

XM Monitoring Modules Specifications

Catalog Numbers 1440 Series

The XM® series of intelligent I/O modules process, in real-time, the critical parameters that are used to assess the current health and predict the future health of industrial machinery. This real-time processing provides machinery protection and reduces downtime. Use the XM modules in a standalone system, or integrate them with existing automation and control systems.

Type	Module	Cat. No.	Page
Measurement modules	XM DYN Dynamic Measurement Module	1440-DYN02-01RJ	2
	XM-124 Standard Dynamic Measurement Module	1440-SDM02-01RA	6
	XM-220 Dual Speed Module	1440-SPD02-01RB	12
Relay modules	XM-441 Expansion Relay Module	1440-REX00-04RD	17
	XM-442 Voted EODS Relay Module	1440-REX03-04RG	20
Accessories	Terminal Bases	1440-TB-A, 1440-TB-B, 1440-TB-D, 1440-TB-G, 1440-TBS-J	23
	Serial Configuration Utility	N/A	24
	Fuse Kit	1440-5AFUSEKIT	24
	Serial Communication Cable	1440-SCDB9FXM2	25
	ControlNet Adapter	1440-ACNR	25



XM DYN Dynamic Measurement Module

The XM dynamic measurement module (catalog number 1440-DYN02-01RJ) is a two-channel, general-purpose monitor that supports measurements of dynamic inputs such as vibration, pressure, and strain. You can use the module to monitor shaft, casing, and pedestal vibration in equipment that rotates. The module is designed specifically for integration with ControlLogix® controllers, which are connected through the 1440-ACNR ControlNet adapter.

Table 1 - XM DYN Dynamic Measurement Module Attribute Descriptions

Attribute	XM DYN (1440-DYN02-01RJ)
Inputs	
Two dynamic channel inputs	<ul style="list-style-type: none"> Eddy current transducer signals Accelerometer signals Voltage signals from any dynamic measurement sensor such as velocity or pressure transducer
Transducer power	<ul style="list-style-type: none"> Constant voltage 24V DC, -24V DC, 60 mA Constant current 4.5 mA +30%/-20% from 24V DC (IEPE) Bias current: monitors self-powered coil-based transducers None
Voltage ranges	<ul style="list-style-type: none"> -20...0V DC -10...10V DC 0...20V DC
Input impedance	> 100 kΩ
Sensitivity	Up to 15% from nom

mV/g	mV/ips	mV/mms	mV/mil	mV/μm	mV/psi	mV/mbar	V/V
10	100	4	100	3.94	20	0.29	1
25	150	6	150	5.91	50	0.73	
50	200	8	200	7.87	100	1.45	
100	500	20	285	11.2			
500	1000	40					
1000							
10000							

Tachometer Input	
One tachometer input	±25V (50V max peak-to-peak)
Input impedance	> 120 kΩ
Range	1...1.2 M rpm/0.0167...20 kHz
Pulses per revolution	0 (tach off)...50,000
Rate of change of speed, max	500 Hz/s
Outputs	
Buffered outputs	<ul style="list-style-type: none"> One active buffer per dynamic channel One resistive buffer for tachometer

Table 1 - XM DYN Dynamic Measurement Module Attribute Descriptions (continued)

