

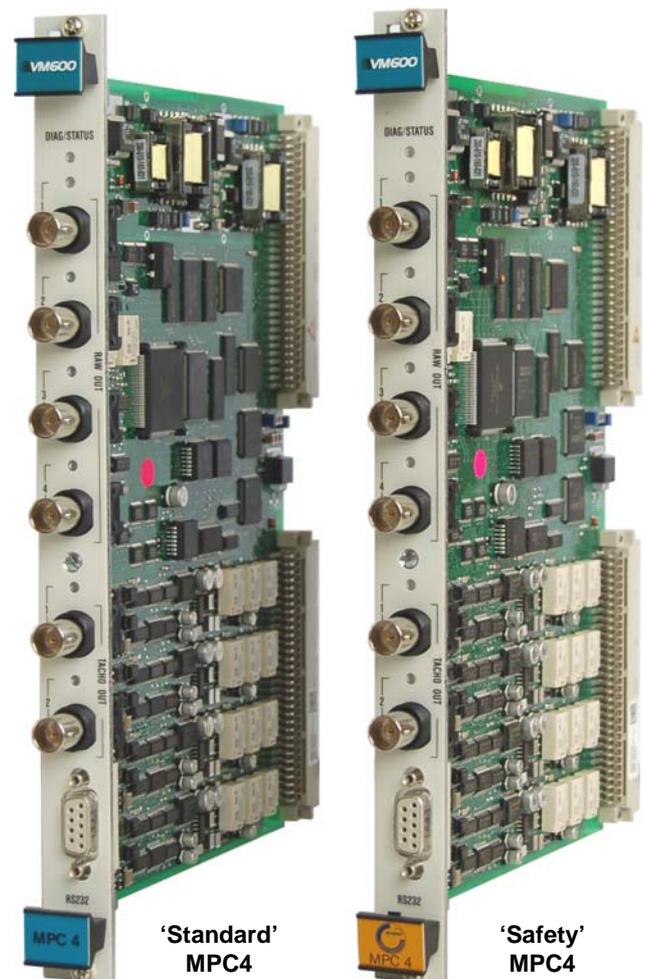


MPC4

Machinery protection card Type MPC4

FEATURES

- » From the Vibro-Meter® product line
- » Continuously online machinery protection card
- » Real-time measurement and monitoring using state-of-the-art DSP techniques
- » 4 dynamic signal inputs and 2 tachometer (speed) inputs, all individually programmable
- » Programmable broad-band and narrow-band filters
- » Simultaneous amplitude and phase monitoring in order tracking mode
- » Programmable Alert, Danger and OK set points
- » Adaptive Alert and Danger levels
- » Front panel BNC connectors for easy analysis of raw signals
- » 7 front panel LEDs show status and alarms
- » Integrated power supply for many Vibro-Meter front-ends, including ICP accelerometers and proximity systems
- » Live insertion and removal of cards
- » Available in 'standard', 'separate circuits' and 'safety' (SIL) versions



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DESCRIPTION

MPC4 card

The MPC4 machinery protection card is the central element in the VM600 series machinery protection system (MPS), from Meggitt Sensing Systems' Vibro-Meter® product line. This very versatile card is capable of measuring and monitoring up to four dynamic signal inputs and up to two speed inputs simultaneously.

The dynamic signal inputs are fully programmable and can accept signals representing acceleration, velocity and displacement (proximity), among others. On-board multi-channel processing allows measurement of various physical parameters, including relative and absolute vibration, S_{max} , eccentricity, thrust position, absolute and differential housing expansion, displacement and dynamic pressure.

Digital processing includes digital filtering, integration or differentiation (if required), rectification (RMS, mean value, true peak or true peak-to-peak), order tracking (amplitude and phase) and measurement of the transducer-target gap.

The speed (tachometer) inputs accept signals from a variety of speed sensors, including systems based on proximity probes, magnetic pulse pick-up sensors or providing TTL signals. Fractional tacho ratios are also supported.

The calibration may be expressed in metric or imperial units. Alert and Danger set points are fully programmable, as are alarm time delay, hysteresis and latching. The Alert and Danger levels can be adapted as a function of the speed or any external information.

