XM-220 Dual Speed Module

User Guide
Firmware Revision 5

1440-SPD02-01RB

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.

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

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Introduction

This chapter provides an overview of the XM-220 Dual Speed module. It also discusses the components of the module.

Introducing the XM-220 Module

The XM-220 Dual Speed module is a member 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.

The XM-220 is a two channel module that accepts input from any two tachometers of any standard type including eddy current probes, magnetic pickups, optical tachometers, and TTL output devices. It measures speed, rotor acceleration, and peak speed and is capable of detecting zero speed, locked rotor, and reverse rotation conditions. It is also used as a component of the XM Electronic Overspeed Detection system.

The XM-220 can be configured (using the configuration software) to operate in three different modes. This controls how the sensors are used to calculate the speed, acceleration, and peak measurements.

- Dual Channel Mode - This is the default mode. The two sensors are used independently to perform two separate sets of speed, acceleration, and peak speed measurements.
- Single Redundant Channel Mode- One of the two sensors is used perform the speed, acceleration, and peak speed measurements. The module automatically switches to the other (redundant) sensor when a transducer or tachometer fault is detected on the current sensor.
- Reverse Rotation Mode - The two sensors are used to monitor speed and direction of a single shaft. The two sensors must be mounted out of phase from each other so that the rotational direction can be determined by monitoring which sensor the shaft keyway passes first. Refer to Sensor Placement for Reverse Rotation on page 35.

The module includes a single on-board relay (expandable to five), two 4-20mA outputs, and a buffered output for each input. A third buffered output is available when the module is functioning in the single redundant channel mode. This buffered output signal corresponds to the active input signal so that the machine speed can be accurately tracked regardless of which of the redundant sensors is active.

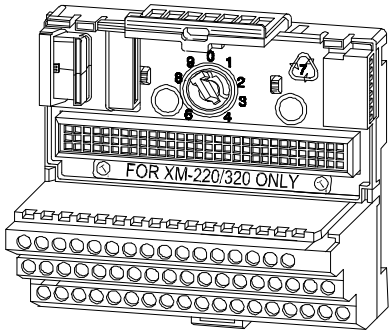
The XM-220 can operate stand-alone, or it can be deployed on a standard or dedicated DeviceNet network where it can provide real-time data and status information to other XM modules, PLCs, distributed control systems (DCS), and Condition Monitoring Systems.

The 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.

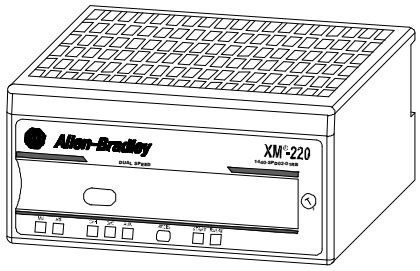
XM-220 Module Components

The XM-220 module consists of a terminal base and an instrument module. The XM-220 Dual Speed module and the XM-941 Position/Speed Terminal Base are shown below.

Figure 1.1 XM-220 Module Components



XM-941 Speed/Position Module
Terminal Base Unit
Cat. No. 1440-TB-B



XM-220 Dual Speed Module
Cat. No. 1440-SPD02-01RB

- XM-941 Position/Speed Module Terminal Base - A DIN rail mounted base unit that provides terminations for all field wiring required by Position and Speed modules, including the XM-220.

- XM-220 Dual Speed Module - Mounts on the XM-941 terminal base unit via a keyswitch and a 96-pin connector. The XM-220 contains the measurement electronics, processor, relay, and serial interface port for local configuration.

IMPORTANT The XM-441 Expansion Relay module may be connected to the XM-220 module via the XM-941 terminal base unit.

When connected to the XM-220, the Expansion Relay module simply "expands" the capability of the XM-220 by adding four additional epoxy-sealed relays. The XM-220 controls the Expansion Relay module by extending to it the same logic and functional controls as the XM-220 module's on-board relay.

Using this Manual

This manual introduces you to the XM-220 Dual Speed module. It is intended for anyone who installs, configures, or uses the XM-220 Dual Speed 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-220 module.

Chapter 2 "Installing the XM-220 Dual Speed Module" describes how to install, wire, and use the XM-220 module.

Chapter 3 "Configuration Parameters" provides a complete listing and description of the XM-220 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 XM-220 module.

Appendix B "DeviceNet Information" provides information to help you configure the XM-220 over a DeviceNet network.

Appendix C "DeviceNet Objects" provides information on the DeviceNet objects supported by the XM-220 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-220 module is referred to as XM-220, Speed 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 XM-220 Dual Speed Module

This chapter discusses how to install and wire the XM-220 Dual Speed module. It also describes the module indicators and the basic operation of the module.

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, and instructions 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 300V
- 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

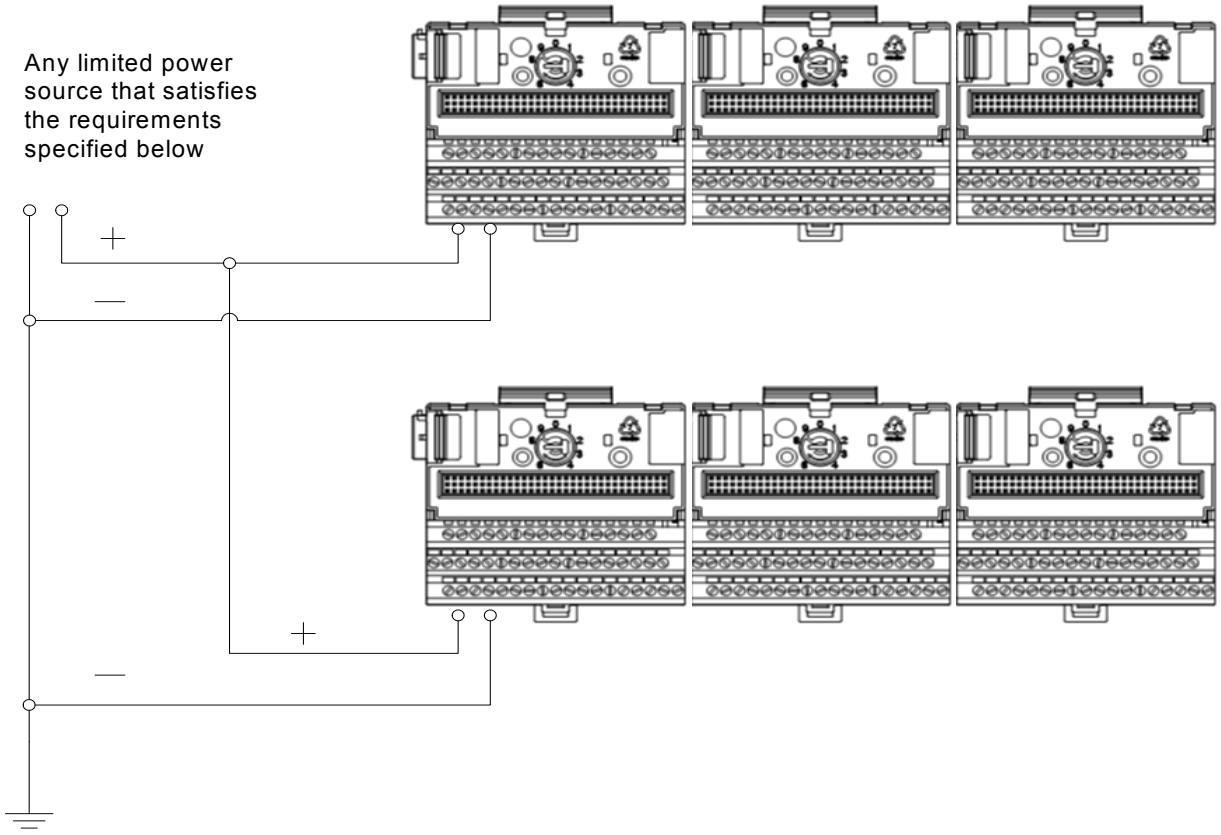
Before installing your module, calculate the power requirements of all modules interconnected via their side connectors. The total current draw through the side connector cannot exceed 3A. Refer to the specifications for the specific modules for power requirements.

ATTENTION

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

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

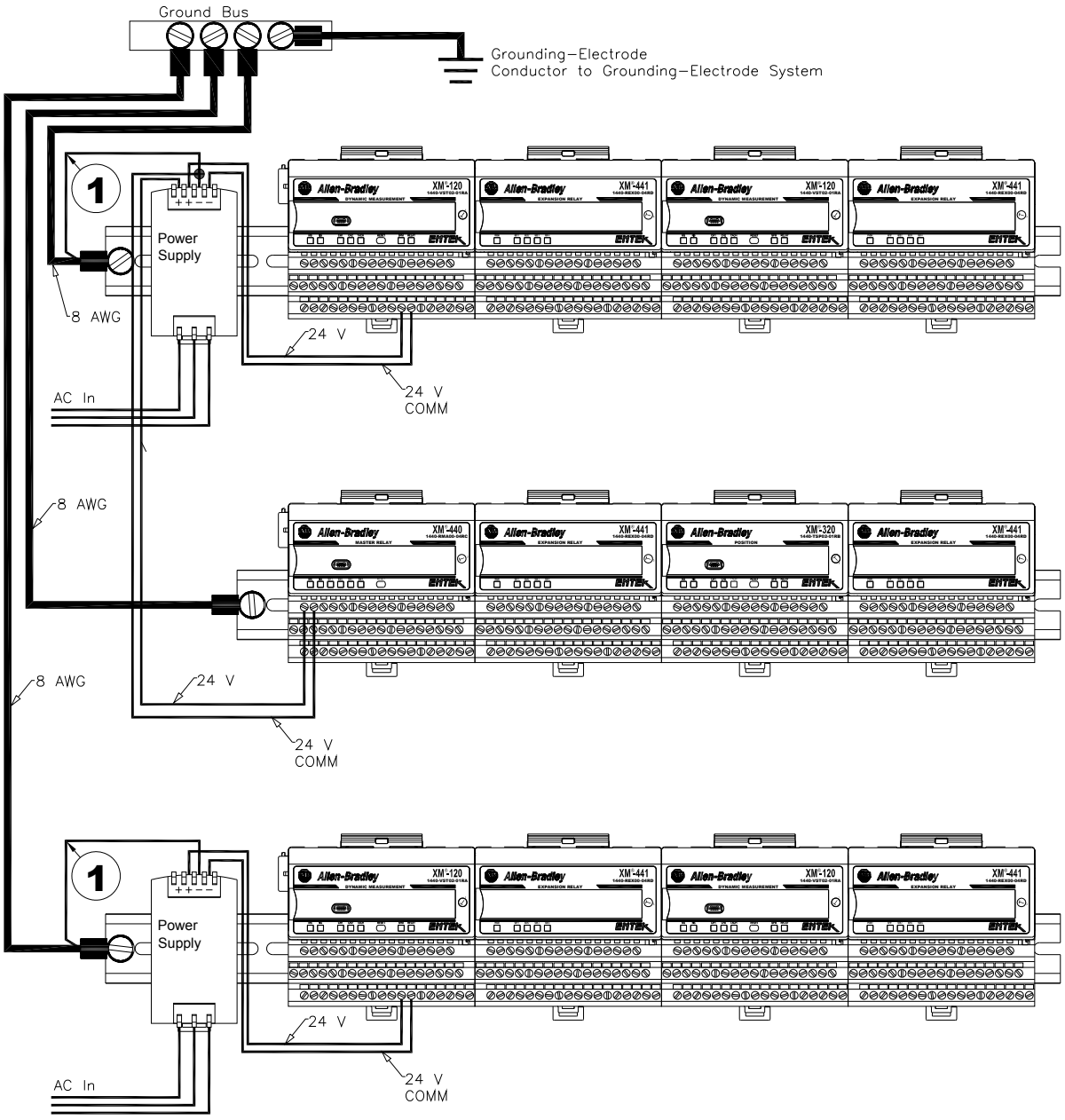
Use these grounding requirements to ensure safe electrical operating circumstances, and to help avoid potential emi and ground noise that can cause unfavorable operating conditions for your XM system.

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.

