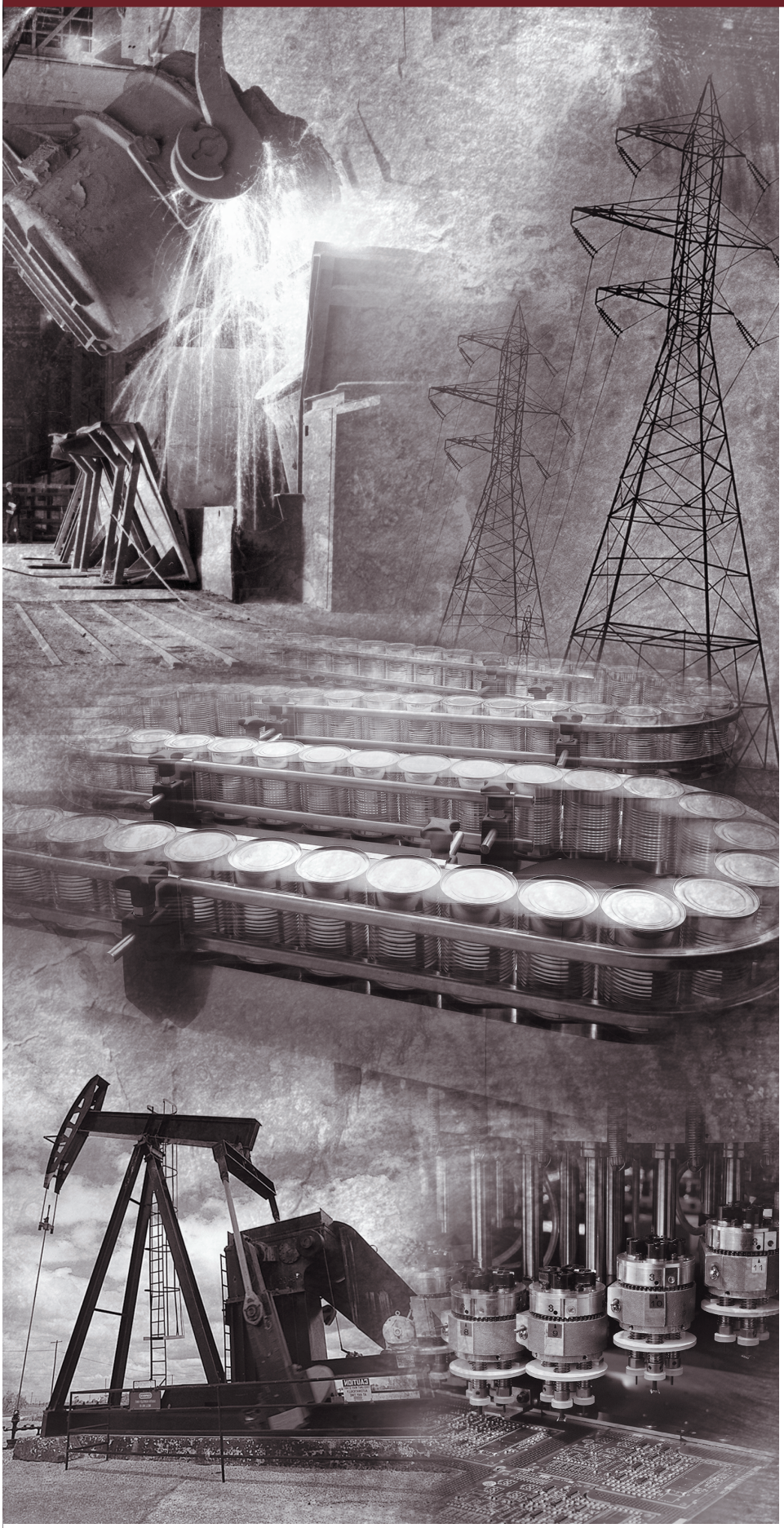


Allen-Bradley

ULTRA 100 Series Digital Servo Drives

with DeviceNet

This manual was created for DeviceNet Firmware 2.01.

Rockwell Automation

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations. For example:

ATTENTION

This symbol identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention statements help you to:

- identify a hazard
- avoid the hazard
- recognize the consequences

TIP

This symbol identifies information that is critical for successful application and understanding of the product.

Printed in the United States of America.

Table of Contents

Appendix: B Polled I/O Examples

Appendix: C Explicit Message Examples

Appendix: D Programming Reference

Safety

Using the ULTRA 100 Series, Digital Servo Drive with DeviceNet

It is recommended that you also read the *ULTRA 100 Series Installation Manual* (publication 1398-5.2) in addition to this manual before attempting to install or operate the ULTRA 100 Drive with DeviceNet. By reading the manuals you will become more familiar with safe practices and procedures for operation of the ULTRA 100 Drive with DeviceNet. This manual provides DeviceNet specific information. Use the *ULTRA 100 Series Installation Manual* (publication 1398-5.2) for reference information about interface with the drive.

Your Responsibilities

The equipment described in these manuals are intended for use in an industrial environment. Personal injury and damage to equipment can result from not following all applicable safety codes, procedures, and requirements.

As a qualified user or installer of this device, you are responsible for determining the suitability of the product for the intended application. Rockwell Automation is neither responsible nor liable for indirect or any consequential damage resulting from the inappropriate use of this product.

A qualified person or installer is someone who is familiar with all safety requirements and established safety practices relating to the installation, operation, and maintenance of this equipment. For more detailed definitions, refer to *IEC 364*.

It is recommended that anyone who operates or maintains electrical or mechanical equipment should have a basic knowledge of First Aid. As a minimum, they should know the location of First Aid equipment, and the identity of the designated First Aid personnel in the area.

Installation

A safe attitude is essential to "working safe" in an Industrial Environment. Being safe is important to you and those working around you. Safety labeling on equipment does not represent an all inclusive set of instruction to ensure safe operation of equipment. Safety labeling is only meant to be a guide and reminder of safety hazards. You should know what hazards are associated with equipment in your area before attempting any work on any equipment. If you wish further information, please contact your nearest safety representative.

ATTENTION

Observe all applicable local, national, and international safety codes when using this equipment.

Wiring practices, grounding, disconnects, and over-current protection are of particular importance.

Failure to observe safety codes could result in personal injury and/or damage to equipment.

The general hazards that may be encountered with the use of this equipment are: electrical, mechanical, and stored energy.

Electrical Hazards

Proper sizing and installation procedures are required for electrical power equipment in an industrial environment. Installation must be undertaken by qualified personnel. .

ATTENTION

High voltage is present on the terminals of the ULTRA 100 Drive with DeviceNet.

After removing power, check for remaining voltage before making or removing any connection.

Failure to observe this safety procedure could result in personal injury and/or damage to equipment.

ATTENTION

Ground the ULTRA 100 Drive with DeviceNet enclosure.

Ensure that the device enclosure is connected to a safety (earth) ground.

Failure to observe this safety procedure could result in personal injury and/or damage to equipment.

ATTENTION

Static discharge occurring at the DeviceNet connector on the ULTRA 100 with DeviceNet may cause a malfunction.

Static control precautions are required with wire connections to the ULTRA 100 Drive with DeviceNet. Refer to *Guarding Against Electrostatic Damage*, (publication 8000-4.5.2) or other applicable ESD protection handbook.

