FLOWSERVE

USER INSTRUCTIONS

Limitorque MX DeviceNet Field Unit

FCD LMENIM2328-00 – 11/05

Installation

Operation

Maintenance

Experience In Motion
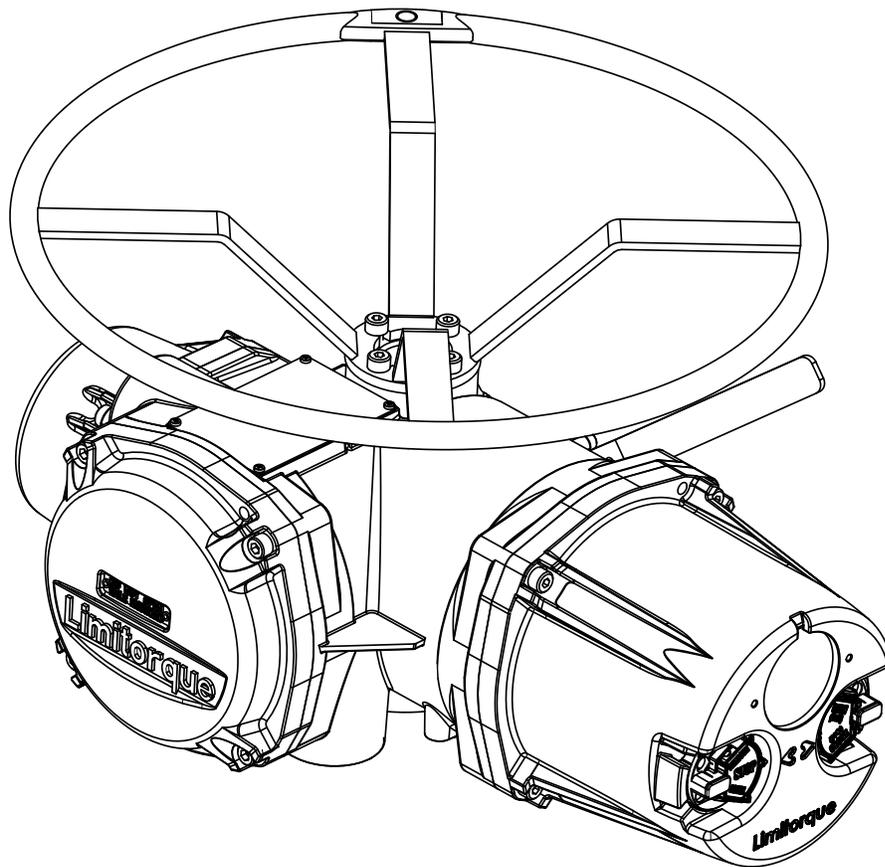
Limitorque MX DeviceNet Field Unit Installation and Operation Manual

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Declaration of DeviceNet Conformance –
ODVA Certification

ODVA
Networks Built on a
Common Industrial Protocol

Declaration of Conformity
to the DeviceNet™ Specification

ODVA hereby issues this Declaration of Conformity to the DeviceNet™ Specification for the product(s) described below. The Vendor listed below (the "Vendor") has holds a valid the Terms of Usage Agreement for the DeviceNet Technology from ODVA, which is incorporated herein by reference, thereby agreeing that it is the Vendor's ultimate responsibility to assure that its DeviceNet Compliant Products conform to the DeviceNet Specifications and that the DeviceNet Specifications are provided by ODVA to the vendor on an AS IS basis without warranty. NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE BEING PROVIDED BY ODVA.

In recognition of the below DeviceNet Compliant Product(s) having been DeviceNet Conformance Tested at ODVA-authorized Test Service Provider and having received a passing result from ODVA at the Composite Test Revision Level specified below, this Declaration of Conformity authorizes the Vendor to use the DeviceNet Certification Marks in conjunction with the specific DeviceNet Compliant Product(s) described below, for so long as the Vendor's Terms of Usage Agreement for the DeviceNet Technology remains valid.

DeviceNet.
CONFORMANCE TESTED

Certification Logo Mark

DeviceNet CONFORMANCE TESTED ™

Certification Word Mark

This Declaration of Conformity is issued on **27 February 2006** on behalf of ODVA by:

Katherine Voss

Katherine Voss
Executive Director

Vendor Information	
Vendor Name	**Flowserve Corporation**
Vendor Address	**5114 Woodall Road** **Lynchburg, VA 24506** **USA**

Test Information	
Test Date	**16-17 February 2006**
Composite Test Revision	**18**
ODVA File Number	**10331**

Product Information

Identity Object Instance <u>1</u>

Device(s) Under Test	Value
Vendor ID (Identity Object Attribute 1)	**966**
Network Category	**Node**
Device Type (Identity Object Attribute 2)	**0**
Device Profile Name	**Generic Device**
Product Revision (Identity Object Attribute 4)	**1.002**

Products Covered Under This Declaration of Conformity			
No.	Product Code (Identity Object Attribute 3)	Product Name (Identity Object Attribute 7)	SOC File Name
1	**19800**	**Flowserve MX**	**DLI.stc**

5

Abbreviations

CIP   Common Industrial Protocol

CAN   Controller Area Network

COS   Change of State

ODVA   Open DeviceNet Vendor Association

UCMM   Unconnected Message Manager

NV-RO   Non-Volatile Read Only. Data is stored in non-volatile memory and can only be read. Data is stored during Power-Off. For DeviceNet Limitorque Interface this storage area is FLASH

NV-RW   Non-Volatile Read Write. Data is stored in non-volatile memory and can be read and write. Data is stored during Power-Off. For DeviceNet Limitorque Interface this storage area is EEPROM

V-RO   Volatile Read Only. Data is stored in volatile memory and can only be read (e.g. Status). Data is lost during Power-Off. For DeviceNet Limitorque Interface this storage area is RAM

V-RW   Volatile Read Write. Data is stored in volatile memory and can be read and write data is lost during Power-Off, for DeviceNet Limitorque Interface this storage area is RAM.

DNFU   DeviceNet Field Unit (PCB w/in actuator control compartment)

SPI   Synchronous Peripheral Interface

PCB   Printed Circuit Board

1   Introduction

1.1   Purpose

This manual explains how to install and operate the Limitorque MX™/DeviceNet field unit (DNFU) and is to be used as an addendum to Bulletin LMENIM2306, Limitorque MX Installation and Operation Manual. Up to 63 actuators, each containing a DeviceNet field unit, may be connected by a single 5 strand, twisted-pair cable to form a DeviceNet network, two wires for connection to the data highway and two wires for connection to the DC power lines of the network highway, plus a screen connection. A suitable power supply and termination resistors on the highway are required in order for the FU to function correctly. This network permits the actuators to be operated by various control room devices such as a distributed control system (DCS), a programmable logic controller (PLC), or a personal computer (PC). The DeviceNet system communicates status and alarm data from each MX actuator.

1.2   How to Use this Manual

Each section provides the MX user with information on installing and operating the MX DNFU.

Section 1, Introduction: Details user safety and knowledge requirements, system capabilities, and features.

Section 2, System Components: Focuses on the description of the DeviceNet system hardware and software components.

Section 3, Installation and Configuration: Provides details for installing and configuring a DNFU.

Section 4, Object Model Diagram: Provides a list of inputs and outputs supported through the Assembly Object system information.

Section 5, View DeviceNet Status

Section 6, Associated Documents

Section 7, Troubleshooting

Section 8, How to Order Parts

Section 9, Regulatory Information

Section 10, Wiring Diagram

1.3   User Safety

Safety notices in this manual detail precautions the user must take to reduce the risk of personal injury and damage to the equipment. The user must read and be familiar with these instructions before attempting installation, operation, or maintenance. Failure to observe these precautions could result in serious bodily injury, damage to the equipment, warranty void, or operational difficulty. User must follow local and state safety regulations.

Safety notices are presented in this manual in three forms:

☠   **WARNING:** Refers to personal safety. Alerts the user to potential danger. Failure to follow warning notices could result in personal injury or death.

☠

⚠ **CAUTION:** Directs the user's attention to general precautions that, if not followed, could result in personal injury and/or equipment damage.

NOTE: Highlights information critical to the user's understanding of the actuator's installation and operation.

1.4   User Knowledge

It is recommended that the user read this manual in its entirety before the DeviceNet equipped actuator is installed and operated.

The user needs to have a fundamental knowledge of electronics and microprocessor concepts. An understanding of valve actuators and digital control systems is also of benefit to the DNFU user.

1.5   DeviceNet System Capabilities and Features

DeviceNet is a low cost communications protocol which permits up to 64 nodes (devices) to be installed over a single network and is based upon CAN (Controller Area Network), a broadcast protocol developed for the automotive industry. DeviceNet™ protocol is defined as an open network standard and Limitorque's device is certified for use by the ODVA, Open Device Standard Association. DeviceNet is usually PLC input controlled and the Limitorque MX electronic actuator is well suited for this communication system. A typical network is seen in Figure 1.1.

Figure 1.1 – Typical Network
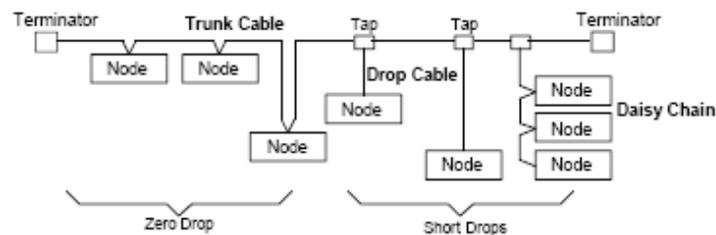
1.5.1   General Specifications

1.5.1.1   Network Specifications
DeviceNet is a digital, trunk/drop network that connects and serves as a communication network between industrial controllers and I/O devices.

DeviceNet follows the Open Systems Interconnection (OSI) model, an ISO standard for network communications that is hierarchical in nature. Networks that follow this model define all necessary functions from the physical implementation up to the protocol and methodology to communicate control and information data within and across networks.

Table 1.1 – Network specifications

Network Size	Up to 63 Nodes
Network Length	Selectable end-to-end network distance varies with speed 125 Kbps 500 m (1,640 ft) 250 Kbps 250 m (820 ft) 500 Kbps 100 m (328 ft)
Bus Topology	Linear (trunkline/dropline); power and signal on the same network cable
Bus Addressing	Multi-Master and Master/Slave special case; polled of change-of-state (exception-based)
System Features	Selectable end-to-end network distance varies with speed

Termination resistor (121 ohms) must be used at each end of the network

1.5.1.2   MX Field Unit Specifications

- CIP Generic Device Profile (Device Type = 00hex) extended to DNFU requirements

- Group 2 Server

- UCMM capable device

- Predefined Master/Slave Connection Set supporting

    - Explicit Connection

    - Polled I/O Connection

    - Bit-Strobed I/O Connection

    - Change of State / Cyclic I/O Connection

    - Full support of fragmentation protocol

- Device Heartbeat Message

- Device Shutdown Message

- Offline Connection Set

- Galvanical Isolation: The isolation voltage for the DNFU is up to 1,500 VRMS for 1 minute (1,800 VRMS for 1 second

- Power Supply: The DNFU Interface will be powered from the DeviceNet bus. A switching regulator is used to generate the internal supply voltage: VCC nominal 5.0 V ± 5 %

- Surge Suppression: The DNFU Interface is equipped with surge suppression for the DeviceNet network data and power lines. Surge suppression is compliant with IEC 61000-6-2:2001.

