

# XM-120 and XM-121 Dynamic Measurement Modules

XM® is Allen-Bradley's award winning, and the world's most comprehensive family of distributed machine condition monitoring and protection devices.

With the XM series, discreet or networked monitoring solutions can be quickly and cost effectively deployed for steam, gas and hydro turbines, motors, compressors, pumps, fans, blowers and most other rotating machinery.



## Distributed, Intelligent Condition Monitoring

The XM-120 Standard and the XM-121 Low Frequency Dynamic Measurement Modules are intelligent 2-channel plus tachometer monitors that measure vibration and speed in rotating equipment.

Unlike most monitors that measure only the overall level of vibration, the XM-120/121 modules measure an array of critical parameters that can be used to provide comprehensive real time assessment of the machines health.

These measurements coupled with the extreme precision offered by the modules 24-bit A/D make them

ideally suited for detecting machinery problems. Virtually any fault that manifests itself through changes in the magnitude or phase of vibration can be detected by the advanced signal processing capabilities of the modules. These include most mechanical and electrically induced faults such as unbalance, bearing wear, rotor cracks and rubs, instabilities such as oil whirl, pre-load conditions / misalignment and anti-friction bearing defects.

Each channel can accept input from and provide power to any standard integrated Electronics Piezo Electric (IEPE) accelerometer, any standard - 24Vdc eddy current probe (driver) or any voltage output measurement

device such as a velocity or pressure transducer. In addition the tachometer can accept input from and provide power to most common speed sensing devices.

The modules can operate stand alone, with no interface to higher-level systems. But when required, they can be deployed on a DeviceNet network where they can provide real-time data and status information to other XM modules, PLC's, DCS and Condition Monitoring Systems.

With two 4-20mA outputs and a single onboard relay, expandable to five, the modules offer a complete monitoring system in a small, simple, easily installed, easily maintained package.

LISTEN.  
THINK.  
SOLVE.™

# Specifications

## Communications

### DeviceNet<sup>1</sup>

- Standard DeviceNet protocol for all functions
  - Available Electronic Data Sheet (EDS) file
  - Baud rate set by bus master to 125kb, 250kb or 500kb
  - Configurable and customizable I/O Poll Response assembly helps optimize space utilization within users scanner input tables
- <sup>1</sup>The modules use only the DeviceNet protocol, not power.

### Serial<sup>2</sup>

- RS-232 via mini-connector or terminal block
- Baud rate auto baud to 19200

<sup>2</sup>Local configuration via the included Configuration Utility software.

### Side Connector

- Allows interconnecting adjacent modules. The interconnect passes primary power, DeviceNet and XM-441 Expansion Relay module signal lines.

## Dynamic Inputs

### Type:

- Eddy current transducer signals
- Accelerometer signals
- Voltage signals from any dynamic measurement device such as a velocity or pressure transducer

### Transducer Power:

- Constant voltage (-24Vdc)
- Constant current (4.5mA ±20% from +24Vdc)
- None (voltage input)

Voltage Range: Selectable as 0 to ±20V (min) 40Vmax. peak-to-peak

Sensitivity: User configurable

Input Impedance: >100k

## Tachometer Input

### Type:

- ±25V (50V max. peak to peak)
- 1 to 50,000 events per revolution

Input impedance: 120k minimum

### Speed/Frequency Range:

- 1 to 1,200,000 RPM (0.0167 to 20,000Hz)

### Speed measurement error:

- |                          |         |
|--------------------------|---------|
| 1 to 12,000 RPM          | ±1 RPM  |
| 12,001 to 120,000 RPM    | ±6 RPM  |
| 120,001 to 1,200,000 RPM | ±50 RPM |

Pulses per Revolution: 0 (off) to 50,000

## Outputs

### 2 Isolated 4--20mA Outputs:

- Configured as any measured parameter
- 300 ohm max load

### Buffered Outputs:

- 1 active buffer per vibration input channel
- 1 resistive buffer for tachometer
- 2 buffered outputs per channel can be accommodated via BNC or other appropriate connections

## Indicators

### 7 Status LED's:

- |                     |           |            |
|---------------------|-----------|------------|
| Module              | Channel 1 | Tachometer |
| Network             | Channel 2 | Relay      |
| Setpoint Multiplier |           |            |

## Signal Conditioning

### Sampling Modes:

- Asynchronous
- Synchronous

Frequency range: 1 Hz to 20 kHz

### Resolution:

- A/D Conversion: 24 bits
- Range: <80dBfs (0.01% fs), -90dBfs (typical)

Lines	Blocksize	Lines	Blocksize
100	256	400	1024
200	512	800	2048

Amplitude range: Dependent on sensitivity

Integration: Two levels - 1 hardware, 1 firmware

### Averaging:

- Asynchronous: Averaged spectra
- Synchronous: Averaged time waveforms

Low Pass Filters: Configured per channel

- Spectra FMAX: 10 Hz - 20 kHz
- Overall measurement LP filter: 200 Hz - 20 kHz
- Roll Off: -24 dB per octave

High Pass Filters: Configured per channel

Module	Filters <sup>3</sup>					
	Hz	1	5	10	40	1k
XM-120	cpm	60	300	600	2.4k	60k
	Hz	0.2	0.8	2	4	23.8
XM-121	cpm	12	60	120	240	1428

<sup>3</sup> First filter is not available when integrating.

