MXDE3

DeviceNet & Ethernet Communications Module

User's Manual

890041-01-02

BENSHAW
ADVANCED CONTROLS & DRIVES


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1 - Introduction

Technical Support

Technical Support personnel are available to answer questions and provide technical support over the telephone. Refer to Page 10 for contact information.

Start-Up Services

Information about start-up services and fees are available by contacting Benshaw. Refer to Page 10 for contact information

Documentation

Benshaw can provide all customers with:

- Operation Manuals
- Wiring Diagrams

All drawings are produced in AutoCAD™ and are available on CD / DVD or via e-mail by contacting Benshaw Customer Service.

On-Line Documentation

All MXDE3 documentation is available on-line at http://www.benshaw.cwfc.com

Replacement Parts

Spare and replacement parts can be purchased from Benshaw Technical Support.

Publication History

Refer to the inside back cover.

Warranty

Benshaw provides a standard 1 Year factory warranty of the MXDE3 Communication Module.

Contacting Benshaw

Information about Benshaw products and services is available by contacting Benshaw at one of the following offices:

Benshaw Corporate Headquarters

615 Alpha Drive
Pittsburgh, PA 15116
Phone: 412-968-0100
Tech Support: 1-800-203-2416
Fax: 412-968-5415

Benshaw Canada

550 Bright Street East
Listowel, Ontario N4W 3W3
Phone: 519-291-5112
Tech Support: 1-877-291-5112
Fax: (519) 291-2595

Technical support for the MXDE3 Communication Module is available at no charge by contacting Benshaw Customer Service at any of the above telephone numbers. A service technician is available Monday through Friday from 8:00 a.m. to 5:00 p.m. EST.

NOTE: An on-call technician is available after normal business hours and on weekends by calling Benshaw and following the recorded instructions.

To help assure prompt and accurate service, please have the following information available when contacting Benshaw:

- Name of Company
- Telephone number where the caller can be contacted
- Fax number of caller
- Benshaw product name
- Benshaw model number
- Benshaw serial number
- Name of product distributor
- Approximate date of purchase
- A brief description of the application

Overview

MXDE3 Communications Module

The Benshaw MXDE3 Communications Module is designed to make communicating with an MX^2 or MX^3 starter a simple and easy task. The MXDE3 requires only a few simple configuration parameters to connect with a DeviceNet, EtherNet/IP, PCCC, or Modbus-TCP network. Configuration parameters are easily accessed from the built in web server (refer to Section 4).

CAUTION: When using the MXDE3 on a DeviceNet, Modbus-TCP or EtherNet/IP network, the serial timeout function of the MX^2/MX^3 must be enabled. Refer to the Communications Timeout parameters in an MX^2 or MX^3 User Manual for details on enabling the serial time-out function.

Technical Specifications

Network Interface

RJ-45 10/100Base-T Ethernet port

Protocols Supported

EtherNet/IP

PCCC

Modbus-TCP

DeviceNet

LEDs

Five LEDs for device and communication status.

Refer to Section 6, Tables 91 and 92 for LED Diagnostic Codes

Physical Characteristics

Dimensions: 4.2”x 3.25”x 1”

Power Requirements

DC Input Voltage: 230mA @ 8V to 80mA @ 28V

Environmental

Operating Temperature: -40^{o}C to +85^{o}C

MXDE3 Part Numbers

DeviceNet Communications:	COM-100000-00
Ethernet Communications:	COM-100000-01


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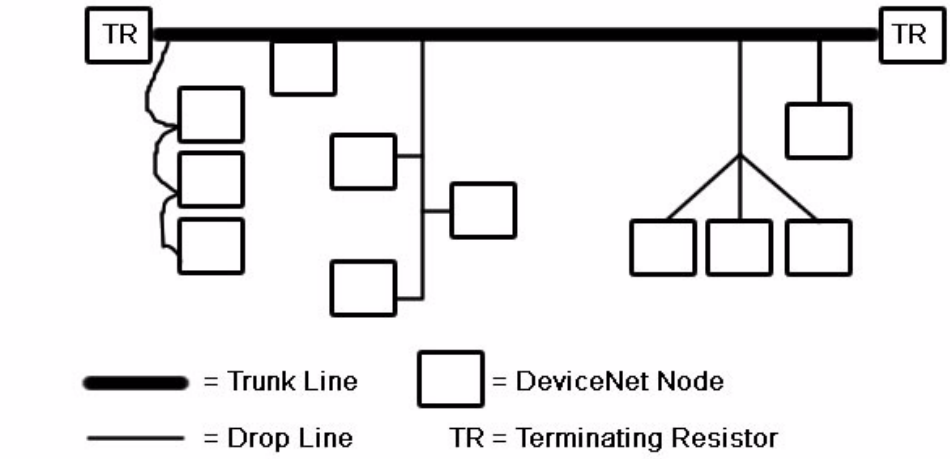
2 - Installation

DeviceNet Considerations

DeviceNet can be configured in a variety of topologies. One example is outlined below.



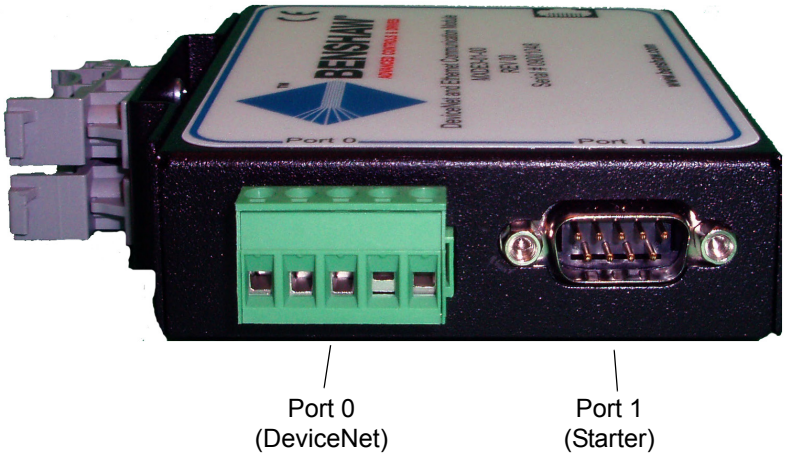
There are physical specifications to consider when installing a DeviceNet network or adding a new DeviceNet device. The table below outlines the maximum cable length for both trunk and drop lines.

DeviceNet Cable Length Limits

Table 1: DeviceNet Cable Limits

Comm Speed	125 Kbps	250 Kbps	500 Kbps
Thick Trunk Length	500m (1640ft)	250m (820ft)	100m (328ft)
Thin Trunk Length	100m (328 ft)	100m (328 ft)	100m (328 ft)
Maximum Length of a Single Drop	6m (20 ft)	6m (20 ft)	6m (20 ft)
Cumulative Length of All Drops	156m (512ft)	78m (256ft)	39m (128ft)

LEDs and Connectors



DeviceNet Connector

Table 2: DeviceNet Connector Description (PORT0)

PIN	CAN
1	V-
2	CAN-
3	SHIELD
4	CAN+
5	V+

Starter Connector

The Starter Connector is used to connect the MXDE3 to a Benshaw starter. See Section 2, Page 17 for an example wiring diagram.

Table 3: DB-9 Connector Description (PORT1)

PIN	RS-485
2	A -
5	Common
7	B +

Ethernet (RJ45) Connector

The Ethernet Connector is located next to the Power LED on the back panel of the MXDE3. Connect an RJ45 cable into the jack (shown below) on the MXDE3 communications module.

There are two LEDs associated with the Ethernet connection; Speed and Link. The Speed LED indicates the current communication speed. If the Speed LED is off, the connection speed is 10 MB. If the Speed LED is illuminated, the connection speed is 100 MB. The Link LED indicates that a valid link is established and there is activity on the connection.

NOTE: For Ethernet capabilities, the module must be powered by 8 to 28 VDC using the supplied barrel connector.

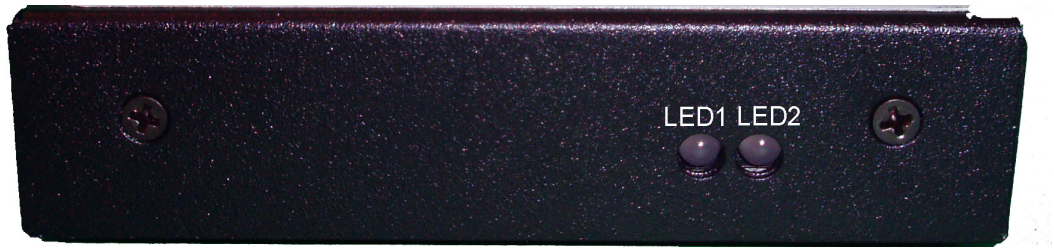
Power Connector

The Power jack is located next to the Power LED (shown above). Insert the power connection from the supplied 24VDC power supply into this jack. The Power LED should be illuminated whenever power is applied.

CAUTION: DeviceNet should receive power from the DeviceNet network Port 0 only. Do not supply power to the Power jack. For DeviceNet, the power jack is used for Ethernet applications only.

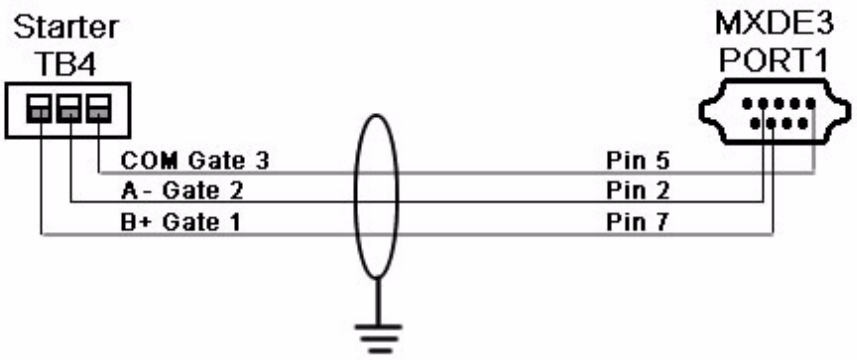
Activity LEDs

There are two communication activity LEDs on the MXDE3 communications module, located on the side opposite the DIN rail mounting hardware (pictured below). Both LEDs are two color, and indicate various states of Ethernet and DeviceNet communications. LED1 indicates Ethernet communication status, while LED2 indicates DeviceNet communications. For a complete list of states, refer to Section 6, Troubleshooting.

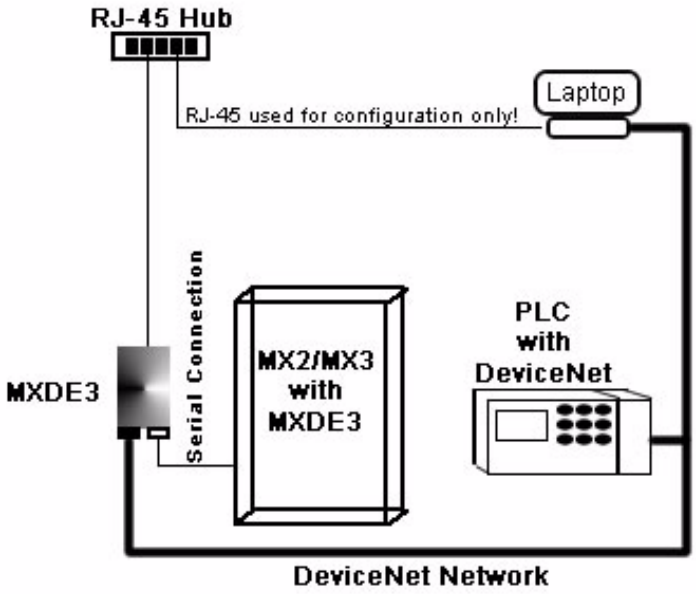


Wiring Examples

Serial



DeviceNet

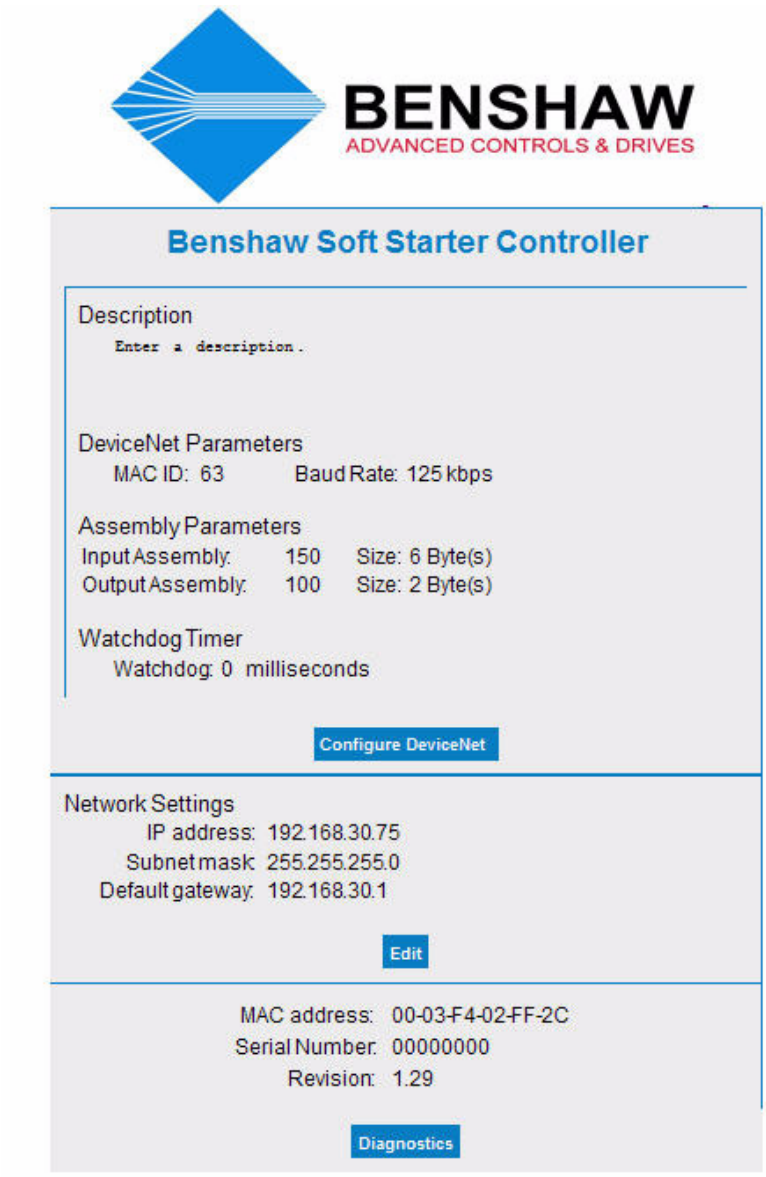


Quickstart - Web Page Based Setup

Web Page

The Web Page Based Setup tool is designed to make both monitoring and basic configuration intuitive and simple. Enter IP Address 192.168.1.200 (Default) into a connected web browser; the Benshaw Soft Starter Controller web-page shown below will be displayed.

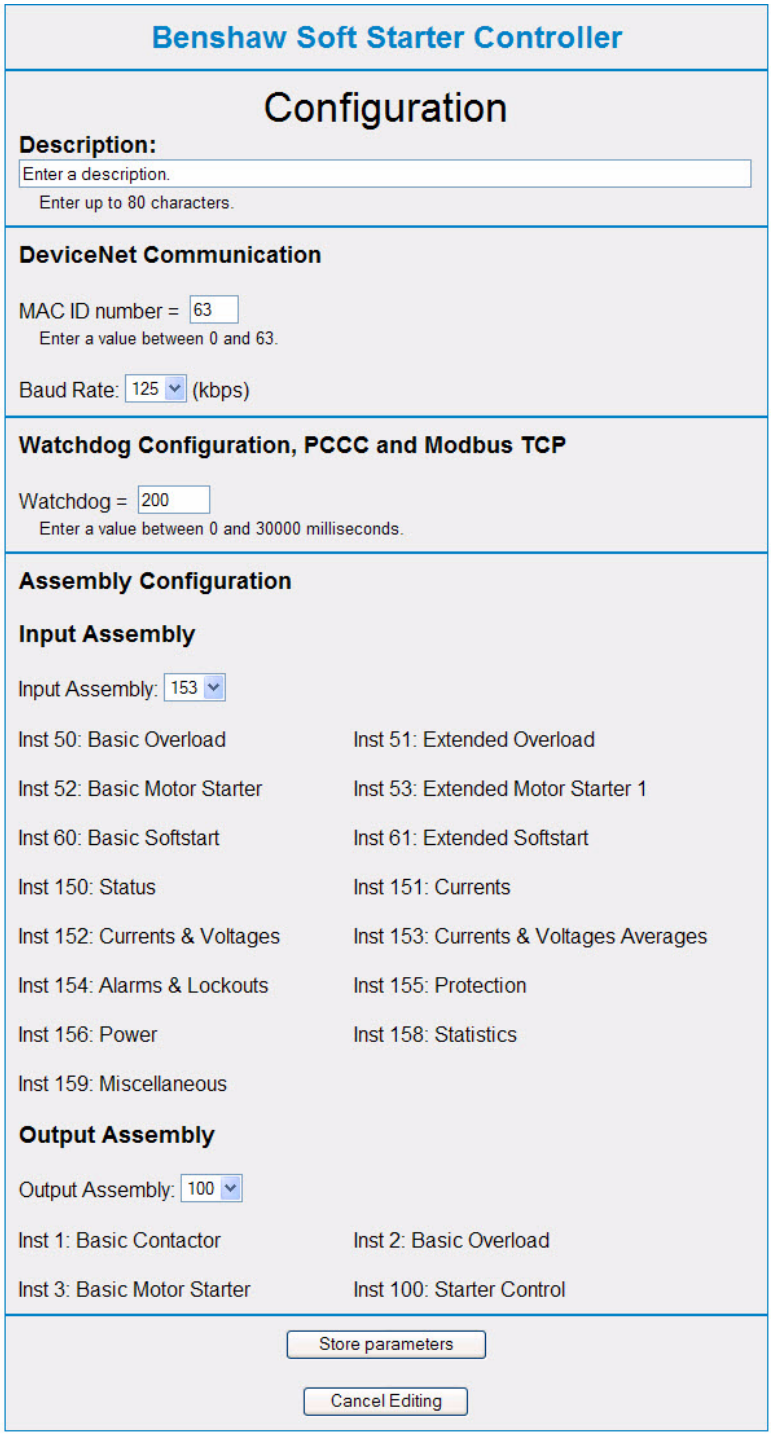
NOTE: The MXDE3 must be connected to the starter, and a computer to the MXDE3 ethernet port before accessing the web based configuration tool.



The Web Page Based Setup tool is divided into 4 sections: DeviceNet Configuration, Network Configuration, Device Info, and Diagnostics.

DeviceNet Configuration

Selecting the Configure DeviceNet button on the Home Page will enable the DeviceNet Configuration web-page below.

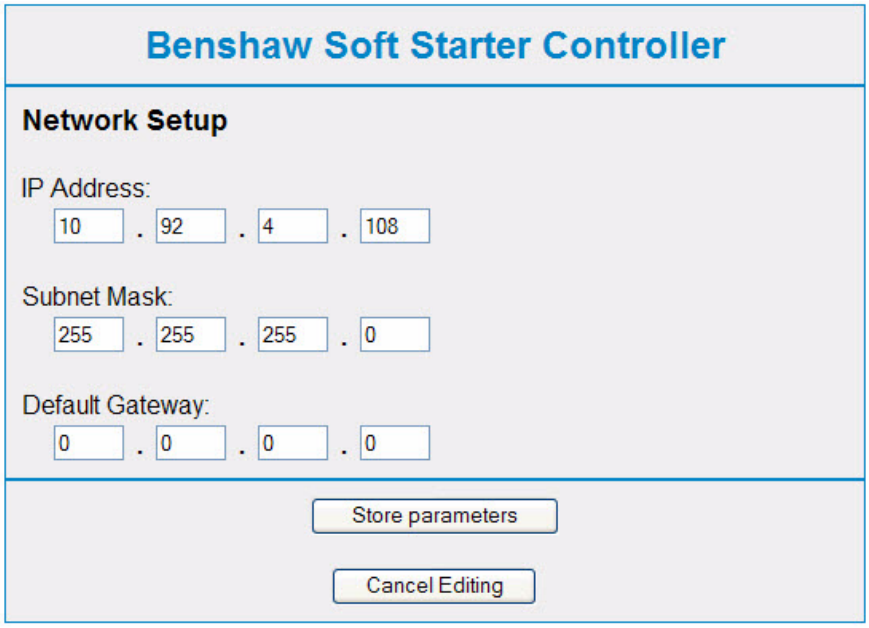


The DeviceNet Configuration screen enables access to a Controller Description, DeviceNet Communication, and Assembly Configuration parameters.

To enter a description, click within the Description field and enter the new description. Specifying a new MAC ID number is accomplished in the same manner. To select a different Baud Rate, click on the drop down arrow next to the current baud rate, then select either 125, 250, or 500 kbps. To select a different Input or Output Assembly, click on the drop down arrow next to the current assembly and select one from the drop down list. Click Store Parameters to save the changes.