Environmental conditions

The DNFU environmental parameters are within the same environmental constraints as the actuator.

2   System Components

2.1   Introduction

This section gives an overview of the components used in the DeviceNet system. The field unit is installed in each MX actuator. The network cable connects the field unit to the network via the actuator terminal block. The network cable is connected to a host controller, typically a PLC.

2.2   Hardware

NOTE: Recommended storage procedures are detailed in Bulletin LMAIM1314 Limitorque MX Maintenance and Spare Parts Manual. Failure to comply with recommended procedures will void the warranty. For longer-term storage, contact Limitorque for procedures and recommendations.

Figure 2.1 – MX-05 Actuator
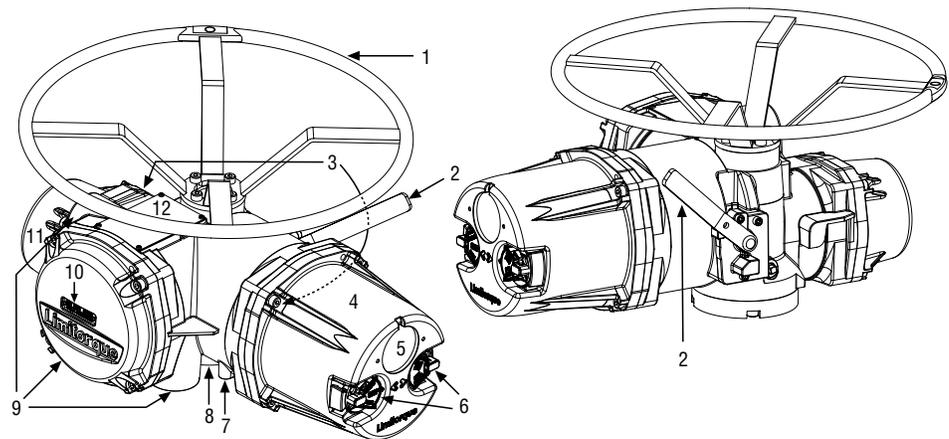
Table 2.1 – MX-05 Actuator

1	Handwheel
2	Declutch Lever
3	Oil Fills (dotted arrow depicts fill on declutch side)
4	Controls Compartment (field unit location)
5	LCD Display
6	Control Knobs
7	Ground Lug
8	Thrust/Torque Base
9	Conduit Entries
10	Terminal Compartment
11	Motor
12	Nameplate

2.2.1   Limitorque MX

The MX is a multi-turn valve actuator designed for operation of ON-OFF and modulating valve applications. This actuator controls the opening and closing of valves. See Figure 2.1.

The MX features include:

• Non-intrusive setup

• Separately sealed terminal chamber

• Patented absolute encoder for valve position sensing (no battery required)

• 32-character LCD for indication and calibration with configuration permitted in six languages.

• Sophisticated electronic control, monitoring, and diagnostic capabilities with patented LimiGard™ technology

2.2.2   DeviceNet Field Unit

The DeviceNet field unit is installed in the MX controls compartment. This unit permits the actuator to be controlled by a host controller, typically a PLC, via the DeviceNet network. The DNFU includes two high-level, surge-protected, and isolated network communication channels, configurable digital I/O, and configuration via LCD screen. The following commands and information may be transmitted over the DeviceNet network:

• "OPEN," "STOP," and "CLOSE" commands

• "ESD" and "MOVE–TO" position commands

• Actuator status and alarm messages

• Six digital inputs and two analog inputs for user

• A surge-protected and isolated communication channels

• MX control panel configuration

• Torque output (for reference only) and position feedback

• Four digital outputs (standard)

Figure 2.2 – DeviceNet Field Unit
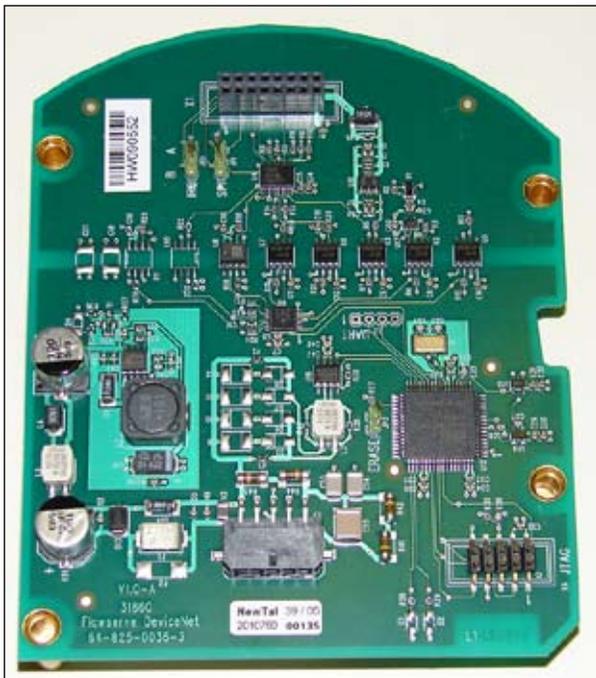
2.2.3 Hardware interface

The DeviceNet Limitorque Interface is comprised of a minimum of one PCB with two interfaces - One for the DeviceNet Terminal Block connector and one for the SMT Main Board.

Figure 2.3 gives an overview about the hardware. The microcontroller on the DeviceNet Limitorque Interface handles the DeviceNet protocol, stores the DeviceNet parameters in an EEPROM, and communicates with the SMT Main Board via SPI.

Figure 2.3 – DeviceNet Limitorque Interface
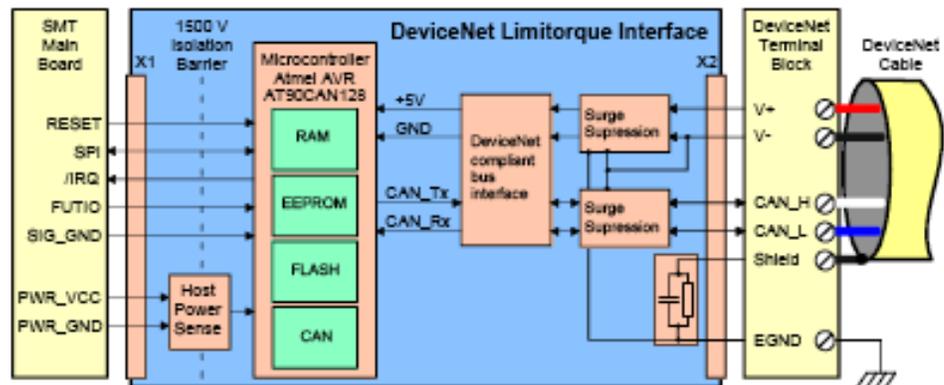
2.2.4 Network Cable

DeviceNet is a CAN - based protocol that uses 5 wires including a shield. Two of the conductors are used for 24V DC power & up to 8 amps (4 amps for NEC Class 2) may be passed along the hi-way from a suitable power source. Two conductors are used for the CAN bus signals, CAN_H and CAN_L, which are usually smaller in diameter. Limitorque recommends Belden cable for connecting to a DeviceNet network. The specifications for thick and thin cable (per site requirements) are as follows:

Table 2.2 – Belden Cable Specifications

Belden Part No.	AWG (Stranding) dia. Inches Nom. DCR	Insulation material (color code)	Nominal O.D.	Nom Impedance (ohms)	Nominal Capacitance	Test Frequency (MHz)	Maximum Attenuation dB/100ft
3082A	2 – 15 AWG (19 x 28) 3.6 ohm/1000 ft 11.8 ohm/km	Power pair (Black/Red)	12.2 mm	120	12.0 pF/ft	0.125 0.5 1	0.13 0.25 1.36
	2 – 18 AWG (19 x 30) 6.9 ohm/1000 ft 22.7 ohm/km	Data pair (Blue/White)					
3084A	2 – 22 AWG (19 x 34) 17.5 ohm/1000 ft 57.4 ohm/km	Power pair (Black/Red)	7.2 mm	120	12.0 pF/ft	0.125 0.5 1	0.29 0.50 1.70
	2 – 18 AWG (19 x 36) 28.0 ohm/1000 ft 91.9 ohm/km	Data pair (Blue/White)					

Table 2.3 – Total cable length between repeaters or nodes:

Network Size	125 KBPS	250 KBPS	500 KBPS
Thick Trunk Length	500 m (1,640 ft)	250 m (1,640 ft)	100 m (1,640 ft)
Thin Trunk Length	100 m (328 ft)	100 m (328 ft)	100 m (328 ft)
Flat Trunk Length	380 m (1,250 ft)	200 m (656 ft)	75 m (246 ft)
Maximum Drop Length	6 m (20 ft)	6 m (20 ft)	6 m (20 ft)
Cumulative Drop Length	156 m (512 ft)	78 m (256 ft)	39 m (128 ft)

Note: Each actuator includes 0.60 meters of internal drop length.

3   Installation and Configuration

3.1   Site and Network Cable Preparation

3.1.1   Site Preparation

Prepare the site and associated equipment for operation of the DeviceNet controlled MX actuators as follows:

1. Prepare a detailed site plan consisting of the following:

    • Actuator locations, tag numbers, DeviceNet addresses

    • Junction boxes, terminal strip locations, and tag numbers

2. Provide free access to the MX control panel and terminal block for setup, configuration, and troubleshooting.

3. Prepare cable and label all wires. See Section 3.1.2, Network Cable Preparation.

4. Install power and control wires in separate conduits. Shielding is not sufficient to prevent induction of stray voltages onto signal leads from the power lines.

5. Install and verify earth grounds.

NOTE: Limitorque defines an effective local earth ground as a low impedance (less than 5 ohms) path to:

    • A ground electrode placed in close vicinity of the actuator that is free of ground loop currents. OR

    • A safety ground that is free of ground loop currents running from the actuator back to the system ground electrode. If the signal wiring is run on aerial cable where it may be exposed to high-energy electrostatic discharge (such as lightning), a low impedance path to ground that is capable of high current must be provided a short distance from the actuator as described above. OR

    • A power distribution grid identifying the impact of power isolation to a particular actuator or group of actuators should be provided.

3.1.2   Network Cable Preparation

3.1.2.1   Network Cable Connection to the Field Unit

The DeviceNet field unit is connected to the network via the MX terminal block. The network cable is connected to the terminal block as shown in Figure 3.1.

Figure 3.1 – Network cable connection to terminal block
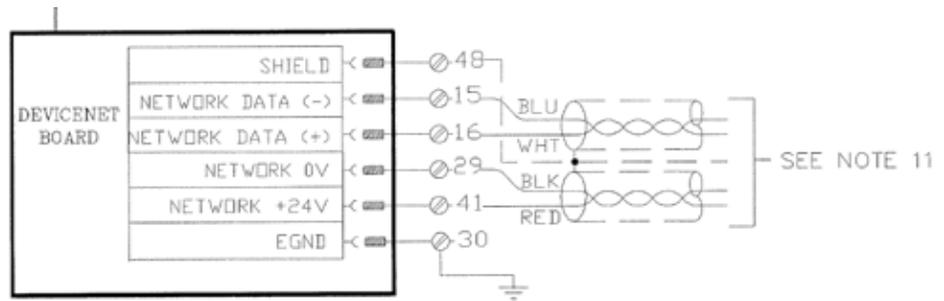
NOTE: Recommended DeviceNet cable is Belden 3084A or equal. 121 ohm, ¼ W +/-1% termination resistors must be connected at each segment end. Customer is required to connect wire between terminal 30 and chassis ground for surge protection. Preferred network wiring is to connect shield to terminal 48 for only one unit on each segment. Connect remaining individual network cable shields together to ensure proper shielding of entire network. Consult wiring diagram for exact terminal connection points as they may change.

