DATA SHEET

vibro-meter®

VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module

MPC4^{Mk2} IOC4^{Mk2}

CE

KEY FEATURES AND BENEFITS

- VibroSight® compatible hardware from the vibro-meter® product line
- VM600^{Mk2} (second generation) machinery protection and condition monitoring module
- 4 dynamic channels and 2 auxiliary channels configurable as either tachometer inputs or DC inputs
- VM600^{Mk2} system safety-line to drive all system relays to a safe state
- Diagnostics (built-in self-test (BIST)) provides continuous feedback on the health of the module
- Individually configurable inputs (with sensor power supply outputs), channel filters, processing and outputs – with simultaneous data acquisition (fixed frequency or order tracked)
- Up to 10 processed outputs per channel
- Multiple alarms per processed output with configurable limits, hysteresis and time delay
- AND, OR and majority voting logic functions for the combination of alarm and status information

KEY BENEFITS AND FEATURES *(continued)*

- Discrete outputs: 4 user-configurable relays for use by alarms and 1 common circuit-fault relay
- Analog outputs: 4 outputs configurable as either 4 to 20 mA or 0 to 10 V
- Conforms to API 670
- Direct system Ethernet communications
- Compatible with VM600^{Mk2} system racks (ABE04x) and slimline racks (ABE056)

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KEY BENEFITS AND FEATURES *(continued)*

- Live insertion and removal of modules (hot-swappable) with automatic reconfiguration
- Software configurable
- Front-panel status indicators (LEDs)

APPLICATIONS

- VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} machinery protection
- VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} condition monitoring (available Q3 2021)
- Vibration and/or combustion monitoring
- API 670 applications

DESCRIPTION

Introduction

The VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module is designed for operation with the second generation of VM600^{Mk2} rack-based machinery protection system (MPS), from Meggitt's vibro-meter® product line. The VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} module consists of processing and input/output (interface) modules that provide 4 dynamic and 2 auxiliary channels of machinery protection and optional condition monitoring in VM600^{Mk2} systems.

VM600^{Mk2} rack-based monitoring systems

The vibro-meter® VM600^{Mk2} rack-based monitoring system is the evolution of Meggitt's solution for the protection and monitoring of rotating machinery used in the power generation and oil & gas industries. VM600^{Mk2} solutions are recommended when a centralised monitoring system with a medium to large number of measurement points (channels) is required. It is typically used for the monitoring and/or protection of larger machinery such as gas, steam and hydro turbines, and generators, smaller machines such as compressors, fans, motors, pumps and propellers, as well as balance-of-plant (BOP) equipment.

A VM600^{Mk2} system consists of a 19" rack, a rack power supply and one or more monitoring modules. Optionally, relay modules and rack controller and communications interface modules can also be included.

Two types of rack are available: a VM600^{Mk2} system rack (ABE04x, 6U) that can house up to twelve monitoring modules, and a VM600^{Mk2} slimline rack (ABE056, 1U) that can house one monitoring module. The racks are typically mounted in standard 19" rack cabinets or enclosures installed in an equipment room.

Different VM600^{Mk2} monitoring modules are available for machinery protection, condition monitoring and/or combustion monitoring applications. For example, the MPC4^{Mk2} + IOC4^{Mk2} module supports both machinery protection and condition monitoring, the XMV16 + XIO16T module supports extended condition monitoring for vibration and the XMC16 + XIO16T module supports extended condition monitoring for combustion.

Note: For the MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module, the machinery protection functionality is available by default, while the condition monitoring functionality is optional and depends on the purchased VibroSight® software license.

The RLC16^{Mk2} relay module is an optional module used to provide additional relays when the four user-configurable relays per MPC4^{Mk2} + IOC4^{Mk2} module are not sufficient for an application.

The CPUM^{Mk2} + IOCN^{Mk2} rack controller and communications interface module is an optional module used to provide additional VM600^{Mk2} system functionality such as fieldbus communications; module data aggregation, processing and sharing; rack and/or fieldbus communications redundancy; front-panel alarm reset (AR); MPS rack (CPUx) security; system event and measurement event logging.

VM600^{Mk2} rack-based monitoring systems complement the VibroSmart® distributed monitoring systems that are also available from Meggitt's vibro-meter® product line, and are compatible with the same VibroSight® machinery monitoring software suite.

DESCRIPTION (*continued*)

MPC4^{Mk2} + IOC4^{Mk2} module and VM600^{Mk2} racks

A MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module is used as part of a VM600^{Mk2} rack-based monitoring system. The MPC4^{Mk2} + IOC4^{Mk2} module can be used in a VM600^{Mk2} system rack (ABE04x) or slimline rack (ABE056).

The MPC4^{Mk2} module is always used with an associated IOC4^{Mk2} module as a pair/set of modules. Both the MPC4^{Mk2} and the IOC4^{Mk2} are single-width modules that occupy a single VM600^{Mk2} rack slot (module position). The MPC4^{Mk2} is installed in the front of a VM600^{Mk2} rack and the associated IOC4^{Mk2} is installed in the rear of the rack, in the slot directly behind the MPC4^{Mk2}. Each module connects directly to the rack's backplane using two connectors.

Note: The MPC4^{Mk2} + IOC4^{Mk2} module is compatible with all VM600^{Mk2} racks (ABE04x system racks and ABE056 slimline racks) and later VM600 racks.