### Roll Off (minimum):

- None or Single Integration: -24 dB per octave
- Double Integration: -48 dB per octave

### Engineering Units:

volt	ips	mils	psi
g	mm/s	µm	Pa

## Complex Data

Spectra (synchronous or asynchronous)

Time Waveform (synchronous or asynchronous)

## Measured Parameters

### Real Time Measurements

Parameter Refresh Rate (Seconds)		
Overall (True)	Greater of	0.0053
Gap		
Overall (RMS)	Greater of	0.0053
Speed	Greater of	<u>Overall Time Constant<sup>4</sup></u> 5.8
SMAX		0.0053
		<u>1</u> Tachometer Freq (Hz)

<sup>4</sup> Affects the responsiveness and low frequency content of RMS derived overall measurements. Typical user settings range from 0.045 to 0.8.

Overall:

- RMS
- Peak (true or calculated)
- Peak to Peak (true or calculated)

Gap (or transducer bias voltage)

Speed

SMAX Magnitude and Phase

Acceleration (RPM/min) - refreshed once/sec

FFT-based Measurements<sup>5</sup>

FFT Refresh Rate Calculations (seconds)	
Asynchronous	Synchronous
$\frac{\text{Number of lines}}{\text{FMAX (Hz)}}$	$\frac{\text{Number of lines}}{\text{Speed (Hz) x Num Orders}}$

<sup>5</sup> When implementing protection solutions using FFT derived parameters users must consider the parameter refresh rates with respect to the applications performance requirements.

4 Bands per Channel:

- Overall in band
- Max peak in band

Orders:

- Magnitude: 1x, 2x, 3x
- Phase: 1x, 2x

Not 1x

Sum Harmonics

- Summed harmonic magnitudes from user defined first order to maximum order in FFT.

### Data Buffers

Trend Buffer

- Trend Record: 1 to 16 parameters
- Trend Interval: 1 to 3600 seconds
- Trigger: Saved when specified relay actuates, or on command from an XM-440, host or controller.
- Capacity: 170 to 2048 records depending on the number of parameters stored.

Trip Spectra or Time Waveform

- Current time waveforms or spectra saved upon the same trigger defined for the Trend Buffer (above).

Speed Buffer

- Su/Cd Record: 1 to 16 parameters
- Su/Cd Interval: 1 to 3600 RPM
- Trigger: Records are sampled while speed is between user specified min and max values.
- Sampled while speed is increasing only during startup.
- Capacity: 113 to 512 records depending on the number of parameters stored.
- Latching or non-latching

### Alarms

Number: 16 alarm and danger pairs

Alarmed Parameters: Any measured parameter

Operators: >, <, <>, ><

Hysteresis: User defined

Startup inhibit/Set point multiplication:

- Period: 0 to 1092 min in 0.1 min increments
- Inhibit Multiplier: 0 to 10 (0=disarm)

Inhibit/multiplication initiated by:

- Front terminal SPM circuit closure
- DeviceNet command

Inhibit/multiplication terminated by:

- Expired timer
- Front terminal SPM circuit open
- DeviceNet command

Speed Inhibit: Alarm is disabled if speed is outside an optionally specified range.

### Relays

Number:

- Single on-board relay, two sets of contacts – DPDT (2 Form C), plus
- Four virtual relays or
- Four additional relays when linked to an XM-441 Expansion Relay<sup>6</sup> module.

<sup>6</sup> For Expansion Relay Rating refer to XM441 Technical data sheet ENMON-TD441A-EN-P

Onboard Relay Rating:

- Voltage: Max. = 120 Vdc, 125 Vac
- Current: Max. = 3.5 A<sup>5</sup> Min. = 0
- Power: Max. = 60 W, 62.5 VA
- UL Rating:
  - 120 Vac @ 0.5 Amps resistive;
  - 110 Vdc @ 0.3 Amps resistive;
  - 30 Vdc @ 1.0 Amps resistive

<sup>5</sup> Max current up to 40°C then derates to 2A at 65°C.

Failsafe:

- Normally energized (failsafe), or
- Normally de-energized (non-fail-safe)

Latching:

- Latching, or
- Non-latching

Time Delay: 0 to 25.5 sec in 0.1 sec increments

Voting Logic: Single or paired "And" or "Or" logic

Reset:

- Local reset switch on top of module
- Remote reset switch wired to terminal base
- Digital reset via serial or DeviceNet interface

Activation On:

Alarm Status		Fault	
Normal	Alert	Transducer	Module
Danger	Disarm	Tachometer	

### Maximum Speed Capture

Retains the value of the highest speed observed.

### Nonvolatile Configuration

Module configuration is retained in nonvolatile memory from where it is read upon power up.

## Power

Module: 21.6 - 26.4Vdc

Consumption: 300mA Max (175mA Typical)

Heat Production:

- Max: 7 Watts (24 BTU/hr)
- Typical: 4 Watts (14 BTU/hr)

Redundant Power:

- Redundant power inputs on terminal base. Module auto switches on loss of primary power.

## Approvals

CE, C-Tick, ODVA, UL, EEX, CSA Class I, Div 2, Groups A, B, C, D

## Environmental

Temperature

- Operating: -20 to +65°C (-4 to 149°F)
- Storage: -40 to +85°C (-40 to 185°F)

Relative Humidity: 95% non-condensing

Conformal Coating:

- Per material specifications
- MIL-I-46058C / IPC-CC-830
- In accordance with IPC-A-610C

## Physical

Dimensions

- Height: 3.8in (97mm)
- Width: 3.7in (94mm)
- Depth: 3.7in (94mm)

Weight

- Module: 6.8 ounces (193 grams)
- Base: 8.2 ounces (232 grams)

## How to Order

Catalog Number	Description
1440-VST02-01RA	XM-120 Standard Dynamic Measurement Module*
1440-VLF02-01RA	XM-121 Low Frequency Dynamic Module*
1440-TB-A	Terminal Base A for XM-12x
1440-SCDB9FXM2	XM Serial Communications Cable

\* Requires Terminal Base A

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