Extended vibration monitoring card pair

FEATURES

» From the Vibro-Meter® product line

» Designed for operation with the VibroSight® software total monitoring solution

» 16 dynamic vibration channels and 4 tachometer channels, all individually configurable

» Simultaneous data acquisition on all channels

» Up to 20 configurable processed outputs per channel

» High-resolution FFT up to 6400 lines every 1 s

» Configurable asynchronous and synchronous sampling

» 24-bit data acquisition and high SNR data processing, with data quality checks

» 5 configurable severities per processed output and 8 detection levels with hysteresis and time delay

» Supports signal sharing in VM600 racks

» EMI protection on all inputs

» Live insertion and removal of cards (hot-swappable)

» Direct gigabit Ethernet communication

» Hardware is fully software configurable

APPLICATIONS

» Condition monitoring and vibration analysis, such as the general analysis of rotating machinery and rotor dynamics

XMV16

XIO16T

DESCRIPTION

Extended vibration monitoring card pair

The XMV16 / XIO16T extended vibration monitoring card pair consists of an XMV16 extended vibration monitoring card and an XIO16T extended input/ output card. This card pair provides all of the interfacing and signal processing functions required of an intelligent data acquisition system and is a central element in the VM600 series Total Monitoring Solution, from Meggitt Sensing Systems' Vibro-Meter® product line. The cards are designed for operation with the VibroSight® software – to acquire and analyse your vibration data before communicating the results directly to a host computer using the on-board Ethernet controller.

The XMV16 card is installed in the front of the rack and the XIO16T card is installed in the rear. Either a VM600 standard rack (ABE04x) or slimline rack (ABE056) can be used and each card connects directly to the rack's backplane using two connectors.

The XMV16 / XIO16T card pair is fully software configurable and can be programmed to capture data based on time (for example, continuously at scheduled intervals), events, machine operating conditions or other system variables. Individual measurement channel parameters including frequency bandwidth, spectral resolution, windowing function and averaging can also be configured to meet the needs of specific applications.

Extended vibration monitoring card

The XMV16 card performs the analogue to digital conversion and all of the digital signal processing functions, including the processing for each processed output (waveform or spectrum).

The XMV16 card acquires and processes data in high-resolution (24-bit ADC) to generate the desired waveforms and spectra. The main data acquisition mode (principal mode) performs continuous data acquisition that is suitable for normal operation, increasing vibration levels and transient operations.

The 20 available processed outputs per channel can provide any configurable band based on the asynchronously or synchronously acquired waveforms and spectra. A range of rectifier functions are available, including RMS, peak, peak-to-peak, true peak, true peak-to-peak and DC (Gap). Outputs are available for display to any standard (metric or imperial).

Various methods of averaging can be performed at the processing block level and at the output (extracted data) level. The multi-channel processing functions supported include absolute shaft vibration, full spectrum, orbit and filtered orbit, shaft centerline and S_{max}.

Events are generated when values exceed one of five user configurable severities or exceed rate-of-change alarms. The amount of pre-event and post-event data buffered in the on-board memory is configurable.

Machine states, such as full load (onload), overspeed and transient are detected from checks of the reference speed against trigger levels. These states can be used by the software's machine operating conditions to control system behaviour. Typically, higher density logging is available depending on machine operating conditions, configurable speed and time intervals, or any other process parameter.

Extended input/output card

The XIO16T card acts as a signal interface for the XMV16 card, performs all of the analogue signal conditioning and also supports the external communications. In addition, it protects all inputs against signal surges and EMI to meet EMC standards.

The XIO16T card's inputs are fully software configurable and can accept signals representing speed and phase reference (for example, from TQ xxx sensors) and vibration derived from acceleration, velocity and displacement (for example, from CA xxx, CE xxx, CV xxx and TQ xxx sensors). The inputs also accept any dynamic or quasi-static signals that are appropriately signal conditioned.

Externally, the XIO16T card interfaces to the transmission cables coming from the sensor system's transducers and conditioners using the rear connectors. Internally, input signals can be shared between cards in a VM600 rack (including with MPC4 machinery protection cards) using the VM600 tacho bus and raw bus, which reduces external wiring requirements.

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

DESCRIPTION *(continued)*

API 670 standard, which ensures that the functionality of the MPS does not depend on and is not 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, XMx16/XIO16T card pairs do not share any communication buses with MPC4/IOC4T machinery protection card pairs in a VM600 rack, and XMx16/XIO16T card pairs are configured and operated using the VibroSight® software (while MPC4/IOC4T card pairs are configured and operated using the VM600 MPSx software).