Failure to observe this safety procedure could result in personal injury and/or damage to equipment.

ATTENTION

Loose electrical contacts can cause a fire.

Solder on contacts can loosen over time. Do not tin (solder) exposed leads on cables going to high voltage terminals.

Failure to observe this safety practice could result in intermittent service and/or damage to equipment.

Voltage Potentials

Voltage potentials for the internal amplifier circuitry vary from 325 Volts above to 325 Volts below earth ground with a 240 Volt input. Voltages can exceed 450 VDC or 240 VAC within the ULTRA 100 Drive with DeviceNet. All circuits, including the connections on the front panel, should be considered "hot" when power is connected and after power is removed for the length of time specified in the warning on the front of the amplifier.

Motor Power Cabling

Terminal block connections 6 through 9 connect the device to the windings of the motor. If these connections get crossed, the motor can immediately start to run with no control, at full rpm.

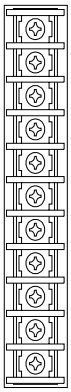
ATTENTION

Wire motor signal connections correctly between the motor and amplifier.

Ensure R,S, T, and ground connections are correct before attaching a motor into a system. If wires are crossed, motors can immediately run at full rpms with no control.

Failure to observe this safety procedure can result in personal injury and/or damage to equipment.

Terminal block for DC bus and motor connections



Position	Identifier	Description
1	DC BUS+	DC Bus+ voltage
2	DC BUS-	DC Bus- voltage
3	L1 (Line 1)	100-240 VAC input power
4	L2/N (Line 2)	100-240 VAC input power
5	Ground Symbol	Safety (earth) ground
6	R	R phase power to motor
7	S	S phase power to motor
8	T	T phase power to motor
9	Ground Symbol	Motor case ground

ATTENTION

Ensure all motor wiring is connected securely to the terminals on the ULTRA 100 Drive with DeviceNet.

Loose wires can cause fire and/or stray static discharge. Always remove power before making or removing any connection on the ULTRA 100 Drive with DeviceNet.

Failure to observe this safety procedure could result in personal injury and/or damage to equipment.

Shield Termination

Motor power cables are shielded. The power cable shield is designed to be grounded during the ULTRA 100 Drive with DeviceNet installation. A small portion of the cable jacket is stripped, which exposes the shield wires. The exposed area must be clamped at the bottom of the amplifier chassis using the clamp provided. It is critical for EMC performance that the shield wires be clamped against the area of the chassis which is not painted.

ATTENTION

Ground shielding on power cables.

High voltage potentials can be discharged from the shield, if it is not grounded to the enclosure of the device.

Failure to ground a shielded power cable to the device can result in personal injury and/or damage to equipment.

ATTENTION

Do not connect to the internal circuitry of the ULTRA 100 Drive with DeviceNet.

Terminal and plug connections on the front panel are the only points where connections should be made.

Failure to observe this safety procedure could result in personal injury and/or damage to equipment.

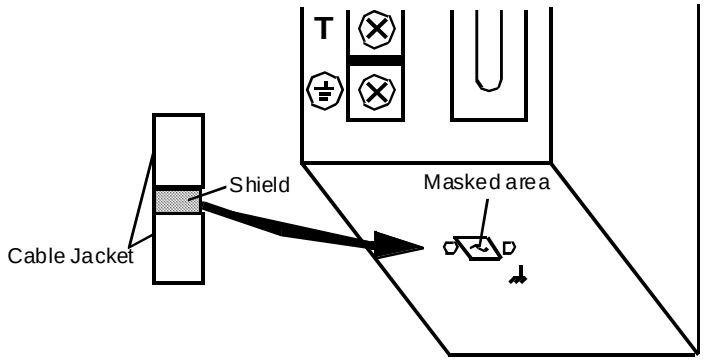
ATTENTION

The DC- terminal connector should never be connected to earth ground.

The ULTRA 100 Drive with DeviceNet requires a floating DC bus.

Failure to observe this safety procedure could result in personal injury and/or damage to equipment.

Figure 1.1
Motor Power EMC Shield Connection (on bottom of Drive)



Power cable shield termination clamp on bottom of DDM-005(X) DN, DDM-009(X) DN, DDM-019(X) DN.

Mechanical Hazards

Mechanical hazards are typically associated with the automatic movement of machine controlled rotating and reciprocating equipment. Appropriate precautions must be taken to ensure power to the device is disconnected before personnel have access to the moving parts of a system.

ATTENTION

Secure mounting of all moving components before powering a system.

Motors and linkages must be securely mounted before a system is operated. Disassembled equipment should be appropriately identified (tagged-out) and access to electrical power restricted (locked-out).

Failure to observe these safety procedures could result in personal injury and/or damage to equipment.

ATTENTION

Restrict casual contact to equipment.

The ULTRA 100 Drive with DeviceNet and any external shunt devices should be installed in an industrially rated cabinet to provide device protection and restricted access.

Failure to observe this safety procedure could result in exposure to electrical hazards and/or damage to equipment.

ATTENTION

Avoid contaminating electronic components.

Provide a quality air source to cabinets; free of debris, oil, corrosives, or electrically conductive contaminates. All cabinets should have scheduled inspections and be cleaned as needed.

Failure to observe these safety procedures could result in breakdown and/or damage to equipment.

Stored Energy Hazards

Stored energy hazards are both electrical and mechanical.

Electrical hazards can be avoided by disconnecting the ULTRA 100 Drive with DeviceNet from its power source and measuring the DC bus voltage to verify it is at a safe level. Wait for the time indicated in the warning on the front of the amplifier prior to removing the protective cover or touching any connections.

ATTENTION

High voltage is present on the DC Bus and terminal block connections for several minutes after electrical power is removed.

Measure remaining voltage on the terminal block prior to removing the protective cover or touching any connections.

Failure to observe this safety procedure could result in personal injury and/or damage to equipment.

Mechanical hazards require a risk analysis on the effects of any stored mechanical energy, as well as the potential for the conversion of electrical energy stored in the ULTRA 100 Drive with DeviceNet being converted to mechanical energy. Automatic movement of machine controlled rotating and reciprocating equipment can occur from the stored energy in a system.

ATTENTION

High energy is temporarily stored in system components, even when equipment is stopped.

High electrical and mechanical energy can be stored in devices and system linkages. Check and dissipate any stored energy before working on equipment.

Failure to observe this safety procedure could result in personal injury and/or damage to equipment.

Safety Guidelines

The following points should be observed for the safety of personnel and equipment:

- System and safety documentation must be made available and observed at all times.
- Only qualified personnel (familiar with the equipment) are permitted to install, operate, and maintain it.
- All non-qualified personnel are physically restricted from the equipment.
- Systems must be installed in accordance with all applicable safety and regulatory codes.
- The equipment is intended for permanent connection to a main power input. It is not intended for use with a portable power input .

ATTENTION

Commissioning the ULTRA 100 Drive with DeviceNet can disrupt network communications. Ensure your device is not connected to a live DeviceNet network.

Set the node address and Data Rate via the rotary DIP switches with the DeviceNet cable disconnected from the ULTRA 100 Drive with DeviceNet or the power turned off at its supply.

ATTENTION

To safely shutdown, do not toggle the ENABLE input command.