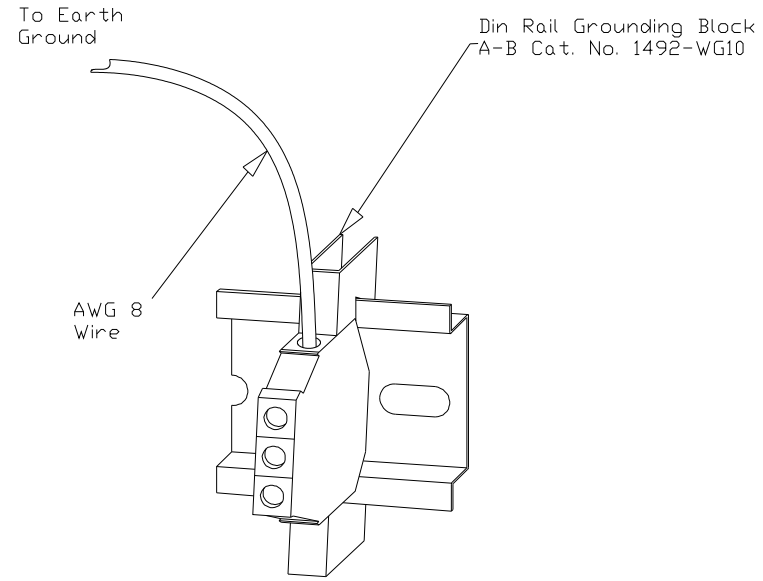
Figure 2.2 XM System DIN Rail Grounding



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

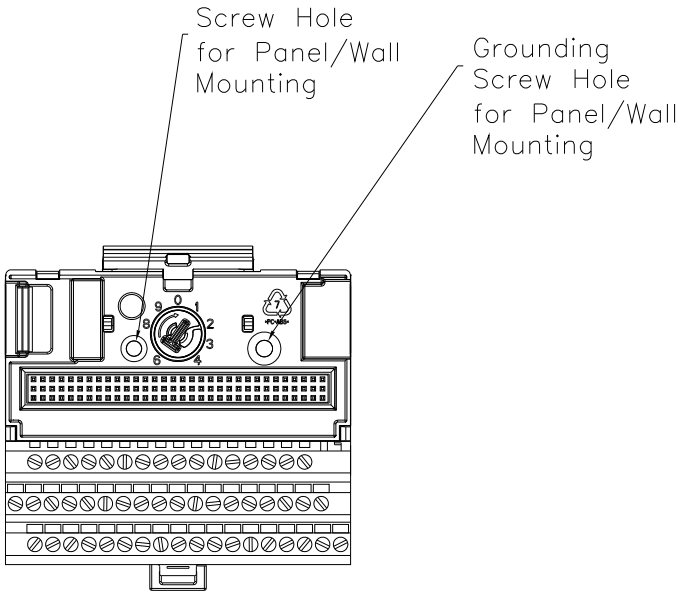
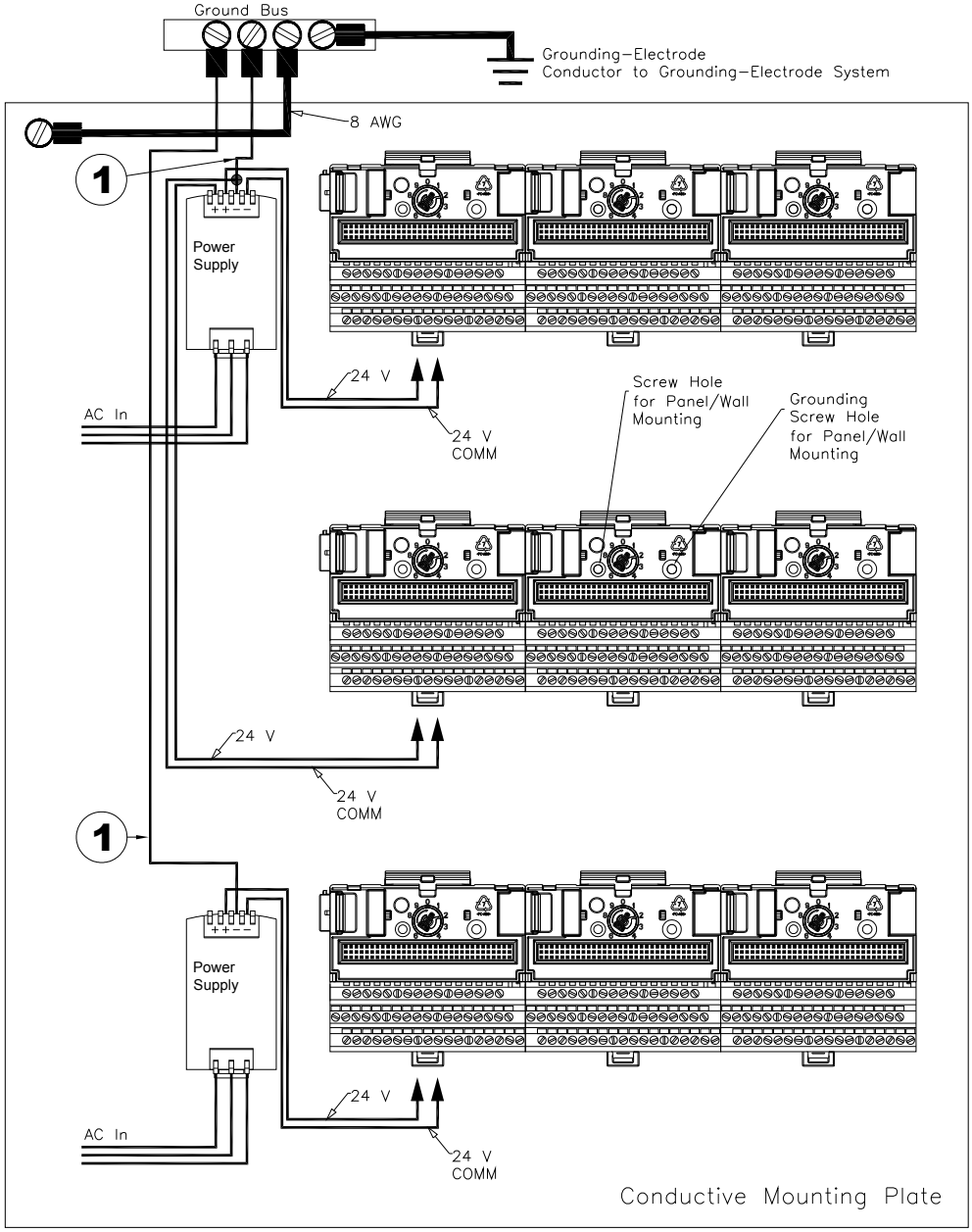


Figure 2.5 Panel/Wall Mount Grounding



1 Use 14 AWG wire.

24V Common Grounding

24V power to the XM modules Must be grounded. When two or more power supplies power the XM system, ground the 24V 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 24V 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.

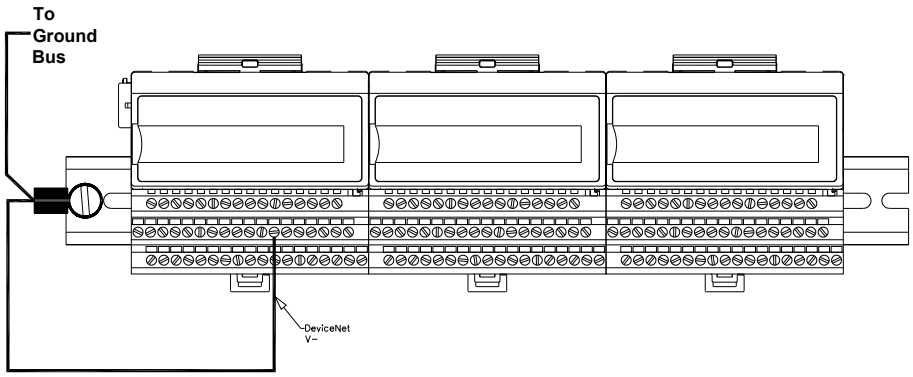
Transducer Grounding

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 measurement modules. The XM-941 terminal base, Cat. No. 1440-TB-B, is the only terminal base unit used with the XM-220.

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

ATTENTION

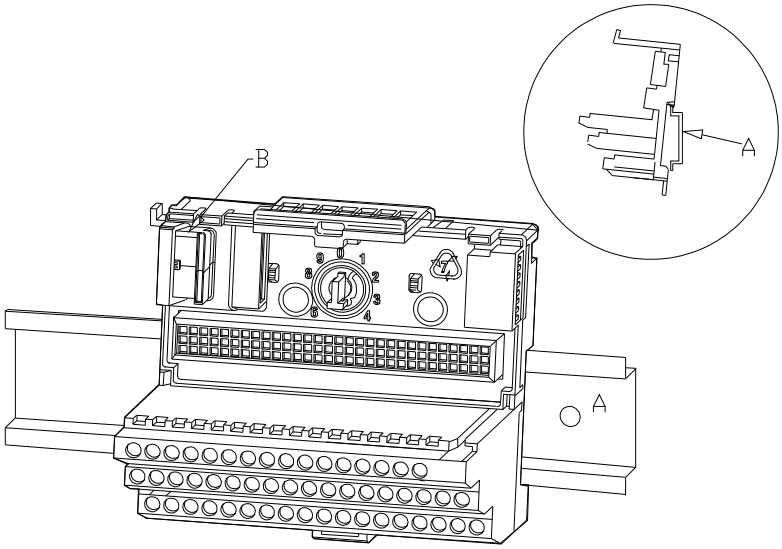
The XM modules make a chassis ground connection through the DIN rail. Use zinc plated, yellow chromated steel DIN rail to assure proper grounding. Using other DIN rail materials (e.g. aluminum, plastic, etc.), which can corrode, oxidize or are poor conductors can result in improper or intermittent platform 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 steps below to mount the XM-941 terminal base unit on a DIN rail (A-B pt no. 199-DR1 or 199-DR4).

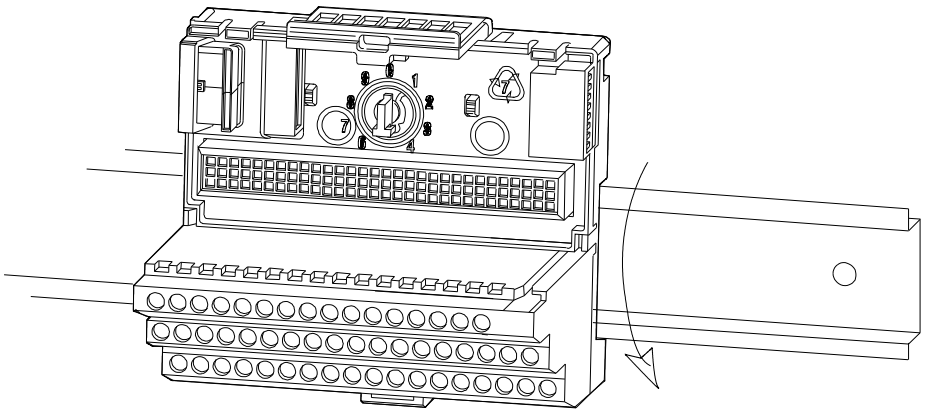
1. Position the terminal base on the 35 x 7.5mm DIN rail (A).



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.

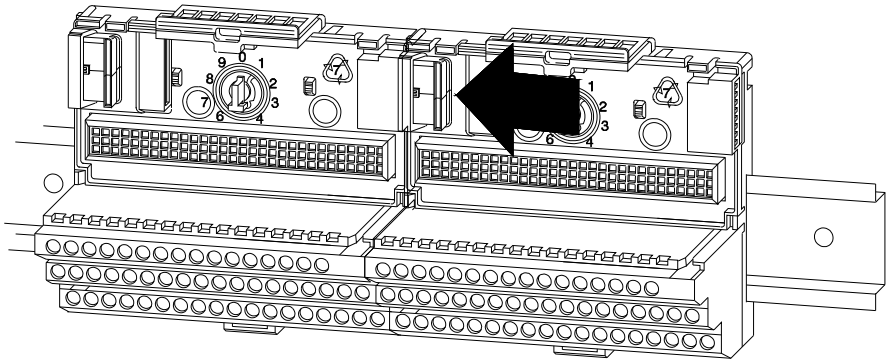
Interconnecting Terminal Base Units

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 7.5mm 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 unit to complete the backplane connection.



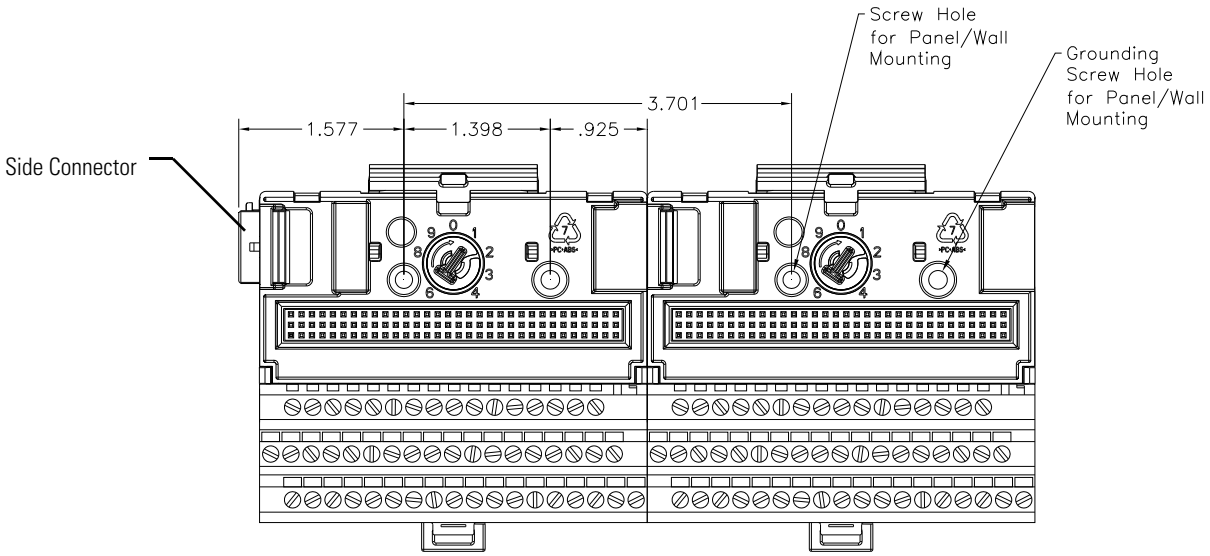
Panel/Wall Mounting

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.

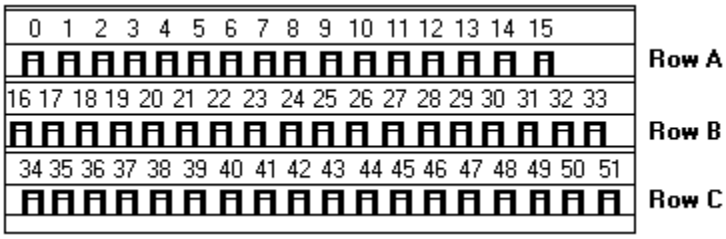


2. Drill the necessary holes for the #6 self-tapping mounting screws.
3. Secure the terminal base unit using two #6 self-tapping screws.
4. To install another terminal base unit, retract the side connector into the base unit. Make sure it is **fully retracted**.
5. Position the terminal base unit up 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-220 is compatible only with the XM-941 terminal base unit, Cat. No. 1440-TB-B.

Figure 2.7 XM-941 Terminal Base Unit



XM-941, Cat. No. 1440-TB-B

Terminal Block Assignments

The terminal block assignments and descriptions for the XM-220 module are shown below.

