XM-121 Absolute Shaft Module

User Guide
Firmware Revision 5

1440-VLF02-01RA

ALLEN-BRADLEY • ROCKWELL SOFTWARE

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://literature.rockwellautomation.com) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

WARNING 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence
SHOCK HAZARD 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
BURN HAZARD 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

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Safety Approvals

The following information applies when operating this equipment in hazardous locations.	**Informations sur l'utilisation de cet équipement en environnements dangereux.**
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system arfe subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.

WARNING

EXPLOSION HAZARD -

- Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.
- Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
- Substitution of components may impair suitability for Class I, Division 2.
- If this product contains batteries, they must only be changed in an area known to be nonhazardous.

AVERTISSEMENT

RISQUE D'EXPLOSION –

- Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement.
- Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit.
- La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2.
- S'assurer que l'environnement est classé non dangereux avant de changer les piles.

IMPORTANT

Wiring to or from this device, which enters or leaves the system enclosure, must utilize wiring methods suitable for Class I, Division 2 Hazardous Locations, as appropriate for the installation in accordance with the product drawings as indicated in the following table.

Model	Catalog Number	Haz Location Drawings*		Model	Catalog Number	Haz Location Drawings*	
		w/o Barriers	w/ Barriers			w/o Barriers	w/ Barriers
XM-120	1440-VST0201RA	48178-HAZ	48179-HAZ	XM-320	1440-TPS0201RB	48238-HAZ	48239-HAZ
XM-121	1440-VLF0201RA			XM-360	1440-TPR0600RE	48295-HAZ	48299-HAZ
XM-122	1440-VSE0201RA			XM-361	1440-TUN0600RE		
XM-123	1440-VAD0201RA			XM-361	1440-TTC0600RE		
XM-160	1440-VDRS0600RH	51263-HAZ	51264-HAZ	XM-440	1440-RMA0004RC	48240-HAZ	N/A
XM-161	1440-VDRS0606RH			XM-441	1440-REX0004RD	48241-HAZ	N/A
XM-162	1440-VDRP0600RH			XM-442	1440-REX0304RG	48642-HAZ	N/A
XM-220	1440-SPD0201RB	48640-HAZ	48641-HAZ				

* Drawings are available on the included CD

Chapter 1

Introduction

Chapter 2

Installing the Absolute Shaft Module

Chapter 3

Configuration Parameters

Introduction

This chapter provides an overview of the XM-121 Absolute Shaft module. It also discusses the components of the module.

IMPORTANT This manual only describes how to install and use the XM-121 Absolute Shaft module. For information about the low frequency dynamic measurement module, refer to the XM-120/121 Dynamic Measurement Module User Guide.

Introducing the Absolute Shaft Module

The XM-121 Absolute Shaft module is an XM-121 Low Frequency Dynamic module with alternative, XM-121A, firmware loaded onto it. The XM-121 is part of the Allen-Bradley™ XM® Series, a family of DIN rail mounted condition monitoring and protection modules that operate both in stand-alone applications or integrate with Programmable Logic Controllers (PLCs) and control system networks.

Shaft Absolute is the measure of the shaft's motion relative to free space – its absolute motion. In the Absolute Shaft module, the Shaft Absolute measurement is calculated by summing signals of both an eddy current probe, measuring the motion of the shaft relative to the case, and an Allen-Bradley 9000 series sensor (accelerometer or velocity) measuring the absolute motion of the case.

In addition to vibration inputs, the Absolute Shaft module accepts one tachometer input to provide speed measurement and order analysis functions. It also includes a single on-board relay (expandable to five with an XM-441 module), two 4-20 mA outputs, and a buffered output for each input. The module can collect data under steady-state and startup/coast-down conditions, and monitor up to nine alarms making it a complete monitoring system.

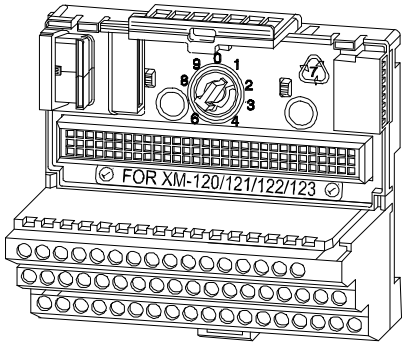
It can operate stand-alone, or it can be deployed on a standard or dedicated DeviceNet network where it can provide real-time data and status information to other XM modules, PLCs, distributed control systems (DCS), and Condition Monitoring Systems.

The Absolute Shaft module can be configured remotely via the DeviceNet network, or locally using a serial connection to a PC or laptop. Refer to Chapter 3 for a list of the configuration parameters.

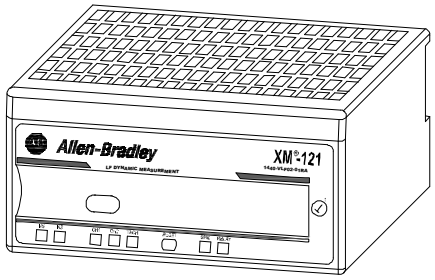
Absolute Shaft Module Components

The Absolute Shaft module consists of a terminal base unit and an instrument module. The XM-121 Low Frequency Dynamic Measurement Module and the XM-940 Terminal Base are shown below.

Figure 1.1 Absolute Shaft Module Components



XM-940 Dynamic Measurement Module Terminal Base Unit
Cat. No. 1440-TB-A



XM-121 Low Frequency Dynamic Measurement Module
Cat. No. 1440-VLF02-01RA

- XM-940 Dynamic Measurement Module Terminal Base - A DIN rail mounted base unit that provides terminations for all field wiring required by XM Dynamic Measurement and Absolute Shaft modules.
- XM-121 Low Frequency Dynamic Measurement Module - The XM-121 mounts on the XM-940 terminal base via a keyswitch and a 96-pin connector. The XM-121 contains the measurement electronics, processors, relay, and serial interface port for local configuration.

IMPORTANT

The XM-441 Expansion Relay module may be connected to the XM-121 module via the XM-940 terminal base.

When connected to the module, the Expansion Relay module simply "expands" the capability of the XM-121 by adding four additional epoxy-sealed relays. The module controls the Expansion Relay module by extending to it the same logic and functional controls as the on-board relay.

Using this Manual

This manual introduces you to the XM-121 Absolute Shaft module. It is intended for anyone who installs, configures, or uses the XM-121 Absolute Shaft module.

Organization

To help you navigate through this manual, it is organized in chapters based on these tasks and topics.

Chapter 1 "Introduction" contains an overview of this manual and the XM-121 module.

Chapter 2 "Installing the XM-121 Absolute Shaft Module" describes how to install, wire, and use the Absolute Shaft module. It also provides instructions on how to install the Absolute Shaft firmware.

Chapter 3 "Configuration Parameters" provides a complete listing and description of the Absolute Shaft parameters. The parameters can be viewed and edited using the XM Serial Configuration Utility software and a personal computer.

Appendix A "Specifications" lists the technical specifications for the Absolute Shaft module.

Appendix B "DeviceNet Information" provides information to help you configure the module over a DeviceNet network.

Appendix C "DeviceNet Objects" provides information on the DeviceNet objects supported by the XM-121 Absolute Shaft module.

Appendix D "Guidelines for Setting the Full Scale Value" provides guidelines for determining the optimal Full Scale value in the XM-121 Absolute Shaft module.

For definitions of terms used in this Guide, see the Glossary at the end of the Guide.

Document Conventions

There are several document conventions used in this manual, including the following:

The XM-121 Absolute Shaft module is referred to as XM-121, Absolute Shaft module, device, or module throughout this manual.

TIP A tip indicates additional information which may be helpful.

EXAMPLE This convention presents an example.

Installing the Absolute Shaft Module

This chapter discusses how to install and wire the XM-121 Absolute Shaft module. It also describes the module indicators and the basic operations of the module, and provides instructions to install the Absolute Shaft firmware.

ATTENTION

Environment and Enclosure

This equipment is intended for use in a Pollution Degree 2 Industrial environment, in overvoltage Category II applications (as defined in IED publication 60664–1), at altitudes up to 2000 meters without derating.

This equipment is supplied as “open type” equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present, and appropriately designed to prevent personal injury resulting from accessibility to live parts. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosures.

XM Installation Requirements

This section describes wire, power, and grounding requirements for an XM system.

Wiring Requirements

Use solid or stranded wire. All wiring should meet the following specifications:

- 14 to 22 AWG copper conductors without pretreatment; 8 AWG required for grounding the DIN rail for electromagnetic interference (emi) purposes
- Recommended strip length 8 millimeters (0.31 inches)
- Minimum insulation rating of 300 V
- Soldering the conductor is forbidden
- Wire ferrules can be used with stranded conductors; copper ferrules recommended

ATTENTION

See the XM Documentation and Configuration Utility CD for Hazardous Locations installation drawings. The XM Documentation and Configuration Utility CD is packaged with the XM modules.

Power Requirements

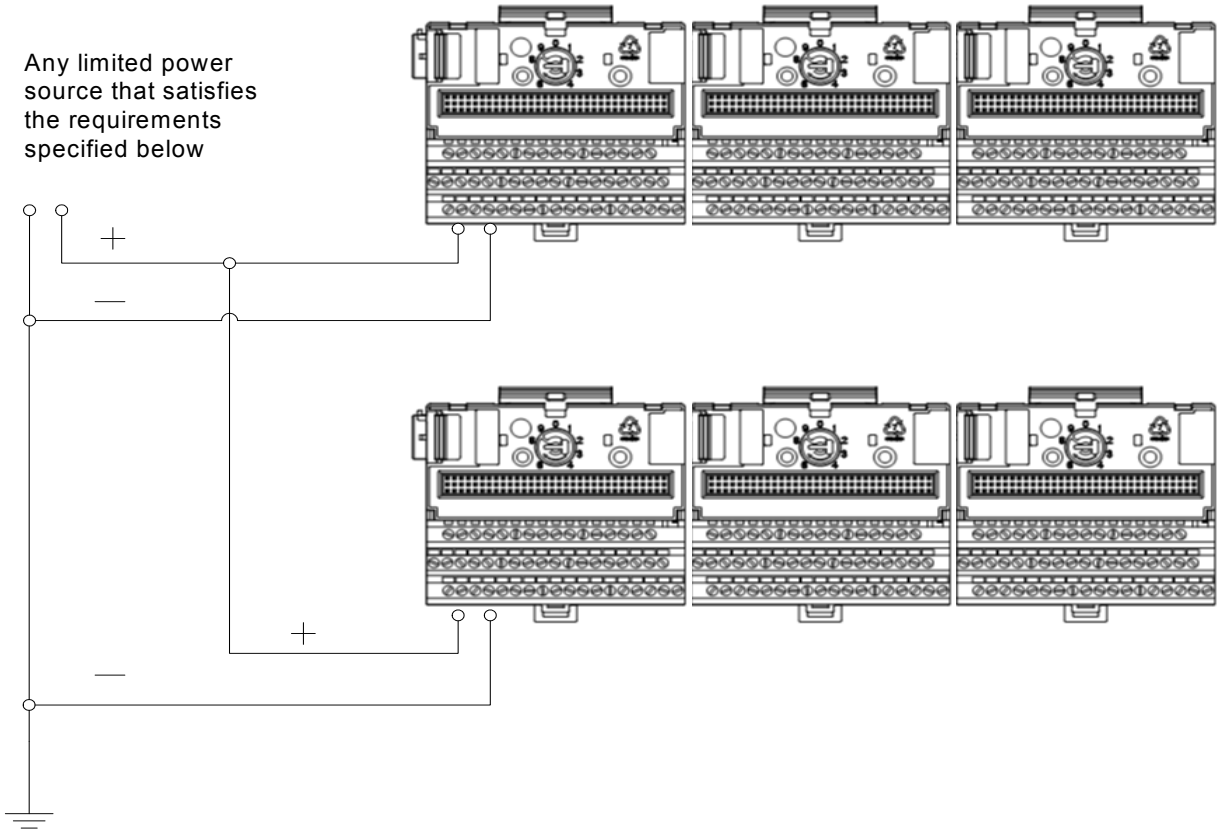
Before installing your module, calculate the power requirements of all modules interconnected via their side connectors. The total current draw through the side connector cannot exceed 3 A. Refer to the specifications for the specific modules for power requirements.

ATTENTION

A separate power connection is necessary if the total current draw of the interconnecting modules is greater than 3 A.

Figure 2.1 is an illustration of wiring modules using separate power connections.

Figure 2.1 XM Modules with Separate Power Connections



Power Supply Requirements

XM Power Supply Requirements	
Protection	Listed Class 2 rated supply, or
	Fused* ITE Listed SELV supply, or
	Fused* ITE Listed PELV supply
Output Voltage	24 Vdc ± 10%
Output Power	100 Watts Maximum (~4A @ 24 Vdc)
Static Regulation	± 2%
Dynamic Regulation	± 3%
Ripple	< 100mVpp
Output Noise	Per EN50081-1
Overshoot	< 3% at turn-on, < 2% at turn-off
Hold-up Time	As required (typically 50mS at full rated load)
* When a fused supply is used the fuse must be a 5 amp, listed, fast acting fuse such as provided by Allen-Bradley part number 1440-5AFUSEKIT	

IMPORTANT See Application Technique "XM Power Supply Solutions", publication ICM-AP005A-EN-E, for guidance in architecting power supplies for XM systems.

Grounding Requirements

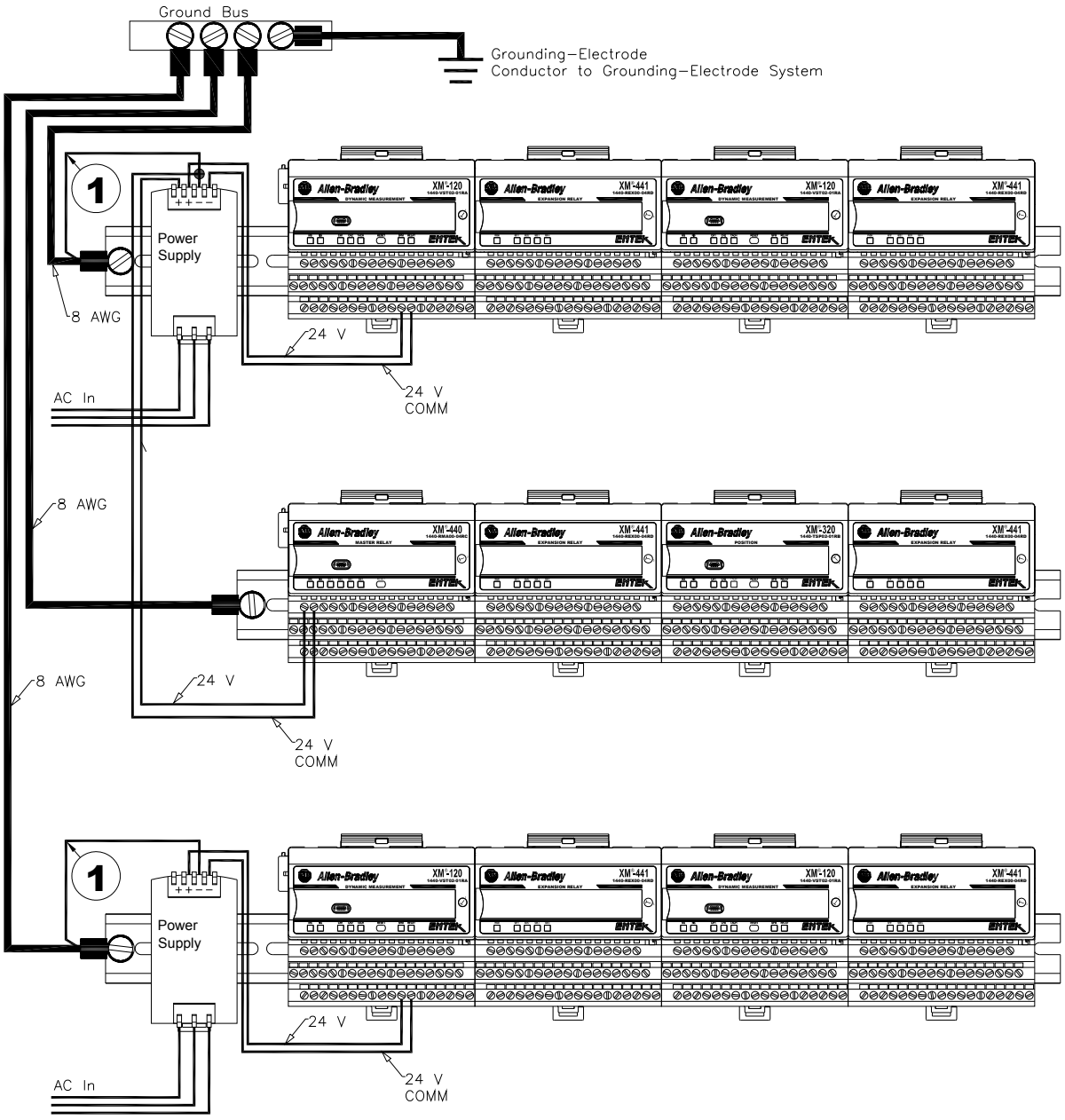
Use these grounding requirements to ensure safe electrical operating circumstances, and to help avoid potential emi and ground noise that can cause unfavorable operating conditions for your XM system.

DIN Rail Grounding

The XM modules make a chassis ground connection through the DIN rail. The DIN rail must be connected to a ground bus or grounding electrode conductor using 8 AWG or 1 inch copper braid. See Figure 2.2.

Use zinc-plated, yellow-chromated steel DIN rail (Allen-Bradley part no. 199-DR1 or 199-DR4) or equivalent to assure proper grounding. Using other DIN rail materials (e.g. aluminum, plastic, etc.), which can corrode, oxidize, or are poor conductors can result in improper or intermittent platform grounding.

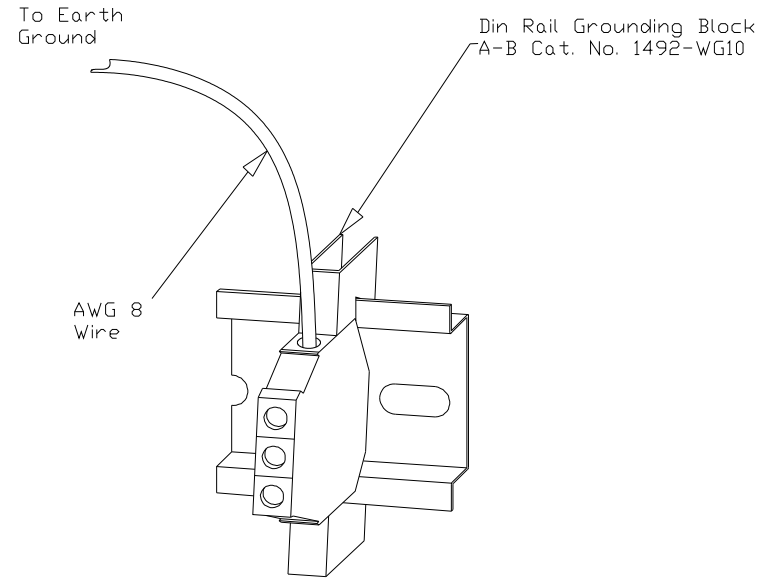
Figure 2.2 XM System DIN Rail Grounding



1 Use 14 AWG wire.

The grounding wire can be connected to the DIN rail using a DIN Rail Grounding Block (Figure 2.3).

Figure 2.3 DIN Rail Grounding Block



Panel/Wall Mount Grounding

The XM modules can also be mounted to a conductive mounting plate that is grounded. See Figure 2.5. Use the grounding screw hole provided on the terminal base to connect the mounting plate the Chassis terminals.

Figure 2.4 Grounding Screw on XM Terminal Base

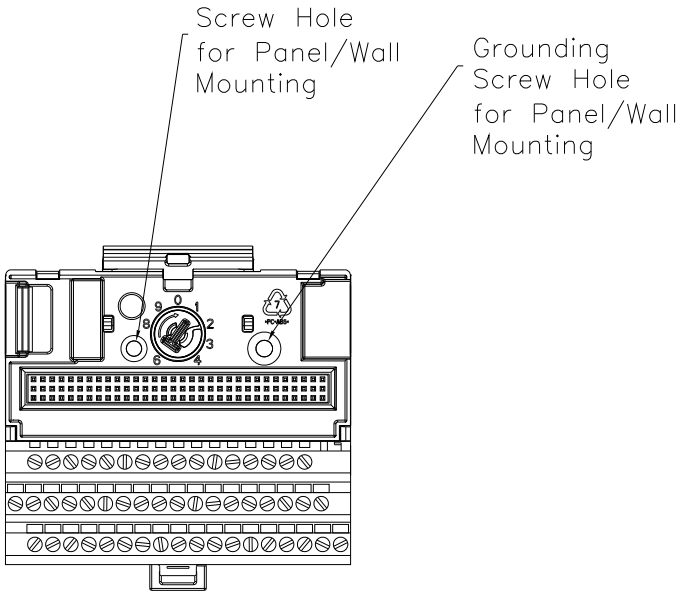
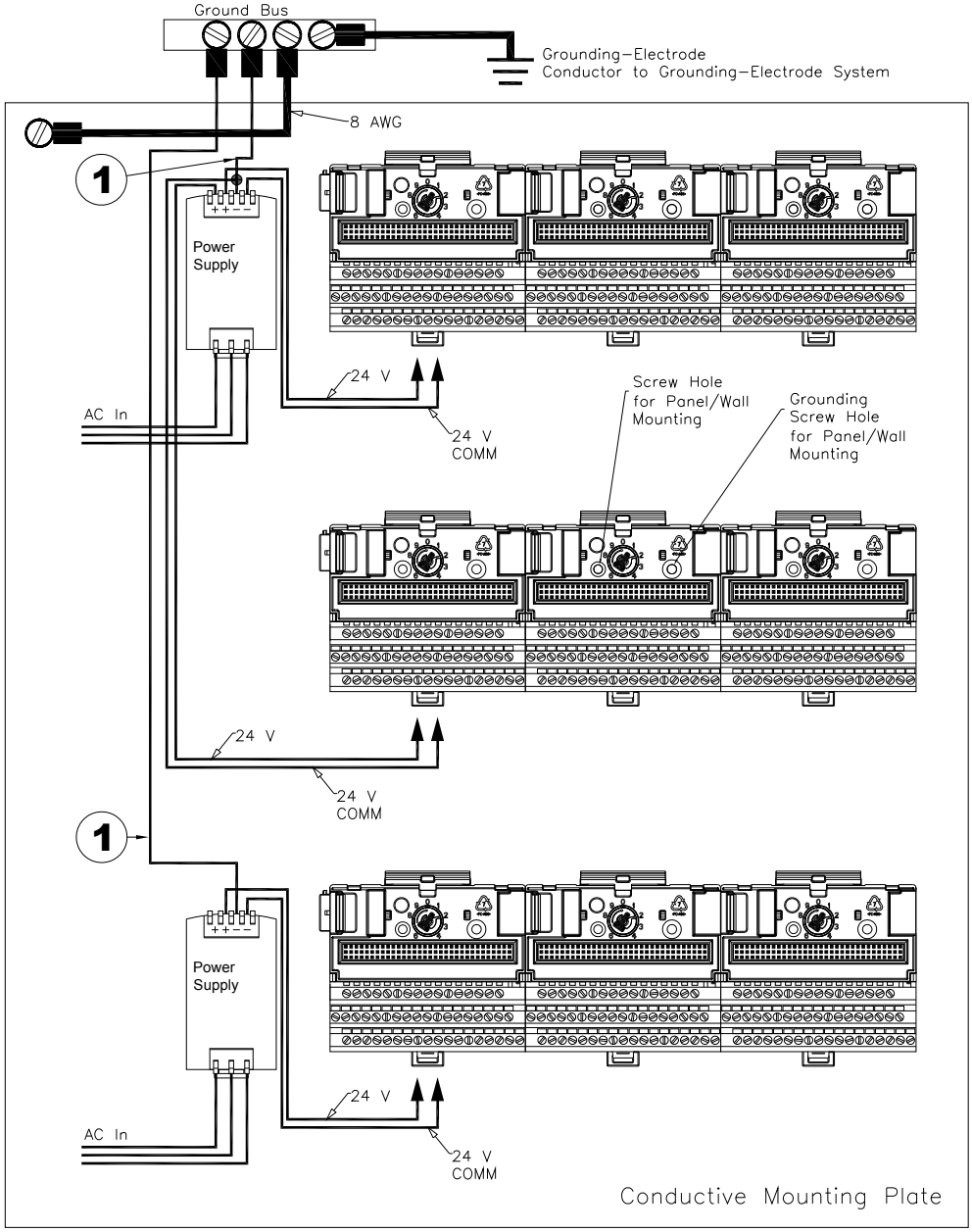


Figure 2.5 Panel/Wall Mount Grounding



1 Use 14 AWG wire.

24 V Common Grounding

24 V power to the XM modules must be grounded. When two or more power supplies power the XM system, ground the 24 V Commons at a single point, such as the ground bus bar.

IMPORTANT If it is not possible or practical to ground the -24Vdc supply, then it is possible for the system to be installed and operate ungrounded. However, if installed ungrounded then the system must not be connected to a ground through any other circuit unless that circuit is isolated externally. Connecting a floating system to a non-isolated ground could result in damage to the XM module(s) and/or any connected device. Also, operating the system without a ground may result in the system not performing to the published specifications regards measurement accuracy and communications speed, distance or reliability.

IMPORTANT The 24 V Common and Signal Common terminals are internally connected. They are isolated from the Chassis terminals unless they are connected to ground as described in this section. See Terminal Block Assignments on page 18 for more information.

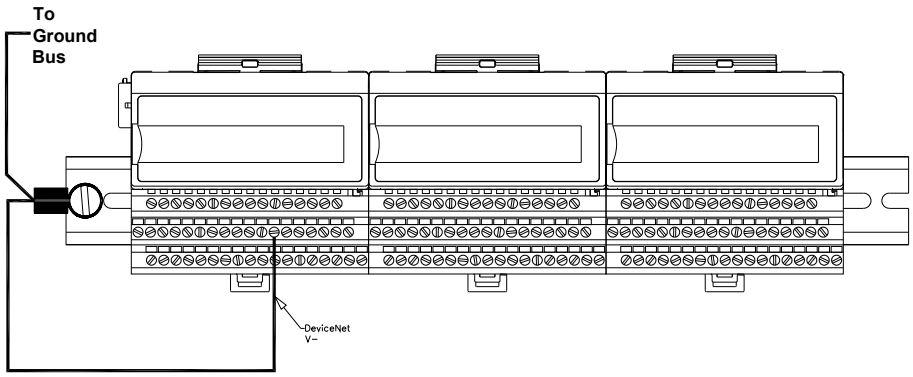
Transducer Grounding

Make certain the transducers are electrically isolated from earth ground. Cable shields must be grounded at one end of the cable, and the other end left floating or not connected. It is recommended that where possible, the cable shield be grounded at the XM terminal base (Chassis terminal) and not at the transducer.

DeviceNet Grounding

The DeviceNet network is functionally isolated and must be referenced to earth ground at a single point. XM modules do not require an external DeviceNet power supply. Connect DeviceNet V- to earth ground at one of the XM modules, as shown in Figure 2.6.

Figure 2.6 Grounded DeviceNet V- at XM Module



ATTENTION

Use of a separate DeviceNet power supply is not permitted. See Application Technique "XM Power Supply Solutions", publication ICM-AP005A-EN-E, for guidance in using XM with other DeviceNet products.

For more information on the DeviceNet installation, refer to the ODVA Planning and Installation Manual - DeviceNet Cable System, which is available on the ODVA web site (http://www.odva.org).

Switch Input Grounding

The Switch Input circuits are functionally isolated from other circuits. It is recommended that the Switch RTN signal be grounded at a single point. Connect the Switch RTN signal to the XM terminal base (Chassis terminal) or directly to the DIN rail, or ground the signal at the switch or other equipment that is wired to the switch.

Mounting the Terminal Base Unit

The XM family includes several different terminal base units to serve all of the XM modules. The XM-940 terminal base, Cat. No. 1440-TB-A, is the only terminal base unit used with the Absolute Shaft module.

The terminal base can be DIN rail or wall/panel mounted. Refer to the specific method of mounting below.