Always remove power to the ULTRA 100 Drive with DeviceNet before maintaining or repairing the unit.

Failure to observe this safety procedure could result in personal injury and/or damage to equipment.

Introduction

Purpose of this manual

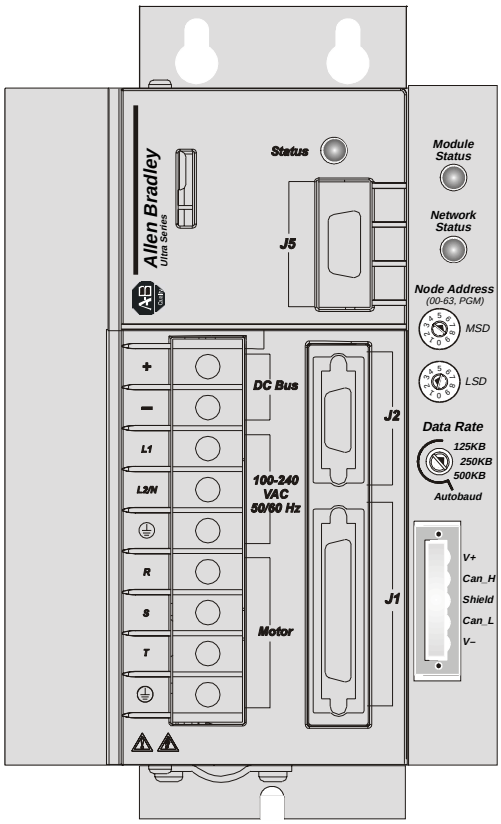
This manual is intended to be used by persons using the ULTRA 100 Drive with DeviceNet. This includes ULTRA 100 Drive with DeviceNet-005-DN, 005X-DN, 009-DN, 009X-DN, 019-DN, or 019X-DN.

The DeviceNet network is an open, global industry-standard communication network designed to provide an interface through a single cable from a programmable controller directly to "smart" devices such as sensors, push buttons, motor starters, simple operator interfaces and drives.

DeviceNet Interface Description

The ULTRA 100 Drive with DeviceNet connector and interface allows for connection to a DeviceNet network.

Figure 2.1
ULTRA 100 Drive with DeviceNet



Predefined Master/Slave Connection Set

A set of messaging connections that facilitate communications and is typically seen in a master/slave relationship is known as the Predefined Master/Slave Connection set. The master is the device that gathers and distributes I/O data for the process controller. A DeviceNet master scans its slave devices based on a scan list it contains. A slave device returns I/O data to its master device. The I/O data exchanged over this connection is pre-defined.

The process controller (normally a PLC or a computer running PLC emulation software) can receive information through a master scanning device and a ULTRA 100 Drive with DeviceNet. The ULTRA 100 Drive with DeviceNet supports Explicit, Polled I/O, Change of State, and Cyclic Messaging.

Explicit Response/Request Messages

Explicit request messages are used to perform operations such as reading and writing attributes. Explicit response messages indicate the results of the attempt to service an explicit request message. Within the slave device, explicit requests and responses are received and transmitted by a single connection object.

Polled I/O Command/Response Messages

The Poll command is an I/O message transmitted by the master device. A Poll command is directed toward a specific slave device. A separate Poll command must be sent to each slave device that is to be polled. The Poll response is the I/O message that the slave device transmits back to the master device. Within the slave device, Poll commands and responses are received and transmitted by a single connection object.

Change-of-State/Cyclic Messages

A Change of State/Cyclic message is directed towards a single specific node (master or slave). An Acknowledge response may or may not be returned to this message. In the master or slave device, the producing Change of State message and the consuming Acknowledge message are received/transmitted by one connection object.

The consuming Change of State message and producing Acknowledge messages are received/transmitted by a second connection object.

- ULTRA 100 Drive with DeviceNet implements the Unconnected Message Manager (UCMM) which is used to establish an explicit message connection. This connection is then used to move information from one node to another.
- Faulted-node Recovery, allows the node address of a device to be changed even when it is faulted on the network. This feature requires the support of proper PC software tools.
- User-configured Fault Response, provides the ability to customize communication error messages to the drive actions.

Connect to the DeviceNet network

A DeviceNet network is a arrangement of electrical power and device distribution. A DeviceNet network is planned and adjusted for optimal communications.

Before proceeding to add devices, you need to record the following:

- network data rate,
- network cable system map (topology) to which you are connecting,
- distances between cable system components,
- device current draw and voltage drop for each device on the network, and
- limitation of the trunk and drop cables.

Refer to the following recommended trunk and drop lengths.

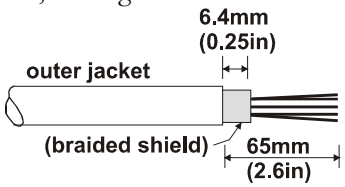
Data Rates	125 Kbps	250 Kbps	500 Kbps
Thick Trunk Line	500 m (1,640 ft.)	250 m (820 ft.)	100 m (328 ft.)
Thin Trunk Lengths	100 m (328 ft.)	100 m (328 ft.)	100 m (328 ft.)
Maximum Drop Length	6 m (20 ft.)	6 m (20 ft.)	6 m (20 ft.)
Cumulative Drop Budget	156 m (512 ft.)	78 m (256 ft.)	39 m (128 ft.)

Refer to the *DeviceNet Cable System Planning and Installation Manual* (publication DN-6.7.2) for specific guidance in calculating and attaching the ULTRA 100 Drive with DeviceNet to a network.

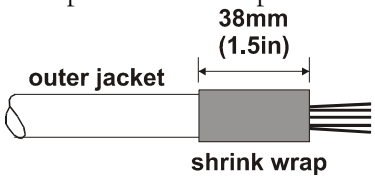
Wiring the open-style connector

To attach a plugable, open style, screw-connector to the DeviceNet cable:

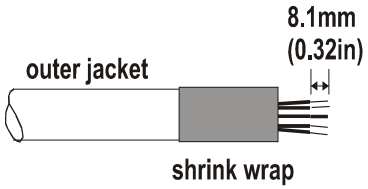
1. Strip 65mm (2.6in) to 75mm (2.96in) of the outer jacket from the end of the line, leaving no more than 6.4mm (0.25in) of the braided shield exposed.



2. Wrap the end of the line with 38mm (1.5in) of shrink wrap, covering part of the exposed wires and part of the trunk line insulation.

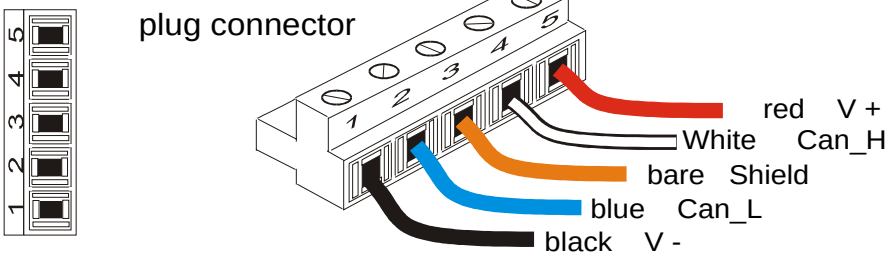


3. Strip 8.1mm (0.32in) of the insulation from the end of each of the insulated wires. Trim the last 6.5mm (0.26in) of the bare wires so that the outside dimension does not exceed 0.17mm (0.045in).