System communications

In a VM600^{Mk2} system (one or more MPC4^{Mk2} + IOC4^{Mk2} modules and any associated RLC16^{Mk2} modules), the main communications interface is the LAN (Ethernet) connector on the front panel of each MPC4^{Mk2} module, which is used for used for communication with the VibroSight® software running on an external computer.

In a VM600^{Mk2} rack (ABE4x), the VME bus can be used to share information between modules in the rack. For example, an MPC4^{Mk2} + IOC4^{Mk2} module can provide information such as measurement, alarm and/or status data to a CPUM^{Mk2} + IOCN^{Mk2} module which can then share the information via one of its industry standard fieldbuses.

In a VM600^{Mk2} system (one or more MPC4^{Mk2} + IOC4^{Mk2} modules and any associated MPC4^{Mk2} modules), the RLC16^{Mk2} modules are controlled and operated by a MPC4^{Mk2}, as determined by the configuration. The VM600^{Mk2} rack's Open collector (OC) bus and Raw bus are used to exchange control and status information between the MPC4^{Mk2} + IOC4^{Mk2} and RLC16^{Mk2} modules.

Relays

The MPC4^{Mk2} + IOC4^{Mk2} module includes five relays. The four user-configurable relays (RL1 to RL4) can be used by a VM600^{Mk2} system to remotely indicate system alarm and/or status information. While, a common circuit-fault relay (FAULT) is used to indicate a problem with the MPC4^{Mk2} + IOC4^{Mk2} module, as detected by the internal diagnostics (BIST).

The relays in a VM600^{Mk2} system (one or more MPC4^{Mk2} + IOC4^{Mk2} modules and any associated RLC16^{Mk2} modules), are driven by control circuitry that supports a VM600^{Mk2} system safety-line, that is, a system-wide control signal that automatically drives all system relays (IOC4^{Mk2} and RLC16^{Mk2}) and analog outputs (IOC4^{Mk2}) to a safe state should a problem be detected. In this way, IOC4^{Mk2} and RLC16^{Mk2} relays configured as normally energised (NE) can always be de-energised in the event of a problem with one of the components of the relay coil control signal.

Note: This supports the "de-energise to trip principle" required in safety-related applications.

Software

MPC4^{Mk2} + IOC4^{Mk2} modules, as part of a VM600^{Mk2} system, are software configured using the VibroSight® software.

To meet stringent cybersecurity and API 670 requirements, the MPC4^{Mk2} + IOC4^{Mk2} module segregates machinery protection (MPS) and condition monitoring (CMS) by using separate configurations and different VibroSight configuration software:

- VibroSight Protect supports the configuration and operation of the machinery protection (MPS) functionality for a VM600^{Mk2} system.
- VibroSight Capture supports the configuration and operation of the condition monitoring (CMS) functionality for a VM600^{Mk2} system.
- 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.

DESCRIPTION (*continued*)

More generally for extended condition monitoring system (CMS) applications, the VibroSight software supports the configuration and operation of XMx16 + XIO16T modules for condition monitoring and/or combustion monitoring, including the processing and presentation of measurement data for analysis. VibroSight is also used to configure and manage CPUM^{Mk2} + IOCN^{Mk2} modules.

Note: The VibroSight® software is also from the vibro-meter® product line.

Applications information

As part of a VM600^{Mk2} system, MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring modules are ideal for the protection and/or condition monitoring of critical assets such as gas, steam or hydro turbines and other high-value rotating machines in a wide range of industrial applications.

For further information, contact your local Meggitt representative.

SPECIFICATIONS

Supported sensors

Currently available : Compatible with a wide range of sensors and measurement chains with current (2-wire) or voltage (3-wire) outputs, including the following sensors from the Meggitt vibro-meter® product line:
- CAxxx vibration sensors (piezoelectric accelerometers)
- CExxx and PVxxx vibration sensors (piezoelectric accelerometers and velocity sensors)
- CVxxx and VExxx vibration sensors (velocity sensors)
- CPxxx dynamic pressure sensors (piezoelectric pressure sensors)
- TQxxx proximity sensors
- LSxxx air-gap sensors.

Dynamic inputs

Number of channels : 4 (independent channels)

Voltage inputs

- DC measurement range : 0 to +20 V_{DC} or 0 to −20 V_{DC}.
  Note: 10 Hz DC filter (see **DC filtering on page 5**).
- AC measurement range : ±20 $V_{PEAK-PEAK}$
- AC + DC measurement range : ±24 $V_{PEAK-PEAK}$

Common-mode voltage range : −50 to +50 V_{DC}

Common-mode rejection ratio (CMRR) : >55 dB, up to 60 Hz.
>60 dB, from 45 to 65 Hz.

Current inputs

- DC measurement range : 0 to 35 mA
- AC measurement range : ±30 $mA_{PEAK-PEAK}$
- AC + DC measurement range : ±50 $mA_{PEAK-PEAK}$

Frequency bandwidth : DC to 20 kHz

Input impedance

- Voltage : ≥100 kΩ, between the differential (high and low) inputs
- Current : 200 Ω ±0.2%

Accuracy

- Amplitude : ±1% of full scale
- Phase : ±1° from 10 Hz to 2 kHz.
  ±15° from 2 to 20 kHz.