Prepare the network cable for connection to the MX terminal block as follows.

⚠ **CAUTION:** Strip stranded conductors carefully; do not damage the strands. This will weaken the conductor. Do not nick conductors or conductor insulation when stripping away the insulation. Nicking stresses the conductor and can cause the conductor to break. This type of damage may not be apparent and failure can occur later without warning.

NOTE: Excess cable should be cut, not coiled or looped, to prevent noise induction into the network and to reduce signal loss through unnecessarily long cable runs.

Cable Preparation
1. Remove two to three inches (5 to 8 cm) of the outer plastic jacket.

2. Separate the cable parts. Unbraid the shield and peel back the foil shield to the same point where the outer jacket was removed. Cut away the braided shield and the foil shield. Strip the insulation from the conductors approximately 0.4 inch (1 cm).

3. Apply heat shrink tubing to insulate the drain wire and to provide stress relief to the cable.

⚠ **CAUTION:** Do not melt the insulation. NOTE: Ungrounded drain wires should be cut even with the cable sheath. The brand foil and drain wire should have heat shrink tubing applied.

4. Install ring tongue connectors. Flowserve recommends the use of Thomas & Betts #RZ22-6 for optimum results.

5. Connect the network cables to the MX terminal block as shown in Wiring Diagram #18-499-0038-3.

Table 3.1

48	Shield
15	(Blue) DATA (-)
16	(White) DATA (+)
29	(Black) Network 0 V
41	(Red) Network 24V
30	Earth ground for surge protection circuit

NOTE: *Ground each segment of the cabling at only one point to prevent ground loops, which can affect system performance. Verify the actuator is properly grounded.*

6. Install jumper cable from terminal block pin 30 to earth ground or ground lug.

3.2   Installation Verification

3.2.1   Network Cabling Installation Verification

After installation is complete and prior to operation, inspect the network cable and its connection to each field unit for the following:

NOTE: Units should be disconnected from power. Network should be disconnected from host.

1. There should be:

    • No nicks in the insulation—this can cause a short between conductors or to the grounded shield.

    • No cut strands in a stranded conductor—this can cause a poor connection and eventually an open circuit.

2. Verify that there is data wiring on each actuator per wiring diagram.

3. Cable armor should not be shorted to the cable shield/drain wire. Cable armor may not be at ground potential and could be subject to lightning surges.

The shield/drain wire should only be grounded at one end of each cable segment (the section between adjacent actuators between the host system and an actuator) to avoid ground loop problems.

The ground/earth connection should be at true ground potential and effective at all times. See Section 3.1.1, Site Preparation.

3.2.2   DNFU Installation Verification

NOTE: Connect to either 24 V DC power or mains and activate power.

Verify the field unit is installed as follows:

1. Enter the "SETUP" mode as detailed in Bulletin LMAIM1306/2306, MX Installation and Operation Manual.

2. In the "SETUP" mode, use the black control knob to select "YES" to the main menu selection "VIEW DIAGNOSTICS?"

3. Select "YES" to the display "VIEW HARDWARE STATUS?"

4. Select "YES" to scroll through the menu selections. The LCD will read "DeviceNet (OK) – NEXT?" if installed.

NOTE: If the "DeviceNet (OK) – NEXT?" does not appear, contact Flowserve for assistance.

19. To return to the normal display, use the red knob to select either "LOCAL" or "REMOTE."

4   Object Model Diagram

Figure 4.1 – Object Model of DeviceNet Limitorque Interface
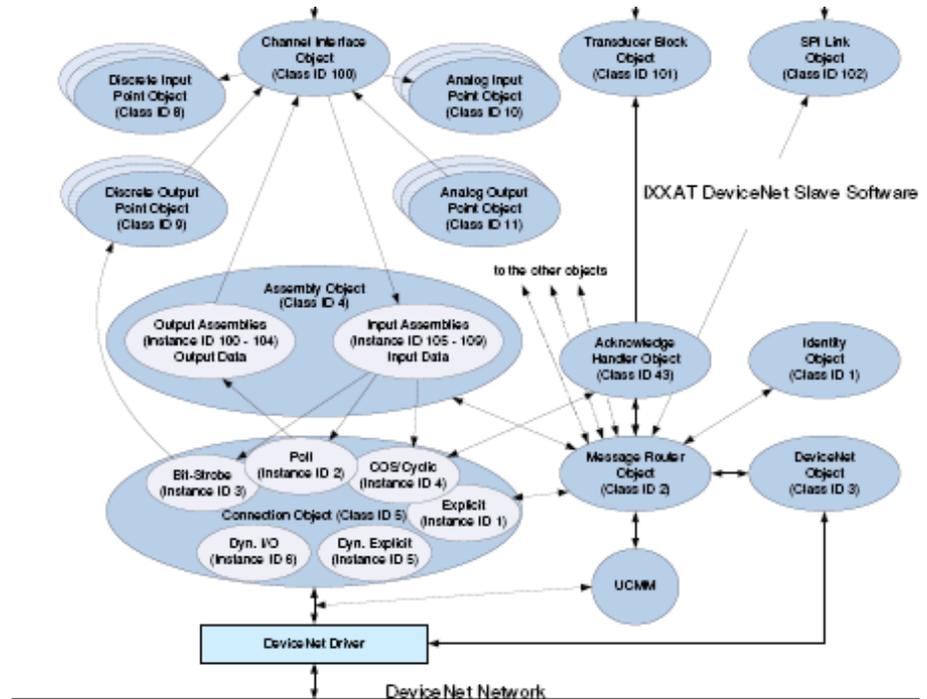
4.1   Assembly Objects

The Assembly Object binds attributes of multiple objects, which allows data to or from each object to be sent or received over a single connection. Assembly Objects can be used to bind input data or output data. The terms input and output are defined from the networks point of view. An input will produce data on the network and an output will consume data from the network

The terms input and output are defined from the networks point of view.

• An input is a signal produced at the actuator and sent to the PLC via the network.

• An output is a signal produced at the PLC and sent to the actuator via the network.

The user may select one output and one input instance.

The default assembly objects are as follows: Polled input - 105, Polled output - 100, Bitstrobe - 107, COS - 109.

Table 4.1

Instance ID	Type	Data Component Name	Size
100	Output	Output 1 (All Control Channels)	9
101	Output	Output 2 (Analog Control and ESD only)	5
102	Output	Output 3 (Discrete Control and ESD only)	4
103	Output	Output 4 (Analog Control only)	3
104	Output	Output 5 (Discrete Control only)	3
105	Input	Input 1 (All Status Information)	16
106	Input	Input 2 (Position and Faults only)	6
107	Input	Input 3 (Position and Faults only)	8
108	Input	Input 4 (Position, User and Faults only)	11
109	Input	Input 5 (Faults and Alarms only)	6

4.2   Output Assembly Instances

Table 4.2 – Output Assembly Instance 100

Assembly Object Instance ID	Data Component Name	Class ID	Class Name	Instance ID	Attribute ID	Attribute Name	Data Type
100	Output 1	100	Channel Interface	1	20	Ctrl_Status_Chan	BYTE
		100	Channel Interface	1	1	AO_Ctrl_Valve_ Flow_Chan	INT
		100	Channel Interface	1	9	DO_Position_Chan	BYTE
		100	Channel Interface	1	21	DO_ESD_Poll_Cnxn	BOOL
		100	Channel Interface	1	11	DO_Relay_Chan	BYTE
		100	Channel Interface	1	18	DO_Move_Test_Chan	BOOL
		100	Channel Interface	1	19	AO_Analog_Output_Chan	UNIT

Table 4.3 – Output Assembly Instance 101

Assembly Object Instance ID	Data Component Name	Class ID	Class Name	Instance ID	Attribute ID	Attribute Name	Data Type
101	Output 2	100	Channel Interface	1	20	Ctrl_Status_Chan	BYTE
		100	Channel Interface	1	1	AO_Ctrl_Valve_ Flow_Chan	INT
		100	Channel Interface	1	21	DO_ESD_Poll_Cnxn	BOOL
		100	Channel Interface	1	10	DO_Move_Test_Chan	BOOL

Table 4.4 – Output Assembly Instance 102

| Assembly Object Instance ID | Data Component Name | Class | | Instance ID | Attribute | | |
		ID	Name		ID	Name	Data Type
102	Output 3	100	Channel Interface	1	20	Ctrl_Status_Chan	BYTE
		100	Channel Interface	1	9	DO_Position_Chan	BYTE
		100	Channel Interface	1	21	DO_ESD_Poll_Cnxn	BOOL
		100	Channel Interface	1	18	DO_Move_ Test_Chan	BOOL

Table 4.5 – Output Assembly Instance 103

| Assembly Object Instance ID | Data Component Name | Class | | Instance ID | Attribute | | |
		ID	Name		ID	Name	Data Type
103	Output 4	100	Channel Interface	1	20	Ctrl_Status_Chan	BYTE
		100	Channel Interface	1	1	AO_Ctrl_Valve_ Flow_Chan	INT

Table 4.6

| Assembly Object Instance ID | Data Component Name | Class | | Instance ID | Attribute | | |
		ID	Name		ID	Name	Data Type
104	Output 5	100	Channel Interface	1	20	Ctrl_Status_Chan	BYTE
		100	Channel Interface	1	9	DO_Position_Chan	BYTE
		100	Channel Interface	1	21	DO_ESD_Poll_Cnxn	BOOL

Table 4.7 – Input Assembly Instance 105

Assembly Object Instance ID	Data Component Name	Class		Instance ID	Attribute		Data Type
		ID	Name		ID	Name	
105	Input 1	100	Channel Interface	1	17	DI_Actuator_ Faults_3_Chan	BYTE
		100	Channel Interface	1	4	DI_Actuator_ Faults_1_Chan	BYTE
		100	Channel Interface	1	6	DI_Actuator_ Alarms_Chan	BYTE
		100	Channel Interface	1	2	DI_Pos_And_ Bus_Mode_Chan	BYTE
		100	Channel Interface	1	5	DI_Actuator_ Faults_2_Chan	BYTE
		100	Channel Interface	1	12	AI_Position_Chan	INT
		100	Channel Interface	1	7	DI_Disc_User_ Input_Chan	BYTE
		100	Channel Interface	1	8	DI_Read_Disc_ Output_Chan	BYTE
		100	Channel Interface	1	13	AI_Analog_ Input_2_Chan	INT
		100	Channel Interface	1	14	AI_Analog_ Input_2_Chan	INT
		100	Channel Interface	1	16	DI_Alarms_2_ Chan	BYTE
		100	Channel Interface	1	15	AI_Torque_Chan	INT

Table 4.8

Assembly Object Instance ID	Data Component Name	Class		Instance ID	Attribute		Data Type
		ID	Name		ID	Name	
106	Input 2	100	Channel Interface	1	17	DI_Actuator_ Faults_3_Chan	BYTE
		100	Channel Interface	1	4	DI_Actuator_ Faults_1_Chan	BYTE
		100	Channel Interface	1	6	DI_Actuator_ Alarms_Chan	BYTE
		100	Channel Interface	1	2	DI_Pos_And_ Bus_Mode_Chan	BYTE
		100	Channel Interface	1	12	AI_Position_Chan	INT