4. Insert each wire into the appropriate clamping cavity of the plugable screw connector, according to the color of the cable insulation. Tighten the clamping screws to secure each wire.

5. Use a 1/8 inch, flat bladed screwdriver to firmly attach wires in the connector.



Device Connector	Cable Color	Designation
5	red	V +
4	white	Can_H
3	bare	Shield
2	blue	Can_L
1	black	V -

6. Attach the ULTRA 100 Drive with DeviceNet to the DeviceNet network.

ATTENTION

Static discharge occurring at the DeviceNet connector on the ULTRA 100 Drive with DeviceNet may cause a malfunction.

Static control precautions are required with wire connections to the ULTRA 100 Drive with DeviceNet. Refer to *Guarding Against Electrostatic Damage*, (publication 8000-4.5.2) or other applicable ESD protection handbook.

Failure to observe this safety procedure could result in personal injury and/or damage to equipment.

Network configuration of ULTRA 100 Drive with DeviceNet

PC interface cards and RS-232 device modules are available that allow you to connect a computer directly to a DeviceNet network to communicate with devices on the network. This allows you to use DeviceNet management software to help in configuring the DeviceNet network.

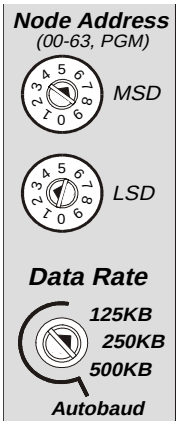
Setting rotary DIP switches to node address and data rate

Three rotary DIP switches are used to configure node address and data rate. The switches are read at power-up, when a reset command is issued from the DeviceNet network, and when DeviceNet power is restored after the detection of a DeviceNet power loss (including the removal and reinserting of the DeviceNet connector).

Three rotary DIP switches, MSD (Most Significant Digit) and LSD (Least Significant digit) are used to set the node address (00-63). The third rotary DIP switch is used to configure the Data Rate (125, 250, 500 kps, and Autobaud).

With the DeviceNet cable disconnected from the ULTRA 100 Drive with DeviceNet or the power to the device turned OFF, you can safely change the switches to desired settings. The Autobaud selection automatically matches the device data rate to the rate of the network.

Figure 4.1
Rotary DIP Switches



The node address and data rate default values are: a node address of 63 and a data rate of 125 kps.

The node address and data rate are programmable if the rotary switch Node address is not valid (>63).

The programmed values are accessible via Parameters objects and the DeviceNet Object. Refer to Appendix D, Programming Reference for more information.

Configuring the Network using Software

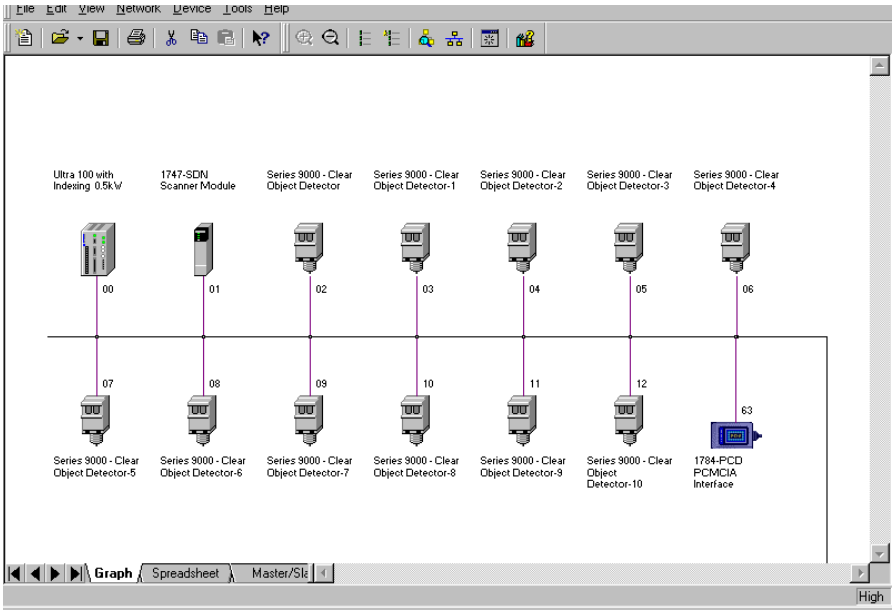
ATTENTION

Commissioning the ULTRA 100 Drive with DeviceNet can disrupt network communications. Ensure your device is not connected to a live DeviceNet network.

Set the node address and data rate via the rotary switches with the DeviceNet cable disconnected from the ULTRA 100 Drive with DeviceNet or the power to the device turned off at its supply.

Using your DeviceNet management software, select the Network screen to check available node settings. Add the ULTRA 100 Drive with DeviceNet Electronic data Sheet (EDS) to the management software's library

Figure 4.2
Rockwell Software's RSNetWorx for DeviceNet network screen



Rockwell Software's RSNetWorx for DeviceNet software allows a user to create a workable EDS file directly from the ULTRA 100 Drive with DeviceNet. The EDS file is also available at the Rockwell Automation/ Allen-Bradley web site (www.ab.com).

Creating the EDS File

EDS files are also available to be down loaded from the world wide web at www.ab.com/networks/eds.

TIP

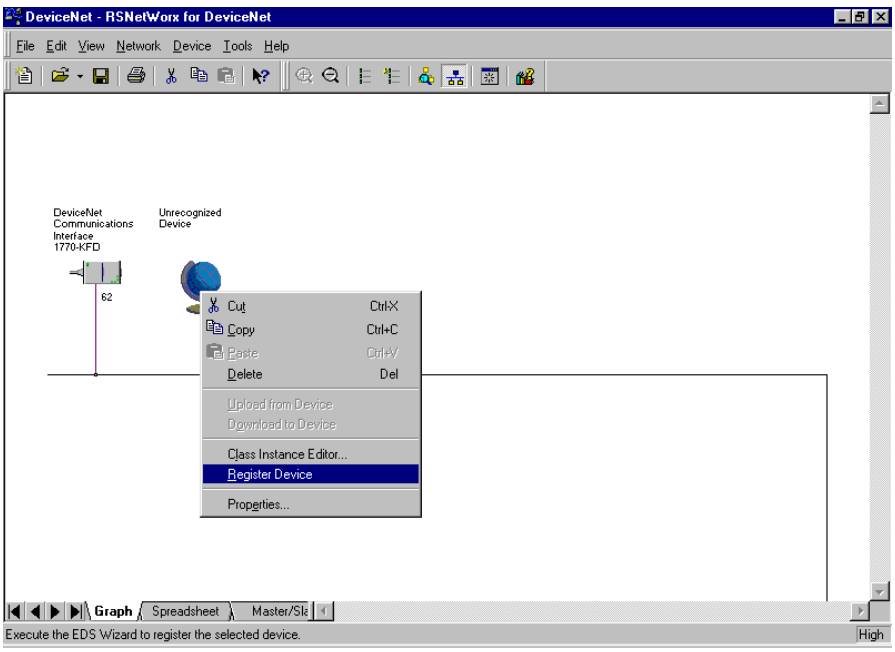
Do not generate an EDS file from the ULTRA 100 Drive with DeviceNet unless an EDS file is not available. Attempting to create or edit an EDS will destroy the current EDS information.