Applications information

This extended vibration monitoring card pair is highly suitable for vibration monitoring in a wide range of industrial applications. See the VibroSight software data sheet for further information. For specific applications, contact your nearest Meggitt Sensing Systems representative.

SPECIFICATIONS

Speed and phase reference (tachometer) inputs

Number of independent channels	: 4
Speed measurement	: 1 to 100 000 RPM (0.017 Hz to 1.667 kHz)
Speed measurement resolution	: 5 ns
Edge detection	: Rising or falling
Input signal type	: Tachometer channels 1 and 2 support voltage and current inputs. Tachometer channels 3 and 4 support voltage inputs only.
Current measuring resistor	: 200 Ω
Tachometer voltage range	: −20 to +20 V_{DC}
Tachometer current range	: −30 to +30 mA
Input impedance	: ≥100 kΩ
Maximum pulses per revolution	: 128 for speed calculation 1 only for phase reference
Triggering thresholds	: Rising = ⅔ of peak-to-peak value, falling = ⅓ of peak-to-peak value
Input voltage range	: 0.8 to 500 $V_{peak-to-peak}$ in range 0.3 Hz to 10 kHz 2.0 to 500 $V_{peak-to-peak}$ in range 10 kHz to 50 kHz

Minimum input voltage for reliable detection

• *Square-wave input signal*	: 0.8 $V_{peak-to-peak}$ (0.016 Hz to 10 kHz) 2.0 $V_{peak-to-peak}$ (10 kHz to 50 kHz)
• *Sinusoidal input signal*	: 10.0 $V_{peak-to-peak}$ (0.016 Hz to 1 Hz) 2.0 $V_{peak-to-peak}$ (1 Hz to 10 Hz) 0.8 $V_{peak-to-peak}$ (10 Hz to 10 kHz) 2.0 $V_{peak-to-peak}$ (10 kHz to 50 kHz)
Range of DC component	: −20 to +20 V
Maximum common mode voltage	: ±50 V
Protection filters	: Filtered for protection against EMI (electromagnetic interference), conforming to CE standards

VM600 rack signal sharing

• *XMV16 and XMVS16*	: To and from the VM600 tacho bus (up to 6 lines)

SPECIFICATIONS *(continued)*

Dynamic inputs

Number of independent channels	: 16
A/D converter	: 24 bit
Maximum sampling rate	: 98 kHz
Dynamic input (voltage)	: −30 to +30 V (20 V_{DC} + 10 V_{AC}) (input impedance ≥ 200 kΩ)
Dynamic input (current)	: −25 to +25 mA (current measuring resistor = 100 Ω)

Accuracy
- *Amplitude* : 1% of input FSD (reduced operating temperature range of 0 to +55 °C)
2% of input FSD (full operating temperature range of 0 to +65 °C)

- *Phase* : −1.35° (up to 1 kHz bandwidth, no HP filter)
−6.70° (up to 5 kHz bandwidth, no HP filter)

Measurement range
- *AC* : 0.1, 0.25, 0.5, 1.0, 2.5, 5.0, 10.0 V_{peak} FSD
- *AC/DC* : 5.0, 10.0 V_{peak} FSD
- *DC* : −20 to +20 V

Frequency bandwidth
- *AC* : 0.10 Hz to 38 kHz (HP filter at −3 dB).
An optional (software configurable) high-pass filter can be added to the AC path to increase the HP cutoff frequency to 1.0 Hz, 3.0 Hz or 10.0 Hz.
- *DC* : DC to 1.0 Hz (LP filter at −3 dB)

Signal to noise ratio (SNR)	: 115 dB (1 kHz measurement BW with 2.5 V_{peak} FSD)
	105 dB (10 kHz measurement BW with 2.5 V_{peak} FSD)
	100 dB (full BW)
Crosstalk attenuation	: Typically 80 dB
Maximum common mode voltage	: 50 V
CMRR	: 75 dB at 50/60 Hz
Protection filters	: Filtered for protection against EMI (electromagnetic interference), conforming to CE standards

VM600 rack signal sharing
- *XMV16* : To and from the VM600 raw bus
- *XMVS16* : VM600 raw bus not supported