Table 4.9 – Input Assembly Instance 107

Assembly Object Instance ID	Data Component Name	Class		Instance ID	Attribute		
		ID	Name		ID	Name	Data Type
107	Input 3	100	Channel Interface	1	17	DI_Actuator_ Faults_3_Chan	BYTE
		100	Channel Interface	1	4	DI_Actuator_ Faults_1_Chan	BYTE
		100	Channel Interface	1	6	DI_Actuator_ Alarms_Chan	BYTE
		100	Channel Interface	1	2	DI_Pos_And_ Bus_Mode_Chan	BYTE
		100	Channel Interface	1	12	AI_Position_Chan	INT
		100	Channel Interface	1	15	AI_Torque_Chan	INT

Table 4.10 Input Assembly Instance 108

Assembly Object Instance ID	Data Component Name	Class		Instance ID	Attribute		
		ID	Name		ID	Name	Data Type
108	Input 4	100	Channel Interface	1	17	DI_Actuator_ Faults_3_Chan	BYTE
		100	Channel Interface	1	4	DI_Actuator_ Faults_1_Chan	BYTE
		100	Channel Interface	1	6	DI_Actuator_ Alarms_Chan	BYTE
		100	Channel Interface	1	2	DI_Pos_And_ Bus_Mode_Chan	BYTE
		100	Channel Interface	1	12	AI_Position_Chan	INT
		100	Channel Interface	1	7	DI_Disc_User_ Input_Chan	BYTE
		100	Channel Interface	1	13	AI_Analog_ Input_2_Chan	INT
		100	Channel Interface	1	15	AI_Torque_Chan	INT

Table 4.11 Input Assembly Instance 109

Assembly Object Instance ID	Data Component Name	Class		Instance ID	Attribute		
		ID	Name		ID	Name	Data Type
109	Input 5	100	Channel Interface	1	17	DI_Actuator_ Faults_3_Chan	BYTE
		100	Channel Interface	1	4	DI_Actuator_ Faults_1_Chan	BYTE
		100	Channel Interface	1	6	DI_Actuator_ Alarms_Chan	BYTE
		100	Channel Interface	1	2	DI_Pos_And_ Bus_Mode_Chan	BYTE
		100	Channel Interface	1	5	DI_Actuator_ Faults_2_Chan	BYTE
		100	Channel Interface	1	16	DI_Alarms_2_ Chan	BYTE

4.2.1   DI_Position_and_Bus_Mode_Chan

Table 4.12

Value	Definition
0x21	Remote + Opened
0x22	Remote + Closed
0x24	Remote + Opening
0x28	Remote + Closing
0x30	Remote + Stop
0x41	Local + Opened
0x42	Local + Closed
0x44	Local + Opening
0x48	Local + Closing
0x50	Local + Stop
0x81	Stop + Opened
0x82	Stop + Closed
0x84	Stop + Opening
0x88	Stop + Closing
0x90	Stop + Stop

4.2.2   DI_Position_Chan

Table 4.13

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved	Reserved	Stop	Closing	Opening	Closed	Opened

Table 4.14 – Possible values of DI_Position_Chan

Value	Definition
0x01	Opened
0x02	Closed
0x04	Opening
0x08	Closing
0x10	Stop

4.2.3   DI_Actuator_Faults_1_Chan

Table 4.15

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved	Motor Over Temp	Phase Error	Over Torque	Manual Moved	Valve Jammed	Monitor Relay

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Table 4.16 – Possible values of DI_Actuator_Faults_1_Chan

Value	Definition
0x01	Monitor Relay
0x02	Valve Jammed
0x04	Manual Moved
0x08	Over Torque
0x10	Phase Error
0x20	Motor Over Temperature
0x03	Monitor Relay + Valve Jammed
0x05	Monitor Relay + Manual Moved
0x09	Monitor Relay + Over Torque
0x11	Monitor Relay + Phase Error
0x21	Monitor Relay + Motor Over Temperature
0x07	Monitor Relay + Valve Jammed + Manual Moved
0x13	Monitor Relay + Valve Jammed + Phase Error
0x23	Monitor Relay + Valve Jammed Motor Over Temperature

4.2.4   DI_Actuator_Faults_2_Chan

Table 4.17

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved	Close Torque Switch Fault	Open Torque Switch Fault	Manual Moved	Valve Jammed	Phase Error	Thermal Overload

Table 4.18 – Possible values of DI_Actuator_Faults_2_Chan

Value	Definition
0x01	Thermal Overload
0x02	Phase Error
0x04	Valve Jammed
0x08	Manual Moved
0x10	Open Torque Switch Fault
0x20	Close Torque Switch Fault
0x03	Thermal Overload + Phase Error
0x05	Thermal Overload + Valve Jammed
0x09	Thermal Overload + Manual Moved
0x18	Manual Moved + Open Torque Switch Fault
0x28	Manual Moved + Close Torque Switch Fault

4.2.5   DI_Actuator_Alarms_Chan

Table 4.19

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved	Move Test Active*	Not in Remote	Close Inhibit Active	Open Inhibit Active	Remote ESD Active	Local ESD Active

* Available with Revision 1 to DeviceNet board.

Table 4.20 – Possible values of DI_Actuator_Alarms_Chan

Value	Definition
0x01	Local ESD Active
0x02	Remote ESD Active
0x04	Open Inhibit Active
0x08	Close Inhibit Active
0x05	Local ESD Active + Open Inhibit Active
0x09	Local ESD Active + Close Inhibit Active
0x06	Remote ESD Active + Open Inhibit Active
0x0A	Remote ESD Active + Open Inhibit Active
0x0C	Open Inhibit Active + Close Inhibit Active

4.2.6   DI_Disc_User_Input_Chan

Table 4.21

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Discrete Input #8	Discrete Input #7	Discrete Input #6	Discrete Input #5	Discrete Input #4	Discrete Input #3	Discrete Input #2	Discrete Input #1

4.2.7   DI_Read_Disc_Output_Chan

Table 4.22

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Relay Discrete Output #7	Relay Discrete Output6 #	Relay Discrete Output #5	Relay Discrete Output #4	Relay Discrete Output #3	Relay Discrete Output #2	Relay Discrete Output #1

4.2.8   DO_Position_Chan

Table 4.23

Value	Definition
0x00	Stop
0x01	Open
0x02	Close
0x03 – 0xFF	Reserved

4.2.9   DO_ESD_Chan (Read Only)

Table 4.24

Value	Definition
0x00	Disable Network ESD
0x01	Enable Network ESD

DO_ESD_Chan can't be written directly via the DeviceNet network, it is Read-Only. The attribute Enable_Broadcast_ESD_Ctrl defines if a device is part of the broadcast ESD control scheme from Bit-Strobe Connection or not. The resulting DO_ESD_Chan is defined in the following table.

The MX allows the standard I/O connection to assert ESD, or the broadcast bit strobe connection to assert ESD.

Table 4.25

DO_ESD_ Poll_Cnxn Attribute 21	Ctrl_Status_Chan Attribute 20 Bit 2	DO_ESD_ Bit_Strobe_Cnxn Attribute 22	Enable_Broadcast_ ESD_Ctrl Attribute 23	DO_ESD_ Chan
X	0	X	0	0
0	1	X	0	0
1	1	X	0	1
X	0	0	1	0
X	0	1	1	1
1	1	1	1	1
0	1	0	1	0
0	1	1	1	1
1	1	0	1	1

4.2.10 DO_Relay_Chan

Table 4.26 Available with Revision 1 to DeviceNet board

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	User Output AR-3	User Output AR-2	User Output AR-1	User Output AS-4	User Output AS-3	User Output AS-2	User Output AS-1

4.2.11 DI_Actuator_Faults_3_Chan

Available with Revision 1 to DeviceNet board.

Table 4.27

Bit 7 – Bit 4	Bit 6	Bit 5	Bit 4	Bit 3
Reserved	Reserved	Interboard Power failure	Interboard Communications Failure	Reserved

4.2.12 Ctrl_Status_Chan

Outputs are not used by the device unless the corresponding bit from the table below is enabled.

Table 4.28

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved	Reserved	Reserved	DO_ Relay_ Chan	DO_ ESD_Poll_ Cnxn	DO_ Position_ Chan	AO_ Ctrl_ Valve_ Flow_ Chan

4.2.13 DI_Alarms_2_Chan

Table 4.29

Bit 7 – Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Battery not installed (only until first time installed)	Flat battery indication	Low battery indication	Indication of 24VDC UPS power available

4.2.14 DI_Actuator_Faults_3_Chan

Table 4.30

Bit 7 – Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Low Battery Indication	Interboard Power Fault	Interboard Communication Fault	Limiguard Fault

4.3   Channel Interface Object

Table 4.31

Attribute ID	Access Rule	Name	Data Type	Description of Attribute	Semantics of Value
1	RW	AO_Crtl_Valve_ Flow_Chan	INT	Desired valve position	Range 0 - 1000
2	RO	DI_Position_And_ Bus_Mode_Chan	BYTE	Valve Status and Control Mode	Section 4.2.1
3	RO	DI_Position_ Chan	BYTE	Valve Status	Section 4.2.2
4	RO	DI_actuator_ Faults_1_Chan	BYTE	Mechanical and electrical faults 1	Section 4.2.3
5	RO	DI_actuator_ Faults_2_Chan	BYTE	Mechanical and electrical faults 2	Section 4.2.4
6	RO	DI_Actuator_ Alarms_Chan	BYTE	Emergency shut-down and inhibit information	Section 4.2.5
7	RO	DI_Disc_ User_Input_Chan	BYTE	Discrete input from user	Section 4.2.6
8	RO	DI_Read_Disc_ Output_Chan	BYTE	Monitor state of relay Discrete outputs	Section 4.2.7
9	RW	DO_Position_ Chan	BYTE	Command Stop/Open/Close	Section 4.2.8
10	RO	DO_ESD_ Chan	BOOL	Command Emergency ShutDown	Section 4.2.9
11	RW	DO_Relay_ Chan	BYTE	Command Energize relays	Section 4.2.10
12	RO	AI_Position_ Chan	INT	Current valve position	Range 0 - 1000
13	RO	AI_Analog_ Input_1_Chan	INT	Value of generic Analog input 1	Range 0 – 100%
14	RO	AI_Analog_ Input_2_Chan	INT	Value of generic Analog input 2	Range 0 – 100%
15	Get (V-RO)	AI_Torque_Chan	INT	Current torque output	Range 0-120%
16	Get (V-RO)	DI_Alarms_2_Chan	BYTE	Battery & power supply information	Section 4.2.13
17	RO	DI_actuator_ Faults_3_Chan	BYTE	Mechanical and electrical faults 3	Section 4.2.14
18	Get/Set (V-RW)	DO_Move_Test_Chan	BOOL	Move test request	0-no request 1-request move test
19	Get/Set (V-RW)	AO_Analog_Output_Chan	UINT	Control of generic analog output	Range 0-1000%
20	RW	CTRL_Status_ Chan	BYTE	Set the status associated with the various control values	Section 4.2.12