Rockwell Software's RSNetWorx for DeviceNet allows a user to create a workable EDS file by uploading parameter information directly from the ULTRA 100 Drive with DeviceNet.

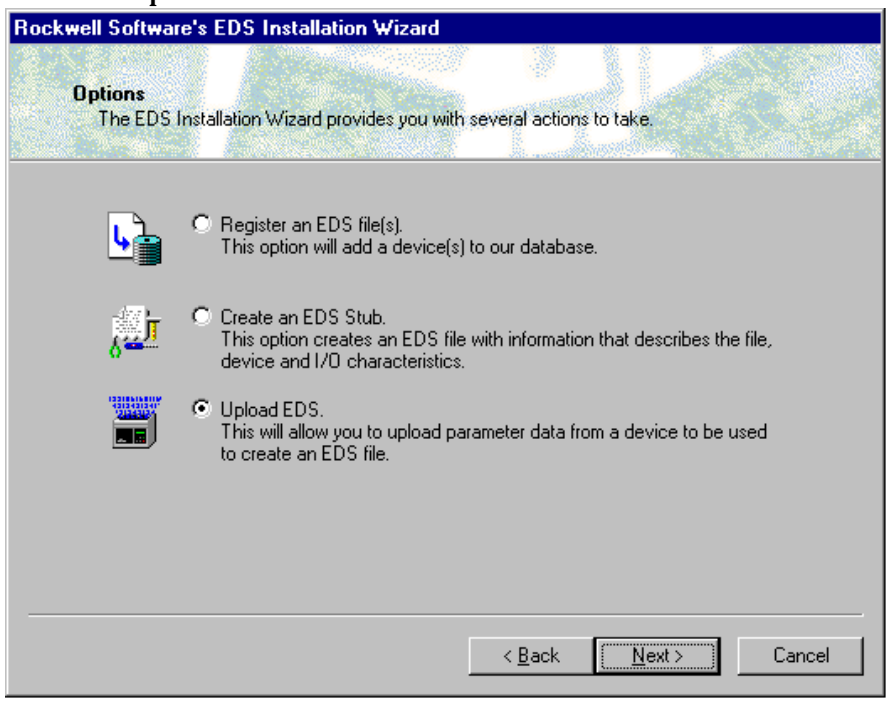
1. Connect to the DeviceNet network by pressing F10, or selecting **Network>Online** from the menu.

2. Rockwell Software's RSNetWorx for DeviceNet is now connected to the DeviceNet network. Select **Network>Single Pass browse** form the menu.

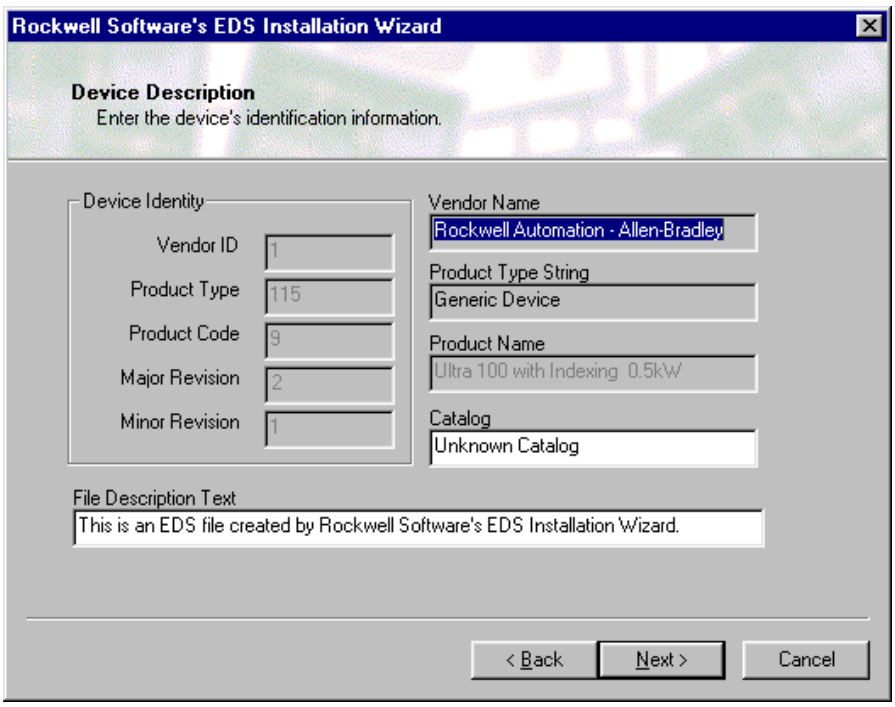
3. Register the device by selecting **Device>Register Device** form the menu or right click on the device and select **Register Device** from the window.



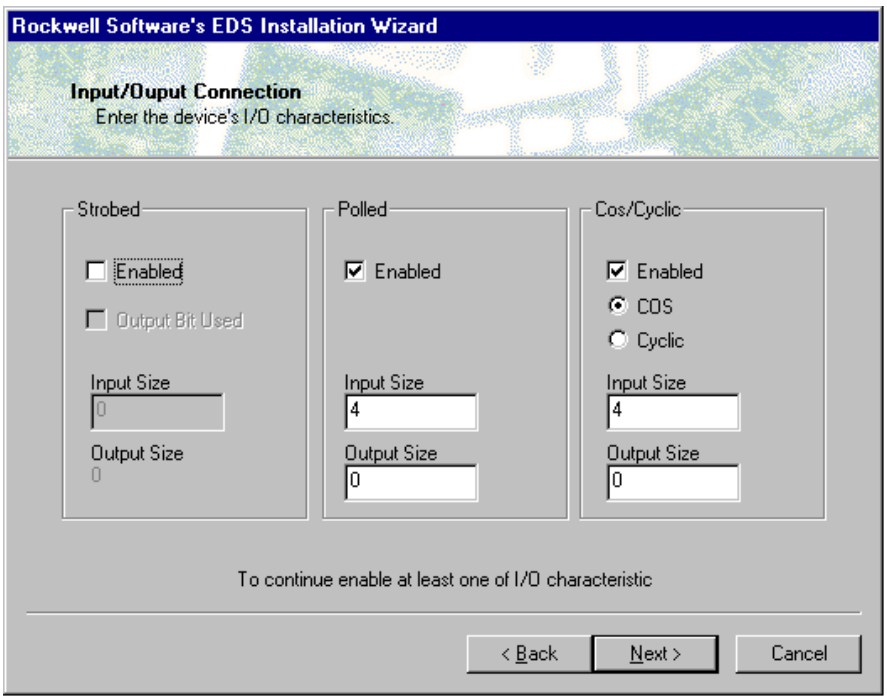
4. Select **Upload EDS**.