Principal mode

Fixed frequency bandwidth (asynchronous)	: 40 Hz to 38 kHz (configurable)
Order tracking speed range (synchronous)	: 15 to 100 000 RPM
Order tracking bandwidth (synchronous)	: 1.56, 3.125, 6.25, 12.5, 25, 50, 100, 200 and 400 orders
FFT resolution	: 100 to 6 400 lines
FFT window	: Rectangular, Hanning, Hamming, Flat top, Blackman and Blackman-Harris
Real-time sampling rate	: 2.56 x frequency bandwidth
Update rate	: 1 s maximum for an FFT up to 6 400 lines.
Extracted variable	: 20 per processing block (configurable)
Extracted variable type	: Amplitude, phase and frequency (configurable)
Integration count	: 0, 1 or 2
Averaging	: Time domain (complex) and frequency domain (mean, RMS, peak hold)
Rectifiers	: Time domain rectifiers: true peak, true RMS, true peak-to-peak, minimum, maximum, average, electrical DC and common-mode voltage. Frequency domain rectifiers: RMS, peak (scaled peak) and peak-to-peak (scaled peak-to-peak).

SPECIFICATIONS *(continued)*

Note: The principal data acquisition mode is the main acquisition mode for XMx16 cards and is used to obtain measurements (waveforms, spectra and extracted data) from a dynamic input channel. The measurements are acquired continuously (every 1 second), making the principal mode suitable for monitoring machinery that is operating under nominal, steady state conditions, such as increasing vibration levels and the capture of transients. Principal mode measurements can be displayed in the VibroSight Vision software and logged to a VibroSight Server database.

Auxiliary mode

Fixed frequency bandwidth (asynchronous)	: 40 Hz to 38 kHz (configurable)
Order tracking speed range (synchronous)	: 15 to 100 000 RPM
Order tracking bandwidth (synchronous)	: 1.56, 3.125, 6.25, 12.5, 25, 50, 100, 200 and 400 orders
FFT resolution	: 100 to 6400 lines
FFT window	: Rectangular, Hanning, Hamming, Flat top, Blackman and Blackman-Harris
Sampling rate	: 2.56 x frequency bandwidth
Logging rate	: 10 min maximum, on a scheduled basis
Integration count	: 0, 1 or 2
Averaging	: Time domain (complex) and frequency domain (mean, RMS, peak hold)

Note: To complement the measurements obtained using the principal data acquisition mode, the auxiliary data acquisition mode allows more detailed measurement data (such as higher-resolution waveforms and spectra) to be obtained from the machinery being monitored, at reduced update rates. Auxiliary mode measurements can be displayed in the VibroSight Vision software and logged to a VibroSight Server database.

Direct mode

Fixed frequency bandwidth (asynchronous)	: 40 Hz to 38 kHz (configurable)
Sampling rate	: 2.56 x frequency bandwidth
Recording rate	: Configurable pre-event logging duration (up to 15 360 000 samples), for up to 15 alarm events

Note: The direct data acquisition mode is used to obtain a digitised continuous long-duration waveform from a dynamic input channel for the time leading up to an alarm event. Direct mode data is a resampled waveform taken directly from the XMx16 card itself with no processing (such as FFT, averaging or filtering) applied. This pre-event direct data is recorded in files on a local hard disk drive of the computer running the VibroSight Server. Direct mode measurements cannot be displayed in the VibroSight Vision software so a third-party program is required for data visualisation.

Pre-event data (buffers)

XMx16 card buffer for static data (extracted data) – principal mode and auxiliary mode

• *On-board memory*	: A maximum of 1140 static data items (extracted data) per extracted output
• *Data storage rate*	: 1 s

XMx16 card buffer for dynamic data (waveforms and spectra) – principal mode and auxiliary mode

• *On-board memory*	: A maximum of 38 dynamic data items (waveforms and spectra) per processing block
• *Data storage rate*	: 1 s and/or 10 s

VibroSight Server software buffer – direct mode

• *Host computer memory (hard disk drive)*	: A maximum of 15 360 000 samples (continuous long-duration waveform) per processing block
• *Data storage rate*	: "Streamed" to file

SPECIFICATIONS *(continued)*

Configuration

XMV16 / XIO16T hardware	: Fully software configurable

Time synchronisation

Protocol used between cards and host computer	: Network Time Protocol (NTP)

Communications

On-board Ethernet LAN

- *Type* : Gigabit Ethernet
- *Network interface* : 1000BASE-T
- *Data transfer rate* : Up to 1000 Mbps (1 Gbps)
- *Maximum distances* : The XMV16 can support a distance of up to 100 m at 1000 Mbps (1000BASE-T compliant).
  The XIO16T can support a distance of up to 60 m at 1000 Mbps.
  For distances greater than the specified maxima, the cards operate at reduced data transfer rates.