Dynamic input range : ≥80 dB, from 3 Hz to 20 kHz

DC filtering

DC filter

- Cutoff frequency (−3 dB) : 10 Hz ±3.5 Hz
- Roll-off : −40 dB/decade (second order)

Note: The DC filter is used to extract the DC part of a dynamic input when it is configured as a DC input.

High-pass filtering

High-pass filter

- Cutoff frequency (−3 dB) : 0.1, 1 or 3 Hz (or bypassed)
- Roll-off : −20 dB/decade (first order)
- Phase error : <1° at 100 times the cutoff frequency (10, 100 or 300 Hz)

Note: The high-pass filter is used to configure a dynamic input for an AC only input signal with one of 3 different cutoff frequencies. This filter can be disabled in order to allow the DC-coupling of the input signal (AC + DC).

SPECIFICATIONS *(continued)*

Auxiliary inputs

Number of channels	: 2 (independent channels) configurable as either tachometer inputs or DC inputs
Common-mode voltage range	: −50 to +50 V_{DC}
Common-mode rejection ratio (CMRR)	: >50 dB, up to 60 Hz. >55 dB, from 45 to 65 Hz.
Tachometer input	
• Triggering method	: Crossing of threshold on rising edge or falling edge of signal
• Triggering threshold	: 2/3 of peak-peak value ±10% for rising edge. 1/3 of peak-peak value ±10% for falling edge.
• Tachometer pulse acquisition/ detection (on input)	: Up to 51.2 kHz. Note: For a one tooth wheel/system.
• Speed / frequency measurement range	: 1 to 100000 RPM / 0.1667 to 1666.67 Hz. Note: Configurable tacho divider of 1 to 255 (pulses per revolution).
• Voltage range	: 0.6 to 50 $V_{PEAK-PEAK}$ from 2 Hz to 10 kHz. 2 to 50 $V_{PEAK-PEAK}$ from 10 kHz to 50 kHz.
Auxiliary input	
• Current range input	: ±50 $mA_{PEAK-PEAK}$ (AC + DC measurement range)
• Voltage range input	: ±50 $V_{PEAK-PEAK}$
DC input	
• Voltage measurement range	: 0 to +20 V_{DC} or 0 to −20 V_{DC}. Note: 10 Hz DC filter (see **DC filtering on page 6**).
• Current measurement range	: ±50 $mA_{PEAK-PEAK}$ (AC + DC input)
Input impedance	
• Voltage	: ≥100 kΩ, between the differential (high and low) inputs
• Current	: 200 Ω ±0.2%
Dynamic input range	: ≥72 dB

DC filtering

DC filter	
• Cutoff frequency (−3 dB)	: 10 Hz ±3.5 Hz
• Roll-off	: −40 dB/decade (second order)

Note: The DC filter is used to extract the DC part of an auxiliary input when it is configured as a DC input.

Sensor / measurement chain OK check

Number of levels	: Up to 16 configurable threshold levels (16 DC regions)
OK level range	
• Voltage inputs	: ±20 V_{DC}
• Current inputs	: 0 to 23 mA
Operating principle	
• SIL safety sensors	: Line-fault detection of conditions such as a problem with the sensor and/or cabling, problem with the signal conditioner, and/or other problem with the measurement chain or power supply. Note: Requires a SIL safety sensor/measurement chain that provides a suitable diagnostic signal (DC bias level), for example, measurement chains using IPC707 or IQS900 signal conditioners.
• Standard sensors	: Powered sensors – line-fault detection of conditions such as open-circuit or short-circuit. Unpowered sensors – line-fault detection of conditions such as open-circuit.

SPECIFICATIONS *(continued)*

Digital signal processing

Analogue to digital converter (ADC)	: 24 bit
Dynamic range	: ≥80 dB
Frequency bandwidth	: 0 Hz to 20 kHz
Accuracy	
• Amplitude	: ≤1% of input full scale
• Phase	: ≤1.5°
Digital filtering	
• Notch filter	: 50 or 60 Hz
• ISO 2954 filter	: 10 Hz to 1 kHz (−3 dB), −24 dB/octave
• Band-pass filter	: <0.1 dB ripple in pass band, >55 dB attenuation in stop band, 0.1 or 3 dB attenuation at cutoff, −24 to −60 dB/octave slope
• High-pass filter	: 0.25 to 400 Hz
• Low-pass filter	: 10 Hz to 20 kHz
Measurement resolution	: 2048 point waveform / 800 line spectrum
FFT window	: Hanning
FFT resolution	: 800 spectral lines
Integration count	: 0, 1 or 2
Qualifiers (rectifiers)	: RMS, Peak, Peak-Peak and Average. Scaled Peak, Scaled Peak-Peak and Scaled Average.
Extracted data (measurements)	: 2 to 10 processed outputs per channel/processing function. See **Processing functions on page 7**.
Extracted data type	: Scalar, Vector
Order tracking	: Digital resampling
Update rate (internal)	: 20 ms min. for time domain processing. 100 ms min. for frequency domain processing.
VibroSight® software update rate (external)	: Configurable as 100 ms, 200 ms, 500 ms, 1 s, 2 s, 5 s, 10 s, 20 s, 50 s, …

Processing functions

The following configurable signal processing blocks and measurements are supported by the MPC4^{Mk2} + IOC4^{Mk2} module:

Single-channel processing

Bearing absolute vibration (BAV) – fixed frequency or order tracked

- Dynamic channels only (piezoelectric vibration sensors)
- ISO 2954 or band-pass filtering
- Up to 10 measurements for fixed-frequency data acquisition: up to 6 time-domain measurements (2 direct and 2 per integration level) and up to 4 frequency-domain measurements
- Up to 6 measurements for order-tracked data acquisition: up to 2 time-domain measurements (2 direct) and up to 4 frequency-domain measurements
- 1 speed measurement from the associated tachometer.

