

In general, a MPC4Mk2 module enters the Operational mode after successfully passing the power-on self-test (POST) in Power-up mode.

NOTE: Operational mode is the main mode of the MPC4Mk2 module, where the module runs all of its processing functions.

In Operational mode, the MPC4Mk2 module can run in one of two modes, as follows:

- Locked (safety/secure operating mode)

  When Locked, a MPC4Mk2 module (VM600Mk2 MPS) performs its machinery protection functions while ensuring the security of the module/system and it's configuration. That is, the configuration cannot be changed and maintenance activities cannot be performed.

- Unlocked (maintenance operating mode)

  When Unlocked, a MPC4Mk2 module (VM600Mk2 MPS) performs its machinery protection functions without ensuring the security of the module/system and it's configuration. That is, the configuration can be changed and maintenance activities can be performed.

In Operational mode, the MPC4Mk2 module indicates the actual mode it is operating in, as follows:

- Locked (safety/secure operating mode):
  - The LOCK LED is green (LOCK ●)
  - The common circuit-fault relay (FAULT) is energised.
- Unlocked (maintenance operating mode)
  - The LOCK LED is red (LOCK ●)
  - The common circuit-fault relay (FAULT) is de-energised.

NOTE: The LOCK LED indicates the status of the VM600Mk2 MPS, as follows:
• LOCK ● indicates that the VM600Mk2 MPS is Locked.
• LOCK ● indicates that the VM600Mk2 MPS is Unlocked.

NOTE: The common circuit-fault relay (FAULT) indicates the status of the VM600Mk2 MPS, as follows:
• FAULT relay energised indicates that the VM600Mk2 MPS is Locked (that is, in the safety/secure operating mode).
• FAULT relay de-energised indicates that the VM600Mk2 MPS is either Unlocked (that is, in the maintenance operating mode) or is in the Fail-safe mode.

To switch between the two modes:

- When Locked (safety/secure operating mode), press button 2 (right) 5 times within 5 seconds to switch to Unlocked.
- When Unlocked (maintenance operating mode), press and hold button 2 (right) for at least 1 second to switch to Locked.

NOTE: The MPC4Mk2 module will not switch from Unlocked to Locked when an alarm bypass (AB) is active.

When in the Operational mode, the MPC4Mk2 module's recovery firmware can be changed (see 3.3.6 Changing the firmware for a MPC4Mk2 module).

4.4.3 Fail-safe mode

A MPC4Mk2 module enters the Fail-safe mode if the module does not pass the power-on self-test (POST) in Power-up mode or if the module does not pass the periodic internal diagnostics (built-in self-test (BIST)) in Operational mode.

In Fail-safe mode:

- The MPC4Mk2 module activates the system-wide VM600Mk2 MPS safety-line control signal in order to automatically drive all system relays (IOC4Mk2 and RLC16Mk2) and analog outputs (IOC4Mk2) to a safe state.

  NOTE: In a VM600Mk2 machinery protection system, the system-wide VM600Mk2 MPS safety-line control signal – associated with the Fail-safe mode – automatically drives all system relays (VM600Mk2 and RLC16Mk2) and analog outputs (IOC4Mk2) to a safe state should a problem be detected by the internal diagnostics (BIST).

- The MPC4Mk2 module de-energises its common circuit-fault relay (FAULT) in order to indicate that a problem has been detected and that the VM600Mk2 system can no longer ensure the safety of the machinery being monitored.

When a MPC4Mk2 module is in Fail-safe mode, VibroSight System Manager can be used to display diagnostic fault codes corresponding to problems with the module/system.

NOTE: Any Error class 1 fatal-level problems must be resolved before a module can leave the Fail-safe mode. For further information, see Appendix A: Diagnostic fault codes.

In Fail-safe mode:

- For an Error class 2 error-level problem, press and hold button 2 (right) for 1 second in order to force the MPC4Mk2 module into the Operational mode.
- For an Error class 1 fatal-level problem, press and hold both button 1 (left) and button 2 (right) for 2 seconds in order to force the MPC4Mk2 module into the Operational mode.

For further information on MPC4Mk2 module buttons and operating modes respectively, see 2.2.2 MPC4Mk2 module buttons and 4.4 MPC4Mk2 module operating modes.

For further information on the diagnostic fault codes (problems) that can be displayed by the VibroSight System Manager software for a module/system, see Appendix A: Diagnostic fault codes.

4.4.4 Recovery mode

A MPC4Mk2 module automatically enters the Recovery mode if the module does not have operational firmware.

A MPC4Mk2 module (VM600Mk2 MPS) can also be manually forced into the Recovery mode from other modes. That is, at any time, a MPC4Mk2 module (VM600Mk2 MPS) can be reset (rebooted) and forced into the Recovery mode (see 4.5 Resetting a VM600Mk2 MPS).

The Recovery mode allows the end-user/operator to change/upload MPC4Mk2 module firmware, which is required for a module delivered as a spare part (see 2.2.3 MPC4Mk2 module factory assigned defaults).

The Recovery mode also allows a module to be recovered in the unlikely event of a problem such as corrupted operational firmware (machinery protection and/or condition monitoring) or a corrupted configuration. For example, due to a power interruption during a firmware upgrade.

However, it is important to be aware note that in the Recovery mode, the MPC4Mk2 module's configuration is automatically erased.

NOTE: In the Recovery mode, the MPC4Mk2 module's configuration is automatically erased. Accordingly, after leaving the Recovery mode, a MPC4Mk2 module must be configured using VibroSight Protect, before the module can be used in an application.

To leave the Recovery mode, the MPC4Mk2 module (VM600Mk2 MPS) can be reset (rebooted) in order to enter the Operational mode of the machinery protection firmware uploaded by the end-user/operator when in the Recovery mode (see 4.5 Resetting a VM600Mk2 MPS).

4.5 Resetting a VM600Mk2 MPS

When in most operating modes, the MPC4Mk2 module (VM600Mk2 MPS) can be reset (reboot) into the Power-up mode (see 4.4.1 Power-up mode).

For example, to reset (reboot) a MPC4Mk2 module:

- Press and hold both button 1 (left) and button 2 (right) for at least 2 seconds.
- Release both button 1 (left) and button 2 (right).

Similarly, the MPC4Mk2 module (VM600Mk2 MPS) can be reset (reboot) and forced into the Recovery mode (see 4.4.4 Recovery mode).

For example, to reset (reboot) a MPC4Mk2 module and force it into the Recovery mode:

- Press and hold both button 1 (left) and button 2 (right) for at least 2 seconds.
- Release button 2 (right) while keeping button 1 (left) pressed for a further 5 seconds (approx.). Then Release button 1 (left).

See also Table 2-2.

4.6 MPC4Mk2 + IOC4Mk2 module output behaviour after a reset and during power up

Following the reset (reboot) of a VM600Mk2 MPC4Mk2 + IOC4Mk2 module, the MPC4Mk2 module temporarily enters the Power-up mode where it takes approximately 30 seconds to boot and complete its power-on self-test (POST). While in the Power-up mode, the MPC4Mk2 + IOC4Mk2 module's outputs are held in their default states.

After a successful POST, the module automatically enters the Operational mode and the MPC4Mk2 + IOC4Mk2 module's outputs are then updated in accordance with the state of the input signals and the module's configuration – but only after a stabilisation time period.

The total stabilisation time period before a module's outputs are updated after a reset consists of the time spent in the Power-up mode (30 seconds approx.) plus the longest of the time delays configured for the module's sensor / measurement chain OK checks, as follows:

$$T_{Stabilisation} = T_{Power\text{-}up\ mode} + T_{Delay\ (NOK\ to\ OK)}$$

For the MPC4Mk2 + IOC4Mk2 module, the input for each channel has an associated Sensor OK check that is used to verify if the sensor / measurement chain is connected and operating normally.

The Sensor OK check has a configurable time delay (Delay (NOK to OK)) that allows an input to stabilise before the module will recognise it as valid.

NOTE: For a VibroSight / VM600Mk2 MPC4Mk2 + IOC4Mk2 system, the Sensor OK check uses a default time delay (Delay (NOK to OK)) value of 10 seconds.
The time delay can be configured to any value between 0 and 60 seconds.

For example, for a VibroSight / VM600Mk2 MPC4Mk2 + IOC4Mk2 system using all default time delay values:

$$T_{Stabilisation} = T_{Power\text{-}up\ mode} + T_{Delay\ (NOK\ to\ OK)}$$

$$T_{Stabilisation} = 30\ s\ (approx.) + 10s = 40\ s\ (approx.)$$

Following a reset (reboot), after 40 s, the MPC4Mk2 + IOC4Mk2 module will update its outputs.

For example, for a VibroSight / VM600Mk2 MPC4Mk2 + IOC4Mk2 system using one time delay value of 60 seconds:

$$T_{Stabilisation} = T_{Power\text{-}up\ mode} + T_{Delay\ (NOK\ to\ OK)}$$

$$T_{Stabilisation} = 30\ s\ (approx.) + 60s = 90\ s\ (approx.)$$

Following a reset (reboot), after 90 s, the MPC4Mk2 + IOC4Mk2 module will update its outputs.

NOTE: For a VibroSight / VM600Mk2 MPC4Mk2 + IOC4Mk2 system, 90 seconds is the longest possible total stabilisation time period before a module's outputs are updated due to the Sensor OK check time delay limit of 60 seconds (max.).

4.7 MPC4Mk2 + IOC4Mk2 module data update rates

During normal operation, the VM600Mk2 MPC4Mk2 + IOC4Mk2 module updates its outputs at the following data update rates:

- 20 ms (min.) for time-domain processing
- 100 ms (min.) for frequency-domain processing.

NOTE: During normal operation, MPC4Mk2 + IOC4Mk2 and RLC16Mk2 relays are also updated every 20 ms.

Please note that the data update rates given above are the MPC4Mk2 + IOC4Mk2 module's internal data update rates, while the data update rates used by the VibroSight software are different.

For example, VibroSight Capture has a default condition monitoring update rate of 1 s (configurable from 100 ms) while the logging rates for data logging rules are also configured independently (configurable from 100 ms), and VibroSight Vision has a separate interval (data update rate) for the display of live data.

5 CPUM^{Mk2} + IOCN^{Mk2} RACK CONTROLLER AND COMMUNICATIONS INTERFACE MODULE

This chapter provides information on the VM600^{Mk2} CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module.

NOTE: Refer to the *VM600^{Mk2} CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module data sheet* for detailed information on the key features and benefits, and specifications for this module.

This includes an introduction to VM600^{Mk2} rack (CPUM^{Mk2}) security, the CPUM^{Mk2} alarm reset, fieldbus configuration, and the firmware that runs on the module.

NOTE: The CPUM^{Mk2} is not compatible with the MPC4/IOC4T and AMC8/IOC8T (that is, first-generation VM600 cards/systems).

5.1 VM600^{Mk2} CPUM^{Mk2} + IOCN^{Mk2} rack control and communications interfacing

The VM600^{Mk2} CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module consists of central processing unit (CPU) and input/output (interface) modules that act as a system controller and data communications gateway for VM600^{Mk2} systems.

5.2 VM600^{Mk2} rack (CPUM^{Mk2}) security

The VibroSight® software implements a system of user levels (with different user access rights (privileges)) to control and limit the functionality of the software/system available to different users. There are three levels of user: Read, Master and Admin with password protection.

In addition to the VibroSight® software's system of user levels, a VM600^{Mk2}/VM600 rack containing a CPUM^{Mk2} module can implement additional rack security features in order to limit the functionality of the system (MPS) that are available via the CPUM^{Mk2} to Ethernet-based connections, such as the VibroSight software and/or Modbus connections.

More specifically, when VM600^{Mk2} rack (CPUM^{Mk2}) security is enabled, the module will prevent (block) the following system operations:

- Fieldbus configuration files being uploaded.
- XMC16 configuration files being uploaded.
- Modbus commands such as alarm bypass, alarm reset, trip multiply and sensor bypass (channel inhibit).

The security key lock on the front panel of the CPUM^{Mk2} module is used to enable or disable a VM600^{Mk2} rack (CPUM^{Mk2}) security as follows:

- When the key-operated switch turned to the left, security is disabled.
  With security disabled, access to the system is open. This setting is required for system development activities such as the uploading of configurations.
- When the key-operated switch turned to the right, security is enabled.
  With security enabled, access to the system is restricted. This setting is recommended for normal system operation, that is, the monitoring and protection of machinery.

See also 2.5.2 CPUM^{Mk2} module buttons.

5.3 CPUM^{Mk2} alarm reset

A VM600^{Mk2}/VM600 rack containing a CPUM^{Mk2} module can activate a rack-wide VM600^{Mk2} MPS alarm reset signal that clears the alarms for all of the other VM600^{Mk2} MPS processing modules in the same rack (such as the MPC4^{Mk2}).

More specifically, pressing the ALARM RESET button on the front panel of the CPUM^{Mk2} module causes the CPUM^{Mk2} module to send an alarm reset messages to all VM600^{Mk2} modules in the rack via the rack's VME bus. This resets (clears) the latched alarms and associated relays for the MPC4^{Mk2} modules in the rack (that is, MPC4^{Mk2} + IOC4^{Mk2} modules, and associated RLC16^{Mk2} modules).

The CPUM^{Mk2} alarm reset is effectively the rack-wide equivalent of activating the alarm reset (AR) signal of the discrete signal interface (DSI) input to each individual CPUM^{Mk2} module.

NOTE: Alarm reset functionality is used to reset (clear) MPC4^{Mk2} module alarms that are configured as "latched". When an alarm configured as latched is generated, it stays in the alarm condition when the signal level goes below the alarm threshold and remains latched until an alarm reset is activated.

See also 2.5.2 CPUM^{Mk2} module buttons.

5.4 CPUM^{Mk2} fieldbus configuration

As the communications interface for a VM600^{Mk2} rack/system, the CPUM^{Mk2} + IOCN^{Mk2} module can communicate with the other VM600^{Mk2} MPS processing modules in the same rack (such as the MPC4^{Mk2}) via the rack's VME bus in order to obtain measurement data values and/or status information that can be shared with third-party systems such as a DCS or PLC via the fieldbus interfaces on the IOCN^{Mk2} input/output module (rear of rack).

In general, the data shared via fieldbus can be "raw" measurement data and/or status information obtained from MPC4^{Mk2} modules, status information obtained from the CPUM^{Mk2} module itself, and/or further processed data. For example, the processing supported includes

basic mathematical functions such as arithmetic and logical operations, and many other supporting functions.