Ethernet Configuration

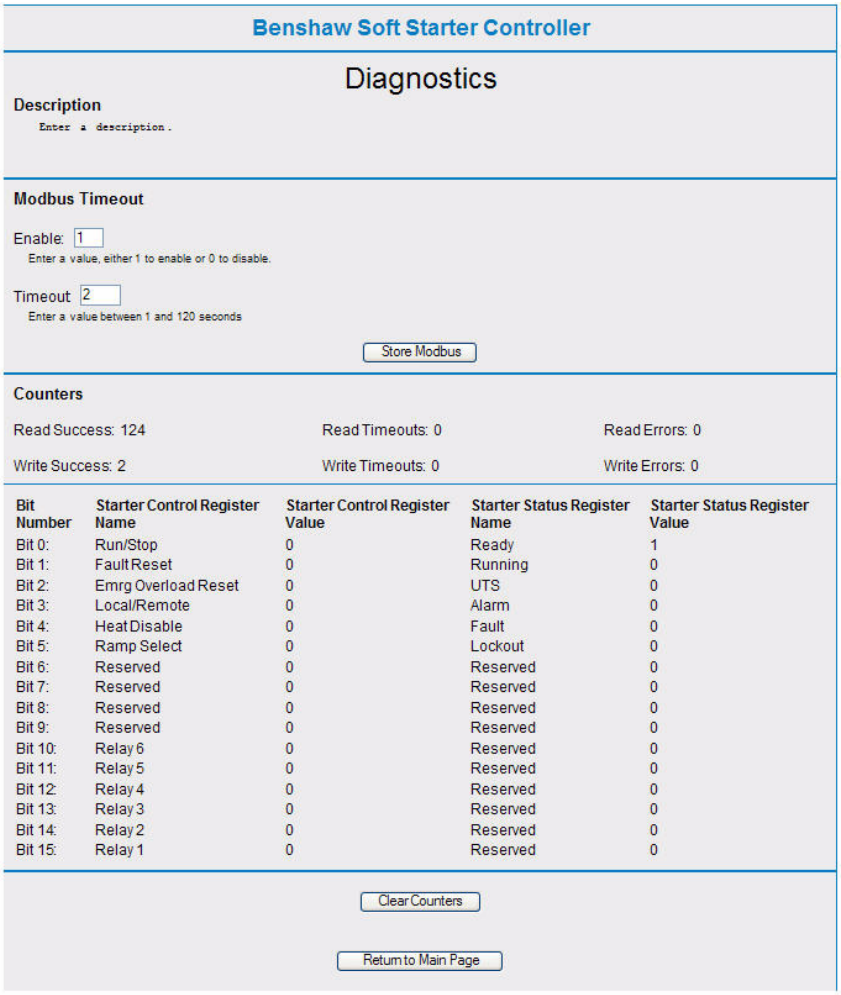
Click the Edit button within the Network Settings box on the home page to access the Network Setup web-page shown below.



From the Network Setup screen the IP Address, Subnet Mask, and Default Gateway can be configured. Click within the first box of the parameter to be changed, erase the current value, then enter the required value. After the first three digits are entered, the next box will automatically highlight. Continue to enter new values to overwrite the current values, and each subsequent box will highlight when the current box is full. Conversely, double-clicking on any box enables overwriting of a current value. When changes are complete, click Store Parameters to save the changes and return to the Main screen.

Diagnostics

Clicking on the Diagnostics button at the bottom of the home page enables access to the Diagnostics web page below.



Benshaw Soft Starter Controller

Diagnostics

Description

Enter a description.

Modbus Timeout

Enable: 1

Enter a value, either 1 to enable or 0 to disable.

Timeout 2

Enter a value between 1 and 120 seconds

Store Modbus

Counters

Read Success: 124 Read Timeouts: 0 Read Errors: 0

Write Success: 2 Write Timeouts: 0 Write Errors: 0

Bit Number	Starter Control Register Name	Starter Control Register Value	Starter Status Register Name	Starter Status Register Value
Bit 0:	Run/Stop	0	Ready	1
Bit 1:	Fault Reset	0	Running	0
Bit 2:	Emrg Overload Reset	0	UTS	0
Bit 3:	Local/Remote	0	Alarm	0
Bit 4:	Heat Disable	0	Fault	0
Bit 5:	Ramp Select	0	Lockout	0
Bit 6:	Reserved	0	Reserved	0
Bit 7:	Reserved	0	Reserved	0
Bit 8:	Reserved	0	Reserved	0
Bit 9:	Reserved	0	Reserved	0
Bit 10:	Relay 6	0	Reserved	0
Bit 11:	Relay 5	0	Reserved	0
Bit 12:	Relay 4	0	Reserved	0
Bit 13:	Relay 3	0	Reserved	0
Bit 14:	Relay 2	0	Reserved	0
Bit 15:	Relay 1	0	Reserved	0

Clear Counters

Return to Main Page

Information on the Diagnostics page pertains only to the RS485 Modbus connection between the MXDE3 and the starter: It does not pertain to the Modbus-TCP interface.

The MXDE3 must be connected to the starter. Use the web page shown above to ensure that Enable is set to 1 and Timeout is set to 2 in the Modbus Timeout box.

In the Counters box, the current number of read/write successes, read/write timeouts and read/write errors can be monitored. A communications timeout occurs if there is no response within the timeout limit after a read or write is requested. On-screen data is not automatically updated, and must be refreshed by pressing F5 on the PC keyboard. Clicking on the Clear Counters button at the bottom of this screen will reset all counters to zero.

The current state of the Starter Control and Status Registers can be viewed in the Register Status box. The Starter Control Register provides the current states of various digital inputs and relay outputs. The Starter Status Register provides the current state of the starter. On-screen data is not automatically updated, and must be refreshed by pressing F5 on the PC keyboard.

Clicking on the Return to Main Page button will return the display to the Main page.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3 - CIP Device Profile

The CIP (Common Interface Profile) is utilized by both DeviceNet and Ethernet/IP.

Data Types

The following data types are used in the Object model for the MXDE3 communications module.

Table 4: Data Types Used in the Object Model

Data Type	Description
USINT	Unsigned Short Integer (8-bit)
UINT	Unsigned Integer (16-bit)
UDINT	Unsigned Double Integer (32-bit)
INT	Signed Integer (16-bit)
DINT	Single Double Integer (32-bit)
STRING	Character String (1 Byte per Character)
SHORT STRINGnn	Character String (1st Byte is length; up to nn Characters)
BOOL	Boolean (0 or 1)
BYTE	Bit String (8-bits)
WORD	Bit String (16-bits)
DWORD	Bit String (32-bits)
REAL	IEEE 32-bit Single Precision Floating Point

Identity Object

(0x01 - 1 Instance)

Table 5: Identity Object Class Attributes (0x01 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 6: Identity Object Instance Attributes (0x01 - Instance 1)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Vendor Number	UINT	605	GET
2	Device Type	UINT	0x17	GET
3	Product Code Number	UINT	0x07 or 0x08	GET
4	Product Major Revision Product Minor Revision	USINT USINT	01 01	GET
5	Status	WORD	See Below	GET
6	Serial Number	UDINT	Unique 32 Bit Value	GET
7	Product Name	SHORT STRING32	MX^2 or MX^3 (Dependent on Product Number)	GET

Table 7: Identity Object Status Values

Bit(s)	Called	Description
0	Owned	TRUE indicates the device (or an object within the device) has an owner. Within the Master/Slave paradigm the setting of this bit means that the Predefined Master/Slave Connection Set has been allocated to a master. Outside the Master/Slave paradigm the meaning of this bit is not applicable.
1		*Reserved, shall be 0*
2	Configured	TRUE indicates the application of the device has been configured to do something different than the out-of-the-box default. This shall not include configuration of the communications.
3		*Reserved, shall be 0*
4 - 7	Extended Device Status	Vendor specific or as defined by table below. The EDS shall indicate if the device follows the public definition for these bits.
8	Minor Recoverable Fault	TRUE indicates the device detected a problem with itself, which is thought to be recoverable. The problem does not cause the device to go into one of the faulted states.
9	Minor Unrecoverable Fault	TRUE indicates the device detected a problem with itself, which is thought to be unrecoverable. The problem does not cause the device to go into one of the faulted states.
10	Major Recoverable Fault	TRUE indicates the device detected a problem with itself, which caused the device to go into the “Major Recoverable Fault” state.
11	Major Unrecoverable Fault	TRUE indicates the device detected a problem with itself, which caused the device to go into the “Major Unrecoverable Fault” state.

Table 7: Identity Object Status Values (Continued)

Bit(s)	Called	Description
12 - 15		*Reserved, shall be 0*

Table 8: Identity Object Extended Device Status Values

Bits 4 - 7	Extended Device Status Description
0000	Self-Testing or Unknown
0001	Firmware update in progress
0010	At least one faulted I/O Connection
0011	No I/O connection established
0100	Non-Volatile Configuration bad
0101	Major Fault - either bit 10 or 11 is TRUE (1)
0110	At least one I/O connection in Run mode
0111	At least one I/O connection established, all in Idle mode
1000 and 1001	Reserved, Shall be 0
1010 through 1111	Vendor / Product specific

Table 9: Identity Object Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x05	No	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single

Message Router Object

(0x02 - 1 Instance)

****** No Supported Services or Attributes ******

DeviceNet Object

(0x03 - 1 Instance)

Table 10: DeviceNet Object Class Attributes (0x03 - Instance 0)

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

Table 11: DeviceNet Object Instance Attributes (0x03 - Instance 1)

Attribute ID	Name	Data Type	Access Rule	Description
1	Mac ID	USINT	Get/Set	Node Address - range of 0-63 Note: Set from web page
2	Baud Rate	USINT	Get/Set	0-125 kbps 1-250 kbps 2-500 kbps Note: Change does not take effect until after the starter is reset
5	Structure of: Allocation Choice Byte Master's Mac ID	BYTE USINT	GET GET	1- Explicit Message 2- Polled I/O

Table 12: DeviceNet Object Common Services

Service Code	Implemented for		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Input Assembly Object

(0x04 - 25 Instances)

Table 13: Assembly Object Class Attributes (0x04 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	2	Get
2	Max Instance	UINT	159	Get
100	I/O Input Produce Length	UINT	8	Get
101	I/O Input Assembly Instance	UINT	153	Get / Set
102	I/O Output Consume Length	UINT	3	Get
103	I/O Output Assembly Instance	UINT	100	Get / Set

Table 14: Assembly Object Input Instance 50 (0x32) - Basic Overload Input

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Faulted / Trip

Table 15: Assembly Object Input Instance 51 (0x33) - Extended Overload Input

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Warning	Faulted / Trip

Table 16: Assembly Object Input Instance 52 (0x34) - Basic Motor Starter Input

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	Reserved	Reserved	Reserved	Running 1	Reserved	Faulted / Trip

Table 17: Assembly Object Input Instance 53 (0x35) - Extended Motor Starter 1 Input

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	Reserved	Ready	Reserved	Running 1	Warning	Faulted / Trip

Table 18: Assembly Object Input Instance 60 (0x3C) - Basic Softstart Input

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Reference	Reserved	Reserved	Reserved	Reserved	Running 1	Reserved	Faulted / Trip

Table 19: Assembly Object Input Instance 61 (0x3D) - Extended Softstart Input

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Reference	Reserved	Reserved	Ready	Reserved	Running 1	Warning	Faulted / Trip

Table 20: Assembly Object Input Instance 150 (0x96) - Input Status

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Reference	Reserved	Reserved	Ready	Reserved	Running 1	Warning	Faulted / Trip
1	Lockout	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Start
2	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1
3	Current Fault Code							
4	Analog Input LSB							
5	Analog Input MSB							

Table 21: Assembly Object Input Instance 151 (0x97) - Input Currents

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Reference	Reserved	Reserved	Ready	Reserved	Running 1	Warning	Faulted / Trip
1	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
2	L1 Current LSB (0.1 A rms)							
3	L1 Current MSB (0.1 A rms)							
4	L2 Current LSB (0.1 A rms)							
5	L2 Current MSB (0.1 A rms)							
6	L3 Current LSB (0.1 A rms)							
7	L3 Current MSB (0.1 A rms)							

Table 22: Assembly Object Input Instance 152 (0x98) - Input Currents & Voltages

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Reference	Reserved	Reserved	Ready	Reserved	Running 1	Warning	Faulted / Trip
1	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
2	L1 Current LSB (0.1 A rms)							
3	L1 Current MSB (0.1 A rms)							
4	L2 Current LSB (0.1 A rms)							
5	L2 Current MSB (0.1 A rms)							
6	L3 Current LSB (0.1 A rms)							
7	L3 Current MSB (0.1 A rms)							
8	L1 Voltage LSB							
9	L1 Voltage MSB							
10	L2 Voltage LSB							
11	L2 Voltage MSB							
12	L3 Voltage LSB							
13	L3 Voltage MSB							
14	Power Factor (0.01%) LSB (signed integer: -lag, +lead)							
15	Power Factor (0.01%) MSB (signed integer: -lag, +lead)							

Table 23: Assembly Object Input Instance 153 (0x99) - Input Current/Voltage Averages

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Reference	Reserved	Reserved	Ready	Reserved	Running 1	Warning	Faulted / Trip
1	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
2	Average Current LSB (0.1 A rms)							
3	Average Current MSB (0.1 A rms)							
4	Average Voltage LSB							
5	Average Voltage MSB							
6	Power Factor (0.01%) LSB (signed integer: -lag, +lead)							
7	Power Factor (0.01%) MSB (signed integer: -lag, +lead)							

Table 24: Assembly Object Input Instance 154 (0x9A) - Input Alarms and Lockouts

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Reference	Reserved	Reserved	Ready	Reserved	Running 1	Warning	Faulted / Trip
1	A12 Low Frequency	A11 Not CBA	A10 Not ABC	A8 Other RTD	A7 Bearing RTD	A6 Stator RTD	A5 Motor PTC	A2 Motor Overload
2	A25 High Line L2-L3	A24 High Line L1-L2	A23 Low Line L3-L1	A22 Low Line L2-L3	A21 Low Line L1-L2	A15 Not Three Phase	A14 Not Single Phase	A13 High Frequency
3	A36 Lagging PF	A35 Leading PF	A34 Under Current	A31 Over Current	A29 PORT Timeout	A28 No Line	A27 Phase Loss	A26 High Line L3-L1
4	A63 DI 4	A62 DI 3	A61 DI 2	A60 DI 1	A53 Tach Loss	A47 Stack Over Temp	A38 Ground Fault	A37 Current Imbalance
5	Reserved	Reserved	Reserved	A71 Analog Input	A67 DI 8	A66 DI 7	A65 DI 6	A64 DI 5
6	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
7	L47 Stack Over Temp	L46 Disconnect	L45 Run Interlock	L8 Other RTD	L7 Bearing RTD	L6 Stator RTD	L5 Motor PTC	L2 Motor Overload
8	Reserved	Reserved	L80 RTD Comm. Loss	L59 Starts per Hour	L58 Backspin Timer	L57 Time Between Starts	L56 RTD Open/ Short	L50 Low Control Power

Table 25: Assembly Object Input Instance 155 (0x9B) - Input Protection

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Reference	Reserved	Reserved	Ready	Reserved	Running 1	Warning	Faulted / Trip
1	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
2	Motor Overload (%)							
3	Residual Ground Fault Current (0.1A)							
4	Current Imbalance (0.1%) LSB							
5	Current Imbalance (0.1%) MSB							
6	Zero-Sequence Ground Fault Current (0.1A) LSB							
7	Zero-Sequence Ground Fault Current (0.1A) MSB							

Table 26: Assembly Object Input Instance 156 (0x9C) - Input Power

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Reference	Reserved	Reserved	Ready	Reserved	Running 1	Warning	Faulted / Trip
1	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
2	Tru Torque %							
3	Power %							
4	Watts (0:7)							
5	Watts (8:15)							
6	Watts (16:23)							
7	Watts (24:31)							
8	VA (0:7)							
9	VA (8:15)							
10	VA (16:23)							
11	VA (24:31)							
12	VAR (0:7) (signed integer)							
13	VAR (8:15) (signed integer)							
14	VAR (16:23) (signed integer)							
15	VAR (24:31) (signed integer)							
16	KWh (0:7)							
17	KWh (8:15)							
18	KWh (16:23)							
19	KWh (24:31)							

Table 27: Assembly Object Input Instance 158 (0x9E) - Input Statistics

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Reference	Reserved	Reserved	Ready	Reserved	Running 1	Warning	Faulted / Trip
1	Running Minutes							
2	Running Hours LSB							
3	Running Hours MSB							
4	Number of Starts LSB							
5	Number of Starts MSB							
6	Peak Starting Current (A) LSB							
7	Peak Starting Current (A) MSB							
8	Last Starting Duration (0.1s) LSB							
9	Last Starting Duration (0.1s) MSB							

Table 28: Assembly Object Input Instance 159 (0x9F) - Input Misc

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	At Reference	Reserved	Reserved	Ready	Reserved	Running 1	Warning	Faulted / Trip
1	Phase Order							
2	Line Frequency (0.1Hz) LSB							
3	Line Frequency (0.1Hz) MSB							

Table 29: Assembly Object Input Data Mapping

Data Component Name	Class Name	Class Number	Instance Number	Attribute Number	Modbus Register Read From
Faulted	Control Supervisor	0x29	0x01	0x0A	Bit4: 40021 Bit4: 30021
Warning	Control Supervisor	0x29	0x01	0x0B	Bit3: 40021 Bit3: 30021
Running1	Control Supervisor	0x29	0x01	0x07	Bit1: 40021 Bit1: 30021
Ready	Control Supervisor	0x29	0x01	0x09	Bit0: 40021 Bit0: 30021
At Reference	Softstart	0x2D	0x01	0x03	Bit2: 40021 Bit2: 30021
Start	Discrete Input Point	0x08	0x09	0x03	Bit0: 40022 Bit0: 30022
DI1	Discrete Input Point	0x08	0x01	0x03	Bit1: 40022 Bit1: 30022
DI2	Discrete Input Point	0x08	0x02	0x03	Bit2: 40022 Bit2: 30022
DI3	Discrete Input Point	0x08	0x03	0x03	Bit3: 40022 Bit3: 30022
DI4	Discrete Input Point	0x08	0x04	0x03	Bit4: 40022 Bit4: 30022
DI5	Discrete Input Point	0x08	0x05	0x03	Bit5: 40022 Bit5: 30022
DI6	Discrete Input Point	0x08	0x06	0x03	Bit6: 40022 Bit6: 30022
DI7	Discrete Input Point	0x08	0x07	0x03	Bit7: 40022 Bit7: 30022
DI8	Discrete Input Point	0x08	0x08	0x03	Bit8: 40022 Bit8: 30022
Present Fault Code	Control Supervisor	0x29	0x01	0x0D	40027 / 30027
L1 Current	Overload	0x2C	0x01	0x08	40029 / 30029
L2 Current	Overload	0x2C	0x01	0x09	40030 / 30030
L3 Current	Overload	0x2C	0x01	0x0A	40031 / 30031
L1 Voltage	Status & Control	0x69	0x01	0x11	40036 / 30036
L2 Voltage	Status & Control	0x69	0x01	0x12	40037 / 30037
L3 Voltage	Status & Control	0x69	0x01	0x13	40038 / 30038

Table 29: Assembly Object Input Data Mapping (Continued)

Data Component Name	Class Name	Class Number	Instance Number	Attribute Number	Modbus Register Read From
Power Factor	Status & Control	0x69	0x01	0x15	40040 / 30040
Average Current	Overload	0x2C	0x01	0x5	40028 / 30028
Average Voltage	Status & Control	0x69	0x01	0x10	40035 / 30035
A2 - Motor Overload	Status & Control	0x69	0x01	0x04	Bit 0: 40023 Bit 0: 30023
A5 - Motor PTC	Status & Control	0x69	0x01	0x04	Bit 1: 40023 Bit 1: 30023
A6 - Stator RTD	Status & Control	0x69	0x01	0x04	Bit 2: 40023 Bit 2: 30023
A7 - Bearing RTD	Status & Control	0x69	0x01	0x04	Bit 3: 40023 Bit 3: 30023
A8 - Other RTD	Status & Control	0x69	0x01	0x04	Bit 4: 40023 Bit 4: 30023
A10 - Not ABC	Status & Control	0x69	0x01	0x04	Bit 5: 40023 Bit 5: 30023
A11 - Not CBA	Status & Control	0x69	0x01	0x04	Bit 6: 40023 Bit 6: 30023
A12 - Low Frequency	Status & Control	0x69	0x01	0x04	Bit 7: 40023 Bit 7: 30023
A13 - High Frequency	Status & Control	0x69	0x01	0x04	Bit 8: 40023 Bit 8: 30023
A14 - Not Single Phase	Status & Control	0x69	0x01	0x04	Bit 9: 40023 Bit 9: 30023
A15 - Not Three Phase	Status & Control	0x69	0x01	0x04	Bit 10: 40023 Bit 10: 30023
A21 - Low Line L1 - L2	Status & Control	0x69	0x01	0x04	Bit 11: 40023 Bit 11: 30023
A22 - Low Line L2 - L3	Status & Control	0x69	0x01	0x04	Bit 12: 40023 Bit 12: 30023
A23 - Low Line L3 - L1	Status & Control	0x69	0x01	0x04	Bit 13: 40023 Bit 13: 30023
A24 - High Line L1 - L2	Status & Control	0x69	0x01	0x04	Bit 14: 40023 Bit 14: 30023
A25 - High Line L2 - L3	Status & Control	0x69	0x01	0x04	Bit 15: 40023 Bit 15: 30023
A26 - High Line L3 - L1	Status & Control	0x69	0x01	0x05	Bit 0: 40024 Bit 0: 30024
A27 - Phase Loss	Status & Control	0x69	0x01	0x05	Bit 1: 40024 Bit 1: 30024
A28 - No Line	Status & Control	0x69	0x01	0x05	Bit 2: 40024 Bit 2: 30024
A29 - PORT Timeout	Status & Control	0x69	0x01	0x05	Bit 3: 40024 Bit 3: 30024
A31 - Over Current	Status & Control	0x69	0x01	0x05	Bit 4: 40024 Bit 4: 30024
A34 - Under Current	Status & Control	0x69	0x01	0x05	Bit 5: 40024 Bit 5: 30024

Table 29: Assembly Object Input Data Mapping (Continued)