ATTENTION

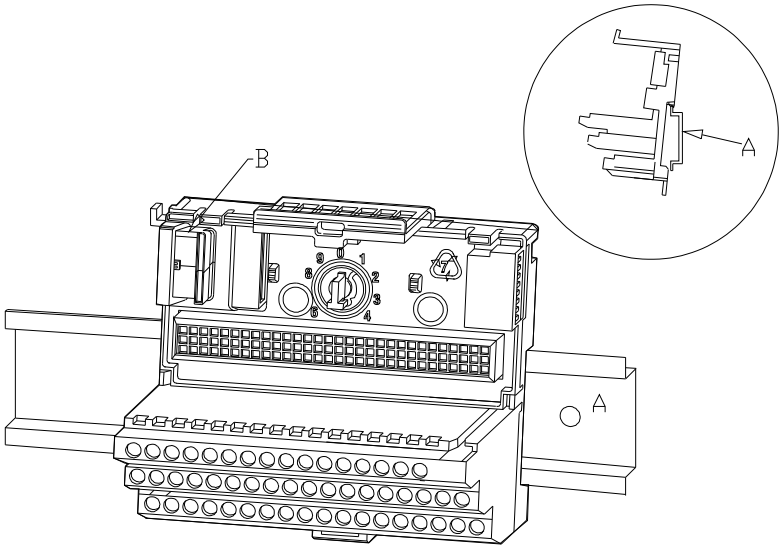
The XM modules make a chassis ground connection through the DIN rail. Use zinc plated, yellow chromated steel DIN rail to assure proper grounding. Using other DIN rail materials (e.g. aluminum, plastic, etc.), which can corrode, oxidize or are poor conductors can result in improper or intermittent platform grounding.

You can also mount the terminal base to a grounded mounting plate. Refer to Panel/Wall Mount Grounding on page 10.

DIN Rail Mounting

Use the following steps to mount the XM-947 terminal base unit on a DIN rail (A-B pt no. 199-DR1 or 199-DR4).

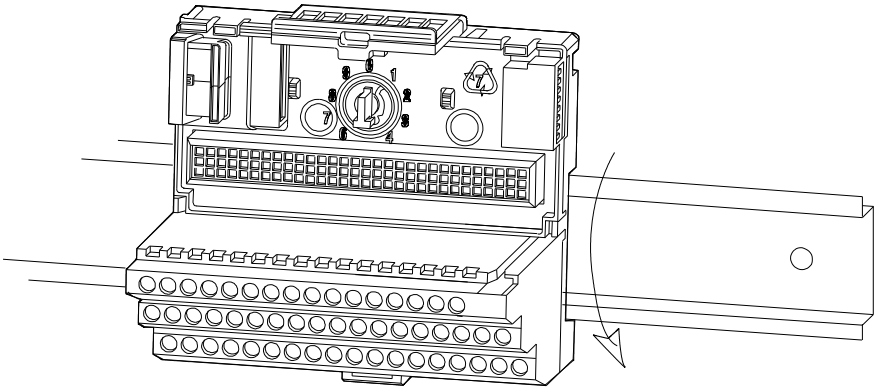
1. Position the terminal base on the 35 x 7.5 mm DIN rail (A).



Position terminal base at a slight angle and hook over the top of the DIN rail.

2. Slide the terminal base unit over leaving room for the side connector (B).

3. Rotate the terminal base onto the DIN rail with the top of the rail hooked under the lip on the rear of the terminal base.



4. Press down on the terminal base unit to lock the terminal base on the DIN rail. If the terminal base does not lock into place, use a screwdriver or similar device to open the locking tab, press down on the terminal base until flush with the DIN rail and release the locking tab to lock the base in place.

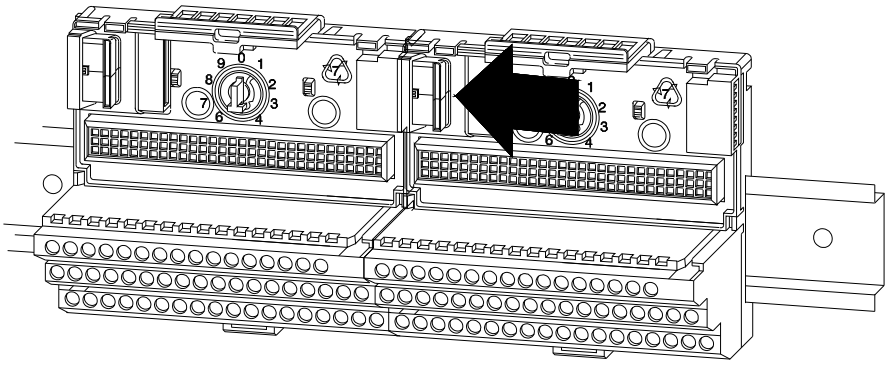
Interconnecting Terminal Base Units

Follow the steps below to install another terminal base unit on the DIN Rail.

IMPORTANT Make certain you install the terminal base units in order of left to right.

1. Position the terminal base on the 35 x 7.5 mm DIN rail (A).
2. Make certain the side connector (B) is **fully retracted** into the base unit.
3. Slide the terminal base unit over tight against the neighboring terminal base. Make sure the hook on the terminal base slides under the edge of the terminal base unit.
4. Press down on the terminal base unit to lock the terminal base on the DIN rail. If the terminal base does not lock into place, use a screwdriver or similar device to open the locking tab, press down on the terminal base until flush with the DIN rail and release the locking tab to lock the base in place.

5. Gently push the side connector into the side of the neighboring terminal base to complete the backplane connection.



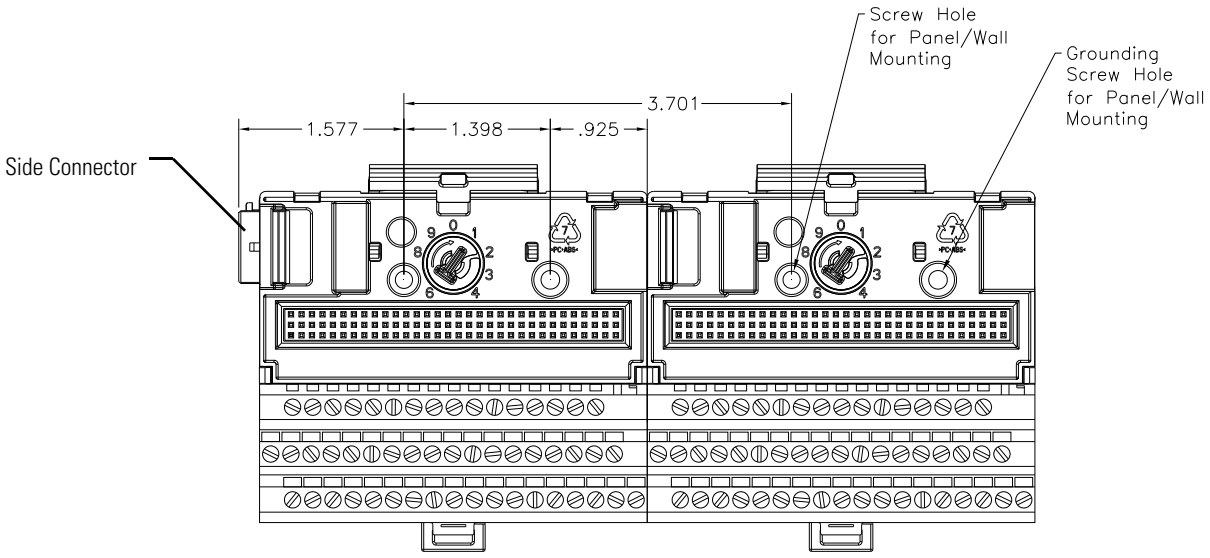
Panel/Wall Mounting

Installation on a wall or panel consists of:

- laying out the drilling points on the wall or panel
- drilling the pilot holes for the mounting screws
- installing the terminal base units and securing them to the wall or panel

Use the following steps to install the terminal base on a wall or panel.

1. Lay out the required points on the wall/panel as shown in the drilling dimension drawing below.

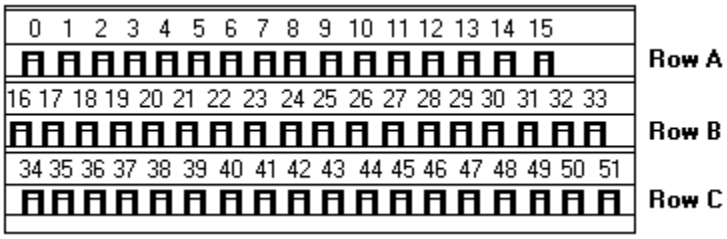


2. Drill the necessary holes for the #6 self-tapping mounting screws.
3. Secure the terminal base unit using two #6 self-tapping screws.
4. To install another terminal base unit, retract the side connector into the base unit. Make sure it is **fully retracted**.
5. Position the terminal base unit up tight against the neighboring terminal base. Make sure the hook on the terminal base slides under the edge of the terminal base unit.
6. Gently push the side connector into the side of the neighboring terminal base to complete the backplane connection.
7. Secure the terminal base to the wall with two #6 self-tapping screws.

Connecting Wiring for Your Module

Wiring to the module is made through the terminal base unit on which the module mounts. The XM-121 is compatible only with the XM-940 terminal base unit, Cat. No. 1440-TB-A.

Figure 2.7 XM-940 Terminal Base Unit



XM-940 (Cat. No. 1440-TB-A)

Terminal Block Assignments

The terminal block assignments and descriptions for the Absolute Shaft module are shown below.

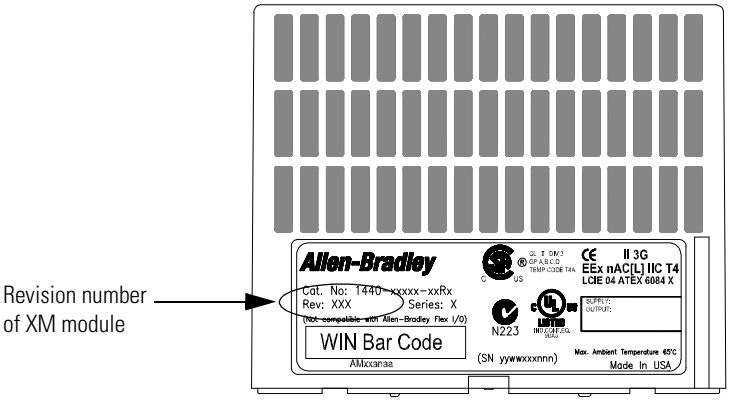
ATTENTION

The following table applies only to the XM-121 module revision B01 (and later). Earlier revisions of the module do not support the wiring configuration of the Absolute Shaft module.

Refer to the installation instructions for the specific XM module for its terminal assignments.

TIP

The XM module's revision number is on the product label (which is located on the front of the XM module, as shown below).



WARNING

EXPLOSION HAZARD

Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.

Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.

Terminal Block Assignments

No.	Name	Description
0	Xducer 1 (+)	Vibration transducer 1 (shaft relative) connection
1	Xducer 2 (+)	Vibration transducer 2 (case absolute) connection
2	Buffer 1 (+)	Vibration signal 1 buffered output
3	Buffer 2 (+)	Vibration signal 2 buffered output
4	Tach/Signal In (+)	Tachometer transducer/signal input, positive side
5	Buffer Power 1 IN	Channel 1 buffer power input Connect to terminal 21 for negative biased transducers
6	Positive Buffer Bias	Provides positive (-5 V to +24 V) voltage compliance to buffered outputs Connect to terminal 22 (CH 2) for positive bias transducers
7	TxD	PC serial port, transmit data
8	RxD	PC serial port, receive data
9	XRTN[1]	Circuit return for TxD and RxD
10	Chassis	Connection to DIN rail ground spring or panel mounting hole
11	4-20 mA 1 (+)	4-20 mA output 300 ohm maximum load
12	4-20 mA 1 (-)	
13	Chassis	Connection to DIN rail ground spring or panel mounting hole
14	Chassis	Connection to DIN rail ground spring or panel mounting hole
15	Chassis	Connection to DIN rail ground spring or panel mounting hole
16	Xducer 1 (-)[1]	Vibration transducer 1 connection
17	Xducer 2 (-)[1]	Vibration transducer 2 connection
18	Signal Common[1]	Vibration buffered output return
19	TACH Buffer	Tachometer transducer/signal output
20	Tachometer (-)	Tachometer transducer/signal return, TACH Buffer return
21	Buffer/Xducer Pwr (-)	Provides negative (-24 V to +9 V) voltage compliance to buffered outputs Connect to terminal 5 (CH 1) for negative bias transducers Transducer power supply output, negative side; used to power external sensor (40 mA maximum load)

Terminal Block Assignments

No.	Name	Description
22	Buffer Power 2 IN	Channel 2 buffer power input Connect to terminal 6 for positive biased transducers for negative biased transducers
23	CAN_High	DeviceNet bus connection, high differential (white wire)
24	CAN_Low	DeviceNet bus connection, low differential (blue wire)
25	+24 V Out	Internally connected to 24 V In 1 (terminal 44) Used to daisy chain power if XM modules are not plugged into each other
26	DNet V (+)	DeviceNet bus power input, positive side (red wire)
27	DNet V (-)	DeviceNet bus power input, negative side (black wire)
28	24 V Common[1]	Internally connected to 24 V Common (terminals 43 and 45) Used to daisy chain power if XM modules are not plugged into each other If power is not present on terminal 44, there is no power on this terminal
29	4-2 0mA 2 (+)	4-20 mA output 300 ohm maximum load
30	4-20 mA 2 (-)	
31	Chassis	Connection to DIN rail ground spring or panel mounting hole
32	Chassis	Connection to DIN rail ground spring or panel mounting hole
33	Chassis	Connection to DIN rail ground spring or panel mounting hole
34	Chassis	Connection to DIN rail ground spring or panel mounting hole
35	Chassis	Connection to DIN rail ground spring or panel mounting hole
36	Chassis	Connection to DIN rail ground spring or panel mounting hole
37	Chassis	Connection to DIN rail ground spring or panel mounting hole
38	Chassis	Connection to DIN rail ground spring or panel mounting hole
39	SetPtMult	Switch input to activate Set Point Multiplication (active closed)
40	Switch RTN	Switch return, shared between SetPtMult and Reset Relay
41	Reset Relay	Switch input to reset internal relay (active closed)
42	Reserved	
43	24 V Common[1]	Internally DC-coupled to circuit ground
44	+24 V In	Connection to primary external +24 V power supply, positive side
45	24 V Common[1]	Connection to external +24 V power supply, negative side (internally DC-coupled to circuit ground)
46	Relay N.C. 1	Relay Normally Closed contact 1
47	Relay Common 1	Relay Common contact 1
48	Relay N.O. 1	Relay Normally Open contact 1
49	Relay N.O. 2	Relay Normally Open contact 2
50	Relay Common 2	Relay Common contact 2
51	Relay N.C. 2	Relay Normally Closed contact 2

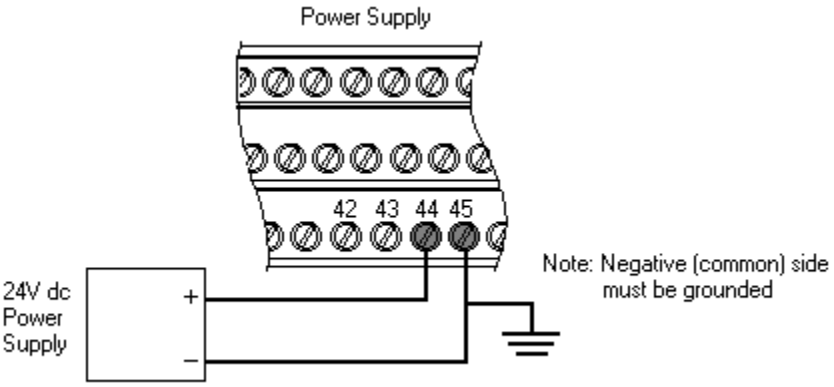
1 Terminals are internally connected and isolated from the Chassis terminals.

Connecting the Power Supply

Power supplied to the module must be nominally 24 Vdc (±10%) and must be a Class 2 rated circuit.

Wire the DC-input power supply to the terminal base unit as shown in Figure 2.8.

Figure 2.8 DC Input Power Supply Connections



IMPORTANT A Class 2 circuit can be provided by use of an NEC Class 2 rated power supply, or by using a SELV or PELV rated power supply with a 5 Amp current limiting fuse installed before the XM module(s).

IMPORTANT 24Vdc needs to be wired to terminal 44 (+24 V In) to provide power to the device and other XM modules linked to the wired terminal base via the side connector.

ATTENTION The power connections are different for different XM modules. Refer to the installation instructions for your specific XM module for complete wiring information.

Connecting the Relays

The XM-121 has both Normally Open (NO) and Normally Closed (NC) relay contacts. Normally Open relay contacts close when the control output is energized. Normally Closed relay contacts open when the control output is energized.

The alarms associated with the relay and whether the relay is normally de-energized (non-failsafe) or normally energized (failsafe) depends on the configuration of the module. Refer to Relay Parameters on page 59 for details.

Table 2.1 shows the on-board relay connections for the module.

IMPORTANT All XM relays are double pole. This means that each relay has two contacts in which each contact operates independently but identically. The following table and illustrations show wiring solutions for both contacts; although, in many applications it may be necessary to wire only one contact.

TIP The Expansion Relay module may be connected to the module to provide additional relays. Refer the XM-441 Expansion Relay Module User's Guide for wiring details.

IMPORTANT The NC/NO terminal descriptions (page 20) correspond to a de-energized (unpowered) relay.

When the relay is configured for non-failsafe operation, the relay is normally de-energized.

When the relay is configured for failsafe operation, the relay is normally energized, and the behavior of the NC and NO terminals is inverted.

Table 2.1 Relay Connections for XM-121

Configured for Failsafe Operation			Relay 1 Terminals	
Nonalarm	**Alarm**	**Wire Contacts**	**Contact 1**	**Contact 2**
Closed	Opened	COM	47	50
		NO	48	49
Opened	Closed	COM	47	50
		NC	46	51

Configured for Non-failsafe Operation			Relay 1 Terminals	
Nonalarm	**Alarm**	**Wire Contacts**	**Contact 1**	**Contact 2**
Closed	Opened	COM	47	50
		NC	46	51
Opened	Closed	COM	47	50
		NO	48	49

Figures 2.9 and 2.10 illustrate the behavior of the NC and NO terminals when the relay is wired for failsafe, alarm or nonalarm condition or non-failsafe, alarm or nonalarm condition.

Figure 2.9 Relay Connection - Failsafe, Nonalarm Condition
Non-failsafe, Alarm Condition

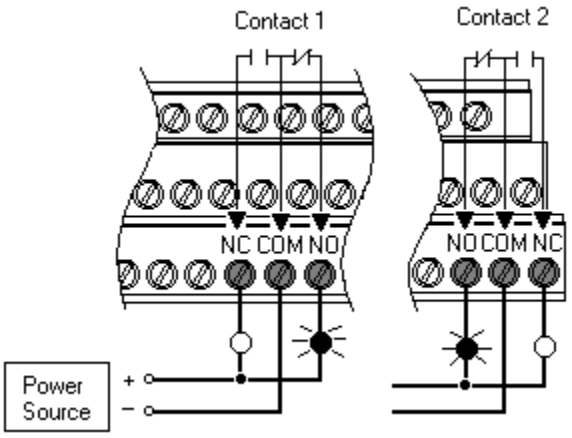
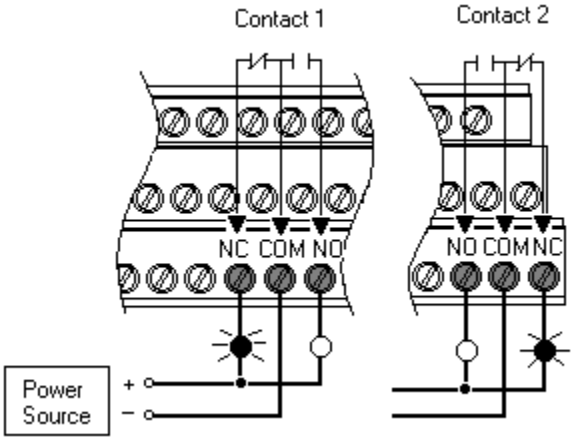


Figure 2.10 Relay Connection - Failsafe, Alarm Condition
Non-failsafe, Nonalarm Condition



Alternate Relay Wiring

Figures 2.11 and 2.12 show how to wire both ends of a single external indicator to the XM terminal base for failsafe, nonalarm or alarm condition or non-failsafe, nonalarm or alarm condition.

Figure 2.11 Relay Connection - Failsafe, Nonalarm Condition
Non-failsafe, Alarm Condition

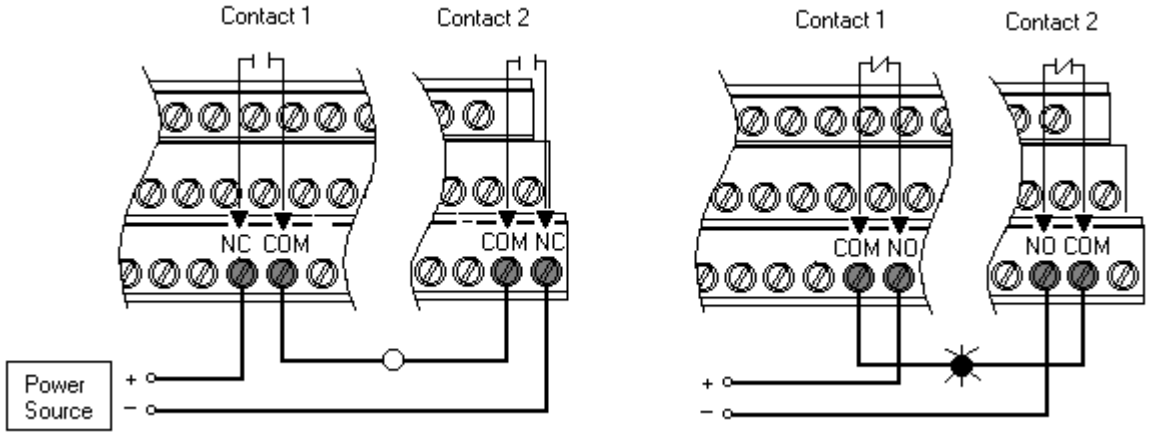
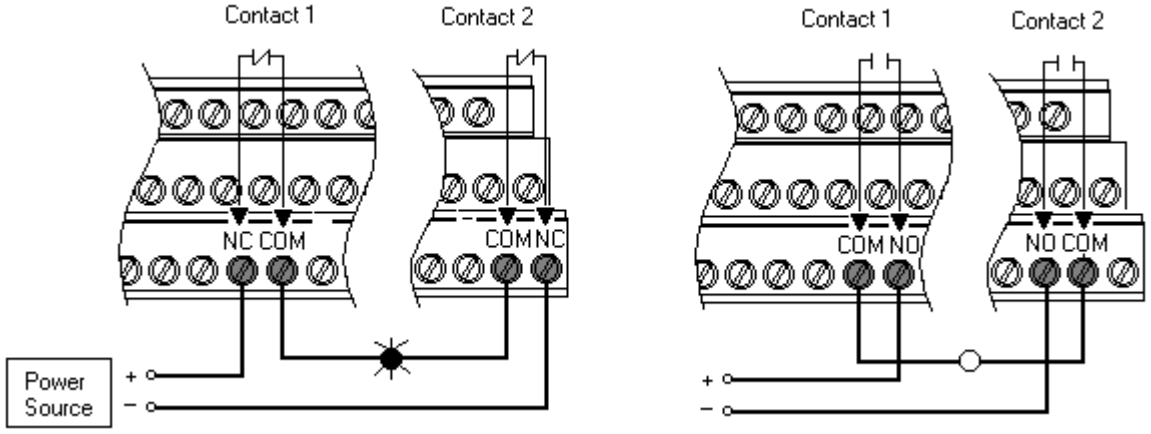


Figure 2.12 Relay Connection - Failsafe, Alarm Condition
Non-failsafe, Nonalarm Condition



Connecting the Tachometer Signal

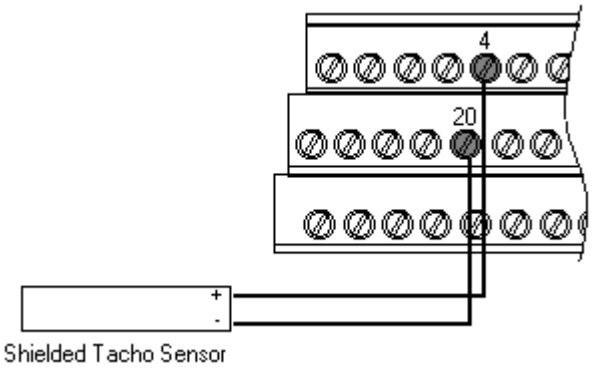
The XM-121 provides a single tachometer input signal. The signal processing performed on the tachometer signal depends on the configuration of the module. See page 52 for a description of the tachometer parameters.

IMPORTANT If you are not using the tachometer input, set the **Pulses per Revolution** parameter to zero (0). This will disable the tachometer measurement and prevent the module from indicating a tachometer fault (TACH indicator flashing yellow). A tachometer fault occurs when no signal pulses are received on the tachometer input signal for a relatively long period.

Connecting a Magnetic Pickup Tachometer

Figure 2.13 shows the wiring of a magnetic pickup tachometer to the terminal base unit.

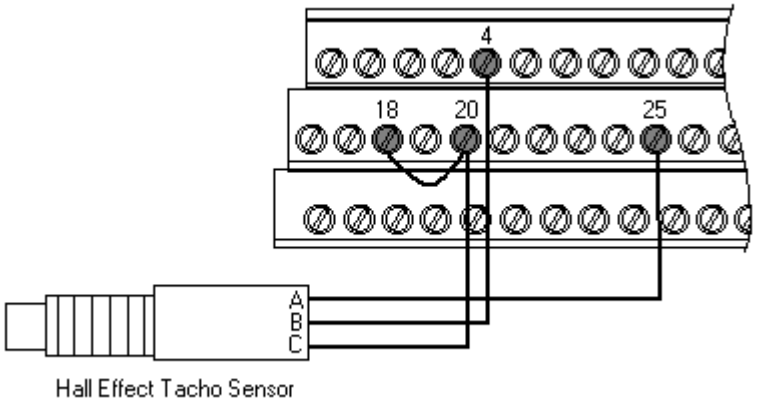
Figure 2.13 Magnetic Pickup Tachometer Signal Connection



Connecting a Hall Effect Tachometer Sensor

Figure 2.14 shows the wiring of a Hall Effect Tachometer Sensor, Cat. No. 44395, to the terminal base unit.

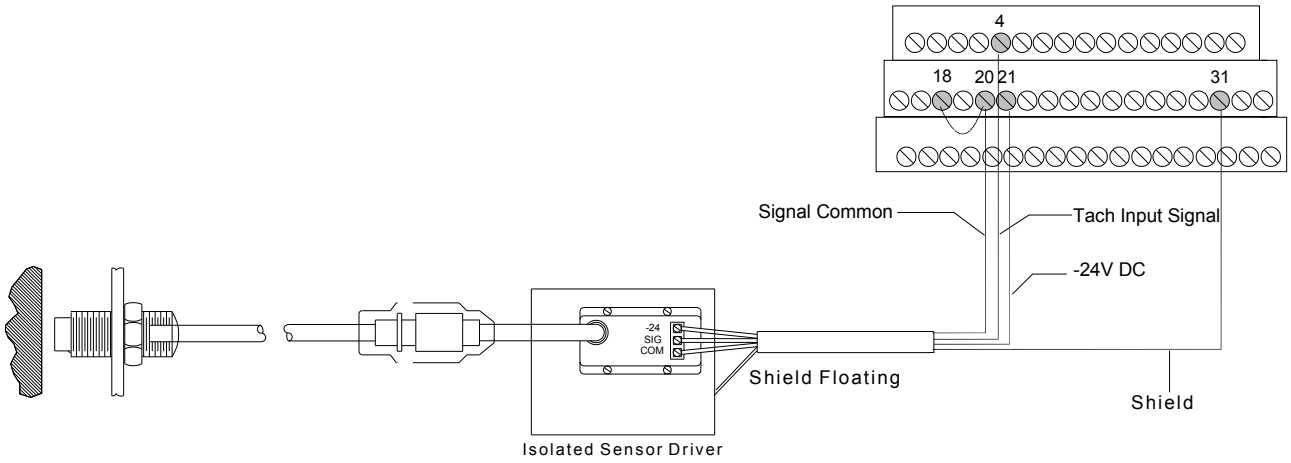
Figure 2.14 Hall Effect Tachometer Signal Connection



Connecting a Non-Contact Sensor to the Tachometer Signal

Figure 2.15 shows the wiring of a non-contact sensor to the tachometer input signal.