In addition to exporting information, the CPUM^{Mk2} + IOCN^{Mk2} module's fieldbus interfaces also allow commands to be sent to a VM600^{Mk2} rack/system, for example, commands via Modbus such as alarm bypass, alarm reset, trip multiply and sensor bypass (channel inhibit) for the VM600^{Mk2} modules in the rack.

In order to act as a communications interface, the CPUM^{Mk2} + IOCN^{Mk2} module must first be configured as required by the application. This is done by uploading a fieldbus configuration file to the CPUM^{Mk2} module using VibroSight Protect (see 5.4.1 Fieldbus configuration files and 3.4.4 Uploading a fieldbus configuration file to a CPUM^{Mk2} module in a VM600^{Mk2}/VM600 rack using VibroSight Protect).

It is important to note that a fieldbus configuration file must be uploaded to a CPUM^{Mk2} module in order for a VM600^{Mk2} MPS system containing the CPUM^{Mk2} + IOCN^{Mk2} module to be configured.

NOTE: A VibroSight / VM600^{Mk2} MPS must be configured as a whole, that is, the VibroSight Protect software requires concurrent access to all modules in the VM600^{Mk2}/VM600 rack in order to configure the system.

NOTE: For a VibroSight / VM600^{Mk2} MPS containing a CPUM^{Mk2} + IOCN^{Mk2} module, a fieldbus configuration file must have been uploaded to the CPUM^{Mk2} module in order to configure the system.

NOTE: Even if the communications interface functionality is not required by the application, a "dummy" fieldbus configuration file (consisting of the initial header section) is still required (see B.8 Dummy fieldbus configuration file).

5.4.1 Fieldbus configuration files

VM600^{Mk2} CPUM^{Mk2} fieldbus configuration files are external files that are currently generated and edited manually using an external text editor. In this sense, CPUM^{Mk2} fieldbus configuration files (`*.cfg`) are similar to the CPUx Modbus configuration files (`modbusDefault.cfg`) used by first-generation VM600 cards/systems. Contact Meggitt SA for further information.

In the future, VibroSight Protect will incorporate this functionality, allowing fieldbus configuration files to be generated and edited without the use of external tools.

5.4.1.1 Modbus fieldbus configuration files

See Appendix B: Modbus fieldbus.

5.4.1.2 PROFIBUS fieldbus configuration files

See Appendix C: PROFIBUS fieldbus.

5.5 CPUM^Mk2 module firmware

The CPUM^Mk2 module runs firmware which can be upgraded or otherwise changed by the end-user/operator as required.

The CPUM^Mk2 module runs the firmware shown in Table 5-1.

Table 5-1: CPUM^Mk2 module firmware

CPUM^Mk2 module firmware	Description
`base-system-640-034-001-000.tgz`	The firmware used by the CPUM^Mk2 module

Notes

The CPUM^Mk2 module firmware is identified by its part number (PNR) as follows:
• `base-system-640-034-001-vvv.tgz`
((file name `base-system-640-034-001-vvv` and file name extension `.tgz`).

In a CPUM^Mk2 module firmware part number (PNR):
• `vvv` represents the version number of the firmware.

CPUM^Mk2 module firmware is packaged and distributed as a `.tgz` file (a compressed archive file format) with a PNR such as `base-system-640-034-001-vvv`. In such a PNR, the `xxx-xxx-001-xxx` denotes the firmware is packaged in the tgz file format.

For a CPUM^Mk2 module delivered as part of a VM600^Mk2 solution, the CPUM^Mk2 module normally comes with the latest version of module firmware.

For a MPC4^Mk2 module delivered as a spare part, the MPC4^Mk2 module normally runs a recent version of firmware, which allows the latest firmware to be changed/uploaded as required.

See also 2.5.3 CPUM^Mk2 module factory assigned defaults.

VibroSight System Manager can be used to display the firmware available on a CPUM^Mk2 module and to change/upgrade the module firmware, as required (3.3.10 Checking and/or changing the firmware for a CPUM^Mk2 module).

6 END-OF-LIFE PRODUCT DISPOSAL

A VM600^{Mk2} machinery monitoring system is an electrical/electronic product, therefore, it must be disposed of in a acceptable manner at the end of its useful life. This is important in order to reduce pollution and improve resource efficiency.

NOTE: For environmental and economic reasons, end-of-life electrical and electronic equipment must be collected and treated separately from other waste: it must not go into landfill (or tip, dump, rubbish dump, garbage dump or dumping ground).

In Europe (the European Union), end-of-life electrical/electronic products are classed as waste electrical and electronic equipment (WEEE), and are subject to the requirements of the European Union (EU) directive 2012/19/EU on waste electrical and electronic equipment (commonly referred to as the WEEE directive).

According to the WEEE regulations, all waste electrical and electronic equipment should be collected separately and then treated and disposed of in accordance with the best available and environmentally friendly techniques. This is because electronic waste (or e-waste) may contain substances harmful to the environment and/or to human health. In addition, electronic waste is also a valuable source of raw materials that can contribute to a circular economy.

The WEEE symbol (a “crossed-out wheeled bin”) is used on product labelling to indicate equipment that must be properly treated and disposed of at the end of its life (see Figure 6-1).

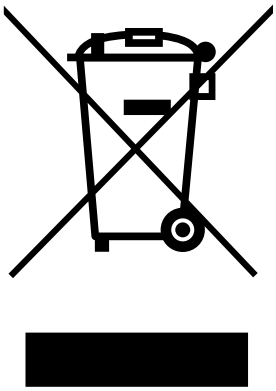


Figure 6-1: WEEE symbol

Although a number of non-EU countries have enacted WEEE regulations, different end-of-life product disposal laws and regulations apply in other countries and regions of the world. Accordingly, please consult your local authorities to obtain the information and guidance relevant to your country and region.

NOTE: At the end of its useful life, electrical/electronic products must be disposed of in an environmentally friendly manner.
In European Union Member States, the WEEE directive is applicable.
In other countries and regions of the world, different laws and regulations may be applicable, so please consult your local authorities.

For additional end-of-life product disposal information and guidance, contact your local Meggitt representative. Alternatively, contact our main office:

Environment, health and safety department
Meggitt SA
Route de Moncor 4
Case postale
1701 Fribourg
Switzerland

Telephone: +41 26 407 11 11
Email: ehs@ch.meggitt.com
Website: www.meggittsensing.com/energy

7 SERVICE AND SUPPORT

7.1 Contacting us

Meggitt's worldwide customer support network offers a range of support, including 7.2 Technical support and 7.3 Sales and repairs support. For customer support, contact your local Meggitt representative. Alternatively, contact our main office:

Customer support department
Meggitt SA
Route de Moncor 4
Case postale
1701 Fribourg
Switzerland

Telephone: +41 26 407 11 11
Email: energysupport@ch.meggitt.com
Website: www.meggittsensing.com/energy

7.2 Technical support

Meggitt's technical support team provide both pre-sales and post-sales technical support, including:

- General advice
- Technical advice
- Troubleshooting
- Site visits.

NOTE: Contact your local Meggitt representative or Meggitt SA for further information (see 7.1 Contacting us).

7.3 Sales and repairs support

Meggitt's sales team provide both pre-sales and post-sales support, including advice on:

- New products
- Spare parts
- Repairs.

NOTE: If a product has to be returned for repairs, then it should be accompanied by a completed Energy product return form. See 7.4 Repairs and returns.

7.4 Repairs and returns

If a Meggitt vibro-meter® Energy product needs to be returned to Meggitt Switzerland, please use the online Energy product return procedure on the Meggitt vibro-meter® Energy website at: www.meggittsensing.com/energy/service-and-support/repair

NOTE: For further information, refer to a *VM600 machinery protection system (MPS) hardware manual* or contact us (see 7.1 Contacting us).

7.5 End-of-life product disposal

VM600^{Mk2}/VM600 machinery protection system (MPS) hardware is an electrical/electronic product, therefore, it must be disposed of in a acceptable manner at the end of its useful life. This is important in order to reduce pollution and improve resource efficiency.

NOTE: At the end of its useful life, a VM600^{Mk2}/VM600-rack based monitoring system must be disposed of in an environmentally friendly manner.
In European Union Member States, the WEEE directive is applicable.
In other countries and regions of the world, different laws and regulations may be applicable, so please consult your local authorities.

NOTE: For further information, refer to a *VM600 machinery protection system (MPS) hardware manual* or contact us (see 7.1 Contacting us).

APPENDIX A: DIAGNOSTIC FAULT CODES

This appendix provides information on the diagnostic fault codes displayed by the VibroSight System Manager software for VM600Mk2 machinery protection system (MPS) hardware.

This includes how to access and interpret the diagnostic fault codes.

A.1 Displaying diagnostic fault code information for a VM600Mk2 machinery protection system (MPS)

VibroSight System Manager is used to display information about a VM600Mk2 machinery protection system (MPC4Mk2 + IOC4Mk2 and RLC16Mk2), including the diagnostic fault codes that are generated by the internal diagnostics (built-in self-test (BIST)) running on MPC4Mk2 modules in order to provide continuous feedback on the health of a system.

NOTE: The main window (centre) in VibroSight System Manager displays lots of information for the selected MPC4Mk2 module, such as General information, Time synchronisation, Network, **Diagnostics** and Firmware versions.

1- Start VibroSight System Manager.

2- In the System Explorer window (left), select the Devices view (bottom).

The System Explorer window updates to display all of the VibroSight-compatible devices that System Manager can see on the network.

3- In the System Explorer window, under MPC4 modules, select the MPC4Mk2 module.

In the System Explorer window, VibroSight-compatible devices are listed in a serial number (IP address) format. For example: xxxxxxx (xxx.xxx.xxx.xxx in dot-decimal notation) for a VM600Mk2 module such as a MPC4Mk2.

NOTE: It is recommended that VibroSight-compatible devices such as a MPC4Mk2 module are identified by their serial number (for example, APxxxxx), as an IP address (xxx.xxx.xxx.xxx in dot-decimal notation) can be easily changed.
The product's serial number is assigned in the factory during manufacture and cannot be changed, but the product's IP address (xxx.xxx.xxx.xxx in dot-decimal notation) can be changed to meet the requirements of a network.

The main window (centre) updates to display information for the MPC4Mk2 module, grouped in sections such as General information, Time synchronisation, Network, Diagnostics and Firmware versions.

4- In the main window (centre), under Diagnostics, the Diagnostics entry lists the current diagnostic fault code value for the VM600Mk2 system (MPC4Mk2 + IOC4Mk2 and RLC16Mk2). See A.2 VM600Mk2 system diagnostic fault codes.

For example, during normal operation with no problems detected, the listed value is:

Diagnostics: 0: No Fault

See also 3.1 VibroSight System Manager and 3.3.3 Displaying information about a MPC4Mk2 module.

A.2 VM600Mk2 system diagnostic fault codes

Table A-1 lists the diagnostic fault codes for all Error class 1 fatal-level problems that can be displayed for a VM600Mk2 system.

Table A-1: VM600Mk2 system diagnostic fault codes – Error class 1 fatal-level problems

VM600Mk2 system diagnostic fault codes				
Fault code	**Error class**	**Confirmation**		**Definition**
		Number	**Window**	
Error class 1 – Fatal-level problems				
1	1	1	Infinite	FAULT_POWER_SUPPLY_VREF. V_{REF} power supply failure.
5	1	10	3 s	FAULT_AUX1_DC_COMPONENT_FAIL. DC component failure on auxiliary input channel 1 (AX1).
6	1	10	3 s	FAULT_AUX2_DC_COMPONENT_FAIL. DC component failure on auxiliary input channel 2 (AX2).
31	1	10	3 s	FAULT_DYN1_DC_COMPONENT_FAIL. DC component failure on dynamic input channel 1 (CH1).
32	1	10	3 s	FAULT_DYN2_DC_COMPONENT_FAIL. DC component failure on dynamic input channel 2 (CH2).
33	1	10	3 s	FAULT_DYN3_DC_COMPONENT_FAIL. DC component failure on dynamic input channel 3 (CH3).
34	1	10	3 s	FAULT_DYN4_DC_COMPONENT_FAIL. DC component failure on dynamic input channel 4 (CH4).
45	1	2	1 s	FAULT_ADC_SERIAL_DATA_ERROR. DYN ADC status bits failure.
46	1	1	Infinite	FAULT_LOGIC_SPI_COM_ERROR. Communication error with the IOC4G2 [IOC4Mk2].
50	1	1	Infinite	FAULT_TEMPORAL_MONITORING. CPU load >100% in one cycle.
51	1	10	60 s	FAULT_MEM_USAGE_FAILURE. Memory load >80%.
52	1	1	Infinite	FAULT_IOC_PNR_NOT_COMPATIBLE. IOC4G2 [IOC4Mk2] PNR is not compatible.

Table A-1: VM600Mk2 system diagnostic fault codes – Error class 1 fatal-level problems *(continued)*

VM600Mk2 system diagnostic fault codes				
Fault code	**Error class**	**Confirmation**		**Definition**
		Number	**Window**	
Error class 1 – Fatal-level problems *(continued)*				
54	1	1	Infinite	FAULT_CYCLE_COUNT_NOT_MONOTONIC. Cycle counter of the FPGA not monotonic.
58	1	1	Infinite	FAULT_FW_GENERIC_FAILURE. Generic firmware (FW) failure.
61	1	1	Infinite	FAULT_IOC_CONFIG_FAILURE. IOC4G2 [IOC4Mk2] configuration validity criteria not met.
64	1	1	Infinite	FAULT_MUX_ADC_FAILURE. XADC multiplexer (MUX) incorrect sequence.
65	1	2	40 ms	FAULT_POWER_SUPPLY_P10V. +10 V_{DC} power supply failure.
66	1	2	40 ms	FAULT_POWER_SUPPLY_M10V. −10 V_{DC} power supply failure.
67	1	2	40 ms	FAULT_POWER_SUPPLY_AGND. Analog ground power supply failure.
74	1	1	Infinite	FAULT_IOC_RELAY_STATUS. IOC4G2 [IOC4Mk2] relay status mismatch.
76	1	4	80 ms	FAULT_RLC_GLOBAL_STATUS. RLC16G2 [RLC16Mk2] global status signal not OK (NOK).
83	1	1	Infinite	FAULT_PL_REGISTER_FAILURE. Error in the configuration register of the PL driver.
92	1	1	Infinite	FAULT_VME_CPLD_NOT_SUPPORTED. MPC4G2 [MPC4Mk2] VME CPLD is not supported by the current ESW.

NOTE: An Error class 1 fatal-level problem may not be recoverable, for example, if it is related to a persistent hardware problem (failure). Contact Meggitt SA for further information.