Data Component Name	Class Name	Class Number	Instance Number	Attribute Number	Modbus Register Read From
A35 - Leading PF	Status & Control	0x69	0x01	0x05	Bit 6: 40024 Bit 6: 30024
A36 - Lagging PF	Status & Control	0x69	0x01	0x05	Bit 7: 40024 Bit 7: 30024
A37 - Current Imbalance	Status & Control	0x69	0x01	0x05	Bit 8: 40024 Bit 8: 30024
A38 - Ground Fault	Status & Control	0x69	0x01	0x05	Bit 9: 40024 Bit 9: 30024
A47 - Stack Over Temp	Status & Control	0x69	0x01	0x05	Bit 10: 40024 Bit 10: 30024
A53 - Tach Loss	Status & Control	0x69	0x01	0x05	Bit 11: 40024 Bit 11: 30024
A60 - DI 1	Status & Control	0x69	0x01	0x05	Bit 12: 40024 Bit 12: 30024
A61 - DI 2	Status & Control	0x69	0x01	0x05	Bit 13: 40024 Bit 13: 30024
A62 - DI 3	Status & Control	0x69	0x01	0x05	Bit 14: 40024 Bit 14: 30024
A63 - DI 4	Status & Control	0x69	0x01	0x05	Bit 15: 40024 Bit 15: 30024
A64 - DI 5	Status & Control	0x69	0x01	0x06	Bit 0: 40025 Bit 0: 30025
A65 - DI 6	Status & Control	0x69	0x01	0x06	Bit 1: 40025 Bit 1: 30025
A66 - DI 7	Status & Control	0x69	0x01	0x06	Bit 2: 40025 Bit 2: 30025
A67 - DI 8	Status & Control	0x69	0x01	0x06	Bit 3: 40025 Bit 3: 30025
A71 - Analog Input	Status & Control	0x69	0x01	0x06	Bit 4: 40025 Bit 4: 30025
L2 - Motor Overload	Status & Control	0x69	0x01	0x07	Bit 0: 40026 Bit 0: 30026
L5 - Motor PTC	Status & Control	0x69	0x01	0x07	Bit 1: 40026 Bit 1: 30026
L6 - Stator RTD	Status & Control	0x69	0x01	0x07	Bit 2: 40026 Bit 2: 30026
L7 - Bearing RTD	Status & Control	0x69	0x01	0x07	Bit 3: 40026 Bit 3: 30026
L8 - Other RTD	Status & Control	0x69	0x01	0x07	Bit 4: 40026 Bit 4: 30026
L45 - Run Interlock	Status & Control	0x69	0x01	0x07	Bit 5: 40026 Bit 5: 30026
L46 - Disconnect	Status & Control	0x69	0x01	0x07	Bit 6: 40026 Bit 6: 30026
L47 - Stack Over Temp	Status & Control	0x69	0x01	0x07	Bit 7: 40026 Bit 7: 30026
L50 - Low Control Power	Status & Control	0x69	0x01	0x07	Bit 8: 40026 Bit 8: 30026

Table 29: Assembly Object Input Data Mapping (Continued)

Data Component Name	Class Name	Class Number	Instance Number	Attribute Number	Modbus Register Read From
L56 - RTD Open/Short	Status & Control	0x69	0x01	0x07	Bit 9: 40026 Bit 9: 30026
L57 - Time Between Starts	Status & Control	0x69	0x01	0x07	Bit 10: 40026 Bit 10: 30026
L58 - Backspin Timer	Status & Control	0x69	0x01	0x07	Bit 11: 40026 Bit 11: 30026
L59 - Starts per Hour	Status & Control	0x69	0x01	0x07	Bit 12: 40026 Bit 12: 30026
L80 - RTD Comm. Loss	Status & Control	0x69	0x01	0x07	Bit 13: 40026 Bit 13: 30026
Motor Overload	Overload	0x2C	0x01	0x0C	40039 / 30039
Residual Ground Fault Current	Overload	0x2C	0x01	0x0C	40033 / 30033
Current Imbalance	Overload	0x2C	0x01	0x06	40032 / 30032
Zero-Sequence Ground Fault Current	Overload	0x2C	0x01	0x6A	40034 / 30034
TruTorque %	Status & Control	0x69	0x01	0x04	40056 / 30056
Power %	Status & Control	0x69	0x01	0x05	40057 / 30057
Watts (low 16)	Status & Control	0x69	0x01	0x16	40041 / 30041
Watts (high 16)	Status & Control	0x69	0x01	0x17	40042 / 30042
VA (low 16)	Status & Control	0x69	0x01	0x18	40043 / 30043
VA (high 16)	Status & Control	0x69	0x01	0x19	40044 / 30044
vars (low 16)	Status & Control	0x69	0x01	0x1A	40045 / 30045
vars (high 16)	Status & Control	0x69	0x01	0x1B	40046 / 30046
kW hours (low 16)	Status & Control	0x69	0x01	0x1C	40047 / 30047
kW hours (high 16)	Status & Control	0x69	0x01	0x1D	40048 / 30048
Analog input	Status & Control	0x69	0x01	0x20	40051 / 30051
Running Time (mins)	Real TIme Data	0x66	0x01	0x02	40054 / 30054
Running Time (hrs)	Real Time Data	0x66	0x01	0x01	40053 / 30053
Starts	Soft Start	0x2D	0x01	0x64	40055 / 30055
Peak Starting Current	Real Time Data	0x66	0x01	0x06	40058 / 30058
Last Starting Duration	Real Time Data	0x66	0x01	0x07	40059 / 30059
Phase Order	Status & Control	0x69	0x01	0x1E	40049 / 30049
Line Frequency	Status & Control	0x69	0x01	0x1F	40050 / 30050

Output Assembly Object

(0x04 - 4 Instances)

Table 30: Assembly Object Output Instance 1 (0x01) - Basic Contactor Output

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Run 1

Table 31: Assembly Object Output Instance Attribute 2 (0x02) - Basic Overload Output

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	Reserved	Reserved	Reserved	Fault Reset	Reserved	Reserved

Table 32: Assembly Object Output Instance Attribute 3 (0x03) - Basic Motor Starter Output

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	Reserved	Reserved	Reserved	Fault Reset	Reserved	Run1

Table 33: Assembly Object Output Instance Attribute 100 (0x64) - Starter Control

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	Ramp Select	Heater Disable	Local Remote	Emergency OL Reset	Fault Reset	Run1
1	Reserved	Reserved	Relay 6	Relay 5	Relay 4	Relay 3	Relay 2	Relay 1

Table 34: Assembly Object Output Data Mapping

Data Component Name	Class Name	Class Number	Instance Number	Attribute Number	Modbus Register Read / Write
Run 1	Control Supervisor	0x29	0x01	0x03	Bit 0: 40020 Bit 0: 30020
Fault Reset	Control Supervisor	0x29	0x01	0x0C	Bit 1: 40020 Bit 1: 30020
Emergency OL Reset					Bit 2: 40020 Bit 2: 30020
Local Remote					Bit 3: 40020 Bit 3: 30020
Heater Disable					Bit 4: 40020 Bit 4: 30020
Ramp Select					Bit 5: 40020 Bit 5: 30020
Relay 1	Discrete Output Point	0x09	0x01	0x03	Bit 15: 40020 Bit 15: 30020
Relay 2	Discrete Output Point	0x09	0x02	0x03	Bit 14: 40020 Bit 14: 30020
Relay 3	Discrete Output Point	0x09	0x03	0x03	Bit 13: 40020 Bit 13: 30020
Relay 4	Discrete Output Point	0x09	0x04	0x03	Bit 12: 40020 Bit 12: 30020
Relay 5	Discrete Output Point	0x09	0x05	0x03	Bit 11: 40020 Bit 11: 30020
Relay 6	Discrete Output Point	0x09	0x06	0x03	Bit 10: 40020 Bit 10: 30020

Heartbeat and Configuration Instances

Input Only Heartbeat (Instance 128 - EtherNet/IP ONLY)

This instance allows clients to monitor input data without providing output data.

Listen Only Heartbeat (Instance 129 - EtherNet/IP ONLY)

This instance allows clients to monitor input data without providing output data. To utilize this connection type, an owning connection must exist from a second client and the configuration of the connection must match exactly.

Discrete / Analog Configuration (Instance 148 - EtherNet/IP ONLY)

This instance is used to supply Discrete / Analog configuration information as the connection is allocated. Configuration data is not required, but must match if supplied. Contents of the configuration instance are TBD.

ASCII Configuration (Instance 149 - EtherNet/IP ONLY)

This instance is used to supply ASCII configuration information as the connection is allocated. Configuration data is not required, but must match if supplied. Contents of the configuration instance are TBD.

Table 35: Assembly Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	Yes	Yes	Set_Attribute_Single

Connection Object

(0x05 - 2 Instances)

Table 36: Connection Object Class Attributes (0x05 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 37: Connection Object Instance Attributes (0x05 - Instance 1-2) Explicit, Polled I/O

Attribute ID	Name	Data Type	Data Value		Access Rule
			Instance 1 Explicit Message Connection	Instance 2 Polled I/O Message Connection	
1	State	USINT	0 = NonExistent 3 = Established 5 = Deferred Delete	0 = NonExistent 1 = Configuring 3 = Established 4 = Timed Out	Get
2	Instance Type	USINT	0	1	Get
3	Transport Trigger	USINT	0x83	0x82	Get
4	Produced Connection ID	UINT	$10xxxxxx011_{BIN}$ XXXXXX = Node Address	$01111xxxxxx_{BIN}$ XXXXXX = Node Address	Get
5	Consumed Connection ID	UINT	$10xxxxxx100_{BIN}$ XXXXXX = Node Address	$10xxxxxx100_{BIN}$ XXXXXX = Node Address	Get
6	Initial Comm. Character	USINT	0x21	0x01	Get
7	Produced Connection Size	UINT	VARIES	VARIES	Get
8	Consumed Connection Size	UINT	VARIES	VARIES	Get
9	Expected Packet Rate	UINT	2500 msec	0	Get / Set
12	Watchdog Timeout Action	USINT	4 = Deferred Delete	0 = TImeout	Get / Set
13	Produced Connection Path Length	UINT	0	6	Get
14	Produced Connection Path	USINT Array	NULL	20h 04h 24h 64h 30h 03h	Get
15	Consumed Connection Path Length	UINT	0	6	Get
16	Consumed Connection Path	USINT Array	NULL	20h 04h 24h 70h 30h 03h	Get

Table 38: Connection Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Connection Manager Object

(0x06 - Ethernet/IP)

*** No Supported Services or Attributes ***

Discrete Input Object

(0x08 - 9 Instances)

Table 39: Discrete Input Object Class Attributes (0x08 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	2	Get
2	Max Instance	UINT	9	Get

Table 40: Discrete Input Object Class Attributes (0x08 - Instances 1 - 9)

Attribute ID	Name	Data Type	Data Value	Access Rule
3	Values of digital inputs DI1-DI8 and the Start digital input	BOOL	0	Get

Table 41: Discrete Input Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single

Discrete Output Point Object

(0x09 - 6 Instances)

Table 42: Discrete Output Point Object Class Attributes (0x09 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get
2	Max Instance	UINT	6	Get

Table 43: Discrete Output Point Object Class Attributes (0x09 - Instances 1 - 6)

Attribute ID	Name	Data Type	Data Value	Access Rule
3	Values of relays R1-R6	BOOL	0	Get / Set

Table 44: Discrete Output Point Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Motor Data Object

(0x28 - 1 Instance)

Table 45: Motor Data Object Class Attributes (0x28 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 46: Motor Data Object Class Instance Attributes (Instance 1)

Attribute ID	Name	Access	Data Type	Description
3	Motor Type	Get / Set	USINT	Valid Values Are: 0 - Non-Standard Motor 3 - PM Synchronous Motor 4 - FC Synchronous Motor 6 - Wound Rotor Induction Motor 7 - Squirrel Cage Induction Motor
6	FLA	Get / Set	UINT	Motor Nameplate full load Amps Units: 100mA
7	Rated Voltage	Get / Set	UINT	Motor Nameplate rate base voltage Units: V

Table 47: Motor Data Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Control Supervisor Object

(0x29 - 1 Instance)

Table 48: Control Supervisor Object Class Attributes (0x29 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 49: Control Supervisor Object Class Instance Attributes (Instance 1)

Attribute ID	Name	Data Type	Access Rule	Description
3	Run1	BOOL	Get / Set	0 to 1: Run 1 to 0: Stop
6	State	USINT	Get	2 - Not Ready 3 - Ready 4 - Enabled 5 - Stopping 6 - Fault Stop 7 - Faulted
7	Running	BOOL	Get	1 - Enabled or Stopping or Fault Stop 0 - Not Ready or Ready or Faulted
9	Ready	BOOL	Get	1 - Ready or Enabled or Stopping 0 - Other States
10	Faulted	BOOL	Get	1 - Fault Occurred (latched) 0 - No Faults present
11	Warning	BOOL	Get	1 - Warning (not latched) 0 - No Warnings present
12	FaultRst	BOOL	Get / Set	0 to 1: Fault Reset
13	FaultCode	UINT	Get	Code of most recent fault. See Table 85: Fault Log Object: Fault Codes

Table 50: Control Supervisor Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x05	No	Yes	Reset
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Overload Object

(0x2C - 1 Instance)

Table 51: Overload Object Class Attributes (0x2C - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1 thru 7	Revision	UINT	1	Get

Table 52: Overload Object Class Instance Attributes (Instance 1)

Attribute ID	Name	Access Rule	Data Type	Description
3	FLA	Get / Set	INT	Motor Nameplate Full Load Amps Units: 100mA
4	Class	Get / Set	USINT	Overload Class. Valid values are 0-40 with 0 for no overload calculation.
5	Average Current	Get	UINT	Average of the three phase currents Units: 100mA
6	% Phase Imbalance	Get	USINT	Current phase imbalance calculated as: 100 x max [(max_curr-avg_curr),(avg_curr-min_curr)] / avg_curr
7	% Thermal	Get	USINT	% Thermal Capacity (overload content)
8	L1 Current	Get	UINT	Line 1 current Units: 100mA
9	L2 Current	Get	UINT	Line 2 Current Units: 100mA
10	L3 Current	Get	UINT	Line 3 current Units: 100mA
11	Residual Ground Current	Get	INT	Residual Ground Fault current Units: 100mA

Table 53: Overload Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Softstart Object

(0x2D - 1 Instance)

Table 54: Softstart Object Class Attributes (0x2D - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 55: Softstart Object Class Instance Attributes (Instance 1)

Attribute ID	Name	Access Rule	Data Type	Description
3	At Reference	Get	BOOL	
4	Start Mode	Get / Set	USINT	1 - Open Loop Voltage Ramp 10 - Closed Loop Current Ramp 11 - TruTorque Ramp 12 - Power Ramp 13 - Tach Ramp
5	Stop Mode	Get	USINT	0 - Coast 1 - Decel (ramp down) 2 - Brake 11 - TruTorque Decel
6	Ramp Mode	Get	USINT	2 dual independent ramps
7	Ramp Time 1	Get / Set	UINT	Units: 100ms
9	Ramp Time 2	Get / Set	UINT	Units: 100ms
12	Kick Enable 1	Get / Set	BOOL	
13	Kick Time 1	Get / Set	USINT	Units: 100ms
15	Energy Saver	Get / Set	BOOL	
16	Decel Ramp Time	Get / Set	UINT	Units: 100ms
18	DC Braking Current	Get / Set	UINT	Percent of FLA (Motor Data Instance Attribute 6)

Table 56: Softstart Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

TCP Object - Ethernet I/P

(0xF5 - 1 Instance)

Table 57: TCP Object Class Attributes (0xF5 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 58: TCP Object Class Instance Attributes (Instance 1)

Attribute ID	Name	Data Type	Default Data Value	Access Rule
1	Status*	DWORD	1	Get
2	Configuration Capability*	DWORD	0	Get
3	Configuration Control*	DWORD	0	Get
4	Physical Link Object* Structure of: Path Size Path	 Path Size: UINT Path: Array Of WORD	 2 0x20F6 0x2401	Get
5	Interface Configuration* Structure of: IP Address Network Mask Gateway Address Name Server Name Server 2 Domain Name Size Domain Name	 UDINT UDINT UDINT UDINT UDINT UINT STRING	 0 0 0 0 0 0 0	Get
6	Host Name* Structure of: Host Name Size Host Name	 UINT STRING	 0 0	Get
** See Section 5-3.2.2 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on these attributes.*				

Table 59: TCP Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Ethernet Link Object - Ethernet I/P

(0xF6 - 1 Instance)

Table 60: Ethernet Link Object Class Attributes (0xF6 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 61: Ethernet Link Object Class Instance Attributes (Instance 1)

Attribute ID	Name	Data Type	Default Data Value	Access Rule
1	Interface Speed*	UDINT	100	Get
2	Interface Flags*	DWORD	3	Get
3	Physical Address*	USINT Array[6]	0	Get
** See Section 5-4.2.2.1 of "Volume 2: EtherNet/IP Adaptation of CIP" from ODVA for more details on these attributes.*				

Table 62: Ethernet Link Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single

Modbus/Serial Object

(0x65 - 1 Instance)

Table 63: Ethernet Link Object Class Attributes (0x65 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 64: Modbus/Serial Object Class Instance Attributes (Instance 1)

Attribute ID	Name	Data Type	Default Data Value	Access Rule
1	Modbus Slave ID (1-247)	USINT	1	Get / Set
2	Baud Rate: 0 = 4800 1 = 9600 2 = 19200	USINT	2	Get / Set
3	Parity: 0 = 8None 1 = 8Even 2 = 8Odd	USINT	1	Get / Set
4	Stop Bits: 0 = 1 Stop Bit 1 = 2 Stop Bits	USINT	0	Get / Set
10	Timeout (milliseconds) (10ms - 60000ms)	UINT	100	Get / Set

Table 65: Modbus/Serial Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Real Time Data Object - *MX³ Only*

(0x66 - 1 Instance)

Table 66: Real TIme Data Object Class Attributes (0x66 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 67: Real TIme Data Object Class Instance Attributes (Instance 1)

Attribute ID	Name	Description
1	Running Time	Units: Hours Range: 0-65535 Data Type: UINT
2	Running Time	Units: Minutes Range: 0-59 Data Type: UINT
3	Starts	Data Type: UINT
4	TruTorque	Units: % Data Type: UINT
5	Power %	Units: % Data Type: UINT
6	Peak Starting Current	Units: A Data Type: UINT
7	Last Starting Duration	Units: 0.1 Seconds Data Type: UINT
8	Hottest Stator RTD Temperature	Units: °C Range: 0-200 Data Type: UINT NOTE: *MX³ Only*
9	Hottest Bearing RTD Temperature	
10	Hottest Other RTD Temperature	
11	RTD 1 Temperature	
12	RTD 2 Temperature	
13	RTD 3 Temperature	
14	RTD 4 Temperature	
15	RTD 5 Temperature	
16	RTD 6 Temperature	
17	RTD 7 Temperature	
18	RTD 8 Temperature	
19	RTD 9 Temperature	
20	RTD 10 Temperature	
21	RTD 11 Temperature	
22	RTD 12 Temperature	
23	RTD 13 Temperature	
24	RTD 14 Temperature	

Table 67: Real TIme Data Object Class Instance Attributes (Instance 1)

Attribute ID	Name	Description
25	RTD 15 Temperature	Units: ^{o}C Range: 0-200 Data Type: UINT *Note: MX^3 Only*
26	RTD 16 Temperature	
27	RTDs Enable	Units: Range: Each of the sixteen bits represents an RTD. A “1” indicates the RTD is enabled. Bit 0 represents RTD 1. Bit 15 represents RTD 16. Data Type: WORD *Note: MX^3 Only*
28	RTDs Assigned as Stator	Units: Range: Each of the sixteen bits represents an RTD. A “1” indicates the RTD is assigned to the Stator group. Data Type: WORD *Note: MX^3 Only*
29	RTDs Assigned as Bearing	Units: Range: Each of the sixteen bits represents an RTD. A “1” indicates the RTD is assigned to the Bearing group. Data Type: WORD *Note: MX^3 Only*
30	RTDs Assigned as Other	Units: Range: Each of the sixteen bits represents an RTD. A “1” indicates the RTD is assigned to the Other group. Data Type: WORD *Note: MX^3 Only*
31	RTDs with Open Leads	Units: Range: Each of the sixteen bits represents an RTD. A “1” indicates the RTD has an open lead. Data Type: WORD *Note: MX^3 Only*
32	RTDs with Shorted Leads	Units: Range: Each of the sixteen bits represents an RTD. A “1” indicates the RTD has a shorted lead. Data Type: WORD *Note: MX^3 Only*
33	Remaining Lockout Time	Units: Seconds Data Type: UINT *Note: MX^3 Only*
34	Date/Time (Lower 16 bits)	Units: Seconds Range: Seconds elapsed since 12:00 AM on January 1, 1972. Data Type: UDINT *Note: MX^3 Only*
35	Date/Time (Upper 16 bits)	

Table 68: Real TIme Data Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Parameters Object - *MX³ Only*

(0x67 - 1 Instance)

Table 69: Parameter Object Class Attributes (0x67 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 70: Parameter Object Instance Attributes (Instance 1) - Read and Writeable

Attribute ID	Name	Description
1	Acceleration Profile	Units: Range: 0: Linear 1: Squared 2: S-Curve Data Type: UINT *Note: MX³ Only*
2	Deceleration Profile	
3	PORT Bypass Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX³ Only*
4	PORT Bypass Delay Time	Units: 100 mSec Range: 1-50 Data Type: UINT *Note: MX³ Only*
5	PORT Recovery Method	Units: Range: 0: Voltage Ramp 1: Fast Recover 2: Current Ramp 3: Current Ramp 2 4: Ramp Select 5: Tach Ramp Data Type: UINT *Note: MX³ Only*
6	Tachometer Full Speed Voltage	Units: 10 mV Range: 100-1000 Data Type: UINT *Note: MX³ Only*
7	Tachometer Loss Delay Time	Units: 100 mSec Range: 1-900 Data Type: UINT *Note: MX³ Only*
8	Tachometer Loss Action	Units: Range: 0: Fault 1: Closed Loop Current Ramp 2: TruTorque Ramp 3: Power Ramp Data Type: UINT *Note: MX³ Only*

Table 70: Parameter Object Instance Attributes (Instance 1) - Read and Writeable (Continued)