A digital output is available internally (on the corresponding IOC4T card) for each alarm level. These alarm signals may be routed on a bus within the VM600 rack to drive relays on optional relay cards (such as the IRC4 and RLC16).

The processed dynamic (vibration) signals and speed signals are available at the rear of the rack (on the front panel of the IOC4T) as analog output signals. Voltage-based (0 to 10 V) and current-based (4 to 20 mA) signals are provided.

The MPC4 performs a self-test and diagnostic routine on power-up. In addition, the card's built-in "OK System" continuously monitors the level of signals provided by the sensors and indicates any

problem due to a broken transmission line, faulty transducer or conditioner.

An LED indicator on the MPC4 front panel indicates whether a processing or hardware error has occurred. Six additional LEDs (one per input channel) indicate whether the OK System has detected a fault and whether an alarm has occurred on the channel.

The MPC4 card is available in three versions: a 'standard' version, a 'separate circuits' version and a 'safety' (SIL) version, all of which function as a card pair using an IOC4T input/output card.

'Standard' and 'safety' (SIL) versions of the MPC4

Both the 'standard' version and the 'safety' (SIL) version of the MPC4 card are certified to IEC 61508 and ISO 13849.

The 'standard' MPC4 card is the original version, intended for safety systems using a VM600 rack with a limited range of cards, that is, 'standard' MPC4 / IOC4T card pairs and RLC16 relay cards. It has a VME-compatible slave interface and is fully software configurable via RS-232 (on the front panel of the card) or VME.

The 'safety' MPC4 card, also known as the MPC4 SIL, was developed to permit a wider range of installation options. Specifically, VM600 racks that also contain condition monitoring cards (such as the CMC16 and XMx16) and relay cards (such as the IRC4 and RLC16). To safety certify these configurations, it was necessary to ensure that the 'safety' MPC4 is isolated from the other cards in a VM600 rack, so that there is no possibility of its configuration being inadvertently modified.

Therefore, the 'safety' (SIL) version of the MPC4 does not include a VME-compatible slave interface, nor does it provide all of the signal processing capabilities of the 'standard' MPC4 card (see Specifications – 'standard' and 'separate circuits' MPC4 cards only on page 6).

Segregation of MPS and CMS

The VM600 rack, machinery protection cards, condition monitoring cards and associated software are designed for compliance with the machinery protection system (MPS) and condition monitoring system (CMS) "segregation" requirements of the API 670 standard, which ensures that the functionality of the MPS does not depend on and is not

DESCRIPTION *(continued)*

compromised in any way by the operation of the CMS.

So although machinery protection cards and condition monitoring cards can easily share sensor signals from measurement chains, MPC4/IOC4T card pairs do not share any communication buses with XMx16/XIO16T condition monitoring card pairs in a VM600 rack, and MPC4/IOC4T card pairs are configured and operated using the VM600 MPSx software (while XMx16/XIO16T card pairs are configured and operated using the VibroSight® software).

Applications information

The MPC4 cards are highly suitable for machinery protection in a wide range of industrial applications. For further information on the use of MPC4 cards, refer to the *VM600 Functional Safety Manual MAVM600-FS/E*. For specific applications, contact your nearest Meggitt Sensing Systems representative.

SPECIFICATIONS – ALL MPC4 CARDS**Dynamic signal inputs**

Number of inputs	: 4 per MPC4 card
DC range	: 0 to +20 V or 0 to –20 V
AC range	: ±10 V (maximum)
Common mode voltage range	: –50 to +50 V
CMRR	: >60 dB at 50 Hz
Crosstalk	: –72 dB
Input impedance	: 200 kΩ
Current input range	
• DC signals	: 0 to 25 mA
• AC signals	: ±8 mA (maximum)
Analog AC frequency band (without integration)	: 0.1 Hz to 10 kHz
Analog AC frequency band (with integration)	: 2.5 Hz to 10 kHz
Analog frequency band for throughput to other cards and buffered AC outputs	: DC to 60 kHz (–3 dB)
Current measuring resistor	: 324.5 Ω

Processing options**Broad-band**

Filtering options	: High-pass, low-pass or band-pass
LP/HP ratio in pass band	: 500 (maximum)
Ripple	: ±0.3 dB
Slope	: 6 to 60 dB/octave (software configurable)
Attenuation outside pass band	: >50 dB
Amplitude accuracy	: ±1% of full-scale
Linearity error	: <±1%
Equivalent input noise (without integration)	: <200 μV RMS

SPECIFICATIONS – ALL MPC4 CARDS *(continued)*

Narrow-band (tracking)

The 'standard' and 'separate circuits' versions of the MPC4 card support narrow-band tracking (see Specifications – 'standard' and 'separate circuits' MPC4 cards only on page 6).