Table A-2 lists the diagnostic fault codes for all Error class 2 error-level problems that can be displayed for a VM600Mk2 system.

Table A-2: VM600Mk2 system diagnostic fault codes – Error class 2 error-level problems

VM600Mk2 system diagnostic fault codes				
Fault code	**Error class**	**Confirmation**		**Definition**
		Number	**Window**	
Error class 2 – Error-level problems				
63	2	1	Infinite	FAULT_SLOT_ID_MISMATCH. VME (rack) slot number (ID) mismatch between the configuration and the detection. (That is, between the value configured for the module in VibroSight Protect and the actual module position as detected in the rack.)
81	2	1	Infinite	FAULT_FRONT_END_READY. IOC4G2 [IOC4Mk2] not ready after a reboot.
87	2	1	Infinite	FAULT_SVP_NOT_CONFIGURED. Protection configuration not present.

Table A-3 lists the diagnostic fault codes for all Error class 3 warning-level problems that can be displayed for a VM600Mk2 system.

Table A-3: VM600Mk2 system diagnostic fault codes – Error class 3 – warning-level problems

VM600Mk2 system diagnostic fault codes				
Fault code	**Error class**	**Confirmation**		**Definition**
		Number	**Window**	
Error class 3 – Warning-level problems				
3	3	3	10 s	FAULT_AUX1_DC_SATURATION. DC is outside of ±20 V *or* ±25 A range on auxiliary input channel 1 (AX1).
4	3	3	10 s	FAULT_AUX2_DC_SATURATION. DC is outside of ±20 V *or* ±25 A range on auxiliary input channel 2 (AX2).
7	3	1	60 s	FAULT_AUX1_TACHO_OVERFLOW. Input FIFO overflow of tacho on auxiliary input channel 1 (AX1).
8	3	1	60 s	FAULT_AUX2_TACHO_OVERFLOW. Input FIFO overflow of tacho on auxiliary input channel 2 (AX2).
35	3	2	1 s	FAULT_DYN1_AC_SATURATION. Dynamic saturation on dynamic input channel 1 (CH1).
36	3	2	1 s	FAULT_DYN2_AC_SATURATION. Dynamic saturation on dynamic input channel 2 (CH2).
37	3	2	1 s	FAULT_DYN3_AC_SATURATION. Dynamic saturation on dynamic input channel 3 (CH3).
38	3	2	1 s	FAULT_DYN4_AC_SATURATION. Dynamic saturation on dynamic input channel 4 (CH4).
39	3	2	10 s	FAULT_DYN1_DC_SATURATION. DC saturation on dynamic input channel 1 (CH1).
40	3	2	10 s	FAULT_DYN2_DC_SATURATION. DC saturation on dynamic input channel 2 (CH2).
41	3	2	10 s	FAULT_DYN3_DC_SATURATION. DC saturation on dynamic input channel 3 (CH3).
42	3	2	10 s	FAULT_DYN4_DC_SATURATION. DC saturation on dynamic input channel 4 (CH4).

Table A-3: VM600Mk2 system diagnostic fault codes – Error class 3 – warning-level problems

VM600Mk2 system diagnostic fault codes				
Fault code	**Error class**	**Confirmation**		**Definition**
		Number	**Window**	
Error class 3 – Warning-level problems *(continued)*				
43	3	10	5 s	FAULT_ETHERNET_ERROR. Ethernet PHY or socket error.
44	3	10	5 s	FAULT_VME_ERROR. VME polling connection / disconnection.
60	3	1	Infinite	FAULT_SVP_CONFIG_FAILURE. Protection configuration (SVP) [MPC4Mk2] validity criteria not met.
77	3	1	Infinite	FAULT_FLASH_MEMORY_FAILURE. Error on the P-NVM (firmware (FW) and users configuration).
78	3	2	1 s	FAULT_MASS_STORAGE_FAILURE. Error on the MS-NVM (mass storage).
79	3	1	Infinite	FAULT_NVM_FAILURE. Error on the RT-NVM (user and system settings).
88	3	1	Infinite	FAULT_UNEXPECTED_RESET. Unexpected reset detected.
90	3	1	Infinite	FAULT_CONFIGURED_WITHOUT_VS_CONFIG. The MPC4G2 [MPC4Mk2] is using a IOC4G2 [IOC4Mk2] backup configuration. Data accesses from the VibroSight software will not work.
91	3	1	Infinite	FAULT_IOC4G2_CONFIGURED. The IOC4G2 [IOC4Mk2] backup configuration has been updated after a reboot because it was obsolete (for example, due to a module swap) or different from the MPC4G2 [MPC4Mk2] configuration.

In Table A-1, Table A-2 and Table A-3:

The **Fault code** is used to uniquely identify a problem (error/failure), as reported by the VibroSight System Manager software (see A.1 Displaying diagnostic fault code information for a VM600Mk2 machinery protection system (MPS)).

The **Error class** is used to classify different levels of problem, as follows:

- Error class 1 identifies “fatal-level” problems.
  With a fatal-level problem, the VM600Mk2 system (MPC4Mk2 + IOC4Mk2 and RLC16Mk2) will enter the Fail-safe mode.
  The VM600Mk2 system cannot leave the Fail-safe mode until the problem has been resolved.
- Error class 2 identifies “error-level” problems.
  With an error-level problem, the VM600Mk2 system (MPC4Mk2 + IOC4Mk2 and RLC16Mk2) will enter the Fail-safe mode.
  The system can leave the Fail-safe mode by using RESET to reboot the VM600Mk2 system (MPC4Mk2) to the Operational mode (Unlocked (maintenance operating mode)).
- Error class 3 identifies “warning-level” problems.
  With a warning-level problem, the VM600Mk2 system (MPC4Mk2 + IOC4Mk2 and RLC16Mk2) will continue to operate within the constraints of the problem.
  Warning-level problems are primarily identified for information only and no immediate user action is required.

The **Confirmation Number** and **Window** are the criteria used by the VM600Mk2 system (MPC4Mk2) to detect a problem.

For example, with Number: 1 and Window: Infinite, the problem (fault) is confirmed when the fault is detected by a system once over any time period.

For example, with Number: 3 and Window: 10 s, the problem (fault) is confirmed when the fault is detected by a system three times over any 10 second time period.

The **Definition** provides additional information that describes the problem in order to help resolve the issue.

Key (Table A-1, Table A-2 and Table A-3):

AUX = auxiliary input channel, CPLD = complex programmable logic device,
DYN = dynamic input channel, FPGA = field programmable gate array, FW = firmware,
HW = hardware, MUX = multiplexer, PL = HW Programmable part of a SVP,

PNR = part number, SVP = safety vibration processor (MPC4Mk2), PHY = physical layer,
SW = software, VME = Versa Module Eurocard (a computer bus standard).

MS-NVM = Non-volatile mass storage device, used to store events and the signal processing of historical data for analysis in event of alarm detection. Order of GB (gigabytes).

P-NVM = Non-volatile device used to store FPGA, SW programs (bootloader and applications) and the user application configuration. Order of MB (megabytes).

RT-NVM = Non-volatile ferroelectric device used to store run-time parameters. Order of kB (kilobytes).

A.3 Sensor/measurement chain OK checks

It is important to note that the sensor/measurement chain OK checks implemented by a MPC4^{Mk2} + IOC4^{Mk2} module for the line-fault detection of problems with sensors, cabling and/or signal conditioners are not part of the module's internal diagnostics (built-in self-test (BIST)). Accordingly, the results of any sensor/measurement chain OK checks are not included in the diagnostic fault codes displayed by VibroSight System Manager.

More specifically, a problem with a sensor/measurement chain OK check will not result in any diagnostic fault codes, and will not result in a VM600^{Mk2} system (MPC4^{Mk2} + IOC4^{Mk2} and RLC16^{Mk2}) entering the Fail-safe mode.

NOTE: In a VM600^{Mk2} machinery protection system, the system-wide VM600^{Mk2} MPS safety-line control signal – associated with the Fail-safe mode – automatically drives all system relays (VM600^{Mk2} and RLC16^{Mk2}) and analog outputs (IOC4^{Mk2}) to a safe state should a problem be detected by the internal diagnostics (BIST)

APPENDIX B: MODBUS FIELDBUS

This appendix provides information on Modbus fieldbus operation and configuration for the VM600Mk2 CPUMMk2 + IOCNMk2 rack controller and communications interface module.

This includes an explanation of the parameters and syntax of Modbus fieldbus configuration files.

B.1 VM600Mk2 CPUMMk2 Modbus features

The CPUMMk2 + IOCNMk2 module's support for Modbus is characterised by the following features:

- The CPUMMk2 module acts as a Modbus fieldbus server (slave) device.
- The Modbus server starts automatically when the module starts (boots).
- After starting (booting), the Modbus server reads the Modbus fieldbus configuration from the copy of the configuration stored on the module.
- The Modbus server supports both Modbus RTU and Modbus TCP:
  - Modbus RTU, that is, serial-based Modbus communications, will be available via J1 (FIELDBUS1) and J4 (FIELDBUS2) on the IOCNMk2 input/output module in the future.

NOTE: It is important to note that the CPUMMk2 + IOCNMk2 module does not currently support Modbus RTU.

  - Modbus TCP, that is, Ethernet-based Modbus communications, will be available via J2 (FIELDBUS1) and J5 (FIELDBUS2) on the IOCNMk2 input/output module in the future.

NOTE: It is important to note that the CPUMMk2 + IOCNMk2 module currently supports Modbus TCP via its system Ethernet interfaces (ports) – not via its fieldbus interfaces (ports).

- The Modbus server is always ready to receive a new configuration (uploaded via the fieldbus configuration file (`*.cfg`) using VibroSight Protect).
- During activation of a VM600Mk2 MPS configuration using VibroSight Protect, the Modbus fieldbus configuration is automatically parsed and checked for errors, with configuration errors reported via VibroSight Protect.
- If a Modbus client (master) device attempts to use a Modbus function code that is not supported by the module's Modbus server (slave), then an exception response is generated (exception code 01: illegal function).
- If a Modbus client (master) device attempts to read values (coils/bits using Modbus function code 01/02 or registers using Modbus function code 03/04) that are not available from the module's Modbus server (slave), that is, not defined in the Modbus configuration, an exception response is generated (exception code 02: illegal data address).

- Similarly, if a Modbus client (master) device attempts to write values (coils/bits using Modbus function code 05 or registers using Modbus function code 16) that are not available from the module's Modbus server (slave), that is, not defined in the Modbus configuration, then an exception response is generated (exception code 02: illegal data address).
- The Modbus server can scale measurement data values, if configured as scaled in the VM600Mk2 MPS configuration. More specifically, data values can be scaled and converted to the 16-bit unsigned short integer (U) data type. See B.6.4.2 Modbus addressing and data types.
- The Modbus server can provide alarm values, if configured in the VM600Mk2 MPS configuration. More specifically, alarm threshold values (Danger+, Alert+, Alert− and Danger−) are available in a 32-bit floating point (F) data type. See B.6.4.2 Modbus addressing and data types.
- The Modbus server can logically combine bit values using logical bit operations: AND, OR, NOT and XOR.
- The Modbus server can logically pack and unpack bit values to and from the 16-bit unsigned short integer (U) data type using special operations: PACK and UNPACK.

For further information on the functions/operations available, see B.6.4 [MAPPING] section – general, B.6.5 [MAPPING] section – CPUMMk2 module specific and B.6.6 [MAPPING] section – MPC4Mk2 module specific.

B.1.1 Modbus performance

The CPUMMk2 + IOCNMk2 module's support for Modbus is characterised by the following performance level:

- >1000 16-bit value requests per second.

B.2 Modbus function codes

Modbus is a client-server (master-slave) protocol based on transactions which consist of (1) a request issued by the client and (2) a response issued by the server. These transactions use different Modbus function codes to access different types of data.

The CPUM^{Mk2} module's Modbus server supports the Modbus function codes listed in Table B-1.

Table B-1: Modbus function codes supported by the CPUM^{Mk2} module's Modbus server

CPUM^{Mk2} module Modbus function codes			
Function code		**Function**	**Definition**
Dec.	**Hex.**		
01	0x01	Read coils	Read coils is used to read from 1 to 2000 contiguous bits (coils) of a remote device (Modbus server). This function is typically used to read VM600^{Mk2} module status information such as alarm or status bits.
02	0x02	Read discrete inputs	Read discrete inputs is used to read from 1 to 2000 contiguous bits (discrete inputs) of a remote device (Modbus server). This function is typically used to read VM600^{Mk2} module status information such as alarm or status bits.
03	0x03	Read holding registers	Read holding registers is used to read from 1 to 125 contiguous 2-byte values (holding registers) in a remote device (Modbus server). This function is typically used to read VM600^{Mk2} module measurement data such as vibration, combustion or other process levels.
04	0x04	Read input registers	Reading input registers is used to read from 1 to 125 contiguous 2-byte values (input registers) in a remote device (Modbus server). This function is typically used to read VM600^{Mk2} module measurement data such as vibration, combustion or other process levels.
05	0x05	Write single coil	Write single coil is used to write a single bit (coil) to a remote device (Modbus server). This function is typically used to reset (clear) latched alarm or status information.

Table B-1: Modbus function codes supported by the CPUM^{Mk2} module's Modbus server *(continued)*

CPUM^{Mk2} module Modbus function codes			
Function code		**Function**	**Definition**
Dec.	**Hex.**		
06	0x06	Write single register	Write single register is used to write a 2-byte value (holding register) to a remote device (Modbus server). This function is typically used to set VM600^{Mk2} module configuration parameters.
15	0x0F	Write multiple coils	Write multiple coils is used to write from 1 to 2000 contiguous bits (multiple coils) to a remote device (Modbus server). A logical '1' in a bit position of the field requests the corresponding output to be ON; a logical '0' requests it to be OFF.
16	0x10	Write multiple registers	Writing multiple registers is used to write from 1 to 125 contiguous 2-byte values (multiple registers) to a remote device (Modbus server). This function is typically used to set VM600^{Mk2} module configuration parameters.

Notes

If a Modbus client (master) device attempts to use a Modbus function code that is not supported by the CPUM^{Mk2} module's Modbus server (slave), then an exception response is generated (exception code 01: illegal function).

If a Modbus client (master) device attempts to read values (bits/coils using Modbus function code 01/02 or registers using Modbus function code 03/04) that are not available from the module's Modbus server (slave), that is, not defined in the Modbus configuration, an exception response is generated (exception code 02: illegal data address).

Similarly, if a Modbus client (master) device attempts to write values (bits/coils using Modbus function code 05 or registers using Modbus function code 16) that are not available from the module's Modbus server (slave), that is, not defined in the Modbus configuration, then an exception response is generated (exception code 02: illegal data address).