Broad-band pressure (BBP) – fixed frequency or order tracked

- Dynamic channels only (dynamic pressure sensors)
- Band-pass and notch filtering
- Up to 6 measurements for fixed-frequency or order-tracked data acquisition: up to 2 time-domain measurements and up to 4 frequency-domain measurements.

SPECIFICATIONS *(continued)*

Shaft relative vibration (SRV) – fixed frequency or order tracked

- Dynamic channels only (proximity sensors)
- Band-pass filtering
- Up to 6 measurements for fixed-frequency or order-tracked data acquisition:
  up to 2 time-domain measurements and up to 4 frequency-domain measurements (AC displacement)
- 1 quasi-static measurement (DC gap)
- 1 speed measurement from the associated tachometer.

Note: Shaft relative vibration (SRV) processing outputs include both dynamic (AC) and quasi-static (DC) components.

Position/displacement (PS)

- Dynamic or auxiliary channels
- 1 quasi-static measurement (DC gap).

Note: Position/displacement processing is equivalent to the DC gap component of Shaft relative vibration (SRV) processing.

Shaft axial position – collar (SAPC)

- Dynamic or auxiliary channels
- 1 quasi-static measurement (position).

Shaft axial position – shaft end (SAPS)

- Dynamic or auxiliary channels
- 1 quasi-static measurement (position).

Rotor position (RPS)

- Dynamic or auxiliary channels
- 1 quasi-static measurement (position).

Differential expansion – collar (DE)

- Dynamic or auxiliary channels
- 1 quasi-static measurement (position).

Rotor expansion – collar (RE)

- Dynamic or auxiliary channels
- 1 quasi-static measurement (position).

Quasi-static pressure (QSP)

- Dynamic or auxiliary channels
- 1 quasi-static measurement (position).

Quasi-static temperature (QST)

- Dynamic or auxiliary channels
- 1 quasi-static measurement (position).

Speed (SP)

- Auxiliary channels only
- 1 speed measurement.

SPECIFICATIONS *(continued)*

Multi-channel processing

Shaft absolute vibration (SAV)

- Two dynamic channels only – of types BAV and SRV
- Identical filter types and cut off frequencies
- 1 time-domain measurement.

X-Y shaft relative processing (SMAX)

- Two dynamic channels only – of type SRV
- Identical filter types and cut off frequencies
- 1 time-domain S_{max} measurement:
  $S_{max\ (PEAK-PEAK)}$ according to ISO 7919-1 Method B, or
  $S_{max\ (PEAK)}$ or $S_{max\ (PEAK-PEAK)}$ according to ISO 7919-1 Method C.

Dual mathematical function (DMF)

- Two dynamic channels only
- Identical processing types and rectifier types
- 1 mathematically calculated measurement:
  Sum, Subtraction, RMS Sum, RMS Subtraction, Min or Max.

Differential housing expansion (DHE)

- Two dynamic channels only
- Identical processing types and rectifier types
- 1 mathematically calculated measurement:
  Sum, Subtraction, RMS Sum, RMS Subtraction, Min or Max.

Notes
In general, the MPC4^{Mk2} + IOC4^{Mk2} module supports one processing block per input channel.
A maximum of 6 processing blocks can be configured per MPC4^{Mk2} + IOC4^{Mk2} module. A maximum of 3 multi-channel processing blocks can be configured per MPC4^{Mk2} + IOC4^{Mk2} module (two for dynamic input channels and one for auxiliary input channels). There are 2 to 10 processed outputs (data extractions) per processing function, depending on the function.

Alarm processing

Alarms	: Alarm with configurable limits (severity levels), hysteresis and time delay per processed output (data extraction)
Time delay	: Up to 60 s in steps of 100 ms
Hysteresis	: Up to 20% of the alarm level (physical quantity)
Severity levels	
• Machinery protection applications	: Out of range+, Danger+, Alert+, Normal, Alert−, Danger−, Out of range−
• Basic condition monitoring applications	: Out of range+, Danger+, Alert+, Information+, Normal, Information−, Alert−, Danger−, Out of range−
Adaptive monitoring	: Adaptive monitoring uses a control parameter provided by an auxiliary channel (typically speed) to multiply the configured alarm limits by multiple coefficients configured for different ranges of the control parameter. Trip multiplier uses the DSI TM control signal to multiply the configured alarm limits by a single configurable coefficient. See **Discrete signal interface (DSI) inputs on page 10**.

SPECIFICATIONS *(continued)*

Alarm combination

Logic functions	: AND, OR and majority voting logic (1oo2, 2oo2 and 2oo3), with optional inversion of individual inputs
Level 1 (basic) logic functions	
• Number	: 32
• Number of inputs per logic function	: 32
• Configurable inputs	: Sensor OK checks, measurement alarms (such as Danger+, Alert+, Alert− and Danger−) and/or associated data quality indicators (status bits)
Level 2 (advanced) logic functions	
• Number	: 32
• Number of inputs per logic function	: 32
• Configurable inputs	: Outputs from level 1 (basic) logic functions. Note: Level 1 (basic) and level 2 (advanced) logic functions can be combined to generate more complex logic function.
Alarm update rate (internal)	: 100 ms max. Note: This is the time required for the MPC4^{Mk2} + IOC4^{Mk2} module to detect and initiate an alarm, including output relay (RL1 to RL4) activation.