Continued on next page

Table 4.31 – Continued

Attribute ID	Access Rule	Name	Data Type	Description of Attribute	Semantics of Value
21	Get/Set (V-RW)	DO_ESD_ Poll_Cnxn	BOOL	Command emergency shutdown from Poll Connection	Section 4.2.9
22	Get/Set (V-RW)	DO_ESD_ Bit_Strobe_Cnxn	BOOL	Command emergency shutdown from Bit-Strobe Connection	Section 4.2.9
23	Get/Set (NV-RW)	Enable_ Broadcast_ ESD_Ctrl	BOOL	Enable device to be a part of the broadcast ESD control scheme from Bit-Strobe Connection	Section 4.2.9 0 = Disable (Default) 1 = Enable

4.4   Transducer Block Object

Table 4.32

Attribute ID	Access Rule	Name	Data Type	Description	Semantics of Value
1	RW	Setp_Cutoff_Dec	UINT	When the servo setpoint goes below the defined percent of span, the position goes to the limit position CLOSE	Range 0 – 1000 Default = 0
2	RW	Setp_Cutoff_Inc	UINT	When the servo setpoint goes above the defined percent of span, the position goes to the limit position OPEN	Range 0 – 1000 Default = 0
3	RO	Scaled_values_0	WORD	APT/ATT scaling information	See Table 4.33
4	RO	Scaled_values_1	WORD	APT (Modbus Register 3)	Engineering Use
5	RO	Scaled_values_2	WORD	ATT (Modbus Register 4)	Engineering Use
6	RO	TP_Status_0	UINT	Reserved	Engineering Use
7	RO	TP_Status_1	UINT	Start_Position	Engineering Use
8	RO	TP_Status_2	UINT	Stop_Position	Engineering Use
9	RO	TP_Status_3	UINT	Num_Samples	Engineering Use
10	RO	TP_Status_4	UINT	Max_Torque_Mid	Engineering Use
11	RO	TP_Status_5	UINT	Max_Torque Postion	Engineering Use
12	RO	TP_Status_6	UINT	Avg_Torque	Engineering Use
13	RO	TP_Status_7	UINT	Stop_Torque	Engineering Use
14	RO	TP_Status_8	UINT	Max_Torque_BOT	Engineering Use
15	RO	TP_Status_9	UINT	Maz_Torque_EOR	Engineering Use
16	RO	TQ_Status_0	UINT	Reserved	Engineering Use
17	RO	TQ_Status_1	UINT	MB_TQ_Close_ Avg_Last	Engineering Use
18	RO	TQ_Status_2	UINT	MB_TQ_Open_Avg_ Last	Engineering Use
19	RO	TQ_Status_3	UINT	MB_TQ_Open_ Peak_Last	Engineering Use

Table 4.32 – Continued

Attribute ID	Access Rule	Name	Data Type	Description	Semantics of Value
20	RO	TQ_Status_4	UINT	MB_TQ_Open_ Breakout_Last	Engineering Use
21	RO	TQ_Status_5	UINT	MB_TQ_Close_ Breakout_Last	Engineering Use
22	RO	TQ_Status_6	UINT	MB_TQ_Open_ Ending_Last	Engineering Use
23	RO	TQ_Status_7	UINT	MB_TQ_Close_ Ending_Last	Engineering Use
24	RO	TQ_Status_8	UINT	MB_TQ_Close_ Peak_Last	Engineering Use
25	RO	TQ_Status_9	UINT	MB_TQ_Open_ Peak_Last	Engineering Use
26	RO	TQ_Status_10	UINT	MB_TQ_Open_ Breakout_Ref	Engineering Use
27	RO	TQ_Status_11	UINT	MB_TQ_Close_ Breakout_Ref	Engineering Use
28	RO	TQ_Status_12	UINT	MB_TQ_Open_ Ending_Ref	Engineering Use
29	RO	TQ_Status_13	UINT	MB_TQ_Close_ Ending_Ref	Engineering Use
30	RO	TQ_Status_14	UINT	MB_TQ_Close_ Peak_Ref	Engineering Use
31	RW	Travel_Limit_Low	UINT	Lower limit of the valve position in percent of travel span	Range 0 – 1000 Default = 0
32	RW	Travel_Limit_Up	UINT	Upper limit of the valve position in percent of travel span	Range 0 – 1000 Default = 0
33	RW	Valve_Maint_ Date	SHORT-STRING	Date of last valve maintenance	String length is limited to 16 char. Default = 0 (empty)
34	RW	Valve_Serial_Num	SHORT-STRING	Serial number of the valve belonging to the positioner of electronic device	String length is limited to 16 char. Default = 0 (empty)
35	RO	Valve_status_0	WORD	Requested relay channel value	Default = 0
36	RO	Valve_status_1	WORD	Status Register – Modbus Register 9	Default = 0
37	RO	Valve_status_2	WORD	Fault Register – Modbus Register 10	Default = 0
38	RO	Valve_status_3	WORD	Digital Output Register – Modbus Register 11	Default = 0
39	RO	Valve_status_4	WORD	Digital Input #1 Register – Modbus Register 12	Default = 0
40	RW	Valve_status_5	WORD	Digital Input #2 Register – Modbus Register 13	Default = 0

Continued on next page

Table 4.32 – Continued

Attribute ID	Access Rule	Name	Data Type	Description	Semantics of Value
41	RW	Valve_Type	USINT	Type of valve	0 = linear moving valve, sliding valve (Default) 1 = rotary moving valve, part-turn 2 = rotary moving valve, multi-turn
42	RO	Actuator_Type	USINT	Type of actuator	0 = electropneumatic 1 = electric (default) 2 = electrohydraulic 3 = others
43	RO	Diagnostic_ Values_0	UINT	Reserved	Engineering Use
44	RO	Diagnostic_ Values_1	UINT	Main Voltage	Engineering Use
45	RO	Diagnostic_ Values_2	UINT	Actuator Position	Engineering Use
46		Diagnostic_ Values_3	UINT	Analog input #1	Engineering Use
47		Diagnostic_ Values_4	UINT	Analog Input #2	Engineering Use
48	RW	Tag_Name	SHORT-STRING	Tag name for generic use	String length is limited to 32 char. Default = 0 (empty)
49	Get/Set (NV-RW)	Comm_Loss_ Action	USINT	Actuator action upon detection of communication loss	0 = No Action (Default) 1 = Open 2 = Close 3 = Stop 4 = Preset Position
50	Get/Set (NV-RW)	Comm_Loss_ Position	UINT	Position to take upon a communication loss	Range = 0 – 1000 Default = 0
51	Get/Set (NV-RW)	Comm_Loss_ Timeout	UINT	Time to wait after detection of communication loss until actuator action is taken	Range = 0 – 4095 Default = 255
52	Get/Set (NV-RW)	Deadband	UINT	Deadband percentage to use when positioning	Range = 0 – 1000 Default = 2
53	Get/Set (NV-RW)	Proportional_ Band	UINT	Proportional band percentage to use when positioning	Range = 0 – 1000 Default = 8
54	Get/Set (NV-RW)	TQ_Switch_ Adjust	USINT	Percentage of full torque to limit operation to	Range = 0 – 100 % Default = 0 (Disabled)
55	RW	Actuator_Control_ Mode	USINT	Configure actuator for open/close or positioning operation	1 = Analog (Positioning Mode) 2 = Digital (Open/Close Mode) Default = 2

NOTE: Attributes 49-55 are reserved for Revision 1 to DeviceNet.

Table 4.33 – Transducer Attribute – Scaled values attribute 3

Bit 7 - 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Unused	DDC Offset 0 = 0 mA 1 = 4 mA	ATT Polarity 0 = high value 4 mA 1 = high value 20 mA	Analog Torque Transmitter (ATT) 0 = ATT Disabled 1 = ATT Enabled	APT Polarity 0 = high value 4 mA 1 = high value 20 mA	Analog Position Transmitter (APT) 0 = APT Disabled 1 = APT Enabled

Table 4.34

Bit 15 - 11	Bit 10 - 9	Bit 3
Unused	Scaling 0 = 0 – 100 1 = 0 – 255 2 = 0 -4095 3 = Reserved	Unused

4.4.1   Identity Object Instance Attributes

Table 4.35 – Identity Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Description of Attribute	Semantics of Value
1	Get (NV-RO)	Vendor ID	UINT	Identification of each vendor by number	966 (3C6hex) (Note 1)
2	Get (NV-RO)	Device Type	UINT	Indication of general type of product	00hex (Generic Device)
3	Get (NV-RO)	Product Code	UINT	Identification of a particular product of an individual vendor	19800 (4D58hex) (Note 2)
4	Get (NV-RO)	Revision	STRUCT of	Revison of the item the Identity Object represents	1.1 (Note 3)
		Major Revision	USINT	Major Revision of DeviceNet Limitorque Interface	
		Minor Revision	USINT	Minor Revision of DeviceNet Limitorque Interface	
5	Get (V-RO)	Status	WORD	Summary status of device	(Note 4)
6	Get (NV-RW)	Serial Number	UDINT	Serial number of device	(Note 5)
7	Get (NV-RW)	Product Name	SHORT_ STRING	Human readable identification	"Flowserve MX" (Note 6)
8	Get (V-RO)	State	USINT	Present state of the device as represented by the state transition diagram	
10	Get/Set (NV-RW)	Heartbeat Interval	USINT	The nominal interval between heartbeat messages in seconds	The default value is 0. Zero disables transmission of the heartbeat message.
100	Get (V-RO)	EEPROM Failure	BOOL	Result of EEPROM checksum verification	0 = EEPROM contents is o.k. 1 = EEPROM contents may be defective due to checksum error

The further optional attributes

• Configuration Consistency Value (Attribute ID 9)

• Active Language (Attribute ID 11)

• Supported Language List (Attribute ID 12)

• International Product Name (Attribute ID 13)

• Semaphore (Attribute ID 14)

are not supported by DeviceNet Limitorque Interface.

Some of the instance attributes do not have any external interfaces, these values are managed directly in the DeviceNet Slave Software.

NOTE 1: The Vendor ID is managed by the ODVA. Flowserve has already obtained a valid Vendor ID. The Vendor ID will be assigned during compile time as a constant of the DeviceNet Slave Software and stored in Flash-Memory of the DeviceNet Limitorque Interface. Thus it cannot be altered during runtime.

NOTE 2: The Product Code of the DeviceNet Limitorque Interface has already been assigned by Flowserve. It typically maps to a catalog or model number. The Product Code will be assigned during compile time as a constant of the DeviceNet Slave Software and stored in Flash-Memory of the DeviceNet Limitorque Interface. Thus it cannot be altered during runtime.

NOTE 3: The Revision of the DeviceNet Limitorque Interface. Has already been assigned by Flowserve. It typically links to the revision control system of a company. The format of the revision is Major.Minor, starting with 1.1, because 0 is not allowed in CIP. The default value for this attribute is therefore 0x0101. The revision must match the entry of the EDS-File delivered with the DeviceNet Limitorque Interface. The Revision will be assigned during compile time as a constant of the DeviceNet Slave Software and stored in Flash-Memory of the DeviceNet Limitorque Interface. Thus it cannot be altered during runtime.

NOTE 4: The Status represents the current status of the device. Important here are the bits 8 to 11 which make faults visible to the user.