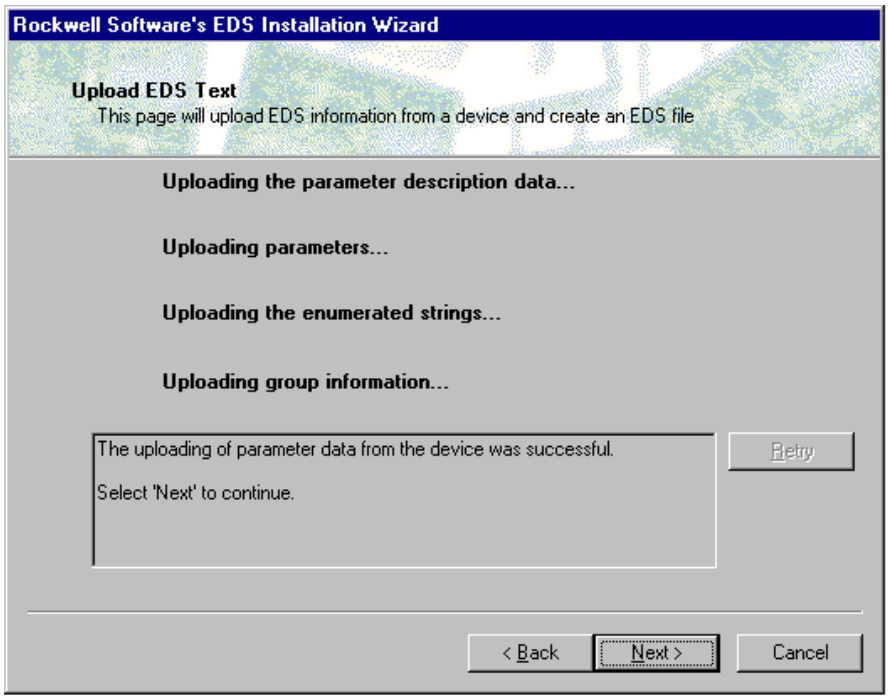
5. Ensure the vendor and product information is correct and click the **Next** button.



6. Enable the Polled connection and select the default input size of 4 bytes and the default output size of 0 bytes. Enable the COS/Cyclic connection and select the default input size of 4 bytes and the default output size of 0 bytes. Also ensure that the COS box is checked and click the **Next** button.



7. After reading all the data from the drive and verifying the operation was a success, click the **Next** button.



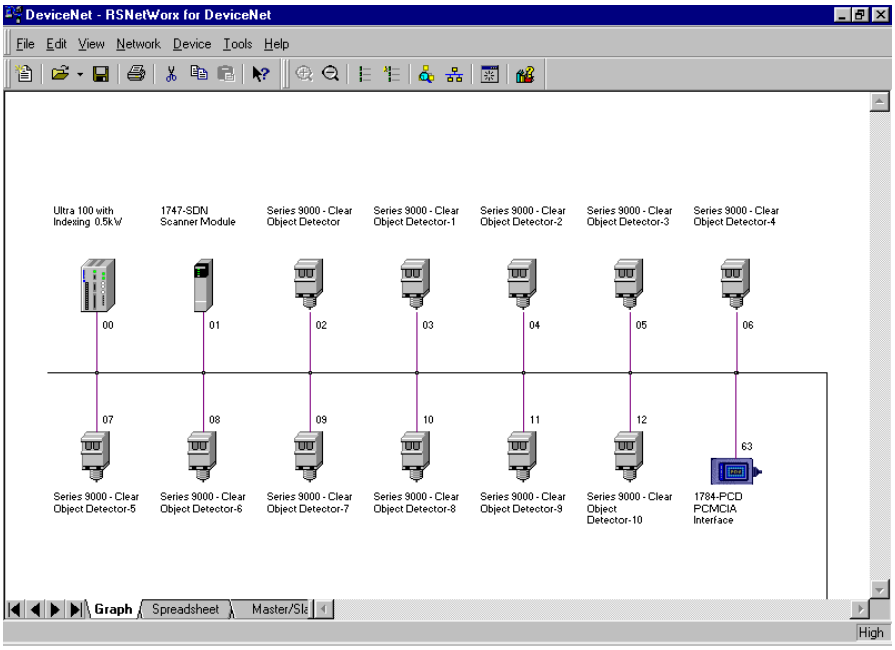
8. Select the new device and click the **Change Icon** button if an icon other than default needs to be selected. After selecting the new icon click the **Next** button.

9. Click the **Next** button and you can see the ULTRA 100 Drive with DeviceNet icon.

Modifying ULTRA 100 Drive with DeviceNet Configuration Data

Now, the ULTRA 100 Drive with DeviceNet device configuration data can be accessed with Rockwell Software's RSNetWorx for DeviceNet or any other configuration tool that supports EDS files. Invoke the tool configuration by double-clicking the ULTRA 100 Drive with DeviceNet node in the Network Configuration screen or by selecting its icon and selecting **Device>Properties** from the menu.

Figure 4.3
Rockwell Software's RSNetWorx for DeviceNet network screen



Using Messaging with a 1747-SDN DeviceNet Scanner

Getting Started

This appendix provides information using a 1747-SDN DeviceNet scanner Module to provide deviceNet communications between a SLC 500 processor and other DeviceNet devices. Refer to the following manuals for more detailed product information.

- *1747-SDN DeviceNet Scanner Module* (Pub 1747-5.8)
- *1747-SDN DeviceNet Scanner* (Pub 1747-6.5.2)

Understanding Messaging

To begin, we need to understand the communication interface between the SLC processor and DeviceNet devices through the Scanner Module.

The Scanner Module

The Scanner Module communicates with DeviceNet devices over the network to:

- Read inputs from a device,
- Write outputs to a device,
- Download configuration data, and
- Monitor a device's operational status.

The Scanner Module communicates with the SLC processor in the form of M1/M0 file transfers and/or Discrete I/O (DIO).

IMPORTANT The M1/M0 file transfer is a method of moving large amounts of data between a SLC processor and its Scanner Module. It transfers files containing a maximum of 256 words and may take more than one SLC program scan to complete.

IMPORTANT Discrete input and output (DIO) is the transfer of one to 32 words between a SLC processor and its Scanner Module. All 32 words of input data and all 32 words of output data are updated on each SLC program scan.

Information exchanged includes:

- Device I/O data,
- Status information, and
- Configuration data.

Communicating with Your Device's Input/Output Data

The Scanner Module communicates I/O data via Strobe, Poll, Change of State, and Cyclic messages. It uses these messages to solicit data from or deliver data to each device. Data received from the devices, or input data, is organized by the Scanner Module and made available to your processor. Data received from your SLC processor, or output data, is organized in the Scanner Module and sent on to your devices.

A strobe message is a multicast transfer of data (which is 64-bits in length) sent by the scanner that solicits a response from each slave device. There is one bit for each of the possible 64 node addresses. The devices respond with their data, which can be as many as 8 bytes.

IMPORTANT The ULTRA 100 Drive with DeviceNet does not support the Strobe message even though the Scanner Module does.

A Poll message is a point-to-point transfer of data (0 to 255 bytes) sent by the scanner that solicits a response from a single device. The device responds with its input data (0 to 255 bytes).