The 'safety' MPC4 card does not support narrow-band tracking.

Relative shaft vibration

Frequency band

- *Vibration* : 0.1 Hz to 10 kHz
- *Gap/position* : DC to 1 Hz

Amplitude accuracy

- *Vibration* : $\pm 1.2\%$ of full-scale
- *Gap/position* : $\pm 1\%$ of full-scale
- *Linearity error* : $< \pm 1\%$

Initial gap/offset compensation : Available

Buffered (raw) dynamic signal outputs

These signals are available on the MPC4 card's BNC outputs and the IOC4T card's raw outputs.

Frequency range : DC to 10 kHz (-0.1 dB or 1%).
DC to 60 kHz (-3 dB).

Admissible load on output : > 50 k Ω

Amplitude error : $< 2\%$

Phase error : $< 5^\circ$ (DC to 10 kHz)

Transfer ratio

- *Voltage input* : 1 V/V
- *Current input* : 0.3245 V/mA

Speed/phase reference inputs and outputs

The 'standard' and 'separate circuits' versions of the MPC4 card support speed/phase reference inputs and outputs (see Specifications – 'standard' and 'separate circuits' MPC4 cards only on page 6).

The 'safety' MPC4 card does not support speed/phase reference inputs and outputs.

Alarm programming

Level detectors

- *Vibration systems* : Over-level switching (A+, D+) and under-level switching (A-, D-)
- *Accelerometer systems* : Over-level switching (A+, D+)
- *Speed channel* : 2 Alert levels (A-, A+)

Alarm scanning interval : 100 ms (maximum)

Alarm level value : User-programmable within range

Hysteresis : User-programmable within range

Latching : User-programmable within range

Alarm delay time : User-programmable within range

Alarm outputs : Individual alarms and common alarms (open-collector transistor)

Adaptation criteria (for adaptive monitoring) : Speed or digital input

Logical combinations : AND, OR, majority voting logic

Number of logical combinations : 8 basic functions and 4 advanced functions

SPECIFICATIONS – ALL MPC4 CARDS *(continued)***OK system**

Range	: -20 to +20 V
Operating principle	
• <i>Powered sensors</i>	: DC voltage monitoring (open circuit and short circuit line check)
• <i>Unpowered sensors</i>	: Open circuit line check only

Transducer power supply

Voltage power supply	: +27.2 V $\pm 5\%$ in the range 0 to 25 mA. -27.2 V $\pm 5\%$ in the range 0 to 25 mA. +15.0 V $\pm 5\%$ in the range 0 to 25 mA.
Current power supply	: 6.16 mA $\pm 5\%$ in the range 1 to 23 V
Over-current protection (on-board)	: 11.0 A on +5 V line

Power supply to MPC4 card

Supply voltage	: 5 V _{DC} $\pm 5\%$ and ± 12 V _{DC}
Consumption from +5 V _{DC} supply	: 12.5 W, plus an additional 1 W per sensor used
Consumption from ± 12 V _{DC} supply	: 2.5 W (maximum)

Communications

VME bus	: D16 / A24 slave mode. The 'standard' and 'separate circuits' versions of the MPC4 card include a VME bus. The 'safety' MPC4 card does not include a VME bus.
RS-232 port	: Configuration port, proprietary protocol
Bus to IOC4T card	: IP (Industry Pack)

Notes: The 'standard' and 'separate circuits' versions of the MPC4 card are fully software configurable via RS-232 or VME. The 'safety' MPC4 card is fully software configurable via RS-232 only.