NOTE 5: The Serial Number is used in conjunction with the Vendor ID to form a unique identifier for each device. Flowserve is responsible for guaranteeing the uniqueness of the serial number across all of its devices. The SMT Main Board will initialize the DeviceNet Limitorque Interface with data every time a loss of communication condition between the DeviceNet Limitorque Interface and the SMT Main Board had occurred. A part of this initialization data will be a unique board ID coming from the SMT Main Board. Upon reception of this unique board ID from the SMT Main Board, the DeviceNet Limitorque Interface will construct a Serial Number value. The transducer/spi software will then get the currently stored serial number value from the DeviceNet stack, compare it to the one just constructed based on the data from the main board, and if different, set the new value in the Identity Object / EEPROM. Also, if the values were different, the transducer / spi software will then request that the DeviceNet board reset to it's "factory default" non-volatile condition (exception: the serial number in EEPROM is not overwritten again).

NOTE 6: The Product Name should represent a short description of the product/product family represented by the product in attribute 3. It is limited to 32 characters. The product name should default to "Limitorque". However, at "spi initialization time", the product name attribute can be updated by some kind of API function call by the transducer / spi driver.

4.4.2   Behavior

Table 4.36 – Behavior

Event	Source	Description
Power Applied	DeviceNet Limitorque Interface	Connect DeviceNet bus power
Passed Tests	DeviceNet Limitorque Interface	No errors detected during internal selftest

FailedTests	DeviceNet Limitorque Interface	One or more of the following errors have been detected during self-test of the DeviceNet Limitorque Interface e.g. - FLASH Checksum Error - RAM Memory Test Error
Activated	SMT Main Board	Is_Active-Flag is TRUE
Deactivated	SMT Main Board	Is_Active-Flag is FALSE OR EEPROM Checksum Error
Minor Fault	SMT Main Board	Conditions that can cause this event are e.g. valve jam, overtemp, overtorque and phase loss. This event is triggered if Attribute DI_Actuator_Faults_1_Chan in Channel Object Class is ≠ 0x00
Major Recoverable Fault	SMT Main Board	Conditions that can cause this event are e.g. communication fault, power fault or Limiguard fault of the SMT Main Board. This event is triggered if Attribute DI_Actuator_Faults_3_Chan in Channel Object Class is ≠ 0x00
Major Unrecoverable Fault	DeviceNet Limitorque Interface	Internal Diagnostic Fault detected e.g. - Receive Queue Overrun - Transmit Queue Overrun - CAN Controller Overrun

4.4.3   DeviceNet Object Instance Attributes

Table 4.37 – DeviceNet Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Description of Attribute	Semantics of Value
1	Get/Set (NV-RW)	MAC ID	USINT	Node Address	Range 0 – 63 see also Chapter 5.2.1
2	Get/Set (NV-RW)	Baud Rate	USINT	Baud Rate	Range 0 – 2
3	Get/Set (V-RW)	BOI	BOOL	Bus-Off Interrupt	
4	Get/Set (V-RW)	Bus-Off Counter	USINT	Number of times CAN went to the bus-off state	
5	Get (V-RO)	Allocation Information	STRUCT of		
		Allocation Choice Byte	BYTE	See [2] Chapter 3-5	
		Master's MAC ID	USINT	MAC ID of Master (from allocate)	
6	Get (V-RO)	MAC ID Switch Changed	BOOL	The Node Address Switch(es) have changed since last power-up/reset	0 = No Change 1 = Change since last power-up or reset
7	Get (V-RO)	Baud Rate Switch Changed	BOOL	The Baud Rate Switch(es) have changed since last power-up/reset	0 = No Change 1 = Change since last power-up or reset
8	Get (NV-RW)	MAC ID Switch Value	USINT	Actual Value of Node Address Switch(es)	Range 0 – 99
9	Get (NV-RW)	Baud Rate Switch Value	USINT	Actual Value of Baud Rate Switch(es)	Range 0 – 9
100	Get/Set (NV/RW)	Autobaud	BOOL	Enable/Disable Autobaud Detection	0 = Disable 1 = Enable (default)

NOTE 1: At boot time of the DeviceNet Limitorque Interface the values stored in non-volatile memory are used. The SMT Main Board could at any time send new values via SPI.

The other instance attributes do not have any external interfaces, these values are managed in the protocol stack of the DeviceNet Slave Software.

The further optional attribute Quick Connect (Attribute ID 10) is not supported by DeviceNet Limitorque Interface.

4.4.4   Discrete Input Point Object – Class ID 8 (08$_{hex}$)

The Discrete Input Point Object is used to provide an interface to a subset of the discrete inputs of the MX.The Discrete Input Point Object is implemented with 15 instances described in Table 3.1-25, so that each of the selected discrete inputs of the MX is connected to one instance.

The purpose of this object is to have a SINGLE-BIT access to the discrete inputs from user and to monitor the state of relay discrete outputs of the MX via the DeviceNet network for test and diagnostic purposes.

The Discrete Input Point Object is just another representation of the selected discrete input data in the Channel Interface Object Instance Attribute 7 (DI_Disc_User_Input_Chan) and Attribute 8 (DI_Read_Disc_Output_Chan) .

Table 4.38 – Discrete Input Point Object

Instance ID	Channel Interface Object	Source
1	Instance Attribute 7, Bit 0	DI_Disc_User_Input_Chan Discrete Input #1
2	Instance Attribute 7, Bit 1	DI_Disc_User_Input_Chan Discrete Input #2
3	Instance Attribute 7, Bit 2	DI_Disc_User_Input_Chan Discrete Input #3
4	Instance Attribute 7, Bit 3	DI_Disc_User_Input_Chan Discrete Input #4
5	Instance Attribute 7, Bit 4	DI_Disc_User_Input_Chan Discrete Input #5
6	Instance Attribute 7, Bit 5	DI_Disc_User_Input_Chan Discrete Input #6
7	Instance Attribute 7, Bit 6	DI_Disc_User_Input_Chan Discrete Input #7
8	Instance Attribute 7, Bit 7	DI_Disc_User_Input_Chan Discrete Input #8
9	Instance Attribute 8, Bit 0	DI_Read_Disc_Output_Chan Relay Discrete Output #1
10	Instance Attribute 8, Bit 1	DI_Read_Disc_Output_Chan Relay Discrete Output #2
11	Instance Attribute 8, Bit 2	DI_Read_Disc_Output_Chan Relay Discrete Output #3
12	Instance Attribute 8, Bit 3	DI_Read_Disc_Output_Chan Relay Discrete Output #4
13	Instance Attribute 8, Bit 4	DI_Read_Disc_Output_Chan Relay Discrete Output #5
14	Instance Attribute 8, Bit 5	DI_Read_Disc_Output_Chan Relay Discrete Output #6
15	Instance Attribute 8, Bit 6	DI_Read_Disc_Output_Chan Relay Discrete Output #7

4.4.5   Discrete Output Point Object – Class ID 9 (09$_{hex}$)

The Discrete Output Point Object is used to provide an interface to a subset of the discrete outputs of the MX. The implementation of this object follows the guidelines of [1] Chapter 5-10.

The Discrete Output Point Object is implemented with 7 instances described in Table 3.1-29, so that each of the selected discrete outputs of the MX is connected to one instance.

The purpose of this object is to have a SINGLE-BIT access to the relays of the MX via the DeviceNet network for test and diagnostic purposes.

The Discrete Output Point Object is just another representation of the selected discrete output data in the Channel Interface Object Instance Attribute 11 (DO_Relay_Chan) see Chapter 3.2.1.2.

Table 4.39 – Discrete Output Point Object

Instance ID	Channel Interface Object	Source
1	Instance Attribute 11, Bit 0	DO_Relay_Chan User Output AS-1
2	Instance Attribute 11, Bit 1	DO_Relay_Chan User Output AS-2
3	Instance Attribute 11, Bit 2	DO_Relay_Chan User Output AS-3
4	Instance Attribute 11, Bit 3	DO_Relay_Chan User Output AS-4
5	Instance Attribute 11, Bit 4	DO_Relay_Chan User Output AR-1
6	Instance Attribute 11, Bit 5	DO_Relay_Chan User Output AR-2
7	Instance Attribute 11, Bit 6	DO_Relay_Chan User Output AR-3

4.4.6   Analog Input Point Object – Class ID 10 (0A$_{hex}$)

The Analog Input Point Object is used to provide an interface to a subset of the analog inputs of the MX. The implementation of this object follows the guidelines of [1] Chapter 5-11.

The Analog Input Point Object is implemented with 2 instances described in Table 3.1-33, so that each of the selected analog inputs of the MX is connected to one instance.

The purpose of this object is to have a SINGLE access to the generic analog inputs of the MX via the DeviceNet network for test and diagnostic purposes.

The Analog Input Point Object is just another representation of the selected analog input data in the Channel Interface Object Instance Attribute 13 (AI_Analog_Input_1_Chan) and Attribute 14 (AI_Analog_Input_1_Chan) see Chapter 3.2.1.2.

Table 4.40 – Analog Input Point Object

Instance ID	Channel Interface Object	Source
1	Instance Attribute 13	AI_ANALOG_INPUT_1_CHAN
2	Instance Attribute 14	AI_ANALOG_INPUT_2_CHAN

4.4.7   Analog Output Point Object – Class ID 11 (0B$_{hex}$)

The Analog Output Point Object is used to provide an interface to a subset of the analog outputs of the MX. The implementation of this object follows the guidelines of [1] Chapter 5-12.

The Analog Output Point Object is implemented with 1 instance described in Table 3.1-37, so that each of the selected analog outputs of the MX is connected to one instance.

The purpose of this object is to have a SINGLE access to the generic analog outputs of the MX via the DeviceNet network for test and diagnostic purposes.

The Analog Output Point Object is just another representation of the selected analog output data in the Channel Interface Object Instance Attribute 19 (AO_Analog_Output_Chan) see Chapter 3.2.1.2.

Table 4.41 – Analog Output Point Object

Instance ID	Channel Interface Object	Source
1	Instance Attribute 19	AO_Analog_Output_CHAN

4.4.8   MAC ID

The MX-DeviceNet unit may have the MAC ID set by one of two different methods. The first is the MX LCD display. The other is via the DeviceNet bus.

4.4.9   Baud Rate

The MX-DeviceNet unit may have the Baud Rate set by one of two different methods. The first is the MX LCS display. The other is via the DeviceNet bus.

4.5   Network Management

4.5.1   Offline Connection Set

NOTE: The DeviceNet Limitorque Interface supports Offline Connection Set. The Offline Connection Set is used to bring back a node to the DeviceNet bus which is in the Communication Fault State. This state will be entered in the case of a duplicate MAC ID error is detected.

4.5.2   Device Heartbeat Message

The DeviceNet Limitorque Interface supports Device Heartbeat message. This message broadcasts the current state of the DeviceNet Limitorque Interface. Table 4.42 shows the format of the data field of the Device Heartbeat Message.

Table 4.42 – Format of the Device Heartbeat Message

Byte Set	7	6	5	4	3	2	1	0
0	DeviceNet Protocol Specific							
1								
2	Identity Object Instance ID = 1							
3								
4	Device Stats = 3							
5	Reserved (0)				EV (0)	SF	UF (0)	DF
6	(0) because the Configuration Consistency Value (Attribute 8 of the Identity Object Instance) is not supported by the DeviceNet Limitorque							
7								

EV   Event Flag, zero (0)

SF   System Fault, a fault in the device caused by DeviceNet bus interaction (e.g. connection timeout). This flag is set, when a system fault is present. This DeviceNet Limitorque Interface flag is set when a connection times out.