Attribute ID	Name	Description
9	Time/Date Format	Units: Range: 0: mm/dd/yy, 12 Hour 1: mm/dd/yy, 24 Hour 2: yy/mm/dd, 12 Hour 3: yy/mm/dd, 24 Hour 4: dd/mm/yy, 12 Hour 5: dd/mm/yy, 24 Hour Data Type: UINT *Note: MX^3 Only*
10	Current Imbalance Delay Time	Units: 100 mSec Range: 1-900 Data Type: UINT *Note: MX^3 Only*
11	Zero Sequence Ground Fault Trip Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
12	Zero Sequence Ground Fault Trip Level	Units:100 mA Range: 10-250 Data Type: UINT *Note: MX^3 Only*
13	Ground Fault Delay Time	Units: 100 mSec Range: 1-900 Data Type: UINT *Note: MX^3 Only*
14	Phase Loss Delay Time	Units: 100 mSec Range: 1-50 Data Type: UINT *Note: MX^3 Only*
15	Over Frequency Trip Level	Units: Hz Range: 24-72 Data Type: UINT *Note: MX^3 Only*
16	Under Frequency Trip Level	Units: Hz Range: 23-71 Data Type: UINT *Note: MX^3 Only*
17	Over/Under Frequency Delay Time	Units: 100 mSec Range: 1-900 Data Type: UINT *Note: MX^3 Only*
18	Power Factor Leading Trip Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
19	Power Factor Leading Trip Level	Units: Range: 80-99 = -0.80 - -0.99 lag 100-199 = 1.00 - +0.01 Lead Data Type: UINT *Note: MX^3 Only*

Table 70: Parameter Object Instance Attributes (Instance 1) - Read and Writeable (Continued)

Attribute ID	Name	Description
20	Power Factor Lagging Trip Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
21	Power Factor Lagging Trip Level	Units: Range: 1-99 = -0.01 - -0.99 lag 100-120 = 1.00 - +0.80 lead Data Type: UINT *Note: MX^3 Only*
22	Power Factor Delay TIme	Units: 100 mSec Range: 1-900 Data Type: UINT *Note: MX^3 Only*
23	Backspin Timer Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
24	Backspin Time	Units: minutes Range: 1-180 Data Type: UINT *Note: MX^3 Only*
25	Time Between Starts Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
26	Time Between Starts	Units: minutes Range: 1-180 Data Type: UINT *Note: MX^3 Only*
27	Starts per Hour Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
28	Starts per Hour	Units: Range: 1-6 Data Type: UINT *Note: MX^3 Only*
29	Speed Switch Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
30	Speed Switch Delay Time	Units: seconds Range: 1-250 Data Type: UINT *Note: MX^3 Only*

Table 70: Parameter Object Instance Attributes (Instance 1) - Read and Writeable (Continued)

Attribute ID	Name	Description
31	Motor PTC Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
32	Motor PTC Delay Time	Units: seconds Range: 1-5 Data Type: UINT *Note: MX^3 Only*
33	PORT Trip Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
34	PORT Trip Delay Time	Units: 100 mSec Range: 1-900 Data Type: UINT *Note: MX^3 Only*
35	Motor Overload Alarm Level	Units: % Range: 1-100 Data Type: UINT *Note: MX^3 Only*
36	Motor Overload Lockout Level	Units: % Range: 1-99 Data Type: UINT *Note: MX^3 Only*
37	Motor Overload Auto Lockout Calculation	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
38	Motor Overload RTD Biasing Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
39	Motor Overload RTD Biasing Minimum	Units: ^{o}C Range: 0-198 Data Type: UINT *Note: MX^3 Only*
40	Motor Overload RTD Biasing Middle	Units: ^{o}C Range: 1-199 Data Type: UINT *Note: MX^3 Only*
41	Motor Overload RTD Biasing Maximum	Units: ^{o}C Range: 105-200 Data Type: UINT *Note: MX^3 Only*

Table 70: Parameter Object Instance Attributes (Instance 1) - Read and Writeable (Continued)

Attribute ID	Name	Description
42	DI 4 Configuration	Units: Range: Same as DI1 through DI3 configuration in the Configuration Object (0x6A). Data Type: UINT *Note: MX3 Only*
43	DI 5 Configuration	
44	DI 6 Configuration	
45	DI 7 Configuration	
46	DI 8 Configuration	
47	R4 Configuration	Units: Range: Same as R1 through R3 configuration in the Configuration Object (0x6A). Data Type: UINT *Note: MX3 Only*
48	R5 Configuration	
49	R6 Configuration	
50	RTD Module 1 Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX3 Only*
51	RTD Module 1 Address	Units: Range: 16-23 Data Type: UINT *Note: MX3 Only*
52	RTD Module 2 Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX3 Only*
53	RTD Module 2 Address	Units: Range: 16-23 Data Type: UINT *Note: MX3 Only*
54	RTD 1 Group	Units: Range: 0: Off 1: Stator 2: Bearing 3: Other Data Type: UINT *Note: MX3 Only*
55	RTD 2 Group	
56	RTD 3 Group	
57	RTD 4 Group	
58	RTD 5 Group	
59	RTD 6 Group	
60	RTD 7 Group	
61	RTD 8 Group	
62	RTD 9 Group	
63	RTD 10 Group	
64	RTD 11 Group	
65	RTD 12 Group	
66	RTD 13 Group	
67	RTD 14 Group	
68	RTD 15 Group	
69	RTD 16 Group	

Table 70: Parameter Object Instance Attributes (Instance 1) - Read and Writeable (Continued)

Attribute ID	Name	Description
70	RTD Stator Alarm Level	Units: ^{o}C Range: 1-200 Data Type: UINT *Note: MX^3 Only*
71	RTD Bearing Alarm Level	
72	RTD Other Alarm Level	
73	RTD Stator Trip Level	
74	RTD Bearing Trip Level	
75	RTD Other Trip Level	
76	RTD Voting Enable	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
77	Slow Speed Enable 2	Units: Range: 0: Disable 1: Enable Data Type: UINT *Note: MX^3 Only*
78	Slow Speed 2	Units: Range: Same as Slow Speed 1 in the Configuration Object (0x06A). Data Type: UINT *Note: MX^3 Only*
79	Slow Speed Current Level 2	Units: %FLA Range: 10-400 Data Type: UINT *Note: MX^3 Only*

Table 71: Parameter Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Event Log Object - MX^3 Only

(0x68 - 99 Instances)

Table 72: Event Log Object Class Attributes (0x68 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 73: Event Log Object Instance Attributes (Instances 1-99)

Attribute ID	Name	Data Type	Description
1	Event Code	USINT	Units: BOOL Range: See Event Code Table (75) *Note: MX^3 Only* Since the event code contains both events (such as Start, Stop, Up To Speed, etc.) and faults, bit 15 indicates whether a record is an event or a fault. A 1 indicates a fault, and a 0 indicates an event. The remaining 15 bits contain either the event code or fault code. Refer to the Fault Log Object (0x6B) for a table of fault codes.
2	System State	USINT	Units: BOOL Range: See System States Table (76) *Note: MX^3 Only*
3	Time Stamp	TIME_OF_DAY	
4	Date Stamp	DATE	

Table 74: Event Log Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Table 75: Event Log Object - Event Codes

Event Code	Description
101	Start Commanded
102	Slow Speed Commanded
103	Up To Speed
104	Energy Saver Entered
105	Energy Saver Exited
106	Stop Commanded
107	Stop Complete
110	Motor Overload Warning

Table 75: Event Log Object - Event Codes (Continued)

Event Code	Description
111	Motor Overload Lockout Entered
112	Motor Overload Lockout Cleared
113	Stack Overload Warning
114	Stack Overload Lockout Entered
115	Stack Overload Lockout Cleared
116	Emergency Overload Reset
117	Stator RTD Warning
118	Bearing RTD Warning
119	Other RTD Warning
140	Disconnect Opened
141	Disconnect Closed
142	Run Interlock Opened
170	PORT Entered due to Low Voltage
171	PORT Entered due to Low Current
172	PORT Bypass Contactor Opened
173	PORT Power Returned
174	PORT Recovery Completed
180	Parameters Reset to Defaults
181	Time/Date Changed
182	Passcode Enabled
183	Passcode Cleared
184	Factory Passcode Entered
185	Event Log Cleared
186	Run Time Reset
187	kWh Reset
188	Reflash Mode Entered
190	System Powered Up
191	System Powered Down
192	Low Control Power Detected
193	Standard BIST Entered
194	Powered BIST Entered
195	BIST Passed

Table 76: Event Log Object - System States Table

System State	Description
0	Initializing
1	Locked Out
2	Faulted
3	Stopped
4	Heating
5	Kicking
6	Ramping
7	Slow Speed
8	Not UTS
9	UTS
10	Phase Control / Current Follower
11	Decelerating
12	Braking
13	Wye
14	PORT
15	BIST
16	Shorted SCR Test
17	Open SCR Test

Status and Control Object

(0x69 - 1 Instance)

Table 77: Status and Control Object Class Attributes (0x69 - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 78: Status and Control Object Instance Attributes (Instance 1)

Attribute ID	Name	Description
1	Starter Control	Units: Range: Bit 0: Run/Stop Bit 1: Fault Reset Bit 2: Emergency Overload Reset Bit 3: Local/Remote Bit 4: Heat Disable Bit 5: Ramp Select Bit 10: Relay 6 Bit 11: Relay 5 Bit 12: Relay 4 Bit 13: Relay 3 Bit 14: Relay 2 Bit 15: Relay 1 Data Type: WORD *Notes:* *MX^2 1-3 Relays* *MX^3 1-6 Relays*
2	Starter Status	Units: Range: Bit 0: Ready Bit 1: Running Bit 2: UTS Bit 3: Alarm Bit 4: Fault Bit 5: Lockout Data Type: WORD
3	Input Status	Units: Range: Bit 0: Start Bit 1: DI 1 Bit 2: DI 2 Bit 3: DI 3 Bit 4: DI 4 Bit 5: DI 5 Bit 6: DI 6 Bit 7: DI 7 Bit 8: DI 8 Data Type: WORD *Notes:* *MX^2 DI 1-3* *MX^3 DI 1-8*

Table 78: Status and Control Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
4	Alarm Status 1	Units: Range: Bit 0: "A OL" - Motor Overload Bit 1: "A 5" - Motor PTC Bit 2: "A 6" - Stator RTD Bit 3: "A 7" - Bearing RTD Bit 4: "A 8" - Other RTD Bit 5: "A 10" - Phase Rotation not ABC Bit 6: "A 11" - Phase Rotation not CBA Bit 7: "A 12" - Low Line Frequency Bit 8: "A 13" - High Line Frequency Bit 9: "A 14" - Phase Rotation not 1PH Bit 10: "A 15" - Phase Rotation not 3PH Bit 11: "A 21" - Low line L1-L2 Bit 12: "A 22" - Low line L2-L3 Bit 13: "A 23" - Low line L3-L1 Bit 14: "A 24" - High line L1-L2 Bit 15: "A 25" - High line L2-L3 Data Type: WORD *Note:* *MX^2 exclude Bit 1-4*
5	Alarm Status 2	Units: Range: Bit 0: "A 26" - High line L3-L1 Bit 1: "A 27" - Phase loss Bit 2: "noL" - No line Bit 3: "A 29" - PORT Timeout Bit 4: "A 31" - Overcurrent Bit 5: "A 34" - Undercurrent Bit 6: "A 35" - PF Too Leading Bit 7: "A 36" - PF Too Lagging Bit 8: "A 37" - Current Imbalance Bit 9: "A 38" - Ground Fault Bit 10: "A 47" - Stack Overtemperature Bit 11: "A 53" - Tach Loss Bit 12: "A 60" - DI 1 Bit 13: "A 61" - DI 2 Bit 14: "A 62" - DI 3 Bit 15: "A 63" - DI 4 Data Type: WORD *Note:* *MX^2 exclude Bit 3, 6-7, 11 and 15*
6	Alarm Status 3	Units: Range: Bit 0: "A 64" - DI 5 Bit 1: "A 65" - DI 6 Bit 2: "A 66" - DI 7 Bit 3: "A 67" - DI 8 Bit 4: "A 71" - Analog Input Trip Data Type: WORD *Note:* *MX^2 Bit 4 only*

Table 78: Status and Control Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
7	Lockout Status	Units: Range: Bit 0: "L OL" - Motor Overload Bit 1: "LPtc" - Motor PTC Bit 2: "Lrtd" - RTD Stator Bit 3: "Lrtd" - RTD Bearing Bit 4: "Lrtd" - RTD Other Bit 5: "L rl" - Run Interlock Bit 6: "L dS" - Disconnect Open Bit 7: "L Ot" - Stack Overtemperature Bit 8: "L CP" - Control Power Bit 9: "Lrtd" - RTD Open/Short Bit 10: "LtbS" - Time Between Starts Bit 11: "L bS" - Backspin Bit 12: "LSph" - Starts per Hour Bit 13: "Lrtd" - RTD Comm Loss Data Type: WORD *Note:* *MX^2 exclude Bit 1-4 and Bit 9-13*
8	Present Fault Code	Units: Range: Data Type: UINT Note: See codes in the Fault Log Object (0x6B)
9	Average Current	Units: A Range: Data Type: UINT
10	L1 Current	Units: A Range: Data Type: UINT
11	L2 Current	
12	L3 Current	
13	Current Imbalance	Units: 0.1% Range: Data Type: UINT
14	Residual Ground Fault Current	Units: % FLA Range: Data Type: UINT
15	Zero Sequence Ground Fault	Units: 0.001 A Range: Data Type: UINT *Note: MX^3 Only*
16	Average Voltage	Units: V Range: Data Type: UINT
17	L1-L2 Voltage	Units: A Range: Data Type: UINT
18	L2-L3 Voltage	
19	L3-L1 Voltage	
20	Motor Overload	Units: % Range: Data Type: UINT
21	Power Factor	Units: 0.01 Range: -99 - +100 Data Type: INT
22	Watts (Low 16)	Units: W Range: Data Type: UDINT
23	Watts (High 16)	

Table 78: Status and Control Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
24	VA (Low 16)	Units: VA Range: Data Type: UDINT
25	VA (High 16)	
26	vars (Low 16)	Units: var Range: Data Type: DINT
27	vars (High 16)	
28	kW hours (Low 16)	Units: kWh Range: Data Type: UDINT
29	kW hours (High 16)	
30	Phase Order	Units: Range: 0: No Line 1: ABC 2: CBA 3: SPH Data Type: UINT
31	Line Period	Units: microseconds Range: Data Type: UINT
32	Analog Input %	Units: 0.1% Range: -1000 - +1000 Data Type: INT
33	Analog Output %	Units: 0.1% Range: 0-1000 Data Type: UINT

Table 79: Status and Control Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Configuration Object

(0x6A - 1 Instance)

Table 80: Configuration Object Class Attributes (0x6A - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 81: Configuration Object Instance Attributes (Instance 1)

Attribute ID	Name	Description
1	Motor FLA	Units: A Range: 0-6400 Data Type: UINT
2	Motor Service Factor	Units: 0.01 Range: 100-199 Data Type: UINT
3	Independent Start/Run Motor Overloads	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
4	Motor Overload Running Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
5	Motor Overload Running Class	Units: Range: 1-40 Data Type: UINT
6	Motor Overload Starting Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
7	Motor Overload Staring Class	Units: Range: 1-40 Data Type: UINT
8	Motor Overload Hot/Cold Ratio	Units: % Range: 0-99 Data Type: UINT
9	Motor Overload Cooling Time	Units: 0.1 minutes Range: 10-9999 Data Type: UINT
10	Local Source	Units: Range: 0: Keypad 1: Terminal 2: Serial Data Type: UINT
11	Remote Source	

Table 81: Configuration Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
12	Start Mode	Units: Range: 0: Open Loop Voltage Ramp 1: Closed Loop Current Ramp 2: TruTorque Ramp 3: Power Ramp 4: Tach Ramp Data Type: UINT *Note:* *MX^2 0-3*
13	Initial Motor Current 1	Units: % FLA Range: 50-600 Data Type: UINT
14	Maximum Motor Current 1	Units: % FLA Range: 100-800 Data Type: UINT
15	Ramp Time 1	Units: seconds Range: 0-300 Data Type: UINT
16	Initial Motor Current 2	Units: % FLA Range: 50-600 Data Type: UINT
17	Maximum Motor Current 2	Units: % FLA Range: 100-800 Data Type: UINT
18	Ramp Time 2	Units: seconds Range: 0-300 Data Type: UINT
19	UTS Time	Units: seconds Range: 0-900 Data Type: UINT
20	Initial V/T/P (Voltage/Torque/Power)	Units: % Range: 1-100 Data Type: UINT
21	Max T/P (Torque/Power)	Units: % Range: 10-325 Data Type: UINT
22	Stop Mode	Units: Range: 0: Coast 1: Voltage Decel 2: TruTorque Decel 3: DC Brake Data Type: UINT
23	Decel Begin Level	Units: % Range: 1-100 Data Type: UINT
24	Decel End Level	Units: % Range: 1-99 Data Type: UINT
25	Decel Time	Units: seconds Range: 1-180 Data Type: UINT
26	DC Brake Level	Units: % Range: 10-100 Data Type: UINT

Table 81: Configuration Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
27	DC Brake Time	Units: seconds Range: 1-180 Data Type: UINT
28	DC Brake Delay	Units: 100 mSec Range: 1-30 Data Type: UINT
29	Kick Enable 1	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
30	Kick Current Level 1	Units: % FLA Range: 1-800 Data Type: UINT
31	Kick Time 1	Units: 100 mSec Range: 1-100 Data Type: UINT
32	Kick Enable 2	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
33	Kick Current Level 2	Units: % FLA Range: 100-800 Data Type: UINT
34	Kick Time 2	Units: 100 mSec Range: 1-100 Data Type: UINT
35	Slow Speed Enable 1	Units: Range: 0: Disabled 1: Enabled Data Type: UINT

Table 81: Configuration Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description	
36	Slow Speed 1	Units: % Range: 0: 1.0 1: 1.5 2: 1.6 3: 1.7 4: 1.9 5: 2.0 6: 2.5 7: 2.6 8: 2.8 9: 2.9 10: 3.1 11: 3.3 12: 3.5 13: 3.8 14: 4.2 15: 4.5 16: 5.0 17: 5.5 18: 6.2 19: 7.1 20: 8.3 21: 9.1 22: 10.0 23: 11.1 24: 12.5 25: 14.3 26: 16.7 27: 20.0 28: 25.0 29: 33.3 30: 37.5 31: 40.0 Data Type: UINT *Note:* *MX^2 0-1*	MX$^{2:}$ 0: 7.1 1: 14.3
37	Slow Speed Current Level 1	Units: % FLA Range: 10-400 Data Type: UINT	
38	Slow Speed Time Limit Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT	
39	Slow Speed Time Limit	Units: seconds Range: 1-900 Data Type: UINT	
40	Slow Speed Kick Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT	
41	Slow Speed Kick Level	Units: % FLA Range: 100-800 Data Type: UINT	
42	Slow Speed Kick Time	Units: 100 mSec Range: 0-100 Data Type: UINT	

Table 81: Configuration Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
43	Rated RMS Voltage	Units: V Range: 0: 100 1: 110 2: 120 3: 200 4: 208 5: 220 6: 230 7: 240 8: 350 9: 380 10: 400 11: 415 12: 440 13: 460 14: 480 15: 500 16: 525 17: 575 18: 600 19: 660 20: 690 21: 800 22: 1000 23: 1140 24: 2200 25: 2300 26: 2400 27: 3300 28: 4160 29: 4600 30: 4800 31: 6000 32: 6600 33: 6900 34: 10000 35: 11000 36: 11500 37: 12000 38: 12470 39: 13200 40: 13800 Data Type: UINT *Note:* *MX^2 0-23*
44	Input Phase Sensitivity	Units: Range: 0: Ins 1: ABC 2: CBA 3: SPH Data Type: UINT
45	Motor Rated Power Factor	Units: 0.01 Range: 1-100 Data Type: UINT
46	Overcurrent Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT

Table 81: Configuration Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
47	Overcurrent Level	Units: % FLA Range: 50-800 Data Type: UINT
48	Overcurrent Delay Time Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
49	Overcurrent Delay TIme	Units: 100 mSec Range: 1-900 Data Type: UINT
50	Undercurrent Trip Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
51	Undercurrent Trip Level	Units: % FLA Range: 5-100 Data Type: UINT
52	Undercurrent Trip Delay Time Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
53	Undercurrent Trip Delay Time	Units: 100 mSec Range: 1-900 Data Type: UINT
54	Current Imbalance Trip Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
55	Current Imbalance Trip Level	Units: % Range: 5-40 Data Type: UINT
56	Residual Ground Fault Trip Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
57	Residual Ground Fault Trip Level	Units: % FLA Range: 5-100 Data Type: UINT
58	Over Voltage Trip Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
59	Over Voltage Trip Level	Units: % Range: 1-40 Data Type: UINT
60	Under Voltage Trip Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT

Table 81: Configuration Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
61	Under Voltage Trip Level	Units: % Range: 1-40 Data Type: UINT
62	Over/Under Voltage Delay Time	Units: 100 mSec Range: 1-900 Data Type: UINT
63	Digital Input Trip Delay Time	Units: 100 mSec Range: 1-900 Data Type: UINT
64	Auto Fault Reset Count Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
65	Auto Fault Reset Delay Time	Units: 100 mSec Range: 1-900 Data Type: UINT
66	Auto Fault Reset Count Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
67	Auto Fault Reset Count	Units: Range: 1-10 Data Type: UINT
68	Controlled Fault Stop	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
69	DI 1 Configuration	Units: Range: 0: Off 1: Stop 2: Fault High 3: Fault Low 4: Fault Reset 5: Disconnect 6: Inline Feedback (F49) 7: Bypass / 2M Feedback (F48) 8: Emergency Motor OL Reset 9: Local / Remote Control Source 10: Heat Disable 11: Heat Enable 12: Ramp Select 13: Slow Speed Forward 14: Slow Speed Reverse 15: DC Brake Disable 16: DC Brake Enable 17: Run Enable 18: Run Disable 19: Speed Switch Normally Open 20: Speed Switch Normally Closed Data Type: UNIT *Note:* *MX^2 0-18*
70	DI 2 Configuration	
71	DI 3 Configuration	