Discrete signal interface (DSI) inputs

Control signal	
• Alarm bypass (AB)	: A closed contact between the DSI AB and RET inputs inhibits the activation of alarms and relays on the MPC4^{Mk2} + IOC4^{Mk2} module. Note: The common circuit-fault relay (FAULT) is activated when Alarm bypass (AB) is enabled.
• Alarm reset (AR)	: A closed contact between the DSI AR and RET inputs resets (clears) the alarms and relays latched by the MPC4^{Mk2} + IOC4^{Mk2} module. Note: The Alarm reset (AR) input is edge-sensitive and a high-to-low transition is required to activate the reset. The Alarm reset (AR) input should not be held low and must transition low-to-high before another reset (high-to-low) can activate the reset.
• Trip multiply (TM)	: A closed contact between the DSI TM and RET inputs multiplies the configured alarm levels for the MPC4^{Mk2} + IOC4^{Mk2} module by a scale factor (software configurable)
Operating principle	: Detection of an open circuit or a closed circuit on the input

Buffered outputs – dynamic channels

Number	: 4
Type	: Buffered outputs (buffered "raw" analog signal). Buffered analog signals corresponding to dynamic channel input channels (CH1 to CH4) are available on BNC connectors on the MPC4^{Mk2} module (front of rack) and on the J2 screw-terminal connector on the IOC4^{Mk2} module (rear of rack). See **Connectors on page 17**.
Frequency bandwidth	: DC to 60 kHz
Output impedance	: <5 Ω

SPECIFICATIONS *(continued)*

Accuracy
- Amplitude : ±0.1 dB up to 20 kHz.
  ±3 dB from 20 to 60 kHz.
- Phase : <1° from 10 Hz to 2 kHz.
  <15° from 2 to 20 kHz.

Transfer ratios
- Voltage input : 1 V/V
- Current input : 0.2 V/mA

Admissible load on output
- Resistance : ≥50 kΩ
- Capacitance : Able to drive up to 3 m of cable with a typical capacitance of 100 pF/m
- Impedance : >50 kΩ with a load capacitance <5 nF

Buffered outputs – auxiliary channels

Number : 2

Type : Buffered outputs (buffered "raw" analog signal or TTL-level signal). Buffered analog signals corresponding to auxiliary input channels (AX1 and AX2) are available on BNC connectors on the MPC4^{Mk2} module (front of rack) and on the J2 connector on the IOC4^{Mk2} module (rear of rack).
See **Connectors on page 17**.
Note: When an auxiliary input is configured as a tachometer input, a buffered TTL-level signal corresponding to the auxiliary input channel (AX1 or AX2) is available on the J2 connector on the IOC4^{Mk2} module (rear of rack). When an auxiliary input is configured as a DC input, no digital TTL-level signal is available.

Frequency bandwidth : DC to 60 kHz

Output impedance
- Buffered TTL-level signal (tachometer input) : <300 Ω
- Buffered "raw" analog signal (DC input) : <5 Ω

Signal levels : 0 to 5 V TTL-compatible signal (non-inverting)

Admissible load on output
- Resistance : >50 kΩ
- Capacitance : Able to drive up to 3 m of cable with a typical capacitance of 100 pF/m
- Impedance : >50 kΩ with a load capacitance <5 nF

Analog outputs

Number of local outputs : 4 single-ended outputs.
Used to output quasi-static measurement signals (DC).
Individually configurable as either current or voltage output signals.

SPECIFICATIONS *(continued)*

Current outputs

- Range : 4 to 20 mA (nominal).
  Two modes of operation are supported, as follows:
  • Mode 1, measured value with quality checks – the analog output is driven in the 4 to 20 mA signal range during normal operation, and the analog output is driven to 2 mA to indicate a problem.
  • Mode 2, measured value without quality checks – the analog output is driven in the 2 to 23 mA signal range.
  Note: Current outputs are 0 mA ± 0.5 mA when disabled.
- Resolution : 10 µA
- Accuracy : ≤1% of full scale
- Admissible load on output : ≤360 Ω.
  Note: Compliance voltage is 10 V min.

Voltage outputs

- Range : 0 to 10 V.
  Note: Voltage outputs are 0 V ±10 mV when disabled.
- Resolution : 2.5 mV
- Accuracy : ≤1% of full scale
- Admissible load on output : ≥50 kΩ with a load capacitance <5 nF

Update rate / frequency bandwidth : 100 ms / 10 Hz max.