Figure 2.15 Non-Contact Sensor to Tachometer Signal Connection

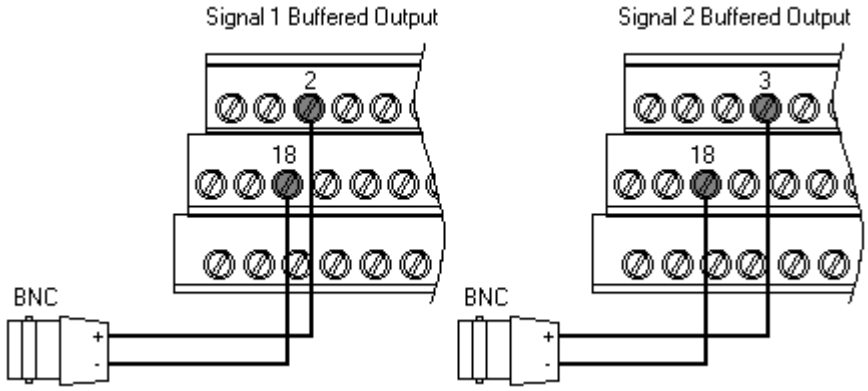


Connecting the Buffered Outputs

The XM-121 provides buffered outputs of all transducer input signals. The buffered output connections may be used to connect the module to portable data collectors or other online systems.

Figure 2.16 shows the buffered output connections for the modules.

Figure 2.16 Buffered Output Connections



IMPORTANT **Applies only to XM-121 module revision B01 (and later).**

The voltage operating range of the buffered outputs must be configured to coincide with the corresponding transducer bias range. This operating range is configured by placing a jumper from terminal 5 (channel 1) and terminal 22 (channel 2) to either terminal 6 (Positive Buffer Bias) or terminal 21 (Buffer -), depending on the transducer. See Table 2.2. Note the buffered output operating range is configured independently per channel.

Table 2.2 Configuring Buffered Output Operating Range

Transducer	Input Range	Channel	Connect Terminal	To Terminal
Negative Bias[1]	-24 to +9V	1	5	21
Positive Bias[2]	-5 to +24V	2	22	6
Non-Bias	-5 to +9V	2	----	----

1 The signal from the non-contact probe must be connected to channel 1 on the terminal base.

2 The signal from the 9000 sensor must be connected to channel 2 on the terminal base.

Connecting the Transducers

The Absolute Shaft module can accept input from a non-contact eddy current probe and a case mounted vibration sensor (accelerometer or velocity sensor). The signal from a non-contact eddy current probe must be connected to channel 1. The Absolute Shaft module supports the 5, 8, and 11mm Allen-Bradley 2100 Series and Bently Nevada 3300 XL Series probes.

The case mounted vibration sensor must be connected to channel 2. The Absolute Shaft module supports the following Allen-Bradley 9000 series sensors.

Table 2.3 Supported Allen-Bradley 9000 Series Sensors

Cat. No.	Model
EK-43781I	9000A General Purpose Sensor
EK-43808I	9100VO Velocity Output Sensor
EK-43786I	9100CSA General Purpose Sensor
EK-43805I	9100T High Temperature Sensor

Important Considerations

When mounting the vibration sensor and the non-contact eddy current probe, it is important to note the following:

- The two sensors should be mounted at or adjacent to each machine bearing.
- The sensors should be mounted in the same geometric plane.
- It is preferable to mount the transducers at the same point on the same bearing half. This can be done by using a dual mounting housing (such as the Dual Probe Holder, Cat. No. EK-29000-DPH01). The positions chosen should be the same at each bearing.

Connecting a Non-Contact Sensor and 9000 Series Sensor

The following figure shows the wiring of a non-contact sensor and a 9000 series sensor to the terminal base unit. The non-contact sensor must be wired to channel 1 and the 9000 sensor must be wired to channel 2.

IMPORTANT The Absolute Shaft module requires the XM-121 module revision B01 (and later). Earlier revisions of the module do not support the Absolute Shaft wiring configuration.

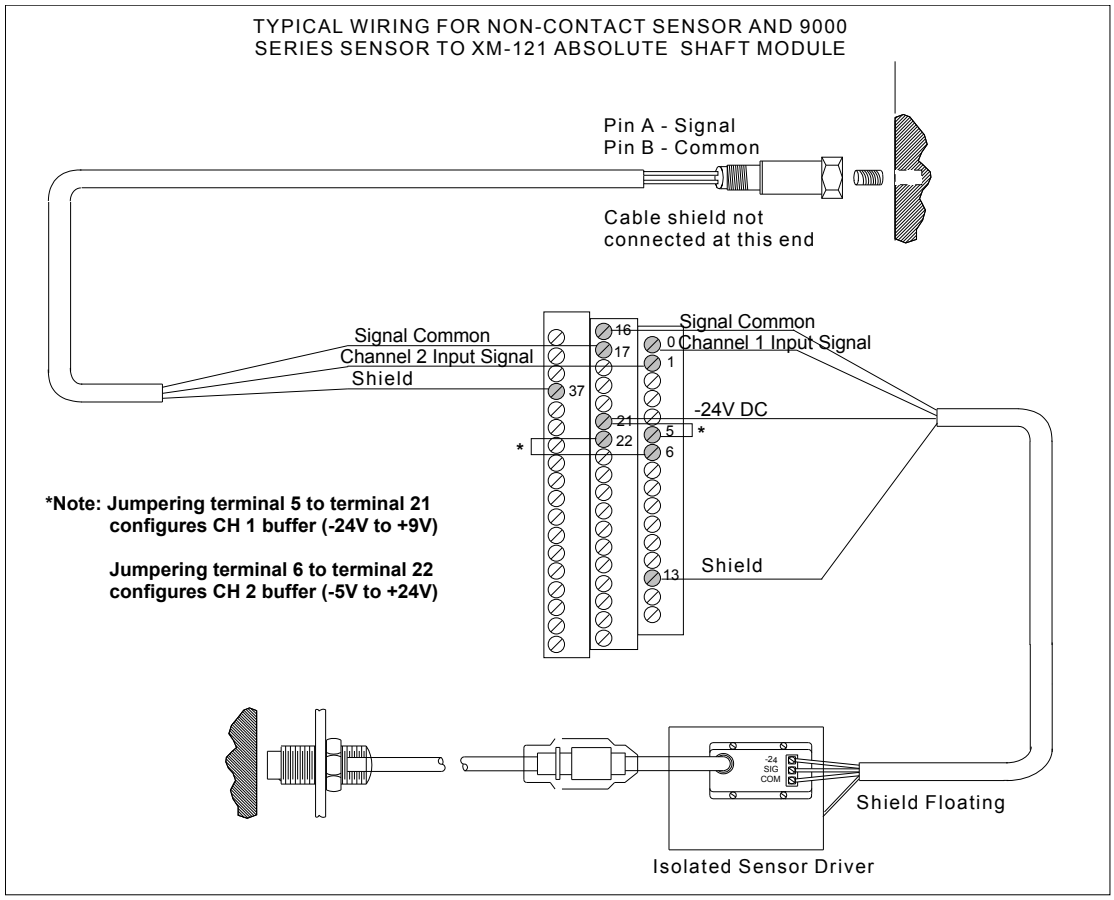
ATTENTION

You may ground the cable shield at either end of the cable. Do not ground the shield at both ends. Recommended practice is to ground the cable shield at the terminal base and not at the transducer. Any convenient Chassis terminal may be used (see Terminal Block Assignments on page 18).

IMPORTANT The internal transducer power supply is providing power to the non-contact sensor.

IMPORTANT Make certain the **IEPE Power** parameter for channel 2 is enabled so power is provided to the 9000 sensor. Refer to Channel Parameters on page 46.

Figure 2.17 Non-Contact Sensor and 9000 Series Sensor Wiring



Connecting Two Non-Contact Sensors and 9000 Series Sensor

The following figure shows the wiring of two non-contact sensors and a 9000 series sensor to the terminal base unit. One non-contact sensor must be wired to channel 1 and the 9000 sensor must be wired to channel 2. The second non-contact sensor is wired to the tachometer input signal.

IMPORTANT The Absolute Shaft module requires the XM-121 module revision B01 (and later). Earlier revisions of the module do not support the Absolute Shaft wiring configuration.

ATTENTION

You may ground the cable shield at either end of the cable. Do not ground the shield at both ends. Recommended practice is to ground the cable shield at the terminal base and not at the transducer. Any convenient Chassis terminal may be used (see Terminal Block Assignments on page 18).

IMPORTANT

The internal transducer power supply is providing power to the non-contact sensor connected to channel 1.

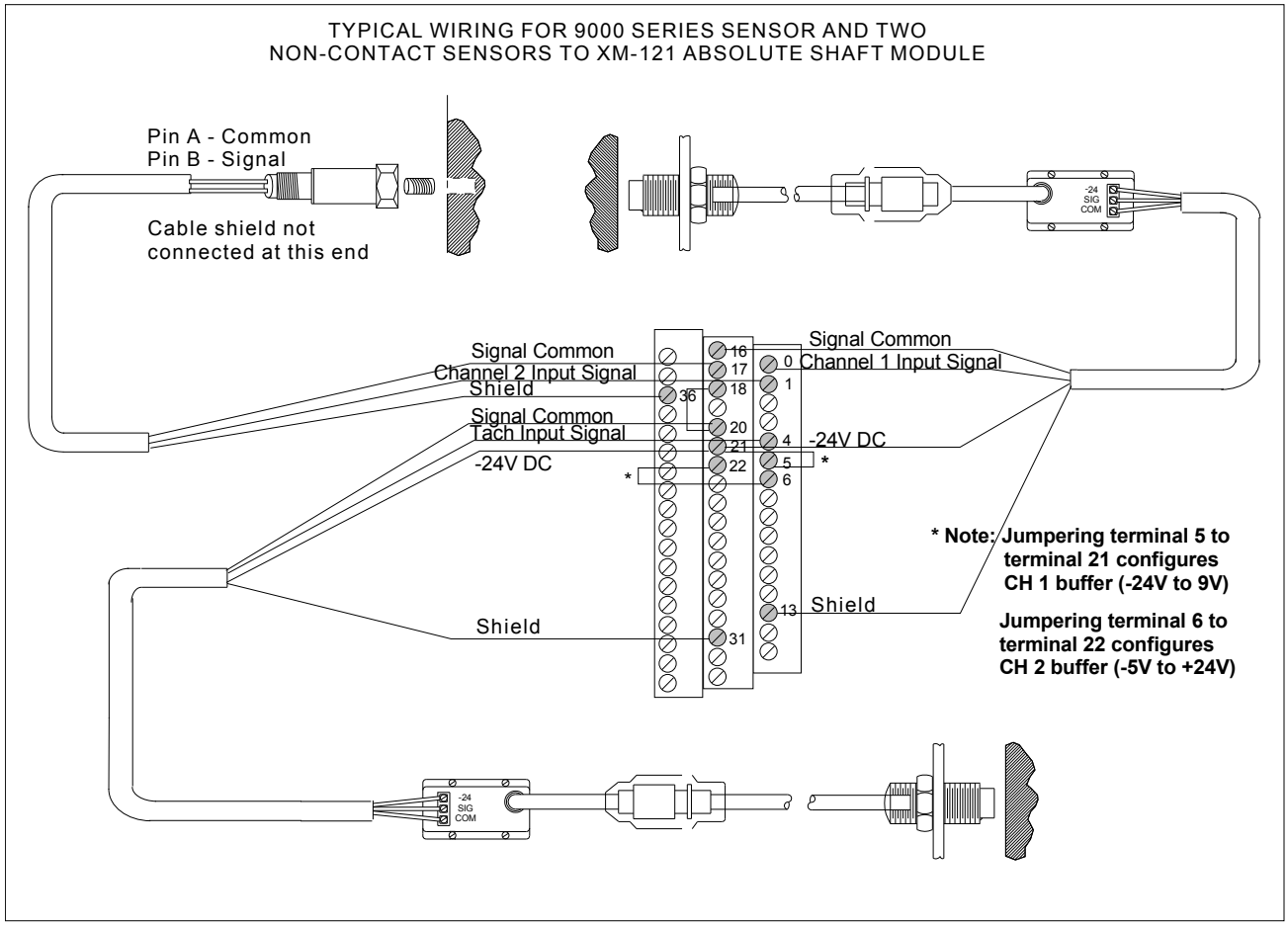
IMPORTANT

Make certain the **IEPE Power** parameter for channel 2 is enabled so power is provided to the 9000 sensor. Refer to Channel Parameters on page 46.

IMPORTANT

Transducer DC bias is monitored on all signals.

Figure 2.18 9000 Series Sensor and Two Non-Contact Sensors



Connecting the Remote Relay Reset Signal

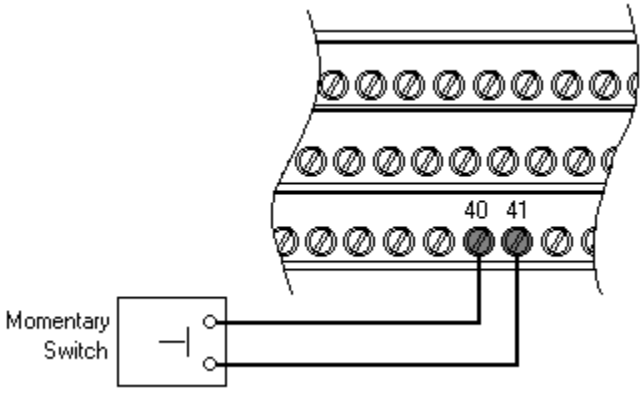
If you set the module relay to latching and the relay activates, the relay stays activated even when the condition that caused the alarm has ended. The remote relay reset signal enables you to reset your module relay remotely after you have corrected the alarm condition. This includes latched relays in the Expansion Relay module when it is attached to the XM-121.

TIP If you set a module relay to latching, make sure that any linked relays, such as relays in an XM-440 Master Relay Module, are **not** configured as latching. When both relays are set to latching, the relay in each module will have to be independently reset when necessary.

TIP You can discretely reset a relay using the serial or remote configuration tool.

Wire the Remote Relay Reset Signal to the terminal base unit as shown in Figure 2.19.

Figure 2.19 Remote Relay Reset Signal Connection



ATTENTION

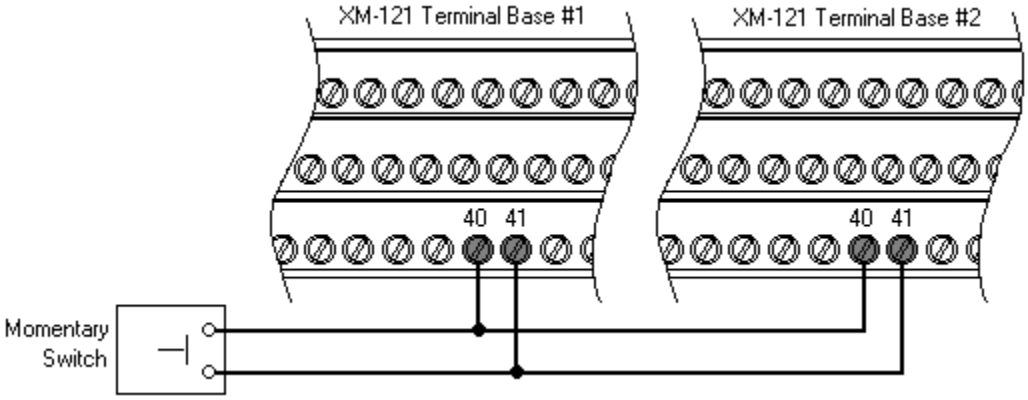
The Switch Input circuits are functionally isolated from other circuits. It is recommended that the Switch RTN signal be grounded at a signal point. Connect the Switch RTN signal to the XM terminal base (Chassis terminal) or directly to the DIN rail, or ground the signal at the switch or other equipment that is wired to the switch.

A single switch contact can also be shared by multiple XM modules wired in parallel as shown in Figure 2.20.

ATTENTION

The relay reset connections may be different for different XM modules. Figure 2.20 applies only to the XM-121 module. Refer to the installation instructions for the module for its terminal assignments.

Figure 2.20 Typical Multiple XM Modules Remote Relay Reset Signal Connection

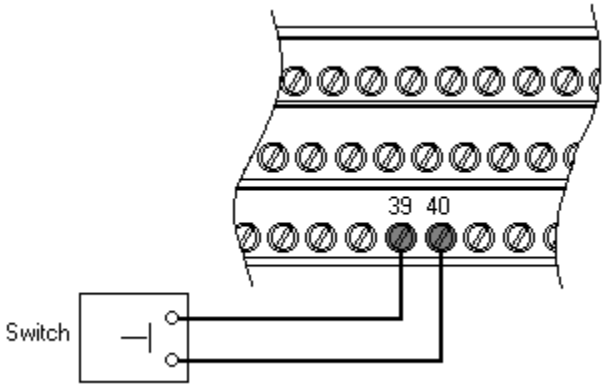


Connecting the Setpoint Multiplication Switch

You can configure the module to multiply the alarm setpoints, or inhibit the alarms during the start-up period. This can be used to avoid alarm conditions that may occur during startup, for example, when the monitored machine passes through a critical speed.

Wire the Setpoint Multiplication switch to the terminal base unit as shown in Figure 2.21.

Figure 2.21 Setpoint Multiplication Connection



ATTENTION

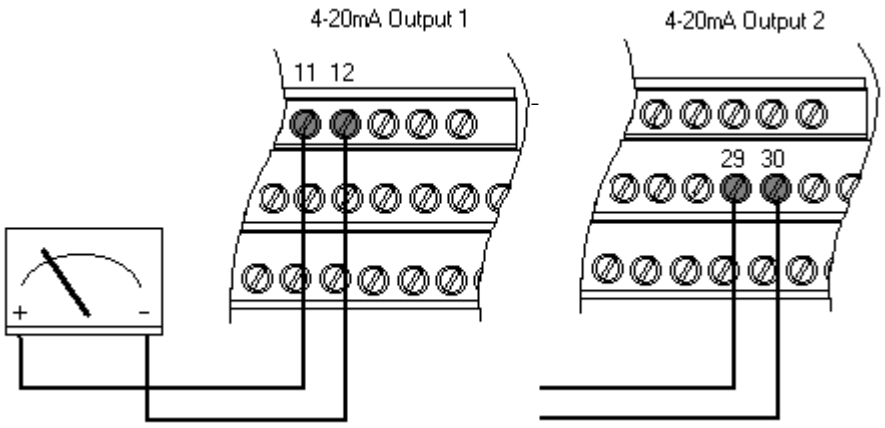
The Switch Input circuits are functionally isolated from other circuits. It is recommended that the Switch RTN signal be grounded at a signal point. Connect the Switch RTN signal to the XM terminal base (Chassis terminal) or directly to the DIN rail, or ground the signal at the switch or other equipment that is wired to the switch.

Connecting the 4-20 mA Outputs

The module includes an isolated 4-20 mA per channel output into a maximum load of 300 ohms. The measurements that the 4-20 mA output tracks and the signal levels that correspond to the 4 mA and 20 mA are configurable. Refer to 4-20 mA Output Parameters on page 63 for details.

Wire the 4-20 mA outputs to the terminal base unit as shown in Figure 2.22.

Figure 2.22 4-20 mA Output Connections



ATTENTION

The 4-20 mA outputs are functionally isolated from other circuits. It is recommended that the outputs be grounded at a single point. Connect the 4-20 mA (-) to the XM terminal base (Chassis terminal) or directly to the DIN rail, or ground the signal at the other equipment in the 4-20 mA loop.

Serial Port Connection

The XM-121 includes a serial port connection that allows you to connect a PC to it and configure the module's parameters. There are two methods of connecting an external device to the module's serial port.

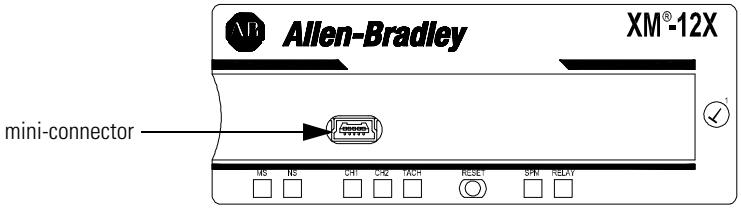
- **Terminal Base Unit** - There are three terminals on the terminal base unit you can use for the serial port connection. They are TxD, RxD, and RTN (terminals 7, 8, and 9, respectively). If these three terminals are wired to a DB-9 female connector, then a standard RS-232 serial cable with 9-pin (DB-9) connectors can be used to connect the module to a PC (no null modem is required).

  The DB-9 connector should be wired to the terminal block as shown.

XM-121 Terminal Base Unit (Cat. No. 1440-TB-A)		**DB-9 Female Connector**
TX Terminal (terminal 7)	----------	Pin 2 (RD - receive data)
RX Terminal (terminal 8)	----------	Pin 3 (TD - transmit data)
RTN Terminal (terminal 9)	----------	Pin 5 (SG - signal ground)

- **Mini-Connector** - The mini-connector is located on top of the module, as shown in Figure 2.23.

Figure 2.23 Mini-Connector



A special cable (Cat. No. 1440-SCDB9FXM2) is required for this connection. The connector that inserts into the PC is a DB-9 female connector, and the connector that inserts into the module is a USB Mini-B male connector.

WARNING

If you connect or disconnect the serial cable with power applied to the module or the serial device on the other end of the cable, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

IMPORTANT

If 24V Common is not referenced to earth ground, we recommend you use an RS-232 isolator, such as Phoenix PSM-ME-RS232/RS232-P (Cat. No. 1440-ISO-232-24), to protect both the XM module and the computer.

DeviceNet Connection

The XM-121 includes a DeviceNet™ connection that allows the module to communicate with a programmable controller, DCS, or another XM module.

DeviceNet is an open, global, industry-standard communications network designed to provide an interface through a single cable from a programmable controller to a smart device such as the XM-121. As multiple XM modules are interconnected, DeviceNet also serves as the communication bus and protocol that efficiently transfers data between the XM modules.

Connect the DeviceNet cable to the terminal base unit as shown.

Connect	To	Terminal
Red Wire	DNet V+	26 (Optional - see note)
White Wire	CAN High	23
Bare Wire	Shield (Chassis)	10
Blue Wire	CAN Low	24
Black Wire	DNet V-	27

IMPORTANT

The DeviceNet power circuit through the XM module interconnect, which is rated at only 300 mA, is not intended or designed to power DeviceNet loads. Doing so could damage the module or terminal base.

To preclude this possibility, even unintentionally, it is recommended that DeviceNet V+ be left unconnected.

ATTENTION

You must ground the DeviceNet shield at only one location. Connecting the DeviceNet shield to terminal 10 will ground the DeviceNet shield at the XM module. If you intend to terminate the shield elsewhere, do not connect the shield to terminal 10.

ATTENTION

The DeviceNet network must also be referenced to earth at only one location. Connect DNet V- to earth or chassis at one of the XM modules.

ATTENTION

The DNet V+ and DNet V- terminals are inputs to the XM module. Do not attempt to pass DeviceNet power through the XM terminal base to other non-XM equipment by connecting to these terminals. Failure to comply may result in damage to the XM terminal base and/or other equipment.

IMPORTANT

Terminate the DeviceNet network and adhere to the requirements and instructions in the ODVA Planning and Installation Manual - DeviceNet Cable System, which is available on the ODVA web site (http://www.odva.org).

The devices are shipped from the factory with the network node address (MAC ID) set to 63. The network node address is software settable. You can

use the XM Serial Configuration Utility or RSNetWorx™ for DeviceNet (Version 3.0 or later) to set the network node address. Refer to the appropriate documentation for details.

IMPORTANT The baud rate for the XM-121 is set by way of "baud detection" (Autobaud) at power-up.

Mounting the Module

The XM-121 mounts on the XM-940 terminal base unit, Cat. No. 1440-TB-A. We recommend that you mount the module after you have connected the wiring on the terminal base unit.

ATTENTION

The XM-121 module is compatible only with the XM-940 terminal base unit. The keyswitch on the terminal base unit should be at position 1 for the modules.

Do not attempt to install the XM-121 module on other terminal base units.

Do not change the position of the keyswitch after wiring the terminal base.

ATTENTION

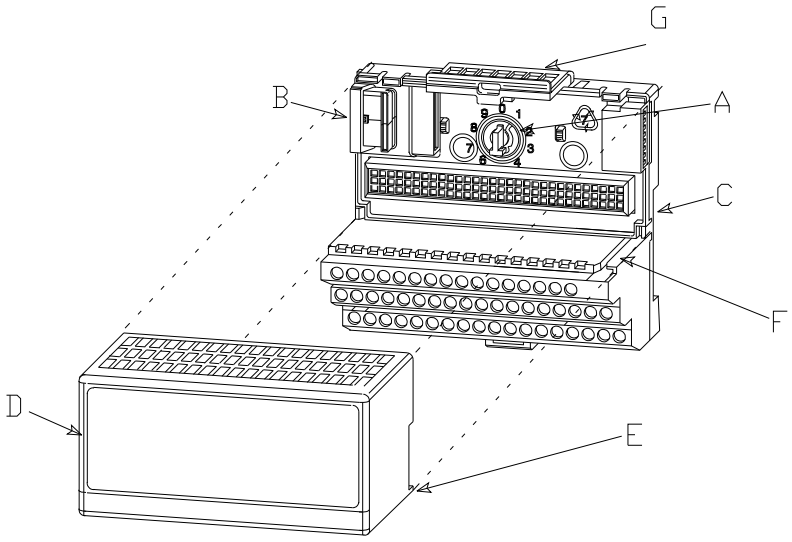
This module is designed so you can **remove and insert it under power**. However, when you remove or insert the module with power applied, I/O attached to the module can change states due to its input/output signal changing conditions. Take special care when using this feature.

WARNING

When you insert or remove the module while power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

IMPORTANT Install the overlay slide label to protect serial connector and electronics when the serial port is not in use.

1. Make certain the keyswitch (A) on the terminal base unit (C) is at position 1 as required for the module.



2. Make certain the side connector (B) is pushed all the way to the left. **You cannot install the module unless the connector is fully extended**.

3. Make sure that the pins on the bottom of the module are straight so they will align properly with the connector in the terminal base unit.

4. Position the module (D) with its alignment bar (E) aligned with the groove (F) on the terminal base.

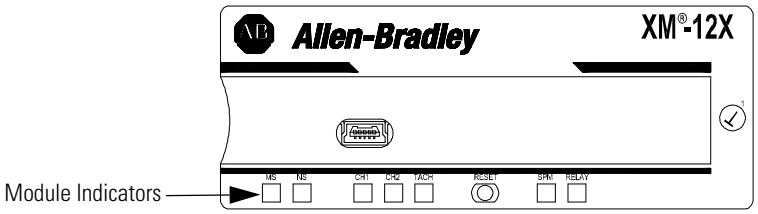
5. Press firmly and evenly to seat the module in the terminal base unit. The module is seated when the latching mechanism (G) is locked into the module.

6. Repeat the above steps to install the next module in its terminal base.

Module Indicators

The Absolute Shaft module has seven LED indicators, which include a module status (MS) indicator, a network status (NS) indicator, a status indicator for each channel (CH1, CH2, and TACH), an activation indicator for the Setpoint Multiplier, and a status indicator for the Relay. The LED indicators are located on top of the module.

Figure 2.24 LED Indicators



The following tables describe the states of the LED status indicators.