Environmental

Operating	
• <i>Temperature</i>	: -25 to +65°C (-13 to +149°F)
• <i>Humidity</i>	: 0 to 90% non-condensing
Storage	
• <i>Temperature</i>	: -40 to +85°C (-40 to +185°F)
• <i>Humidity</i>	: 0 to 95% non-condensing

Physical

Height	: 6U (262 mm, 10.3 in)
Width	: 20 mm (0.8 in)
Depth	: 187 mm (7.4 in)
Weight	: 0.40 kg (0.88 lb)

SPECIFICATIONS – ‘STANDARD’ AND ‘SEPARATE CIRCUITS’ MPC4 CARDS ONLY

Processing options

Narrow-band (tracking)

Constant Q filter	: Q = 28
Frequency range	: 0.15 Hz to 10 kHz
Max. frequency ratio in selected band	: $f_{upper} / f_{lower} = 25$
Rate of change of speed	: 450 Hz/sec. (in band 25 to 500 Hz)
Order extraction	: 1/3 X, 1/2 X, 1X, 2X, 3X, 4X
Phase error	: $< \pm 6^\circ$ maximum. $< \pm 1^\circ$ typical (with order = 1X).
Amplitude accuracy	: $\pm 1.2\%$
Linearity error	: $< \pm 1\%$

Speed/phase reference inputs

Number of inputs	: 2 per MPC4 card
Triggering method	: Crossing of thresholds on rising/falling edge of signal
Triggering thresholds	: Rising = 2/3 of peak-peak value, falling = 1/3 of peak-peak value
Tacho range	: 0.016 Hz to 50 kHz on input. 0.016 Hz to 1092 Hz (1 to 65535 RPM) after division by the “wheel teeth number”.
Speed resolution	: 0.001 Hz (internal)
Input voltage range	: 0.4 to 500 Vpp in the range 0.3 Hz to 10 kHz. 2.0 to 500 Vpp in the range 10 kHz to 50 kHz.
Minimum input voltage for reliable detection	
• <i>Square-wave input signal</i>	: 0.8 Vpp (0.016 Hz to 10 kHz). 2.0 Vpp (10 kHz to 50 kHz).
• <i>Sinusoidal input signal</i>	: 10 Vpp (0.016 Hz to 1 Hz). 2.0 Vpp (1 Hz to 10 Hz). 0.8 Vpp (10 Hz to 10 kHz). 2.0 Vpp (10 kHz to 50 kHz).
Range of DC component	: -20 to +20 V

 For speed/phase reference input channels, it can be more difficult to achieve the minimum input voltage required when current is selected as the signal transmission mode. Therefore, the 200 Ω current-to-voltage conversion resistor used by the MPC4 card for current-modulated input signals should be used in any system design calculations in order to ensure reliable detection.

Speed/phase reference outputs

BNC outputs	: TTL compatible
Outputs to IOC4T and Tacho Bus (VM600 rack)	: TTL compatible
Speed resolution	: 1 RPM (external)

ORDERING INFORMATION

To order please specify

Type	Designation	Ordering number
MPC4	Machinery protection card: 'Standard' version	200-510-SSS-1Hh
	'Separate circuits' version, in accordance with CEI/IEC 60255-5	200-510-SSS-2Hh
	'Safety' (SIL) version, safety certified in accordance with IEC 61508 and ISO 13849	200-510-SSS-3Hh

Note: "SSS" represents the firmware (embedded software) version and "Hh" the hardware version. "H" increments are for major modifications that can affect product interchangeability. "h" increments are for minor modifications that have no effect on interchangeability.

Headquartered in the UK, Meggitt PLC is a global engineering group specializing in extreme environment components and smart sub-systems for aerospace, defence and energy markets.

Meggitt Sensing Systems is the operating division of Meggitt specializing in sensing and monitoring systems, which has operated through its antecedents since 1927 under the names of ECET, Endevco, Ferroperm Piezoceramics, Lodge Ignition, Sensorex, Vibro-Meter and Wilcoxon Research. Today, these operations are integrated under one strategic business unit called Meggitt Sensing Systems, headquartered in Switzerland and providing complete systems, using these renowned brands, from a single supply base.

The Meggitt Sensing Systems facility in Fribourg, Switzerland was formerly known as Vibro-Meter SA, but is now Meggitt SA. This site produces a wide range of vibration and dynamic pressure sensors capable of operation in extreme environments, leading-edge microwave sensors, electronics monitoring systems and innovative software for aerospace and land-based turbo-machinery.



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