Attribute	XM DYN (1440-DYN02-01RJ)
Indicators	
Status indicators	<ul style="list-style-type: none"> • Module • Network • Channel 0 • Channel 1 • Tachometer • Setpoint multiplier • Virtual relay
Communication	
XM bus	<ul style="list-style-type: none"> • Autobaud 125 Kbps, 250 Kbps, or 500 Kbps • Max distance: 10 m (32.81 ft) • Node number that is mechanically set to simplify installation and commissioning • Customizable poll assembly optimizes space utilization within scanner • Logix Controller integration over the ControlNet network Via 1440-ACNR Adapter
Signal Conditioning	
Sampling mode	<ul style="list-style-type: none"> • Selectable per channel • Asynchronous <ul style="list-style-type: none"> – FMAX: 1 Hz . . . 20 kHz • Synchronous <ul style="list-style-type: none"> – FMAX: 10 < Orders x Speed (Hz) < 5000 – Order range: 4 . . . 200 – Min FMAX: 10 Hz – Max FMAX: 5000 Hz
Resolution	<ul style="list-style-type: none"> • A/D conversion: 24 bits • Dynamic range: 80 dBfs (0.01% fs), 90 dBfs, typical
FFT lines	100, 200, 400, 800
Integration	None, single, or double
High pass analog filters	<ul style="list-style-type: none"> • -3 dB corners: 0.2, 1, 5, 10, 40 Hz Roll off: -30 dB/octave for the 0.2 Hz filter, otherwise 24 dB/octave <ul style="list-style-type: none"> • Spike Energy • gSE HPF: 200, 500, 1000, 2000, 5000 Hz Roll off: -12 dB/octave
Low pass filter	<ul style="list-style-type: none"> • Applied to integrated acceleration measurements • -6 dB corner: 2 kHz Roll off: -12 dB/octave
Units	g, ips, mm/s, mils, μ m, PSI, mbar, volt
Measurements	
Types	<ul style="list-style-type: none"> • FFT and time waveform • Asynchronous or synchronous
Real time	Overall <ul style="list-style-type: none"> • RMS • Peak (true or calculated) • Peak-to-peak (true or calculated) • Optional low pass filter <ul style="list-style-type: none"> – -3 dB corner: 200 Hz . . . 20 kHz – Roll off: -24 dB/octave • Gap (or transducer bias voltage) • Speed • SMAX magnitude • SMAX phase

Table 1 - XM DYN Dynamic Measurement Module Attribute Descriptions (continued)

Attribute	XM DYN (1440-DYN02-01RJ)
FFT derived	<ul style="list-style-type: none"> • FFT bands <ul style="list-style-type: none"> – Four bands per channel – Defined in frequency or order domain – Overall or max peak in band • Orders <ul style="list-style-type: none"> – Magnitude: 1x, 2x, 3x – Phase: 1x, 2x • Not 1x • Sum harmonics
Alarms	
Number	<ul style="list-style-type: none"> • Six alert and danger pairs • Alarm on any measured value
Operators	<ul style="list-style-type: none"> • Greater than • Less than • Inside range • Outside range
Hysteresis	User-defined
Startup inhibit/setpoint multiplication	<ul style="list-style-type: none"> • Period 0 . . . 1092 min • Inhibit/multiplication function: Multiply by N (0 . . . 10, 0 = Disarm)
Speed inhibit	Speed range can be specified for each alarm. When applied, the alarm is disabled if the speed is outside the defined range
Configuration	
Automatic module configuration	Automatically configured from a configuration that is stored in module memory at power-up, or from a configuration that is held in a Logix5000™ controller.
Relays	
One virtual relay	<ul style="list-style-type: none"> • Logic is provided to drive one virtual relay. • Relay status indicator
Relay function	<ul style="list-style-type: none"> • Normally energized (fail-safe) or normally de-energized (non-failsafe) • Latching or non-latching • Time delay: 0 . . . 25.5 s in 100 ms increments • Single or paired AND or OR logic applied to any alarm • Reset by digital command from configuration software, via a command from the XM bus, or from output tag when integrated via ControlNet adapter
Alarm status to activate on	<ul style="list-style-type: none"> • Normal • Alert • Danger • Gap/bias out of range • Module fault • Tachometer fault • Disarm
Power	
Type	Requires Class 2 power supply
Module	24V DC
Consumption	<ul style="list-style-type: none"> • 250 mA, max • 210 mA, typical
Heat production	<ul style="list-style-type: none"> • 4.56 W, max • 3.60 W, typical
North American Temp Code	T4A
IEC Temp Code	T4

Table 1 - XM DYN Dynamic Measurement Module Attribute Descriptions (continued)