Table 81: Configuration Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
72	Relay 1 Configuration	Units: Range: 0-22 0: Off 1: Fault Fail Safe 2: Fault Non-Fail Safe 3: Running 4: Up To Speed 5: Alarm 6: Ready 7: Locked Out 8: Over Current Alarm 9: Under Current Alarm 10: Overload Alarm 11: Shunt Trip Fail Safe 12: Shunt Trip Non Fail Safe 13: Faulted on Ground Fault 14: In Energy Saver Mode 15: Heating 16: Slow Speed 17: Slow Speed Forward 18: Slow Speed Reverse 19: DC Braking 20: Cooling Fan 21: PORT 22: Tach Loss Data Type: UINT *Note:* *MX^2 0-20*
73	Relay 2 Configuration	
74	Relay 3 Configuration	
75	Analog Input Trip Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
76	Analog Input Trip Type	Units: Range: 0: Low - Fault below preset level 1: High - Fault above preset level Data Type: UINT
77	Analog Input Trip Level	Units: % Range: 0-100 Data Type: UINT
78	Analog Input Trip Delay Time	Units: 100 mSec Range: 1-900 Data Type: UINT
79	Analog Input Span	Units: % Range: 1-100 Data Type: UINT
80	Analog Input Offset	Units: % Range: 0-99 Data Type: UINT

Table 81: Configuration Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
81	Analog Output Function	Units: Range: 0: Off (no output) 1: 0 - 100% Current 2: 0 - 200% Current 3: 0 - 800% Current 4: 0 - 150% Voltage 5: 0 - 150% Overload 6: 0 - 10kW 7: 0 - 100kW 8: 0 - 1MW 9: 0 - 10MW 10: 1 - 100% Analog Input 11: 0 - 100% Firing 12: Calibration (full output) Data Type: UINT
82	Analog Output Span	Units: % Range: 1-125 Data Type: UINT
83	Analog Output Offset	Units: % Range: 0-99 Data Type: UINT
84	Inline Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
85	Inline Delay Time	Units: 100 mSec Range: 10-100 Data Type: UINT
86	Bypass Feedback Time	Units: 100 mSec Range: 1-50 Data Type: UINT
87	Keypad Stop	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
88	Modbus Timeout Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
89	Modbus Timeout	Units: seconds Range: 1-120 Data Type: UINT

Table 81: Configuration Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
90	CT Ratio	Units: Range: 0: 72:1 1: 96:1 2: 144:1 3: 288:1 4: 864:1 5: 2640:1 6: 3900:1 7: 5760:1 8: 8000:1 9: 14400:1 10: 28800:1 11: 50:5 12: 150:5 13: 250:5 14: 400:5 15: 600:5 16: 800:5 17: 2000:5 18: 5000:5 Data Type: UINT *Note:* *MX^2 0-10*
91	Auto Start	Units: Range: 0: Disabled 1: Start after power applied 2: Start after fault reset 3: Start after power applied and fault reset Data Type: UINT
92	Energy Saver Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
93	Heater / Anti-Windmill Enable	Units: Range: 0: Disabled 1: Enabled Data Type: UINT
94	Heater / Anti-Windmill Level	Units: % FLA Range: 1-40 Data Type: UINT
95	Starter Type	Units: Range: 0: Normal (Outside Delta) 1: Inside Delta 2: Wye Delta 3: Phase Controller 4: Current Follower 5: Across The Line (Full Voltage) Data Type: UINT

Table 81: Configuration Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
96	LED Display Meter Configuration	Units: Range: 0: Status 1: Avg Current 2: L1 Current 3: L2 Current 4: L3 Current 5: Current Imbalance % 6: Residual Ground Current 7: Avg Volts 8: L1-L2 Volts 9: L2-L3 Volts 10: L3-L1 Volts 11: Overload 12: Power Factor 13: Watts 14: VA 15: vars 16: kW Hours 17: MW Hours 18: Phase Order 19: Line Frequency 20: Analog Input 21: Analog Output 22: Running Days 23: Running Hours 24: Starts 25: TruTorque % 26: Power % 27: Peak Starting Current 28: Last Starting Duration 29: Zero Sequence Ground Current 30: Hottest Stator RTD Temperature 31: Hottest Bearing RTD Temperature 32: Hottest Other RTD Temperature 33: Hottest RTD Temperature Data Type: UINT *Note:* *MX^2 0-28*

Table 81: Configuration Object Instance Attributes (Instance 1) (Continued)

Attribute ID	Name	Description
97	LCD Display Meter 1 Configuration	Units: Range: 1: Avg Current 2: L1 Current 3: L2 Current 4: L3 Current 5: Current Imbalance % 6: Residual Ground Current 7: Avg Volts 8: L1-L2 Volts 9: L2-L3 Volts 10: L3-L1 Volts 11: Overload 12: Power Factor 13: Watts 14: VA 15: vars 16: kW Hours 17: MW Hours 18: Phase Order 19: Line Frequency 20: Analog Input 21: Analog Output 22: Running Days 23: Running Hours 24: Starts 25: TruTorque % 26: Power % 27: Peak Starting Current 28: Last Starting Duration 29: Zero Sequence Ground Current 30: Stator RTD Temperature 31: Bearing RTD Temperature 32: Other RTD Temperature 33: Hottest RTD Temperature Data Type: UINT *Note:* *MX^2 1-28*
98	LCD Display Meter 2 Configuration	
99	Miscellaneous Commands	Units: Range: 0: None 1: Standard BIST 2: Powered BIST 3: Reset Run Time 4: Reset kWh 5: Enter Reflash Mode 6: Store Parameters 7: Load Parameters 8: Factory Reset Data Type: UINT

Table 82: Configuration Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Fault Log Object

(0x6B - 9 Instances)

Table 83: Fault Log Object Class Attributes (0x6B - Instance 0)

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get

Table 84: Fault Log Object Instance Attributes (Instances 1-9)

Attribute ID	Name	Description
1	Fault Code	Units: Range: 00-99 Data Type: UINT *Note: See Table 85, Fault Codes below*
2	System State	Units: Range: 0-17 Data Type: UINT *Note: See Table 85, Fault Codes below*
3	Line Current 1	Units: Arms Range: Data Type: UINT
4	Line Current 2	
5	Line Current 3	
6	Line Voltage 1-2	Units: Range: Data Type: UINT
7	Line Voltage 2-3	
8	Line Voltage 3-1	
9	Kilowatts	Units: kW Range: Data Type: UINT
10	Line Frequency	Units: 0.1 Hz Range: 230-720, or 0 if no line Data Type: UINT
11	Run Time	Units: hours Range: Data Type: UINT

Table 85: Fault Log Object - Fault Codes

Fault Code	Description
00	No Fault
01	UTS Time Limit Expired
02	Motor Thermal Overload Trip
03	Slow Speed Time Limit Expired
04	Speed Switch
05	Motor PTC
06	Stator RTD

Table 85: Fault Log Object - Fault Codes (Continued)

Fault Code	Description
07	Bearing RTD
08	Other RTD
10	Phase Rotation Error, not ABC
11	Phase Rotation Error, not CBA
12	Low Line Frequency
13	High Line Frequency
14	Input Power Not Single Phase
15	Input Power Not Three Phase
21	Low Line L1-L2
22	Low Line L2-L3
23	Low Line L3-L1
24	High Line L1-L2
25	High Line L2-L3
26	High Line L3-L1
27	Phase Loss
28	No Line
29	PORT Time Limit Expired
30	I.O.C.
31	Overcurrent
34	Undercurrent
35	Power Factor Leading
36	Power Factor Lagging
37	Current Imbalance
38	Ground Fault
39	No Current at Run
40	Shorted / Open SCR
41	Current at Stop
46	Disconnect Open
47	Stack Protection Fault (stack thermal overload)
48	Bypass Contactor Fault
49	Inline Contactor Fault
50	Control Power Low
51	Current Sensor Offset Error
53	Tachometer Loss
54	BIST Fault
55	BIST CT Fault
56	Open or Shorted RTD
60	External Fault on DIN#1 Input

Table 85: Fault Log Object - Fault Codes (Continued)

Fault Code	Description
61	External Fault on DIN#2 Input
62	External Fault on DIN#3 Input
63	External Fault on DIN#4 Input
64	External Fault on DIN#5 Input
65	External Fault on DIN#6 Input
66	External Fault on DIN#7 Input
67	External Fault on DIN#8 Input
71	Analog Input Level Fault Trip
80	RTD Communication Fault
81	Keypad Communication Fault
82	Modbus Timeout Fault
84	Interboard Communication Fault
85	IO Card - SW Fault
86	IO Card - Current Sensor Offset Error
87	IO Card - Real Time Clock Error
88	IO Card - Illegal Instruction Trap
89	IO Card - SW Watchdog Fault
90	IO Card - Spurious Interrupt
91	IO Card - Program EPROM Checksum Fault
94	CPU Error - SW Fault
95	CPU Error - Parameter EEPROM Checksum Fault
96	CPU Error - Illegal Instruction Trap
97	CPU Error - SW Watchdog Fault
98	CPU Error - Spurious Interrupt
99	CPU Error - Program EPROM Checksum Fault

Table 86: System State Code Tables

Fault Code	Description
00	Initializing
01	Locked Out
02	Faulted
03	Stopped
04	Heating
05	Kicking
06	Ramping
07	Slow Speed
08	Not UTS (Up To Speed)

Table 86: System State Code Tables (Continued)

Fault Code	Description
09	UTS
10	Phase Control / Current Follower
11	Decelerating
12	Braking
13	Wye
14	PORT
15	BIST
16	Shorted SCR Test
17	Open SCR Test

Table 87: Fault Log Object - Common Services

Service Code	Implemented For		Service Name
	Class Level	Instance Level	
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

DeviceNet Example

Purpose

This example will demonstrate how to add an MX^2/MX^3 to an Allen Bradley DeviceNet network. This example illustrates the following:

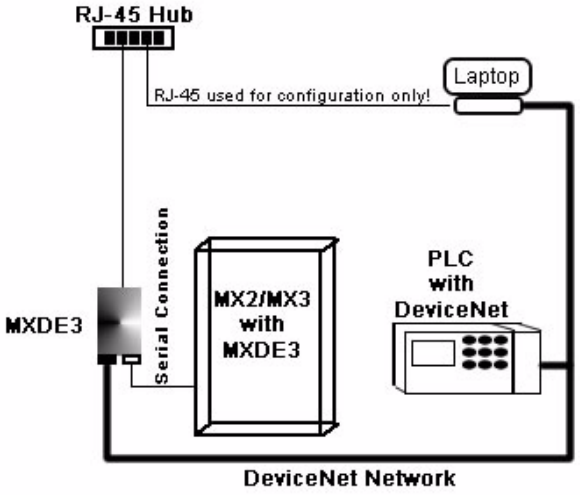
Hardware:
- Benshaw Communication Module COM-100000-01
- MicroLogix 1500 Base Unit 1764-24AWA
- MicroLogix 1500 Processor Unit 1764-LSP
- DeviceNet Scanner 1769-SDN
- Right End Cap / Terminator 1769-ECR
- Allen-Bradley PC to MicroLogix cable 1761-CBL-PM02
- Allen-Bradley PCMCIA Card
- Generic USB to Serial adapter
- Generic Ethernet Hub
- RJ45 patch cable
- Laptop PC with Windows XP SP2

Software:
- Benshaw Communication Module built in web server.
- RSLogix 500 version 7.30.00 (CPR 9)
- PanelBuilder32 version 03.82.01 (Build 451)
- BOOTP-DHCP Server version 2.3.2.0
- RSNetWorx for DeviceNet version 8.00.01 (CPR 7)

NOTE: This document assumes the user has basic working understanding of the above Allen-Bradley hardware and software line.

Reference:
- Input Instance Attributes (151): Table 21
- Output Instance Attributes (100): Table 33

Hardware setup



Customizing the Communications Module

The MXDE3 Communication Module has been pre-configured and tested; shipped ready for customization to a DeviceNet network.

Refer to Section 2, Web Page Based Setup.

Using Web Page Based Setup perform the following steps:

1. Assign a MAC ID number (i.e. 63) to identify the Benshaw soft starter on a DeviceNet network.
2. Set the baud rate to match a network (125 for this example).
3. Set an Input/Output Assembly (this example uses Input instance 151 and Output instance 100).
4. Click “Store Parameters”

NOTE: A reboot of the device may be required. If required, the web page will display refresh instructions at the top of the page (i.e. press F5 upon reboot).

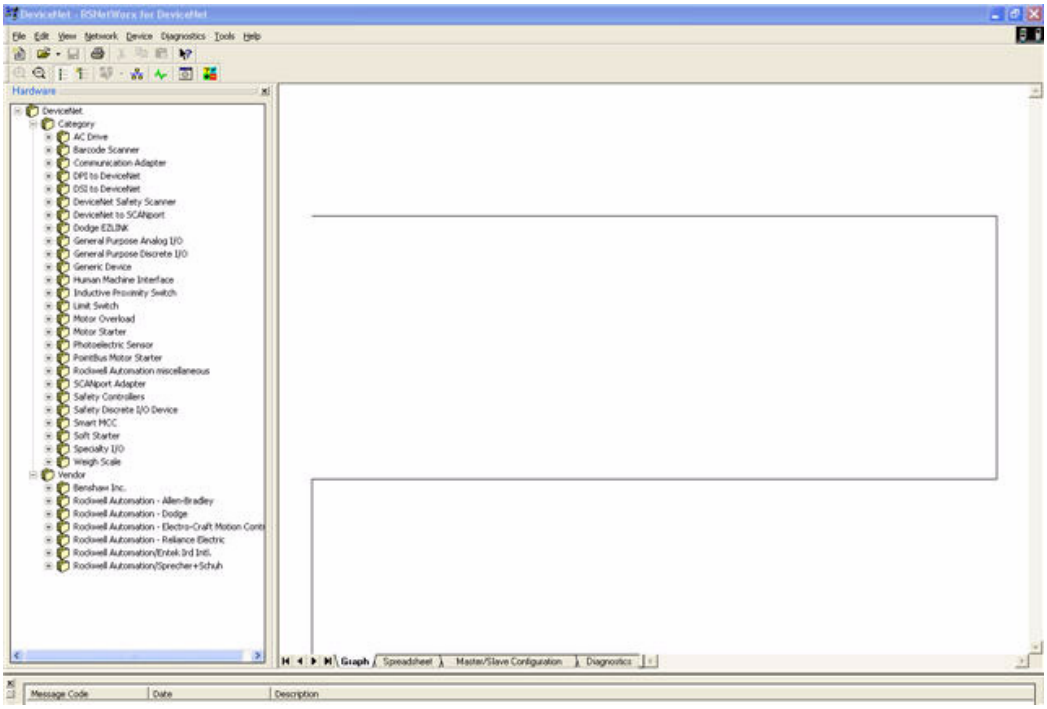
RSNetWorx for DeviceNet

Registering the MX^2/MX^3 without an EDS:

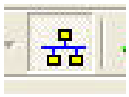
The next step in customization/setup is to register the device on a DeviceNet network using RSNetWorx for DeviceNet.

1. Launch the RSNetWorx for DeviceNet program.

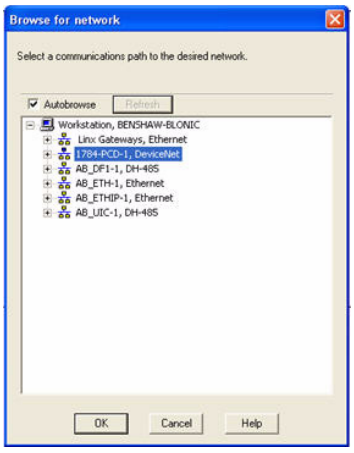
   If this is a new network, something similar to the following image should be displayed.



2. Click the “Online” icon to place RSNetWorx for DeviceNet in the online state.



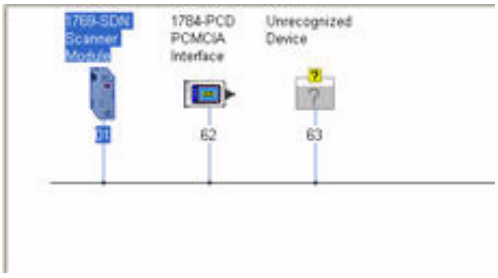
3. A “Browse for Network Connection” dialog box is displayed similar to the following image.



Select a network connection, then click “OK”.

4. An RSNetWorx for DeviceNet dialog box is displayed, click “OK”.

5. RSNetWorx for DeviceNet will begin to scan the network. Once complete, a graphic representation of the network appears, similar to the following image:



6. Note the yellow question mark on node 63. This indicates the device requires registration.

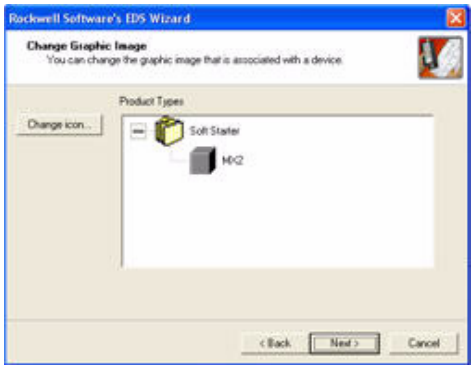
7. Right click the appropriate device and select “Register Device”. This wizard is used to create a stub EDS. The following screen appears:

8. Click “Next”, then the following screen will appear. Select “Create an EDS file” then click “Next”.

9. The EDS wizard reads the device description from the communication module. The “File Description” field can now be altered to whatever is most descriptive/applicable to the network, then click “Next”.

10. The next screen displayed is the Input/Output Type and Size screen. Set Type to “Polled”, and Input/Output Bytes to match the instance chosen during customization of the communication module. In this example, Input Instance 151 with a byte size of 8, and Output Instance 100 with a byte size of 2 was selected. Click “Next”.

11. The next screen displayed is the Change Graphic Image screen. In this example, the image will NOT be changed. Click “Next”.

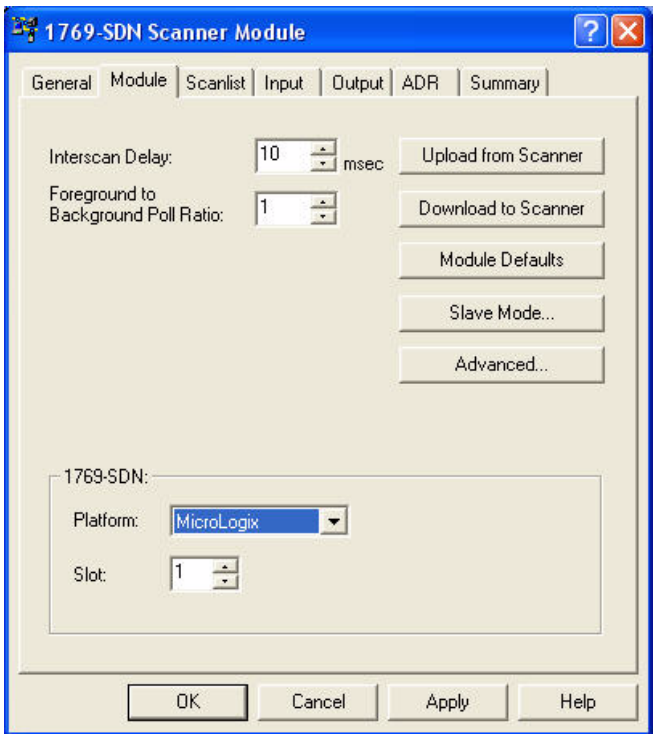


12. The next screen displayed is the Final Task Summary, which is to confirm the creation of an EDS file for the MX device. Click “Next”.

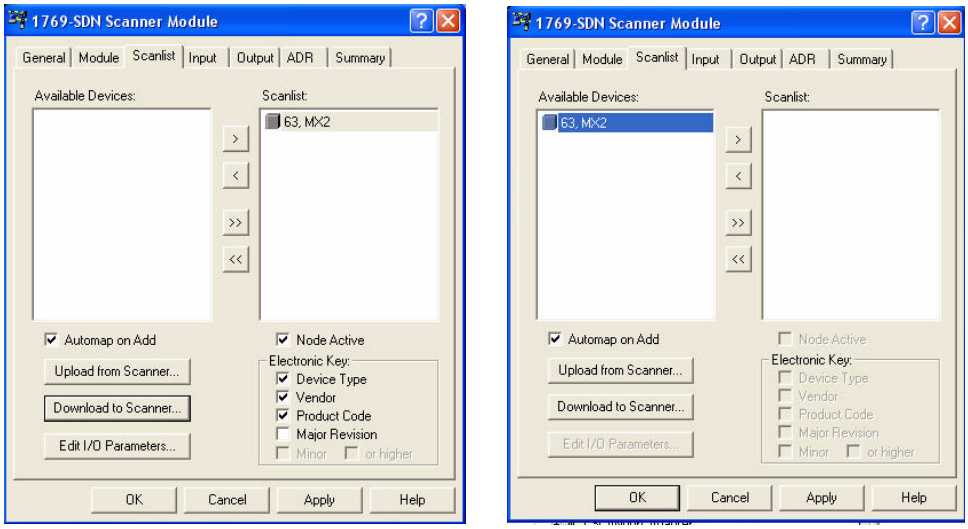
13. Click “Finish”.

14. The network icon representing the unrecognized device is now titled “MX” with a yellow question mark. Right click the appropriate device, then click “Upload from Device” to register the device and remove the yellow question mark.