UF   User Fault, a fault in the device caused by user interaction. This flag is set when a user fault is present. The conditions under which is set are vendor specific. This DeviceNet Limitorque Interface flag is not used and is zero (0).

DF   Device Fault, an internal fault in the device not caused by user or bus interaction (e.g. hardware fault). This flag is set when a device fault is present. This DeviceNet Limitorque Interface flag is set under the following conditions:

- (DI_Actuator_Faults_1_Chan ≠ 0) OR (DI_Actuator_Faults_3_Chan ≠ 0)

The Device Heartbeat Message is triggered by the Identity Object Instance Attribute Heartbeat Interval (Attribute ID 10). For this, the Heartbeat Interval has to be set to the time interval of the Device Heartbeat Message in seconds.

4.5.1   Device Shutdown Message

The DeviceNet Limitorque Interface supports the Device Shutdown Message. The DeviceNet Limitorque Interface produces this message when it transitions to the offline state. Table 4.43 shows the format of the data field of the Device Shutdown in Message.

Table 4.43 – Format of the Device Shutdown Message

Byte Offset	7	6	5	4	3	2	1	0
0	DeviceNet Protocol Specific							
1								
2	Class ID							
3								
4	Instance ID							
5								
6	Shutdown Code							
7	Range 200hex – 2FFhex							

For the DeviceNet Limitorque Interface, the Class ID and the Instance ID of this message depends on the originator of the Device Shutdown Message, e.g. after Reset-Service performed on the Identity Object, Class ID 1 and Instance 1, a Device Shutdown Message is sent.

For application purposes 2 Bytes of the Device Shutdown Message are reserved for the Shutdown Code. Then vendor specific range of this code is 200 – 2FF. Table 4.44 lists all Shutdown Codes of the DeviceNet Limitorque Interface.

Table 4.44 – Device Shutdown Codes

Class ID	Instance ID	Shutdown Code	Causes of Shutdown
1	1	4	Remote Reset: Reset service of the identity Object
3	1	4	Remote reset: Setting of the MAC ID via Attribute 1 of the DeviceNet Object
0	0	5	Internal diagnostic fault: An internal diagnostic fault has caused the service to shut down. Reason for this can be an overrun of the CAN transmit queue, CAN receive queue or CAN Controller receive buffer
0	0	4	DeviceNet Limitorque Interface will be reset because SMT Main Board signal RESET is active.
102	1	0x201	DeviceNet Limitorque Interface will be reset because SMT Main Board has changed MAC ID via LCD
102	1	0x202	DeviceNet Limitorque Interface will be reset because SMT Main Board has changed Baud rate via LCD

4.6   Configuration Confirmation

DNFU operation cannot be verified until the complete DeviceNet system is operational. However, routine checks can be performed to verify many functions.

4.6.1   Checking Connections

Verify that all connections, including data wires, shield ground, are in accordance with MX wiring diagrams and DNFU diagrams in Section 3.1.2, Network Cable Preparation.

4.6.2   View Settings

Refer to Bulletin LMAIM1306/2306, MX Installation and Operation Manual to access the "VIEW SETTINGS" menu. Verify the settings as follows:

5   View DeviceNet Status

Figure 5.1 – DeviceNet Screens
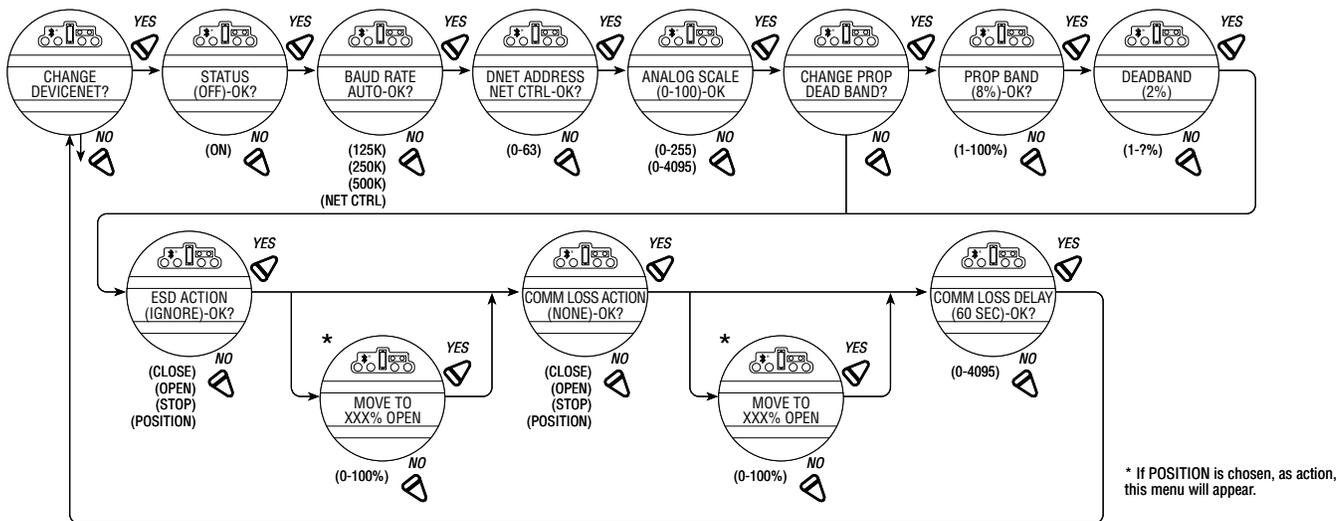
VIEW DNET STATUS?
This selection permits the User to view pertinent information which summarizes the status of the DeviceNet option board.

VIEW MODULE STATUS?
• Answer "YES" to determine status of individual DN board within the actuator.

• Configuration choices are:

• "OFF" = board installed but turned off

• "OPERATIONAL" – The device is operating in a normal condition.

• "STANDBY" = The device needs commissioning due to configuration missing, incomplete or incorrect.

• "RECOVERABLE FAULT" = Conditions that can cause this event are e.g. communication fault, power fault or Limigard fault of the SMT Main Board. Device may need resetting.

• "UNRECOVERABLE FAULT" = Internal Diagnostic Fault detected e.g.

   • Receive Queue Overrun

   • Transmit Queue Overrun

   • CAN Controller Overrun

• Device may need replacing.

• "SELF TESTING" = The device is in self-test mode.

VIEW NETWORK STATUS?
Answer "YES" to determine status of DN network.

• "NOT ON LINE" = Device is not on-line.

- The device has not completed the self test yet.

- The device may not be powered, look at Module Status Display.

- "ONLINE" = Device is on-line but has no connections in the established state.

  - The device has passed the SELF test, is on-line, bus has no established connections to other nodes.

  - For a Group 2 Only device it means that this device is not allocated to a master.

  - For a UCMM capable device it means that the device has no established connections.

- "CONNECTED" = The device is on-line and has connections in the established state.

  - For a Group 2 Only device it means that the device is allocated to a Master.

  - For a UCMM capable device it means that the device has one or more established connections.

- "CONN TIMEOUT" = One or more I/O Connections are in the Timed-Out state.

- "COMM FAULT" = Failed communication device. The device has detected an error that has rendered it incapable of communicating on the network (Duplicate MAC ID, or Bus-off).

- "ID COM FLT REQ" = 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.

5.1   Checking the Normal Display

Place the selector switch in "LOCAL" or "REMOTE" position. The valve position will be indicated at the top of the LCD. "STATUS OK" or "DNET COMM LOSS" should be indicated at the bottom of the LCD display.

If "STATUS OK" is displayed, the DNFU is communicating with the DeviceNet network.

If "DNET COMM LOSS" is displayed, no communication is occurring. This could be due to a number of factors, including problems with the host DeviceNet system and/or network. Check all local connections and configurations. Confirm that the host is connected, configured for baud rate, protocol to match DeviceNet, and operational. See also Section 7, Troubleshooting.

Figure 5.2
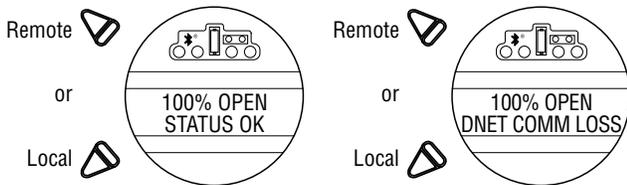
5.2   EDS File

The DeviceNet Limitorque Interface can be configured using Rockwell Automation RSNetWorx for DeviceNet and an EDS-File. Table 5.1 shows a list of all supported parameters.

Table 5.1 Parameter List

Parameter No.	Access	Path to Object
1-23	Read/Write resp. Read Only	Channel Interface Object, Instance Attributes 1-23
24-78	Read/Write resp. Read Only	Transducer Block Object, Instance Attributes 1-55
79	Read/Write	DeviceNet Object, Instance Attribute 'MAC ID'
80	Read/Write	DeviceNet Object, Instance Attribute 'Baud Rate'
81	Read	DeviceNet Object, Instance Attribute 'MAC ID Switch Changed'
83	Read	DeviceNet Object, Instance Attribute 'MAC ID Switch Value'
85	Read/Write	DeviceNet Object, Instance Attribute 'Autobaud'
86	Read/Write	Connection Object, Poll Instance Attribute 'Polled I/O Input'
87	Read/Write	Connection Object, Poll Instance Attribute 'Polled I/O Output'
88	Read/Write	Connection Object, Bit-Strobe Instance Attribute 'Bit-Strobe I/O Input'
89	Read/Write	Connection Object, COS/Cyclic Instance Attribute 'COS/Cyclic I/O Input'

6   Associated Documents

Quick Start-Up Instructions (Limitorque MX Actuators): Limitorque Bulletin LMAIM1310/2310

MX Installation and Operation Manual: Limitorque Bulletin LMAIM1306/2306

Protection, Control and Monitoring Features of MX Electric Actuators: Limitorque Bulletin LMABR1300/2300

MX Maintenance and Spare Parts Manual: Limitorque Bulletin LMAIM1314/2314

ODVA Planning and Installation Manual available from ODVA.

7   Troubleshooting

Refer to Section 10, Wiring Diagram.

1. With power off and network disconnected, verify continuity between A1, A2 and A1*, A2*.

2. With power applied and network disconnected, verify 0.2 to 0.45 VDC between A1, A1* and A2, A2*.

3. Confirm that a jumper cable is installed between the grounding lug and terminal 30.

Verify proper setup for MX DeviceNet.

4. MPC (modulating position control) must be OFF.

5. ESD must be configured for desired function and properly wired.

6. OPEN INHIBIT must be configured for desired function and properly wired.

7. CLOSE INHIBIT must be configured for desired function and properly wired.

8. Remote control is not selected if not in use. Properly wired if selected.

9. Confirm there are no duplicate DeviceNet addresses.

10. Confirm that ground is at one end only per network cable segment.

11. Confirm protocol, baud rate

Main power supply must be within +/- 10% of nominal unit power rating at all times. Refer to nameplate for voltage.

UPS of 24 V DC must be within +/- 10% at all times.

7.1   Workmanship

The Limitorque MX is non-intrusive which facilitates ease of configuration without removal of the controls cover. Removal of the controls cover without permission from Flowserve can void the warranty.

Practice all plant and safety codes and standards. Failure to follow instructions can result in personal injury and/or property damage.