Attribute	XM DYN (1440-DYN02-01RJ)
Environmental	
Temperature, operating	-20...70 °C (-4...158 °F)
Temperature, storage	-40...85 °C (-40...185 °F)
Relative humidity	5...95% noncondensing
Physical	
Terminal base	1440-TBS-J
Dimensions (H x W x D), approx	97 x 94 x 94 mm (3.8 x 3.7 x 3.7 in.)
Weight, approx	0.172 kg (0.38 lb)
Certifications⁽¹⁾	
cULus	UL Listed for US and Canada. See File E234338 UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, which are certified for U.S. and Canada. See UL File E194810
CE	European Union 2004/108/EC EMC Directive, compliant with: <ul style="list-style-type: none"> • EN 61326-1; Meas./Control/Lab., Industrial Requirements • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
C-Tick	Australian Radiocommunications Act, compliant with: <ul style="list-style-type: none"> • AS/NZS CISPR 11; Industrial Emissions
Ex	European Union 94/9/EC ATEX Directive, compliant with: <ul style="list-style-type: none"> • EN 60079-15; Potentially Explosive Atmospheres, Protection "n" • EN 60079-11; Explosive Atmospheres, Protection "i" • EN 60079-0; General Requirements • Ex nA IIC T4 X Gc
KCC	Korean Registration of Broadcasting and Communications Equipment, compliant with: <ul style="list-style-type: none"> • Article 58-2 of Radio Waves Act, Clause 3

(1) When product or packaging is marked. See the Product Certification link at <http://www.rockwellautomation.com> for Declarations of Conformity, Certificates, and other certification details.

XM-124 Standard Dynamic Measurement Module

The XM-124 module (catalog number 1440-SDM02-01RA) is a two-channel, general-purpose monitor that supports dynamic measurements such as vibration, pressure, strain, and spike energy (gSE). The module also supports static (DC) thrust and eccentricity measurements.

The XM-124 consolidates and improves on most of the functionality that is provided by the earlier XM-120, XM-120E, XM-121, XM-122 and XM-123 modules. It also provides the same basic, single-channel, thrust measurement as the XM-320 module. The XM-124 is suitable for monitoring almost any rotating machine, including steam turbines, aeroderivative and industrial gas turbines, hydro turbines, motors, pumps, fans, compressors, and gearboxes.

Table 2 - XM-124 Standard Dynamic Measurement Module Attribute Descriptions

Attribute	XM-124 (1440-SDM02-01RA)
Inputs	
Two dynamic channel inputs	<ul style="list-style-type: none"> Eddy current transducer signals Accelerometer signals Voltage signals from any dynamic measurement device, such as a velocity or pressure transducer
Transducer power	<ul style="list-style-type: none"> Constant voltage: 24V DC, -24V DC, 40 mA Constant current 4.5 mA \pm 30% / -20% from 24V DC (IEPE) None (voltage input) Tachometer can be powered, constant voltage, or configured as voltage input
Voltage range	<ul style="list-style-type: none"> -20...0V DC -10...10V DC 0...20V DC
Input impedance	> 100 k Ω
Sensitivity	Up to 15% from nom

mV/g	mV/ips	mV/mms	mV/mil	mV/ μ m	mV/psi	mV/mbar	V/V
10	100	4	100	3.94	20	0.29	1
25	150	6	150	5.91	50	0.73	
50	200	8	200	7.87	100	1.45	
100	500	20	285	11.2			
500	1000	40					
1000							
10000							

Tachometer Input	
One tachometer input	<ul style="list-style-type: none"> \pm25V (50V max peak-to-peak) 1...50,000 events/revolution
Input impedance	> 120 k Ω
Range	<ul style="list-style-type: none"> 1...1,200,000 rpm 0.0167...20,000 Hz
Pulses per revolution	0 (tach off)...50,000
Rate of change of speed, max	500 Hz/s

Table 2 - XM-124 Standard Dynamic Measurement Module Attribute Descriptions (continued)

