APPLICATION GUIDE
CONDITION MONITORING

XM-120 & XM-121 MACHINE VIBRATION MONITOR

The XM-120 (Standard) and the XM-121 (Low Frequency) Dynamic Measurement Modules are intelligent 2-channel general-purpose monitors that support the measurement of dynamic inputs such as vibration, pressure and strain. The modules also have a third channel for tachometer inputs. They are well suited for monitoring shaft, casing and pedestal vibration in almost all rotating equipment applications. The two modules are identical except for their high pass filter selections. The XM-120 supports shaft eccentricity monitoring when its alternate XM-120E firmware is loaded, and the XM-121 supports absolute shaft measurements when its alternate XM-121A firmware is loaded.

Like the XM-120, the XM-122 provides onboard processing of critical vibration parameters, advanced alarm and relay logic, easy installation and superior serviceability. However, unlike the XM-120, the XM-122 is not a real-time protection monitor.

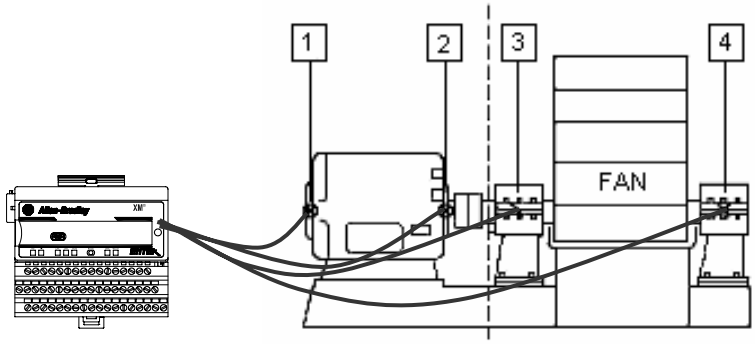
INDUSTRIES

- Automotive
- Discrete Manufacturing
- Food Processing
- Metals
- Mining
- Marine
- Oil & Gas
- Paper
- Power
- Water/ Waste Water

LISTEN. THINK. SOLVE.℠

FAN/BLOWER & MOTOR

FITTED WITH ROLLING ELEMENT (ANTI-FRICTION) BEARINGS



Accelerometers: 1 per bearing location. 1, 2, 3& 4 installed in the horizontal direction

This document provides a general guidance in how to apply an XM Series condition monitoring system to the specified class of equipment. The objective is to implement a monitoring solution that will identify the majority of faults common to this class of machinery at the earliest indication of the fault and to do this for the lowest possible total cost. Contact your local authorized Allen-Bradley distributor or Rockwell Automation sales office to customize a system more specific to your application.

VIBRATION CHARACTERISTICS				
	Fault	**Amplitude**	**Frequency**	**Remarks**
1	Unbalance	Proportional to unbalance (in radial direction).	1 x RPM	Most Common cause of vibration.
2	Misalignment of couplings or bearings. Bent Shaft.	Large in axial direction, 50% or more of radial vibration.	1 x RPM usual, 2 & 3 x RPM sometimes.	Best found by appearance of large axial vibration. Use dial indicators or other method for positive diagnosis.
3	Mechanical Looseness	Large in radial direction. 1 x rpm usually largest peak	1 x RPM and sometimes multiples	Looseness between machine and plates or foundation and poor grouting. Look for loose pillow block bolts or cracks. Distortion of the frame or base referred to as soft foot.
4	Bad bearings anti-friction type	Unsteady – use velocity measurement if possible	Very high several times RPM	Bearing responsible most likely the one nearest the point of largest high frequency vibration.
5	Shaft looseness	Usually in radial direction	Many RPM harmonics	Usually accompanied by unbalance and/or misalignment. Poor fit or excessive clearances.
6	Electrical	Disappears when power is turned off	1 x RPM or 1 or 2 x synchronous frequency	If vibration amplitude drops of instantly when power is turned off cause is electrical

TYPICAL OPERATING SPEEDS 48-600 RPM

YOU WILL NEED: *		
Catalog #	**Description**	**QTY**
1440-VLF02-01RA	XM-121 Low Frequency Vibration Module	2
1440-TB-A	Terminal Base for XM-120 / XM-121/ XM-122	2
EK-43794I	Model 9100L Low Frequency Accelerometer	4
EK46801I	32' Accelerometer Cable (splash proof)	4
1440-SCDB9-FXM2	Programming Cable	1

** Additional requirements may include power supply, enclosure, power or DeviceNet cables, junction boxes, sensor adhesives / mounting tools, etc.*