Module Status (MS) Indicator

Color	State	Description
No color	Off	No power applied to the module.
Green	Flashing Red	Module performing power-up self test.
	Flashing	Module operating in Program Mode[1].
	Solid	Module operating in Run Mode[2].
Red	Flashing	• Application firmware is invalid or not loaded. Download firmware to the module. • Firmware download is currently in progress.
	Solid	An unrecoverable fault has occurred. The module may need to be repaired or replaced.

1 Program Mode - Typically this occurs when the module configuration settings are being updated with the XM Serial Configuration Utility. In Program Mode, the module does not perform its normal functions. The signal processing/measurement process is stopped, and the status of the alarms is set to the disarm state to prevent a false alert or danger status.

2 Run Mode - In Run Mode, the module collects measurement data and monitors each vibration measurement device.

Network Status (NS) Indicator

Color	State	Description
No color	Off	Module is not online. • Module is autobauding. • No power applied to the module, look at Module Status LED.
Green	Flashing	Module is online (DeviceNet) but no connections are currently established.[1]
	Solid	Module is online with connections currently established.
Red	Flashing	One or more I/O connections are in the timed-out state.
	Solid	Failed communications (duplicate MAC ID or Bus-off).

1 Normal condition when the module is not a slave to an XM-440, PLC, or other master device.

Channel 1, Channel 2, and Tachometer Status Indicators

Color	State	Description
No color	Off	• Normal operation within alarm limits on the channel. • No power applied to the module, look at Module Status LED.
Yellow	Solid	An alert level alarm condition exists on the channel (and no transducer fault, tachometer fault, or danger level alarm condition exists).
	Flashing Tach LED	A tachometer fault (no transducer fault) condition exists on the tachometer channel
	Flashing CH1/2 LED	A tachometer fault condition exists and the channel's alarm speed range is enabled (and no transducer fault on the channel's transducer).
Red	Solid	A danger level alarm condition exists on the channel (and no transducer fault or tachometer fault condition exists).
	Flashing	A transducer fault condition exists on the channel.

Setpoint Multiplier Indicator

Color	State	Description
Yellow	Off	Setpoint multiplier is not in effect.
	Solid	Setpoint multiplier is in effect.

Relay Indicator

Color	State	Description
Red	Off	On-board relay is not activated.
	Solid	On-board relay is activated.

Basic Operations

Powering Up the Module

The module performs a self-test at power-up. The self-test includes an LED test and a device test. During the LED test, the indicators will be turned on independently and in sequence for approximately 0.25 seconds.

The device test occurs after the LED test. The Module Status (MS) indicator is used to indicate the status of the device self-test.

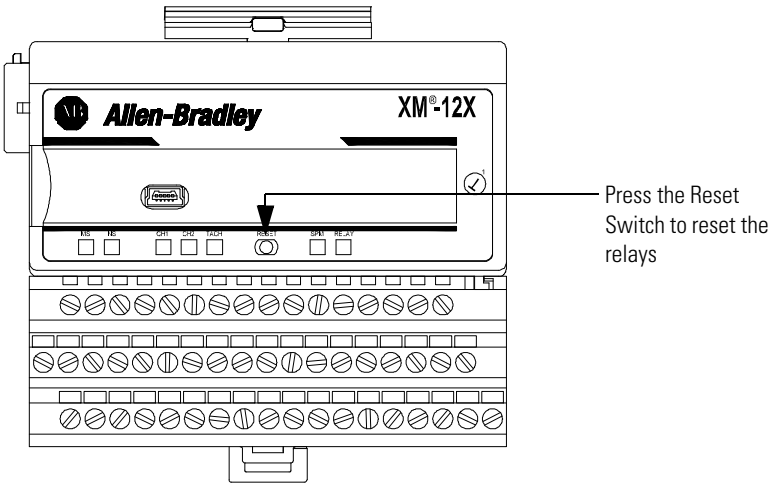
MS Indicator State	Description
Flashing Red and Green	Device self-test is in progress.
Solid Green or Flashing Green	Device self-test completed successfully, and the firmware is valid and running.
Flashing Red	Device self-test completed, the hardware is OK, but the firmware is invalid. Or, the firmware download is in progress.
Solid Red	Unrecoverable fault, hardware failure, or Boot Loader program may be corrupted.

Refer to Module Indicators on page 38 for more information about the LED indicators.

Manually Resetting Relays

The XM-121 has an external reset switch located on top of the module, as shown in Figure 2.25.

Figure 2.25 Reset Switch



The switch can be used to reset all latched relays in the module. This includes the relays in the Expansion Relay Module when it is attached to the XM-121 module.

IMPORTANT The Reset switch resets the relays only if the input is no longer in alarm or the condition that caused the alarm is no longer present.

Installing the XM-121 Absolute Shaft Firmware

Before you can use the XM-121 Absolute Shaft module, you must install the Absolute Shaft firmware onto the XM-121 Low Frequency Dynamic Measurement module. The Absolute Shaft firmware is provided on the XM Documentation and Configuration Utility CD (version 5.0 or later) that is packaged with the XM modules.

TIP XM firmware update files are available for download from the XM Firmware Update page at http://support.rockwellautomation.com

Complete the following steps to install the XM-121 Absolute Shaft firmware.

1. Make certain you have installed the XM Serial Configuration Utility onto the computer that will be connected directly to the XM-121 module. Refer to the XM-12X Dynamic Measurement Modules Installation Instructions for assistance.

2. Insert the XM Documentation and Configuration Utility CD into the CD-ROM drive of the computer.

3. Connect the computer to the XM-121 module using the special serial cable. Refer to Serial Port Connection on page 34.

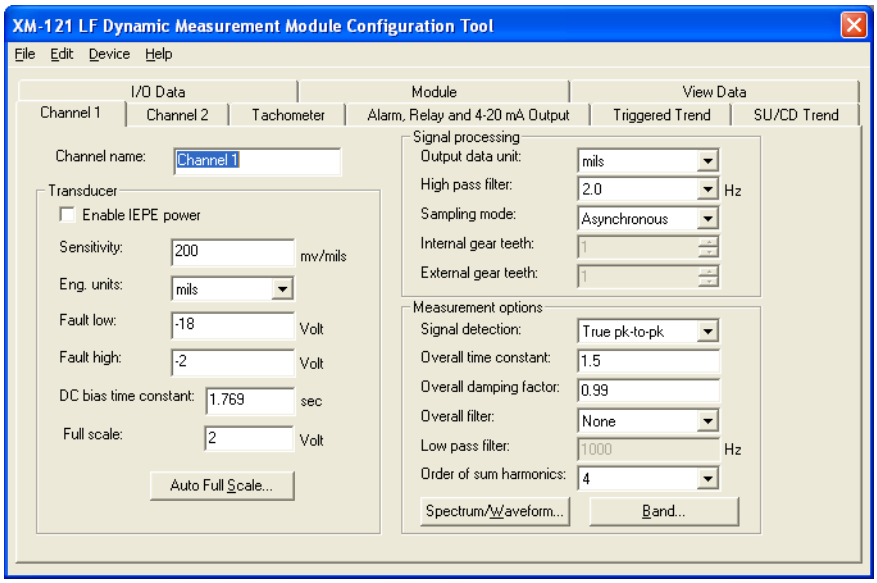
4. Power up the XM-121 module if you haven't already done so, and start the XM Serial Configuration Utility program. Click the **Start** program, and then select **Programs > Entek > XM > Serial Config Utility**.

TIP

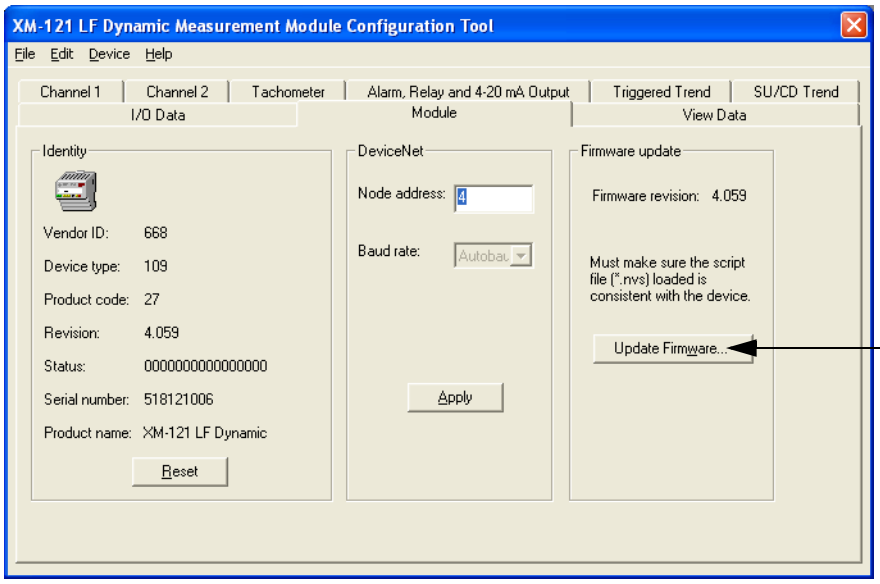
The Serial Configuration Utility defaults to the COM 1 serial port. If you are not using COM 1, select the correct COM port on the XM Serial Configuration Utility screen.

When you are connected to an XM-121 module, the XM-121 module type appears on the XM icon, and the connection icon changes to show the connection.

5. Click the **Configure** button on the XM Serial Configuration Utility screen. The XM-121 LF Dynamic Measurement Module Configuration Tool screen appears.



6. Click the **Module** tab.



7. In the Firmware Update group, click **Update Firmware** to initiate the firmware update. The **Open** dialog box appears.

8. Navigate to the Firmware directory on the CD and select the "xm12A.nvs" file.

9. Click **Open** to start the firmware update and click **Yes** to confirm. The Configuration Tool begins the update and shows its progress in the **Progress** dialog box.

10. When the update completes, the message "The module is configured with the factory defaults. You need to download a configuration." appears. Click **OK**.

11. Click **OK** again to return to the XM Serial Configuration Utility screen. Notice that the XM Module icon displays XM-121A instead of XM-121.

12. You are now ready to configure the Absolute Shaft module. Click the **Configure** button to display the Absolute Shaft parameters in the Configuration Tool. Refer to Chapter 3 for a complete list of the Absolute Shaft configuration parameters.

TIP

Review and edit the Absolute Shaft parameters as necessary. When you are finished, download the parameters to the module. The module will remain in Program mode until you download a configuration.
For assistance on how to use the XM Serial Configuration Utility, refer to the online help.

Configuration Parameters

This chapter provides a complete listing and description of the Absolute Shaft parameters. The parameters can be viewed and edited using the XM Serial Configuration Utility software and a personal computer. If the module is installed on a DeviceNet network, configuring can also be performed using a network configuration tool such as RSNetWorx (Version 3.0 or later). Refer to your configuration tool documentation for instructions on configuring a device.

IMPORTANT The appearance and procedure to configure the parameters may differ in different software.

Channel Parameters

The channel parameters define the characteristics of the transducers you will be using with the Absolute Shaft module. Use the parameters to configure the transducer sensitivity, operating range, and power requirements. There are two instances of the channel parameters, one for each channel.

The Absolute Shaft module requires the correct transducers.

- Channel 1 must be connected to a non-contact probe measuring acceleration in mils or µm.
- Channel 2 must be connected to a 9000 series sensor measuring acceleration or velocity in ips, mm/sec or g's.

Channel Parameters

<table>
<tr><th>Parameter Name</th><th>Description</th><th>Values/Comments</th></tr>
<tr><td>Channel Name (XM Serial Configuration Utility only)</td><td>A descriptive name to help identify the channel in the XM Serial Configuration Utility.</td><td>Maximum 18 characters</td></tr>
<tr><td><table><tr><th>XM Configuration Utility</th><th>EDS File</th></tr><tr><td>Enable IEPE</td><td>IEPE Power</td></tr></table></td><td>Controls whether to provide standard accelerometer (IEPE) power to the transducer (channel 2 only). Refer to Connecting the Transducers on page 27 for wiring requirements.</td><td><table><tr><th>XM Configuration Utility</th><th>EDS File</th></tr><tr><td>Check = Enable</td><td>Enabled</td></tr><tr><td>Clear = Disable</td><td>Disabled</td></tr></table></td></tr>
<tr><td><table><tr><th>XM Configuration Utility</th><th>EDS File</th></tr><tr><td>Sensor</td><td>Case Sensor Type</td></tr></table></td><td>The type of case sensor wired to channel 2.</td><td>Options: 9100VO
9000A
9100CSA
9100T</td></tr>
<tr><td>Sensitivity</td><td>The sensitivity of the transducer in millivolts per Eng. Unit.</td><td>The sensitivity value is included with the transducer's documentation or it may be imprinted on the side of the transducer.</td></tr>
<tr><td>Eng. Units</td><td>Defines the native units of the transducer. Your choice controls the list of possible selections available in the Output Data Units parameter. It also affects other module parameters.</td><td><table><tr><th>Channel</th><th>Sensor</th><th>Eng. Unit Options</th></tr><tr><td>1</td><td>------</td><td>mils
µm</td></tr><tr><td>2</td><td>9100 VO</td><td>ips
mm/s</td></tr><tr><td></td><td>9000A</td><td>g</td></tr><tr><td></td><td>9100 CSA</td><td>g</td></tr><tr><td></td><td>9100 T</td><td>g</td></tr></table></td></tr>
<tr><td>Fault Low</td><td>The minimum, or most negative, expected DC voltage from the transducer.</td><td rowspan="2">Volts

Note: A voltage reading outside this range constitutes a transducer fault.</td></tr>
<tr><td>Fault High</td><td>The maximum expected DC bias voltage from the transducer.</td></tr>
</table>

Channel Parameters

<table>
<tr><th>Parameter Name</th><th>Description</th><th>Values/Comments</th></tr>
<tr><td>DC Bias Time Constant</td><td>The time constant used for exponential averaging (low pass filtering) of the transducer DC bias measurement. The corner frequency for the low pass filter is 1 / (2π x DC Bias Time Constant). The greater the value entered, the longer the settling time of the measured value to a change in the input signal. See example table below.
<table>
<tr><th>Time Constant (seconds)</th><th>-3dB Frequency (Hz)</th><th>Settling (seconds)</th></tr>
<tr><td>1</td><td>0.159</td><td>2.2</td></tr>
<tr><td>2</td><td>0.080</td><td>4.4</td></tr>
<tr><td>3</td><td>0.053</td><td>6.6</td></tr>
<tr><td>4</td><td>0.040</td><td>8.8</td></tr>
<tr><td>5</td><td>0.032</td><td>11</td></tr>
<tr><td>6</td><td>0.027</td><td>13.2</td></tr>
<tr><td>7</td><td>0.023</td><td>15.4</td></tr>
<tr><td>8</td><td>0.020</td><td>17.6</td></tr>
<tr><td>9</td><td>0.018</td><td>19.8</td></tr>
<tr><td>10</td><td>0.016</td><td>22</td></tr>
</table></td><td>Seconds</td></tr>
<tr><td>Full Scale</td><td>The maximum signal level expected to be processed by the channel. This value is used to determine the programmable gain settings across each stage of the channel's analog signal processing circuit.</td><td>Volt

Important: See Appendix D for further guidance and recommended Full Scale value settings.</td></tr>
<tr><td>Output Data Units</td><td>The data units of the measured values.

Important: The Channel 1 output data units depend on the units you select for Channel 2. If Channel 2 is set to "ips" or "mils" then Channel 1 is set to "mils." If Channel 2 is set to "mm/s or "µm" then Channel 1 is set to "µm."</td><td>Channel 2 Options: mils
ips
mm/s
µm</td></tr>
<tr><td>Autoscale (XM Serial Configuration Utility only)</td><td>Calculates a new Full Scale value based upon the current input signal level.</td><td>Enter a safety factor value greater than or equal to 1.0.

The safety factor is a number that will be multiplied to the current signal level to determine the new Full Scale setting.</td></tr>
</table>

Signal Processing Parameters

The signal processing parameters determine the signal processing that will be performed on the input signals. Use these parameters to select the high and low pass filters. The signal processing parameters apply to both channels.

Signal Processing Parameters

Parameter Name	Description	Values/Comments
Low HPF Frequency (EDS File only)	Shows the corner frequency for the Low high pass filter option.	
Medium HPF Frequency (EDS File only)	Shows the corner frequency for the Medium high pass filter option.	
High HPF Frequency (EDS File only)	Shows the corner frequency for the High high pass filter option.	
Very High HPF Frequency (EDS File only)	Shows the corner frequency for the Very High high pass filter option.	
High Pass Filter	Sets the high pass filter to apply to the measurements. The high pass filter is useful in removing low frequency signal components that would dominate the signal. The high pass filter attenuates all frequencies below a defined frequency. It allows, or passes, frequencies above the defined frequency.	
Low Pass Filter	Sets the frequency above which the input signal will be significantly attenuated.	Enter a value from 200 to 4000 Hz.

Measurement Parameters

Overall Measurement Parameters

Use the overall measurement parameters to configure the overall measurement. There are two instances of the overall measurement parameters, one for each channel.

Overall Measurement Parameters

<table>
<tr><th>Parameter Name</th><th>Description</th><th>Values/Comments</th></tr>
<tr><td>Signal Detection</td><td>The measurement (or calculation) performed on the input signal to produce the Overall Value. See Data Parameters on page 69.

• RMS - The Overall Value is the root mean squared (RMS) signal level of the input signal.
• Calculated Peak - The Overall Value is the measured RMS value multiplied by the square root of two (1.4142).
• Calculated Peak-to-Peak - The Overall Value is the measured RMS value multiplied by two times the square root of two (2.8284).
• True Peak - The Overall Value is the output of a peak detector applied to the input signal.
• True Peak-to-Peak - The Overall Value is the output of a peak-to-peak detector applied to the input signal.</td><td>Options: RMS
Calculated Peak
Calculated Peak-to-Peak
True Peak
True Peak-to-Peak

Important: When changing the signal detection, make certain to check the Overall Time Constant value.</td></tr>
<tr><td>Overall Time Constant</td><td>For RMS measurements, the Overall Time Constant parameter sets the 3-DB bandwidth (Hz) for the digital filtering used to calculate the Overall Value. The 3-dB bandwidth is roughly equal to 1 / (2π x Overall Time Constant). The greater the Overall Time Constant, the slower the response of the measured Overall Value to change in the input signal.

For example, an Overall Time Constant of 0.1 seconds may be appropriate for monitoring the Overall Value of an input signal with a fundamental frequency of 1.6 Hz and above. Although, the response to a step change in input will take approximately 2.2 times the Overall Time Constant to settle. Therefore, for an Overall Time Constant of 0.1 seconds, the settling time will be approximately 0.22 seconds.

For True Peak measurements, the Overall Time Constant sets the decay rate of the peak detection meter. The greater the Overall Time Constant, the slower the Peak is decayed.</td><td>Enter a value greater than 0 (zero).

Recommended Values:
The recommended values are appropriate for a typical 50/60Hz machine, and may need to be adjusted depending on the application.

• For True Peak or True Peak-to-Peak measurements, set the Overall Time Constant to 1.5.
• For RMS, Calculated Peak, or Calculated Peak-to-Peak measurements, set the Overall Time Constant to one of the following:

<table><tr><th>High Pass Filter</th><th>Overall Time Constant</th></tr><tr><td>0.8 Hz</td><td>0.2</td></tr><tr><td>2 Hz</td><td>0.08</td></tr><tr><td>4Hz or 23.8 Hz</td><td>0.045</td></tr></table></td></tr>
</table>

Overall Measurement Parameters

Parameter Name	Description	Values/Comments
Overall Damping Factor	This parameter is used in conjunction with the **Overall Time Constant** to vary the characteristics of the response of the digital filter used in calculating the **Overall Value**. An overall value for a measurement with a damping factor near 1.0 (critical damping) will slowly rise or fall for the full settling time specified by the **Overall Time Constant** before reaching the final value. An overall value for a measurement with a damping factor near 0.707 will rise or fall quickly and may "overshoot" (measure a value greater or less than the final value) before reaching the final value for a given input signal.	Enter a value from 0.707 to 1.0.

Waveform Measurement Parameters

Use the waveform measurement parameters to set up the waveform measurements. The waveform measurement parameters apply to both channels.

Waveform Measurement Parameters

Parameter Name	Description	Values/Comments
Number of Points	The number of samples in the waveform measurement.	Options: 256 512 1024 2048
Waveform Period	The total period of the waveform measurement.	Seconds
FMAX (Hz) (XM Serial Configuration Utility only)	Displays the maximum frequency included in the waveform measurement.	

TIP

The **Waveform Period** and the **Number of Points** must be configured such that the **FMAX** (Number of Points/(2.56 x waveform period)) is from 10 Hz to 9375 Hz.

The table below shows some example settings for these parameters. Note that the Waveform Period may be rounded up to the next closes period due to available sampling rates. Combinations that will be rounded are indicated with an "x".

Table 3.A FMAX for Combinations of Waveform Period & Number of Points

Period (seconds)	Number of Points			
	256	512	1024	2048
0.02	5000	x	x	x
0.2	500	1000	2000	4000
2	50	100	200	400
20	x	10	20	40
80	x	x	x	10

Vector Measurement Parameters

Use these parameters to select and define the filter used to track the machine speed multiple. The vector measurement parameters apply to both channels.

Vector Measurement Parameters

Parameter Name	Description	Values/Comments
Tracking Filter	The type of filter used to track the machine speed multiple. • **Bandwidth** - The bandwidth of the filter remains the same at all machine speeds. • **Q** - The ratio of the bandwidth to the center frequency (machine speed) remains the same.	Options: Bandwidth Q
Bandwidth	Enter the bandwidth for the **Bandwidth** filter. The bandwidth is a measure of the width of a filter.	Enter a value from 0.1 to 25 Hz. **Note:** This value is used only when **Bandwidth** is selected as the tracking filter type.

Vector Measurement Parameters

Parameter Name	Description	Values/Comments
Q	Enter the Q value for the **Q** filter. Q is the measure of the sharpness of a filter	Enter a value from 1 to 200 Hz. **Note:** This value is used only when **Q** is selected as the tracking filter type. **Important: The** tracking filter bandwidth in Constant Q mode is limited between 0.5 and 15 Hz.

Speed Measurement Parameter

Use the speed measurement parameter to configure the filtering performed on the speed measurement.

Speed Measurement Parameter

Parameter Name	Description	Values/Comments
Exponential Averaging Time Constant	Sets the 3-dB bandwidth for the digital filter used to calculate the **Speed Value** and **Acceleration Measured Value**. The 3-dB bandwidth is roughly equal to 1 / (2π x **Exponential Averaging Time Constant**). The greater the value entered, the longer the response of the measured Speed Value and Acceleration Measured Value to a change in the input signal (less sensitive to noise in the signal). See example table below.	

Time Constant (milliseconds)	-3dB Frequency (Hz)	Settling Time (milliseconds)
5	31.8310	11
10	15.9155	22
20	7.9577	44
50	3.1831	110
100	1.5915	220
1200	0.1326	2640

Tachometer Parameters

The tachometer parameters define the characteristics of the tachometer and determine the signal processing that will be performed on the tachometer signal.

Tachometer Transducer Parameters

Tachometer Transducer Parameters

<table>
<tr><th>Parameter Name</th><th>Description</th><th>Values/Comments</th></tr>
<tr><td>Tachometer Name (XM Serial Configuration Utility only)</td><td>A descriptive name to help identify the tachometer in the XM Serial Configuration Utility software.</td><td>Maximum 18 characters</td></tr>
<tr><td>Fault Low</td><td>The minimum, or most negative, expected DC voltage from the transducer.</td><td rowspan="2">Volts

Note: A voltage reading outside this range constitutes a transducer fault.</td></tr>
<tr><td>Fault High</td><td>The maximum expected DC voltage from the transducer.</td></tr>
<tr><td>DC Bias Time Constant</td><td>The time constant used for exponential averaging (low pass filtering) of the transducer DC bias measurement. The corner frequency for the low pass filter is 1 / (2 x π x DC Bias Time Constant). See example table below.
<table>
<tr><th>Time Constant (seconds)</th><th>-3dB Frequency (Hz)</th><th>Settling (seconds)</th></tr>
<tr><td>1</td><td>0.159</td><td>2.2</td></tr>
<tr><td>2</td><td>0.080</td><td>4.4</td></tr>
<tr><td>3</td><td>0.053</td><td>6.6</td></tr>
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<tr><td>9</td><td>0.018</td><td>19.8</td></tr>
<tr><td>10</td><td>0.016</td><td>22</td></tr>
</table></td><td>Seconds</td></tr>
</table>

Tachometer Signal Processing Parameters

IMPORTANT

The Absolute Shaft module requires the tachometer to track the machine speed (tracking filter) and to calculate the 1X measurements.

If you are not using the tachometer channel, set the **Pulses Per Revolution** to zero. This will disable the tachometer measurement, and prevent the module from indicating a tachometer fault.

Tachometer Signal Processing Parameters

Parameter Name	Description	Values/Comments
Pulses Per Revolution	The number of tachometer signal pulses per revolution of the shaft (number of gear teeth). This setting is useful if a proximity probe located over a gear or shaft with a multi-toothed speed sensing surface is used to generate the input signal.	Enter zero if you are not using the tachometer channel to disable the tachometer measurement. **Note:** When pulses per revolution is greater than 1, the module will not consistently synchronize to the same pulse, and the phase measurement may change if the module's synchronizes on a different pulse. **Important:** The tachometer signal is required (**Pulses Per Revolution** set to 1 or more) for the speed and 1X measurements.
XM Configuration Utility: **Speed Multiplier** **EDS File**: **Tach Multiplier**	The input tachometer signal is multiplied by this value to obtain the measured speed.	This value must be greater than zero.
Fault Time-Out	The number of seconds the module should wait after the last valid tach pulse before it indicates a tachometer fault.	Enter a value from 1 to 64 seconds.
XM Configuration Utility: **Auto Trigger** **EDS File**: **Trigger Mode**	Sets the trigger mode. In Auto Trigger mode, the minimum signal amplitude for triggering is 2 volts peak-to-peak and minimum frequency is 6 CPM (0.1 Hz). In Manual Trigger mode, the value entered in **Trigger Threshold** is used as the trigger point. Minimum signal amplitude for triggering is 500 millivolts peak-to-peak and minimum frequency is 1 CPM.	**XM Configuration Utility** / **EDS File** Check = Auto Mode / Auto Clear = Manual Mode / Manual

Tachometer Signal Processing Parameters

Parameter Name	Description	Values/Comments
Trigger Hysteresis	The amount of hysteresis around the trigger threshold. In Auto Trigger mode, the value entered is a percentage of the peak-to-peak input signal. This value can range from 0 to 50%. In Manual Trigger mode, the value entered is a voltage level. The hysteresis voltage is added to or subtracted from the threshold voltage to determine the hysteresis range. The minimum value is 0.12 volts.	% in Auto Trigger mode Volt in Manual Trigger mode
Trigger Threshold	The signal level to be used as the trigger value when in Manual Trigger mode.	Enter a value from +16 to -16 volts dc. **Note:** This value is not used in Auto Trigger mode.
Trigger Slope	The input signal slope to be used as the trigger value when in Manual Trigger mode.	Options: Positive Negative **Note:** This value is not used in Auto Trigger mode.

Alarm Parameters

The Alarm parameters control the operation of the alarms (alert and danger level) and provide alarm status. The Absolute Shaft module provides nine alarms. Each alarm is permanently associated with a corresponding measurement (for example, Channel 1 Shaft Relative Overall alarm, Channel 2 Case Absolute Overall alarm, and so on). Use the parameters to configure which measurement the alarm is associated with, as well as the behavior of the alarm.

Alarm Parameters

Parameter Name	Description	Values/Comments
Alarm (XM Serial Configuration Utility only)	Sets the alarm to be configured in the XM Serial Configuration Utility. Each alarm is associated with a particular measurement.	Options: Ch. 1 SR (shaft relative) Overall Ch. 2 CA (case absolute) Overall Ch. 1 SR 1X Mag Ch. 2 CA 1X Mag Shaft Absolute Overall Shaft Absolute 1X Mag Ch. 1 DC Bias Ch. 2 DC Bias Speed
Name (XM Serial Configuration Utility only)	A descriptive name to identify the alarm in the XM Serial Configuration Utility.	Maximum 18 characters

Alarm Parameters

<table>
<tr><th>Parameter Name</th><th>Description</th><th>Values/Comments</th></tr>
<tr><td>Enable</td><td>Enable/disable the selected alarm.