ATTENTION

The terminal block assignments are different for different XM modules. The following table applies only to the XM-220. Refer to the installation instructions for the specific XM module for its terminal assignments.

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 (+)	Transducer 1 connection
1	Xducer 2 (+)	Transducer 2 connection
2	Buffer 1 (+)	Signal 1 buffered output
3	Buffer 2 (+)	Signal 2 buffered output
4	Switched Buffer (+)	Switched buffered output for use with redundant mode
5	Buffer Power 1 IN	Channel 1 buffer power input Connect to terminal 6 for positive biased transducers or terminal 21 for negative biased transducers

Terminal Block Assignments

No.	Name	Description
6	Positive Buffer Bias	Provides positive (-5V to +24V) voltage compliance to buffered outputs Connect to terminals 5 (CH 1) and 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	4-20mA 1 (+)	4-20mA output 300 ohm maximum load
12	4-20mA 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]	Transducer 1 connection
17	Xducer 2 (-)[1]	Transducer 2 connection
18	Buffer Common[1]	Buffered output return
19	Overspeed/Circuit Fault	Overspeed and circuit fault output signal Used as input by the EODS Relay module
20	Switched Buffer (-)	Switched buffered output for use with redundant mode (inverted signal)
21	Buffer/Xducer Pwr (-)	Provides negative (-24V to +9V) voltage compliance to buffered outputs Connect to terminals 5 (CH 1) and 22 (CH 2) for negative bias transducers Transducer power supply output, negative side; used to power external sensors (40mA maximum load)
22	Buffer Power 2 IN	Channel 2 buffer power input Connect to terminal 6 for positive biased transducers or terminal 21 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	+24V Out	Internally connected to 24V 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	24V Common[1]	Internally connected to 24V 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	4-20mA 2 (+)	4-20mA output 300 ohm maximum load
30	4-20mA 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

Terminal Block Assignments

No.	Name	Description
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	Start	Switch input to activate startup switch (active closed)
40	Switch RTN	Switch return for Start and Reset Relay
41	Reset Relay	Switch input to reset internal relay (active closed)
42	+24V In 2 (EODS ONLY)	Connection to an external +24V power supply, positive side, when used as a part of an EODS system[2]
43	24V Common[1]	Connection to external +24V power supply, negative side (internally DC-coupled to circuit ground)
44	+24V In	Connection to primary external +24V power supply, positive side
45	24V Common[1]	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.

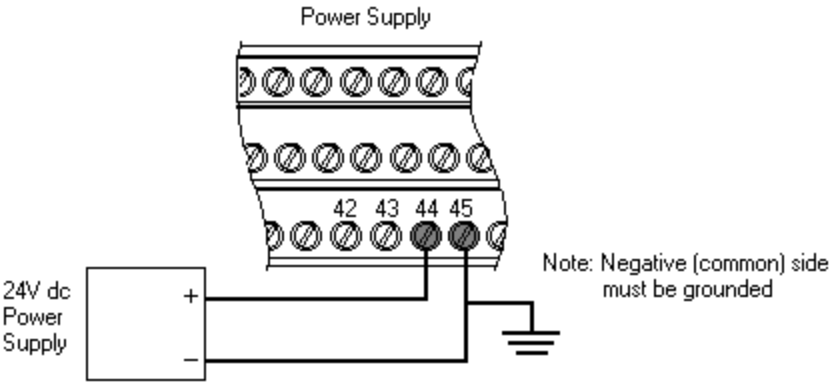
2 When the XM-220 is used as part of an Electronic Overspeed Detection System, redundant power may be applied directly to the module per the XM Electronic Overspeed Detection System User Guide, publication GMSI10-UM015A-EN-E.

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.

IMPORTANT When the XM-220 is used as part of an Electronic Overspeed Detection System, redundant power may be applied directly to the module per the XM Electronic Overspeed Detection System User Guide, publication GMSI10-UM015A-EN-E.

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-220 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 53 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 information 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 XM-220 to provide additional relays. Refer to the XM-441 Expansion Relay Module User 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-220

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

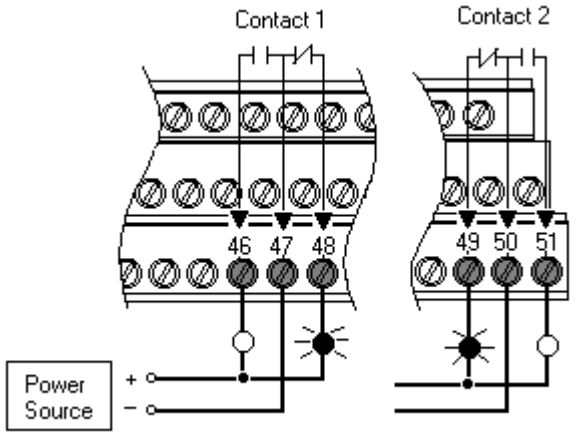
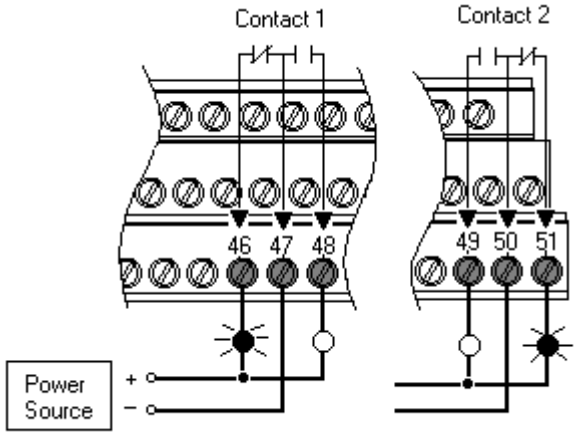


Figure 2.10 Relay Connection - Failsafe, Alarm Condition
Non-failsafe, Nonalarm Condition



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

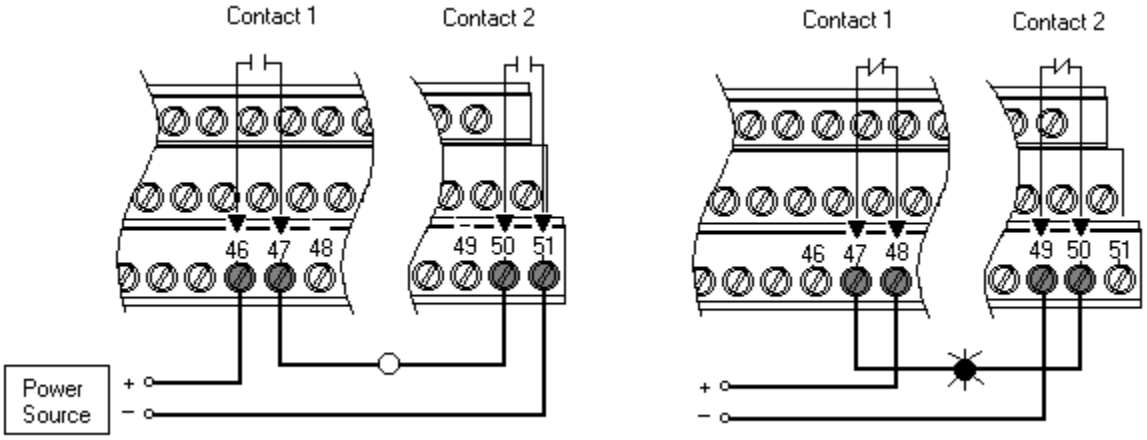
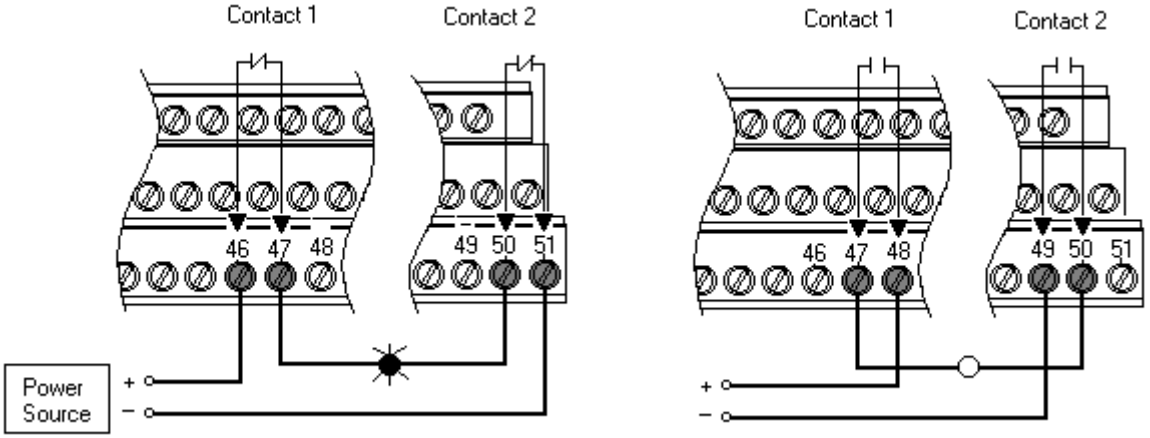


Figure 2.12 Relay Connection - Failsafe, Alarm Condition
Non-failsafe, Nonalarm Condition

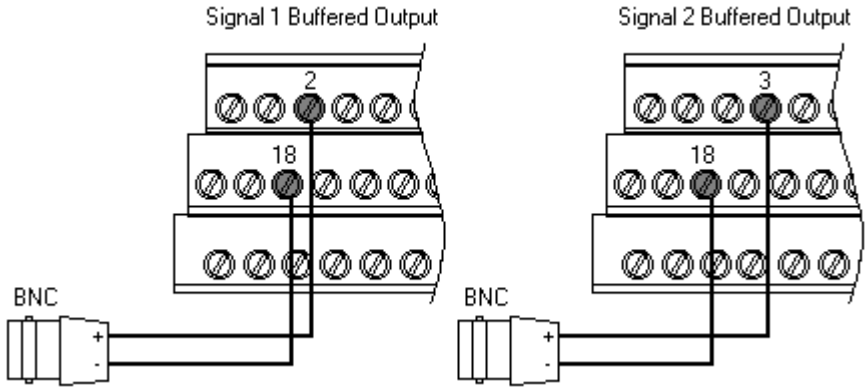


Connecting the Buffered Outputs

The XM-220 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 2.13 shows the buffered output connections for the module.

Figure 2.13 Buffered Output Connections



IMPORTANT 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) to either terminal 6 (Positive Buffer Bias) or terminal 21 (Buffer -), depending on the transducer. See Table 2.2. The buffered output operating range is configured independently per channel.

Table 2.2 Configuring Buffered Output Input Range

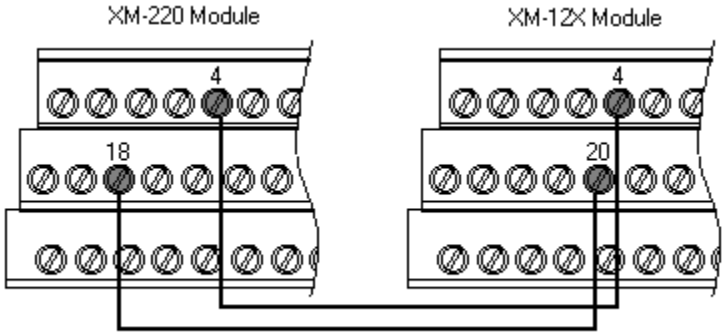
Transducer	Input Range	Channel	Connect Terminal	To Terminal
Negative Bias	-24 to +9V	1	5	21
		2	22	21
Positive Bias	-5 to +24V	1	5	6
		2	22	6
Non-Bias	-5 to +9V	1	---	---
		2	---	---

Connecting the Switched Buffered Output

The XM-220 can be configured to automatically switch to a second (redundant) sensor when a transducer or tachometer fault is detected on the current sensor. When the module is functioning in redundant mode, it provides a third buffered output which outputs a signal corresponding to the active input signal. This allows you to accurately track the machine speed regardless of which of the redundant sensors is active. The signal from the switched buffered output is a CMOS (0 to 5 volt) level square-wave.

The XM-220 switched buffered output can be connected to as many as 19 XM-12X modules, which includes the XM-120, XM-121, XM-122, and XM-123 modules. Figure 2.14 shows the switched buffered output connection to an XM-12X module.

Figure 2.14 Switched Buffered Output



IMPORTANT To invert the input signal, connect a jumper from terminal 20 (Switched Buffer -), instead of terminal 4, on the XM-220 terminal base to terminal 4 (Tach/Signal In +) on the XM-12X terminal base.

IMPORTANT Make certain to set the **Measurement Mode** parameter to "Single Redundant Channel." Refer to Measurement Mode Parameter on page 46.

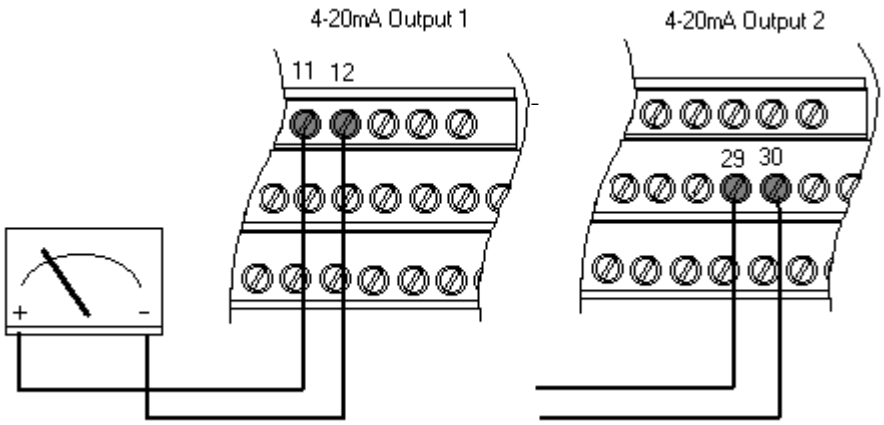
TIP When the **Measurement Mode** parameter is set to either "Dual Channel" or "Reverse Rotation," the Switched Buffer output will correspond to channel 1 input.