Short-circuit protection : Yes

Discrete outputs

Relays

- Number : 5.
  4 × output relays (RL1 to RL4) – suitable for alarm and/or status outputs.
  1 × common circuit-fault relay (FAULT) – for fault indication.
  See **Relay characteristics on page 14**.
- Configurable functions : Normally energized (NE) or normally de-energized (NDE).
  Latched or unlatched.
- Configurable inputs : From the sensor OK checks, the measurement alarms (Danger+, Alert+, Alert−, Danger−) and/or the logic functions of the MPC4^{Mk2} module

Communication interfaces

External (Ethernet)

- Number : 1.
  Available on LAN connector of the MPC4^{Mk2} module.
  See **Connectors on page 17**.
- Network interface : 10/100BASE-TX
- Data transfer rate : Up to 100 Mbps
- Maximum distances : System Ethernet communications can support distances up to 100 m at 100 Mbps, depending on Ethernet cabling.
  For distances greater than the specified maximum, the Ethernet interface operates at reduced data transfer rates.
- Protocols : TCP/IP (proprietary protocols) for communication with a computer running software such as VibroSight®

SPECIFICATIONS *(continued)*

Internal (VME)

- Bus interface : A24/D16 slave mode

Note: In a VM600^{Mk2} rack (ABE4x), the VME bus can be used to share information between modules in the rack. For example, MPC4^{Mk2} + IOC4^{Mk2} modules can provide information such as measurement, alarm and status data to a CPUM^{Mk2} + IOCN^{Mk2} rack controller module which can then share the information via one of its industry standard fieldbuses. While in the opposite direction, a CPUM^{Mk2} + IOCN^{Mk2} rack controller module can issue alarm bypass (AB), alarm reset (AR) and trip multiply (TM) commands to MPC4^{Mk2} + IOC4^{Mk2} modules in the rack (when modules are Unlocked (maintenance operating mode)).

VM600^{Mk2} module compatibility : The MPC4^{Mk2} + IOC4^{Mk2} module is compatible with RLC16^{Mk2} modules as part of a VM600^{Mk2} system.
The MPC4^{Mk2} + IOC4^{Mk2} module includes benefits and features such as improved measurement capability, VM600^{Mk2} system safety-line functionality and module diagnostics (BIST) that are not supported by the VM600^{Mk1} MPC4/IOC4T card pair.
Note: In a VM600^{Mk2} system, the MPC4^{Mk2} module automatically configures its relays as normally energized (NE) or normally de-energized (NDE), as per the configuration created using VibroSight Protect, whereas the VM600^{Mk1} RLC16 relay card uses jumpers on the card to manually configure the relays as NE or NDE.

System communications

External : System communication interface (Ethernet) for communication with VibroSight® software running on an external computer

Internal – VM600^{Mk2} VME : VME bus interface for communication with controlling/processing modules via rack backplane. For example, with a CPUM^{Mk2} + IOCN^{Mk2} rack controller module.

Internal – VM600^{Mk2} rack buses : Open collector (OC) bus and/or Raw bus to share and monitor RLC16^{Mk2} module relays, and distribute the system-wide safety-line control signal.
Raw bus to monitor/share the RLC16^{Mk2} module's status.

Note: Generally, in a VM600^{Mk2} rack (ABE4x), the Raw bus is used to share dynamic input signals between processing modules, the Tacho bus is used to share tachometer (speed) input signals between processing modules, and the Open collector (OC) bus is used by processing modules to drive relay modules, all in the same rack. For example, the Raw bus and the Tacho bus are commonly used to share sensor signals (vibration and speed respectively) between different machinery protection modules and/or condition monitoring modules.

Specifically for a VM600^{Mk2} system in a VM600^{Mk2} rack (ABE4x), the Open collector (OC) bus and/or Raw bus can be used to connect up to 32 outputs from a MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module to RLC16^{Mk2} relay modules in the same rack, if additional relays are required.

External communication links/connections

- Connection to a computer/network : The system communication interface (LAN connector on MPC4^{Mk2} module) can be used for connections/communications between the MPC4^{Mk2} module and a computer/network, using standard Ethernet cabling. See **Connectors on page 17**.
- VibroSight® software : Used for the configuration of a VM600^{Mk2} system (one or more MPC4^{Mk2} + IOC4^{Mk2} modules and any associated RLC16^{Mk2} modules)

SPECIFICATIONS *(continued)*

Configuration

MPC4^{Mk2} + IOC4^{Mk2} module : Software configurable via/over Ethernet, using a computer running the VibroSight® software.
The IOC4^{Mk2} includes non-volatile memory that stores a copy of the configuration for the MPC4^{Mk2} + IOC4^{Mk2} module, such that if the MPC4^{Mk2} is replaced (hot-swapped), it is automatically reconfigured using the configuration from the IOC4^{Mk2}.
Note: Jumpers on the IOC4^{Mk2} module are manually configured to select the VM600^{Mk2} rack's Open collector (OC) bus and/or Raw bus lines that control and monitor the module's relays, and distribute the system-wide VM600^{Mk2} system safety-line control signal. The jumper information is generated by the VibroSight® software.

Relay characteristics

Number : 4 × user-configurable relays (RL1 to RL4).
1 × common circuit-fault relay (FAULT).

Type : Single-pole double-throw (SPDT) / 1 Form C, epoxy-sealed or equivalent

Contact arrangement : 1 × COM, 1 × NC and 1 × NO contact per relay (RL1 to RL4 and FAULT).
Additional fused contact (1 × COM FUSED) for common circuit-fault relay (FAULT) only.
See **Relay fuse on page 15** and **Connectors on page 17**.