Note: The Alarm Status is set to "Disarm" when the alarm is disabled.</td><td><table><tr><th>XM Configuration Utility</th><th>EDS File</th></tr><tr><td>Check to Enable</td><td>Enabled</td></tr><tr><td>Clear to Disable</td><td>Disabled</td></tr></table></td></tr>
<tr><td>Condition</td><td>Controls when the alarm should trigger.

• Greater than - Triggers the alarm when the measurement value is greater than or equal to the Alert and Danger Threshold values.
The Danger Threshold value must be greater than or equal to the Alert Threshold value for the trigger to occur.
• Less than - Triggers the alarm when the measurement value is less than or equal to the Alert and Danger Threshold values.
The Danger Threshold value must be less than or equal to the Alert Threshold value for the trigger to occur.
• Inside range - Triggers the alarm when the measurement value is equal to or inside the range of the Alert and Danger Threshold values.
The Danger Threshold (High) value must be less than or equal to the Alert Threshold (High) value AND the Danger Threshold (Low) value must be greater than or equal to the Alert Threshold (Low) value for the trigger to occur.
• Outside range - Triggers the alarm when the measurement value is equal to or outside the range of the Alert and Danger Threshold values.
The Danger Threshold (High) value must be greater than or equal to the Alert Threshold (High) value, AND the Danger Threshold (Low) value must be less than or equal to the Alert Threshold (Low) value for the trigger to occur.</td><td>Options: Greater Than
Less Than
Inside Range
Outside Range</td></tr>
</table>

Alarm Parameters

Parameter Name	Description	Values/Comments
Alert Threshold (High)	The threshold value for the alert (alarm) condition. **Note**: This parameter is the greater threshold value when **Condition** is set to "Inside Range" or "Outside Range."	Same measurement unit as **Output Data Unit** selection for the specified channel.
Danger Threshold (High)	The threshold value for the danger (shutdown) condition. **Note**: This parameter is the greater threshold value when **Condition** is set to "Inside Range" or "Outside Range."	
Alert Threshold (Low)	The lesser threshold value for the alert (alarm) condition. **Note:** This parameter is not used when **Condition** is set to "Greater Than" or "Less Than."	
Danger Threshold (Low)	The lesser threshold value for the danger (shutdown) condition. **Note:** This parameter is not used when **Condition** is set to "Greater Than" or "Less Than."	
Hysteresis	The amount that the measured value must fall (below the threshold) before the alarm condition is cleared. For example, Alert Threshold = 120 and Hysteresis = 2. The alarm (alert) activates when the measured value is 120 and will not clear until the measured value is 118. **Note:** The Alert and Danger Thresholds use the same hysteresis value. **Note:** For the Outside Range condition, the hysteresis value must be less than **Alert Threshold (High)** – **Alert Threshold (Low)**.	Same measurement unit as **Output Data Unit** selection for the specified channel**.**
Startup Period	The length of time that the **Threshold Multiplier** is applied to the thresholds. The startup period begins when the setpoint multiplier switch is reopened (push button disengaged or toggle switch flipped to off).	Enter a value from 0 to 1092 minutes, adjustable in increments of 0.1 minutes.

Alarm Parameters

<table>
<tr><th>Parameter Name</th><th>Description</th><th>Values/Comments</th></tr>
<tr><td>Threshold Multiplier</td><td>The action to take when the setpoint multiplier switch is closed (push button engaged or toggle switch flipped to on) and during the startup period once the switch is reopened. The module applies the multiplier to the alarm thresholds during this time to avoid false alarms at resonance frequencies.

Note: The multiplication may have the opposite of the intended effect under certain circumstances. For example, if the Condition is set to "Less Than" and the thresholds are positive, then multiplication of the threshold values increases the likelihood of the measured value being within the alarm range. Therefore, you may want to set Threshold Multiplier to zero to disable the alarm during the startup period.</td><td>Enter any fractional value between 0 and 10.

Enter 0 (zero) to disabled the alarm during the startup period.</td></tr>
<tr><td>Inhibit Tachometer Fault</td><td>Controls whether to inhibit the tachometer fault during the startup period.

During startup, the machine may be turning very slowly and cause the XM module to detect a tachometer fault. The Alarm status will state that a tachometer fault condition exists unless the tachometer fault is inhibited.</td><td><table><tr><th>XM Configuration Utility</th><th>EDS File</th></tr><tr><td>Check means inhibit tachometer fault</td><td>Inhibit Tach Fault</td></tr><tr><td>Clear means do not inhibit tachometer fault</td><td>Do not inhibit</td></tr></table></td></tr>
<tr><td>Speed Range Enable</td><td>Controls whether the selected alarm is enabled only when the measured speed is within a machine speed range. Enter the machine speed range in Speed Range High and Speed Range Low.</td><td><table><tr><th>XM Configuration Utility</th><th>EDS File</th></tr><tr><td>Check to Enable</td><td>Enabled</td></tr><tr><td>Clear to Disable</td><td>Disabled</td></tr></table>
Note: The tachometer must be enabled (Pulses Per Revolution set to 1 or more) and a tachometer signal must be provided at the tachometer input when Speed Range Enable is enabled.</td></tr>
<tr><td>Speed Range Low</td><td>The lesser threshold of the machine speed range. This value must be less than the Speed Range High value.

This parameter is not used when Speed Range Enabled is disabled.</td><td>RPM</td></tr>
<tr><td>Speed Range High</td><td>The greater threshold of the machine speed range. This value must be greater than the Speed Range Low value.

This parameter is not used when Speed Range Enabled is disabled.</td><td>RPM</td></tr>
</table>

Relay Parameters

The Relay parameters control the operation of the on-board relay, as well as the relays on the Expansion Relay (XM-441) module. Use these parameters to configure which alarm(s) the relay is associated with, as well as the behavior of the relay.

IMPORTANT A relay can be defined, regardless of whether or not it is physically present. A non-physical relay is a virtual relay. When a relay (physical or virtual) activates, the module sends a Change of State (COS) message to its master, which acts on the condition as necessary. An XM-440 Master Relay Module can activate its own relays in response to a relay (physical or virtual) activation at any of its slaves.

Relay Parameters

Parameter Name	Description	Options/Comments
Number (XM Serial Configuration Utility only)	Sets the relay to be configured in the XM Serial Configuration Utility.	Relay Number 1 is the on-board relay. Numbers 2 through 5 are either relays on the Expansion Relay module when it's connected to the module or virtual relays. Virtual relays are non-physical relays. Use them when you want the effect of the relay (monitor alarms, delay, and change status) but do not need an actual contact closure. For example, a PLC or controller monitoring the relay status. **Note:** The **Relay Installed** parameter indicates whether a relay is a virtual relay or a physical relay on a module.
Name (XM Serial Configuration Utility only)	A descriptive name to help identify the relay in the XM Serial Configuration Utility.	Maximum 18 characters
Enable	Enable/disable the selected relay. **Note:** The **Relay Current Status** is set to "Not Activated" when the relay is disabled. See page 69.	**XM Configuration Utility** / **EDS File** Check to Enable / Enabled Clear to Disable / Disabled

Relay Parameters

Parameter Name	Description	Options/Comments
XM Configuration Utility: **Latching** **EDS File**: **Latching Option**	Controls whether the relay must be explicitly reset after the alarm subsides.	**XM Configuration Utility** / **EDS File** Check means latching (relay must be explicitly reset) / Latching Clear means non-latching (relay is reset once the alarm condition has passed) / Nonlatching
Activation Delay	Enter the length of time for which the **Activation Logic** must be true before the relay is activated. This reduces nuisance alarms caused by external noise and/or transient vibration events. **Important:** True Peak and True Peak-to-Peak signal detection is more sensitive to transients and noise. To avoid false relay trips, it is strongly recommended that the **Activation Delay** value is greater than the **Overall Time Constant** value when **Signal Detection** is set to "True Peak" or "True Peak-to-Peak." Refer to Overall Measurement Parameters on page 48.	Enter a value from 0 to 25.5 seconds, adjustable in increments of 0.1 seconds. Default is 1 second
XM Configuration Utility: **Activation Logic** **EDS File**: **Logic**	Sets the relay activation logic. • **A or B** - Relay is activated when either **Alarm A** or **Alarm B** meets or exceeds the selected **Alarm Status** condition(s). • **A and B** - Relay is activated when both **Alarm A** and **Alarm B** meet or exceed the selected **Alarm Status** condition(s). • **A Only** - Relay is activated when **Alarm A** meets or exceeds the selected **Alarm Status** condition(s).	Options: A only A or B A and B
XM Configuration Utility: **Alarm A/B** **EDS File**: **Alarm Identifier A/B**	Sets the alarm(s) that the relay will monitor. The alarm must be from the same device as the relay. When the **Activation Logic** is set to "A and B" or "A or B," you can select an alarm in both **Alarm A** and **Alarm B**. The system monitors both alarms. When the **Activation Logic** is set to "A Only," you can select only an alarm in **Alarm A**.	Options: Ch 1 SR Overall Ch 2 CA Overall Ch 1 SR 1X Magnitude Ch 2 CA 1X Magnitude Shaft Absolute Overall Shaft Absolute 1X Magnitude Ch 1 DC Bias Ch 2 DC Bias Speed **Note:** You can only select an alarm that is enabled.

Relay Parameters

Parameter Name	Description	Options/Comments
XM Configuration Utility / **EDS File** **Alarm Status to Activate On** / **Alarm Levels**	Sets the alarm conditions that will cause the relay to activate. You can select more than one. • **Normal** - The current measurement is not within excess of any alarm thresholds. • **Alert** - The current measurement is in excess of the alert level threshold(s) but not in excess of the danger level threshold(s). • **Danger** - The current measurement is in excess of the danger level threshold(s). • **Disarm**-The alarm is disabled or the device is in Program mode. • **Xdcr Fault** - The transducer's DC bias measurement is outside of the transducer's **Fault High/Fault Low** range. • **Module Fault** - Hardware or firmware failure, or an error has been detected and is preventing proper operation of the device. • **Tacho Fault** - A required tachometer signal has not been detected. Note that there is no transducer fault either.	Options: Normal Danger Xdcr Fault Tacho Fault Alert Disarm Module Fault Check to enable. Clear to disable.
Relay Installed	Indicates whether the relay is a physical relay on a module or a virtual relay. If the relay is a physical relay, then you can set the **Failsafe** parameter. If the relay is a virtual relay, the **Failsafe** parameter is not used or it is disabled.	**XM Configuration Utility** / **EDS File** Check = Physical Relay / Installed = Physical Relay Clear = Virtual Relay / Not Installed = Virtual Relay

Relay Parameters

Parameter Name		Description	Options/Comments	
XM Configuration Utility	**EDS File**	Determines whether the relay is failsafe or non-failsafe. Failsafe operation means that when in alarm, the relay contacts are in their "normal," de-energized, or "shelf-state" positions. In other words, normally closed relays are closed in alarm, and normally open relays are open in alarm. With failsafe operation, a power failure equals an alarm. The following are true of a relay in failsafe operation: • The relay is energized when power is applied to the module. • The relay in a nonalarmed condition has power applied to the coil. • In alarm condition, power is removed from the relay coil, causing the relay to change state. For non-failsafe operation, the following are true: • Under nonalarm conditions, the relay closes the circuit between the common and the N.C. (normally closed) terminals. • Under alarm conditions, the relay changes state to close the circuit between the common and the N.O. (normally open) terminals. For failsafe operation, the following are true: • Under nonalarm (with power applied to the unit) conditions, the relay closes the circuit between the common and the N.O. terminals. • Under alarm or loss-of-power conditions, the relay changes state to close the circuit between the common and the N.C. terminals.	**XM Configuration Utility**	**EDS File**
Failsafe Relay	**Failsafe Option**		Check means failsafe	Failsafe
			Clear means non-failsafe	Nonfailsafe

4-20 mA Output Parameters

The 4-20 mA output parameters define the characteristics of the two 4-20 mA output signals. The parameters are the same for each output.

4-20 mA Output Parameters

Parameter Name	Description	Options/Comments
Enable	Enables/disables the 4-20 mA output.	**XM Configuration Utility** / **EDS File** Check to enable / Enabled Clear to disable / Disabled
Measurement	Sets the type of measurement and the channel that the 4-20 mA output signal will track.	Options: Ch 1 SR Overall Ch 2 CA Overall Ch 1 SR 1X Magnitude Ch 2 CA 1X Magnitude Shaft Absolute Overall Shaft Absolute 1X Magnitude Ch 1 DC Bias Ch 2 DC Bias Speed
Min Range	The measured value associated with the 4 mA.	Same measurement unit as **Output Data Unit** selection for the specified channel**.**
Max Range	The measured value associated with the 20 mA.	

IMPORTANT Measured values between **Min Range** and **Max Range** are scaled into the range from 4.0 to 20.0 to produce the output value. The **Min Range** value does not have to be less than the **Max Range** value. If the **Min Range** value is greater than the **Max Range** value, then the output signal is effectively inverted from the input signal.

IMPORTANT The 4-20 mA outputs are either on or off. When they are on, the 4-20 mA outputs overshoot the 4 and 20 mA limits by 10% when the measurement exceeds the minimum and maximum range. This means the minimum current produced is 3.6 mA and the maximum current produced is 22 mA.

When the 4-20 mA outputs are off, they produce a current approximately 2.9 mA. The 4-20 mA outputs are off under the following conditions:

- The 4-20 mA outputs are set to "Disable" (see **Enable** on the previous page).
- The module is in Program mode.
- A transducer fault or tachometer fault occurs that affects the corresponding measurement.

Triggered Trend Parameters

The Absolute Shaft module can collect a triggered trend. A triggered trend is a time-based trend that is collected when a relay is activated, or the module receives a trigger event.

Once the triggered trend is configured, the XM module continuously monitors the trended measurements. When a trigger occurs, the XM module collects additional data as specified by the **Post Trigger** parameter. The Absolute Shaft module can also store the waveform at the time of the trigger.

The XM module can only store one triggered trend. Unless the triggered trend is latched, the trend data is overwritten with new data when the next trigger occurs.

The triggered trend parameters define the trend data that is collected by the module. Use these parameters to select the measurements included in the trend records, the interval between trend records, and which relay triggers (activates) the collection of the trend data.

IMPORTANT The Triggered Trend parameters are not included in the EDS file and cannot be edited using generic configuration tools such as RSNetWorx for DeviceNet.

Triggered Trend Parameters

Parameter Name	Description	Values/Comments
Enable Triggered Trend Measurements	Enables/disables the triggered trend measurements. Select to configure the triggered trend measurements.	Check to enable. Clear to disable.
Select Measurements	Sets the measurements to be collected and stored in the module.	More than one measurement can be selected.
Number of Records	The maximum number of measurement sets that can be collected in the trend buffer. The measurement sets make up the trend data.	The Number of Records is automatically calculated based upon the number of **Trended Measurements** selected.
Latch Enable	Determines whether the trigger trend is latched or unlatched. Latched means that subsequent triggers are ignored after the initial trigger. This prevents the trend data from being overwritten with new data until the trigger is manually reset (click Reset Trigger button). Unlatched means that the trend data is overwritten with new data every time a trigger occurs.	Check means latched Clear means unlatched

Triggered Trend Parameters

Parameter Name	Description	Values/Comments
Relay Number	Sets the relay that triggers the trend to be collected.	None means that the trend can only be triggered manually or by a trigger event (for example, XM-440). Relay Numbers 1 through 5 are either relays on the Expansion Relay module when it's connected to the module or virtual relays. **Note:** The relay must be enabled. Refer to Relay Parameters on page 59.
Record Interval	The amount of time between consecutive trend records. **Note:** If you enter a Record Interval, the **Trend Span** is automatically updated.	1 to 3600 seconds
Trend Span	The total amount of time that can be covered by the trend data (**Number of Records** x **Record Interval)**. **Note**: If you edit the Trend Span, the **Record Interval** is automatically updated.	Seconds
Post Trigger	The percentage of records to be collected once the trigger occurs. For example, if you set Post Trigger to 20%, then 80% of the records in the trend are before the trigger occurs, and 20% of the records in the trend are after the trigger occurs. This allows you to evaluate what happened after the trigger occurred.	0 to 100 Percent
Status	Shows the status of the trend data.	Possible status values: • Not collected - No trend data is currently collected. • Collecting - A trigger has occurred and data (including post-trigger data) is being collected. • Collected - A trend has been saved to the buffer and is available to view and upload.
View Trend Data	Displays a plot of the collected trend data.	
Reset Trigger	Resets the trigger if **Latch enabled** is selected. This allows the module to overwrite the previous trend data when the next trigger occurs.	
Manual Trigger	Triggers the module to collect the trend data without relay activation.	
View Collected Data	Displays a plot of the collected waveform data.	

SU/CD Trend Parameters

The Absolute Shaft module can collect startup or coast-down trend data when the machine speed passes into a defined speed range. A tachometer input is required to collect the startup/coast-down trend.

The XM module collects a startup trend when the machine speed rises through the **Minimum Speed** + 8 RPM, and stops when the machine speed crosses either the **Minimum Speed** or the **Maximum Speed**. The module collects data only when machine speed is increasing. It does not collect data if the machine speed is constant or decreasing.

The XM module collects a coast-down trend when the machine speed falls through the **Maximum Speed** - 8 RPM, and stops when the machine speed crosses either the **Minimum Speed** or the **Maximum Speed**. The module collects data when the machine speed is decreasing or increasing during a coast-down trend (for example, a coast-down restart).

The XM module can only store one startup/coast-down trend. Unless the startup/coast-down trend is latched, the trend data is overwritten with new data when the next startup or coast-down occurs.

The SU/CD trend parameters define the trend data that is collected by the module during the startup or coast-down of a machine. Use these parameters to configure the measurements included in the startup and coast-down trend records, the interval between trend records, and the minimum and maximum speed limits at which record collection starts and stops.

IMPORTANT The SU/CD Trend parameters are not included in the EDS file and cannot be edited using generic configuration tools such as RSNetWorx for DeviceNet.

SU/CD Trend Parameters

Parameter Name	Description	Values/Comments
Enable SU/CD Trend	Enables/disables the SU/CD trend measurements. Select to configure the SU/CD trend measurements.	Check to enable. Clear to disable.
Select Measurements	Sets the measurements to be collected and stored in the module. **Note**: The Speed measurement is always included in the startup/coast-down trend.	More than one measurement can be selected.
Number of Records	The maximum number of measurement sets that can be collected in the trend buffer. The measurement sets make up the trend data.	The Number of Records is automatically calculated based upon the number of **Trended Measurements** selected.

SU/CD Trend Parameters

Parameter Name	Description	Values/Comments
Latch Enable	Determines whether the startup/coast-down trend is latched or unlatched. Latched means that subsequent startup/coast-down trends are ignored after the initial startup/coast-down. This prevents the trend data from being overwritten with new data until the trigger is manually reset (click Reset Trigger button). Unlatched means that the startup/coast-down trend data is overwritten with new data every time the machine speed crosses into the speed range.	Check means latched Clear means unlatched
Record Interval	The change in speed between consecutive records. **Note:** If you enter a Record Interval, the **Maximum Trend Span** is automatically updated.	1 to 3600 RPM
Maximum Trend Span	The maximum change in speed that can be covered by the trend data (**Number of Records** x **Record Interval)**. **Note**: If you edit the Trend Span, the **Record Interval** is automatically updated.	RPM
Minimum Speed	The lesser limit of the speed range in which records are collected in the startup/coast-down trend. This value must be less than the **Maximum Speed** value.	RPM Startup/Coast-down Trend Considerations: • The XM module collects a startup trend when the machine speed rises through the **Minimum Speed** + 8 RPM, and stops when the machine speed crosses either the **Minimum Speed** or the **Maximum Speed**. The module collects data only when the machine speed is increasing. It does not collect data if the machine speed is constant or decreasing. • The XM module collects a coast-down trend when the machine speed falls through the **Maximum Speed** - 8 RPM, and stops when the machine speed crosses either the **Minimum Speed** or the **Maximum Speed**. The module collects data when the machine speed is decreasing or increasing during a coast-down trend (for example, a coast-down restart).
Maximum Speed	The greater limit of the speed range in which records are collected in the startup/coast-down trend. This value must be greater than the **Minimum Speed** value.	

SU/CD Trend Parameters

Parameter Name	Description	Values/Comments
Status	Shows the status of the trend data.	Possible status values: • Not collected - No trend data is currently collected. • Collecting - A trigger has occurred and data is being collected. • Collected - A trend has been saved to the buffer and is available to view and upload.
View Trend Data	Displays a plot of the collected trend data.	
Reset Trigger	Resets the trigger if **Latch enabled** is selected. This allows the module to overwrite the previous trend data when the machine speed crosses into the speed range.	

I/O Data Parameters

The I/O data parameters are used to configure the content and size of the DeviceNet I/O Poll response message.

IMPORTANT

The Absolute Shaft module must be free of Poll connections when configuring the **Poll Output** (**Poll Response Assembly)** and **Poll Size**. Any attempt to download the parameters while a master device has established the Poll connection with the XM module will result in an error.

To close an existing Poll connection with an XM-440, switch the XM-440 from Run mode to Program mode. Refer to Changing Operation Modes on page 81.

To close an existing Poll connection with other master devices, remove the module from the scan list or turn off the master device.

I/O Data Parameters

Parameter Name	Description	Values/Comments
COS Size (XM Serial Configuration Utility only)	The size (number of bytes) of the Change of State (COS) message.	The COS Size cannot be changed.
COS Output (XM Serial Configuration Utility only)	The Assembly instance used for the COS message. The COS message is used to produce the Alarm and Relay status for the module.	The COS Output cannot be changed. Refer to COS Message Format on page 86 for more information.

I/O Data Parameters

Parameter Name		Description	Values/Comments
Poll Size		Sets the size (number of bytes) of the Poll response message. Decreasing the maximum size will truncate data from the end of the Assembly structure. **Important:** If you set the **Poll Output** to "Custom Assembly," the poll size is automatically set to the actual size of the customized Poll response.	The minimum size is 4 bytes and the maximum size is 124 bytes.
XM Configuration Utility	**EDS File**	Sets the Assembly instance used for the Poll response message. Each Assembly instance contains a different arrangement of the Poll data. The Poll response message is used by the XM module to produce measured values. It can contain up to 31 REAL values for a total of 124 bytes of data.	Options: Assembly Instance 101 Custom Assembly Refer to Poll Message Format on page 85 for more information.
Poll Output	**Poll Response Assembly**		
Assembly Instance Table (XM Serial Configuration Utility only)		Displays the format of the currently selected COS or Poll Assembly instance.	The highlighted (yellow) Assembly structure bytes are included in the I/O message.
Custom Assembly (XM Serial Configuration Utility only)		Defines a custom data format for the Poll response. The custom assembly can contain any of the measurement parameters included in Assembly instance 101, as well as alarm and relay configuration parameters.	You can select up to 20 parameters. Refer to Poll Message Format on page 85 for more information.

Data Parameters

The Data parameters are used to view the measured values of the input channels, as well as to monitor the status of the channels, alarms, and relays.

TIP To view all the data parameters in the XM Serial Configuration Utility, click the **View Data** tab.

Monitor Data Parameters

Monitor Data Parameters

Parameter Name	Description	Values/Comments
Overall	Shows the measured overall value for the calculated shaft absolute, non-contact probe (Channel 1), and vibration sensor on the case (Channel 2).	
Magnitude	Shows the magnitude shaft absolute vibration value.	**Requirement:** The tachometer must be enabled (**Pulses Per Revolution** set to 1 or more), and a tachometer signal must be present.
Phase	Shows the shaft absolute vibration phase value.	
XM Configuration Utility: **EDS File** **Transducer Fault**: **Transducer Status**	States whether a transducer fault exists on the associated channel. If a fault exists, the overall, magnitude, phase, and gap values may not be accurate.	Possible status values: No Fault Fault
1X Magnitude	Shows the magnitude of the vibration at machine speed.	**Requirement:** The tachometer must be enabled (**Pulses Per Revolution** set to 1 or more), and a tachometer signal must be present.
1X Phase	Shows the phase of the vibration at machine speed.	
XM Configuration Utility: **EDS File** **Xdcr DC Bias**: **Measured DC Bias**	Shows the measured average DC offset of the transducer signal. This value is compared with **Fault High** and **Fault Low** to determine whether the transducer is working properly.	
XM Configuration Utility: **EDS File** **Speed Status**: **Transducer 3 Status**	States whether a fault condition (no tachometer signal or transducer fault) exists on the tachometer channel. If a fault exists, the speed value may not be accurate.	Possible status values: No Fault Fault
Speed Value	Shows the measured speed value.	**Requirement:** The tachometer must be enabled (**Pulses Per Revolution** set to 1 or more), and a tachometer signal must be present.
Peak Speed	Shows the greatest measured **Speed Value** (positive or negative) since the most recent reset.	

Alarm and Relay Status Parameters

Alarm and Relay Status Parameters

Parameter Name	Description	Values/Comments
Alarm Status	States the current status of the alarm.	Possible status values: • **Normal** - The alarm is enabled, the device is in Run mode, there is no transducer fault, and the current measurement is not within the **Alert** or **Danger Threshold** value(s). • **Alert** - The alarm is enabled, the device is in Run mode, there is no transducer fault, and the current measurement is in excess of the **Alert Threshold** value(s) but not in excess of the **Danger Threshold** value(s). • **Danger** - The alarm is enabled, the device is in Run mode, there is no transducer fault, and the current measurement is in excess of the **Danger Threshold** value(s). • **Disarm**-The alarm is disabled or the device is in Program mode. • **Transducer Fault** - The alarm is enabled, the device is in Run mode, and a transducer fault is detected on the associated transducer. • **Tachometer Fault** - The alarm is enabled, the device is in Run mode, a tachometer fault exists, but there is **no** transducer fault. • **Module Fault** - Hardware or firmware failure, or an error has been detected and is preventing proper operation of the device.
Relay Status	States the current status of the relay.	Possible status values: Activated Not Activated

Device Mode Parameters

The Device Mode parameters are used to control the functions and the behavior of the device.

IMPORTANT The XM Serial Configuration Utility handles these parameters automatically and transparently to the user.

Device Mode Parameters

Parameter Name	Description	Values/Comments
Device Mode	Sets the current operation mode of the device. Refer to Changing Operation Modes on page 81 for more information.	Options: Run Mode Program Mode
Autobaud	Enables/disables autobaud. When autobaud is set to "Enabled," the module will listen to other devices on the network to determine the correct baud rate to use for communications. When autobaud is set to "Disabled," the module baud rate must be set manually.	Options: Enabled Disabled

Specifications

The Appendix lists the technical specifications for the Absolute Shaft module.