Connecting the 4-20mA Outputs

The module includes an isolated 4-20mA per channel output into a maximum load of 300 ohms. The measurements that the 4-20mA output tracks and the signal levels that correspond to the 4mA and 20mA are configurable. Refer to 4-20mA Output Parameters on page 58.

Wire the 4-20mA outputs to the terminal base unit as shown in Figure 2.15.

Figure 2.15 4-20mA Output Connections



ATTENTION

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

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-220.

TIP

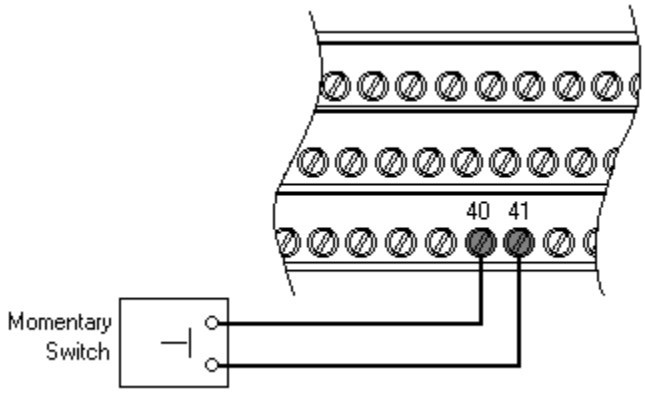
If you set a module relay to latching, make sure that any linked relays, such as relays in an XM-440 Master Relay Module, are **not** configured as latching. When both relays are set to latching, the relay in each module will have to be independently reset when necessary.

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 2.16.

Figure 2.16 Remote Relay Reset Signal Connection



ATTENTION

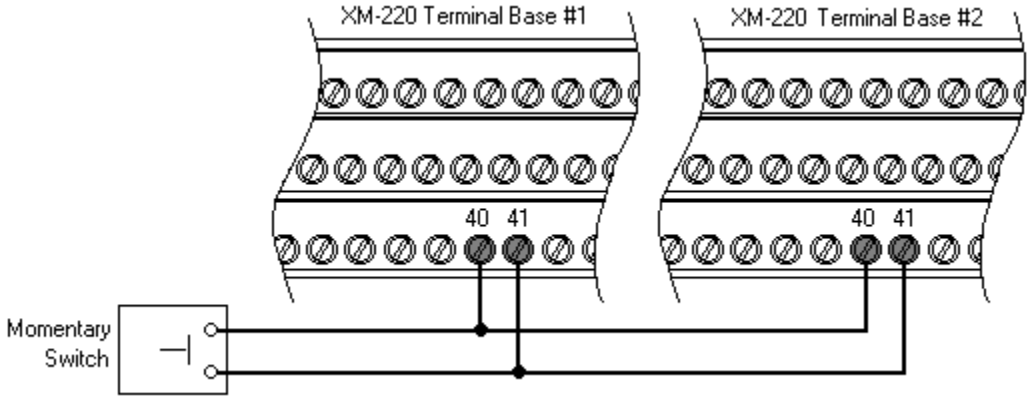
The Switch Input circuits are functionally isolated from other circuits. It is recommended that the Switch RTN signal be grounded at a signal point. Connect the Switch RTN signal to the XM terminal base (Chassis terminal) or directly to the DIN rail, or ground the signal at the switch or other equipment 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 2.17.

ATTENTION

The relay reset connections may be different for different XM modules. Figure 2.17 applies only to the XM-220 module. Refer to the installation instructions for the module for its terminal assignments.

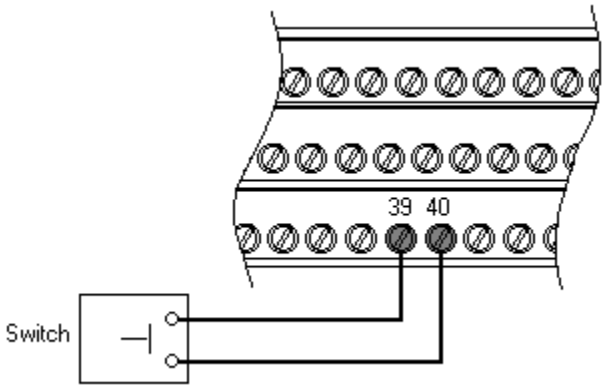
Figure 2.17 Typical Multiple XM Modules Remote Relay Reset Signal Connection



Connecting the Startup Switch

You can configure the module to detect a locked rotor condition or inhibit the tachometer fault alarm status during the start-up period. Wire the Startup switch to the terminal base unit as shown in Figure 2.18.

Figure 2.18 Startup Switch 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 Transducer

The XM-220 can accept input signals from any Allen-Bradley non-contact eddy current probe, magnetic pickups, or TTL output devices.

IMPORTANT

Active magnetic speed sensors or eddy current probes are often used on machines where rotational speeds below 250 rpm must be reliably sensed, for example reverse rotation and zero speed applications. Passive magnetic speed sensors do not typically generate a suitable signal at slow shaft rotational speeds. To sense shaft rotation speeds down to 1 rpm, active magnetic speed sensors or eddy current probes are required.

Connecting a Non-Contact Sensor

The figures below show the wiring of a non-contact eddy current probe to the terminal base unit.

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

A jumper from terminal 5 to terminal 21 is required for channel 1 buffered output. A jumper from terminal 22 to terminal 21 is required for channel 2 buffered output. Refer to Configuring Buffered Output Input Range on page 25.

Figure 2.19 Non-contact Sensor to Channel 1 Wiring

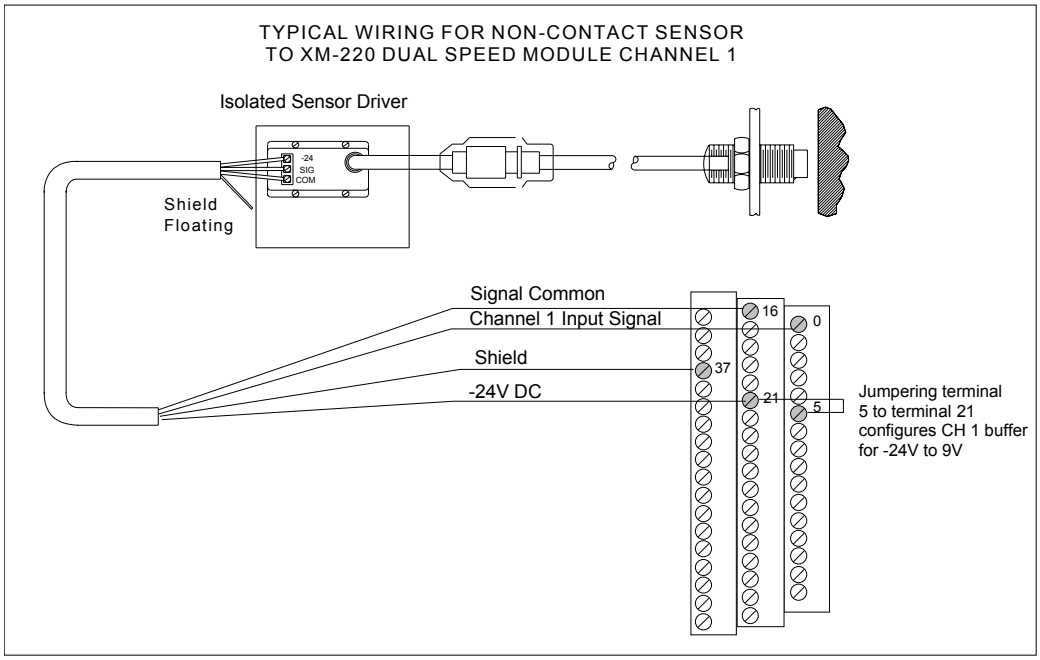
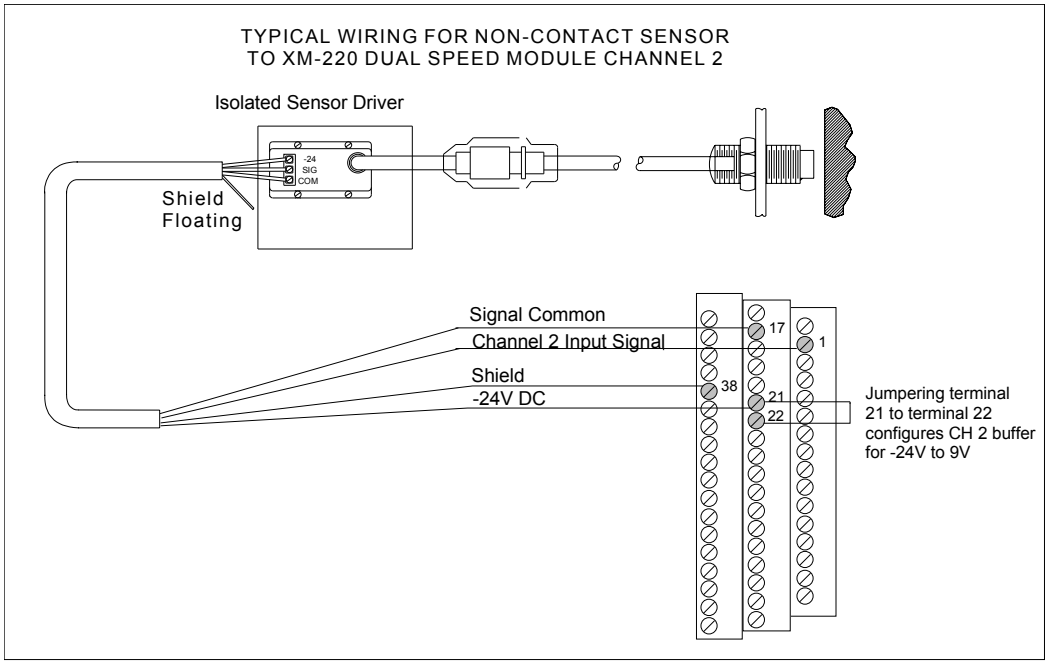


Figure 2.20 Non-contact Sensor to Channel 2 Wiring



Connecting a Magnetic Pickup Sensor

The figures below show the wiring of a passive magnetic pickup sensor to the terminal base unit.

IMPORTANT Active magnetic speed sensors or eddy current probes are often used on machines where rotational speeds below 250 rpm must be reliably sensed, for example reverse rotation and zero speed applications. Passive magnetic speed sensors do not typically generate a suitable signal at slow shaft rotational speeds. To sense shaft rotation speeds down to 1 rpm, active magnetic speed sensors or eddy current probes are required.

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 module does not power the sensor. It measures only the input voltage.

IMPORTANT An internal isolated constant current (0.5mA) supply is provided to detect a cable or transducer fault (short). This current is enabled with the **Enable Bias Current** parameter. Refer to Channel Tachometer Parameters on page 47.

Figure 2.21 Magnetic Pickup to Channel 1 Wiring

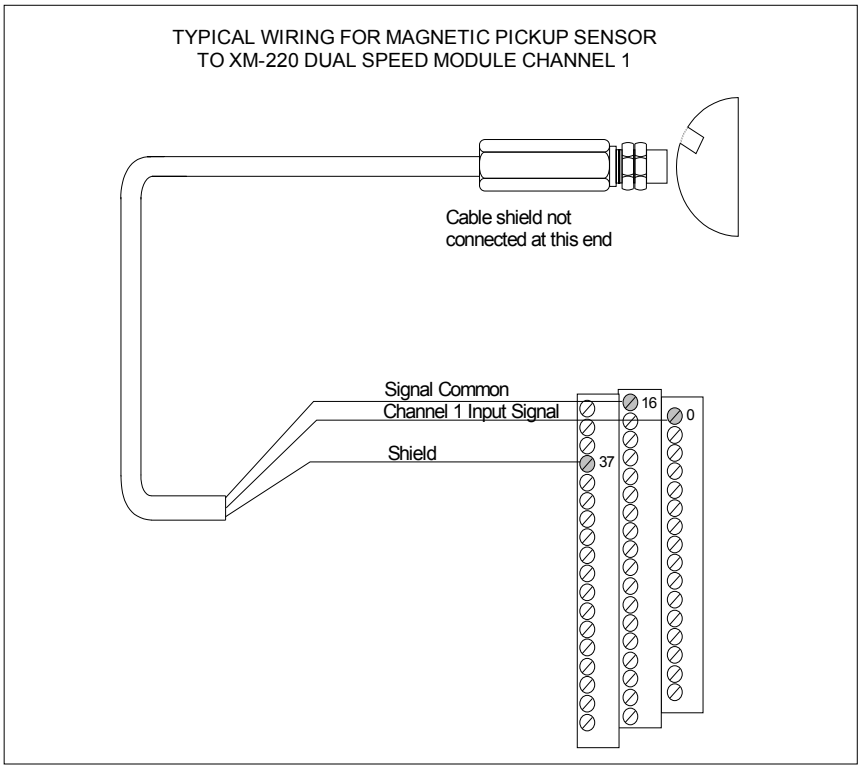
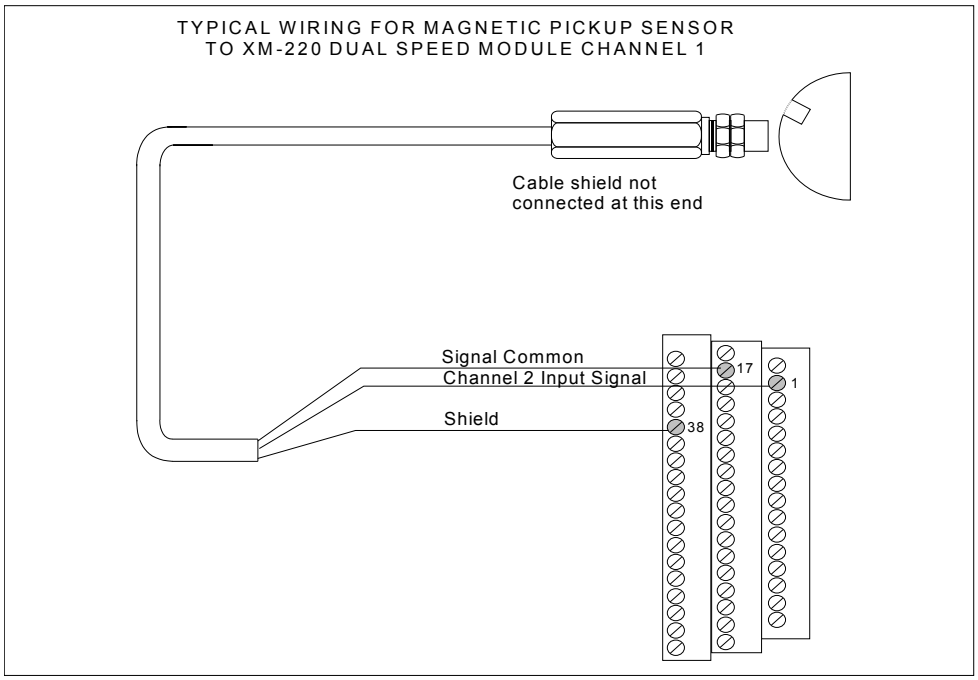


Figure 2.22 Magnetic Pickup to Channel 2 Wiring



Connecting a TTL Output Device

The figures below show the wiring of a TTL output device to the terminal base unit.