B.3 Modbus address spaces

Modbus uses different address spaces to separate the different types of data, which are then accessed using different Modbus function codes.

For example:

In order to use a bit as read/write, the Modbus address space 5 is used because it defines a bit that can be read with Modbus function code 01 and written with Modbus function codes 05 and 15 (0x0F).

In order to define a register as read/write, the Modbus address space 6 is used because it defines a bit that can be read with Modbus function code 03 and written with Modbus function codes 06 and 16 (0x10).

NOTE: If a bit (coil) or a register is defined as writeable, it must have one and only one definition within Modbus address space 5 or 6. If it is defined a second time within Modbus space address 1 or 3, it will result in a parsing error (see B.7 Fieldbus configuration file parsing).

The CPUM^{Mk2} module's Modbus server supports the four separate address spaces listed in Table B-2.

Table B-2: Modbus address spaces codes supported by the CPUM^{Mk2} module's Modbus server

CPUM^{Mk2} module Modbus address spaces		
Address space	**Alias**	**Definition (access permissions)**
1 (5)	Coils	Address space for bits (coils). Readable using function code 01. Can also be writeable using function code 05, if address space is defined as 05.
2	Discrete inputs	Address space for discrete inputs. Readable using function code 02.
3 (6)	Holding/single registers	Address space for holding registers / single registers. Readable using function code 03. Can also be writeable using function code 06, if address space is defined as 06.
4	Input registers	Address space for Input registers. Readable using function code 04.
Notes …		

B.4 Modbus RTU communications

NOTE: The CPUM^{Mk2} + IOCN^{Mk2} module does not currently support Modbus RTU.

B.5 Modbus TCP communications

The CPUM^{Mk2} module's implementation of the Modbus TCP protocol is characterised by the following by the following:

- TCP/IP with no CRC.
- Special MBAP (Modbus application protocol) header.
- A request identifier is added.
- All requests are sent via TCP on a registered port.

NOTE: CRC (or LRC) check fields are not needed in Modbus TCP as TCP/IP already has built-in checksum mechanisms. (That is, there is no need for a second check.)

The CPUM^{Mk2} module's factory assigned defaults for Modbus TCP communications are:

- Port: 502

Modbus TCP communication parameters are defined in the [TCP] section of a Modbus fieldbus configuration file. See B.6.2 [TCP] section.

B.6 Modbus fieldbus configuration file

A fieldbus configuration file (`*.cfg`) for Modbus applications consists of the following main sections:

- [RTU] section
- [TCP] section
- [GLOBAL] section
- [MAPPING] section.

NOTE: In a CPUM^{Mk2} fieldbus configuration file (`*.cfg`), comments start with two forward slashes (`//`).

B.6.1 [RTU] section

NOTE: The CPUM^{Mk2} + IOCN^{Mk2} module does not currently support Modbus RTU.

The RTU section can have one or more sections called [RTU1], [RTU2], [RTU3].

The [RTUx] section has the following settings:

ENABLE = NO

B.6.2 [TCP] section

The [TCP] section has the following settings:

ENABLE = YES/NO (default NO)

PORT = 0-65535 (default 502)

B.6.3 [GLOBAL] section

The [GLOBAL] section has the following settings:

DEFAULT_FLOAT_ORDER = FL/FB/FM1/FM2 (default FM1)

Where …

FB: 32-bit float ordered as “big endian” order ABCD

FL: 32-bit float ordered as “little endian” order DCBA

FM1: 32-bit float ordered as “mixed endian 1” order CDAB

FM2: 32-bit float ordered as “mixed endian 2” order BADC

This line defines the byte ordering of the float (F) data type used, that is, the 32-bit floating-point data type (see B.6.4.2 Modbus addressing and data types).

If the section is missing, the F will have the default order type FM1. Order type FM1 is the most popular one on the market.

DEFAULT_LONG_ORDER = LL/LB/LM1/LM2 (default LB)

Where …
LB: 32-bit long integer ordered as “big endian” order ABCD
LL: 32-bit long integer ordered as “little endian” order DCBA
LM1: 32-bit long integer ordered as “mixed endian 1” order CDAB
LM2: 32-bit long integer ordered as “mixed endian 2” order BADC

This line defines the byte ordering of the long integer (L) data type used, that is, the 32-bit (signed) long integer data type (see B.6.4.2 Modbus addressing and data types).

If the section is missing, the L will have the default order type LB. Order type LB indicates big-endian ordering for the bytes comprising a 32-bit long integer.

Note: 32-bit values are not part of the original Modbus specification. However, extensions have been implemented which allow 32-bit values to be retrieved via Modbus by using two consecutive registers. The byte ordering of data contained in the two consecutive registers was not standardised. Due to this, the user must be able to describe the ordering they prefer. Accordingly, the user has the ability to allow 32-bit floating-point values to be retrieved in different formats.

B.6.4 [MAPPING] section – general

B.6.4.1 Mapping syntax

In general, the [Mappings] section has the following syntax:

Address:Function[:Type[:Min:Max]] = SlotNr:CardType:ValueName

The section :Min:Max is optional and is only required to be used when working with scaled values.

ValueName is module (card) dependent. For further information, see B.6.6 [MAPPING] section – MPC4^{Mk2} module specific.

B.6.4.2 Modbus addressing and data types

Address range: 0 to 65535

Modbus function code range: 1 to 5, 15 and 16 (0x01 to 0x05, 0x0F and 0x10 in hex.)

Data type can be one of the following:

F: 32-bit float ordered as defined by DEFAULT_FLOAT_ORDER*
FB: 32-bit float ordered as “big endian” order ABCD
FL: 32-bit float ordered as “little endian” order DCBA
FM1: 32-bit float ordered as “mixed endian 1” order CDAB
FM2: 32-bit float ordered as “mixed endian 2” order BADC
L: 32-bit long integer ordered as defined by DEFAULT_LONG_ORDER*
LB: 32-bit long integer ordered as “big endian” order ABCD
LL: 32-bit long integer ordered as “little endian” order DCBA
LM1: 32-bit long integer ordered as “mixed endian 1” order CDAB
LM2: 32-bit long integer ordered as “mixed endian 2” order BADC
U: 16-bit unsigned short integer (0000h to FFFFh)
B: 1-bit

* The DEFAULT_FLOAT_ORDER and DEFAULT_LONG_ORDER are defined in the [GLOBAL] section (see B.6.3 [GLOBAL] section).

B.6.4.3 Module type and rack slot number

CardType can be one of the following:

MPC4G2: For VM600^{Mk2} MPC4^{Mk2} modules.

XMC16: For VM600^{Mk2}/VM600 XMC16/XMV16 modules (cards).

SlotNr range depends on the VM600^{Mk2}/VM600 rack used (system rack (6U – ABE04x) or slimline rack (1U – ABE056)).

For example, for a VM600^{Mk2}/VM600 system rack, the permitted slots for MPC4^{Mk2} modules are 03 to 14 (“Slot3” to “Slot14”).

B.6.4.4 Scaling

NOTE: For every scaled value, the minimum and maximum value is readable by Modbus in the floating-point format.

It is possible to scale values to the unsigned short integer (U) data type. Setting of scaling is possible using the syntax described in B.6.4.1 Mapping syntax. The minimum and maximum values (section :Min:Max) are fully independent from other minimum or maximum values used by a VM600^{Mk2}/VM600 system.

Min is the minimum value corresponding to 0000h in the Modbus register and Max the maximum corresponding to FFFFh in the Modbus register. Values outside the Min:Max range are clipped to 0000h and FFFFh respectively.

B.6.4.5 Reading minimum/maximum values

Address:Function = MIN:Address:Function

or

Address:Function = MAX:Address:Function

Reading of the minimum/maximum is only possible using the float (F) data type.

For example:

30003:4:U:−50.50:250.0 = Slot8:XMC16:DYN1:OUT1:V

30004:4:F = MAX:30003:4

30006:4:F = MIN:30003:4

Explanation of first line:

30003	**4**	**U**	**−50.50**	**250.0**	**=**	**Slot8**	**XMC16**	**DYN1**	**OUT1**	**V**
Modbus address	Modbus function code	Data type	Minimum value	Maximum value		Rack slot	Module (card)	Processing block	Output	Data value

For the XMC16 card located in rack slot 08, read the processing block 1 output 1 vibration value. The value is accessed/available by querying Modbus address 30003 as an unsigned short integer (**U**), using Modbus function code 04 (**4**).

The value is scaled from its real value in the range −50.50 to 250.00 to the unsigned short integer (U) value. More specifically, the value −50.50 is encoded as 0000h and value 250 is encoded as FFFFh on/in the Modbus side/register (values smaller than −50.50 are clipped to 0000h and values greater than 250 are clipped to FFFFh). Note: The minimum and maximum values used cannot be the same.

Explanation of second line:

30004	4	F	=	MAX	30003	4
Modbus address	Modbus function code	Data type		Data value	Modbus address	Modbus function code

Read the maximum Modbus scaling value. The value is encoded as a float (F) and so occupies two 16-bit addresses. The value is available using Modbus function code 04 (**4**) at the Modbus addresses 30004 and 30005.

Explanation of third line:

30006	4	F	=	MIN	30003	4
Modbus address	Modbus function code	Data type		Data value	Modbus address	Modbus function code

Read the minimum Modbus scaling value. The value is encoded as a float (F) and so occupies two 16-bit addresses. The value is available using Modbus function code 04 (**4**) at the Modbus addresses 30006 and 30007.

B.6.4.6 Bit variables

It is possible to define bit variables of the 1-bit (B) data type that can contain only Boolean values.

User defined bit variable names can consist of the letters a-Z, the digits 0-9 and the underscore character (_). No other special characters are allowed.

Every variable must have the $ prefix.

Variables cannot begin with a digit.

The maximum name length is 40 characters.

Variable names are case-insensitive (that is, bit variable names are not case sensitive).

Examples of valid variable names:

$abcd102

$Vibration_channel_2

$Easy

$OK_SOK_VALUE234

Examples of invalid variable names:

$Channel1?!!!

$Channel 0

B.6.4.7 Constant values

It is possible to set addresses or bit variables to constant values. Constants may be set for all data types (F, L, U and B).

Examples of valid uses of constants:

30004:1:B = 1

30004:4:U = 1234

30005:4:F = 10.0

30007:4:L = 12345678

$Variable = 0

Notes: Values for the 1-bit (B) data type or bit variables can be 0 or 1. Values for the 16-bit unsigned short integer (U) data type can range between 0 and 65535. Values for the 32-bit float (F) data type may be a floating point number value.

B.6.4.8 Assignments

It is possible to assign a bit/register/variable to another bit/register/variable.

Examples:

00001:5:B = 1

00002:1:B = 1

$VARIABLE = 00002:1

00003:1:B = 00001:1

00004:1:B = $VARIABLE

$Value = SlotNr:CardType:ValueName

$Value2 = $Value

In case of a type mismatch, certain type conversions are automatically implemented, as follows:

Bit/variable to short (0 or 1)

Bit/variable to float (0.0 or 1.0)

Short to bit/variable (false if 0, true otherwise)

Short to float (0.0 to 65535.0)

Float to bit/variable (false if <0.5, true otherwise)

Float to short (rounded to the nearest integer and then clipped to the range 0-65535)

It is important to note that it is not possible to assign two parts of a float (F) data type to the unsigned short integer (U) data type. For example, the following will not work:

10006:6:F = 65535.0

21018:3:U = 10006:3

21019:3:U = 10007:3

When using a register as a source, it has the syntax Address:Function, so the Modbus function code should be a read one (1, 2, 3, 4), while the destination register's function should be a read variable (1, 2, 3, 4). Writing to the copy register will have no effect and is not allowed.

Note: It is not recommended to combine assignments and scaling!

If the right-hand side of a register was previously defined with scaling, the value assignment will not take that into account and the original (not the scaled value) will be used. For example:

00001:3:U:−50.50:250.0 = Slot8:XMC16:DYN1:OUT1:V // Has value −1.2345

00002:3:F = 00001:3:U // Will be −1.2345

B.6.4.9 Bit operations

One line can have only one operator. For example:

$a = AND($b,$c,$d)

$a = AND($b, 00001, 1, 00002, 2)

$o = OR($o1,$o2,$o3,$o4,$o5,$o6,$o7,$o8,$o9,$o10)

$x = NOT($z)

$f = AND(SELF, $a)

00005:1:B = AND(SELF, $a)

For the AND, OR and XOR operations, 1 to 16 arguments are allowed.

For the NOT operation, only one argument is allowed.

A comma must be used as a separator between the variables.

A variable or a list of variables should be in brackets.

Each bit variable operand can be replaced by a coil or a discrete register (data type B) which is defined as a comma separated pair of value register, function.

The special operand SELF represents the state of the previous evaluation of this operator. The default SELF value after configuration is 1 for the AND operator and 0 otherwise. It is possible to set/clear the SELF operand by writing to the output register of the bit operation. The purpose of this operand is to allow the construction of latch functionality. Basically, NOT(SELF) creates a bit that toggles each time it is accessed.

Bit operation equations are evaluated from top to bottom.

Recursive definitions are not supported.

It is important to note that the XOR function has been implemented in order to return 1 only if one of its inputs is true. For example, XOR($one, $zero, $one, $one) will return 0).

B.6.4.10 Special function for data packing

This function is used for the data packing of bits into a 16-bit unsigned short integer (U).

Address:Function:U = PACK($a,$b,$c,$d,$e,$f,$g,$h,$i,$j,$k,$l,$m,$n,$o,$p)

(LSB) … (MSB)

Address:Function:U = PACK(0,$a,$b,$c,1,0,0,$d,0,0,0,0,0,0,0,0)

Constants 0 and 1 are allowed.

A comma must be used as a separator between the variables.

A list of variables should be in brackets.

If some operands are missing, a default value of 0 will be used, corresponding to the MSBs.

At least one argument should be present.

For this operation, the valid Modbus function codes are 3 or 4.

B.6.4.11 Special function for data unpacking

This function is used for the data unpacking of bits from a 16-bit unsigned short integer (U).

Address:Function:B = UNPACK(address, function, index)

or

$bitvariable = UNPACK(address, function, index)

Where …

Address: Register in the specified Modbus address space.

Function: Modbus function codes 1 or 2.

Index: Bit position in the unsigned short integer (U). Index should be between 1 and 16, where 1 corresponds to the LSB and 16 corresponds to the MSB.

The result of an unpack operation can be assigned to a bit variable.

B.6.4.12 Minimum/maximum operations

This function allows the minimum or maximum in a range of register values to be obtained.