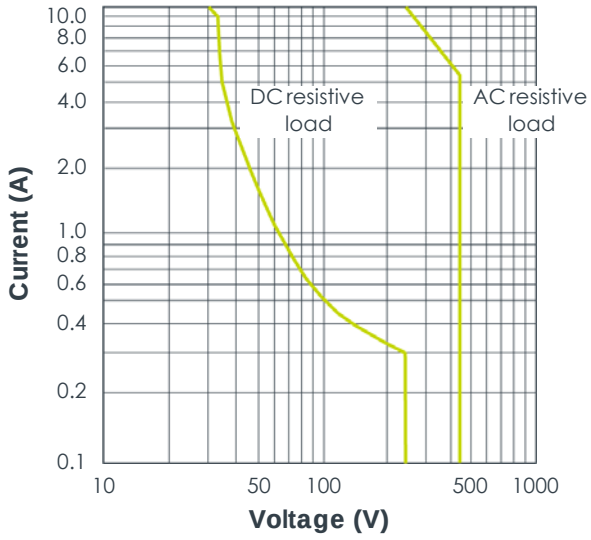
Maximum switching power : 440 V_{AC} / 125 V_{DC}

Maximum switching voltage : 2500 VA / 300 W.
Note: If the switching voltage is >30 V_{DC}, then special precautions must be taken. Contact Meggitt SA for more information.

Maximum switching current : 10 A

Safety approved contact rating : 10 A at 250 V_{AC} / 10 A at 30 V_{DC}

Maximum switching capacity curves :



Operate / release time : 7 / 3 ms typ.

SPECIFICATIONS *(continued)*

Dielectric strength	
• Between open contacts	: 1000 $V_{AC\ (RMS)}$
• Between contact and coil	: 5000 $V_{AC\ (RMS)}$
Insulation resistance	: 1000 MΩ min. (at 500 V_{DC}, 50% relative humidity (RH))
Mechanical life	: >1 × 10^7 operations
Electrical life	: >1 × 10^5 operations (at 8 A, 250 V_{AC})

⚠ **When used in a VM600^{Mk2} slimline rack (ABE056) with a DC power supply, the relay contacts on an IOC4^{Mk2} module have a maximum switching voltage of 70 V_{DC} / 33 $V_{AC\ (RMS)}$ (46.7 $V_{AC\ (PEAK)}$).**

Relay fuse

Contact	: Fused contact (COM FUSED) for common circuit-fault relay (FAULT) only. See **Relay characteristics on page 14** and **Connectors on page 17**.
Type	: Littelfuse 443 series NANO$^{2®}$ 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

Environmental

Temperature	
• Operating	: −20 to 65°C (−4 to 149°F)
• Storage	: −40 to 85°C (−40 to 185°F)
Humidity	
• Operating and storage	: 0 to 95% relative humidity (RH), non-condensing
Altitude	: 2000 m (6560 ft) max. Note: Reduced air density affects cooling ability.

Approvals

Conformity	: CE marking, European Union (EU) declaration of conformity
Electromagnetic compatibility	: EN 61000-6-2:2005. EN 61000-6-4:2007 + A1:2011.
Electrical safety	: EN 61010-1:2010. CAN/CSA-C22.2 No. 61010-1.
Environmental management	: RoHS compliant (2011/65/EU)
Insulation coordination for measuring relays and protection equipment	: Separate circuits according to IEC 60255-27

Note: Some certifications and approvals for the VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} module are pending.

SPECIFICATIONS *(continued)*

Power supply to module (input)

Power source	: VM600^{Mk2} rack power supply
Supply voltages	: +5 V_{DC} and ±12 V_{DC}
Consumption	
• *MPC4^{Mk2}*	: <6 W
• *IOC4^{Mk2}*	: <9 W
Total power consumption (MPC4^{Mk2} + IOC4^{Mk2} module)	: <15 W

Power supplies to sensors (output)

Number	: 6 × independent sensor power supplies. Note: One per input/channel (CH1 to CH4, AX1 and AX2).
Power supply output	
• Constant voltage	: +24 *or* −24 V_{DC} ±3% at up to 35 mA max. Note: Short-circuit protected.
• Constant current	: +6 mA ±1%. Note: Voltage compliance >22 V_{DC}.

Control inputs

MPC4^{Mk2}

• Button 1 (left)	: Used to run the proof test for the MPC4^{Mk2} + IOC4^{Mk2} module
• Button 2 (right)	: Used to lock/unlock the MPC4^{Mk2} + IOC4^{Mk2} module, that is, to switch between the main operating modes of a VM600^{Mk2} system (MPC4^{Mk2} + IOC4^{Mk2} modules and any associated RLC16^{Mk2} modules), as follows: • Locked (secure operating mode) – the VM600^{Mk2} system performs its monitoring and protection functions while ensuring the security of the modules/system and it's configuration. That is, the configuration cannot be changed and maintenance activities cannot be performed. • Unlocked (maintenance operating mode) – the VM600^{Mk2} system performs its monitoring and protection functions without ensuring the security of the modules/system and it's configuration. That is, the configuration can be changed and maintenance activities can be performed. Note: Physical access to a VM600^{Mk2} system (specifically, the MPC4^{Mk2} module) is required in order to change the operating mode and therefore to be able to change the machinery protection (MPS) functionality for a VM600^{Mk2} system.
• Reset	: Simultaneously pushing buttons 1 (left) and 2 (right) is used to reset the MPC4^{Mk2} + IOC4^{Mk2} module and any associated RLC16^{Mk2} modules (VM600^{Mk2} system), resulting in a reboot and power-on self-test (POST)

IOC4^{Mk2}

• DSI signals	: See **Discrete signal interface (DSI) inputs on page 10**

SPECIFICATIONS *(continued)*

Status indicators (LEDs)