XM-121 Absolute Shaft Technical Specifications

Product Feature	Specification
Communications	
DeviceNet	Standard DeviceNet protocol for all functions *NOTE: The XM-121 uses only the DeviceNet protocol, not power. Module power is provided independently.* Available Electronic Data Sheet (EDS) file provides support for most DeviceNet compliant systems Baud rate automatically set by bus master to 125 kb, 250 kb, 500 kb Configurable I/O Poll Response size and Assembly helps optimize space utilization within scanner input tables.
Side Connector	All XM measurement and relay modules include side connectors that allow interconnecting adjacent modules, thereby simplifying the external wiring requirements. The interconnect provides primary power, DeviceNet communication, and the circuits necessary to support expansion modules, such as the XM-441 Expansion Relay module.
Serial	RS-232 via mini-connector or terminal base unit Baud rate fixed at 19200. *NOTE: Local configuration via Serial Configuration Utility.*

XM-121 Absolute Shaft Technical Specifications

Product Feature	Specification
Inputs	
Channel 1	Eddy current transducer Supports 5, 8, & 11 mm Allen-Bradley 2100 Series and Bently Nevada 3300 XL Series probes
Channel 2	Case Mounted Sensor Supports the following sensors: 9000A Gen. Purpose Accel 9100VO Vel Output Accel 9100 CSA Gen Purpose Accel 9100T High Temp Accel
Transducer Power	Constant voltage (-24V dc)* Constant current (4.5 mA ±20% from 24 V supply) None (voltage input) ***Tachometer may be powered, constant voltage, or configured as voltage input.***
Voltage Range	Selectable in software as 0 to ±20 V (min) 40 V max. peak-to-peak
Sensitivity	User configurable in software
Input Impedance	Greater than 100 k
Tachometer	
1 Tachometer Input	±25 V (50 V max. peak to peak) 1 to 50,000 events per revolution
Input Impedance	120 k minimum
Speed/Frequency Range	1 to 1,200,000 RPM 0.0167 to 20,000 Hz
Speed Measurement Error	1 to 120 RPM ± 0.2 RPM 121 to 600 RPM ± 1 RPM 601 to 4000 RPM ± 2 RPM 4001 to 24,000 RPM ± 10 RPM 24,001 to 120,000 RPM ± 20 RPM 120,001 to 600,000 RPM ± 80 RPM 600,001 to 1,200,000 RPM ± 160 RPM
Pulses per Revolution	0 (tach disabled) to 50,000
Max Rate of Change of Speed	500 Hz/sec

XM-121 Absolute Shaft Technical Specifications

Product Feature		Specification
Outputs		
	4-20 mA Outputs	Each output is independently programmed to represent any measured parameter, from either channel Two isolated outputs 300 ohm max load
	Buffered Outputs	1 active buffer per vibration input channel Resistive buffer for tachometer
Indicators		
	7 LEDs	Module Status - red/green Network Status - red/green Channel 1 Status - yellow/red Channel 2 Status - yellow/red Tachometer Status - yellow/red Setpoint Multiplier -yellow Relay - red
Signal Conditioning		
	Tracking Filter	User configurable in software Constant Bandwidth (0.1 to 25 Hz) Constant Q (adjustable 1 to 200 with 0.5 to 15 Hz bandwidth limit) Stopband attenuation > 57 dB Speed range: 4 to 1000 Hz (240 to 60,000 rpm)
	Frequency Range	1 to 10,000 Hz
	Resolution	A/D Conversion: 24 bits Dynamic Range: <80 dBfs (0.01% fs), -90 dBfs (typical)
	Accuracy (minimum)	±1% of channel full scale
	Phase Accuracy	3 degrees above 600 RPM
	Amplitude Range	±21 V
	High Pass Filter	User configurable in software 0.8, 2, 4, or 23.8 Hz -80 dB/decade rolloff
	Low Pass Filter	Adjustable: 600 to 4000 Hz -40 dB/decade rolloff
Complex Data		
	Time Waveform	Block Size: 256, 512, 1024, 2048 Period: 0.02 to 80 seconds

XM-121 Absolute Shaft Technical Specifications

Product Feature	Specification
Measured Parameters	
Shaft Relative (Eddy Current Probe)	Overall 1x Magnitude 1x Phase Gap (volts)
Case Absolute (Velocity or Accelerometer)	Output units selectable as either Velocity or Displacement Overall 1X Magnitude 1X Phase Bias (volts)
Shaft Absolute (Calculated)	Overall 1X Magnitude 1X Phase
Speed	RPM
Alarms	
Number	9 alarm and danger pairs Shaft Absolute Overall Shaft Absolute 1X Magnitude Shaft Relative Overall Casing Absolute Overall Shaft Relative 1X Magnitude Casing Absolute 1X Magnitude Probe Gap Accelerometer Bias Speed
Operators	Greater than Less than Inside range Outside range
Hysteresis	User configurable in software
Startup Inhibit/Set Point Multiplication	Period: 0 to 1092 minutes in 0.1 minute increments Inhibit/Multiplication Function: Multiply by N (0 to 10, 0 = Disarm)
Speed Inhibit	A speed range may be specified for each alarm. When applied, the alarm is disabled when speed is outside of the defined range.

XM-121 Absolute Shaft Technical Specifications

Product Feature	Specification
Relays	
Number	Single on-board relay, two sets of contacts - DPDT (2 Form C) Four additional 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
On-board Relay Rating	Maximum Voltage: 120V dc, 125V ac Maximum Current: 3.5 A* Minimum Current: 0 Maximum Power: 60 W, 62.5 VA **Max current is up to 40°C, then derates to 2 A at 65°C* Agency Rating: 120V ac @ 0.5 A 110V dc @ 0.3 A 30V dc @ 1.0 A
Failsafe	Normally energized (failsafe), or Normally de-energized (non-fail-safe)
Latching	Latching, or Non-latching
Time Delay	0 to 25.5 seconds, adjustable in 100msec increments
Voting Logic	Single or paired "And" or "Or" logic applied to any alarm
Reset	Local reset switch on top of module Remote reset switch wired to terminal base Digital reset command via serial or DeviceNet interface
Activation On	Alarm Status: Normal Alert Danger Disarm Transducer fault Module fault Tacho fault

XM-121 Absolute Shaft Technical Specifications

Product Feature	Specification
Non-Volatile Configuration	A copy of the module configuration is retained in non-volatile memory from where it is loaded upon power up*. **The configuration stored in non-volatile memory can be deleted only by a module-reset command sent via the serial interface, using the Serial Configuration Utility, or via DeviceNet from any compliant software application.*
Accuracy (minimum)	±1% of full scale range for the channel ±1% of alarm setpoint for speed
Power	
Module	+21.6 to +26.4V dc
Consumption	Maximum: 300 mA Typical: 175 mA
Heat Production	Maximum: 7 Watts (24 BTU/hr) Typical: 4 Watts (14 BTU/hr)
Transducer	Isolated 24V dc, user configurable with wiring
Environmental	
Operating Temperature	-20 to +65°C (-4 to +149°F)
Storage Temperature	-40 to +85°C (-40 to +185°F)
Relative Humidity	95% non-condensing
Conformal Coating	All printed circuit boards are conformally coated in accordance with IPC-A-610C.
Physical	
Dimensions	Height: 3.8 in (97 mm) Width: 3.7 in (94 mm) Depth: 3.7 in (94 mm)
Terminal Screw Torque	7 pound-inches (0.6 Nm)

XM-121 Absolute Shaft Technical Specifications

Product Feature	Specification	
Approvals (when product or packaging is marked)	UL	UL Listed for Ordinary Locations
	UL	UL Listed for Class I, Division 2 Group A, B, C, and D Hazardous Locations
	CSA	CSA Certified Process Control Equipment
	CSA	CSA Certified Process Control Equipment for Class I, Division 2 Group A, B, C, and D Hazardous Locations
	EEX*	European Union 94/9/EEC ATEX Directive, compliant with EN 50021; Potentially Explosive Atmospheres, Protection "n"
	CE*	European Union 89/336/EEC EMC Directive
	C-Tick*	Australian Radiocommunications Act, compliant with: AS/NZS 2064, Industrial Emissions
	* *See the Product Certification link at www.rockwellautomation.com for Declarations of Conformity, Certificates and other certification details.*	

DeviceNet Information

Electronic Data Sheets

Electronic Data Sheet (EDS) files are simple text files used by network configuration tools such as RSNetWorx (Version 3.0 or later) to help you identify products and easily commission them on a network. The EDS files describe a product's device type, product revision, and configurable parameters on a DeviceNet network.

The EDS files for the XM modules are installed on your computer with the XM configuration software. The latest EDS files can also be obtained at http://www.ab.com/networks/eds/ or by contacting your local Rockwell Automation representative.

Refer to your DeviceNet documentation for instructions on registering the EDS files.

Changing Operation Modes

XM modules operate in two modes.

Mode	Description
Run	The XM measurement modules collect measurement data and monitor each measurement device. The XM-440 establishes I/O connections with the XM measurement modules in its scan list and monitors their alarms, and controls its own relay outputs accordingly.
Program	The XM module is idle. The XM measurement modules stop the signal processing/measurement process, and the status of the alarms is set to the disarm state to prevent a false alert or danger status. The XM-440 closes the I/O connections with the XM measurement modules in its scan list and stops monitoring their alarms, relays are deactivated unless they are latched. Configuration parameters can be read, updated and downloaded to the XM module.

To change the operation mode of the module, use the Device Mode parameter in the EDS file. Note that the Stop and Start services described on page 83 can also be used to change the operation mode.

IMPORTANT The XM Serial Configuration Utility software automatically puts XM modules in Program mode and Run mode without user interaction.

Transition to Program Mode

Parameter values can only be downloaded to an XM module while the module is in Program mode. Any attempt to download a parameter value while the module is in Run mode will result in a Device State Conflict error.

To transition an XM module from Run mode to Program mode on a DeviceNet network, set the **Device Mode** parameter to "Program mode" and click **Apply**. Note that you cannot change any other parameter until you have downloaded the Program mode parameter.

TIP The Module Status indicator flashes green when the module is in Program mode.

Refer to your DeviceNet documentation for specific instructions on editing EDS device parameters.

TIP You can also use the Stop service described on page 83 to transition XM modules to Program mode.

Transition to Run Mode

In order to collect data and monitor measurement devices, XM modules must be in Run mode. To transition an XM module from Program mode to Run mode on a DeviceNet network, set the **Device Mode** parameter to "Run mode" and click **Apply**.

TIP The Module Status indicator is solid green when the module is in Run mode.

Refer to your DeviceNet documentation for specific instructions on editing EDS device parameters.

TIP You can also use the Start service described on page 83 to transition XM modules to Run mode.

XM Services

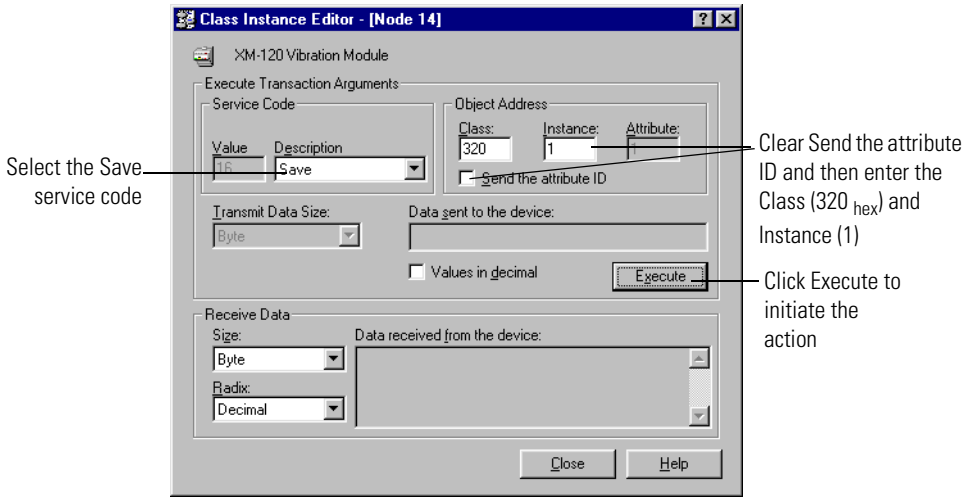
The table below defines services supported by the XM modules. The table includes the service codes, classes, instances, and attributes by their appropriate hexadecimal codes. Use the Class Instance Editor in RSNetWorx to execute these services, as illustrated in the example below.

XM Services

Action	Service Code (Hex)	Class (Hex)	Instance	Attribute	Data
Transition to Run Mode	Start (06)	Device Mode Object (320)	1	None	None
Transition to Program Mode	Stop (07)	Device Mode Object (320)	1	None	None
Save configuration to non-volatile memory (EEPROM)	Save (16)	Device Mode Object (320)	1	None	None
Delete saved configuration from non-volatile memory (EEPROM)	Delete (09)	Device Mode Object (320)	1	None	None
Reset a specific latched relay	Reset (05)	Relay Object (323)	Relay number 1-C for XM-440, 1-5 for XM-12X, XM-320 and XM-220, 1-8 for XM-36X and XM-16X	None	None
Reset all latched relays	Reset (05)	Relay Object (323)	0	None	None
Reset the Peak Speed (XM-12X only)	Reset (05)	Speed Measurement Object (325)	1, 2 for XM-220	None	None
Close the virtual setpoint multiplier switch to activate the alarm setpoint multipliers (not applicable to all XM modules)	Other (33)	Discrete Input Point Object (08)	1	None	None
Open the virtual setpoint multiplier switch to start the setpoint multiplier timers and eventually cancel alarm setpoint multiplication (not applicable to all XM modules)	Other (32)	Discrete Input Point Object (08)	1	None	None

Example

To save the configuration parameters to the non-volatile memory (EEPROM), fill in the Class Instance Editor as shown below.



Invalid Configuration Errors

A Start or Save service request to an XM module may return an Invalid Device Configuration error when there is a conflict amongst the configuration settings.

The general error code for the Invalid Device Configuration error is $D0_{hex}$. An additional error code is returned with the general error code to specify which configuration settings are invalid. The table below lists the additional error codes associated with the Invalid Device Configuration error.

Additional Error Codes returned with the Invalid Device Configuration Error (0xD0)

Error Code (Hex)	Description
01	No specific error information is available.
02	Mismatched transducer, channel, and/or measurement unit.
03	Inverted transducer fault high/low values.
04	Alarm thresholds conflict with the alarm condition.
05	Alarm speed range is invalid.
06	Band minimum frequency is greater than maximum frequency. Or, maximum frequency is greater than FMAX.
07	Relay is associated with an alarm that is not enabled.
08	Tachometer must be enabled for alarm or channel settings.
09	A senseless speed range is enabled on a speed alarm.

Additional Error Codes returned with the Invalid Device Configuration Error (0xD0)

Error Code (Hex)	Description
0A	Too many alarms associated with a single measurement.
0B	Invalid node address in the alarm list.
0C	Too many alarms in the alarm list. Or, no alarms in the alarm list.
0D	Alarm levels cannot be zero for alarms that are enabled.
0E	Too many slaves in the scanner's input data table.
0F	The FMAX and Number of Lines do not yield correct vector calculations.
10	Phase (vector) alarms prohibited with synchronous sampling and more than 1 tachometer pulse per revolution.
11	Can't have order based band on asynchronous channel.
12	Unsupported Sensor Type and Channel ID combination.
13	Invalid Alarm Type for the associated measurement ID.
14	Synchronous sampling is required for alarm on synchronous measurements.
15	Integration is not supported with the Bypass High Pass Filter option.

Absolute Shaft I/O Message Formats

The Absolute Shaft module supports Poll, Change of State (COS), and Bit-Strobe I/O messages. The Poll response message is used by the XM module to produce measured values and the COS message is used to produce the Alarm and Relay Status. The Bit-Strobe message is used by a master device to send a trigger event to all the XM slaves on the network.

Poll Message Format

The Absolute Shaft module Poll request message contains no data. The Poll response message can contain up to 31 REAL values for a total of 124 bytes.

The Absolute Shaft module provides one pre-defined (static) data format of the Poll response, as defined in Assembly instance 101. It also provides a dynamic Assembly instance, instance 199, with which you can define a custom data format for the Poll response. The dynamic Assembly instance can contain any of the measurement parameters included in Assembly instance 101, as well as several of the alarm and relay configuration parameters.

The default Assembly instance is 101 and the default size is 48 bytes. You can change the Assembly instance and define the dynamic Assembly using the configuration software. Refer to I/O Data Parameters on page 68.

The Poll response data can also be requested explicitly through Assembly Object (Class ID 0x4), Instance 101 (0x65), Data Attribute (3).

The following table shows the static data format of Assembly instance 101.

Absolute Shaft Assembly Instance 101 Data Format

Byte	Definition
0–3	Shaft Absolute Overall
4–7	Channel 1 Shaft Relative Overall
8–11	Channel 2 Case Absolute Overall
12–15	Shaft Absolute 1X Magnitude
16–19	Shaft Absolute 1X Phase
20–23	Channel 1 Shaft Relative 1X Magnitude
24–27	Channel 1 Shaft Relative 1X Phase
28–31	Channel 2 Case Absolute 1X Magnitude
32–35	Channel 2 Case Absolute 1X Phase
36-39	Channel 1 DC Bias
40-43	Channel 2 DC Bias
44-47	Speed

COS Message Format

The Absolute Shaft COS message contains five bytes of data as defined in the table below. The COS data can also be requested explicitly through Assembly Object (Class ID 0x4), Instance 100 (0x64), Data Attribute (3).

Absolute Shaft COS Message Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Relay 1 Status	Set Point Multiplier	Alarm 2 Status			Alarm 1 Status		
1	Relay 2 Status	Reserved	Alarm 4 Status			Alarm 3 Status		
2	Relay 3 Status	Reserved	Alarm 6 Status			Alarm 5 Status		
3	Relay 4 Status	Reserved	Alarm 8 Status			Alarm 7 Status		
4	Relay 5 Status	Reserved	Reserved			Alarm 9 Status		

XM Status Values

The following tables describe the XM Status values that are included in the COS messages.

Alarm Status Descriptions

Alarm Status Value	Description
0	Normal
1	Alert
2	Danger
3	Disarm
4	Transducer Fault (Sensor OOR)
5	Module Fault
6	Tachometer Fault
7	Reserved

Relay Status Descriptions

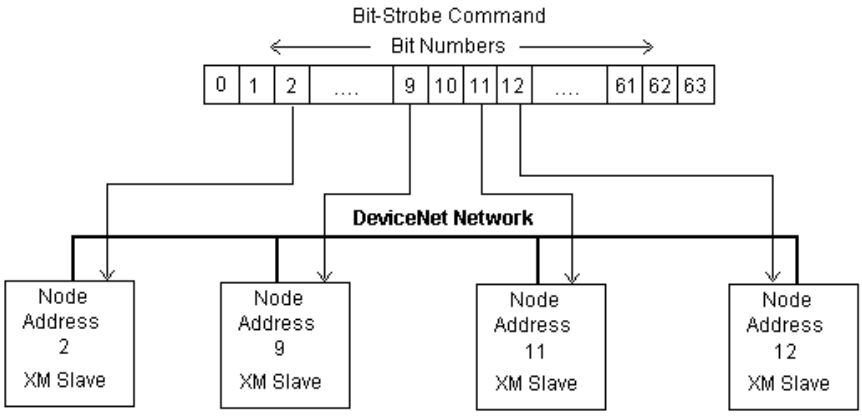
Relay Status Value	Description
0	Not Activated
1	Activated

Bit-Strobe Message Format

The Bit-Strobe command sends one bit of output data to each XM slave whose node address appears in the master's scanlist.

The Bit-Strobe command message contains a bit string of 64 bits (8 bytes) of output data, one output bit per node address on the network. One bit is assigned to each node address supported on the network (0...63) as shown in Figure B.1.

Figure B.1 Bit-Strobe Command



The XM modules use the bit received in a Bit-Strobe connection as a trigger event. When the bit number corresponding to the XM module's node address is set, the XM module will collect the triggered trend data.

Note that the XM modules do not send data in the Bit-Strobe response.

ADR for XM Modules

Automatic Device Replacement (ADR) is a feature of an Allen-Bradley DeviceNet scanner. It provides a means for replacing a failed device with a new unit, and having the device configuration data set automatically. Upon replacing a failed device with a new unit, the ADR scanner automatically downloads the configuration data and sets the node address.

IMPORTANT It is recommended that ADR not be used in safety related applications. If the failure of the ADR server, and a subsequent power cycle, would result in the loss of protection for a machine, then ADR should not be implemented.

ADR can be used with XM modules but keep the following in mind when setting up the XM modules.

- The ADR scanner can not download the configuration data to an XM module if the module has a saved configuration in its non-volatile memory. This happens because the saved configuration is restored and the module enters Run mode when the power is cycled. (Configuration parameters cannot be downloaded while an XM module is in Run mode.) XM modules must be in Program mode for the ADR configuration to be downloaded and this occurs only when there is no saved configuration.

TIP

To delete a saved configuration from non-volatile memory, use the Delete service in RSNetWorx for DeviceNet or perform the following steps in the XM Serial Configuration Utility.

1. Save the current configuration to a file. From the **File** menu, click **Save As** and enter a file name for the configuration.
2. Reset the module to factory defaults. Click the **Module** tab and click the **Reset** button.
3. Reload the saved configuration. From the **File** menu, click **Open** and select the configuration file.
4. Make certain to disable auto save. From the **Device** menu, clear the **Auto Save Configuration** check mark.

- An XM module will enter Run mode automatically after the ADR scanner restores the module's configuration only if the module is in Run mode at the time the configuration is saved to the scanner. If the module is in Program mode when the configuration is saved, then the module will remain in Program mode after the configuration is downloaded by the ADR scanner.

- The ADR scanner saves and restores only the configuration parameters contained in the module's EDS file. Some XM parameters are not included in the EDS file because they are not supported by either the EDS specification or the tools that read the EDS files, for example RSNetWorx for DeviceNet. These configuration parameters will not be restored with ADR.

  Below is a list of the configuration parameters that are not included in the EDS file and can not be saved or restored with ADR.

  – Channel Name
  – Tachometer Name
  – Alarm Name
  – Relay Name
  – All Triggered Trend related parameters (see page 64)

  - All SU/CD Trend related parameters (see page 66)
  - Custom Assembly structure (see page 68)

- The ADR and trigger group functions cannot be used together. A module can have only one primary master so a module cannot be both configured for ADR and included in a trigger group. The ADR scanner must be the primary master for the modules configured for ADR. The XM-440 Master Relay module must be the primary master for modules included in a trigger group.

DeviceNet Objects

Appendix C provides information on the DeviceNet objects supported by the Absolute Shaft module.

TIP Refer to the DeviceNet specification for more information about DeviceNet objects. Information about the DeviceNet specification is available on the ODVA web site (http://www.odva.org).

Identity Object (Class ID 01_H)

The Identity Object provides identification and general information about the device.

Class Attributes

The Identity Object provides no class attributes.

Instance Attributes

Table C.1 Identity Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Default Value
1	Get	Vendor ID	UINT	668 = Entek
2	Get	Device Type	UINT	109 (Specialty I/O)
3	Get	Product Code	UINT	38 (0x26)
4	Get	Revision: Major Minor	STRUCT OF USINT USINT	 Value varies with each firmware revision. Value varies with each firmware revision.
5	Get	Status	WORD	
6	Get	Serial Number	UDINT	
7	Get	Product Name	SHORT_ STRING	"XM-121 Absolute Shaft Module"

Status

The **Status** is a 16 bit value. The following bits are implemented.

Table C.2 Identity Object Status

Bit	Name	Description
0	Owned	TRUE indicates that the module has an owner. More specifically, the Predefined Master/Slave Connection Set has been allocated to a master.
1		Reserved, set to 0
2	Configured	This bit is set whenever a saved configuration is successfully loaded from non-volatile memory. This bit is cleared whenever the default configuration is restored or loaded.
3		Reserved, set to 0

Table C.2 Identity Object Status

Bit	Name	Description
4	Boot Program	Vendor-specific, indicates that the boot program is running. The Main Application must be corrupt or missing.
5 - 7		Vendor-specific, not implemented
8	Minor Recoverable Fault	Set whenever there is a transducer or tachometer fault.
9	Minor Unrecoverable Fault	Not implemented
10	Major Recoverable Fault	Set when the module detects a major problem that the user may be able to recover from. The Module Status LED will flash red. An example of this condition is when the boot program is running.
11	Major Unrecoverable Fault	Set when there is a module status fault (Module Status LED is solid red).
12 - 15		Reserved, set to 0

Services

Table C.3 Identity Object Services

Service Code	Class/Instance Usage	Name
01_h	Instance	Get_Attributes_All
05_h	Instance	Reset
$0E_h$	Instance	Get_Attribute_Single
10_h	Instance	Set_Attribute_Single[1]

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

DeviceNet Object (Class ID 03_H)

The DeviceNet Object is used to provide the configuration and status of a physical attachment to DeviceNet.

Class Attributes

Table C.4 DeviceNet Object Class Attributes

Attr ID	Access Rule	Name	Data Type	Default Value
1	Get	Revision	UINT	2

Instance Attributes

Table C.5 DeviceNet Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Default Value
1	Get/Set	MAC ID[1]	USINT	63
2	Get/Set	Baud Rate[2]	USINT	0
3	Get	Bus-Off Interrupt	BOOL	0
4	Get/Set	Bus-Off Counter	USINT	0
5	Get	Allocation Information	STRUCT of BYTE USINT	0 255
100	Get/Set	Autobaud Disable	BOOL	0 (Ignore attribute 2 and always autobaud)

1 Setting the MAC ID causes the device to reset automatically, after which it will go online with the new MAC ID.

2 The Baud Rate setting can not be set while **Autobaud Disable** is equal to 0. The new baud rate will not take effect until the module is reset.

The **MAC ID**, **Baud Rate**, and **Autobaud Disable** settings are stored in non-volatile memory so they do not reset to the default with each power cycle. The **Baud Rate** attribute supports the following settings:

- 0 = 125 kbps
- 1 = 250 kbps
- 2 = 500 kbps

The **Baud Rate** setting is used only when automatic baud rate detection is disabled (**Autobaud Disable** = 1). When **Autobaud Disable** is set to zero (0), the module ignores its **Baud Rate** setting and performs automatic baud

rate detection instead. This means that the module will determine the network baud rate by listening for network traffic before attempting to go online.

Services

Table C.6 DeviceNet Object Services

Service Code	Class/Instance Usage	Name
$0E_h$	Class/Instance	Get_Attribute_Single
10_h	Instance	Set_Attribute_Single[1]
$4B_h$	Instance	Allocate_Master/Slave_Connetion_Set
$4C_h$	Instance	Release_Group_2_Identifier_Set

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

Assembly Object (Class ID 04_H)

The Assembly Object binds attributes of multiple objects to allow data to or from each object to be sent or received in a single message.

The Absolute Shaft module provides both static and dynamic assemblies.

Class Attribute

Table C.7 Assembly Object Class Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
1	Get	Revision	UINT	Revision of the implemented object.	2

Instances

Table C.8 Assembly Object Instances

Instance	Name	Type	Description
100	Default COS Message	Input	Alarm and Relay Status values
101	Default Poll Response Message	Input	Measurement values
199	Alternate Dynamic Poll Response Message	Input	User configurable measurement values and configuration parameters

Instance Attributes

Table C.9 Assembly Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Value
1	Get	Number of Members in list	UINT	Only supported for Dynamic Assembly instance.
2	Set	Member List	Array of STRUCT:	Only supported for Dynamic Assembly instance.
		Member Data Description	UINT	Size of member data value in bits.
		Member Path Size	UINT	
		Member Path	Packed EPATH	
3	Get	Data	Defined in tables on the following pages.	

Assembly Instance Attribute Data Format

Instance 100 - Alarm and Relay Status

This assembly is sent using COS messaging when any of the Alarm or Relay Status values change.

Table C.10 Instance 100 Data Format (Alarm and Relay Status Values Assembly)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Relay 1 Status	Set Point Multiplier	Alarm 2 Status			Alarm 1 Status		
1	Relay 2 Status	0	Alarm 4 Status			Alarm 3 Status		
2	Relay 3 Status	0	Alarm 6 Status			Alarm 5 Status		
3	Relay 4 Status	0	Alarm 8 Status			Alarm 7 Status		
4	Relay 5 Status	0	0			Alarm 9 Status		

Instance 101 - Measurement Values

This is the default assembly that is sent within the I/O Poll Response message when an I/O Poll Request is received from a DeviceNet Master.

Table C.11 Instance 101 Data Format (Measurement Values Assembly)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0 - 3	Shaft Absolute Overall							
4 - 7	Channel 1 Shaft Relative Overall							
8 - 11	Channel 2 Case Absolute Overall							
12 - 15	Shaft Absolute 1X Magnitude							
16 - 19	Shaft Absolute 1X Phase							
20 - 23	Channel 1 Shaft Relative 1X Magnitude							
24 - 27	Channel 1 Shaft Relative 1X Phase							
28 - 31	Channel 2 Case Absolute 1X Magnitude							
32 - 35	Channel 2 Case Absolute 1X Phase							
36 - 39	Channel 1 DC Bias							
40 - 43	Channel 2 DC Bias							
44 - 47	Speed							

Instance 199 - Dynamic Assembly

This Assembly instance can be created and configured with the XM Serial Configuration Utility or RSMACC Enterprise Online Configuration Utility. Using the configuration software, you determine the format of the data. This assembly instance can be selected to be sent in response to an I/O Poll request from a Master.

The dynamic Assembly can include all of the measurement values included in Assembly instance 101. In addition, the dynamic Assembly can include the following configuration parameters.