Address:Function:DataType = MIN(firstRegister, lastRegister)

and

Address:Function:DataType = MAX(firstRegister, lastRegister)

The register type is not restricted, but all the registers must be defined with the same type as the left-hand (result) register.

The lastRegister must be bigger (higher) than the firstRegister.

The range must be consecutive, without gaps. All registers in the range given by firstRegister to lastRegister must be defined before the operator.

The Modbus address space of the range is defined by the result address space.

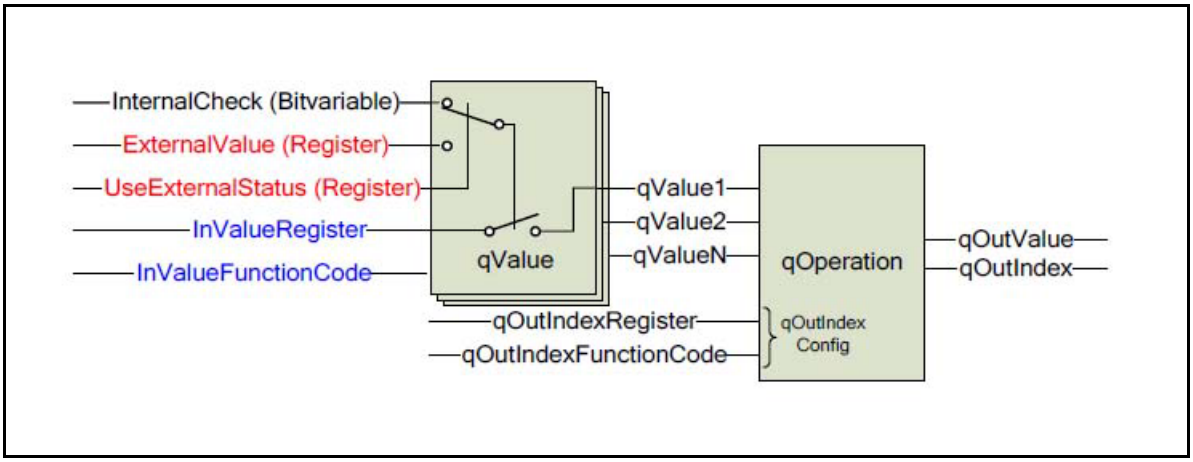
Recursive definitions are not supported.

See also B.6.4.13 Quality operations on a register.

B.6.4.13 Quality operations on a register

It is possible to obtain the minimum or maximum in a range of register values using the minimum/maximum operations (see B.6.4.12 Minimum/maximum operations).

However, the goal of the quality operations on a register is to further include/exclude some values from operations depending on their status, quality or an external command received from a Modbus client (master). This works in accordance with the model illustrated below:



The quality operations (qOperation) QMIN and QMAX give a quality minimum or a quality maximum value respectively, along with its index. The result value is stored as the regular function's output while the corresponding index is stored in the qOutIndex register defined by "qOutIndexRegister" and "qOutIndexFunctionCode". The qOutIndex starts from one and must be defined as a constant or writeable register in Modbus address space 3 or 4. It should be defined before the qOperation.

The qOperation works with one or more qValues and is configured as follows:

Address:Function:Type = qOperator qOutIndexRegister qOutIndexFunctionCode

qValue1

…

qValueN

QEND

Where …

The qOperator can be one of the following:

QMIN: Quality minimum operation

QMAX: Quality maximum operation.

The register addressed by qOutIndexRegister and qOutIndexFunctionCode contains the index of the winning qValue.

Each qValue is defined as follows:

QVALUE internalCheck useExternalStatus externalValue inValueRegister inValueFunctionCode

Where …

internalCheck: Bit variable. Internal quality information
(0 = exclude value from qOperation computation / 1 = use value in qOperation computation).

useExternalStatus: Coil address (Modbus function code 1 or 5). Allows to select between externalValue or InternalCheck for the quality information
(0 = use InternalCheck / 1 = use ExternalValue).

externalValue: Coil address (Modbus function code 1 or 5). External quality information
(0 = exclude value from QOperation computation / 1 = use value in qOperation computation).

inValueRegister: Holding or input register address. Represents a candidate value for the qOperation.

inValueFunctionCode: Represents the Modbus address space where the value register is defined. Can be 3 or 4.

The useInValue evaluation logic defines whether inValue should be used by qOperation:

If useExternalStatus is 1 then
    useInValue = ExternalValue
Else
    useInValue = InternalCheck

All inValues must have the same return type as the qOperation. It is not possible to compare bit (B), unsigned short integer (U) and float (F) values.

A qOperation uses one or more qValues. If all qValues are excluded from the qOperation (by Internal or External check) the qOperation will return the value 0 and the invalid index 0.

Configuration example:

110:3:U = 0

100:3:F = QMAX 110 3

    QVALUE $QValue1Ok 301 300 200 3
    QVALUE $QValue2Ok 302 300 202 3

QEND

In this example, the result value of the QMAX operation will be stored to the register 100:3:F, while the corresponding index will be stored to the register 110:3:U.

The first QValue comes from register 200:3:F and is enabled either by the bit variable $QValue1Ok or by the register 300:1:B, depending on the value of register 301:1:B.

The second QValue comes from register 202:3:F and is enabled either by the bit variable $QValue2Ok or by the register 300:1:B, depending on the value of register 302:1:B.

B.6.4.14 Select operation

The select operation returns the value from a list at the selected index.

The syntax of the select operator is:

Address:Function:Type = SELECT IndexRegister IndexFunctionCode (Values)

or

$bitvariable = SELECT IndexRegister IndexFunctionCode (Values)

Where …

The IndexRegister starts from one. It must be defined before the select operation and must be of the unsigned short integer (U) data type in Modbus address space 3 and 4.

The IndexRegister value must be smaller than the number of values in the Values list. If not, the select operation returns the value 0.

Values is a comma separated list of valueRegister(s) and valueFunctionCode(s).

All values in the Values list must have the same type (that is, value types cannot be mixed) and be of the same type as the return type for the Select operation. For example, if a float (F) is selected, then it is not possible to return a bit (B) or an unsigned short integer (U).

All Values must be defined before the select operation.

B.6.4.15 Comparator operations

The comparator operation returns a 1-bit (B) boolean result indicating the result of a mathematical comparison operation.

The syntax of the comparator operator is:

Address:Function:B = COMPARATOR(operation, regLeft,regLeftFunctionCode, regRight, regRightFunctionCode)

or

$bitvariable = COMPARATOR(operation, regLeft,regLeftFunctionCode, regRight, regRightFunctionCode)

Where …

operation: the enumeration, can be one of the following:

x	Name/description
EQ	Equal (=)
NE	Not equal (!=)
LT	Less than (<)
LE	Les than or equal to (≤)
GT	Greater than (>)
GE	Greater than or equal to (≥)

regLeft: Address of register for left operand.

regLeftFunctionCode: Modbus address space / function code of register for left operand.

regRight: Address of register for right operand.

regRightValueFunctionCode: Modbus address space / function code of register for right operand.

Left and right operands must have the same type. It is not possible to compare bit (B), unsigned short integer (U) and float (F) values. Note: Attempting this will result in a parsing error (see B.7 Fieldbus configuration file parsing).

Since the result of a the compare operation is of data type bit (B), the Modbus address space of the left operand must be 1 or 2.

B.6.4.16 Heartbeat register

The Heartbeat register feature is a configurable field that helps external systems to monitor (and control) the overall status of a VM600^{Mk2}/VM600 system.

This operation makes (runs) a periodic update (auto-increment) of a “heartbeat” register value depending on the configured parameters. It also features a boolean flag parameter that can force the heartbeat to stop and reset the register value.

Each and every cycle, the heartbeat uses the last computed enableFlag. After that, the computation of the new value of enableFlag starts.

If the next execution cycle starts before the computation of enableFlag has finished, the previous value of enableFlag is used and no re-computation is launched. To prevent the heartbeat from being constantly updated should the condition execution become “hanged”, the enableFlagTimeout parameter is used.

The syntax of the heartbeat operator is:

Address:Function:U

= HEARTBEAT(deltaTime, startValue, endValue, deltaValue, errorValue, enableFlagReg, enableFlagRegFnCode, noEnableFlagTolerance)

Where …

deltaTime: The timer used to run the increment operations. Unsigned short integer (U), in 0.01 second (10 ms). (10 = 100 ms ≤ deltaTime ≤ 65535 = 655350 ms = 11 min (approx.)).

startValue: Initial value of the heartbeat register. Unsigned short integer (U).
(0 < startValue < 65535).

endValue: Maximum value of the heartbeat register. After the value reaches endValue, the register value automatically resets to startValue. Unsigned short integer (U).
(1 < endValue < 65535).

deltaValue: Value to add to current heartbeat register value. Unsigned short integer (U).
(0 < deltaValue < 65535).

errorValue: Error value of heartbeat register. The heartbeat register is set to this value when the enableFlagReg is set to FALSE. Unsigned short integer (U).
(0 < errorValue < 65535).

enableFlagReg: Address of the coil/register used as an “enable increment” boolean flag.

enableFlagRegFnCode: Modbus address space of the coil/register used as an “enable increment” boolean flag.

Modbus address space of the return value should be 3 or 4.

Note: The operation is available for 16-bit registers only. While the heartbeat value is accurate, it is updated at most once each 100 ms.

B.6.4.17 Slot status

The slot status register is a bit field that shows the VM600^{Mk2}/VM600 modules (cards) detected in the rack. Only the status of MPC4^{Mk2} (MPC4G2) and XMC16 are currently reported.

For those modules (cards), the status is 1 if the board is detected and running, and 0 otherwise.

The syntax of the slot status operator is:

Address:Function:U = SLOT_STATUS

Where …

Bit 0 corresponds to rack slot 00, bit 1 slot 01, and so on.

Note: The operation is available for 16-bit registers only.

B.6.4.18 Status delay operation

The Status delay operation is designed for making system bits trigger to the OK state only after a certain delay. For example, on system startup or during a sensor/measurement chain stabilisation period.

The operation uses an existing register as an input and sets an output value to 1 or 0 depending on the parameters.

The syntax of the status delay operator is:

Address:Function:B = STATUS_DELAY (bitVariable, delayTime, triggerState)

or

$bitvariable = STATUS_DELAY (bitVariable, delayTime, triggerState)

Where:

bitVariable: The bit variable that should be delayed.

delayTime: Delay value, in seconds (1< delayTime <65 535). It is also possible to specify delayTime as a register:function pair using an unsigned short integer (U) value in that register.

triggerState: The delayed state (0 or 1). The status delay will only work for transitions to this state, and will have no effect on transitions in the other direction.

B.6.4.19 Freeze detect operation

The freeze detect operation monitors a value to see if it evolves over time and sets a flag when this is not the case.

Normally, any float/integer measurement data value coming from a real measurement chain will have certain fluctuations over time (for example, due to signal noise, sensor precision, machine state change and so on).

The syntax of the freeze detect (VALUE_FREEZE) operator is:

Address:Function:B = VALUE_FREEZE(valueReg, valueRegFnCode, deltaValueReg, deltaValueRegFnCode, maxTime)

or

$bitvariable = VALUE_FREEZE(valueReg, valueRegFnCode, deltaValueReg, deltaValueRegFnCode, maxTime)

Where:

valueReg: Register address of the value to monitor.

valueRegFnCode: Modbus address space of the valueReg.

deltaValueReg: Minimal change value. If the fluctuations are less then this value, they are not counted as a value change. This delta value is expressed in the same units as valueReg and should be of the same data type.

deltaValueRegFnCode: Modbus address space of the deltaValueReg.

maxTime: Maximum time allowed for value to have no changes. If the value does not change for more than maxTime seconds, then VALUE_FREEZE returns true (1). However, as soon as a change is detected, it will immediately go back to false (0). Integer.
(0 < maxTime < 94608000 = 3 years (approx.)).

B.6.4.20 Mathematical operations

Mathematical operations allow the Modbus server (slave) to act as a calculator. With this calculator, it is actually possible to do real mathematical operations on registers. For example, it is possible to return in one register the addition of two other registers. The mathematical operations are not available for coils and discrete inputs/registers.

The syntax of the mathematical (CALCULATOR) operator is:

Address:Function:Type = CALCULATOR(CalcType, firstRegister, firstFunctionCode, secondRegister, secondFunctionCode)

Where CalcType can be one of the following:

x	Name/description
ADD	Addition
SUB	Subtraction
MUL	Multiplication
DIV	Division

The data type B (boolean) is not allowed, because a calculation on bit types should be done using bit variable operations (see B.6.4.9 Bit operations).

With the unsigned integer (U) data type is used, the division is an integer division (for example, 65535 / 2 = 32767).

Warnings:

Use these mathematical operations with caution because of potential overflow problems. In case of overflow or divide by 0 cases, then an exception response is generated (exception code 06: device busy).

The mathematical operator is a simple calculator with many limitations (usage of coils and discrete inputs, native types, overflow tests, “mixed type” calculation, F operand limitation…)

If the value defined in the configuration file is in a scaled register, the mathematical operation uses the non-scaled value to do the operation, and any scaling is then done afterwards.

B.6.4.21 Bits scaling operation

The bits scaling operation allows a Modbus register value encoded in one number of bits to be encoded (converted to) to a different number of bits, where both the input and output values are signed. The goal is to correctly preserve and extend the sign bit, with the bit extended to the result register.

The syntax of the bits scaling operator is:

Address:Function:U = BITSSCALING(From, To, FunctionCode, Register)

Where:

From: Number of bits used in the source register.

To: Number of bits to be used in the result register.

The operand register (FunctionCode, Register) must be defined in the configuration file before the operation and must be of the unsigned short integer (U) data type.

For example, to convert a MPC4^{Mk2} value that is stored in 15-bits to a 12-bits representation:

00000:4:U = Slot3:MPC4:C1:O1:V

00001:4:U = BITSSCALING(15,12,4,0)

The bits scaling operator is only available for unsigned short integer (U) registers (0000h to FFFFh)).

Warning: This operation uses the full integer range to scale the values, which means that negative values are taken into account.

B.6.5 [MAPPING] section – CPUM^{Mk2} module specific

B.6.5.1 CPUM^{Mk2} relay

CPU:RELAY:RelayNb = Address:Function

or

CPU:RELAY:RelayNb = $bitVariable

Where …

RelayNb: R1 or R2 (corresponding to RL1 and RL2 of the CPUM^{Mk2} + IOCN^{Mk2} module).

Address: Function should map to an existing bit variable so the Modbus function code is restricted to 01 or 02 (that is, Read coils or Read discrete inputs).