Connectors

XMV16 card

- *Ethernet* : 8P8C (RJ45), female

XIO16T card

- *J1* : Weidmüller 12-pin S2L header (male). Compatible with 12-pin B2L and B2CF plug-in connectors (female).
  Digital inputs (DSI) and outputs (OC) – reserved for future use.
- *J2* : Weidmüller 12-pin S2L header (male). Compatible with 12-pin B2L and B2CF plug-in connectors (female).
  Tachometer inputs (channels 1 to 4).
- *J3* : Weidmüller 24-pin S2L header (male). Compatible with 24-pin B2L and B2CF plug-in connectors (female).
  Dynamic inputs (channels 1 to 8).
- *J4* : Weidmüller 24-pin S2L header (male). Compatible with 24-pin B2L and B2CF plug-in connectors (female).
  Dynamic inputs (channels 9 to 16).
- *Ethernet* : 8P8C (RJ45), female

Note: B2CF plug-in connectors are recommended for all new installations, due to issues arising from the incorrect use of the B2L plug-in connectors. See **Recommendations for reliable connections on page 9**.

Power supply to cards

Power source	: VM600 rack power supply
Supply voltages	: +5 V_{DC} and ±12 V_{DC}
Consumption from +5 V_{DC} supply	: <14 W
Consumption from +12 V_{DC} supply	: <8 W
Consumption from −12 V_{DC} supply	: <4 W
Total power consumption (sum of XMV16 + XIO16T card pair)	: <26 W

SPECIFICATIONS *(continued)*

Environmental

Operating

- *Temperature*   : 0 to +65 °C (+32 to +149 °F)
- *Humidity*   : 0 to 90 % non-condensing

Storage

- *Temperature*   : −40 to +85 °C (−40 to +185 °F)
- *Humidity*   : 0 to 95 % non-condensing

Physical

XMV16 card

- *Height*   : 6 U (262 mm, 10.3 inches)
- *Width*   : 20 mm (0.8 inches)
- *Depth*   : 187 mm (7.4 inches)
- *Weight*   : 0.39 kg (0.86 lb)

XIO16T card

- *Height*   : 6 U (262 mm, 10.3 inches)
- *Width*   : 20 mm (0.8 inches)
- *Depth*   : 125 mm (4.9 inches)
- *Weight*   : 0.32 kg (0.71 lb)

ORDERING INFORMATION

To order please specify

Type	Designation	Ordering number
XMV16	Extended monitoring card for vibration	600-003
XIO16T	Extended input/output card for XMx16	620-002-000-113

For applications that do not share dynamic (vibration) channel signals using the VM600 raw bus, please specify

Type	Designation	Ordering number
XMVS16	Extended monitoring card for vibration	600-016
XIO16T	Extended input/output card for XMx16	620-002-000-113

Notes
The XMVS16 card has the same capabilities and features as the XMV16 card, except that the XMVS16 cannot access and therefore cannot configure anything on the VM600 raw bus. This means that all of the dynamic input channel signals for an XMVS16 card must be wired to the connectors on the front panel of the associated XIO16T card (rear of the VM600 rack).

For combustion monitoring applications, such as combustion dynamics and dynamic pressure pulsation, please specify

XMC16	Extended monitoring card for combustion	600-002
XIO16T	Extended input/output card for XMx16	620-002-000-113

Notes
"HHH" represents the different hardware versions that can be used by a finished product.

ACCESSORIES

Type	Designation	Ordering number
Tachometer inputs cable	Cable assembly for use with the XIO16T's J1 or J2 connector (12-pin)	957.18.40.0617
Dynamic inputs cable	Cable assembly for use with the XIO16T's J3 or J4 connector (24-pin)	957.18.40.0616

Notes
As shown (right), one end of these 1.5 m cable assemblies uses a B2CF connector for connection to the XIO16T card, while the other end provides a male BNC connector for each input signal.

RECOMMENDATIONS FOR RELIABLE CONNECTIONS

It is highly recommended to terminate all wires connected to the B2CF plug-in connectors used by J1, J2, J3 and J4 of the XIO16T card by crimping them with the ferrules supplied in the XIO16T wire-end ferrule kit, in order to help ensure consistent and reliable connections.

Accordingly, the XIO16T wire-end ferrule kit – containing 100 x H0,34/12 TK ferrules and 100 x H0,5/16 OR ferrules – is supplied with each VM600 rack that contains XMC16 / XIO16T, XMV16 / XIO16T or XMVS16 / XIO16T extended condition monitoring card pairs, and with all spare XIO16T cards.

Refer to the VibroSight application note 007 *Interfacing to the XIO16T card: recommendations for reliable connections* and the *XIO16T Wire-end ferrule kit* instruction sheet for more information.

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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