Do NOT remove covers of Division 1 units with power applied to prevent the possible ignition of hazardous atmospheres.

Qualified technicians should perform all service. Dangerous voltages may be present on the circuit boards and terminations.

Use extreme caution when working around power input cables. These cables have potentially lethal voltages on them.

Replace fuses only with specified parts for continued safe operation.

Have qualified personnel verify all wiring and connections against vendor drawings prior to energizing the equipment. Incorrect wiring and/or connections can result in equipment damage.

⚠ **CAUTION:** There is potential to cause electrostatic damage to electronic components. Before handling electronic components, ensure that you are discharged of static electricity by briefly touching a grounded metal object.

The circuit boards in the MX DeviceNet contain components that are subject to damage from electrostatic discharge (static electricity). The following precautions and procedures are recommended when handling circuit boards and components. Failure to observe these practices when handling and shipping circuit board products may void your warranty.

• Keep plastics and other materials prone to the buildup of electrostatic charges (static electricity) away from boards, components, and work area.

• Avoid synthetic or wool clothing; wear cotton or cotton blend materials. Keep components and circuit boards away from clothing and hair.

• Discharge static electricity on your body by touching and momentarily holding a grounded metal object before handling electronic components. This is especially important after walking across carpeted areas.

• Handle components in the field as little as necessary.

• Handle components only by the edges, and avoid contact with leads, circuits, or connectors.

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- Do not touch the surface of the printed circuit board, the connectors, or the components with conductive devices or with your hands.

- Always place the component or board into an anti-static protective bag for transportation or storage.

- Transport all static-sensitive components only in static-shielding carriers or packages. Place static awareness labels on all components to prevent removal from static-shielding container during transit.

- Handle all static-sensitive components at a static-safe work area including floor mat, wrist strap, air ionizer, ground cord, and conductive table mat.

- Do not subject components to sliding movements over any surface, at any time.

8   How to Order Parts

To order parts or obtain further information about your Limitorque DeviceNet field unit, contact your local Limitorque distributor sales office, or:

Flowserve Corporation Flow Control Division

Limitorque Actuation Systems

5114 Woodall Road

P.O. Box 11318 Lynchburg, VA 24506-1318

Phone (434) 528-4400

Fax (434) 845-9736

To find the Limitorque distributor or sales office near you, go to http://www.limitorque.com

All inquiries or orders must be accompanied by the following information supplied on the actuator nameplate:

- Unit size
- Order number
- Serial number

9   Regulatory Information

The Flowserve Limitorque DeviceNet board has been tested in accordance with the listed specifications and complies with European Directive 89/336 EEC, EMC Directive and 73/23 EEC, Low Voltage Directive;

EN 55011:1998 + A2:2001

EN 61000-6-2:2001

10   Wiring Diagram

Figure 10.1 – Typical MX DeviceNet wiring diagram (18-499-0038-3)
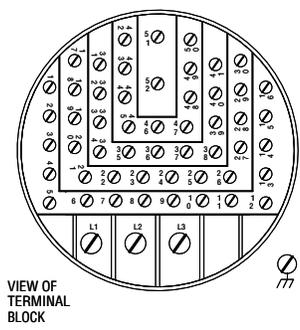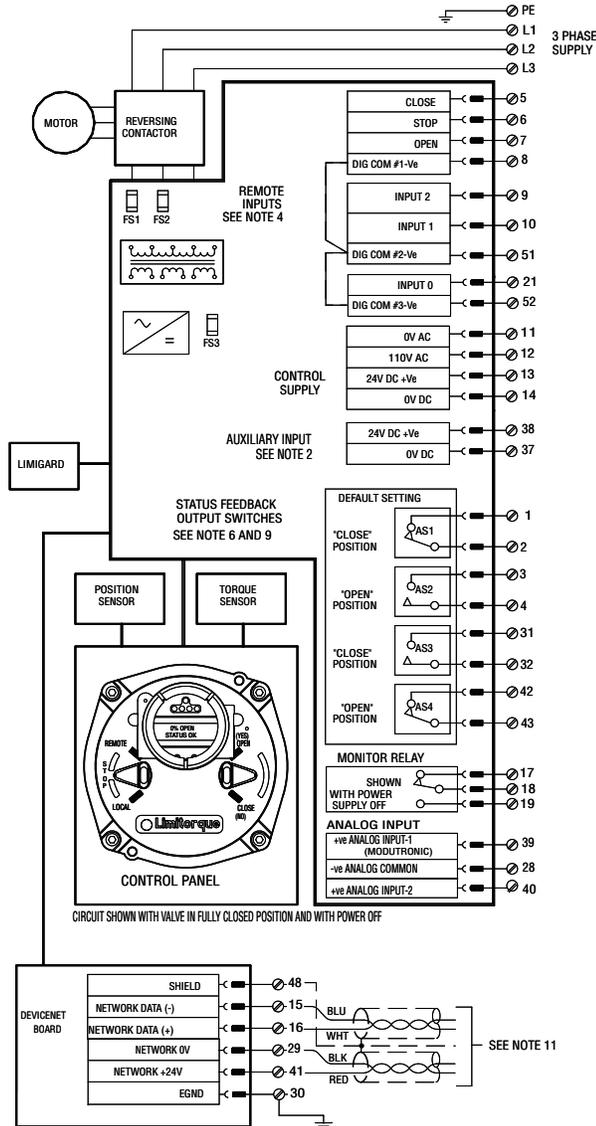
NOTES

1.FUSES

FSI (PRIMARY) — 600V AC, 1A, 200kA Int RATING, FAST ACTING 10.3 x 38.1mm TUBE.

FS2 (PRIMARY)

FS3 (SECONDARY) - 0.1A, 250V, TIME DELAY, 5 x 20mm, GLASS TUBE

2.AUXILIARY INPUT

BACK-UP 24v DC UPS POWER MAY BE CONNECTED TO TERMINAL'S 37 AND 38. MAXIMUM CURRENT DRAW IS 1 AMP. THIS POWERS ALL CONTROLS FOR LOCAL INDICATION AND CONFIGURATION. ANALOG OUTPUT AND ALARM RELAYS SUPPLIED WILL BE POWERED FOR UNITS MANUFACTURED SUBSEQUENT TO Q1/2003. REVERSING CONTACTOR WILL NOT BE POWERED. CUSTOMER SHOULD SUPPLY EXTERNAL FUSE AS REQUIRED BY LOCAL ELECTRICAL CODES.

3.MAXIMUM EXTERNAL LOAD

TERMINALS 13 AND 14 (24V DC) - 10W MAX. EXT. LOAD
TERMINALS 11 AND 12 (110V AC) - 0V MAX EXT. LOAD
SUITABLE FOR DIGITAL INPUTS
ONLY, PROTECTED BY FS3.

4.REMOTE INPUTS

SIGNAL THRESHOLD - MINIMUM "ON" 19.2V AC/DC
MAXIMUM "OFF" 5.0V AC/DC
MAX LOAD - 10 mA / 110V AC
2 mA / 24V DC

INPUTS 0,1,2 ARE FIELD CONFIGURABLE (FIRMWARE VERSION 04\08.00 OR LATER) FOR CLOSE INHIBIT, OPEN INHIBIT, CLOSE/OPEN INHIBIT, USER INPUT, OR ESD. IN ADDITION, INPUT 2 MAY BE CONFIGURED FOR CSE REMOTE SELECTED INDICATION. DEFAULT INPUT CONFIGURATION: INPUT 0 - ESD, INPUT 1 - OPEN INHIBIT, INPUT 2 - CLOSE INHIBIT
SEE INSTALLATION AND OPERATION MANUAL FOR CONFIGURATION PROCEDURES.

5.CONTROL SIGNAL DURATION

REQUIRED CONTROL SIGNAL
DURATION = 250 - 350ms.

6.STATUS FEEDBACK OUTPUT SWITCHES

THE ACTUATOR STATUS CONTACTS (AS) AND ALARM RELAYS (AR) MAY BE INDIVIDUALLY CONFIGURED AS NORMALLY OPEN OR NORMALLY CLOSED LATCHED CONTACTS OR AS BLINKER CONTACTS TO INDICATE ONE OF THE FUNCTIONS LISTED BELOW:

CLOSE	LOCAL STOP/OFF	CLOSE INHIBIT
CLOSING	MANUAL OVERRIDE	OPEN INHIBIT
MID-TRAVEL	REMOTE SELECTED	ESD SIGNAL
OPENING	VALVE JAMMED	NO ANALOG SIGNAL
OPEN	MOTOR OVERTEMP	LOST PHASE
STOPPED	OVERTORQUE	LIMIGARD ACTIVE
VALVE MOVING	OPEN TORQUE SW	HARDWARE FAILURE
LOCAL SELECTED	CLOSE TORQUE SW	

7.CONTACT RATINGS

AS1,2,3 AND 4 - 5.0 AMPS AT 125V AC, 30V DC (250V AC-CENELEC)

MONITOR RELAY - 5.0 AMPS AT 250V AC, 30V DC

8.EXACT END POSITION INDICATION

ON TORQUE-SEATED VALVES THE LCD AND "AS" CONTACTS, CONFIGURED AS END OF TRAVEL LIMITS, AUTOMATICALLY PROVIDE EXACT END OF POSITION INDICATION.

9.DEFAULT SETTING

ACTUATORS ARE NORMALLY SHIPPED WITH DEFAULT SETTINGS AS SHOWN ON THIS DIAGRAM. THE "AS" CONTACTS ARE SHOWN WITH VALVE IN FULLY CLOSED POSITION. SEE CONTACT DEVELOPMENT BELOW.

OUTPUT SWITCH CONTACT DEVELOPMENT			
	VALVE POSITION		
OUTPUT SWITCH	FULL CLOSE	FULL OPEN	FUNCTION
AS1			CLOSE LIMIT
AS2			OPEN LIMIT
AS3			CLOSE LIMIT
AS4			OPEN LIMIT

10.ANALOG INPUT

STANDARD SIGNAL 4-20 mA
INPUT IMPEDANCE = 250 OHMS
INPUT CAPACITACNE = 0.1uf±30%
99% ACCURACY
CONFIGURABLE SCALING

11.DEVICENET

RECOMMENDED DEVICENET CABLE IS BELDEN 3084A OR EQUAL. 120 OHM, 1/4W TERMINATION RESISTORS MUST BE CONNECTED AT EACH SEGMENT END.
CUSTOMER IS REQUIRED TO CONNECT WIRE BETWEEN TERMINAL 30 AND CHASSIS GROUND FOR SURGE PROTECTION. PREFERRED NETWORK WIRING IS TO CONNECT SHIELD TO TERMINAL 48 FOR ONLY ONE UNIT ON EACH SEGMENT. CONNECT REMAINING INDIVIDUAL NETWORK CABLE SHIELDS TOGETHER TO ENSURE PROPER SHIELDING OF ENTIRE NETWORK.

TRANSFORMER TAPPING OPTIONS

TYPE	TAPPING	TYPE	TAPPING
A	220V	B	115V
	380V		220V
	415V		525V
	460V		575V

VIEW OF TERMINAL BLOCK

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FLOWSERVE

FCD LMENIM2328-00   Printed in USA.

To find your local Flowserve representative:

For more information about Flowserve Corporation, visit
www.flowserve.com or call USA 1 800 225 6989

flowserve.com