$bitVariable should be an existing bit variable.

B.6.5.2 Slot status

SlotNr:Status:x

Where …

SlotNr is the rack slot address (slot 03 to slot 14, given as “Slot3” to “Slot14”).

x (a 16-bit unsigned short integer (U)) identifies the module (card) type detected in the rack slot, which can be one of the following:

x	Name/description
0	No module (card)
510	MPC4 (VM600)
550	AMC8 (VM600)
570	XMC16/XMV16 (VM600^{Mk2}/VM600)
650	MPC4^{Mk2} (VM600^{Mk2})

B.6.5.3 Security state

CPU:SecurityState:x

Where …

x can be one of the following:

x	Name/description	Meaning if equal to 0	Meaning if equal to 1
PWP	CPUx password protection state	CPUx is not password protected	CPUx is password protected
LOCK	CPUx lock protection state	CPUx is not locked	CPUx is locked

Note: CPUx password protection state is not applicable to the CPUM^{Mk2} module.

B.6.6 [MAPPING] section – MPC4^{Mk2} module specific

B.6.6.1 Input channel values (float)

SlotNr:MPC4G2:InputChannel:x

Where …

InputChannel:

Dynamic: DYN1-DYN4
Auxiliary: AUX1-AUX2

x (a 32-bit float) can be one of the following:

x	Name/description
DC	DC value

B.6.6.2 Input channel status (bit)

SlotNr:MPC4G2:InputChannel:x

Where …

InputChannel:

Dynamic: DYN1-DYN4
Auxiliary: AUX1-AUX2

x (1-bit) can be one of the following:

x	Name/description	Meaning if equal to 0	Meaning if equal to 1
SBP	Sensor bypass status	Sensor not bypassed	Sensor bypassed
SOK	Sensor OK status	Sensor not OK	Sensor OK

B.6.6.3 Processing channel status (bit)

SlotNr:MPC4G2:ProcessingChannel:x

Where …

ProcessingChannel:

Dynamic: DYN1-DYN4
Auxiliary: AUX1-AUX2
MultiDyn: MULD1-MULD2
MultiAux: MULA1

x (1-bit) can be one of the following:

x	Name/description	Meaning if equal to 0	Meaning if equal to 1
ABP	Alarm bypass status	Alarm not bypassed	Alarm bypassed

B.6.6.4 Output values (float)

SlotNr:MPC4G2:ProcessingBlock:Id:Dimension:V

Where …

ProcessingBlock:

- Dynamic: DYN1-DYN4
- Auxiliary: AUX1-AUX2
- MultiDyn: MULD1-MULD2
- MultiAux: MULA1

Id: 1-64

Dimension: AMP, PHS, FRQ, ANG

B.6.6.5 Output alarm of the associated value (bit)

SlotNr: MPC4G2:ProcessingBlock:Id:Dimension:x

Where …

ProcessingBlock:

- Dynamic: DYN1-DYN4
- Auxiliary: AUX1-AUX2
- MultiDyn: MULD1-MULD2
- MultiAux: MULA1

Id: 1-64

Dimension: AMP, PHS, FRQ, ANG

x can be one of the following:

x	Name/description	Meaning if equal to 0	Meaning if equal to 1
A+	Alert+	No alert	Alert
A−	Alert−	No alert	Alert
D+	Danger+	No danger	Danger
D−	Danger−	No danger	Danger

B.6.6.6 Output status of the associated value (bit)

SlotNr: MPC4G2:ProcessingBlock:Id:Dimension:x

Where …

ProcessingBlock:

Dynamic: DYN1-DYN4
Auxiliary: AUX1-AUX2
MultiDyn: MULD1-MULD2
MultiAux: MULA1

Id: 1-64

Dimension: AMP, PHS, FRQ, ANG

x can be one of the following:

x	Name/description	Meaning if equal to 0	Meaning if equal to 1
SATAC	AC input signal saturated	Not saturated	Saturated
SATDC	DC input signal saturated	Not saturated	Saturated
ASP	Algorithm is in stabilisation phase	Stable	Not stable
SNOK	Sensor not OK check	Sensor OK	Sensor not OK
ASSNOK	Associated speed sensor not OK check	Sensor OK	Sensor not OK
TACOVF	Tacho overflow	OK	Tacho overflow
TDIVON	Tacho divider on	Divider off	Divider on
TACMIS	Possibly one tacho pulse missed	OK	Tacho pulses missed
OSPD	Machine speed is too high for the associated value	OK	Overspeed
USPD	Machine speed is too low for the associated value	OK	Underspeed
RTOOS	Resampling frequency is out of specification for the dynamic channel	OK	Out of specification
TACGLI	Suspicious tacho glitch detected and discarded	OK	Tacho glitch detected
OACC	Over acceleration – speed has more than doubled in one rotation	OK	Over acceleration
ODCC	Over deceleration – speed has more than halved in one rotation	OK	Over deceleration
TNR	Tacho timestamp not received for more than 4 rotations	Tacho received	Tacho not received
HPC	Analog high-pass (HP) filter phase compensation	Not compensated	Compensated
SBP	Sensor bypassed	Not bypassed	Bypassed
ABP	Processing channel alarm bypassed	Not bypassed	Bypassed
GIVLD	Global invalidity	Valid	Not valid

B.6.6.7 First level logical results (bit)

SlotNr:MPC4G2:LOGICAL:L1Rx

Where …
x is the logical function number in the range 1-32.
The function returns 0 for false and 1 for true.

B.6.6.8 Second level logical results (bit)

SlotNr:MPC4G2:LOGICAL:L2Rx

Where …
x is the logical function number in the range 1-32.
The function returns 0 for false and 1 for true.

B.6.6.9 Fault relay output (bit)

SlotNr:MPC4G2:RELAY:FAULT

Where …
The function returns 0 for de-energised and 1 for energised.
Note: This function is for use with the MPC4^{Mk2} + IOC4^{Mk2} module's common circuit-fault relay (FAULT) only.

B.6.6.10 IOC relay outputs (bit)

SlotNr:MPC4G2:RELAY:IOCx

Where …
x is the relay number in the range 0-4, as follows:
0 corresponds to the MPC4^{Mk2} + IOC4^{Mk2} module's common circuit-fault relay (FAULT).
1-4 corresponds to the MPC4^{Mk2} + IOC4^{Mk2} module's user-configurable relays (RL1 to RL4).
The function returns 0 for de-energised and 1 for energised.

B.6.6.11 OCBUS relay outputs (bit)

SlotNr:MPC4G2:RELAY:OCBUSx

Where …
x is the relay number in the range 1-16.
The function returns 0 for de-energised and 1 for energised.

B.6.6.12 RAWBUS relay outputs (bit)

SlotNr:MPC4G2:RELAY:RAWBUSx

Where …
x is the relay number in the range 1-16.
The function returns 0 for de-energised and 1 for energised.

B.6.6.13 Analog outputs (float)

SlotNr:MPC4G2:ANA:Output

Where …
Output: OUT1-OUT4

B.6.6.14 Global status (bit)

SlotNr: MPC4G2:x

Where …
x can be one of the following:

x	Name/description
MCR	MPC4G2 configuration is running
TM	Trip multiply

B.6.6.15 Global status (float)

SlotNr: MPC4G2:x

Where …
x can be one of the following:

x	Name/description
TK	Temperature in Kelvin
TC	Temperature in °Celsius
TF	Temperature in °Fahrenheit

B.6.6.16 Configuration global

SlotNr:MPC4G2:CONFIG:x

Where …
x can be one of the following:

x	Name/description
CRC	Configuration CRC (data type L)
VER	Configuration version (data type L)
ISSIL	Is it a SIL board? (data type B)

B.6.6.17 Configuration of input channel (bit)

SlotNr:MPC4G2:CONFIG:InputChannel:x

Where …

InputChannel:

Dynamic: DYN1-DYN4
Auxiliary: AUX1-AUX2

x can be one of the following:

x	Name/description	Meaning if equal to 0	Meaning if equal to 1
DCU	DC units	Volts (voltage)	Ampere (current)

B.6.6.18 Configuration of output (bit)

SlotNr:MPC4G2:CONFIG: ProcessingBlock:ID:Dimension:x

Where …

ProcessingBlock:

Dynamic: DYN1-DYN4
Auxiliary: AUX1-AUX2
MultiDyn: MULD1-MULD2
MultiAux: MULA1

Id: 1-64

Dimension: AMP, PHS, FRQ, ANG

x can be one of the following:

x	Name/description
USED	Output used

B.6.6.19 Configuration of output alarm levels (float)

SlotNr:MPC4G2:CONFIG: ProcessingBlock:ID:Dimension:x

Where …

ProcessingBlock:

Dynamic: DYN1-DYN4
Auxiliary: AUX1-AUX2
MultiDyn: MULD1-MULD2
MultiAux: MULA1

Id: 1-64

Dimension: AMP, PHS, FRQ, ANG

x can be one of the following:

x	Name/description
A+	Alert+ level
A−	Alert− level
D+	Danger+ level
D−	Danger− level

B.6.6.20 Configuration of output alarm as enabled (bit)

SlotNr:MPC4G2:CONFIG: ProcessingBlock:ID:Dimension:x:USED

Where …

ProcessingBlock:

Dynamic: DYN1-DYN4
Auxiliary: AUX1-AUX2
MultiDyn: MULD1-MULD2
MultiAux: MULA1

Id: 1-64

Dimension: AMP, PHS, FRQ, ANG

x can be one of the following:

x	Name/description
A+	Alert+
A−	Alert−
D+	Danger+
D−	Danger−

B.6.6.21 Configuration of output alarm as latched (bit)

SlotNr:MPC4G2:CONFIG: ProcessingBlock:ID:Dimension:x:LATCHED

Where …

ProcessingBlock:

Dynamic: DYN1-DYN4
Auxiliary: AUX1-AUX2
MultiDyn: MULD1-MULD2
MultiAux: MULA1

Id: 1-64

Dimension: AMP, PHS, FRQ, ANG

x can be one of the following:

x	Name/description
A+	Alert+
A−	Alert−
D+	Danger+
D−	Danger−

B.6.6.22 Commands

SlotNr:MPC4G2:Command:x

Where …

x can be one of the following:

x	Name/description	
ALARM_RESET	Alarm reset (AR)	Alarm reset applied if value not equal to 0 (that is, !=0).
TRIP_MULTIPLY	Trip multiply (TM)	Trip multiply applied if value not equal to current state: Value = 0: No trip multiply Value != 0: Trip multiply.
SENSOR_BYPASS	Sensor bypass	Sensor bypass applied if value not equal to current state: Bit 0: dynamic input channel 1 Bit 1: dynamic input channel 2 Bit 2: dynamic input channel 3 Bit 3: dynamic input channel 4 Bit 4: auxiliary input channel 1 Bit 5: auxiliary input channel 2.
ALARM_BYPASS	Alarm bypass (AB)	Alarm bypass applied if value not equal to current state: Bit 0: dynamic input channel 1 Bit 1: dynamic input channel 2 Bit 2: dynamic input channel 3 Bit 3: dynamic input channel 4 Bit 4: auxiliary input channel 1 Bit 5: auxiliary input channel 2 Bit 6: dual dynamic processing channel 1 Bit 7: dual dynamic processing channel 2 Bit 8: dual auxiliary processing channel 1.

Notes:

For this operation (these commands), the valid Modbus function code is 06.

The command is applied (executed) when the value is actually written.

B.7 Fieldbus configuration file parsing

When VibroSight Protect is used to activate a configuration on a VM600^{Mk2} MPS in the usual way (Tools > System activation), the Modbus fieldbus configuration file (`*.cfg`) is automatically parsed and checked for errors before it is actually activated on the module.

Accordingly, the VibroSight Protect software's Activate configuration dialog box will display/highlight problems with the CPUM^{Mk2} fieldbus configuration file that prevent system activation.

For example:

```
Activation failed.

The following error(s) occurred:

CPUM Slot 0, The fieldbus configuration operation failed with the status
'Configuration parsing error' and the error message 'Error on line 12:
syntax error. Max number of errors displayed is 40. The total number of
errors is 1.' Error during rollback of the configuration.
```

B.8 Dummy fieldbus configuration file

A VibroSight Protect (MPS) configuration containing a CPUM^{Mk2} module requires a fieldbus configuration file (`*.cfg`) to be uploaded to the module in order to configure the fieldbus as required by the application.

Even if the communications interface functionality of a CPUM^{Mk2} module is not required by the application, a “dummy” fieldbus configuration file is still required.