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 TTL device.

Figure 2.23 TTL Output Device to Channel 1 Wiring

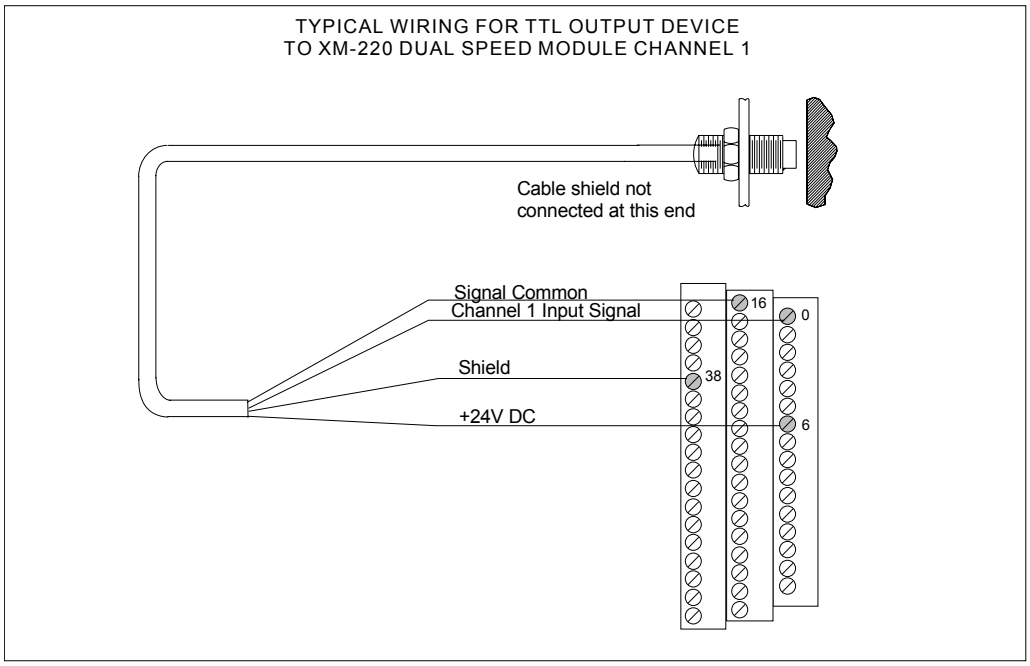
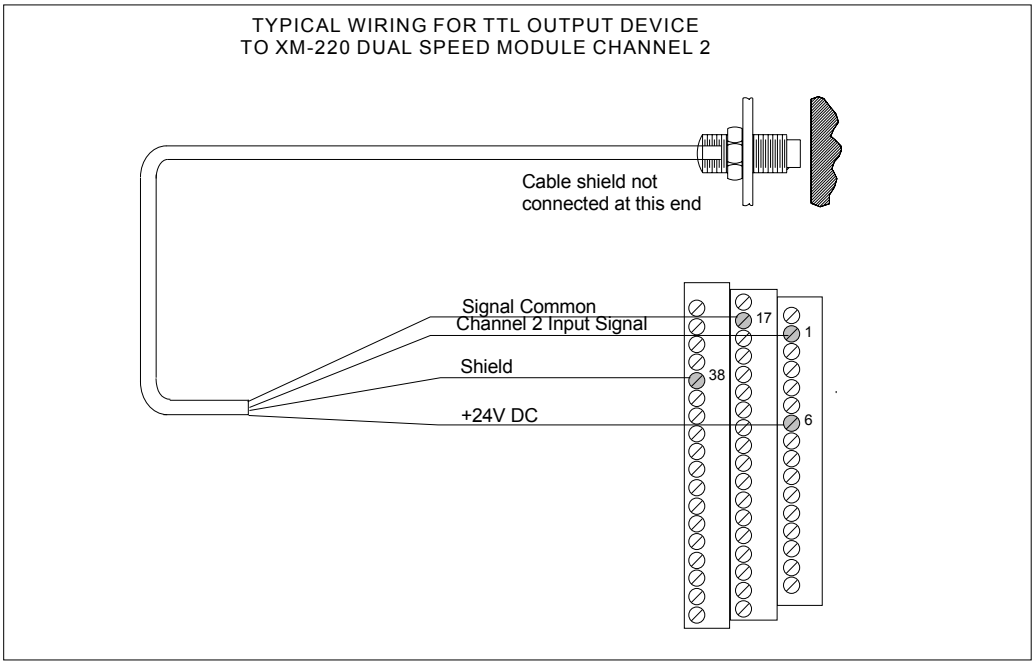


Figure 2.24 TTL Output Device to Channel 2 Wiring



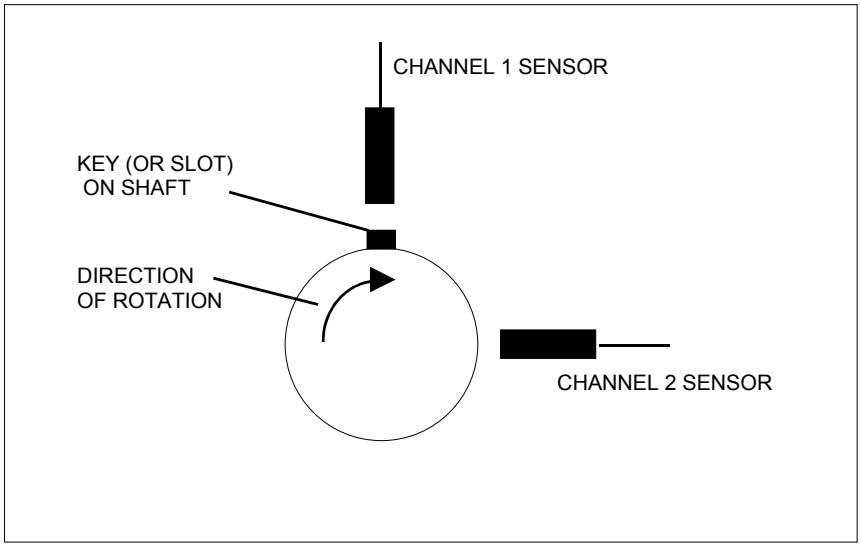
Sensor Placement for Reverse Rotation

The XM-220 module uses two input signals for reverse rotation detection. Connect the first sensor to Channel 1. Connect the second sensor to Channel 2. Refer to Connecting a Non-Contact Sensor on page 30 for wiring details.

Position the sensors so that:

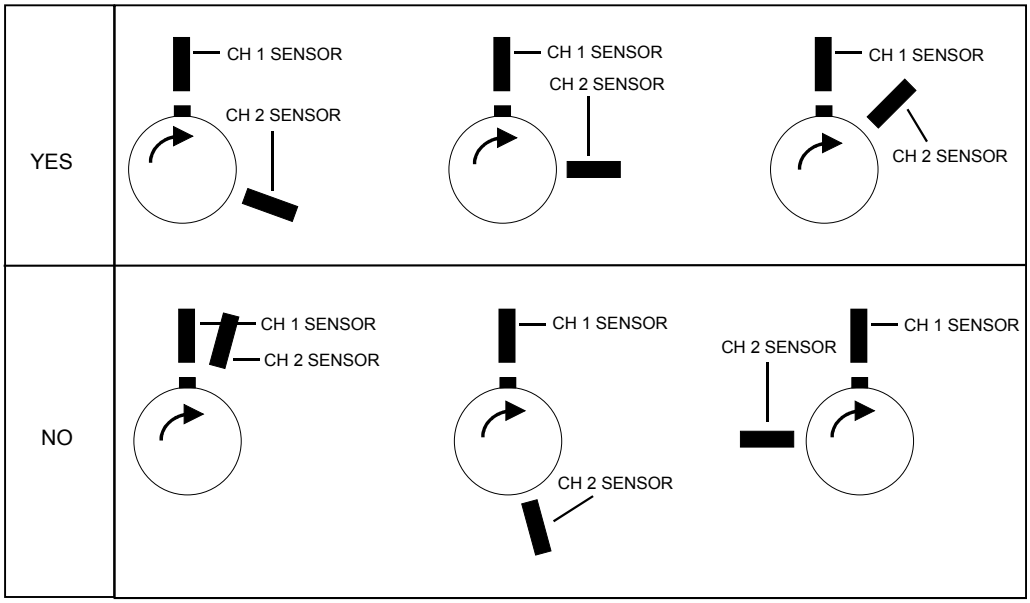
- The keyway passes Channel 1 sensor before it passes Channel 2 sensor as the machine rotates in the forward direction, as illustrated in Figure 2.25.

Figure 2.25 Position of the Sensor



- The sensors are more than 10 degrees apart and less than 170 degrees apart in the direction of forward rotation; 90 degrees is optimum. See Figure 2.26.

Figure 2.26 Spacing of the Sensors



IMPORTANT Make certain to set the **Measurement Mode** parameter to "Reverse Rotation." Refer to Measurement Mode Parameter on page 46.

PC Serial Port Connection

The XM-220 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.

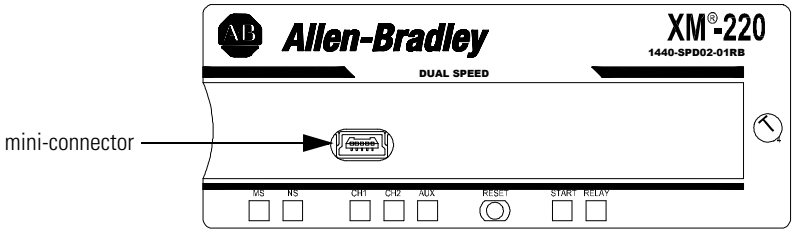
- **Terminal Base Unit** - There are three terminals on the terminal base unit you can use for the serial port connection. They are TxD, RxD, and RTN (terminals 7, 8, and 9, respectively). If these three terminals are wired to a DB-9 female connector, then a standard RS-232 serial cable with 9-pin (DB-9) 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-220 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 the top of the module, as shown below.

Figure 2.27 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-220 includes a DeviceNet™ connection that allows the modules to communicate with a Programmable Logic Controller (PLC), Distributed Control System (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-220. 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-220 is set by way of "baud detection" (Autobaud) at power-up.

Mounting the Module

The XM-220 mounts on the XM-941 terminal base unit, Cat. No. 1440-TB-B. We recommend that you mount the module after you have connected the wiring on the terminal base unit.

ATTENTION

The XM-220 module is compatible only with the XM-941 terminal base unit. The keyswitch on the terminal base unit should be at position 4 for the module.

Do not attempt to install XM-220 modules on other terminal base units.

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

ATTENTION

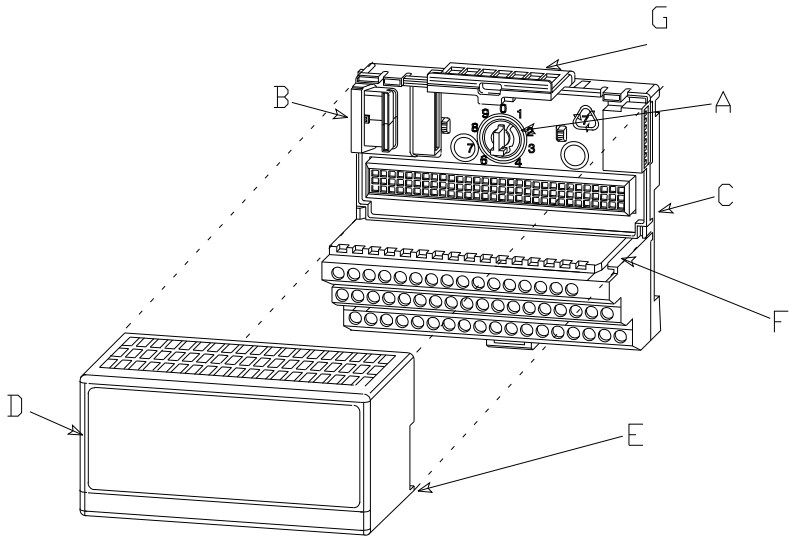
This module is designed so you can **remove and insert it under power**. However, when you remove or insert the module with power applied, I/O attached to the module can change states due to its input/output signal changing conditions. Take special care when using this feature.

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 4 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.