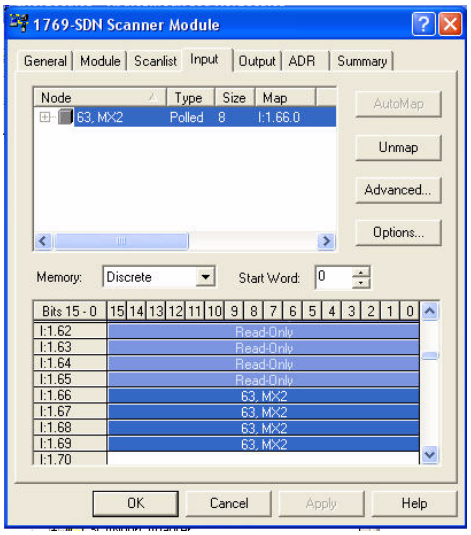
15. Right click the “SDN Card”, then click “Properties”. The options “Upload”, “Download” and “Cancel” will now be available. Click “Upload”. The screen shown below will appear; if “Platform” is NOT set to “MicroLogix”, do so then click the “Scanlist” tab.



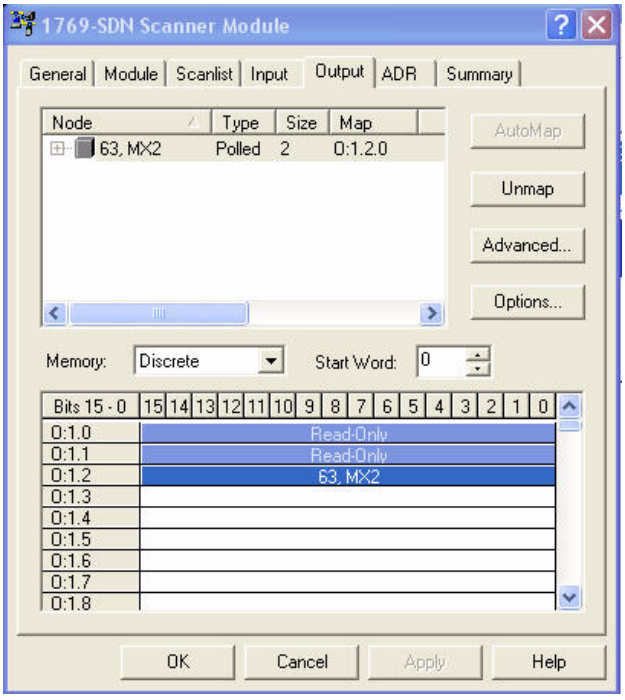
16. Move the “Available Device” to the “Scanlist”, then click “Download to Scanner”. Another dialog box will be displayed; ensure the Selected Scanlist Records are highlighted and the PLC or DeviceNet network is NOT in Run mode, then click “Download to Scanner”.



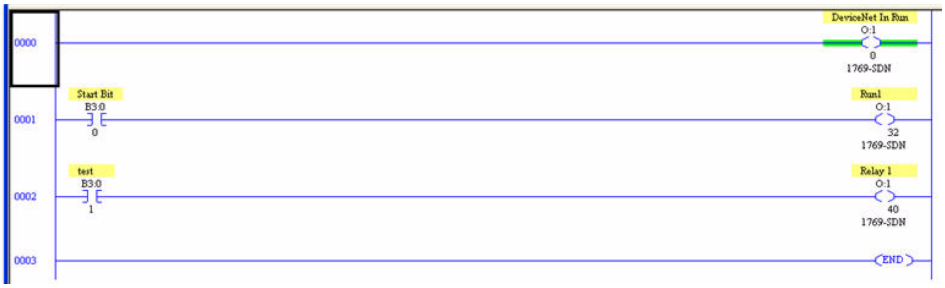
17. After the “Download to Scanner” is complete, click the “Input” tab; the following screen will be displayed. This screen shows where the input instance will be mapped in the SDN. In this example, input instance 151 will begin at (I:1.66).



18. Click the “Output” tab. The following screen will be displayed indicating where the output instance will be mapped in the SDN. In this example, output instance 100 will begin at (O:1.2).



19. Click “OK”. The MX communication module has been registered on the network and downloaded to the scanner card. The ladder logic can now be built.



4 - PCCC

Programmable Controller Communication Commands

PCCC Mapping Table

Table 88: PCCC Mapping Table

	IX	PCCC	Start Reg	End Reg	Length	Notes
Starter Status & Control	1	N7:20	40020	40059	40	
Starter Status & Control *(MX^3 only)*	19	N7:60	40060	40087	28	
Parameters	2	N10:1	40101	40150	50	
	3	N15:1	40151	40199	49	
Parameters *(MX^3 Only)*	20	N22:1	40221	40270	50	
	21	N27:1	40271	40299	29	
IO Card Information *(MX^3 only)*	22	N35:1	40351	40357	7	
Fault Codes	4	N60:1	40601	40619	9	
System States	5	N61:1	40611	40619	9	
L1 Currents	6	N62:1	40621	40629	9	
L2 Currents	7	N63:1	40631	40639	9	
L3 Currents	8	N64:1	40641	40649	9	
L1-L2 Voltages	9	N65:1	40651	40659	9	
L2-L3 Voltages	10	N66:1	40661	40669	9	
L3-L1 Voltages	11	N67:1	40671	40679	9	
Kilowatts	12	N68:1	40681	40689	9	
Line Periods	13	N69:1	40691	40699	9	
Run Time Hours	14	N70:1	40701	40709	9	
Event Log *(MX^3 only)*	23	N80:1	40801	40850	50	
	24	N85:1	40851	40899	49	
System States Log *(MX^3 only)*	25	N90:1	40901	40950	50	
	26	N95:1	40951	40999	49	
Event Time and Date Stamp *(MX^3 only)*	27	N100:1	41001	41050	50	
	28	N105:1	41051	41100	50	
	29	N110:1	41101	41150	50	
	30	N115:1	41151	41198	48	

Refer to Appendix A for a detailed description of the Modbus registers.

NOTE: The “PCCC” chart above was used in conjunction with a PLC5-Read/Write (explicit) message instruction allowing an Allen-Bradley PLC with built in EtherNet/IP, to communicate easily to and from the starter.

PCCC Example

PCCC

"Programmable Controller Communication Commands"

The following example uses a proprietary Client Server Protocol (CSP) protocol, with embedded PCCC commands. The PCCC chart found at the beginning of this section contains the mapped memory locations of the Benshaw Soft Start Modbus registers. When using the (N) registers listed in the chart, along with "explicit" message instructions in the ladder logic, control of the Benshaw Soft Start is a relatively simple task.

Purpose

This example demonstrates how to add an MX^2/MX^3 to an Allen Bradley EtherNet/IP network. The example code on the following pages illustrates the connection.

Hardware: Benshaw Communication Module COM-100000-01

AB MicroLogix 1100 1763-L16AWA

Generic 4 port hub

3 generic RJ45 patch cables

Laptop with XP SP3

Software: Benshaw Communication Module built in web server.

RSLogix 500 version 7.30.00 (CPR 9)

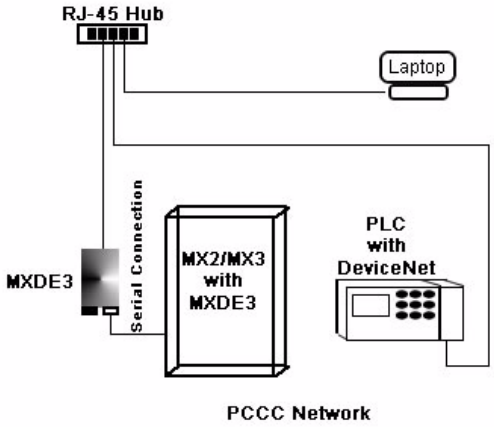
PanelBuilder32 version 03.82.01 (Build 451)

BOOTP-DHCP Server version 2.3.2.0

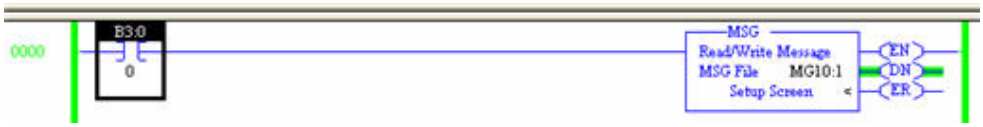
Reference Benshaw Com. Module Manual 890041-01-00

Modbus register Appendix A

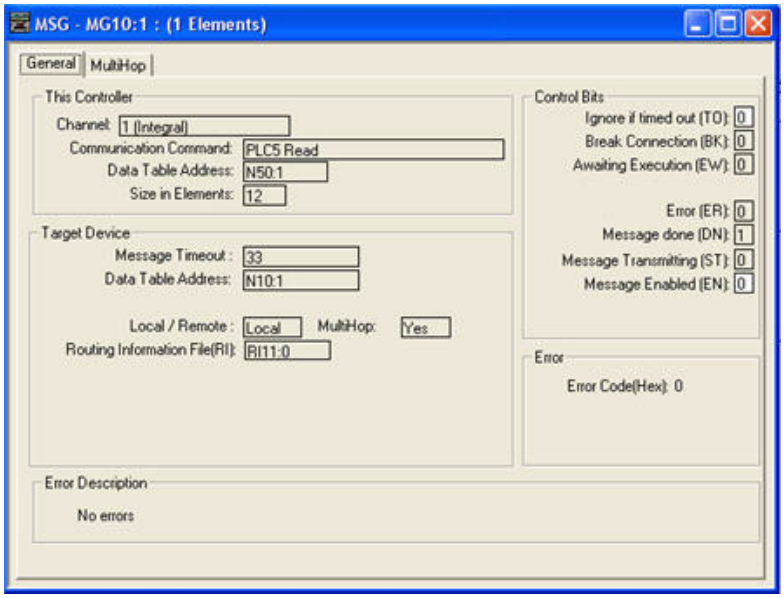
PCCC register map



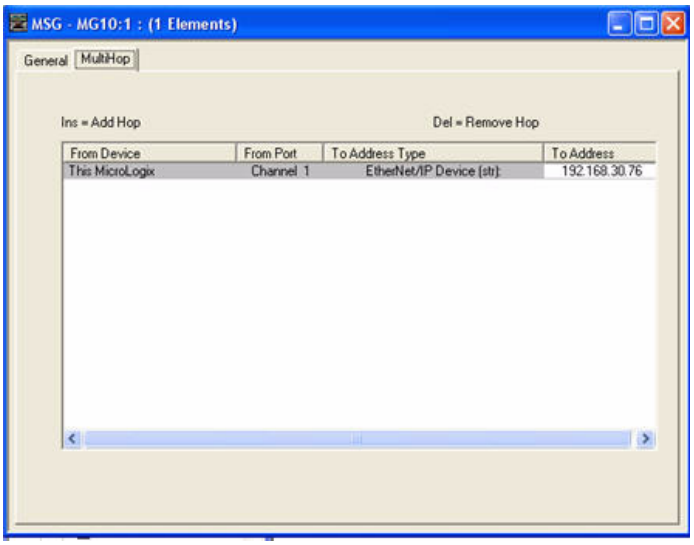
RSLogix 500: Rung 0



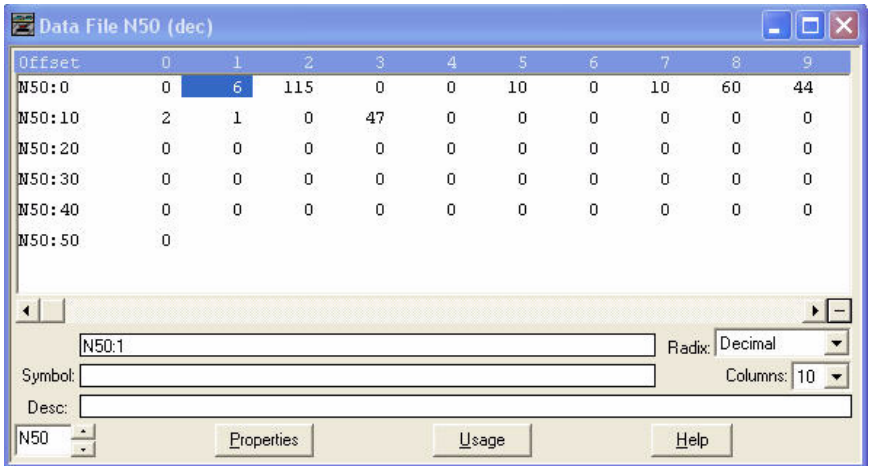
Setup Screen (General): Rung 0



Setup Screen (MultiHop): Rung 0



When “Bit 0” is toggled and a “DN” output is received in Rung 0, register 40101 - 40112 has been read (as shown in the following image).



N50:1=Motor FLA (6), N50:2=Motor Service Factor (115). The (N) registers will match Modbus number N50:1=40101 and N50:2=40102.

5 - Modbus-TCP

Modbus-TCP Mapping

Table 89: Modbus - TCP Mapping

	Start Reg	End Reg	Length	Notes
Starter Status & Control	40020	40059	40	
Starter Status & Control *(MX^3 only)*	40060	40087	28	
Parameters	40101	40150	50	
	40151	40199	49	
Parameters *(MX^3 only)*	40221	40270	50	
	40271	40299	29	
IO Card Information *(MX^3 only)*	40351	40357	7	
Fault Codes	40601	40609	9	
System States	40611	40619	9	
L1 Currents	40621	40629	9	
L2 Currents	40631	40639	9	
L3 Currents	40641	40649	9	
L1-L2 Voltages	40651	40659	9	
L2-L3 Voltages	40661	40669	9	
L3-L1 Voltages	40671	40679	9	
Kilowatts	40681	40689	9	
Line Periods	40691	40699	9	
Run Time Hours	40701	40709	9	
Event Log *(MX^3 Only)*	40801	40850	50	
	40851	40899	49	
System States Log *(MX^3 only)*	40901	40950	50	
	40951	40999	49	
Event Time and Date Stamp *(MX^3 only)*	41001	41050	50	
	41051	41100	50	
	41101	41150	50	
	41151	41198	48	

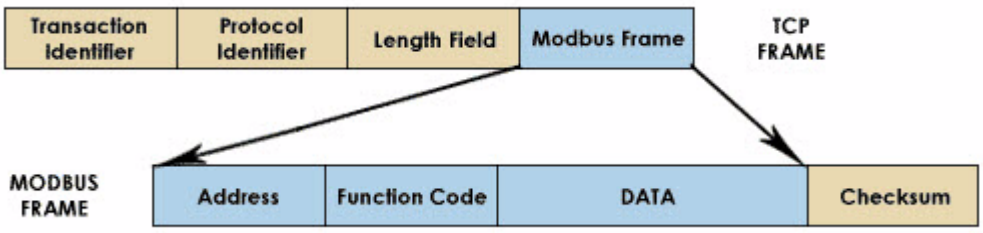
Refer to Appendix A for detailed descriptions of the modbus registers.

NOTE: To increase the efficiency of messages to and from the Starter, read/write PLC message instructions should NOT exceed the “Length” rows shown above.

The Modbus-TCP Protocol

Modbus/TCP embeds a Modbus frame into a TCP frame. This is a connection-oriented transaction in which every query expects a response.

This query/response technique fits well with the master/slave nature of Modbus, adding to the deterministic advantage that Switched Ethernet offers industrial users. The use of OPEN Modbus within the TCP frame provides a completely scalable solution from ten nodes, to ten thousand nodes, without the inherent risk of compromise in other multicast techniques.



Modbus-TCP Example

Purpose

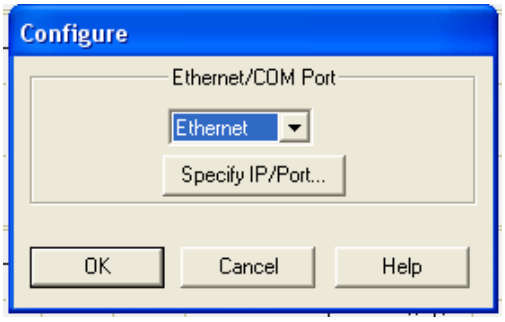
This example demonstrates how to add an MX^2/MX^3 to a Modbus-TCP network. The example code uses the following resources.

Hardware:	Benshaw Communication Module	COM-100000-01
	EzAutomation PLC	EZPLC-A-32E
	Generic 4 port hub	
	3 generic RJ45 patch cables	
	Laptop with XP SP3	
Software:	Benshaw Communication Module built in web server.	
	EzPLC programming software 1.4E	
	EZSeries Touch programming software 5.0	
Resource:	Modbus registers - Appendix A	

Assigning an IP Address

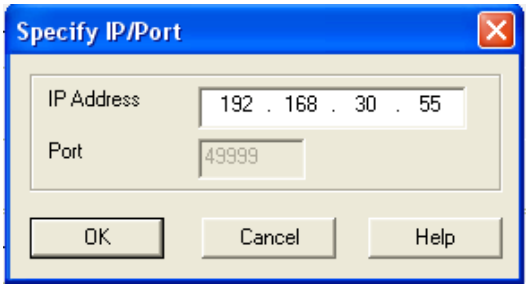
The following is an example of how to assign an IP address to the EzAutomation PLC:

1. Assign the PLC an IP address reachable by the network.
   A. From the drop down menu select “EZPLC” - “COM Configuration”, the following screen will be displayed:



   B. From the “Configure” box shown above, click the “down” arrow, then select “Ethernet”.

C. From the “Configure” box, click “Specify IP/Port”.



D. Enter the IP address for the PLC as assigned by the network administrator, then click the “OK”.

E. From the “Configure” box shown above, click “OK” to return to the main ladder logic screen.

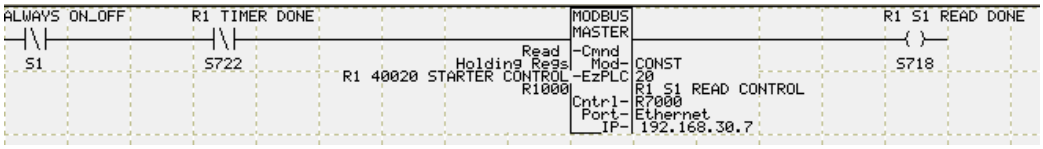
Constructing a Read Message

The following is an example of how to construct a read message in the EzAutomation PLC:

2. The read message logic must now be built. This message will query the Modbus address or addresses via Modbus/TCP. The focus in this example is on Modbus register (40020). Note that one Modbus register, or a block (length) of registers, can be read which have been defined in the Modbus/TCP chart found at the beginning of this section. A read message can be constructed which will query Modbus register (40020) or (40020 - 40059, a length of 40 registers), a practice based on the specification of the hardware being queried.

A. Place a “Modbus Master” instruction in the ladder logic, as shown below.

NOTE: The first “N.C.-contact” instruction (S1) is NOT required; the second “N.C.-contact” (S722) and “N.O.-coil” instruction (S718) are required to toggle through the “Modbus Master” instructions.



B. Double click the “Modbus Master” instruction box.

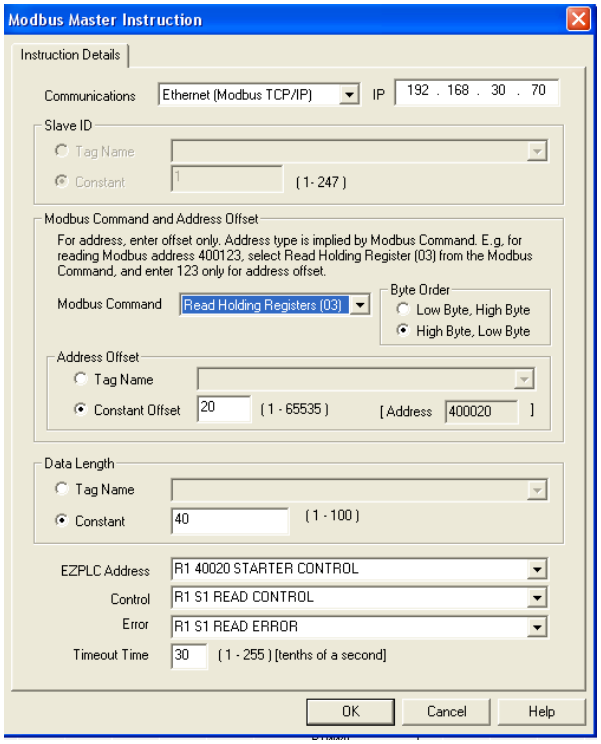
C. In the field next to “Communications”, click the “down” arrow to select “Ethernet (Modbus TCP/IP)”, then assign the IP address given to the Benshaw Communication Module as shown below (the IP address shown is for example purposes only).

D. Next to “Modbus Command”, click the “down” arrow and select “Read Holding Registers (03)”.

E. In the “Address Offset” section, select the bubble next to “Constant Offset” as shown below. (Start with address “40020” by setting the offset to “20”.)

F. In the “Data Length” section, select the bubble next to “Constant”, then enter “40” in the box to the right as shown. The length field is defined in the table located at the beginning of this section. A shorter length of 1, 5, or 7 can be selected, but do NOT exceed the length specified in the table.

G. The remaining fields “EZPLC Address”, “Control”, “Error”, and “Timeout Time” are specific to the EZPLC and should be filled in accordingly.



H. Click “OK”.

3. If properly connected to the communication device, this rung of logic can now be run, loading the Soft Start Modbus registers (40020 - 40059) into PLC memory. In this example, loading would begin with PLC register R1, continuing for a total of 40 registers.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6 - Troubleshooting

Communications Troubleshooting

Table 90: Communications Troubleshooting

Condition	Possible Cause	Possible Solutions
Unable to Communicate with Starter	Loose connection or damaged cable	Check all communication and power cables for loose connections or damage. Replace or correct.
	No power to device	Device not getting power: Check Power LED and correct for absence of proper voltage.
	No DeviceNet or Ethernet communication established	Check Status LEDs. Refer to Table 91 and 92.
	No Communication with Starter	Check Rx/Tx LEDs on MX^2 or MX^3 Card. LEDs should be blinking if communication is established between the starter and the MXDE3. Verify that the starter has control power. Verify that the starter has be configured for serial connections.
Unable to Access Web-Page Setup	Incorrect IP Address	Verify correct IP Address

General Troubleshooting

Status LEDs

There are 3 LEDs on the MXDE3 that are useful indicators of device operations. The Power LED is located next to the power jack, and both a DeviceNet and an EtherNet/IP Status LED are located next to the DIN rail mounting hardware. The following picture shows the Status LEDs, and the charts detail the information provided by the LEDs.