A dummy fieldbus configuration file consists of the initial main sections that are used to configure the default communications parameters: [RTU] section, [TCP] section and [GLOBAL] section. That is, the [MAPPING] section is not required by a “dummy” fieldbus configuration file. An example dummy fieldbus configuration file is shown in Figure B-1.

```
//***************MODBUS CONFIGURATION FILE***************
//
// Name:                Project xyz
//
// Version:             Rev1
// Last modified date:  17.09.2021
// Last modified by:    K.Solinski
//-------------------------------------------------------*
//

[RTU1]
ENABLE = NO                  // YES/NO (default NO)

[TCP]
ENABLE = YES                 // YES/NO (default NO)
PORT = 502                   // 0-65535 (default 502)

[GLOBAL]
DEFAULT_LONG_ORDER = LB
DEFAULT_FLOAT_ORDER = FB
//IS_FULLY_COMPATIBLE = NO   // YES/NO (default NO)
```

Figure B-1: Dummy fieldbus configuration file

B.9 Example fieldbus configuration file

A complete example fieldbus configuration file for a VM600^{Mk2} rack/system containing one CPUM^{Mk2} module using Modbus TCP (in slot 00) and three MPC4^{Mk2} modules (in slots 03, 05, 07) is shown below.

```
//***************MODBUS CONFIGURATION FILE***************
//
// Name:                Project xyz
//
// Version:             Rev1
// Last modified date:  17.09.2021
// Last modified by:    K.Solinski
//-------------------------------------------------------*
//

[RTU1]
ENABLE = NO                  // YES/NO (default NO)

[TCP]
ENABLE = YES                 // YES/NO (default NO)
PORT = 502                   // 0-65535 (default 502)

[GLOBAL]
DEFAULT_LONG_ORDER = LB
DEFAULT_FLOAT_ORDER = FB
//IS_FULLY_COMPATIBLE = NO   // YES/NO (default NO)


[MAPPING]

////////////////////////////////////////////////
// Block1: Configurations
////////////////////////////////////////////////

100:3:F=Slot3:MPC4G2:CONFIG:AUX1:1:AMP:A+
102:3:F=Slot3:MPC4G2:CONFIG:AUX1:1:AMP:D+
104:3:F=Slot3:MPC4G2:CONFIG:DYN1:1:AMP:A+
106:3:F=Slot3:MPC4G2:CONFIG:DYN1:1:AMP:D+
108:3:F=Slot3:MPC4G2:CONFIG:DYN2:1:AMP:A+
110:3:F=Slot3:MPC4G2:CONFIG:DYN2:1:AMP:D+
112:3:F=Slot3:MPC4G2:CONFIG:DYN3:1:AMP:A+
114:3:F=Slot3:MPC4G2:CONFIG:DYN3:1:AMP:D+
116:3:F=Slot3:MPC4G2:CONFIG:DYN4:1:AMP:A+
118:3:F=Slot3:MPC4G2:CONFIG:DYN4:1:AMP:D+
120:3:F=Slot5:MPC4G2:CONFIG:DYN1:1:AMP:A+
122:3:F=Slot5:MPC4G2:CONFIG:DYN1:1:AMP:D+
124:3:F=Slot5:MPC4G2:CONFIG:DYN2:1:AMP:A+
126:3:F=Slot5:MPC4G2:CONFIG:DYN2:1:AMP:D+
128:3:F=Slot5:MPC4G2:CONFIG:DYN3:1:AMP:A+
130:3:F=Slot5:MPC4G2:CONFIG:DYN3:1:AMP:D+
132:3:F=Slot5:MPC4G2:CONFIG:DYN4:1:AMP:A+
134:3:F=Slot5:MPC4G2:CONFIG:DYN4:1:AMP:D+
136:3:F=Slot7:MPC4G2:CONFIG:DYN1:1:AMP:D+
138:3:F=Slot7:MPC4G2:CONFIG:DYN1:1:AMP:A+
140:3:F=Slot7:MPC4G2:CONFIG:DYN1:1:AMP:A-
142:3:F=Slot7:MPC4G2:CONFIG:DYN1:1:AMP:D-
```

```
144:3:F=Slot7:MPC4G2:CONFIG:DYN2:1:AMP:D+
146:3:F=Slot7:MPC4G2:CONFIG:DYN2:1:AMP:A+
148:3:F=Slot7:MPC4G2:CONFIG:DYN2:1:AMP:A-
150:3:F=Slot7:MPC4G2:CONFIG:DYN2:1:AMP:D-
152:3:F=Slot7:MPC4G2:CONFIG:DYN3:1:AMP:D+
154:3:F=Slot7:MPC4G2:CONFIG:DYN3:1:AMP:A+
156:3:F=Slot7:MPC4G2:CONFIG:DYN4:1:AMP:D+
158:3:F=Slot7:MPC4G2:CONFIG:DYN4:1:AMP:A+
160:3:U=Slot7:MPC4G2:CONFIG:DYN4:1:AMP:A-
161:3:U=Slot7:MPC4G2:CONFIG:DYN4:1:AMP:D-
162:3:U=0
163:3:U=0
164:3:U=0
165:3:U=0
166:3:U=0
167:3:U=0
168:3:U=0
169:3:U=0
170:3:U=0
171:3:U=0
172:3:U=0
173:3:U=0
174:3:U=0
175:3:U=0
176:3:U=0
177:3:U=0
178:3:U=0
179:3:U=0
180:3:U=0
181:3:U=0
182:3:U=0
183:3:U=0
184:3:U=0
185:3:U=0
186:3:U=0
187:3:U=0
188:3:U=0
189:3:U=0
190:3:U=0
191:3:U=0
192:3:U=0
193:3:U=0
194:3:U=0
195:3:U=0
196:3:U=0
197:3:U=0
198:3:U=0
199:3:U=0


////////////////////////////////////////////////
// Block2: Values
////////////////////////////////////////////////

200:3:F=Slot3:MPC4G2:AUX1:1:AMP:V
202:3:F=Slot3:MPC4G2:DYN1:1:AMP:V
204:3:F=Slot3:MPC4G2:DYN2:1:AMP:V
206:3:F=Slot3:MPC4G2:DYN3:1:AMP:V
208:3:F=Slot3:MPC4G2:DYN4:1:AMP:V
```

```
210:3:F=Slot5:MPC4G2:DYN1:1:AMP:V
212:3:F=Slot5:MPC4G2:DYN2:1:AMP:V
214:3:F=Slot5:MPC4G2:DYN3:1:AMP:V
216:3:F=Slot5:MPC4G2:DYN4:1:AMP:V
218:3:F=Slot7:MPC4G2:DYN1:1:AMP:V
220:3:F=Slot7:MPC4G2:DYN2:1:AMP:V
222:3:F=Slot7:MPC4G2:DYN3:1:AMP:V
224:3:F=Slot7:MPC4G2:DYN4:1:AMP:V
226:3:U=0
228:3:U=0
230:3:U=0
231:3:U=0
232:3:U=0
233:3:U=0
234:3:U=0
235:3:U=0
236:3:U=0
237:3:U=0
238:3:U=0
239:3:U=0
240:3:U=0
241:3:U=0
242:3:U=0
243:3:U=0
244:3:U=0
245:3:U=0
246:3:U=0
247:3:U=0
248:3:U=0
249:3:U=0
250:3:U=0
251:3:U=0
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254:3:U=0
255:3:U=0
256:3:U=0
257:3:U=0
258:3:U=0
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260:3:U=0
261:3:U=0
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265:3:U=0
266:3:U=0
267:3:U=0
268:3:U=0
269:3:U=0
270:3:U=0
271:3:U=0
272:3:U=0
273:3:U=0
274:3:U=0
275:3:U=0
276:3:U=0
277:3:U=0
278:3:U=0
```

```
279:3:U=0
280:3:U=0
281:3:U=0
282:3:U=0
283:3:U=0
284:3:U=0
285:3:U=0
286:3:U=0
287:3:U=0
288:3:U=0
289:3:U=0
290:3:U=0
291:3:U=0
292:3:U=0
293:3:U=0
294:3:U=0
295:3:U=0
296:3:U=0
297:3:U=0
298:3:U=0
299:3:U=0


////////////////////////////////////////////////
// Block2: Configurations
////////////////////////////////////////////////

$MPC4S3T1Used     = Slot3:MPC4G2:CONFIG:AUX1:1:AMP:USED
$MPC4S3T1Apos     = Slot3:MPC4G2:AUX1:1:AMP:A+
$MPC4S3T1Aneg     = Slot3:MPC4G2:AUX1:1:AMP:A-
$MPC4S3T1Dpos     = Slot3:MPC4G2:AUX1:1:AMP:D+
$MPC4S3T1Dneg     = Slot3:MPC4G2:AUX1:1:AMP:D-
$MPC4S3T1SNOK     = Slot3:MPC4G2:AUX1:SOK

$MPC4S3C1O1Used     = Slot3:MPC4G2:CONFIG:DYN1:1:AMP:USED
$MPC4S3C1O1Apos     = Slot3:MPC4G2:DYN1:1:AMP:A+
$MPC4S3C1O1Aneg     = Slot3:MPC4G2:DYN1:1:AMP:A-
$MPC4S3C1O1Dpos     = Slot3:MPC4G2:DYN1:1:AMP:D+
$MPC4S3C1O1Dneg     = Slot3:MPC4G2:DYN1:1:AMP:D-
$MPC4S3C1O1SNOK     = Slot3:MPC4G2:DYN1:SOK

$MPC4S3C2O1Used     = Slot3:MPC4G2:CONFIG:DYN2:1:AMP:USED
$MPC4S3C2O1Apos     = Slot3:MPC4G2:DYN2:1:AMP:A+
$MPC4S3C2O1Aneg     = Slot3:MPC4G2:DYN2:1:AMP:A-
$MPC4S3C2O1Dpos     = Slot3:MPC4G2:DYN2:1:AMP:D+
$MPC4S3C2O1Dneg     = Slot3:MPC4G2:DYN2:1:AMP:D-
$MPC4S3C2O1SNOK     = Slot3:MPC4G2:DYN2:SOK

$MPC4S3C3O1Used     = Slot3:MPC4G2:CONFIG:DYN3:1:AMP:USED
$MPC4S3C3O1Apos     = Slot3:MPC4G2:DYN3:1:AMP:A+
$MPC4S3C3O1Aneg     = Slot3:MPC4G2:DYN3:1:AMP:A-
$MPC4S3C3O1Dpos     = Slot3:MPC4G2:DYN3:1:AMP:D+
$MPC4S3C3O1Dneg     = Slot3:MPC4G2:DYN3:1:AMP:D-
$MPC4S3C3O1SNOK     = Slot3:MPC4G2:DYN3:SOK

$MPC4S3C4O1Used     = Slot3:MPC4G2:CONFIG:DYN4:1:AMP:USED
$MPC4S3C4O1Apos     = Slot3:MPC4G2:DYN4:1:AMP:A+
$MPC4S3C4O1Aneg     = Slot3:MPC4G2:DYN4:1:AMP:A-
$MPC4S3C4O1Dpos     = Slot3:MPC4G2:DYN4:1:AMP:D+
```

```
$MPC4S3C4O1Dneg     = Slot3:MPC4G2:DYN4:1:AMP:D-
$MPC4S3C4O1SNOK     = Slot3:MPC4G2:DYN4:SOK

$MPC4S5C1O1Used     = Slot5:MPC4G2:CONFIG:DYN1:1:AMP:USED
$MPC4S5C1O1Apos     = Slot5:MPC4G2:DYN1:1:AMP:A+
$MPC4S5C1O1Aneg     = Slot5:MPC4G2:DYN1:1:AMP:A-
$MPC4S5C1O1Dpos     = Slot5:MPC4G2:DYN1:1:AMP:D+
$MPC4S5C1O1Dneg     = Slot5:MPC4G2:DYN1:1:AMP:D-
$MPC4S5C1O1SNOK     = Slot5:MPC4G2:DYN1:SOK

$MPC4S5C2O1Used     = Slot5:MPC4G2:CONFIG:DYN2:1:AMP:USED
$MPC4S5C2O1Apos     = Slot5:MPC4G2:DYN2:1:AMP:A+
$MPC4S5C2O1Aneg     = Slot5:MPC4G2:DYN2:1:AMP:A-
$MPC4S5C2O1Dpos     = Slot5:MPC4G2:DYN2:1:AMP:D+
$MPC4S5C2O1Dneg     = Slot5:MPC4G2:DYN2:1:AMP:D-
$MPC4S5C2O1SNOK     = Slot5:MPC4G2:DYN2:SOK

$MPC4S5C3O1Used     = Slot5:MPC4G2:CONFIG:DYN3:1:AMP:USED
$MPC4S5C3O1Apos     = Slot5:MPC4G2:DYN3:1:AMP:A+
$MPC4S5C3O1Aneg     = Slot5:MPC4G2:DYN3:1:AMP:A-
$MPC4S5C3O1Dpos     = Slot5:MPC4G2:DYN3:1:AMP:D+
$MPC4S5C3O1Dneg     = Slot5:MPC4G2:DYN3:1:AMP:D-
$MPC4S5C3O1SNOK     = Slot5:MPC4G2:DYN3:SOK

$MPC4S5C4O1Used     = Slot5:MPC4G2:CONFIG:DYN4:1:AMP:USED
$MPC4S5C4O1Apos     = Slot5:MPC4G2:DYN4:1:AMP:A+
$MPC4S5C4O1Aneg     = Slot5:MPC4G2:DYN4:1:AMP:A-
$MPC4S5C4O1Dpos     = Slot5:MPC4G2:DYN4:1:AMP:D+
$MPC4S5C4O1Dneg     = Slot5:MPC4G2:DYN4:1:AMP:D-
$MPC4S5C4O1SNOK     = Slot5:MPC4G2:DYN4:SOK

$MPC4S7C1O1Used     = Slot7:MPC4G2:CONFIG:DYN1:1:AMP:USED
$MPC4S7C1O1Apos     = Slot7:MPC4G2:DYN1:1:AMP:A+
$MPC4S7C1O1Aneg     = Slot7:MPC4G2:DYN1:1:AMP:A-
$MPC4S7C1O1Dpos     = Slot7:MPC4G2:DYN1:1:AMP:D+
$MPC4S7C1O1Dneg     = Slot7:MPC4G2:DYN1:1:AMP:D-
$MPC4S7C1O1SNOK     = Slot7:MPC4G2:DYN1:SOK

$MPC4S7C2O1Used     = Slot7:MPC4G2:CONFIG:DYN2:1:AMP:USED
$MPC4S7C2O1Apos     = Slot7:MPC4G2:DYN2:1:AMP:A+
$MPC4S7C2O1Aneg     = Slot7:MPC4G2:DYN2:1:AMP:A-
$MPC4S7C2O1Dpos     = Slot7:MPC4G2:DYN2:1:AMP:D+
$MPC4S7C2O1Dneg     = Slot7:MPC4G2:DYN2:1:AMP:D-
$MPC4S7C2O1SNOK     = Slot7:MPC4G2:DYN2:SOK

$MPC4S7C3O1Used     = Slot7:MPC4G2:CONFIG:DYN3:1:AMP:USED
$MPC4S7C3O1Apos     = Slot7:MPC4G2:DYN3:1:AMP:A+
$MPC4S7C3O1Aneg     = Slot7:MPC4G2:DYN3:1:AMP:A-
$MPC4S7C3O1Dpos     = Slot7:MPC4G2:DYN3:1:AMP:D+
$MPC4S7C3O1Dneg     = Slot7:MPC4G2:DYN3:1:AMP:D-
$MPC4S7C3O1SNOK     = Slot7:MPC4G2:DYN3:SOK

$MPC4S7C4O1Used     = Slot7:MPC4G2:CONFIG:DYN4:1:AMP:USED
$MPC4S7C4O1Apos     = Slot7:MPC4G2:DYN4:1:AMP:A+
$MPC4S7C4O1Aneg     = Slot7:MPC4G2:DYN4:1:AMP:A-
$MPC4S7C4O1Dpos     = Slot7:MPC4G2:DYN4:1:AMP:D+
$MPC4S7C4O1Dneg     = Slot7:MPC4G2:DYN4:1:AMP:D-
$MPC4S7C4O1SNOK     = Slot7:MPC4G2:DYN4:SOK
```

```
300:3:U=PACK($MPC4S3T1Used,$MPC4S3T1Apos,$MPC4S3T1Aneg,
$MPC4S3T1Dpos,$MPC4S3T1Dneg,$MPC4S3T1SNOK,0,0,0,0,0,0,0,0,0)
301:3:U=PACK($MPC4S3C1O1Used,$MPC4S3C1O1Apos,$MPC4S3C1O1Aneg,
$MPC4S3C1O1Dpos,$MPC4S3C1O1Dneg,$MPC4S3C1O1SNOK,0,0,0,0,0,0,0,0,0)
302:3:U=PACK($MPC4S3C3O1Used,$MPC4S3C3O1Apos,$MPC4S3C3O1Aneg,
$MPC4S3C3O1Dpos,$MPC4S3C3O1Dneg,$MPC4S3C3O1SNOK,0,0,0,0,0,0,0,0,0)
303:3:U=PACK($MPC4S3C4O1Used,$MPC4S3C4O1Apos,$MPC4S3C4O1Aneg,
$MPC4S3C4O1Dpos,$MPC4S3C4O1Dneg,$MPC4S3C4O1SNOK,0,0,0,0,0,0,0,0,0)
304:3:U=PACK($MPC4S3C2O1Used,$MPC4S3C2O1Apos,$MPC4S3C2O1Aneg,
$MPC4S3C2O1Dpos,$MPC4S3C2O1Dneg,$MPC4S3C2O1SNOK,0,0,0,0,0,0,0,0,0)
305:3:U=PACK($MPC4S5C1O1Used,$MPC4S5C1O1Apos,$MPC4S5C1O1Aneg,
$MPC4S5C1O1Dpos,$MPC4S5C1O1Dneg,$MPC4S5C1O1SNOK,0,0,0,0,0,0,0,0,0)
306:3:U=PACK($MPC4S5C3O1Used,$MPC4S5C3O1Apos,$MPC4S5C3O1Aneg,
$MPC4S5C3O1Dpos,$MPC4S5C3O1Dneg,$MPC4S5C3O1SNOK,0,0,0,0,0,0,0,0,0)
307:3:U=PACK($MPC4S5C4O1Used,$MPC4S5C4O1Apos,$MPC4S5C4O1Aneg,
$MPC4S5C4O1Dpos,$MPC4S5C4O1Dneg,$MPC4S5C4O1SNOK,0,0,0,0,0,0,0,0,0)
308:3:U=PACK($MPC4S5C2O1Used,$MPC4S5C2O1Apos,$MPC4S5C2O1Aneg,
$MPC4S5C2O1Dpos,$MPC4S5C2O1Dneg,$MPC4S5C2O1SNOK,0,0,0,0,0,0,0,0,0)
309:3:U=PACK($MPC4S7C1O1Used,$MPC4S7C1O1Apos,$MPC4S7C1O1Aneg,
$MPC4S7C1O1Dpos,$MPC4S7C1O1Dneg,$MPC4S7C1O1SNOK,0,0,0,0,0,0,0,0,0)
310:3:U=PACK($MPC4S7C2O1Used,$MPC4S7C2O1Apos,$MPC4S7C2O1Aneg,
$MPC4S7C2O1Dpos,$MPC4S7C2O1Dneg,$MPC4S7C2O1SNOK,0,0,0,0,0,0,0,0,0)
311:3:U=PACK($MPC4S7C3O1Used,$MPC4S7C3O1Apos,$MPC4S7C3O1Aneg,
$MPC4S7C3O1Dpos,$MPC4S7C3O1Dneg,$MPC4S7C3O1SNOK,0,0,0,0,0,0,0,0,0)
312:3:U=PACK($MPC4S7C4O1Used,$MPC4S7C4O1Apos,$MPC4S7C4O1Aneg,
$MPC4S7C4O1Dpos,$MPC4S7C4O1Dneg,$MPC4S7C4O1SNOK,0,0,0,0,0,0,0,0,0)
```