MPC4^{Mk2}

- DIAG/STATUS : Multicolour LED used to indicate the status of the MPC4^{Mk2} + IOC4^{Mk2} module, such as normal operation, configuration status or internal hardware or firmware failures
- CH1 to CH4 : Multicolour LEDs used to indicate the status of the dynamic channels (CH1 to CH4)
- AX1 and AX2 : Multicolour LEDs used to indicate the status of the auxiliary channels (AX1 and AX2)
- LOCK : LED used to indicate the main operating mode of the MPC4^{Mk2} + IOC4^{Mk2} module (VM600^{Mk2} system):
  Locked (safety operating mode) or
  Unlocked (maintenance operating mode)
- LAN : Separate Link and Activity LEDs to indicate the status of system LAN (Ethernet) communications

Connectors

MPC4^{Mk2}

- CH1 to CH4 : BNC connectors (female).
  Buffered "raw" sensor/measurement chain signals for the dynamic channel inputs (CH1 to CH4).
  Note: For the dynamic channels, the buffered "raw" outputs are analog signals.
- AX1 and AX2 : BNC connectors (female).
  Buffered "raw" sensor/measurement chain signals for the auxiliary channel inputs (AX1 and AX2).
  Note: For the auxiliary channels, the buffered "raw" outputs are analog signals. Corresponding digital signals are available on J2.
- LAN : 8P8C (RJ45) modular jack, female.
  System Ethernet for communication between the MPC4^{Mk2} + IOC4^{Mk2} module and a computer running the VibroSight® software.

IOC4^{Mk2}

- J1 : 24-pin S2L connector (male), 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.
  Inputs (analog signals) for the dynamic channels (CH1 to CH4) and the auxiliary channels (AX1 and AX2).
- J2 : 36-pin S2L connector (male), 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.
  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).
  Inputs and ground reference (digital signals) for the DSI control signals (AB, AR and TM).
  Outputs (analog signals) for the analog DC outputs.

SPECIFICATIONS *(continued)*

• J3	: 16-pin connector (male), compatible with 16-pin MC/STF plug-in connectors (female) with screw-terminal connections. Outputs (contacts) for the common circuit-fault relay (FAULT) and the user-configurable relays (RL1 to RL4).

Notes
The connectors are removable to simplify installation and mounting.
There is 1 × COM, 1 × NC and 1 × NO contact available per user-configurable relay (RL1 to RL4).
There is 1 × COM, 1 × COM FUSED, 1 × NC and 1 × NO contact available per common circuit-fault relay (FAULT).

Physical

MPC4^{Mk2}

• Height	: 6U (262 mm, 10.3 in)
• Width	: 20 mm (0.8 in)
• Depth	: 187 mm (7.4 in)
• Weight	: 0.42 kg (0.93 lb) approx.

IOC4^{Mk2}

• Height	: 6U (262 mm, 10.3 in)
• Width	: 20 mm (0.8 in)
• Depth	: 125 mm (4.9 in)
• Weight	: 0.31 kg (0.68 lb) approx.

ORDERING INFORMATION

To order please specify

Type	Designation	Ordering number (PNR)
MPC4^{Mk2}	Different versions of the VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} processing module:	
	– Standard version	600-041
IOC4^{Mk2}	Different versions of the VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} input/output module:	
	– Standard version	600-043

Notes

Different versions of the VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module are available with an optional conformal coating ("varnish") applied to the circuitry of the modules in order to provide additional environmental protection against chemicals, dust, moisture and temperature extremes.

The VM600^{Mk2} MPC4^{Mk2} + IOC4^{Mk2} machinery protection and condition monitoring module supports both machinery protection and condition monitoring (available Q3 2021).
The available functionality is determined by VibroSight® software licensing, as follows:

- Machinery protection functionality is always enabled.
  That is, MPC4^{Mk2} + IOC4^{Mk2} modules are restricted to machinery protection only by default VibroSight software licensing.
- Condition monitoring functionality can be enabled, as required.
  That is, MPC4^{Mk2} + IOC4^{Mk2} modules can be configured to use condition monitoring by purchasing a VibroSight software license with an order option code that specifically enables the additional condition monitoring functionality.

RELATED PRODUCTS

ABE04x	VM600^{Mk2} system racks	: Refer to corresponding data sheet
ABE056	VM600^{Mk2} slimline rack	: Refer to corresponding data sheet
CPUM^{Mk2} + IOCN^{Mk2}	VM600^{Mk2} rack controller and communications interface module	: Refer to corresponding data sheet
RLC16^{Mk2}	VM600^{Mk2} relay module	: Refer to corresponding data sheet
XMx16 + XIO16T	VM600^{Mk2} condition monitoring module	: Refer to corresponding data sheet

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The Energy & Equipment division includes the Energy Sensing and Controls product group that specialises in sensing and monitoring solutions for a broad range of energy infrastructure, and control valves for industrial gas turbines, primarily for the Power Generation, Oil & Gas and Services markets. Energy & Equipment is headquartered in Switzerland (Meggitt SA) and incorporates the vibro-meter® product line, which has over 65 years of sensor and systems expertise and is trusted by original equipment manufacturers (OEMs) globally.

In this publication, a dot (.) is used as the decimal separator and thousands are separated by thin spaces. Example: 12345.67890.

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