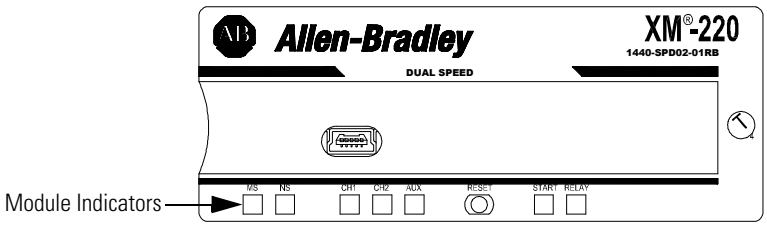
5. Press firmly and evenly to seat the module in the terminal base unit. The module is seated when the latching mechanism (G) is locked into the module.

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

Module Indicators

The XM-220 module has seven LED indicators, which include a module status (MS) indicator, a network status (NS) indicator, a status indicator for each channel (CH1 and CH2), an activation indicator for startup, a status indicator for the Relay, and an indicator (AUX) reserved for future use. The LED indicators are on top of the module.

Figure 2.28 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 and Channel 2 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	Tachometer fault (no transducer fault) condition exists on the channel.
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.

Startup (Start) Indicator

Color	State	Description
Yellow	Off	Startup period is not in effect.
	Solid	Startup period is in effect. • Module may be inhibiting the Tach Fault alarm status. • Module may be monitoring for locked rotor conditions.

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 XM-220 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.

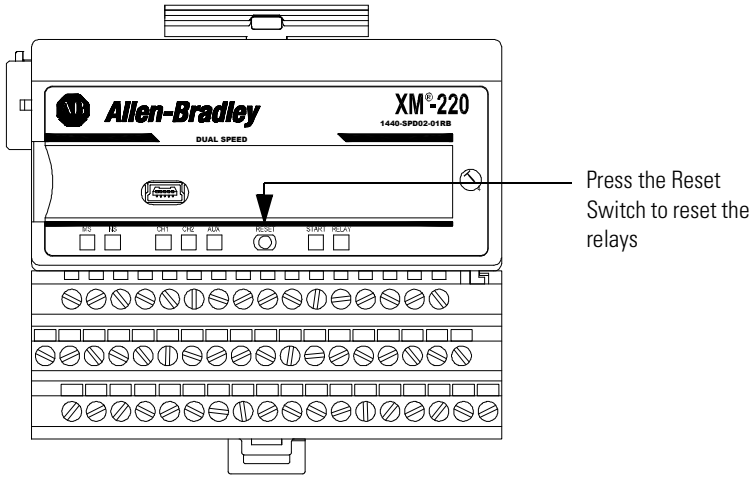
MS Indicator State	Description
Flashing Red and Green	Device self-test is in progress.
Solid Green or Flashing Green	Device self-test completed successfully, and the firmware is valid and running.
Flashing Red	Device self-test completed, the hardware is OK, but the firmware is invalid. Or, the firmware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

Refer to Module Indicators on page 40 for more information about the LED indicators.

Manually Resetting Relays

The XM-220 has an external reset switch located on top of the module, as shown in Figure 2.29.

Figure 2.29 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-220.

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.

Configuration Parameters

This chapter provides a complete listing and description of the XM-220 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.

Measurement Mode Parameter

The Measurement Mode parameter controls how the two sensors are used to calculate the speed, acceleration, and peak measurements. The XM-220 module operates in three different modes:

- **Dual Channel** - This is the default mode. The two sensors are used independently to perform two separate sets of speed, acceleration, and peak speed measurements.
- **Single Redundant Channel** - One of the two sensors is used to perform the speed, acceleration, and peak speed measurements. The module automatically switches to the other (redundant) sensor when a transducer or tachometer fault is detected on the current sensor (and there are no faults on the second sensor).

  The Speed, Acceleration, and Peak Speed measurements are measured only on channel 1. Channel 2 measurements (Speed, Acceleration, and Peak Speed) are not measured.
- **Reverse Rotation** - The two sensors are used to monitor both speed and direction. The two sensors must be mounted out of phase from each other so that the rotational direction can be determined by monitoring which sensor the shaft keyway passes first. Refer to Sensor Placement for Reverse Rotation on page 35.

  Channel 1 measures the Speed, Acceleration, and Peak Speed in the forward direction. Channel 2 measures the Speed, Acceleration, and Peak Speed in the reverse direction.

Measurement Mode Parameter

Parameter Name	Description	Values/Comments
Mode	Controls how the two sensors are used to calculate the speed, acceleration, and peak measurements. See above for more details.	Options: Dual Channel Single Redundant Channel Reverse Rotation

Channel Tachometer Parameters

The Tachometer parameters define the characteristics of the tachometer and determine the signal processing that will be performed on the tachometer signal. There are two instances of the tachometer parameters, one for each channel.

TIP The Channel LED will flash red when a transducer fault condition exists on the channel even if you are not using the channel. You can keep the Channel LED from flashing red on unused channels by setting the unused channel's **Fault High** and **Fault Low** to greater than zero and less than zero, respectively. For example, set **Fault High** to +18 volts and set **Fault Low** to -18 volts.

IMPORTANT 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.

IMPORTANT In Single Redundant Channel mode and Reverse Rotation mode, the **Pulses Per Revolution** must be non-zero for both channels. Redundancy or reverse rotation detection will be impossible if either tachometer is disabled.

IMPORTANT In Reverse Rotation mode, the value entered in **Pulses Per Revolution** must be equal for both channels. And the value entered in **Speed Multiplier** must be the equal for both channels.

Tachometer Parameters

Parameter Name	Description	Values/Comments
Name (XM Serial Configuration only)	A descriptive name to help identify the tachometer channel in the XM Serial Configuration Utility.	Maximum 18 characters

Tachometer Parameters

Parameter Name	Description	Values/Comments
XM Configuration Utility: **Enable Bias Current** **EDS File**: **Bias Current**	Controls whether a small amount of current is injected into the sensor wiring to help detect transducer faults of passive magnetic sensors. Passive magnetic sensors are unbiased and provide no inherent fault detection capability. The XM-220 is able to detect an open or short circuit from the input to the sensor using the resistance of the passive magnetic sensor and a configurable bias current per channel. To use this feature, the resistance of the magnetic sensor must be a minimum of 350 ohms. In an open circuit situation, the Transducer DC bias measurement will read approximately 18 volts. In a short circuit situation, the Transducer DC bias will read near 0 volts. Under normal operating conditions, the Transducer DC bias can range from 0.12 to 3 volts depending on the sensor DC resistance and temperature. This DC bias may also vary between XM-220 devices. It is recommended that the **Fault Low** and **Fault High** be set to 0.2 and 7, respectively. The bias current parameter also adjusts the auto-trigger detection algorithm for passive magnetic signals.	**XM Configuration Utility** / **EDS File** Check = Enable / Enabled Clear = Disable / Disabled **Important:** If you are using passive magnetic sensors, then you must enable the bias current if: • You want to use auto trigger mode. • You want to detect transducer fault conditions.
Fault Low	The minimum, or most negative, expected DC voltage from the transducer.	Volts **Note:** A DC Bias voltage reading outside this range constitutes a transducer fault. **Important**: If you are using passive magnet sensors, it is recommended that the **Fault Low** and **Fault High** be set to 0.2 and 7, respectively. See **Bias Current** parameter for details.
Fault High	The maximum expected DC voltage from the transducer.	

Tachometer 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 / (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><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><table><tr><th>XM Configuration Utility</th><th>EDS File</th></tr><tr><td>Auto Trigger</td><td>Trigger Mode</td></tr></table></td><td>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 (0.0167 Hz).</td><td><table><tr><th>XM Configuration Utility</th><th>EDS File</th></tr><tr><td>Check = Auto Mode</td><td>Auto</td></tr><tr><td>Clear = Manual Mode</td><td>Manual</td></tr></table>
Important: If you are using Auto Trigger mode with passive magnetic sensors, make certain to enable the Bias Current parameter (see page 48). The bias current parameter adjusts the auto-trigger detection algorithm for passive magnetic signals.</td></tr>
<tr><td>Trigger Hysteresis</td><td>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.</td><td>% in Auto Trigger mode
Volt in Manual Trigger mode</td></tr>
</table>

Tachometer Parameters

Parameter Name	Description	Values/Comments
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.	Options: Positive Negative
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. **Important**: When **Mode** is set to either "Single Redundant Channel" or "Reverse Rotation," the Pulses per Revolution value must be non-zero for both Channel 1 and Channel 2. **Important:** When **Mode** is set to "Reverse Rotation," this value must be the same for both Channel 1 and Channel 2.
XM Configuration Utility / **EDS File** **Speed Multiplier** / **Tach Multiplier**	The input tachometer signal is multiplied by this value to obtain the measured speed.	This value must be greater than zero. **Important**: When **Mode** is set to "Reverse Rotation," this value must be the same for Channel 1 and Channel 2.
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.

Alarm Parameters

The Alarm parameters control the operation of the alarms (alert and danger level) and provide alarm status. The XM-220 provides a total of eight alarms. Each alarm is permanently associated with a corresponding measurement (for example, Channel 1 Speed alarm, Channel 2 Acceleration 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)	Selects one of the eight XM-220 alarms. Each alarm is associated with a particular measurement.	Options: Channel 1 Speed Channel 2 Speed Channel 1 Acceleration Channel 2 Acceleration Channel 1 Zero Speed Channel 2 Zero Speed Channel 1 Locked Rotor Channel 2 Locked Rotor

Alarm Parameters

Parameter Name	Description	Values/Comments
Name (XM Serial Configuration Utility only)	A descriptive name to identify the alarm in the XM Serial Configuration Utility.	Maximum 18 characters **Note:** This parameter is not applicable for Locked Rotor alarms.
Enable	Enable/disable the selected alarm. **Note:** The **Alarm Status** is set to "Disarm" when the alarm is disabled.	**XM Configuration Utility** / **EDS File** Check to Enable / Enabled Clear to Disable / Disabled
Condition	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.	Options: Greater Than Less Than Inside Range Outside Range **Note:** This parameter is not applicable for Locked Rotor alarms.

Alarm Parameters

Parameter Name	Description	Values/Comments
Alert Threshold (High)	The threshold value for the alert (alarm) condition. **Important:** For Locked Rotor alarms, the Alert Threshold value must be less than or equal to the **Danger Threshold** value. **Note**: This parameter is the greater threshold value when **Condition** is set to "Inside Range" or "Outside Range."	The thresholds shall be specified in the units of the associated measurement (for example, RPM for speed, RPM/min for acceleration).
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)**.	The hysteresis shall be specified in the units of the associated measurement (for example, RPM for speed, RPM/min for acceleration). **Note:** This parameter is not applicable for Locked Rotor alarms.
Alert Period	The period of time from startup to when the Locked Rotor **Alert Threshold** is enforced. The Locked Rotor Alert alarm is activated if the measured speed fails to exceed the **Alert Threshold** value within this specified time. **Note:** The Alert Period value must be less than or equal to the **Danger Period** value.	Enter a value from 1 to 255 seconds. **Note**: This parameter is only applicable for Locked Rotor alarms.
Danger Period	The period of time from startup to when the Locked Rotor **Danger Threshold** is enforced. The Locked Rotor Danger alarm is activated when the measured speed fails to exceed the **Danger Threshold** within this specified time.	Enter a value from 1 to 255 seconds. **Note**: This parameter is only applicable for Locked Rotor alarms.

Alarm Parameters

<table>
<tr><th>Parameter Name</th><th>Description</th><th>Values/Comments</th></tr>
<tr><td>Startup Period</td><td>The length of time that the tachometer fault is inhibited after the startup period. The startup period begins when the startup switch is reopened (push button disengaged or toggle switch flipped to off).</td><td>Enter a value from 0 to 1092 minutes, adjustable in increments of 0.1 minutes.

Note: This parameter is not applicable for Locked Rotor alarms.</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>
Note: This parameter is not applicable for Locked Rotor alarms.</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

<table>
<tr><th>Parameter Name</th><th>Description</th><th>Options/Comments</th></tr>
<tr><td>Number (XM Serial Configuration Utility only)</td><td>Sets the relay to be configured in the XM Serial Configuration Utility.</td><td>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.</td></tr>
<tr><td>Name (XM Serial Configuration Utility only)</td><td>A descriptive name to help identify the relay in the XM Serial Configuration Utility.</td><td>Maximum 18 characters</td></tr>
<tr><td>Enable</td><td>Enable/disable the selected relay.

Note: The Relay Current Status is set to "Not Activated" when the relay is disabled. See page 60.</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><table><tr><th>XM Configuration Utility</th><th>EDS File</th></tr><tr><td>Latching</td><td>Latching Option</td></tr></table></td><td>Controls whether the relay must be explicitly reset after the alarm subsides.</td><td><table><tr><th>XM Configuration Utility</th><th>EDS File</th></tr><tr><td>Check means latching (relay must be explicitly reset)</td><td>Latching</td></tr><tr><td>Clear means non-latching (relay is reset once the alarm condition has passed)</td><td>Nonlatching</td></tr></table></td></tr>
<tr><td>Activation Delay</td><td>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.</td><td>Enter a value from 0 to 25.5 seconds, adjustable in increments of 0.1 seconds.