Attribute	XM-124 (1440-SDM02-01RA)
Outputs	
4...20 mA	<ul style="list-style-type: none"> • Each output is independently programmed to represent any measured parameter, from either channel • Two isolated outputs • 300 Ω max load
Buffered outputs	<ul style="list-style-type: none"> • One active buffer per dynamic channel • One resistive buffer for tachometer
Indicators	
Status indicators	<ul style="list-style-type: none"> • Module • Network • Channel 1 • Channel 2 • Tachometer • Setpoint multiplier • Virtual relay
Communication	
DeviceNet network	<ul style="list-style-type: none"> • Standard DeviceNet protocol for all functions (not power—module power is provided independently) • Available EDS file supports most DeviceNet compliant systems • Communication rate that is set automatically by bus master to 125 Kbps, 250 Kbps, or 500 Kbps • Configurable I/O Poll Response message helps optimize space utilization within scanner input tables: <ul style="list-style-type: none"> – Selectable poll response assembly – Selectable poll response size (bytes)
Serial	<ul style="list-style-type: none"> • RS-232 via mini-connector or terminal base unit • Communication rate that is fixed at 19.2 Kbps • Local configuration via the Serial Configuration Utility
Signal Conditioning	
Sampling mode	<ul style="list-style-type: none"> • Selectable per channel • Dynamic Measurements <ul style="list-style-type: none"> – Asynchronous <ul style="list-style-type: none"> FMAX: 1 Hz...20 kHz – Synchronous • Order range: 4...200 <ul style="list-style-type: none"> – Min FMAX: 10 Hz – Max FMAX: 5000 Hz, Measured: Orders x Speed (Hz) • Spike Energy • Static Measurements <ul style="list-style-type: none"> – Eccentricity <ul style="list-style-type: none"> Peak-to-Peak Eccentricity • Thrust <ul style="list-style-type: none"> Normal mode (single channel measurement)
Resolution	<ul style="list-style-type: none"> • A/D conversion: 24 bits • Dynamic range: 80 dBfs (0.01% fs), 90 dBfs, typical
FFT lines	100, 200, 400, 800, 1600
Integration	None, single, or double
High pass analog filters	<ul style="list-style-type: none"> • -3 dB corners: 0.2, 1, 5, 10, 40 Hz Roll off: -30 dB/octave for the 0.2 Hz filter, otherwise 24 dB/octave
Low pass analog filter	<ul style="list-style-type: none"> • Applied to integrated acceleration measurements • -3 dB corner: 5 kHz Roll off: -18 dB/octave

Table 2 - XM-124 Standard Dynamic Measurement Module Attribute Descriptions (continued)

Attribute	XM-124 (1440-SDM02-01RA)
Low pass digital filter	Independently configured per channel <ul style="list-style-type: none"> • Optional Overall LP Filter • 100...20000 Hz • Spike Energy • Spectra FMAX: 10...5000 Hz • Roll Off: -24 dB/octave
Tracking digital filter	Independently configured per channel <ul style="list-style-type: none"> • Tracked speed multiple: 0.1...20.0 times the measured (tachometer) rpm • Constant Q: 1...200 • Constant bandwidth: 0.1...25 Hz • Roll off: -36 dB/octave, typical
Band pass digital filter	Independently configured per channel <ul style="list-style-type: none"> • Frequency, min 25...1000 Hz • Frequency, max 100...5500 Hz • Roll off: -60 dB/octave
Units	g, ips, mm/s, mils, μ m, PSI, mbar, volt
Data⁽¹⁾	
Complex data	<ul style="list-style-type: none"> • Spectra (synchronous or asynchronous) • Waveform (synchronous or asynchronous) • Simultaneous waveforms (synchronous) • gSE Spectra
Accuracy, min	<ul style="list-style-type: none"> • $\pm 1\%$ of full scale range for the channel • $\pm 1\%$ of alarm setpoint for speed
Measurements⁽²⁾	
Types	<ul style="list-style-type: none"> • FFT and time waveform • Asynchronous or synchronous
Real time	<ul style="list-style-type: none"> • Overall • RMS • Peak (true or calculated) • Peak-to-peak (true or calculated) • gSE⁽⁵⁾ • Optional low pass filter <ul style="list-style-type: none"> – -3 dB corner: 200 Hz...20 kHz – Roll off: -24 dB/octave • Gap (or transducer bias voltage) • Speed • SMAX magnitude • SMAX phase • Band pass filter value • Tracking filter magnitude • Tracking filter phase • Thrust position • Eccentricity
FFT derived	<ul style="list-style-type: none"> • FFT bands <ul style="list-style-type: none"> – Four bands per channel – Defined in frequency or order domain – Overall or max peak in band • Orders <ul style="list-style-type: none"> – Magnitude: 1x, 2x, 3x – Phase: 1x, 2x • Not 1x • Sum harmonics

Table 2 - XM-124 Standard Dynamic Measurement Module Attribute Descriptions (continued)