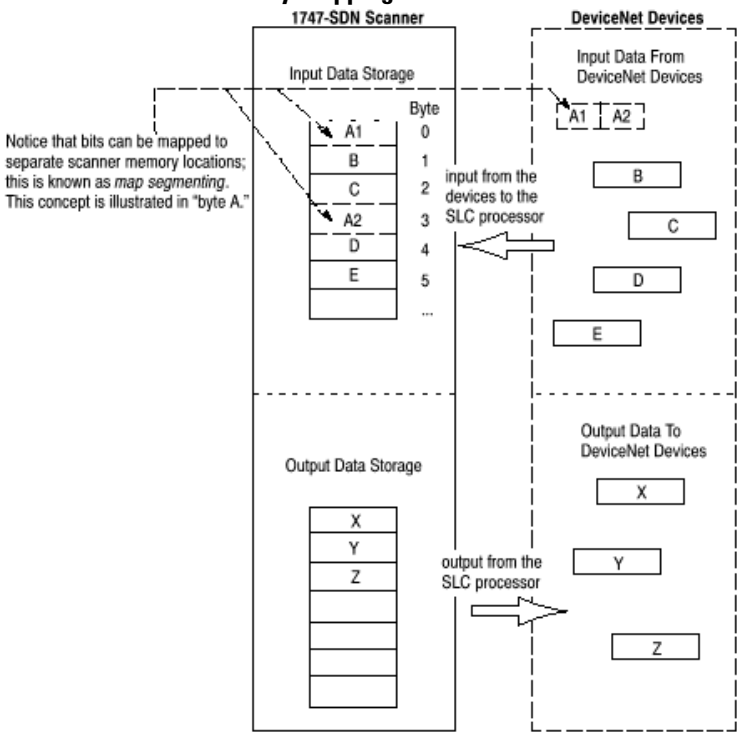
A Change of State message is a point-to-point transfer of data sent whenever a data change occurs or at a user-configurable heartbeat rate. This does not solicit a response.

A Cyclic message is sent only at a user-configurable rate.

IMPORTANT Input and output are defined from the SLC processor's point-of-view. Output is data sent from the processor to a device. Input is data collected by the processor from a device.

IMPORTANT All data sent and received on a DeviceNet network is in byte lengths. A device may, for example, produce only two bits of input information. Nevertheless, since the minimum data size on a DeviceNet network is one byte, two bits of information are included in the byte of data produced by the device. In this case (only two bits of input information), the upper six bits are insignificant.

Figure A.1
1747-SDN Scanner Memory Mapping



Communicating with the SLC 500 Processor

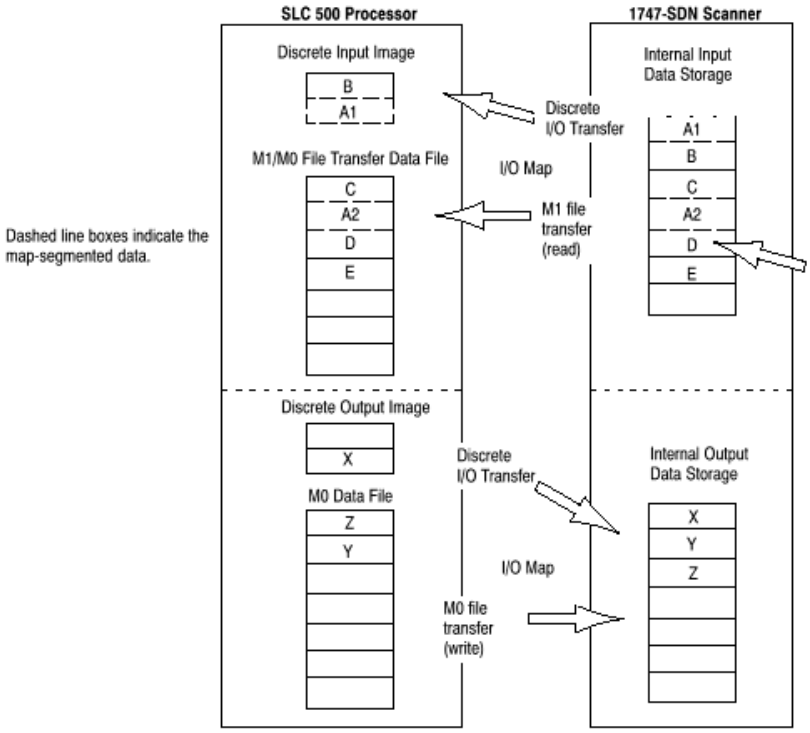
Your SLC processor communicates with the Scanner Module via M1 file transfer reads, M0 file transfer writes, and DIO transfers. Input data, gathered from the network's devices, is organized within the Scanner Module and is made available for the processor to "read" from the M1 file. The Scanner Module does not send data to your SLC processor. Data transferred between your Scanner Module and SLC processor must be initiated by *the processor*. Output data is sent, or "written," to the Scanner Module by your processor by placing the data in the M0 file. This data is organized in the Scanner Module,

which in turn passes the data on to your devices via Strobe, Poll, Change-of-State, or Cyclic messages.

IMPORTANT The M1 file transfer is the transfer of data from the Scanner Module to the SLC processor. The Scanner Module makes data collected from the network's devices available for the processor to "read".

IMPORTANT An M0 file transfer is the transfer of data from the SLC processor to the Scanner Module. The SLC processor "writes" data to the Scanner Module's memory.

Figure A.2
Data transfer initiated by SLC 500 Processor



Scanner Module Tables

To manage the flow of data between the processor and a network's devices, the Scanner Module uses the following data tables:

- Scanner Module Configuration Table,
- Scan List Table,
- Device Input Data Table,
- Device Output Data Table,
- Device Active Table,
- Device Failure Table, and
- Client/Server Transaction Tables.

You can directly configure two of these data tables through Rockwell Software's RSNetWorx for DeviceNet software. These tables are stored in the Scanner Module's non-volatile memory:

- Scanner Module Configuration Table (SCT), and
- Scan List Table (SLT).

Scanner Module Configuration Table (SCT)

The SCT table controls basic information the Scanner Module needs to function on your DeviceNet network. It tells the Scanner Module:

- if it can transmit and receive input and output data,
- how long it waits after each scan before it scans the devices again, and
- when to send out its poll messages

Scan List Table (SLT)

The SLT supports I/O updating for each of your devices on the network. It also makes it possible for your Scanner Module to make device data available to your SLC processor. The SLT contains information for your Scanner Module:

- Which devices to scan (node addresses),
- How to scan each device (strobe, poll, change of state, cyclic or any valid combination),
- How often to scan your devices,
- Exactly where in each device's memory to find the desired data,
- The size of the input data/output data,
- Exactly where to map the input or output data for your processor to read, and
- How your processor reads each device's input data (M1/M0 file or DIO).

RSNetworx for DeviceNet Software

Rockwell Software's RSNetWorx for DeviceNet software configures the Scanner Module's data tables. This software tool connects to the Scanner Module via the DeviceNet network and an RS-232 cable interface or PC interface card. Refer to the manual for RSNetWorx for DeviceNet for information on how to configure the scanner module.

Explicit Messaging with the 1747-SDN Scanner

Explicit Messaging is a way of allowing the user to configure and monitor a slave device's parameters on the DeviceNet network. This form of messaging is performed by copying data to and from the SLC processor M0 and M1 files. Explicit Messaging can only be done by the SLC processor to slave devices that are mapped in the scanner module's scan list.

How it Works

There are five steps to the Explicit Messaging process. The following is a brief description of what happens during this process.