DeviceNet and EtherNet/IP Status LEDs

EtherNet IP (LED1)

Table 91: LED 1 (Ethernet IP) Codes

Ethernet IP LED	State	Indicates
Off (Shown)	Not powered, no IP Address	The Device does not have an IP address (or is powered off)
Solid Green	Connected	The device has at least one established connection (even to the Message Router)
Flashing Green	No Connections	The device has no established connections, but has obtained an IP address
Solid Red	Duplicate IP	The device has detected that its IP address is already in use
Flashing Red	Connection Timeout	One or more of the connections in which this device is the target has timed out
Flashing Red and Green	Self-Test	The device is performing power-up testing

DeviceNet (LED2)

Table 92: LED 2 (DeviceNet) Codes

Ethernet IP LED	State	Indicates
Off (Shown)	Device Not Powered/Not On-Line	The device has not completed the Dup_MAC_ID test, or may not be powered
Solid Green	Device Operational AND On-Line, Connected	• Group 2 Only Devices: Device is allocated to a Master • UCMM Capable Devices: Device has one or more established connections
Flashing Green	Device Operational AND On-Line, Not Connected *or* Device On-Line AND Requires Commissioning	The device has passed the Dup_MAC_ID test, is On-Line, but has no established connections to other nodes. • Group 2 Only Devices: Device is NOT allocated to a Master • UCMM Capable Devices: Device has NO established connections • Configuration missing, incomplete, or incorrect
Solid Red	Minor Fault *and/or* Connection Time-Out *and/or* No Network Power	• Recoverable fault • One or more I/O connections are in the Timed-Out state • No network power present
Flashing Red	Critical Fault or Critical Link Failure	• The device has an unrecoverable fault: May need replacing • Failed communication device: The device has detected an error that has rendered it incapable of communicating with the network (Duplicate MAC ID, or Bus-off)
Flashing Red and Green	Communication Faulted and Received an Identify Comm Fault Request - Long Protocol	A specific Communication Faulted device. The device has detected a Network Access error and is in the Communication Faulted state. The device has subsequently received and accepted an Identify Communication Faulted Request - Long Protocol message.

Advanced DeviceNet Troubleshooting

Network Voltage Requirements (V+ to V-)

Check network voltage at various points across the network, including the ends. If devices with large current demands are connected, the network voltage level will vary as these devices cycle. In these cases, monitor the network voltage over a period of time to determine voltage stability.

Check Signal Voltage Levels

Below are typical values when checking signal voltages. If measurements differ from those below, a problem may be indicated.

Table 93: Signal Voltages

Bus Communication State	CAN_H (White)		CAN_L (Blue)	
	Approx (V Meter)	Range (Scope)	Approx (V Meter)	Range (Scope)
Bus Communication ON	3V	2.5V to 4.0V	2V	1.0V to 2.5V
Bus Communication OFF (Idle)	2.5V	N/A	2V	N/A

Common Mode Voltage Test for Network Power

Apply power to all network power supplies, and configure all nodes for maximum current draw. Measure the DC voltage between V- and the shield. Normal operating range of this measured voltage is less than 4.65V.

Test for Termination Resistors

Stop all Bus communication, then use an Ohm Meter to measure the resistance between CAN_H and CAN_L. Typical readings should be near 60 Ohms. Values above or below this will require the addition or removal of termination resistors. If the value is significantly less than 60 Ohms, check for shorting conditions.

Check for Noise

Observe “noise” with an oscilloscope. The most common symptoms of EMI/RFI problems are CAN FRAME ERRORS which can be monitored using a CAN analyzer. Bursts of CAN frame errors may be observed, often connected with specific nodes. If the problem is intermittent in nature, try to correlate the CAN frame rate error bursts to the operation of other non-related equipment.


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Appendix A - Modbus Registers

Starter Status and Control Common to the MX^2 and MX^3

The following set of registers contains status and control information that exists in both the MX^2 and MX^3. All of these registers are read-only, with the exception of the Starter Control register.

Table 94: Modbus Registers - Starter Status & Control

Absolute Register Address	Description	Range	Units
30020/40020	Starter Control	Bit Mask: Bit 0: Run/Stop Bit 1: Fault Reset Bit 2: Emergency Overload Reset Bit 3: Local/Remote Bit 4: Heat Disable Bit 5: Ramp Select Bit 10: Relay 6 *(MX^3 only)* Bit 11: Relay 5 *(MX^3 only)* Bit 12: Relay 4 *(MX^3 only)* Bit 13: Relay 3 Bit 14: Relay 2 Bit 15: Relay 1	-
30021/40021	Starter Status	Bit Mask: Bit 0: Ready Bit 1: Running Bit 2: UTS Bit 3: Alarm Bit 4: Fault Bit 5: Lockout	-
30022/40022	Input Status	Bit Mask: Bit 0: Start Bit 1: DI 1 Bit 2: DI 2 Bit 3: DI 3 Bit 4: DI 4 *(MX^3 only)* Bit 5: DI 5 *(MX^3 only)* Bit 6: DI 6 *(MX^3 only)* Bit 7: DI 7 *(MX^3 only)* Bit 8: DI 8 *(MX^3 only)*	-
30023/40023	Alarm Status 1	Bit Mask: Bit 0: “A OL” - Motor Overload Bit 1: “A 5” - Motor PTC *(MX^3 only)* Bit 2: “A 6” - RTD Stator *(MX^3 only)* Bit 3: “A 7” - RTD Bearing *(MX^3 only)* Bit 4: “A 8” - RTD Other *(MX^3 only)* Bit 5: “A 10” - Phase Rotation not ABC Bit 6: “A 11” - Phase Rotation not CBA Bit 7: “A 12” - Low Line Frequency Bit 8: “A 13” - High Line Frequency Bit 9: “A 14” - Phase Rotation not 1PH Bit 10: “A 15” - Phase Rotation not 3PH Bit 11: “A 21” - Low Line L1 L2 Bit 12: “A 22” - Low Line L2 L3 Bit 13: “A 23” - Low Line L3 L1 Bit 14: “A 24” - High Line L1 L2 Bit 15: “A 25” - High Line L2 L3	-

Table 94: Modbus Registers - Starter Status & Control (Continued)

Absolute Register Address	Description	Range	Units
30024/40024	Alarm Status 2	Bit Mask: Bit 0: "A 26" - High Line L3-L1 Bit 1: "A 27" - Phase Loss Bit 2: "noL" - No Line Bit 3: "A 29" - PORT TImeout *(MX³ only)* Bit 4: "A 31" - Overcurrent Bit 5: "A 34" - Undercurrent Bit 6: "A 35" - PF Too Leading *(MX³ only)* Bit 7: "A 36" - PF Too Lagging *(MX³ only)* Bit 8: "A 37" - Current Imbalance Bit 9: "A 38" - Ground Fault Bit 10: "A 47" - Stack Overtemperature Bit 11: "A 53" - Tach Loss *(MX³ only)* Bit 12: "A 60" - DI 1 Bit 13: "A 61" - DI 2 Bit 14: "A 62" - DI 3 Bit 15: "A 63" - DI 4 *(MX³ only)*	-
30025/40025	Alarm Status 3	Bit Mask: Bit 0: "A 64" - DI 5 *(MX³ only)* Bit 1: "A 65" - DI 6 *(MX³ only)* Bit 2: "A 66" - DI 7 *(MX³ only)* Bit 3: "A 67" - DI 8 *(MX³ only)* Bit 4: "A 71" - Analog Input Trip	-
30026/40026	Lockout Status	Bit Mask: Bit 0: "L OL" - Motor Overload Bit 1: "LPtc: - Motor PTC *(MX³ only)* Bit 2: "Lrtd" - RTD Stator *(MX³ only)* Bit 3: "Lrtd" - RTD Bearing *(MX³ only)* Bit 4: "Lrtd" - RTD Other *(MX³ only)* Bit 5: "L rI" - Run Interlock Bit 6: "L dS" - Disconnect Open Bit 7: "L Ot" - Stack Overtemperature Bit 8: "L CP" - Control Power Bit 9: "Lrtd" - RTD Open/Short *(MX³ only)* Bit 10: "LtbS" - Time Between Starts *(MX³ only)* Bit 11: "L bS: - Backspin *(MX³ only)* Bit 12: "LSph" - Starts per Hour *(MX³ only)* Bit 13: "Lrtd" - RTD Comm Loss *(MX³ only)*	
30027/40027	Present Fault Code		
30028/40028	Average Current		Arms
30029/40029	L1 Current		Arms
30030/40030	L2 Current		Arms
30031/40031	L3 Current		Arms
30032/40032	Current Imbalance		0.1%
30033/40033	Residual Ground Fault Current		% FLA
30034/40034	Zero Sequence Ground Fault Current *(MX³ only)*		0.001 Arms
30035/40035	Average Voltage		Vrms
30036/40036	L1-L2 Voltage		Vrms
30037/40037	L2-L3 Voltage		Vrms
30038/40038	L3-L1 Voltage		Vrms
30039/40039	Motor Overload		0.01

Table 94: Modbus Registers - Starter Status & Control (Continued)

Absolute Register Address	Description	Range	Units
30040/40040	Power Factor	-99 - +100 (in 16-bit two's compliment signed format)	0.01
30041/40041	Watts (lower 16 bits)	(in 32-bit unsigned integer format)	W
30042/40042	Watts (upper 16 bits)		
30043/40043	VA (lower 16 bits)	(in 32-bit unsigned integer format)	VA
30044/40044	VA (upper 16 bits)		
30045/40045	vars (lower 16 bits)	(in 32-bit two's compliment signed integer format)	var
30046/40046	vars (upper 16 bits)		
30047/40047	kW hours (lower 16 bits)	(in 32-bit unsigned integer format)	kWh
30048/40048	kW hours (upper 16 bits)		
30049/40049	Phase Order	0: no line 1: ABC 2: CBA 3: SPH	-
30050/40050	Line Frequency	230 - 720, or 0 if no line	0.1 Hz
30051/40051	Analog Input %	1000 - +1000 (in 16-bit two's compliment signed format)	0.1%
30052/40052	Analog Output %		0.1%
30053/40053	Running Time	0 - 1000	hours
30054/40054	Running Time	0 - 65535	minutes
30055/40055	Starts	0 - 59	-
30056/40056	TruTorque %		%
30057/40057	Power %		%
30058/40058	Peak Starting Current		Arms
30059/40059	Last Starting Duration		0.1 Sec

Table 95: Starter Control Register

Bit 0 - Run/Stop	0 - Stop 1 - Run
Bit 1 - Fault Reset	0 - No action 1 - Fault Reset
Bit 2 - Emergency Overload Reset	0 - No Action 1 - Emergency Overload Reset
Bit 3 - Local/Remote	0 - Local 1 - Remote
Bit 4 - Heat Disable	0 - Heat Enabled 1 - Heat Disabled
Bit 5 - Ramp Select	0 - Ramp 1 1 - Ramp 2

Table 95: Starter Control Register (Continued)

Bit 10 - Relay 6	0 - De-energize 1 - Energize
Bit 11 - Relay 5	
Bit 12 - Relay 4	
Bit 13 - Relay 3	
Bit 14 - Relay 2	
Bit 15 - Relay 1	

Starter Status and Control Unique to the MX^3

The following set of registers contains status and control information that exists only in the MX^3. All of these registers are read-only with the exception of the Date and Time registers.

Table 96: Starter Status and Control (Unique to the MX^3)

Absolute Register Address	Description	Range	Units
30060/40060	Hottest Stator RTD Temperature	0 - 200	^{o}C
30061/40061	Hottest Bearing RTD Temperature	0 - 200	^{o}C
30062/40062	Hottest Other RTD Temperature	0 - 200	^{o}C
30063/40063	RTD 1 Temperature	0 - 200	^{o}C
30064/40064	RTD 2 Temperature	0 - 200	^{o}C
30065/40065	RTD 3 Temperature	0 - 200	^{o}C
30066/40066	RTD 4 Temperature	0 - 200	^{o}C
30067/40067	RTD 5 Temperature	0 - 200	^{o}C
30068/40068	RTD 6 Temperature	0 - 200	^{o}C
30069/40069	RTD 7 Temperature	0 - 200	^{o}C
30070/40070	RTD 8 Temperature	0 - 200	^{o}C
30071/40071	RTD 9 Temperature	0 - 200	^{o}C
30072/40072	RTD 10 Temperature	0 - 200	^{o}C
30073/40073	RTD 11 Temperature	0 - 200	^{o}C
30074/40074	RTD 12 Temperature	0 - 200	^{o}C
30075/40075	RTD 13 Temperature	0 - 200	^{o}C
30076/40076	RTD 14 Temperature	0 - 200	^{o}C
30077/40077	RTD 15 Temperature	0 - 200	^{o}C
30078/40078	RTD 16 Temperature	0 - 200	^{o}C
30079/40079	RTDs Enabled	Bit Mask: Each of the sixteen bits represents an RTD. A 1 indicates the RTD is enabled. Bit 0 represents RTD 1. Bit 15 represents RTD 16.	-
30080/40080	RTDs Assigned as Stator	Bit Mask: Each of the sixteen bits represents an RTD. A 1 indicates the RTD is assigned to the Stator group.	-

Table 96: Starter Status and Control (Unique to the MX^3) (Continued)

Absolute Register Address	Description	Range	Units
30081/40081	RTDs Assigned as Bearing	Bit Mask: Each of the sixteen bits represents an RTD. A 1 indicates the RTD is assigned to the Bearing Group.	-
30082/40082	RTDs Assigned as Other	Bit Mask: Each of the sixteen bits represents an RTD. A 1 indicates the RTD is assigned to the Other group.	-
30083/40083	RTDs with Open Leads	Bit Mask: Each of the sixteen bits represents an RTD. A 1 indicates the RTD has an open lead.	-
30084/40084	RTDs with Shorted Leads	Bit Mask: Each of the sixteen bits represents an RTD. A 1 indicates the RTD has a shorted lead.	-
30085/40085	Remaining Lockout Time		Sec
30086/40086	Date/Time (lower 16 bits)	(in unsigned integer format)	Sec
30087/40087	Date/Time (upper 16 bits)		

Date/Time Registers

Date and Time are expressed as the number of seconds elapsed since 12:00 AM on January 1st, 1972 in an unsigned 32 bit number.

Parameters Common to the MX^2 and MX^3

The following set of registers contains parameters that exist both in the MX^2 and the MX^3, some of which may have differing ranges between the systems.

All parameter registers are both readable and writable. Certain parameters may not be written to while the starter is running.

Table 97: Parameters Common to MX^2 and MX^3

Absolute Register Address	Description	Range	Units
30101/40101	Motor FLA	1 - 6400	Arms
30102/40102	Motor Service Factor	100 - 199	0.01
30103/40103	Independent Start/Run Motor Overloads	0: Disabled 1: Enabled	-
30104/40104	Motor Overload Running Enable	0: Disabled 1: Enabled	-
30105/40105	Motor Overload Running Class	1 - 40	-
30106/40106	Motor Overload Starting Enable	0: Disabled 1: Enabled	-
30107/40107	Motor Overload Starting Class	1 - 40	-
30108/40108	Motor Overload Hot/Cold Ratio	0 - 99	%

Table 97: Parameters Common to MX^2 and MX^3 (Continued)

Absolute Register Address	Description	Range	Units
30109/40109	Motor Overload Cooling TIme	10 - 9999	0.1 min
30110/40110	Local Source	0: Keypad 1: Terminal 2: Serial	-
30111/40111	Remote Source		
30112/40112	Start Mode	0: Open Loop Voltage Ramp 1: Closed Loop Current Ramp 2: TruTorque Ramp 3: Power Ramp 4: Tach Ramp *(MX^3 only)*	-
30113/40113	Initial Motor Current 1	50 - 600	% FLA
30114/40114	Maximum Motor Current 1	100 - 800	% FLA
30115/40115	Ramp Time 1	0 - 300	Sec
30116/40116	Initial Motor Current 2	50 - 600	% FLA
30117/40117	Maximum Motor Current 2	100 - 800	% FLA
30118/40118	Ramp TIme 2	0 - 300	Sec
30119/40119	UTS Time	1 - 900	Sec
30120/40120	Initial V/T/P	1 - 100	%
30121/40121	Max T/P	10 - 325	%
30122/40122	Stop Mode	0: Coast 1: Voltage Decel 2: TruTorque Decel 3: DC Brake	-
30123/40123	Decel Begin Level	100 - 1	%
30124/40124	Decel End Level	99 - 1	%
30125/40125	Decel Time	1 - 180	Sec
30126/40126	DC Brake Level	10 - 100	%
30127/40127	DC Brake Time	1 - 180	Sec
30128/40128	DC Brake Delay	1 - 30	100 mSec
30129/40129	Kick Enable 1	0: Disabled 1: Enabled	-
30130/40130	Kick Current Level 1	100 - 800	% FLA
30131/40131	Kick Time 1	1 - 100	100 mSec
30132/40132	Kick Enable 2	0: Disabled 1: Enabled	-
30133/40133	Kick Current Level 2	100 - 800	%FLA
30134/40134	Kick Time 2	1-100	100 mSec
30135/40105	Slow Speed Enable 1	0: Disabled 1: Enabled	-

Table 97: Parameters Common to MX^2 and MX^3 (Continued)

Absolute Register Address	Description	Range		Units
		MX^2	*MX^3*	
30136/40136	Slow Speed 1	0: 7.1 1: 14.3	0: 1.0 1: 1.5 2: 1.6 3: 1.7 4: 1.9 5: 2.0 6: 2.5 7: 2.6 8: 2.8 9: 2.9 10: 3.1 11: 3.3 12: 3.5 13: 3.8 14: 4.2 15: 4.5 16: 5.0 17: 5.5 18: 6.2 19: 7.1 20: 8.3 21: 9.1 22: 10.0 23: 11.1 24: 12.5 25: 14.3 26: 16.7 27: 20.0 28: 25.0 29: 33.3 30: 37.5 31: 40.0	%
30137/40137	Slow Speed Current Level 1	10 - 400		% FLA
30138/40138	Slow Speed Time Limit Enable	0: Disabled 1: Enabled		-
30139/40139	Slow Speed Time Limit	1 - 900		Sec
30140/40140	Slow Speed Kick Enable	0: Disabled 1: Enabled		-
30141/40141	Slow Speed Kick Level	100 - 800		% FLA
30142/40142	Slow Speed Kick Time	1 - 100		100 mSec

Table 97: Parameters Common to MX^2 and MX^3 (Continued)

Absolute Register Address	Description	Range	Units
30143/40143	Rated RMS Voltage	0: 100 1: 110 2: 120 3: 200 4: 208 5: 220 6: 230 7: 240 8: 350 9: 380 10: 400 11: 415 12: 440 13: 460 14: 480 15: 500 16: 525 17: 575 18: 600 19: 660 20: 690 21: 800 22: 1000 23: 1140 24: 2200 *(MX^3 only)* 25: 2300 *(MX^3 only)* 26: 2400 *(MX^3 only)* 27: 3300 *(MX^3 only)* 28: 4160 *(MX^3 only)* 29: 4600 *(MX^3 only)* 30: 4800 *(MX^3 only)* 31: 6000 *(MX^3 only)* 32: 6600 *(MX^3 only)* 33: 6900 *(MX^3 only)* 34: 10000 *(MX^3 only)* 35: 11000 *(MX^3 only)* 36: 11500 *(MX^3 only)* 37: 12000 *(MX^3 only)* 38: 12470 *(MX^3 only)* 39: 13200 *(MX^3 only)* 40: 13800 *(MX^3 only)*	Vrms
30144/40144	Input Phase Sensitivity	0: Ins 1: ABC 2: CBA 3: SPH	-
30145/40145	Motor Rated Power Factor	1 - 100	-
30146/40146	Overcurrent Enable	0: Disabled 1: Enabled	-
30147/40147	Overcurrent Level	50 - 800	-
30148/40148	Overcurrent Delay Time Enable	0: Disabled 1: Enabled	-
30149/40149	Overcurrent Delay Time	1 - 900	100 mSec
30150/40150	Undercurrent Trip Enable	0: Disabled 1: Enabled	-
30151/40151	Undercurrent Trip Level	5 - 100	% FLA
30152/40152	Undercurrent Trip Delay Time Enable	0: Disabled 1: Enabled	-

Table 97: Parameters Common to MX^2 and MX^3 (Continued)

Absolute Register Address	Description	Range	Units
30153/40153	Undercurrent Trip Delay Time	1 - 900	100 mSec
30154/40154	Current Imbalance Trip Enable	0: Disabled 1: Enabled	-
30155/40155	Current Imbalance Trip Level	5 - 100	% FLA
30156/40156	Residual Ground Fault Trip Enable	0: Disabled 1: Enabled	-
30157/40157	Residual Ground Fault Trip Level	5 - 100	% FLA
30158/40158	Over Voltage Trip Enable	0: Disabled 1: Enabled	-
30159/40159	Over Voltage Trip Level	1 - 40	%
30160/40160	Under Voltage Trip Enable	0: Disabled 1: Enabled	-
30161/40161	Under Voltage Trip Level	1 - 40	%
30162/40162	Over/Under Voltage Delay Time	1 - 900	100 mSec
30163/40163	Digital Input Trip Delay TIme	1 - 900	100 mSec
30164/40164	Auto Fault Reset Enable	0: Disabled 1: Enabled	-
30165/40165	Auto Fault Reset Delay Time	1 - 900	Sec
30166/40166	Auto Fault Reset Count Enable	0: Disabled 1: Enabled	-
30167/40167	Auto Fault Reset Count	1 - 10	-
30168/40168	Controlled Fault Stop	0: Disabled 1: Enabled	-
30169/40169	DI 1 Configuration	0: Off 1: Stop 2: Fault High 3: Fault Low 4: Fault Reset 5: Disconnect 6: Inline Feedback (F29) 7: Bypass / 2M Feedback (F48) 8: Emergency Motor OL Reset 9: Local / Remote Control Source 10: Heat Disable 11: Heat Enable 12: Ramp Select 13: Slow Speed Forward 14: Slow Speed Reverse 15: DC Brake Disable 16: DC Brake Enable 17: Run Enable 18: Run Disable 19: Speed Switch Normally Open *(MX^3 only)* 20: Speed Switch Normally Closed *(MX^3 only)*	-
30170/40170	DI 2 Configuration		
30171/40171	DI 3 Configuration		