Table C.12 Instance 199 Component Mapping

EPATH (where ii = instance number)	Class Name	Class Number	Instance Number	Attribute Name	Attribute Number	Data Type
21 1D 03 24 ii 30 04	Alarm	$31D_h$	1 - 9	Alarm Enable	4	BOOL
21 1D 03 24 ii 30 07	Alarm	$31D_h$	1 - 9	Condition	7	USINT
21 1D 03 24 ii 30 08	Alarm	$31D_h$	1 - 9	Alert Threshold (High)	8	REAL
21 1D 03 24 ii 30 09	Alarm	$31D_h$	1 - 9	Danger Threshold (High)	9	REAL
21 1D 03 24 ii 30 0A	Alarm	$31D_h$	1 - 9	Alert Threshold Low	10	REAL
21 1D 03 24 ii 30 0B	Alarm	$31D_h$	1 - 9	Danger Threshold Low	11	REAL
21 1D 03 24 ii 30 0C	Alarm	$31D_h$	1 - 9	Hysteresis	12	REAL
21 1D 03 24 ii 30 0D	Alarm	$31D_h$	1 - 9	Threshold (Set Point) Multiplier	13	REAL
21 1D 03 24 ii 30 0E	Alarm	$31D_h$	1 - 9	Startup Period	14	UINT
21 1D 03 24 ii 30 0F	Alarm	$31D_h$	1 - 9	Speed Range Enable	15	BOOL
21 1D 03 24 ii 30 10	Alarm	$31D_h$	1 - 9	Speed Range High	16	REAL
21 1D 03 24 ii 30 11	Alarm	$31D_h$	1 - 9	Speed Range Low	17	REAL
21 1D 03 24 ii 30 14	Alarm	$31D_h$	1 - 9	Inhibit Tach Fault	20	BOOL
21 23 03 24 ii 30 04	Relay	323_h	1 - 5	Relay Enable	4	BOOL
21 23 03 24 ii 30 05	Relay	323_h	1 - 5	Latch Enable	5	BOOL
21 23 03 24 ii 30 06	Relay	323_h	1 - 5	Failsafe Enable	6	BOOL
21 23 03 24 ii 30 07	Relay	323_h	1 - 5	Delay	7	UINT
21 23 03 24 ii 30 09	Relay	323_h	1 - 5	Alarm Level	9	BYTE
21 0F 00 24 ii 30 01	Param	$0F_h$	7 - 11	Parameter Value (Alarm Identifier A)	1	USINT

Table C.12 Instance 199 Component Mapping

EPATH (where ii = instance number)	Class Name	Class Number	Instance Number	Attribute Name	Attribute Number	Data Type
21 0F 00 24 ii 30 01	Param	$0F_h$	12 - 16	Parameter Value (Alarm Identifier B)	1	USINT
21 23 03 24 ii 30 0C	Relay	323_h	1 - 5	Logic	12	USINT
21 23 03 24 ii 30 0E	Relay	323_h	1 - 5	Relay Installed	14	BOOL

The dynamic Assembly instance must be instantiated with a call to the class level Create service. Then the structure can be defined with the Set_Attribute_Single service for the Member List attribute. Only one dynamic Attribute instance is supported so subsequent calls to the Create service will return a Resource Unavailable (0x02) error. The Delete service can be used to destroy the dynamic Assembly instance so that it can be re-created.

Services

Table C.13 Assembly Object Services

Service Code	Class/Instance Usage	Name
$0E_h$	Class/Instance	Get_Attribute_Single
10_h	Instance	Set_Attribute_Single
08_h	Class	Create
09_h	Instance	Delete

Connection Object (Class ID 05_H)

The Connection Object allocates and manages the internal resources associated with both I/O and Explicit Messaging Connections.

Class Attributes

The Connection Object provides no class attributes.

Instances

Table C.14 Connection Object Instances

Instance	Description
1	Explicit Message Connection for pre-defined connection set
2	I/O Poll Connection
3	I/O Strobe Connection
4	I/O COS (change of state) Connection
11 - 17	Explicit Message Connection

Instance Attributes

Table C.15 Connection Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description
1	Get	State	USINT	State of the object.
2	Get	Instance Type	USINT	Indicates either I/O or Messaging Connection.
3	Get	Transport Class Trigger	BYTE	Defines behavior of the Connection.
4	Get	Produced Connection ID	UINT	Placed in CAN Identifier Field when the Connection transmits.
5	Get	Consumed Connection ID	UINT	CAN Identifier Field value that denotes message to be received.
6	Get	Initial Comm Characteristics	BYTE	Defines the Message Group(s) across which productions and consumptions associated with this Connection occur.
7	Get	Produced Connection Size	UINT	Maximum number of bytes transmitted across this Connection.
8	Get	Consumed Connection Size	UINT	Maximum number of bytes received across this Connection.
9	Get/Set	Expected Packet Rate	UINT	Defines timing associated with this Connection.
12	Get/Set	Watchdog Time-out Action	USINT	Defines how to handle Inactivity/Watchdog timeouts.
13	Get	Produced Connection Path Length	UINT	Number of bytes in the production_connection_path attribute.
14	Get	Produced Connection Path	Array of USINT	Specifies the Application Object(s) whose data is to be produced by this Connection Object. See DeviceNet Specification Volume 1 Appendix I.

Table C.15 Connection Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description
15	Get	Consumed Connection Path Length	UINT	Number of bytes in the consumed_connection_path attribute.
16	Get	Consumed Connection Path	Array of USINT	Specifies the Application Object(s) that are to receive the data consumed by this Connection Object. See DeviceNet Specification Volume 1 Appendix I.
17	Get	Production Inhibit Time	UINT	Defines minimum time between new data production.

Services

Table C.16 Connection Object Services

Service Code	Class/Instance Usage	Name
05_h	Instance	Reset
$0E_h$	Instance	Get_Attribute_Single
10_h	Instance	Set_Attribute_Single

Discrete Input Point Object (Class ID 08_H)

The Discrete Input Point Object stores information about the value of the Setpoint Multiplier signal.

Class Attributes

Table C.17 Discrete Input Object Class Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
1	Get	Revision	UINT	Revision of the implemented object.	2

Instance Attributes

Table C.18 Discrete Input Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get	Value	BOOL	Setpoint Multiplier	0 = Off 1 = On
199	Set	Backdoor Service	USINT	Setting this attribute is equivalent to requesting the specified service.	Set to one of the following values to perform the specified service: 0x32 = Open 0x33 = Close

Services

Table C.19 Discrete Input Object Services

Service Code	Class/Instance Usage	Name	Description
$0E_h$	Class/Instance	Get_Attribute_Single	Returns the contents of the specified attribute.
10_h	Instance	Set_Attribute_Single	Sets the contents of the specified attribute.
32_h	Instance	Open	Opens the virtual Setpoint Multiplier switch.
33_h	Instance	Close	Closes the virtual Setpoint Multiplier switch.

Parameter Object (Class ID $0F_H$)

The Parameter Object provides the interface to the Absolute Shaft configuration data. There are 19 Parameter Object instances implemented in the Absolute Shaft module.

Parameter Object instances 1-16 are implemented to provide an alternate method of setting the configuration parameters with EPATH or ENGUNIT data types. And Parameter Object instances 18 and 19 provide an alternate method of setting the Produced Connection Size and Produced Connection Path attributes for the Poll Connection because these attributes can be difficult to get/set directly through the Connection Object.

Instance 17 is provided to select the sensor type for the case absolute channel.

Class Attributes

Table C.20 Parameter Object Class Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
2	Get	Max Instance	UINT	Maximum instance number of an object in this class.	Total number of parameter object instances.
8	Get	Parameter Class Descriptor	WORD	Bits that describe the parameter.	Bit 0 Supports Parameter Instances Bit 1 Supports Full Attrib. Bit 2 Must do non-volatile store Bit 3 Params in non-volatile
9	Get	Config. Assembly Instance	UINT		Set to 0

Instances

There are 19 instances of this object.

Table C.21 Parameter Object Instances

Instance	Read Only	Name	Data Type	Valid Values	Default Value
1	No	Transducer 1 Sensitivity Units	USINT	0 = mils 6 = µm	0
2	No	Transducer 2 Sensitivity Units	USINT	1 = ips 2 = g 5 = mm/s	1
3	Yes	Channel 1 Measurement Units	USINT	0 = mils 6 = µm	0
4	No	Channel 2 Measurement Units	USINT	0 = mils 1 = ips 5 = mm/s 6 = µm	0
5	No	4-20 mA Output 1 Measurement Identifier	USINT	0 = CH 1 SR Overall 1 = CH 2 CA Overall 2 = CH 1 SR 1X Mag. 3 = CH 2 CA 1X Mag. 4 = Shaft Absolute Overall 5 = Shaft Absolute 1X Mag. 6 = CH 1 DC Bias 7 = CH 2 DC Bias 8 = Speed	0

Table C.21 Parameter Object Instances

Instance	Read Only	Name	Data Type	Valid Values	Default Value
6	No	4-20 mA Output 2 Measurement Identifier	USINT	0 = CH 1 SR Overall 1 = CH 2 CA Overall 2 = CH 1 SR 1X Mag. 3 = CH 2 CA 1X Mag. 4 = Shaft Absolute Overall 5 = Shaft Absolute 1X Mag. 6 = CH 1 DC Bias 7 = CH 2 DC Bias 8 = Speed	1
7	No	Relay 1 Alarm Identifier A	USINT	0 = Alarm 1 1 = Alarm 2 2 = Alarm 3 3 = Alarm 4 4 = Alarm 5 5 = Alarm 6 6 = Alarm 7 7 = Alarm 8 8 = Alarm 9	0
8	No	Relay 2 Alarm Identifier A	USINT	0 = Alarm 1 1 = Alarm 2 2 = Alarm 3 3 = Alarm 4 4 = Alarm 5 5 = Alarm 6 6 = Alarm 7 7 = Alarm 8 8 = Alarm 9	0
9	No	Relay 3 Alarm Identifier A	USINT	0 = Alarm 1 1 = Alarm 2 2 = Alarm 3 3 = Alarm 4 4 = Alarm 5 5 = Alarm 6 6 = Alarm 7 7 = Alarm 8 8 = Alarm 9	0
10	No	Relay 4 Alarm Identifier A	USINT	0 = Alarm 1 1 = Alarm 2 2 = Alarm 3 3 = Alarm 4 4 = Alarm 5 5 = Alarm 6 6 = Alarm 7 7 = Alarm 8 8 = Alarm 9	0

Table C.21 Parameter Object Instances

Instance	Read Only	Name	Data Type	Valid Values	Default Value
11	No	Relay 5 Alarm Identifier A	USINT	0 = Alarm 1 1 = Alarm 2 2 = Alarm 3 3 = Alarm 4 4 = Alarm 5 5 = Alarm 6 6 = Alarm 7 7 = Alarm 8 8 = Alarm 9	0
12	No	Relay 1 Alarm Identifier B	USINT	0 = Alarm 1 1 = Alarm 2 2 = Alarm 3 3 = Alarm 4 4 = Alarm 5 5 = Alarm 6 6 = Alarm 7 7 = Alarm 8 8 = Alarm 9	1
13	No	Relay 2 Alarm Identifier B	USINT	0 = Alarm 1 1 = Alarm 2 2 = Alarm 3 3 = Alarm 4 4 = Alarm 5 5 = Alarm 6 6 = Alarm 7 7 = Alarm 8 8 = Alarm 9	1
14	No	Relay 3 Alarm Identifier B	USINT	0 = Alarm 1 1 = Alarm 2 2 = Alarm 3 3 = Alarm 4 4 = Alarm 5 5 = Alarm 6 6 = Alarm 7 7 = Alarm 8 8 = Alarm 9	1
15	No	Relay 4 Alarm Identifier B	USINT	0 = Alarm 1 1 = Alarm 2 2 = Alarm 3 3 = Alarm 4 4 = Alarm 5 5 = Alarm 6 6 = Alarm 7 7 = Alarm 8 8 = Alarm 9	1

Table C.21 Parameter Object Instances

Instance	Read Only	Name	Data Type	Valid Values	Default Value
16	No	Relay 5 Alarm Identifier B	USINT	0 = Alarm 1 1 = Alarm 2 2 = Alarm 3 3 = Alarm 4 4 = Alarm 5 5 = Alarm 6 6 = Alarm 7 7 = Alarm 8 8 = Alarm 9	1
17	No	Case Sensor Type	USINT	0 = 9100 VO 1 = 9000 A 2 = 9100 CSA 3 = 9100 T	0
18	No	Poll Connection Produced Connection Path[1]	USINT	101, 199 (Assembly Object Instance number)	101
19	No	Poll Connection Produced Connection Size[1]	UINT	4 - 124	48

1 The Poll Connection Produced Connection Path and Size parameters cannot be set while the Poll connection is already established with a master/scanner. Attempting to do so will result in an "Object State Conflict" error (error code 0xC) These Parameter instances are a little more flexible than the actual Connection Object attributes because they can be set while the connection is in the NON-EXISTENT state (before the master/scanner allocates the connection).

Instance Attributes

Table C.22 Parameter Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
1	Set	Parameter Value		Actual value of parameter	See Table C.21 for a list of valid values for each instance.
2	Get	Link Path Size	USINT	Size of Link Path	0 (These Parameter instances do not link directly to another object attribute.)
3	Get	Link Path	ARRAY of DeviceNet path	DeviceNet path to the object for the Parameter value.	
		Segment Type/Port	BYTE	See DeviceNet Specification Volume 1 Appendix I for format.	
		Segment Address		See DeviceNet Specification Volume 1 Appendix I for format.	

Table C.22 Parameter Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
4	Get	Descriptor	WORD	Description of Parameter	Bit 0 = Settable Path support Bit 1 = Enum Strings support Bit 2 = Scaling support Bit 3 = Scaling Links support Bit 4 = Read Only Bit 5 = Monitor Bit 6 = Ext. Prec. scaling
5	Get	Data Type	EPATH	Data Type Code	See DeviceNet Specification Volume 1 Appendix J, Section J-6.
6	Get	Data Size	USINT	Number of Bytes in Parameter value.	

Services

Table C.23 Parameter Object Services

Service Code	Class/Instance Usage	Name	Description
$0E_h$	Class/Instance	Get_Attribute_Single	Returns the contents of the specified attribute.
10_h	Class	Set_Attribute_Single	Sets the contents of the specified attribute.[1]

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

Acknowledge Handler Object (Class ID $2B_H$)

The Acknowledge Handler Object is used to manage the reception of message acknowledgments. This object communicates with a message producing Application Object within a device. The Acknowledge Handler Object notifies the producing application of acknowledge reception, acknowledge timeouts, and production retry limit errors.

Class Attributes

The Acknowledge Handler Object provides no class attributes.

Instances

A module provides only a single instance (instance 1) of the Acknowledge Handler Object. This instance is associated with instance 4 of the Connection Object, the slave COS connection to a higher level master.

Instance Attributes

Table C.24 Acknowledge Handler Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Default Value
1	Get/Set	Acknowledge Timer	UINT	16 ms
2	Get/Set	Retry Limit	USINT	1
3	Get	COS Producing Connection Instance	UINT	4

Services

Table C.25 Acknowledge Handler Object Services

Service Code	Class/Instance Usage	Name
$0E_h$	Instance	Get_Attribute_Single
10_h	Instance	Set_Attribute_Single

Alarm Object (Class ID $31D_H$)

The Alarm Object models a two-stage (alert and danger levels) alarm.

Class Attributes

Table C.26 Alarm Object Class Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
1	Get	Revision	USINT	Revision of the implemented object.	2 (indicates that **Threshold Multiplier** is a REAL instead of USINT)

Instances

There are 9 instances of this object. Each instance is permanently associated with a different measurement.

Table C.27 Alarm Object Instances

Instance Number	Associated Measurement
1	CH 1 Shaft Relative Overall
2	CH 2 Case Absolute Overall
3	CH 1 DC Bias
4	CH 2 DC Bias
5	CH 1 Shaft Relative 1X Magnitude
6	CH 2 Case Absolute 1X Magnitude
7	Shaft Absolute Overall
8	Shaft Absolute 1X Magnitude
9	Speed

Instance Attributes

Table C.28 Alarm Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get	Alarm Status	3 BITS	The current status of the alarm.	0 = Normal 1 = Alert (alarm) 2 = Danger (shutdown) 3 = Disarm 4 = Xdcr Fault 5 = Module Fault 6 = Tachometer Fault
4	Get/Set	Alarm Enable	BOOL	Indicates whether this alarm object is enabled.	0 = Disabled 1 = Enabled
6	Get	Threshold Units	USINT	Indicates whether the threshold and hysteresis value are specified in units of measure or percentage of full scale.	Set to 1 1 = Measurement units
7	Get/Set	Condition	USINT	Indicates on which side of the threshold values the alarm and danger conditions exist. Not applicable to vector alarms.	0 = Greater than 1 = Less than 2 = Inside range 3 = Outside range

Table C.28 Alarm Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
8	Get/Set	Alert Threshold (High)	REAL	The threshold value for the alert (alarm) condition (greater threshold for range types).	
9	Get/Set	Danger Threshold (High)	REAL	The threshold value for the danger (shutdown) condition (greater threshold for range types).	
10	Get/Set	Alert Threshold Low	REAL	The lesser threshold value for the alert (alarm) condition for the range condition types.	
11	Get/Set	Danger Threshold Low	REAL	The lesser threshold value for the danger (shutdown) condition for the range condition types.	
12	Get/Set	Hysteresis	REAL	The amount on the safe side of a threshold by which the value must recover to clear the alarm.	
13	Get/Set	Threshold (Setpoint Multiplier)	REAL	Indicates how the thresholds should be adjusted when the setpoint multiplication function is invoked.	0 = Disable alarm > 0 = Multiply the thresholds by the value
14	Get/Set	Startup Period	UINT	The amount of time that the Threshold (Setpoint) Multiplier is applied after the startup signal is received.	Seconds
15	Get/Set	Speed Range Enable	BOOL	Indicates whether this alarm is enabled only within a certain machine speed range.	0 = No speed range (alarm is always enabled) 1 = Speed range (alarm only enabled within speed range)
16	Get/Set	Speed Range High	REAL	Indicates the greater threshold of the machine speed range for which the alarm is enabled (disabled at greater speeds).	CPM (must be greater than **Speed Range Low**)

Table C.28 Alarm Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
17	Get/Set	Speed Range Low	REAL	Indicates the lesser threshold of the machine speed range for which the alarm is enabled (disabled at lesser speeds).	CPM (Must be less than **Speed Range High**)
18	Get/Set	Name	STRING2	A name to help identify this alarm.	
20	Get/Set	Inhibit Tach Fault	BOOL	Determines whether the Tach Fault status is prohibited during the startup period.	0 = Tach Fault allowed 1 = Tach Fault inhibited

Services

Table C.29 Alarm Object Services

Service Code	Class/Instance Usage	Name	Description
$0E_h$	Instance	Get_Attribute_Single	Returns a single attribute.
10_h	Instance	Set_Attribute_Single	Sets a single attribute.[1]

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

Channel Object (Class ID $31F_H$)

The Channel Object models "front-end" processing performed on an input signal before specific measurements are performed. This processing typically includes gain, filtering, and/or integration.

Class Attributes

The Channel Object provides no class attributes.

Instances

There are 2 instances of this object.

Table C.30 Channel Object Instances

Instance	Associated Channel
1	Shaft Relative Channel
2	Case Absolute Channel

Instance Attributes

Table C.31 Channel Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get/Set	Output Data Units[1]	ENGUNIT	The data units of the signal resulting from the signal processing performed in the channel.	See DeviceNet Specification Volume 1 Appendix K. Also see Parameter Object Instances 3 and 4. Valid values: Channel 1 (read only) mils = 0800 hex µm = 2204 hex Channel 2 in/sec = 2B07 hex mm/s = 0900 hex mils = 0800 hex µm = 2204 hex
4	Get	Integration Level of Integration	USINT	The level of integration to perform on the signal.	0 = None 1 = Single
5	Get/Set	Low Cutoff Frequency[2]	USINT	The effective high pass filter (low frequency corner) selection. **Note:** The instance 1 setting applies to both channels	1 = Low 2 = Medium 3 = High 4 = Very high
9	Get/Set	Name	STRING2	A name to help identify this channel.	

Table C.31 Channel Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
10	Get/Set	Full Scale	REAL	The maximum signal expected to be processed by the channel.	Volts peak Setting the Full Scale to a greater value allows the channel to handle greater input signals without saturating or clipping. Setting the Full Scale to a lesser value allows the signal to be measured with greater resolution.
100	Get	Very Low HPF Corner Frequency	REAL	The frequency, in Hz, of the "Very low" **Low Cutoff Frequency** option for attribute 5.	Hz
101	Get	Low HPF Corner Frequency	REAL	The frequency, in Hz, of the "Low" **Low Cutoff Frequency** option for attribute 5.	Hz
102	Get	Medium HPF Corner Frequency	REAL	The frequency, in Hz, of the "Medium" **Low Cutoff Frequency** (low frequency corner) option for attribute 5.	Hz
103	Get	High HPF Corner Frequency	REAL	The frequency, in Hz, of the "High" **Low Cutoff Frequency** option for attribute 5.	Hz
104	Get	Very High HPF Corner Frequency	REAL	The frequency, in Hz, of the "Very high" **Low Cutoff Frequency** option for attribute 5.	Hz

1 This attribute is read-only for instance 1. The instance 1 setting is based upon the instance 2 setting. If the Channel 2 Output Data Units are English, then the Channel 1 Output Data Units will be mils. If the Channel 2 Output Data Units are Metric, then the Channel 1 Output Data Units will be µm.

2 This attribute cannot be set for instance 2. The instance 2 setting matches the channel 1 setting.

Services

Table C.32 Channel Object Services

Service Code	Class/Instance Usage	Name	Description
$0E_h$	Instance	Get_Attribute_Single	Returns a single attribute.
10_h	Instance	Set_Attribute_Single	Sets a single attribute.[1]
$4B_h$	Instance	Auto_Range	Automatically determines the optimal analog hardware range and sets the **Full Scale** value accordingly.[1]

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

Auto_Range

The Auto_Range service calculates a new **Full Scale** value based upon the current input signal level. The caller can specify the maximum signal level that must be handled by the new hardware range in terms of a multiple of the current signal level. The Auto_Range service determines the new **Full Scale** value, sets the **Full Scale** attribute, and returns the new value in the response.

The XM-121 module must be in Run mode to perform the Auto_Range service. Otherwise the "Object State Conflict" (General Error code 0x0C) is returned. The "Busy" (object specific General Error code 0xD0) error response may be returned if the Auto_Range service cannot be completed successfully.

Table C.33 Auto_Range Request Parameters

Name	Data Type	Description of Request Parameters	Semantics of Values
Safety Factor	REAL	Specifies a multiple that, when applied to the current signal level, determines the maximum signal level that must be handled by the hardware.	Must be greater than or equal to 1.0.

Table C.34 Auto_Range Response Parameters

Name	Data Type	Description of Response Parameters	Semantics of Values
Full Scale	REAL	The new **Full Scale** value.	Specifies the maximum signal level expected to be processes by the channel. This value is used to determine the analog hardware range when the hardware supports programmable gain settings. Setting the Full Scale to a greater value allows the channel to handle greater input signals without saturating or clipping. Setting Full Scale to a lesser value allows the signal to be measured with greater resolution. The units of the Full Scale value is Volts peak.

Device Mode Object (Class ID 320_H)

The Device Mode Object is used to control access to the configuration parameters in the module. This object's Device Mode attribute must be in PROGRAM mode to allow the module's configuration parameters to be "Set" (see Services). Attempts to set the configuration parameters while the Device Mode is in RUN mode will return an error. Note that the module collects measurements while in RUN mode but not while it is in PROGRAM mode.

Class Attributes

The Device Mode Object provides no class attributes.

Instance Attributes

Table C.35 Device Mode Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get/Set	Device Mode	UINT	The operating mode of the module.	0 = Power Up 1 = RUN 2 = PROGRAM
199	Set	Backdoor Service	USINT	Setting this attribute is equivalent to requesting the specified service.	Set to one of the following values to perform the specified service: 0x05 = Reset 0x09 = Delete 0x15 = Restore 0x16 = Save

Setting the **Device Mode** attribute to "1" (RUN) is equivalent to executing the **Start** service. Setting the **Device Mode** attribute to "2" (PROGRAM) is equivalent to executing the **Stop** service.

Services

Table C.36 Device Mode Object Services

Service Code	Class/Instance Usage	Name	Description
$0E_h$	Instance	Get_Attribute_Single	Return the value of a single attribute.
10_h	Instance	Set_Attribute_Single	Set the value of a single attribute.
07_h	Instance	Stop	Transitions from Run to the Program state.
06_h	Instance	Start	Validate the device configuration settings and transition to the Run state if OK.
05_h	Instance	Reset	Transition to the Power Up state. Load the non-volatile configuration and transition to the Run state if saved configuration restored.
16_h	Instance	Save	Validate the device configuration settings if necessary and save them to non-volatile memory.
09_h	Instance	Delete	Delete the saved configuration from non-volatile memory.
15_h	Instance	Restore	Load the saved configuration or the factory default configuration from non-volatile memory.

Overall Measurement Object (Class ID 322_H)

The Overall Measurement Object models the measurement of the amplitude of a signal including a wide frequency range.

Class Attributes

The Overall Measurement Object provides no class attributes.

Instances

There are 3 instances of this object.

Table C.37 Overall Measurement Object Instances

Instance	Description
1	Channel 1 Shaft Relative Overall
2	Channel 2 Case Absolute Overall
3	Shaft Absolute Overall

Instance Attributes

Table C.38 Overall Measurement Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get	Overall Value	REAL	Measured value	The output value of the measurement performed by the Overall Measurement Object on the input signal. The result of the measurement process specified by **Measurement** is converted to the units specified by **Data Units** to produce the Overall Value.
4	Get	Status	BOOL	Indicates if a fault or alarm has occurred.	0 = Operating without alarms or faults. 1 = Alarm of fault condition exists. The **Overall Value** attribute may not represent the actual field value.
5	Get	Data Units	ENGUNIT	The units context of the **Overall Value** attribute.	This setting is determined by the Channel Object's **Output Data Units** attribute (see page 112).
6	Get/Set	Measurement[1]	USINT	The measurement (or calculation) performed to produce the **Overall Value**.	0 = RMS 1 = RMS peak 2 = RMS pk-to-pk 3 = Peak 4 = Peak-to-peak 5-255 Reserved

Table C.38 Overall Measurement Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
7	Get/Set	Time Constant[1]	REAL	The detection time constant associated with the output smoothing filter (for the RMS and DC meters) or the decay rate of the peak meters.	Must be greater than zero. For RMS type measurements, the Time Constant attribute specifies the 3-db bandwidth for the digital filtering used to calculate the **Overall Value**. The 3-db bandwidth is roughly equal to (1/Time Constant). The greater the value of the Time Constant, the longer the response of the measured **Overall Value** to change in the input signal. For Peak type measurements, the Time Constant value specifies the decay rate of the peak detection meter. The greater the Time Constant value, the slower the Peak is decayed.
8	Get/Set	Damping Factor[1]	REAL	The damping factor associated with output smoothing filter for the RMS and DC meters (not used with peak meters).	0.7072 to 1.0 The Damping Factor is used in conjunction with the **Time Constant** to vary the characteristics of the response of the filter used in calculating the **Overall Value**. An **Overall Value** for a measurement with Damping Factor near 1.0 will slowly rise or fall for the full settling time specified by the **Time Constant** before reaching the final value. An **Overall Value** for a measurement with a Damping Factor near 0.7072 will rise or fall quickly and may overshoot the final value before reaching the final value for a given input signal. The Damping Factor is only used in conjunction with **RMS** measurement types.
10	Get/Set	Low Pass Corner Frequency[2]	UINT	The corner frequency of the low pass filter. **Note:** The instance 1 setting applies to both channels.	200 to 20000 Hz

1 These attributes cannot be set for instance 3. The instance 3 settings match the channel 1 settings.

2 This attribute cannot be set for instances 2 or 3. The instance 2 and 3 settings match the channel 1 setting.

Services

Table C.39 Overall Measurement Object Services

Service Code	Class/Instance Usage	Name	Description
$0E_h$	Instance	Get_Attribute_Single	Returns a single attribute.
10_h	Instance	Set_Attribute_Single	Sets a single attribute.[1]

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

Relay Object (Class ID 323_H)

The Relay Object models a relay (actual or virtual). A relay can be activated or deactivated based on the status of one or more alarms.