Default is 1 second</td></tr>
</table>

Relay Parameters

Parameter Name		Description	Options/Comments
XM Configuration Utility	**EDS File**	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
Activation Logic	**Logic**		
XM Configuration Utility	**EDS File**	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: Channel 1 Speed Channel 2 Speed Channel 1 Acceleration Channel 2 Acceleration Channel 1 Zero Speed Channel 2 Zero Speed Channel 1 Locked Rotor Channel 2 Locked Rotor **Note:** You can only select an alarm that is enabled.
Alarm A/B	**Alarm Identifier A/B**		

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** - For Speed, Acceleration and Zero Speed alarms, the current measurement is in excess of the alert level threshold(s) but not in excess of the danger level threshold(s). For Locked Rotor Alarms, the measured speed is less than the **Alert Threshold** value when the **Alert Period** expired. The Alert Period is measured when from the reception of the startup signal. • **Danger** - For Speed, Acceleration and Zero Speed alarms, the current measurement is in excess of the danger level threshold(s). For Locked Rotor Alarms, the measured speed is less than the **Danger Threshold** value when the **Danger Period** expired. The Danger Period is measured from the reception of the startup signal. • **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** - For Speed, Acceleration and Zero Speed alarms, a required tachometer signal has not been detected (no transducer fault either), unless the **Inhibit Tachometer Fault** is enabled and the startup period is active. For Locked Rotor Alarms, a required tachometer signal has not been detected and the **Alert Period** has expired. (The tachometer fault is automatically inhibited until the Alert Period has expired).	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

4-20mA Output Parameters

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

4-20mA Parameters

Parameter Name	Description	Options/Comments
Enable	Enables/disables the 4-20mA 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 4-20mA output signal will track.	Options: Channel 1 Speed Channel 2 Speed Channel 1 Acceleration Channel 2 Acceleration
Min Range	The measured value associated with the 4mA.	RPM for Speed RPM/min for Acceleration
Max Range	The measured value associated with the 20mA.	

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

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

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

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 XM-220 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 has established the Poll connection with the XM-220 will result in 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 71.

To close an existing Poll connection with other master devices, remove the XM-220 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 77 for more information.
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** **Poll Output** / **Poll Response Assembly**	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 Assembly Instance 102 Assembly Instance 103 Custom Assembly Refer to Poll Message Format on page 75 for more information.
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 75 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
Speed		Shows the measured speed value.	**Note:** In Single Redundant mode, Channel 2 Speed, Acceleration and Peak Speed measurements are not measured. **Note:** In Reverse Rotation mode, Channel 1 measures the Speed, Acceleration, and Peak Speed in the forward direction, and Channel 2 measures the Speed, Acceleration, and Peak Speed in the reverse direction.
Acceleration		Shows the measured acceleration value.	
XM Configuration Utility	**EDS File**	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.	
Xdcr DC Bias	**Transducer Measured DC Bias**		
Peak Speed		Shows the greatest measured **Speed Value** (positive or negative) since the most recent reset.	
Startup Status (EDS File only)		Shows whether the startup period is in effect.	
Reverse Rotation Status (EDS File only)		Shows the direction of the machine rotation.	Options: Forward Reverse

Alarm and Relay Status Parameters

Alarm and Relay Status Parameters

Parameter Name	Description	Values/Comments
Speed Alarm Status	States the current status of the speed 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's DC bias is outside the transducer's **Fault High/Fault Low** range. • **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.
Acceleration Alarm Status	States the current status of the acceleration alarm	
Zero Speed Alarm Status	States the current status of the zero speed alarm.	

Alarm and Relay Status Parameters

Parameter Name	Description	Values/Comments
Locked Rotor Alarm Status	States the current status of the locked rotor 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 or danger condition, and the measured speed was less than the **Alert Threshold** value when the **Alert Period** expired. • **Danger** - The alarm is enabled, the device is in Run mode, there is no transducer fault, and the measured speed was less than the **Danger Threshold** value when the **Danger Period** expired. • **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 the transducer's DC bias is outside the transducer's **Fault High/Fault Low** range. • **Tachometer Fault** - The alarm is enabled, the device is in Run mode, a tachometer fault exists, (and **no** transducer fault), and the **Alert Period** has expired. • **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 71 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 XM-220 module.

XM-220 Technical Specifications

Product Feature	Specification
Communications	
DeviceNet	Standard DeviceNet protocol for all functions *NOTE: The XM-220 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 125kb, 250kb, 500kb Configurable I/O Poll Response message helps optimize space utilization within scanner input tables. Selectable Poll Response Assembly Selectable Poll Response Size (bytes)
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-220 Technical Specifications

Product Feature	Specification
Inputs	
2 Tachometer Inputs	±25V (50V maximum peak to peak) Eddy current transducer signals Magnetic pickups TTL output devices
Input Impedance	120k ohms minimum
Speed/Frequency Range	1 to 1,200,000 RPM 0.0167 to 20,000 Hz
Speed Measurement Error	1 to 240 RPM ±0.2 RPM 241 to 12,000 RPM ±2 RPM 12,001 to 20,400 RPM ±5 RPM 20,401 to 120,000 RPM ±20 RPM 120,001 to 360,000 RPM ±50 RPM 360,001 to 1,200,000 RPM ±160 RPM
Outputs	
4-20mA Outputs	Each output is independently programmed to represent speed or acceleration, from either channel. Two isolated outputs 300 ohm max load
Buffered Outputs	1 active buffer per input channel Output range configurable by wiring: -24 to +9V -5 to +24V -5 to +9V Third buffered output available when the module is configured for single redundant channel mode. Outputs a CMOS (0 to 5 volts) level square-wave that corresponds to the active input signal.
Sensor Fault Detection	
Eddy Current Transducer	Bias voltage is compared with the fault limits.
Magnetic Pickups	A current source is available for biasing passive magnetic pickups to detect open or short circuits.
Indicators	
7 LEDs	Module Status - red/green Network Status - red/green Channel 1 Status - yellow/red Channel 2 Status - yellow/red Startup -yellow Relay - red AUX - reserved for future use
Measured Units	RPM Direction of Rotation Acceleration in RPM/Minute

XM-220 Technical Specifications

Product Feature	Specification
Measured Parameters	
Direction	Forward Reverse
Speed	
Acceleration	
Peak Speed	
Gap (or transducer bias voltage)	
Measured Units	RPM Direction of Rotation Acceleration in RPM / Minute
Measurement Modes	
Dual Channel	Two sensors are used independently to perform two separate speed, acceleration and peak speed measurements.
Single Redundant Channel	One sensor is used to perform the speed, acceleration and peak speed measurements. If the current sensor fails, the module automatically switches to the second (redundant) sensor.
Reverse Rotation	Two sensors are used to monitor both speed and direction. The two sensors must be mounted out of phase from each other so that the rotational direction can be determined by monitoring which sensor the shaft keyway passes first.
Alarms	
Number	8 alarms, fixed per channel
Alarm Parameters	Alarm and danger pair provided for each of: Speed Acceleration Zero Speed Locked Rotor
Operators	Greater than Less than Inside range Outside range
Hysteresis	User configurable in software

XM-220 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: 3.5A* Minimum Current: 0 Maximum Power: 60W, 62.5VA **Max current is up to 40°C, then derates to 2A at 65°C* Agency Rating: 120V ac @ 0.5A 110V dc @ 0.3A 30V dc @ 1.0A
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
Peak Speed Capture	The XM-220 retains the value of the highest speed observed since module power was cycled or the "peak speed" value was manually reset.

XM-220 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 command sent via the serial interface, using the Serial Configuration Utility, or via DeviceNet from any compliant software application.*
Power	
Module	+21.6 to +26.4V dc
Consumption	Maximum: 300mA Typical: 225mA
Heat Production	Maximum: 7 Watts (24 BTU/hr) Typical: 4 Watts (14 BTU/hr)
Transducer	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: 3.8in (97mm) Width: 3.7in (94mm) Depth: 3.7in (94mm)
Terminal Screw Torque	7 pound-inches (0.6Nm)

XM-220 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 73 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 the 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 model

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

TIP You can also use the Stop service described on page 73 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 the 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 73 to transition XM modules to Run mode.

XM Services

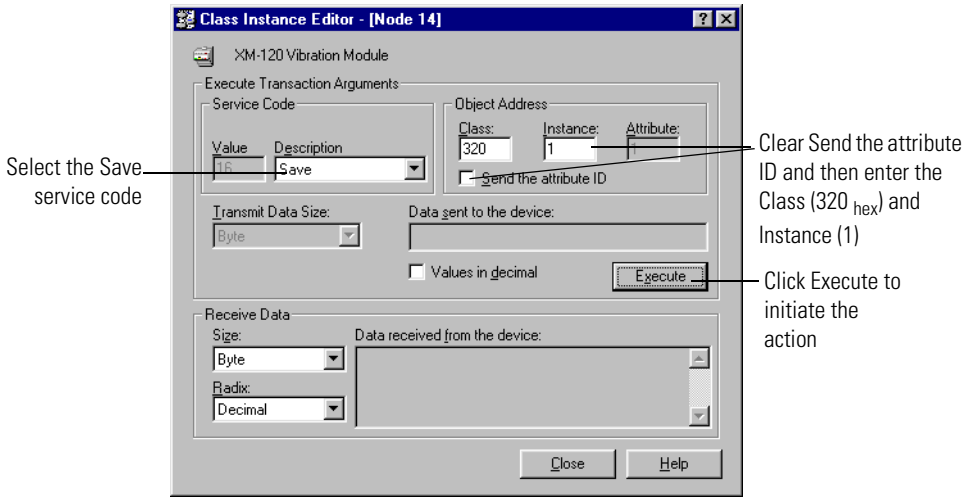
The table below defines services supported by the XM modules. The table includes the service codes, classes, instances, and attributes by their appropriate hexadecimal codes. Use the Class Instance Editor in RSNetWorx to execute these services, as illustrated in the example below.

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 and XM-220 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.

XM-220 I/O Message Formats

The XM-220 module supports Poll and Change of State (COS) I/O messages. The Poll response message is used by the XM modules to produce measured values, and the COS message is used to produce the Alarm and Relay Status.

Poll Message Format

The XM-220 Poll request message contains no data. The Poll response message can contain up to 31 REAL values for a total of 124 bytes.

The XM-220 provides three pre-defined (static) data formats of the Poll response, as defined in Assembly instance 101-103. 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 32 bytes. You can change the Assembly instance and define the dynamic Assembly using the configuration software. Refer to I/O Data Parameters on page 59.

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

The following tables show the static data formats of Assembly instances 101–103.

XM-220 Assembly Instance 101 Data Format

Byte	Definition
0–3	Channel 1 Speed measurement value
4–7	Channel 2 Speed measurement value
8–11	Channel 1 Acceleration measurement value
12–15	Channel 2 Acceleration measurement value
16–19	Channel 1 Gap measurement value
20–23	Channel 2 Gap measurement value
24–27	Channel 1 Peak Speed measurement value
28–31	Channel 2 Peak Speed measurement value

XM-220 Assembly Instance 102 Data Format

Byte	Definition
0–3	Channel 1 Gap measurement value
4–7	Channel 2 Gap measurement value
8–11	Channel 1 Speed measurement value
12–15	Channel 2 Speed measurement value
16–19	Channel 1 Peak Speed measurement value
20–23	Channel 2 Peak Speed measurement value
24–27	Channel 1 Acceleration measurement value
28–31	Channel 2 Acceleration measurement value

XM-220 Assembly Instance 103 Data Format

Byte	Definition
0–3	Channel 1 Speed measurement value
4–7	Channel 1 Acceleration measurement value
8–11	Channel 1 Gap measurement value
12–15	Channel 1 Peak Speed measurement value
16–19	Channel 2 Speed measurement value
20–23	Channel 2 Acceleration measurement value
24–27	Channel 2 Gap measurement value
28–31	Channel 2 Peak Speed measurement value

COS Message Format

The XM-220 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).

XM-220 COS Message Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Relay 1 Status	Startup Period Status	Channel 2 Speed Alarm Status (Alarm 2)			Channel 1 Speed Alarm Status (Alarm 1)		
1	Relay 2 Status	Reverse Rotation Status	Channel 2 Acceleration Alarm Status (Alarm 4)			Channel 1 Acceleration Alarm Status (Alarm 3)		
2	Relay 3 Status	Reserved	Channel 2 Zero Speed Alarm Status (Alarm 6)			Channel 1 Zero Speed Alarm Status (Alarm 5)		
3	Relay 4 Status	Reserved	Channel 2 Locked Rotor Alarm Status			Channel 1 Locked Rotor Alarm Status		
4	Relay 5 Status	Reserved	Reserved			Reserved		

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

Startup Period Status Descriptions

Startup Period Status Value	Description
0	Not Activated
1	Activated

Relay Status Descriptions

Relay Status Value	Description
0	Not Activated
1	Activated

Reverse Rotation Status Descriptions

Reverse Rotation Status Value	Descriptions
0	Forward
1	Reverse

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

  - All SU/CD Trend related parameters
  - Custom Assembly structure (see page 59)

- 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 XM-220 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	35 (0x23)
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-220 Speed 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
$4B_h$	Instance	Allocate_Master/Slave_Connetion_Set
$4C_h$	Instance	Release_Group_2_Identifier_Set

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 XM-220 module provide 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

Table C.8 Assembly Object Instances

Instance	Name	Type	Description
101	Default Poll Response Message	Input	Measurement values
102 - 106	Alternate 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	Startup Period	Alarm 2 Status (CH 2 Speed Alarm)			Alarm 1 Status (CH 1 Speed Alarm)		
1	Relay 2 Status	Reverse Rotation	Alarm 4 Status (CH2 Acceleration Alarm)			Alarm 3 Status (CH1 Acceleration Alarm)		

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
2	Relay 3 Status	0	Alarm 6 Status (CH2 Zero Speed Alarm)			Alarm 5 Status (CH1 Zero Speed Alarm)		
3	Relay 4 Status	0	Locked Rotor Alarm 2 Status			Locked Rotor Alarm 1 Status		
4	Relay 5 Status	0	0			0		

Instance 101 - Measurement Values

This assembly can be selected to be sent in response to an I/O Poll request from a master. This assembly is the default Poll response selection.

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	Channel 1 Speed value							
4 - 7	Channel 2 Speed value							
8 - 11	Channel 1 Acceleration value							
12 - 15	Channel 2 Acceleration value							
16 - 19	Channel 1 Gap value							
20 - 23	Channel 2 Gap value							
24 - 27	Channel 1 Peak Speed							
28 - 31	Channel 2 Peak Speed							

Instance 102 - Measurement Values

This assembly can be selected to be sent in response to an I/O Poll request from a master. This assembly includes all the Gap measurements first.