STANDARD CHANNEL SETTINGS			
Parameter	**Setting**	**Parameter**	**Setting**
Input Unit	g's	HP Filter	0.8 Hz
Fault Low	4	Sampling Mode	Asynchronous
Fault High	16	FMAX	120,000 CPM
Full Scale*	2	Sensitivity	500 mV/g
Output Unit	ips	Num Lines	400
Signal Detection	Calc. Peak	Num Averages	4

** Start with default value - use Auto Scale Function to set once machinery is operating.*

STANDARD BAND SETTINGS				LIMITS	
Fault	**Parameter**	**Min. Freq (CPM)**	**Max. Freq (CPM)**	**Alert**	**Danger**
MOTOR					
1, 2, 4, 6	Band 1	0.3 x RPM	1.2 x RPM	0.090	0.135
2, 4	Band 2	1.2 x RPM	3.2 x RPM	0.035	0/053
3	Band 3	3.2 x RPM	12.2 x RPM	0.025	0.038
3	Band 4	12.2 x RPM	FMAX	0.015	0. 023
	Overall			0.100	0.150
FAN					
1, 2, 4, 6	Band 1	0.3 x RPM	1.2 x RPM	0.113	0.169
3, 4	Band 2	1.2 x RPM	3.2 x RPM	0.044	0.066
3, 5	Band 3*	BPF** - (1 x RPM)	BPF + (1 x RPM)	0.075	0/113
3	Band 4	10.8 x RPM	FMAX	0.035	0.053
	Overall			0.125	0.188

** If BPF is unknown use: Min Freq = 3.2 x RPM, Max Freq = 10.8 x RPM*

*** Blade Pass Frequency (BPF) = Running Speed x Number of blades*

Important: When determining frequencies that should be monitored and alarm levels, the recommendations provided should only be used as general guidelines. Measurement parameters and alarm levels should be determined by the equipment OEM, industry standards such as ISO, and the actual operating characteristics of your equipment.

TYPICAL OPERATING SPEEDS 600-1200 RPM

YOU WILL NEED: *		
Catalog #	**Description**	**QTY**
1440-VSE02-01RA**	XM-122 gSE Vibration Module	2
1440-TB-A	Terminal Base for XM-120 / XM-121 / XM-122	2
EK-43784I	Model 9100 General Purpose Accelerometer	4
EK-46801I	32' Accelerometer Cable (splash proof)	4
1440-SCDB9-FXM2	Programming Cable	1

** Additional requirements may include power supply, enclosure, power or DeviceNet cables, junction boxes, sensor adhesives / mounting tools, etc.*

*** The XM-122 should not be used for real time protection. Use XM-120/XM121 when real time protection is required.*

STANDARD CHANNEL SETTINGS				g'SE Channel Settings	
Parameter	**Setting**	**Parameter**	**Setting**	**Parameter**	**Setting**
Input Unit	g's	HP Filter	5 Hz	g'SE Full Scale*	2
Fault Low	4	Sampling Mode	Asynchronous	High Pass Filter	5000 Hz
Fault High	16	FMAX	60,000 CPM	FMAX	30,000 CPM
Full Scale*	2	Sensitivity	100 mV/g	Num Lines	400
Output Unit	ips	Num Lines	400	Window Type	Hanning
Signal Detection	Calc. Peak	Num Averages	4	Num Averages	4

** Start with default value - use Auto Scale Function to set once machinery is operating.*

STANDARD BAND SETTINGS				LIMITS	
Fault	**Parameter**	**Min. Freq (CPM)**	**Max. Freq (CPM)**	**Alert**	**Danger**
MOTOR AND GEARBOX INBOARD					
1, 2, 4, 6	Band 1	0.3 x RPM	1.2 x RPM	0.180	0.270
2, 4	Band 2	1.2 x RPM	3.2 x RPM	0.070	0.105
3	Band 3	3.2 x RPM	12.2 x RPM	0.050	0.075
3	Band 4	12.2 x RPM	FMAX	0.030	0.045
	Overall			0.200	0.300
GEARBOX OUTBOARD					
1, 2, 4, 6	Band 1	0.3 x RPM	1.2 x RPM	0.225	0.338
2, 4	Band 2	1.2 x RPM	3.2 x RPM	0.088	0.131
3, 5	Band 3*	BPF** - (1 x RPM)	BPF + (1 x RPM)	0.150	0.225
3	Band 4	10.8 x RPM	FMAX	0.070	0.105
	Overall			0.250	0.375

** If BPF is unknown, sue Min Freq – 3.2 x RPM, Max Freq = 10.8 x RPM*

*** Blade Pass Frequency (PBF) = Running Speed x Number of blades.*

Note: *Spike Energy is a measure of energy generated by the repetitive impacts of rolling elements against small cracks or defects in a bearing. Spike Energy is a high frequency vibration measurement that is sensitive to machinery dynamics, accelerometer designs, mounting conditions and measurement locations. The most meaningful use of Spike Energy is a trended overall measurement. When Spike Energy readings are taken, one or more velocity parameters should also be trended so that the correlation between them can be established over time. When the trends of Spike Energy increase, it usually indicates that a problem with bearings, gears or other components may start to develop.*
Establish a baseline value for your machinery. Spike Energy increases of 50% or greater are usually considered significant although this may vary depending upon the type of machine and process in which it is a part.