B.10CPUM^{Mk2} Modbus tips and tricks

B.10.1 Float to integer conversion using the scaling function

When a VibroSight / VM600^{Mk2} system containing a CPUM^{Mk2} + IOCN^{Mk2} module is used to replace an older system containing a CPUM / IOCN card pair, it is important to be aware that the CPUM^{Mk2} module's Modbus interface encodes live measurement values as the float (F) data type.

As a result, it may be necessary to convert such measurement values to the 16-bit unsigned short integer (U) data type in order to remain 100 % compatible with existing systems that standardised on integers for Modbus and cannot be changed for whatever reason.

A quick and easy way to convert a float to an integer uses the scaling function of the CPUM^{Mk2} module's Modbus interface as shown in the example below:

NOTE: In order to convert a float to an integer using the scaling function of the CPUM^{Mk2} module's Modbus interface, CPUM^{Mk2} firmware PNR 640-034-002-00 or later must be used.

Note: This example is part of a fieldbus configuration file for a VM600^{Mk2} rack/system containing a CPUM^{Mk2} module using Modbus TCP (in slot 00) and a MPC4^{Mk2} module (in slot 09).

```
//***************MODBUS CONFIGURATION FILE***************
//
// Name:                Example float to integer conversion using the
//                      scaling function
//
// Version:             Rev1
// Last modified date:  27.10.2022
// Last modified by:    M.Canedo
//-----------------------------------------------------*
//

[RTU1]
ENABLE = NO                  // YES/NO (default NO)

[TCP]
ENABLE = YES                 // YES/NO (default NO)
PORT = 502                   // 0-65535 (default 502)

[GLOBAL]
DEFAULT_LONG_ORDER = LB
DEFAULT_FLOAT_ORDER = FB

…
```

…

[MAPPING]

```
////////////////////////////////////////////////
// Block1: Channel Values
////////////////////////////////////////////////

////////////////////////////////////////////////
//Output Values (float)
//SlotNr:MPC4G2:ProcessingBlock:Id:Dimension:V
//ProcessingBlock:
//Dynamic: DYN1-DYN4
//Auxiliary: AUX1-AUX2
//MultiDyn: MULD1-MULD2
//MultiAux MULA1
//Id: 1-64
//Dimension: AMP, PHS, FRQ, ANG
////////////////////////////////////////////////

////////////////////////////////////////////////
//Reference example:
//30003:4:U:-50.50:250.0=Slot8:XMC16:DYN1:OUT1:V

//Description: Read of processing block 1 output 1 vibration value from the
//XMC16 card located in the slot 8. The value can be accessed by querying
//the MODBUS address 30003 as 16 bit unsigned, MODBUS function 04h.
//The value is scaled from real value with the range -50.50 to 250.00 to
//unsigned 16 bit value.
//Value -50.50 is encoded as 0000h in the MODBUS register
//Value 250 is encoded as FFFFh in the MODBUS side.
//Values grater than 250 are clipped to FFFFh.
//Values smaller than -50.50 are clipped to 0000h
//Of course, the minimum and the maximum value can't be the same.
////////////////////////////////////////////////

//slot#9
100:3:F = Slot9:MPC4G2:DYN1:1:AMP:V                //Float
102:4:U:0.0:0.00025 = Slot9:MPC4G2:DYN1:1:AMP:V    //Integer FC#4
102:3:U:0.0:0.00025 = Slot9:MPC4G2:DYN1:1:AMP:V    //Integer FC#3
```

…

It is important to note that the CPUM^{Mk2} module uses standard SI units for measurement values, which is metres (m) in this particular example (shaft relative vibration).

So the :Min:Max: scaling of `:0.0:0.00025` is used to convert/scale the measurement value to a the measurement range of 0 to 250 µm (0 to 0.000250 m).

See also B.6.4.4 Scaling and B.6.4.5 Reading minimum/maximum values.

Finally, while this particular example shows a CPUM^{Mk2} module (`MPC4G2`), the same functionality is also supported by XMC16/XMV16 modules (`XMC16`).

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APPENDIX C: PROFIBUS FIELDBUS

This appendix provides information on PROFIBUS fieldbus operation and configuration for the VM600Mk2 CPUMMk2 + IOCNMk2 rack controller and communications interface module.

This includes an explanation of the parameters and syntax of PROFIBUS fieldbus configuration files.

NOTE: The VM600Mk2 CPUMMk2 + IOCNMk2 module implements PROFIBUS as an extension of Modbus, that is, the PROFIBUS fieldbus is effectively an additional PROFIBUS layer above the existing Modbus layer.
Accordingly, the information given in this appendix is in addition to the information given in Appendix B: Modbus fieldbus, which should also be read.

C.1 VM600Mk2 CPUMMk2 PROFIBUS features

NOTE: The information given in this section is in addition to the information already given in B.1 VM600Mk2 CPUMMk2 Modbus features.

The CPUMMk2 + IOCNMk2 module's support for PROFIBUS is characterised by the following features:

- The CPUMMk2 module acts as a PROFIBUS fieldbus server (slave) device.
- The PROFIBUS (Modbus) server starts automatically when the module starts (boots).
- After starting (booting), the PROFIBUS (Modbus) server reads the PROFIBUS (Modbus) fieldbus configuration from the copy of the configuration stored on the module.
- The Modbus server supports PROFIBUS DP:
  - DP-V0 server (slave).
  - Up to 244 input bytes and 244 output bytes per fieldbus interface.
  - PROFIBUS, a serial-based communications, is available via J1 (FIELDBUS1) and J4 (FIELDBUS2) on the IOCNMk2 input/output module.

For further information on the functions/operations available, see B.6.4 [MAPPING] section – general, B.6.5 [MAPPING] section – CPUMMk2 module specific and B.6.6 [MAPPING] section – MPC4Mk2 module specific.

C.2 PROFIBUS communications

NOTE: The information given in this section is in addition to the information already given in B.4 Modbus RTU communications.

The CPUM^{Mk2} module's implementation of the PROFIBUS protocol supports the following communication parameters:

- Baud rate: 600, 1200, 4800, 9600, 19200, 38400, 57600, 115200
- Parity: EVEN, ODD or NONE
- Number of bits: 8
- Number of stop bits: 1
- Slave address range: 1-247

(That is, the same communication parameters as its implementation of the Modbus RTU, also a serial-based communications protocol.)

PROFIBUS communication parameters are defined in the [RTU] section of a Modbus fieldbus configuration file. See C.3.1 [RTU] section.

C.3 PROFIBUS fieldbus configuration file

NOTE: The information given in this section is in addition to the information already given in B.6 Modbus fieldbus configuration file.

As the CPUM^{Mk2} + IOCN^{Mk2} module implements PROFIBUS as an extension of Modbus, a PROFIBUS fieldbus configuration file is basically the same as a PROFIBUS fieldbus configuration file but with some additional PROFIBUS specific commands / operators, as described in this appendix.

C.3.1 [RTU] section

See also B.6.1 [RTU] section.

It is important to not that, in general, PROFIBUS characters are comprised of 11 bits, that is, 1 start bit, 8 data bits, 1 parity bit (even) and 1 stop bit.

C.3.2 [GLOBAL] section

See also B.6.3 [GLOBAL] section.

The following command is used to enable PROFIBUS communications:

IS_PROFIBUS_ACTIVATED = YES/NO (default NO)

Note: Enables/disables the PROFIBUS driver. If enabled, at least one PROFIBUS board configuration must exist in the [MAPPINGS] section. See C.3.3 [MAPPING] section – PROFIBUS specific.

If this command is missing, then PROFIBUS communications is disabled by default, and the fieldbus configuration file effectively defaults to being a Modbus fieldbus configuration file.

C.3.3 [MAPPING] section – PROFIBUS specific

See also B.6.4 [MAPPING] section – general, B.6.5 [MAPPING] section – CPUM^{Mk2} module specific and B.6.6 [MAPPING] section – MPC4^{Mk2} module specific.

C.3.3.1 Create PROFIBUS board

This command creates an instance of the PROFIBUS board (server (slave)).

The syntax of the command is:

PROFIBUS_CREATE <FIELDBUS_PORT> <STATION_ADDRESS>

Where:

FIELDBUS_PORT – PROFIBUS fieldbus connection port, which must be unique in the range 1 to 2.

STATION_ADDRESS – Board address in PROFIBUS network. Valid values are 1 to 125.

For example:

PROFIBUS_CREATE 1 10

PROFIBUS_CREATE 2 15

// Create two PROFIBUS connections as follows:

// Fieldbus port 1 with slave address set to 10.

// Fieldbus port 2 with slave address set to 15.

C.3.3.2 Add PROFIBUS data block

This command maps a certain Modbus register range to the PROFIBUS data buffers.

Note: The PROFIBUS board (server (slave)) must have been created before this command is used, using the “PROFIBUS_CREATE” command (see C.3.3.1 Create PROFIBUS board).

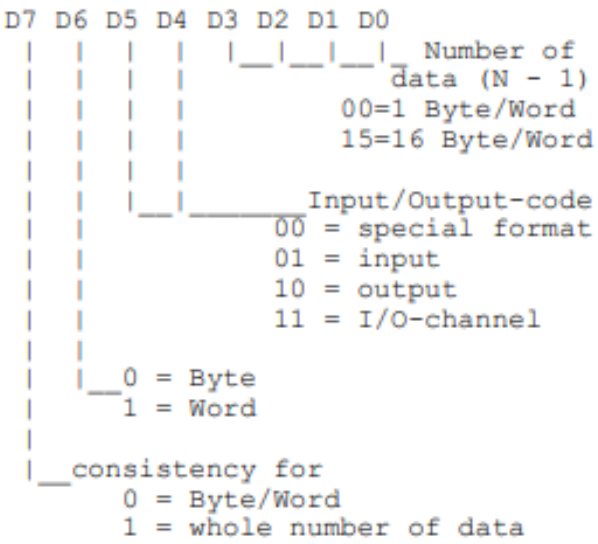
The syntax of the command is:

PROFIBUS_ADD_CFG <FIELDBUS_PORT> <CFG_BYTE> <START_ADDRESS>

Where:

FIELDBUS_PORT – PROFIBUS fieldbus connection port, which must match a value used by a previous “PROFIBUS_CREATE” command. Valid values are 1 or 2.

CFG_BYTE – Data block configuration, in the GSD (general description station) format, as defined in the DIN 19245 T3 standard, section 8.3.5:



Not all possible CFG_BYTE parameter values are currently supported, notably:

- Bits D5-D4 “Input/Output-code” code can be set to either “input” (01) or “output” (10).
- Bit D6 “Byte/Word” must always be set to “Word” (1).
- Bit D7 “Consistency” must always be set to “Byte/Word” (0).

START_ADDRESS – The starting Modbus address from which the number of data defined in CFG_BYTE will be mapped to PROFIBUS. The data are accessed in Modbus address space 3 (holding registers).

For example:

PROFIBUS_ADD_CFG 1 111 00000

// Map 16 words as output (master read) from Modbus address 00000 to PROFIBUS port 1.

PROFIBUS_ADD_CFG 1 95 00000

// Map 16 words as input (master write) from Modbus address 00000 to PROFIBUS port 1.

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