Table 97: Parameters Common to MX^2 and MX^3 (Continued)

Absolute Register Address	Description	Range	Units
30172/40172	R1 Configuration	0: Off 1: Fault Fail Safe 2: Fault Non Fail Safe 3: Running 4: Up To Speed 5: Alarm 6: Ready 7: Locked Out 8: Over Current Alarm 9: Under Current Alarm 10: Overload Alarm 11: Shunt Trip Fail Safe 12: Shunt Trip Non Fail Safe 13: Faulted on Ground Fault 14: In Energy Saver Mode 15: Heating 16: Slow Speed 17: Slow Speed Forward 18: Slow Speed Reverse 19: DC Braking 20: Cooling Fan 21: PORT *(MX^3 only)* 22: Tach Loss *(MX^3 only)*	-
30173/40173	R2 Configuration		
30174/40174	R3 Configuration		
30175/40175	Analog Input Trip Enable	0: Disabled 1: Enabled	-
30176/40176	Analog Input Trip Type	0: Low - Fault below preset level 1: High - Fault above preset level	-
30177/40177	Analog Input Trip Level	0 - 100	%
30178/40178	Analog Input Trip Delay TIme	1 - 900	100 mSec
30179/40179	Analog Input Span	1 - 100	%
30180/40180	Analog Input Offset	0 - 99	%
30181/40181	Analog Output Function	0: Off (no output) 1: 0 - 100% Current 2: 0 - 200% Current 3: 0 - 800% Current 4: 0 - 150% Voltage 5: 0 - 150% Overload 6: 0 - 10kW 7: 0 - 100kW 8: 0 - 1MW 9: 0 - 10MW 10: 1 - 100% Analog Input 11: 0 - 100% Firing 12: Calibration (full output)	-
30182/40182	Analog Output Span	1 - 125	%
30183/40183	Analog Output Offset	0 - 99	%
30184/40184	Inline Enable	0: Disabled 1: Enabled	-
30185/40185	Inline Delay Time	10 - 100	100 mSec
30186/40186	Bypass Feedback Time	1 - 50	100 mSec
30187/40187	Keypad Stop	0: Disabled 1: Enabled	-

Table 97: Parameters Common to MX^2 and MX^3 (Continued)

Absolute Register Address	Description	Range	Units
30188/40188	Modbus Timeout Enable	0: Disabled 1: Enabled	-
30189/40189	Modbus Timeout	1 - 120	Sec
30190/40190	CT Ratio	0: 72:1 1: 96:1 2: 144:1 3: 288:1 4: 864:1 5: 2640:1 6: 3900:1 7: 5760:1 8: 8000:1 9: 14400:1 10: 28800:1 11: 50:5 12: 150:5 13: 250:5 14: 400:5 15: 600:5 16: 800:5 17: 2000:5 18: 5000:5	-
30191/40191	Auto Start	0: Disabled 1: Start after power applied 2: Start after fault reset 3: Start after power applied and fault reset	-
30192/40192	Energy Saver Enable	0: Disabled 1: Enabled	-
30193/40193	Heater / Anti-Windmill Enable	0: Disabled 1: Enabled	-
30194/40194	Heater / Anti-Windmill Level	1 - 40	% FLA
30195/40195	Starter Type	0: Normal (Outside Delta) 1: Inside Delta 2: Wye-Delta 3: Phase Controller 4: Current Follower 5: Across the Line (Full Voltage)	-

Table 97: Parameters Common to MX^2 and MX^3 (Continued)

Absolute Register Address	Description	Range	Units
30196/40196	LED Display Meter	0: Status 1: Avg Current 2: L1 Current 3: L2 Current 4: L3 Current 5: Current Imbalance % 6: Residual Ground Current 7: Avg Volts 8: L1-L2 Volts 9: L2-L3 Volts 10: L3-L1 Volts 11: Overload 12: Power Factor 13: Watts 14: VA 15: vars 16: kW hours 17: MW hours 18: Phase Order 19: Line Frequency 20: Analog Input 21: Analog Output 22: Running Days 23: Running Hours 24: Starts 25: TruTorque % 26: Power % 27: Peak Starting Current 28: Last Starting Duration 29: Zero Sequence Ground Current *(MX^3 only)* 30: Hottest Stator RTD Temperature *(MX^3 only)* 31: Hottest Bearing RTD Temperature *(MX^3 only)* 32: Hottest Other RTD Temperature *(MX^3 only)* 33: Hottest RTD Temperature *(MX^3 only)*	-
30197/40197	LCD Display Meter 1	1: Avg Current 2: L1 Current 3: L2 Current 4: L3 Current 5: Current Imbalance % 6: Residual Ground Current 7: Avg Volts 8: L1-L2 Volts 9: L2-L3 Volts 10: L3-L1 Volts 11: Overload 12: Power Factor 13: Watts 14: VA 15: vars 16: kW hours 17: MW hours 18: Phase Order 19: Line Frequency 20: Analog Input 21: Analog Output 22: Running Days 23: Running Hours 24: Starts 25: TruTorque % 26: Power % 27: Peak Starting Current 28: Last Starting Duration 29: Zero Sequence Ground Current *(MX^3 only)* 30: Hottest Stator RTD Temperature *(MX^3 only)* 31: Hottest Bearing RTD Temperature *(MX^3 only)* 32: Hottest Other RTD Temperature *(MX^3 only)* 33: Hottest RTD Temperature *(MX^3 only)*	-
30198/40198	LCD Display Meter 2		

Table 97: Parameters Common to MX^2 and MX^3 (Continued)

Absolute Register Address	Description	Range	Units
30199/40199	Misc. Commands	0: None 1: Standard BIST 2: Powered BIST 3: Reset Run Time 4: Reset kWh 5: Enter Reflash Mode 6: Store Parameters 7: Load Parameters 8: Factory Reset	-

Misc Command

The Misc Command register allows various commands to be performed. Writing a value of 0 to the register has no effect. Writing any other value to the register causes the command to execute. Reading the register always returns a value of 0.

- Writing a 1 to the register causes the Standard BIST mode to be entered.
- Writing a 2 to the register causes the Powered BIST mode to be entered.
- Writing a 3 to the register causes the run time meter to be reset to 0. Note that in addition to the resettable run time meters, a non-resettable run time meter also exists in the factory register space.
- Writing a 4 to the register causes the kWh and MWh meters to be reset to 0.
- Writing a 5 to the register causes the starter to enter the re-flash mode.
- Writing a 6 to the register causes the current set of parameter values to be stored in a secondary storage area.
- Writing a 7 to the register causes the parameter values to be loaded from data previously stored in the secondary storage area. This may only be done when the starter is stopped.
- Writing an 8 to the register causes the User parameter values to be restored to factory defaults. *Factory parameters will not be restored.*

Parameters Unique to the MX^3

The following set of registers contains parameters that are unique to the MX^3. All parameter registers are both readable and writable. Certain parameters may not be written to while the starter is running.

Table 98: Unique MX^3 Parameters

Absolute Register Address	Description	Range	Units
30221/40221	Acceleration Profile	0: Linear 1: Squared	-
30222/40222	Deceleration Profile	2: S-Curve	-
30223/40223	PORT Bypass Enable	0: Disabled 1: Enabled	-
30224/40224	PORT Bypass Delay Time	1 - 50	100 mSec
30225/40225	PORT Recovery Method	0: Voltage Ramp 1: Fast Recover 2: Current Ramp 3: Current Ramp 2 4: Ramp Select 5: Tach Ramp	-
30226/40226	Tachometer Full Speed Voltage	100-1000	10 mV
30227/40227	Tachometer Loss Delay Time	1-900	100 mSec
30228/40228	Tachometer Loss Action	0: Fault 1: Closed Loop Current Ramp 2: TruTorque Ramp 3: Power Ramp	-
30229/40229	Time/Date Format	0: mm/dd/yy, 12 Hour 1: mm/dd/yy, 24 Hour 2: yy/mm/dd, 12 Hour 3: yy/mm/dd, 24 Hour 4: dd/mm/yy, 12 Hour 5: dd/mm/yy, 24 Hour	-
30230/40230	Current Imbalance Delay Time	1 - 900	100 mSec
30231/40231	Zero Sequence Ground Fault Trip Enable	0: Disabled 1: Enabled	-
30232/40232	Zero Sequence Ground Fault Trip Level	10 - 250	100 mArms
30233/40233	Ground Fault Delay Time	1 - 900	100 mSec
30234/40234	Phase Loss Delay Time	1 - 50	100 mSec
30235/40235	Over Frequency Trip Level	24 - 72	Hz
30236/40236	Under Frequency Trip Level	23 - 71	Hz
30237/40237	Over/Under Frequency Delay Time	1 - 900	100 mSec
30238/40238	Power Factor Leading Trip Enable	0: Disabled 1: Enabled	-
30239/40239	Power Factor Leading Trip Level	80 - 99 = -0.80 - -0.99 lag 100 - 199 = 1.00 - +0.01 lead	-
30240/40240	Power Factor Lagging Trip Enable	0: Disabled 1: Enabled	-
30241/40241	Power Factor Lagging Trip Level	1 - 99 = -0.01 - -0.99 lag 100 - 120 = 1.00 - +0.80 lead	-

Table 98: Unique MX^3 Parameters (Continued)

Absolute Register Address	Description	Range	Units
30242/40242	Power Factor Delay Time	1 - 900	100 mSec
30243/40243	Backspin Timer Disable	0: Disabled 1: Enabled	-
30244/40244	Backspin Time	1 - 180	Min
30245/40245	Time Between Starts Enable	0: Disabled 1: Enabled	-
30246/40246	Time Between Starts	1 - 180	Min
30247/40247	Starts per Hour Enable	0: Disabled 1: Enabled	-
30248/40248	Starts per Hour	1 - 6	-
30249/40249	Speed Switch Enable	0: Disabled 1: Enabled	-
30250/40250	Speed Switch Delay Time	1 - 250	Sec
30251/40251	Motor PTC Enable	0: Disabled 1: Enabled	-
30252/40252	Motor PTC Delay Time	1 - 5	Sec
30253/40253	PORT Trip Enable	0: Disabled 1: Enabled	-
30254/40254	PORT Trip Delay Time	1 - 900	100 mSec
30255/40255	Motor Overload Alarm Level	1 - 100	%
30256/40256	Motor Overload Lockout Level	1 - 99	%
30257/40257	Motor Overload Auto Lockout Calculation	0: Disabled 1: Enabled	-
30258/40258	Motor Overload RTD Biasing Enable	0: Disabled 1: Enabled	-
30259/40259	Motor Overload RTD Biasing Minimum	0 - 198	^oC
30260/40260	Motor OVerload RTD Biasing Middle	1 - 199	^oC
30261/40261	Motor Overload RTD Biasing Maximum	105 - 200	^oC
30262/40262	DI 4 Configuration	Same as DI 1 through DI 3 configuration in the Parameters Common to the MX^2 and MX^3	-
30263/40263	DI 5 Configuration		
30264/40264	DI 6 Configuration		
30265/40265	DI 7 Configuration		
30266/40266	DI 8 Configuration		
30267/40267	R4 Configuration	Same as R1 through R3 configuration in the Parameters Common to the MX^2 and MX^3	-
30268/40268	R5 Configuration		
30269/40269	R6 Configuration		
30270/40270	RTD Module 1 Enable	0: Disabled 1: Enabled	-
30271/40271	RTD Module 1 Address	16 - 23	-

Table 98: Unique MX^3 Parameters (Continued)

Absolute Register Address	Description	Range	Units
30272/40272	RTD Module 2 Enable	0: Disabled 1: Enabled	-
30273/40273	RTD Module 2 Address	16 - 23	-
30274/40274	RTD 1 Group	0: Off 1: Stator 2: Bearing 3: Other	-
30275/40275	RTD 2 Group		
30276/40276	RTD 3 Group		
30277/40277	RTD 4 Group		
30278/40278	RTD 5 Group		
30279/40279	RTD 6 Group		
30280/40280	RTD 7 Group		
30281/40281	RTD 8 Group		
30282/40282	RTD 9 Group		
30283/40283	RTD 10 Group		
30284/40284	RTD 11 Group		
30285/40285	RTD 12 Group		
30286/40286	RTD 13 Group		
30287/40287	RTD 14 Group		
30288/40288	RTD 15 Group		
30289/40289	RTD 16 Group		
30290/40290	RTD Stator Alarm Level	1 - 200	^{o}C
30291/40291	RTD Bearing Alarm Level		
30292/40292	RTD Other Alarm Level		
30293/40293	RTD Stator Trip Level		
30294/40294	RTD Bearing Trip Level		
30295/40295	RTD Other Trip Level		
30296/40296	RTD Voting Enable	0: Disabled 1: Enabled	-
30297/40297	Slow Speed Enable 2	0: Disabled 1: Enabled	-
30298/40298	Slow Speed 2	Same as Slow Speed 1 in the Parameters Common to the MX^2 and MX^3	-
30299/40299	Slow Speed Current Level 2	10 - 400	% FLA

Fault Log and Data

The fault log and data associated with each fault is 9 records deep. As new faults occur, the oldest fault in the log is lost.

Fault Codes

The fault codes may be read from 30601/40601 (most recent) through 30609/40609 (oldest).

Table 99: Fault Codes

Fault Code	Description
0	No Fault
1	UTS Time Limit Expired
2	Motor Thermal Overload Trip
3	Slow Speed TIme Limit Expired
4	Speed Switch
5	Motor PTC
6	Stator RTD
7	Bearing RTD
8	Other RTD
10	Phase Rotation Error, not ABC
11	Phase Rotation Error, not CBA
12	Low Line Frequency
13	High LIne Frequency
14	Input Power Not SIngle Phase
15	Input Power Not Three Phase
21	Low Line L1-L2
22	Low Line L2-L3
23	Low Line L3-L1
24	High Line L1-L2
25	High Line L2-L3
26	High Line L3-L1
27	Phase Loss
28	No Line
29	PORT TIme Limit Exceeded
30	I.O.C.
31	Overcurrent
34	Undercurrent
35	Power Factor Leading
36	Power Factor Lagging
37	Current Imbalance
38	Ground Fault
39	No Current at Run
40	Shorted / Open SCR
41	Current at Stop

Table 99: Fault Codes (Continued)

Fault Code	Description
46	Disconnect Open
47	Stack Protection
48	Bypass Contactor Fault
49	Inline Contactor Fault
50	Control Power Low
51	Current Sensor Offset Error
53	Tachometer Loss
54	BIST Fault
55	BIST CT Fault
56	Open or Shorted RTD
60	External Fault on DIN#1 Input
61	External Fault on DIN#2 Input
62	External Fault on DIN#3 Input
63	External Fault on DIN#4 Input
64	External Fault on DIN#5 Input
65	External Fault on DIN#6 Input
66	External Fault on DIN#7 Input
67	External Fault on DIN#8 Input
71	Analog Input Level Fault Trip
80	RTD Communication Fault
81	Keypad Communication Fault
82	Modbus Timeout Fault
84	Interboard Communication Fault
85	IO Card - SW Fault
86	IO Card - Current Sensor Offset Error
87	IO Card - Real Time Clock Error
88	IO Card - Illegal Instruction Trap
89	IO Card - SW Watchdog Fault
90	IO Card - Spurious Interrupt
91	IO Card - Program EPROM Checksum Fault
94	CPU Error - SW Fault
95	CPU Error - Parameter EEPROM Checksum Fault
96	CPU Error - Illegal Instruction Trap
97	CPU Error - SW Watchdog Fault
98	CPU Error - Spurious Interrupt
99	CPU Error - Program EPROM Checksum Fault

System States

The state that the starter was in when a fault occurs is recorded along with each fault. System States may be read from 30611/40611 (most recent) through 30619/40619 (oldest).

Table 100: System States

System State	Description
0	Initializing
1	Locked Out
2	Faulted
3	Stopped
4	Heating
5	Kicking
6	Ramping
7	Slow Speed
8	Not UTS
9	UTS
10	Phase Control / Current Follower
11	Decelerating
12	Braking
13	Wye
14	PORT
15	BIST
16	Shorted SCR Test
17	Open SCR Test

L1 Currents

Current drawn from Line 1 when a fault occurs is recorded along with each fault. The current (in Amps) may be read from 30621/40621 (most recent) through 30629/40629 (oldest).

L2 Currents

Current drawn from Line 2 when a fault occurs is recorded along with each fault. The current (in Amps) may be read from 30631/40631 (most recent) through 30639/40639 (oldest).

L3 Currents

Current drawn from Line 3 when a fault occurs is recorded along with each fault. The current (in Amps) may be read from 30641/40641 (most recent) through 30649/40649 (oldest).

L1-L2 Voltages

Line voltage present between Lines 1 and 2 when a fault occurs is recorded along with each fault. The voltage (in Volts) may be read from 30651/40651 (most recent) through 30659/40659 (oldest).

L2-L3 Voltages

Line voltage present between Lines 2 and 3 when a fault occurs is recorded along with each fault. The voltage (in Volts) may be read from 30661/40661 (most recent) through 30669/40669 (oldest).

L3-L1 Voltages

Line voltage present between Lines 3 and 1 when a fault occurs is recorded along with each fault. The voltage (in Volts) may be read from 30671/40671 (most recent) through 30679/40679 (oldest).

Kilowatts

Power drawn by the load when a fault occurs is recorded along with each fault. The power (in kilowatts) may be read from 30681/40681 (most recent) through 30689/40689 (oldest).

Line Periods

The line period (1/frequency) present when a fault occurs is recorded along with each fault. Line periods (in microseconds) may be read from 30691/40691 (most recent) through 30699/40699 (oldest).

Run Time Hours

The value of the running time meter when a fault occurs is recorded along with each fault. Running time (in hours) may be read from 30701/40701 (most recent) through 30709/40709 (oldest).

Event Log
(MX^3 Only)

The event log is 99 records deep. As new events occur, the oldest event in the log is lost. Faults are also stored in the event log. Each event is time and date stamped.

Event Codes

Event Codes may be read from 30801/40801 (most recent) through 30899/40899 (oldest). Each of the 99 registers within this range contains a code for one event in the log.

Since the event log contains both events (such as Start, Stop, Up To Speed, etc.) and faults, bit 15 indicates whether a record is an event or a fault. A 1 indicates a fault, and a 0 indicates an event. The remaining 15 bits contain either the event code or fault code.

The faults codes are identical to those reported by the fault log and are defined in Table 85: Fault Log Object: Fault Codes.

Table 101: Event Codes

Event Code	Description
101	Start Commanded
102	Slow Speed Commanded
103	Up to Speed
104	Energy Saver Entered
105	Energy Saver Exited
106	Stop Commanded
107	Stop Complete
110	Motor Overload Warning
111	Motor Overload Lockout Entered
112	Motor Overload Lockout Cleared
113	Stack Overload Warning
114	Stack Overload Lockout Entered
115	Stack Overload Lockout Cleared
116	Emergency Overload Reset
117	Stator RTD Warning
118	Bearing RTD Warning
119	Other RTD Warning
140	Disconnect Opened
141	Disconnect Closed
170	PORT Entered due to Low Voltage
171	PORT Entered due to Low Current
172	PORT Bypass Contactor Opened
173	PORT Power Returned
174	PORT Recovery Completed

Table 101: Event Codes (Continued)

Event Code	Description
180	Parameters Reset to Default
181	Time/Date Changed
182	Passcode Enabled
183	Passcode Cleared
184	Factory Passcode Entered
185	Event Log Cleared
186	Run Time Reset
187	kWh Reset
188	Reflash Mode Entered
190	System Powered Up
191	System Powered Down
192	Low Control Power Detected
193	Standard BIST Entered
194	Powered BIST Entered
195	BIST Passed

System States

The System State when an event or fault occurred may be read from 30901/40901 (most recent) through 30999/40999 (oldest). System States are identical to those reported by the fault log and are defined in Table 99: Fault Codes, Page 115.

Event Time and Date Stamp

The event time and date stamp may be read from 31001/41001 (most recent) through 31198/41198 (oldest). The Time and Date stamp is stored as a 32 bit unsigned integer in two consecutive Modbus registers. Time and Date is expressed as the number of seconds elapsed since 12:00 AM on January 1st, 1972.

Table 102: Time and Date Stamp Registers

Absolute Register Address	Description
31001/41001	Date/Time (lower 16 bits) for most recent event
31002/41002	Date/Time (upper 16 bits) for most recent event
31003/41003	Date/Time (lower 16 bits)
31004/41004	Date/Time (upper 16 bits)
31197/41197	Date/Time (lower 16 bits) for oldest event
31198/41198	Date/Time (upper 16 bits) for oldest event


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Appendix B - Reference Documents

Reference documents

The following publications include technical details about DeviceNet. For a complete list of DeviceNet documentation, refer to the www.odva.org web site.

Volume 1: Common Industrial Protocol (CIP™)

Publication Number: PUB00001, © 2007 Open DeviceNet Vendor Association, Inc. (ODVA)

Volume 3: DeviceNet Adaptation of CIP

Publication Number: PUB00003, © 2007 Open DeviceNet Vendor Association, Inc. (ODVA).

Modbus-RTU Technical Publication

Standard Protocol Implementation as defined under “Modicon Modbus Reference Guide” PI-MBUS-300. Refer to www.modbus.org.


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Revision	Date	ECO#	Description
00	February 27, 2009	2313	Initial Release
01	November 5, 2010	2887	Corrections and Layout Update
02	July19, 2011	E3152	Update Default IP Address

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