Attribute	XM-124 (1440-SDM02-01RA)
Data Buffers	
Delta time buffer	<ul style="list-style-type: none"> • Number of records: 2048 • Delta time interval: 1 . . . 3600 s • Trigger mode: Relay is activated or trigger event (such as DeviceNet command from a controller or host)
Delta rpm buffer	<ul style="list-style-type: none"> • Number of records: 512 • Delta speed interval: 1 . . . 3600 rpm • Trigger mode: Startup collects data in increasing rpm direction only; coast-down collects data in both increasing and decreasing directions • The data that is collected in the buffer is user configurable and can contain up to 16 of the measurements
Spectra or waveform	Saved upon same trigger as delta time buffer
Alarms	
Number	Sixteen alarm and danger pairs
Alarm parameters	Any measured parameter
Operators	<ul style="list-style-type: none"> • Greater than • Less than • Inside range • Outside range
Hysteresis	User configurable in software
Startup inhibit/setpoint multiplication	<ul style="list-style-type: none"> • Period: 0 . . . 1092 min, adjustable in 0.1 min increments • Inhibit/multiplication function: Multiply by N (0 . . . 10, 0 = Disarm)
Speed inhibit	A speed range can be specified for each alarm. When applied, the alarm is disabled when speed is outside of the defined range.
Relays	
Number	<ul style="list-style-type: none"> • Single on-board relay, Single Pole Single Throw (SPST), one Form A • Four additional DPDT relays when interconnected to an XM-441 expansion relay module, or • Four virtual relays whose status can be used by remote control systems or the XM-440 master relay module, also four DPDT relays
Rating (resistive)	<ul style="list-style-type: none"> • Capacity, nominal: 1.5 A @ 24V DC • Capacity, min 100 μA @ 100 mV DC • Power, max 41.4 W • Voltage, max 27.6V DC • Current, max 1.5 A
Expected life (min operations)	<ul style="list-style-type: none"> • Mechanical: 2×10^7 • Electrical @ 20 cpm – 1.5 A, 24V DC: 10^5
Failsafe	<ul style="list-style-type: none"> • Normally energized (fail-safe) or • Normally de-energized (non-fail-safe)
Latching	<ul style="list-style-type: none"> • Latching • Non-latching
Time delay	0 . . . 25.5 s, adjustable in 100 ms increments
Logic	Single or paired AND or OR logic applied to any alarm
Reset	<ul style="list-style-type: none"> • Local reset switch on top of module • Remote reset switch that is wired to terminal base • Digital reset command via serial or DeviceNet interface

Table 2 - XM-124 Standard Dynamic Measurement Module Attribute Descriptions (continued)

Attribute	XM-124 (1440-SDM02-01RA)
Activation on	<ul style="list-style-type: none"> • Alarm status <ul style="list-style-type: none"> – Normal – Alert – Danger – Disarm – Transducer fault – Module fault – Tacho fault
Peak speed capture	The XM-124 retains the value of the highest speed that is observed since module power was cycled or the peak speed value was manually reset
Configuration	
Nonvolatile configuration	<ul style="list-style-type: none"> • A copy of the module configuration is retained in nonvolatile memory from which the configuration is loaded upon powerup • The configuration that is stored in nonvolatile memory can be deleted only by a module-reset command that is sent via a serial interface, using the Serial Configuration Utility or via a DeviceNet interface from any compliant software application
Module	
Power supply	<ul style="list-style-type: none"> • 24V DC • 350 mA • Requires Class 2/SELV/PELV power supply
Power dissipation	8.7 W, max
Isolation voltage	<ul style="list-style-type: none"> • 50V (continuous), basic insulation type between uninsulated live parts and the enclosure with the relay contacts open and closed • Type tested at 707V DC for 60 s between uninsulated live parts and the enclosure with the relay contacts open and closed • Type tested at 707V DC for 60 s between supply and output terminals
Wiring category ⁽³⁾	<ul style="list-style-type: none"> • 2 - on signal ports • 1 - on power and relay ports • 2 - on DeviceNet ports • 3 - on serial ports
North American temp code	T5
IEC temp code	T4
Environmental	
Temperature, operating IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock)	-20...65 °C (-4...149 °F)
Temperature, surrounding air max	65 °C (149 °F)
Temperature, storage IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...85 °C (-40...185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10...500 Hz
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	15 g
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g
Emissions CISPR11 (IEC 61000-6-4)	Class A