Table C.12 Instance 102 Data Format (Measurement Values Assembly)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0 - 3	Channel 1 Gap value							
4 - 7	Channel 2 Gap value							
8 - 11	Channel 1 Speed value							
12 - 15	Channel 2 Speed value							
16 - 19	Channel 1 Peak Speed							
20 - 23	Channel 2 Peak Speed							
24 - 27	Channel 1 Acceleration value							
28 - 31	Channel 2 Acceleration value							

Instance 103 - Measurement Values

This assembly can be selected to be sent in response to an I/O Poll request from a Master. This assembly includes all the Channel 1 measurements first.

Table C.13 Instance 103 Data Format (Measurement Values Assembly)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0 - 3	Channel 1 Speed value							
4 - 7	Channel 1 Acceleration value							
8 - 11	Channel 1 Gap value							
12 - 15	Channel 1 Peak Speed							
16 - 19	Channel 2 Speed value							
20 - 23	Channel 2 Acceleration value							
24 - 27	Channel 2 Gap value							
28 - 31	Channel 2 Peak 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.14 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 - 6	Alarm Enable	4	BOOL
21 1D 03 24 ii 30 07	Alarm	$31D_h$	1 - 6	Condition	7	USINT
21 1D 03 24 ii 30 08	Alarm	$31D_h$	1 - 6	Alert Threshold (High)	8	REAL
21 1D 03 24 ii 30 09	Alarm	$31D_h$	1 - 6	Danger Threshold (High)	9	REAL
21 1D 03 24 ii 30 0A	Alarm	$31D_h$	1 - 6	Alert Threshold Low	10	REAL
21 1D 03 24 ii 30 0B	Alarm	$31D_h$	1 - 6	Danger Threshold Low	11	REAL
21 1D 03 24 ii 30 0C	Alarm	$31D_h$	1 - 6	Hysteresis	12	REAL
21 1D 03 24 ii 30 0E	Alarm	$31D_h$	1 - 6	Startup Period	14	UINT
21 1D 03 24 ii 30 14	Alarm	$31D_h$	1 - 6	Inhibit Tach Fault	20	BOOL

Table C.14 Instance 199 Component Mapping

EPATH (where ii = instance number)	Class Name	Class Number	Instance Number	Attribute Name	Attribute Number	Data Type
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	$0F_h$	4 - 8	Parameter Value (Alarm Identifier A)	1	USINT
21 0F 00 24 ii 30 01	Param	$0F_h$	9 - 13	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.15 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.16 Assembly Object Instances

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

Instance Attributes

Table C.17 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.

Table C.17 Connection Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description
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.
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.18 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 Instance 1 indicates whether the module is in the startup period. Instance 2 indicates whether the machine is rotating in the reverse direction.

Class Attributes

Table C.19 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.20 Discrete Input Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get	Value	BOOL	Value	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

For instance 1, a **Value** of 1 means that the startup period is active. For instance 2, a **Value** of 1 means that the machine is rotating in the reverse direction.

Services

Table C.21 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 Startup switch.
33_h	Instance	Close	Closes the virtual Startup switch.

The **Open** and **Close** services are not valid for Instance 2.

Parameter Object (Class ID $0F_H$)

The Parameter Object provides the interface to the XM-220 configuration data.

Parameter Object instance 1 is for the Speed Mode setting (dual channel, single channel redundant, or reverse rotation). Parameter Object instances 2 to 13 provide an alternate method of setting the configuration parameters with EPATH data types. And Parameter Object instances 14 and 15 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.

Class Attributes

Table C.22 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 15 instances of this object.

Table C.23 Parameter Object Instances

Instance	Read Only	Name	Data Type	Valid Values	Default Value
1	No	Mode	USINT	0 = Dual Channel 1 = Single Channel Redundant 2 = Reverse Rotation	0
2	No	4-20mA Output 1 Measurement Identifier	USINT	0 = CH 1 Speed 1 = CH 2 Speed 2 = CH 1 Accel 3 = CH 2 Accel	0
3	No	4-20mA Output 2 Measurement Identifier	USINT	0 = CH 1 Speed 1 = CH 2 Speed 2 = CH 1 Accel 3 = CH 2 Accel	1
4	No	Relay 1 Alarm Identifier A	USINT	0 = CH 1 Speed Alarm 1 = CH 2 Speed Alarm 2 = CH 1 Accel Alarm 3 = CH 2 Accel Alarm 4 = CH 1 Zero Speed Alarm 5 = CH 2 Zero Speed Alarm 6 = CH 1 Locked Rotor Alarm 7 = CH 2 Locked Rotor Alarm	0

Table C.23 Parameter Object Instances

Instance	Read Only	Name	Data Type	Valid Values	Default Value
5	No	Relay 2 Alarm Identifier A	USINT	0 = CH 1 Speed Alarm 1 = CH 2 Speed Alarm 2 = CH 1 Accel Alarm 3 = CH 2 Accel Alarm 4 = CH 1 Zero Speed Alarm 5 = CH 2 Zero Speed Alarm 6 = CH 1 Locked Rotor Alarm 7 = CH 2 Locked Rotor Alarm	0
6	No	Relay 3 Alarm Identifier A	USINT	0 = CH 1 Speed Alarm 1 = CH 2 Speed Alarm 2 = CH 1 Accel Alarm 3 = CH 2 Accel Alarm 4 = CH 1 Zero Speed Alarm 5 = CH 2 Zero Speed Alarm 6 = CH 1 Locked Rotor Alarm 7 = CH 2 Locked Rotor Alarm	0
7	No	Relay 4 Alarm Identifier A	USINT	0 = CH 1 Speed Alarm 1 = CH 2 Speed Alarm 2 = CH 1 Accel Alarm 3 = CH 2 Accel Alarm 4 = CH 1 Zero Speed Alarm 5 = CH 2 Zero Speed Alarm 6 = CH 1 Locked Rotor Alarm 7 = CH 2 Locked Rotor Alarm	0
8	No	Relay 5 Alarm Identifier A	USINT	0 = CH 1 Speed Alarm 1 = CH 2 Speed Alarm 2 = CH 1 Accel Alarm 3 = CH 2 Accel Alarm 4 = CH 1 Zero Speed Alarm 5 = CH 2 Zero Speed Alarm 6 = CH 1 Locked Rotor Alarm 7 = CH 2 Locked Rotor Alarm	0
9	No	Relay 1 Alarm Identifier B	USINT	0 = CH 1 Speed Alarm 1 = CH 2 Speed Alarm 2 = CH 1 Accel Alarm 3 = CH 2 Accel Alarm 4 = CH 1 Zero Speed Alarm 5 = CH 2 Zero Speed Alarm 6 = CH 1 Locked Rotor Alarm 7 = CH 2 Locked Rotor Alarm	1
10	No	Relay 2 Alarm Identifier B	USINT	0 = CH 1 Speed Alarm 1 = CH 2 Speed Alarm 2 = CH 1 Accel Alarm 3 = CH 2 Accel Alarm 4 = CH 1 Zero Speed Alarm 5 = CH 2 Zero Speed Alarm 6 = CH 1 Locked Rotor Alarm 7 = CH 2 Locked Rotor Alarm	1

Table C.23 Parameter Object Instances

Instance	Read Only	Name	Data Type	Valid Values	Default Value
11	No	Relay 3 Alarm Identifier B	USINT	0 = CH 1 Speed Alarm 1 = CH 2 Speed Alarm 2 = CH 1 Accel Alarm 3 = CH 2 Accel Alarm 4 = CH 1 Zero Speed Alarm 5 = CH 2 Zero Speed Alarm 6 = CH 1 Locked Rotor Alarm 7 = CH 2 Locked Rotor Alarm	1
12	No	Relay 4 Alarm Identifier B	USINT	0 = CH 1 Speed Alarm 1 = CH 2 Speed Alarm 2 = CH 1 Accel Alarm 3 = CH 2 Accel Alarm 4 = CH 1 Zero Speed Alarm 5 = CH 2 Zero Speed Alarm 6 = CH 1 Locked Rotor Alarm 7 = CH 2 Locked Rotor Alarm	1
13	No	Relay 5 Alarm Identifier B	USINT	0 = CH 1 Speed Alarm 1 = CH 2 Speed Alarm 2 = CH 1 Accel Alarm 3 = CH 2 Accel Alarm 4 = CH 1 Zero Speed Alarm 5 = CH 2 Zero Speed Alarm 6 = CH 1 Locked Rotor Alarm 7 = CH 2 Locked Rotor Alarm	1
14	No	Poll Connection Produced Connection Path[1]	USINT	101 - 103, 199 (Assembly Object instance number)	101
15	No	Poll Connection Produced Connection Size[1]	UINT	4 -124	32

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.24 Parameter Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
1	Set	Parameter Value		Actual value of parameter	See Table C.23 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.	
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.
6	Get	Data Size	USINT	Number of Bytes in Parameter value.	

Services

Table C.25 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.26 Acknowledge Handler Object Instance Attributes

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

Services

Table C.27 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

The Alarm Object provides no class attributes.

Instances

There are 6 instances of this object.

Table C.28 Alarm Object Instances

Instance	Measurement
Alarm 1	Channel 1 Speed
Alarm 2	Channel 2 Speed
Alarm 3	Channel 1 Acceleration
Alarm 4	Channel 2 Acceleration
Alarm 5	Channel 1 Zero Speed
Alarm 6	Channel 2 Zero Speed

Instance Attributes

Table C.29 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.	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.	0 = Greater than 1 = Less than 2 = Inside range 3 = Outside range

Table C.29 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.	
14	Get/Set	Startup Period	UINT	The amount of time that the Tach Fault status may be inhibited after the startup signal is received.	Seconds
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

The settable attributes of this object are not affected by the status of the Device Mode Object.

Table C.30 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.

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.31 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.32 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.

Table C.32 Device Mode Object Services

Service Code	Class/Instance Usage	Name	Description
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.

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.33 Relay Object Class Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
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.34 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	USINT	The time period that the voting logic must be true before the relay is activated.	0 to 25.5 seconds (specified in tenths of seconds)
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 4 to 8.

Table C.34 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 9 to 13.
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

Setting the attributes of this object are not affected by the status of the Device Mode Object.

Table C.35 Relay Object Services

Service Code	Class/Instance Usage	Name	Description
05_h	Class/Instance	Reset	Resets latched relay(s).
$0E_h$	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.

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.

Instances

There are 2 instances of the object.

Instance Attributes

Table C.36 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
6	Get/Set	Locked Rotor Alarm Enable	BOOL	Indicates whether the locked rotor alarm is enabled.	0 = Disabled 1 = Enabled
7	Get	Locked Rotor Alarm Status	USINT	The current status of the locked rotor alarm.	0 = Normal 1 = Alert (alarm) 2 = Danger (shutdown) 3 = Disarm 4 = Xdcr Fault 5 = Module Fault 6 = Tachometer Fault 7 = Unknown

Table C.36 Speed Measurement Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
8	Get/Set	Locked Rotor Alert Threshold	REAL	The minimum machine speed that must be obtained within the alert period to avoid an alert status.	CPM
9	Get/Set	Locked Rotor Danger Threshold	REAL	The minimum machine speed that must be obtained within the danger period to avoid a danger status.	CPM
10	Get/Set	Locked Rotor Alert Period	USINT	The amount of time the machine has to reach the alert threshold before an alert status is indicated.	Seconds
11	Get/Set	Locked Rotor Danger Period	USINT	The amount of time the machine has to reach the danger threshold before a danger status is indicated.	Seconds
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
13	Get	Acceleration	REAL	The rate of change of the Speed measurement.	CPM/min

Services

Setting the attributes of this object are not affected by the status of the Device Mode Object.

Table C.37 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.

Instances

There are 2 instances of this object.

Instance Attributes

Table C.38 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).

Table C.38 Tachometer Channel Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
8	Get/Set	Name	STRING2	A name to help identify this channel	18 character 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.39 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 2 instances of this object.

Instance Attributes

Table C.40 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
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 3 = Bias current for passive magnetic sensors
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.41 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.

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

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

Class Attributes

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

Instances

There are 2 instances of this object.

Instance Attributes

Table C.42 4-20mA Output Object Instance Attributes

Attr ID	Access Rule	Name	Data Type	Description	Semantics
3	Get	Value	REAL	The current output value.	mA
4	Get/Set	Enable	BOOL	Indicates whether this 4-20mA output is enabled.	0 = Disabled 1 = Enabled
5	Get/Set	Max Range	REAL	The measured value associated with 20mA.	
6	Get/Set	Min Range	REAL	The measured value associated with 4mA.	
7	Get/Set	Measurement Identifier Path	EPATH	Identifies the class, instance, and attribute of a measurement value that this 4-20mA output is tracking.	See Parameter Object instances 2 and 3. See DeviceNet Specification Volume 1 Appendix I.

Services

Table C.43 4-20mA 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.

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).

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	**125K**	**250K**	**500K**
Thick Trunk Line	500m (1,640ft.)	250m (820ft.)	100m (328ft.)
Thin Trunk Line	100m (328ft.)	100m (328ft.)	100m (328ft.)
Maximum Drop Length	6m (2 ft.)	6m (20ft.)	6m (20ft.)
Cumulative Drop Length	156m (512ft.)	78m (256ft.)	39m (128ft.)

The XM measurement module's 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 125kb, 250kb, 500kb, or Autobaud if another device on the network has set the baud rate.

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 is 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 transmit 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.

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.

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.

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-220 Dual Speed module.

transducer

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

virtual relay

A virtual relay is a non-physical relay. It has the same capabilities (monitors 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

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X

Rockwell Automation Support

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.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect support programs. For more information, contact your local distributor or Rockwell Automation representative, 1or visit http://support.rockwellautomation.com.

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If you experience a problem within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your product up and running.

United States	1.440.646.3434 Monday – Friday, 8am – 5pm EST
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Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

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