Class Attributes

Table C.40 Relay Object Class Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
1	Get	Revision	USINT	Revision of the implemented object.	2 (indicates that **Delay** is a UINT in milliseconds instead of USINT in tenths of seconds)
3	Get	Number of Instances	UINT	Number of Instances in this class.	5
100	Set	Reset All	USINT	Setting this attribute is equivalent to executing the Class Reset service.	Reset All is an attribute that provides a way to perform a Class level Reset service via the Set_Attribute_Single service. Setting this attribute to any value is equivalent to performing the Class level Reset service. Reading the Reset All attribute always returns zero.

Instances

There are 5 instances of this object.

Instance Attributes

Table C.41 Relay Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get	Relay Status	BOOL	The current status of the relay.	0 = Off 1 = On
4	Get/Set	Relay Enable	BOOL	Indicates whether this relay object is enabled.	0 = Disabled 1 = Enabled
5	Get/Set	Latch Enable	BOOL	Indicates whether this relay latches (requires a reset command to deactivate).	0 = Nonlatching 1 = Latching
6	Get/Set	Failsafe Enable	BOOL	Indicates whether this relay is normally energized (activated during power loss).	0 = Non-failsafe (not normally energized) 1 = Failsafe (normally energized)
7	Get/Set	Delay	UINT	The time period that the voting logic must be true before the relay is activated.	milliseconds
8	Get/Set	Name	STRING2	A name to help identify the relay.	18 characters maximum
9	Get/Set	Alarm Level	BYTE	Specifies what alarm status values will cause the relay to activate.	0 = Normal 1 = Alert 2 = Danger 3 = Disarm 4 = Xdcr Fault 5 = Module Fault 6 = Tachometer Fault
10	Get/Set	Alarm Identifier A	EPATH	Identifies the first alarm status the relay monitors.	See Parameter Object instances 7 to 11.

Table C.41 Relay Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
11	Get/Set	Alarm Identifier B	EPATH	Identifies the second alarm status the relay monitors.	See Parameter Object instances 12 to 16.
12	Get/Set	Logic	USINT	Indicates the number of associated alarms that must have a status value specified by **Alarm Level** in order to activate the relay.	0 = Ignore **Alarm Identifier B** and activate the relay based on the status of **Alarm Identifier A**. 1 = Activate the relay if the status of either **Alarm Identifier A** or **B** matches any of the statuses specified by **Alarm Level**. 2 = Activate the relay if the status of both **Alarm Identifier A** and **B** match any of the statuses specified by **Alarm Level**.
14	Get	Relay Installed	BOOL	Indicates whether an actual relay is associated with this instance.	0 = Not installed 1 = Installed

Services

Table C.42 Relay Object Services

Service Code	Class/Instance Usage	Name	Description
05_h	Class/Instance	Reset	Resets latched relay.
$0E_h$	Class/Instance	Get_Attribute_Single	Returns a single attribute.
10_h	Class/Instance	Set_Attribute_Single	Sets a single attribute.[1]

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

Spectrum Waveform Measurement Object (Class ID 324_H)

The Spectrum/Waveform Measurement Object models a spectrum and waveform measurement.

Class Attributes

The Spectrum/Waveform Measurement Object provides no class attributes.

Instances

There are 2 instances of this object.

Table C.43 Spectrum Waveform Measurement Object Instances

Instance	Description
1	Channel 1 Shaft Relative Overall
2	Channel 2 Case Absolute Overall

Instance Attributes

Table C.44 Spectrum Waveform Measurement Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get	Status	BOOL	Indicates if a fault or alarm has occurred.	0 = Operating without alarms or faults. 1 = Alarm or fault condition exists. The Spectrum and Waveform data may not represent the actual field value.
4	Get	Data Units	ENGUNIT	The units context of the **Data** attributes.	See DeviceNet Specification Volume 1 Appendix K.
9	Get/Set	Period[1]	REAL	The period of the waveform.	0.02 to 80.0 seconds
10	Get	Number of Waveform Points[1]	UDINT	Number of points in the waveform data.	256, 512, 1024, or 2048
16	Get	Storage Timestamp	LTIME	Records the timestamp of the stored data.	64-bit microsecond counter value.

1 These attributes cannot be set for instance 2. The instance 2 settings match the channel 1 settings.

Services

Table C.45 Spectrum Waveform Measurement Object Services

Service Code	Class/Instance Usage	Name	Description
$0E_h$	Instance	Get_Attribute_Single	Returns a single attribute.

Table C.45 Spectrum Waveform Measurement Object Services

Service Code	Class/Instance Usage	Name	Description
10_h	Instance	Set_Attribute_Single	Sets a single attribute.[1]
$4C_h$	Instance	Get_Waveform_Chunk	Upload a portion of the current Waveform data.
$4E_h$	Instance	Get_Stored_Waveform_ Chunk	Upload a portion of the stored Waveform data.

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

Get_Stored_Waveform_Chunk

This service functions just like Get_Waveform_Chunk (described below) except it operates on the stored waveform data rather than the current waveform data. A waveform data set is stored in conjunction with the triggered trend's trigger event if the triggered trend is enabled.

Get_Waveform_Chunk

This service returns a portion of the waveform data structure. It is likely that the waveform data structure will be too large to transfer over the network in one message. This service allows the data structure to be transferred over the network in smaller portions so that the explicit message buffer does not need to be so large.

The Waveform Data structure contains an array of values that, taken together, are the output of the sampling performed by the Spectrum/Waveform

Measurement Object on the input signal. The Waveform Data array values are normalized and must be converted to floating point to obtain the true values.

Table C.46 Waveform Data Structure

Byte (DWORD) offset within structure	Structure Member	Data Type	Description
0 (0)	Number of Waveform Points	UDINT	Number of points in the waveform data. This should be equal to the **Number of Waveform Points** attribute setting. It is provided within this structure to assist in determining the size of the structure.
4 (1)	Period	REAL	The period of the waveform. This is the actual period of the waveform and may vary from the **Period** attribute setting.
8 (2)	Amplitude Reference	REAL	Normalization factor This factor is used to convert the normalized array data into floating point values.
12 (3)	Normalized Value Array	Array of INT	The normalized waveform data points These must be converted to floating point values using the Amplitude Reference value.

The total size of the Waveform Data structure in DWORDs is: 3 + (**Number of Waveform Points** / 2).

The Waveform Data is an array of INT (16-bit signed integers ranging from -32768 to 32767). The number of INTs in the Waveform Data array is equal to the **Number of Waveform Points**. To convert the normalized Waveform Data into floating point values, use the following equations:

$$\text{Float Data}_n = \text{Amplitude Reference} \frac{\text{Normalized Data}_n}{32768}$$

Where **Float Data$_n$** is the value for the nth waveform point, and $0 \leq n \leq$ **Number of Waveform Points**.

The Get_Waveform_Chunk service uses the following request and response parameters.

Table C.47 Get_Waveform_Chunk Request Parameters

Name	Data Type	Description of Request Parameters	Semantics of Values
Initial DWORD Offset	UINT	The offset of the first 32-bit value within the data structure to be returned.	0 <= offset < size of the data structure in DWORDs. For example: offset = 0 refers to bytes 0-3 (the number of lines or points value) offset = 1 refers to bytes 4-7 (the FMAX or period values) offset = 2 refers to bytes 8-11 (the amplitude reference value) offset = 3 refers to bytes 12-15 (the first pair of normalized values) offset = 4 refers to bytes 16-19 (the second pair of normalized values) ....
Number of DWORDs	USINT	The number of 32-bit values from the data structure to be returned.	This should be small enough to fit in the explicit message buffer. This will likely be less than the total size of the data structure so that several calls to the service will be required to get the entire data structure.

Table C.48 Get_Waveform_Chunk Response Parameters

Name	Data Type	Description of Response Parameters	Semantics of Values
Number of DWORDs	USINT	The number of 32-bit values actually returned in the Data Chunk array of the response. (Can be less than the number of DWORDs requested.)	If less DWORDs are returned than were requested, the end of the data structure has been reached (the request went beyond the end of the array).
Data Chunk	Array of DWORD	The requested portion of the data structure.	

Speed Measurement Object (Class ID 325_H)

The Speed Measurement Object models a speed measurement of a tachometer signal.

Class Attributes

The Speed Measurement Object provides no class attributes.

Instance Attributes

Table C.49 Speed Measurement Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get	Speed Value	REAL	The measured speed value.	CPM
4	Get	Status	BOOL	Indicates if a fault or alarm has occurred.	0 = Operating without alarms or faults. 1 = Alarm or fault condition exists. The **Speed Value** attribute may not represent the actual field value.
5	Get	Maximum Speed	REAL	The maximum (peak) measured speed value (positive or negative) since the most recent reset.	CPM
12	Get/Set	Time Constant	UINT	The time constant value used for exponential averaging of the **Speed Value** (a low pass filter/output smoothing filter).	Milliseconds

Services

Table C.50 Speed Measurement Object Services

Service Code	Class/Instance Usage	Name	Description
05_h	Instance	Reset	Clears Maximum (Peak) speed to 0.
$0E_h$	Instance	Get_Attribute_Single	Returns a single attribute.
10_h	Instance	Set_Attribute_Single	Sets a single attribute.[1]

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

Tachometer Channel Object (Class ID 326_H)

The Tachometer Channel Object models "front end" processing performed on a tachometer signal before specific measurements are performed.

Class Attributes

The Tachometer Channel Object provides no class attributes.

Instance Attributes

Table C.51 Tachometer Channel Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get/Set	Number of Pulses per Revolution	UINT	The number of signal pulses per revolution of the shaft (number of gear teeth).	0 = Tachometer disabled > 0 = Tachometer enabled
4	Get/Set	Auto Trigger	BOOL	Indicates whether the trigger level is determined automatically from the signal.	0 = Use specified **Trigger Level** and **Hysteresis** 1 = Determine trigger level and hysteresis automatically
5	Get/Set	Trigger Level	REAL	The signal level to be used as the trigger.	Volts
6	Get/Set	Trigger Slope	USINT	The slope of the signal at the threshold crossing to be used as the trigger.	0 = Positive 1 = Negative
7	Get/Set	Trigger Hysteresis	REAL	The amount of hysteresis around the trigger level.	In **Auto Trigger** mode, this value is a percentage of the peak-to-peak input signal and can range from 0 to 50%. In **Manual Trigger** mode, this value is a voltage level (the hysteresis voltage is added or subtracted to the threshold voltage to determine the hysteresis range).
8	Get/Set	Name	STRING2	A name to help identify this channel.	18 characters maximum
9	Get/Set	Multiplier	REAL	A multiplier applied to the tachometer pulse rate.	> 0
10	Get/Set	Fault Time-out	USINT	Number of seconds with no pulses before a Tach Fault is indicated.	1 to 64 seconds

Services

Table C.52 Tachometer Channel Object Services

Service Code	Class/Instance Usage	Name	Description
$0E_h$	Instance	Get_Attribute_Single	Returns a single attribute.
10_h	Instance	Set_Attribute_Single	Sets a single attribute.[1]

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

Transducer Object (Class ID 328_H)

The Transducer Object models a transducer.

Class Attributes

The Transducer Object provides no class attributes.

Instances

There are 3 instances of this object.

Table C.53 Transducer Object Instances

Instance	Description
1	Channel 1 Shaft Relative Transducer
2	Channel 2 Case Absolute Transducer
3	Tachometer Transducer

Instance Attributes

Table C.54 Transducer Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get	DC Bias	REAL	The measured average DC bias of the transducer signal in volts.	Volts
4	Get	Status	BOOL	Indicates whether a transducer fault exists (the measured **DC Bias** is outside the range specified by **Fault High** and **Low**).	0 = No fault 1 = A transducer fault exists
5	Get/Set	Sensitivity Value	REAL	Value of the sensitivity of the transducer in millivolts per **Sensitivity Units**.	
6	Get/Set	Sensitivity Units	ENGUNIT	Units of the denominator of the **Sensitivity Value**.	See DeviceNet Specification Volume 1 Appendix K. Valid values: Channel 1 mils = 0800 hex µm = 2204 hex Channel 2 g =1504 hex in/sec = 2B07 hex mils = 0800 hex mm/s = 0900 hex Channel 3 Not applicable
7	Get/Set	Fault High	REAL	The maximum expected DC Bias voltage from the transducer in volts.	Volts
8	Get/Set	Fault Low	REAL	The minimum expected DC Bias voltage from the transducer in volts.	Volts
9	Get/Set	Power Type	USINT	Indicates the type of power supplied to the transducer.	0 = No power supplied 1 = Constant current (IEPE accelerometer)
13	Get/Set	DC Bias Time Constant	REAL	The time constant value used for exponential averaging of the **DC Bias** value (a low pass filter/output smoothing filter).	Seconds

Services

Table C.55 Transducer Object Services

Service Code	Class/Instance Usage	Name	Description
$0E_h$	Instance	Get_Attribute_Single	Returns a single attribute.
10_h	Instance	Set_Attribute_Single	Sets a single attribute.[1]

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

Vector Measurement Object (Class ID 329_H)

The Vector Measurement Object models the measurement of the amplitude and phase of the input signal at a specific multiple of the machine speed.

Class Attributes

The Vector Measurement Object provides no class attributes.

Instances

There are 3 instances of this object.

Table C.56 Vector Measurement Object Instances

Instance	Description
1	Channel 1 Shaft Relative 1X Vector Measurement
2	Channel 2 Case Absolute 1X Vector Measurement
3	Shaft Absolute 1X Vector Measurement

Instance Attributes

Table C.57 Vector Measurement Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get	Magnitude Value	REAL	The measured magnitude value.	
4	Get	Phase Value	REAL	The measured phase value.	Degrees
5	Get	Status	BOOL	Indicates if a fault or alarm has occurred.	0 = Operating without alarms of faults. 1 = Alarm or fault condition exists. The **Value** attributes may not represent the actual field value.
6	Get	Magnitude Data Units	ENGUNIT	The units context of the **Magnitude Value** attribute.	This setting is determined by the Channel Object's **Output Data Units** setting (see page 112).
7	Get	Speed Value	REAL	The speed at which the magnitude and phase are measured.	Set to 1
8	Get	Speed Data Units	ENGUNIT	The units context of the **Speed Value** attribute.	See DeviceNet Specification Volume 1 Appendix K. This is set to Orders (0x0B00).
9	Get/Set	Filter Type[1]	USINT	The type of tracking filter. (The instance 1 setting applies to both channels.)	0 = Constant bandwidth 1 = Constant Q
10	Get/Set	Bandwidth[1]	REAL	The bandwidth of the tracking filter. (The instance 1 setting applies to both channels.)	
11	Get/Set	Q[1]	REAL	The Q of the tracking filter. (The instance 1 setting applies to both channels.)	

1 These attributes cannot be set for instances 2 or 3. The instance 2 and 3 settings match the channel 1 settings.

Services

Table C.58 Vector Measurement Object Services

Service Code	Class/Instance Usage	Name	Description
$0E_h$	Instance	Get_Attribute_Single	Returns a single attribute.
10_h	Instance	Set_Attribute_Single	Sets a single attribute.[1]

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

4-20 mA Output Object (Class ID $32A_H$)

The 4-20 mA Output Object models the configuration of a 4-20 mA output signal.

Class Attributes

The 4-20 mA Output Object provides no class attributes.

Instances

There are 2 instances of this object.

Instance Attributes

Table C.59 4-20 mA Output Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get/Set	Value	REAL	The current output value.	mA
4	Get/Set	Enable	BOOL	Indicates whether this 4-20 mA output is enabled.	0 = Disabled 1 = Enabled

Table C.59 4-20 mA Output Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
5	Get/Set	Max Range	REAL	The measured value associated with 20 mA.	
6	Get/Set	Min Range	REAL	The measured value associated with 4 mA.	
7	Get/Set	Measurement Identifier Path	EPATH	Identifies the class, instance, and attribute of a measurement value that this 4-20 mA output is tracking.	See Parameter Object Instances 5 and 6. See DeviceNet Specification Volume 1 Appendix I.

Services

Table C.60 4-20 mA Output Object Services

Service Code	Class/Instance Usage	Name	Description
$0E_h$	Instance	Get_Attribute_Single	Returns a single attribute.
10_h	Instance	Set_Attribute_Single	Sets a single attribute.[1]

1 Attributes can only be set while the device is in Program Mode. See the description of the Device Mode Object for more information.

Guidelines for Setting the Full Scale Value

Appendix D provides tables to help you determine the optimal value to use for the **Full Scale** setting in the XM-121 Absolute Shaft module. The signal conditioning circuitry in the module adjusts its dynamic range based upon the value entered in this setting. The full scale value is a voltage level that is dependent upon your monitoring application and other XM configuration settings.

In order to use these tables and to properly select the Full Scale value, you need to know the following information.

- **Maximum Vibration Level** - This is the maximum instantaneous peak vibration level that can be expected at the sensor location (under any monitoring condition) in the units of vibration that will be used for monitoring. For example, if monitoring will be done in velocity then you must know the maximum vibration in ips or mm/s that can exist at the machine.

- **High Pass Filter (HPF) Setting** - In applications that require integration of the native units, the high pass filter setting impacts the full scale signal range. For example, an application that uses an accelerometer whose native units is g's, and is integrated to provide a velocity output in ips or mm/s, requires you to know what high pass filter setting is used in order to best select the Full Scale value.

- **Maximum High Frequency Peak Amplitude (in g's)** - This variable must be considered in applications where an acceleration input is integrated to velocity (ips, mm/s) or displacement (mils, μm) and where high frequency (>5 kHz) acceleration signals are likely present. Such signals are most common in machinery such as gear sets and any machine that is fitted with rolling element bearings. This variable can be measured with a portable instrument or it can be measured using the XM module and associated configuration tool.

TIP Refer to Channel Parameters on page 46 for more information on the Full Scale parameter.

XM-121 Absolute Shaft Full Scale Tables

Use the following tables to help you determine the optimal Full Scale value for the XM-121 Absolute Shaft module. Refer to the table that corresponds to the units of vibration that will be used for monitoring.

Table D.1 XM-121A Measuring Case Absolute with Accelerometer (100 mV/g)

Maximum Vibration Level		Full Scale Setting				Max High Frequency Peak Amplitude
mils pp	micrometers pp	0.8Hz HPF	2Hz HPF	4Hz HPF	23.8Hz HPF	(g pk)
5	125	0.0013	0.003	0.006	0.036	4
10	250	0.0026	0.006	0.012	0.072	4
20	500	0.007	0.02	0.04	0.24	4
50	12500	0.014	0.04	0.08	0.4	12

At frequencies above 60 Hz, the maximum vibration level allowed is reduced. Use the following formula to determine the maximum vibration level.

Max Vibration Level (mils pp) = Max High Freq Peak Amplitude (g) × 19530 / freq^2

Table D.2 XM-121A Measuring Case Absolute with Velocimeter (100 mV/ips)

Maximum Vibration Level		Full Scale Setting			
mils pp	micrometers pp	0.8Hz HPF	2Hz HPF	4Hz HPF	23.8Hz HPF
5	125	0.1			
10	250	0.2			
20	500	0.3			
50	12500	1			

Table D.3 XM-121A Measuring Shaft Relative with Displacement Sensor (200 mV/mil)

Maximum Vibration Level		Full Scale Setting			
mils pp	micrometers pp	0.8Hz HPF	2Hz HPF	4Hz HPF	23.8Hz HPF
5	125	1			
10	250	2.5			
15	375	4			
20	500	5			
50	12500	10			

Example on Using Table

The following example shows you how to use the Full Scale table to determine the optimal Full Scale value.

EXAMPLE

Application: XM-121 Absolute Shaft module with 100 mV/g accelerometer

Units used for monitoring: case absolute, ips or mils

High pass filter: 4 Hz

Maximum vibration level: 8 mils pp

To determine the optimal Full Scale value, follow these steps.

1. Refer to Table D.1 XM-121A Measuring Case Absolute with Accelerometer (100 mV/g) on page 136.

2. Under the Maximum Vibration Level column, select the row that corresponds to 10 mils.

   TIP Since the maximum vibration level of 8 mils is greater than 5 mils, it is necessary to refer to the next higher level in the table, which in this case is 10 mils.

3. Under the 4 Hz High Pass Filter (HPF) column, find the recommended **Full Scale Setting**. The recommended Full Scale Setting for the 4 Hz High Pass Filter is 0.012.

4. Refer to the value under the Max High Frequency Peak Amplitude column to verify that there are not any signals present at the sensor that exceed this value. For the example above, the Max High Frequency Peak Amplitude value is 4 g's.

   If there are signals in excess of this level then increase the Full Scale value to the next higher Max High Frequency Peak Amplitude value, 0.08 in this example. If there are no extraneous signals that exceed this value then proceed with setting the Full Scale at the selected value, 0.012 in this example.

IMPORTANT Step 4 is necessary only in applications where an acceleration input is integrated to velocity (ips, mm/s) or displacement (mils, μm) and where high frequency (>5 kHz) acceleration signals are likely present.

alarm

An alarm alerts you to a change in a measurement. For example, an alarm can notify you when the measured vibration level for a machine exceeds a pre-defined value.

Automatic Device Replacement (ADR)

A means for replacing a malfunctioning device with a new unit, and having the device configuration data set automatically. The ADR scanner uploads and stores a device's configuration. Upon replacing a malfunctioning device with a new unit (MAC ID 63), the ADR scanner automatically downloads the configuration data and sets the MAC ID (node address).

band

A frequency range, such as the frequency range between 1,800 and 3,200 Hz.

baud rate

The baud rate is the speed at which data is transferred on the DeviceNet network. The available data rates depend on the type of cable and total cable length used on the network:

	Maximum Cable Length		
Cable	**125 K**	**250 K**	**500 K**
Thick Trunk Line	500 m (1,640 ft.)	250 m (820 ft.)	100 m (328 ft.)
Thin Trunk Line	100 m (328 ft.)	100 m (328 ft.)	100 m (328 ft.)
Maximum Drop Length	6 m (20 ft.)	6 m (20 ft.)	6 m (20 ft.)
Cumulative Drop Length	156 m (512 ft.)	78 m (256 ft.)	39 m (128 ft.)

The XM measurement modules' baud rate is automatically set by the bus master. You must set the XM-440 Master Relay module's baud rate. You set the XM-440 to 125 kb, 250 kb, 500 kb, or Autobaud if another device on the network has set the baud rate.

Bit-Strobe

A multicast transfer of data sent by a master device to all the XM slaves on the network. The bit-strobe command message contains a bit string of 64 bits (8 bytes) of output data, one output bit per node address on the network.

bus off

A bus off condition occurs when an abnormal rate of errors is detected on the Control Area Network (CAN) bus in a device. The bus-off device cannot receive or transmit messages on the network. This condition is often caused by corruption of the network data signals due to noise or baud rate mismatch.

Change of State (COS)

DeviceNet communications method in which the XM module sends data based on detection of any changed value within the input data (alarm or relay status).

current configuration

The current configuration is the most recently loaded set of configuration parameters in the XM module's memory. When power is cycled, the current configuration is loaded with either the saved configuration (in EEPROM) or the factory defaults (if there is no saved configuration). In addition, the current configuration contains any configuration changes that have been downloaded to the module since power was applied.

DeviceNet network

A DeviceNet network uses a producer/consumer Controller Area Network (CAN) to connect devices (for example, XM modules). A DeviceNet network can support a maximum of 64 devices. Each device is assigned a unique node address (MAC ID) and transmits data on the network at the same baud rate.

A cable is used to connect devices on the network. It contains both the signal and power wires. General information about DeviceNet and the DeviceNet specification are maintained by the Open DeviceNet Vendor's Association (ODVA). ODVA is online at http://www.odva.org.

disarm state

See Program mode.

EEPROM

See NVS (Non-Volatile Storage).

Electronic Data Sheet (EDS) Files

EDS files are simple text files that are used by network configuration tools such as RSNetWorx for DeviceNet to describe products so that you can easily commission them on a network. EDS files describe a product device type, revision, and configurable parameters.

Help window

A window that contains help topics that describe the operation of a program. These topics may include:

- An explanation of a command.
- A description of the controls in a dialog box or property page.
- Instructions for a task.
- Definition of a term.

high pass filter

A filter that excludes all frequencies below a defined frequency. It allows, or passes, frequencies above the defined frequency. It is useful for removing low frequency signal components that would dominate the signal.

low pass filter

A low pass filter excludes frequencies above a defined frequency. It allows, or passes, frequencies below the defined frequency. It is useful as an anti-aliasing filter.

MAC ID

See node address.

master device

A device which controls one or more slave devices. The XM-440 Master Relay module is a master device.

node address

A DeviceNet network can have as many as 64 devices connected to it. Each device on the network must have a unique node address between 0 and 63. Node address 63 is the default used by uncommissioned devices. Node address is sometimes called "MAC ID."

NVS (Non-Volatile Storage)

NVS is the permanent memory of an XM module. Modules store parameters and other information in NVS so that they are not lost when the module loses power (unless Auto Save is disabled). NVS is sometimes called "EEPROM."

online help

Online help allows you to get help for your program on the computer screen by pressing **F1.** The help that appears in the Help window is context sensitive, which means that the help is related to what you are currently doing in the program.

orders

Multiples of the operating speed of a piece of equipment. The first order is the operating speed. The second order is two times the operating speed, and so on.

Polled

DeviceNet communications method in which module sends data in response to a poll request from a master device.

Program mode

The XM module is idle. Typically this occurs when the module configuration settings are being updated with the XM Configuration program. In Program mode, the signal processing/measurement process is stopped. The status of the alarms is set to the disarm state to prevent a false alert or danger status.

Run mode

In Run mode, the module collects measurement data and monitors each measurement device.

settling time

The amount of time it takes a measurement to reach 90% of the final value given a step change in the input signal.

Shaft Absolute

Shaft Absolute is the measurement of the shaft's motion relative to free space (its absolute motion). Shaft Absolute can be measured two ways. The first method, which is used by the XM-121A, is to electronically sum the signals of both a eddy current probe measuring shaft vibration relative to the case, and an acceleration or velocity sensor mounted on the casing measuring case absolute vibration. The second method is to use a shaft rider, which is a spring mounted device that physically rides on the surface of the shaft, normally a velocity sensor mounted on top of the shaft rider.

signal detection

Defines the method of conditioning or measuring a dynamic input signal. Peak (0 to the peak voltage), Peak-Peak (minimum peak to maximum peak), and

RMS (square root of the mean of the square of the values) are the most common methods of signal detection.

slave device

A device that receives and responds to messages from a Master device but does not initiate communication. Slave devices include the XM measurement modules, such as the XM-120 Dynamic Measurement module and the XM-320 Position module.

startup/coast-down trend

A speed-base trend that is collected in an XM module during the startup or coast-down of a machine when the measured machine speed crosses into a defined speed range.

Strobe

See Bit-Strobe.

transducer

A transducer is a device for making measurements. These include accelerometers, velocity pickups, displacement probes, and temperature sensors.

trend

A set of records of one or more measurement parameter(s) collected at regular intervals based on time or speed.

trigger

An event that prompts the collection of trend data.

triggered trend

A time-based trend that is collected in an XM module when a relay on the XM module is activated, or when the module receives a trigger event.

virtual relay

A virtual relay is a non-physical relay. It has the same capabilities (monitor alarms, activation delay, change status) as a physical relay only without any physical or electrical output. The virtual relay provides additional relay status inputs to a controller, PLC, or an XM-440 Master Relay module (firmware revision 5.0 and later).

XM configuration

XM configuration is a collection of user-defined parameters for XM modules.

XM Serial Configuration Utility software

XM Serial Configuration Utility software is a tool for monitoring and configuring XM modules. It can be run on computers running Windows 2000 service pack 2, Windows NT 4.0 service pack 6, or Windows XP operating systems.

Numerics

A

B

C

D

T

V

W

X

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Rockwell Automation provides technical information on the Web to assist you in using its products. At http://support.rockwellautomation.com, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

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