Important: When determining frequencies that should be monitored and alarm levels, the recommendations provided should only be used as general guidelines. Measurement parameters and alarm levels should be determined by the equipment OEM, industry standards such as ISO, and the actual operating characteristics of your equipment.

TYPICAL OPERATING SPEEDS 1200-3600 RPM

YOU WILL NEED: *		
Catalog #	**Description**	**QTY**
1440-VSE02-01RA**	XM-122 gSE Vibration Module	2
1440-TB-A	Terminal Base for XM-120 / XM-121 / XM-122	2
EK-43784I	Model 9100 General Purpose Accelerometer	4
EK-46801I	32' Accelerometer Cable (splash proof)	4
1440-SCDB9-FXM2	Programming Cable	1

** Additional requirements may include power supply, enclosure, power or DeviceNet cables, junction boxes, sensor adhesives / mounting tools, etc.*

*** The XM-122 should not be used for real time protection. Use XM-120/XM-121 when real time protection is required.*

STANDARD CHANNEL SETTINGS				g'SE Channel Settings	
Parameter	**Setting**	**Parameter**	**Setting**	**Parameter**	**Setting**
Input Unit*	g's	HP Filter	10 Hz	g'SE Full Scale*	2
Fault Low	4	Sampling Mode	Asynchronous	High Pass Filter	5000 Hz
Fault High	16	FMAX > 1700 RPM < 1700 RPM	 120,000 CPM 90,000 CPM	FMAX > 1700 RPM < 1700 RPM	 120,000 CPM 90,000 CPM
Full Scale*	2	Sensitivity	100 mV/g	Num Lines	400
Output Unit	Ips	Num Lines	400	Window Type	Hanning
Signal Detection	Calc. Peak	Num Averages	4	Num Averages	4

** Start with default value - use Auto Scale Function to set once machinery is operating.*

STANDARD BAND SETTINGS				LIMITS	
Fault	**Parameter**	**Min. Freq (CPM)**	**Max. Freq (CPM)**	**Alert**	**Danger**
MOTOR					
1, 2, 4, 6	Band 1	0.3 x RPM	1.2 x RPM	0.180	0.270
2, 4	Band 2	1.2 x RPM	3.2 x RPM	0.070	0.105
3	Band 3	BPF* - (1 x RPM)	12.2 x RPM	0.050	0.075
3	Band 4	10.8 x RPM	FMAX	0.030	0.045
	Overall			0.200	0.300
FAN					
1, 2, 4, 6	Band 1	0.3 x RPM	1.2 x RPM	0.225	0.225
2, 4	Band 2	1.2 x RPM	3.2 x RPM	0.088	0.088
3, 5	Band 3*	BPF** – (1 x RPM)	BPF + (1 x RPM)	0.150	0.150
3	Band 4	10.8 x RPM	FMAX	0.070	0.070
	Overall			0.250	0.250

** If BPF is unknown, sue Min Freq – 3.2 x RPM, Max Freq = 10.8 x RPM*

*** Blade Pass Frequency (PBF) = Running Speed x Number of blades.*

Note: *Spike Energy is a measure of energy generated by the repetitive impacts of rolling elements against small cracks or defects in a bearing. Spike Energy is a high frequency vibration measurement that is sensitive to machinery dynamics, accelerometer designs, mounting conditions and measurement locations. The most meaningful use of Spike Energy is a trended overall measurement. When Spike Energy readings are taken, one or more velocity parameters should also be trended so that the correlation between them can be established over time. When the trends of Spike Energy increase, it usually indicates that a problem with bearings, gears or other components may start to develop.*
Establish a baseline value for your machinery. Spike Energy increases of 50% or greater are usually considered significant although this may vary depending upon the type of machine and process in which it is a part.

Important: When determining frequencies that should be monitored and alarm levels, the recommendations provided should only be used as general guidelines. Measurement parameters and alarm levels should be determined by the equipment OEM, industry standards such as ISO, and the actual operating characteristics of your equipment.

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Publication GMSI10-AP013A-EN-E – September 2006