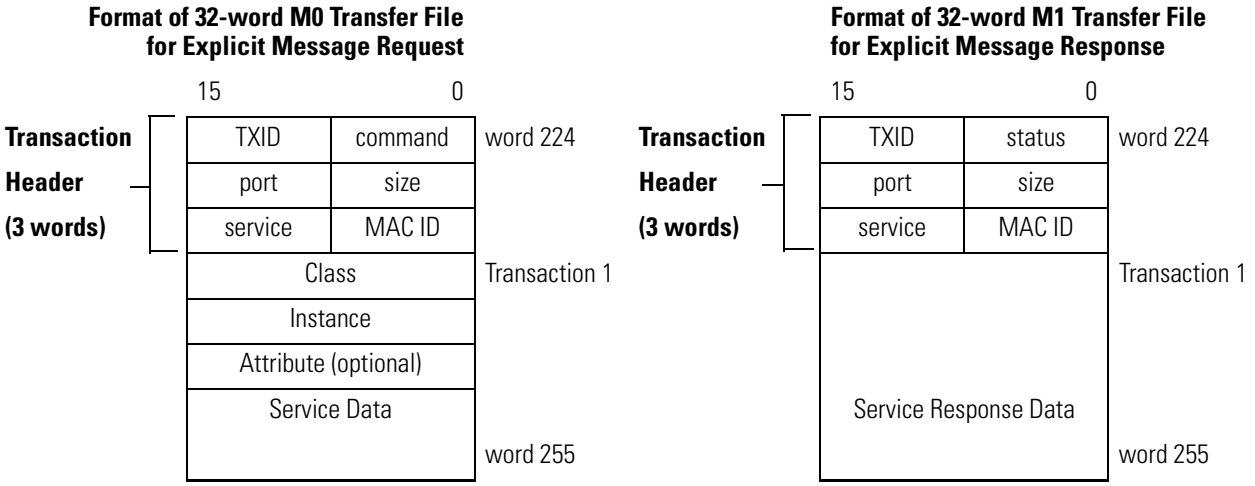
1. Format an M0 file transfer in the SLC processor to send an Explicit Message Request to the scanner module (download).
2. The scanner module transmits the Explicit Message Request to the slave device over the DeviceNet network.
3. The slave device transmits the Explicit Message Response back to the scanner and is queued into a file transfer buffer.
4. The processor uses an M1 file transfer to retrieve the Explicit Message Response from the scanner's buffer (upload).
5. Format an M0 file transfer with a Delete Response command and use the current transaction ID read in step 4. The transaction IDs are deleted and can be reused.

IMPORTANT It is important to note that there is a request message and a response message whether you are reading or writing a parameter.

How to Format the Explicit Message Transaction block

There are ten 32-word transaction blocks within the scanner module reserved for Explicit Message Program Control. These transaction blocks accommodate both downloading of Explicit Message Requests and the uploading of Explicit Message Responses. The scanner module can accommodate one request or response for each transaction block. The following figure describes the format and mapping of transaction blocks for request and response messages in the scanner module:

Figure A.3
Data transfer initiated by SLC 500 Processor



The message buffer is composed of two sections:

- Transaction header — three words that contain information identifying the message transaction.
- Transaction body — in a request, this contains the DeviceNet Class, Instance, Attribute and Service Data portions of the transaction. In a response, this contains the Service Response Data only.

Each of the data fields in the transaction header are one byte in length:

Transaction header data fields

Data Field	Description
TXID	Transaction ID — when the processor creates and downloads a request to the scanner, the processors ladder logic program can assign a TXID to the transaction. This is a one-byte integer in word 31 the range of 1 to 255. The scanner uses this value to track the transaction to completion, and returns the value with the response that matches the request downloaded by the processor.
COMMAND	For each download, a command code instructs the scanner how to administer the request: 0 = Ignore transaction block (block empty) 1 = Execute this transaction block 2 = Get status of transaction TXID 3 = Reset all client/server transactions 4 = Delete this transaction block from response queue 5 to 255 = Reserved
STATUS	For each upload, the status code provides the processor with status on the device and its response: 0 = Ignore transaction block (block empty) 1 = Transaction completed successfully 2 = Transaction in progress (not ready) 3 = Error — Slave not in scan list 4 = Error — Slave off-line 5 = Error — DeviceNet port disabled or off-line 6 = Error — Transaction TXID unknown 7 = Error — Slave not responding to request 8 = Error — Invalid command code 9 = Error — Scanner out of buffers 10 = Error — Other client/server transaction in progress 11 = Error — Could not connect to slave device 12 = Error — Response data too large for block 13 = Error — Invalid port 14 = Error — Invalid size specified 15 = Error — Connection busy 16 to 255 = Reserved
PORT	The DeviceNet port used by this message. The port must be zero (Channel A) as the1747- SDN scanner only has 1 port/channel.
SIZE	The size of the transaction body in bytes. The transaction body can be up to 29 words (58 bytes) in length. If the size exceeds 29 words, an error code will be returned.
SERVICE	The service attribute contains the DeviceNet service request and response codes that match the corresponding request for the TXID.
MAC ID	The DeviceNet network address of the slave device where the transaction is sent. This value can range from 0 to 63. The port and MAC ID uniquely identify the target slave device. The slave device must be listed in the scanner modules scan list and be on-line for the Explicit Message transaction to be completed.

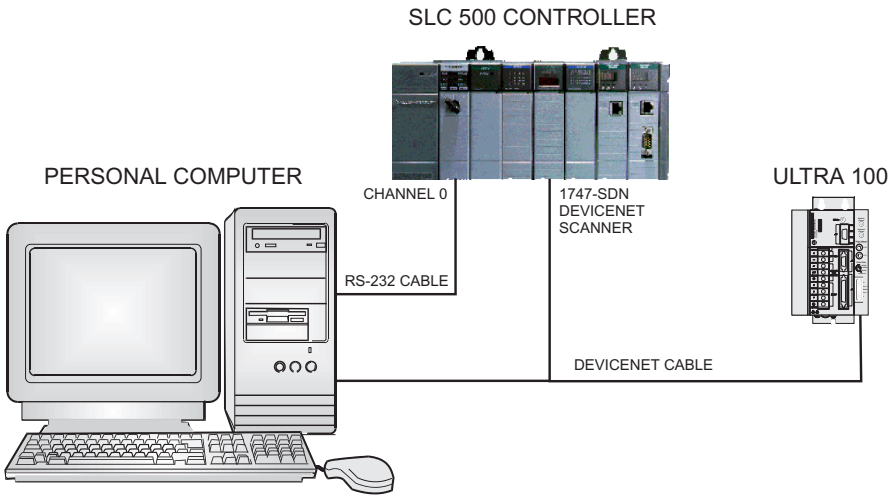
The format of all DeviceNet explicit messages supported by the ULTRA 100 Drive with DeviceNet is (8:16). Within an explicit message, the class field is 8 bits long, and the instance field is 16 bits long.

Polled I/O Examples

These example's use a SLC 5/04, 1747-SDN, and an ULTRA 100 Drive with DeviceNet (Indexing version). In addition, these examples assume:

- The DeviceNet Scanner's module is in Slot 1 of the SLC chassis.
- Ladder programming is done using Rockwell Software: RSLogix 500 (v 2.57.00.00),
- The DeviceNet network is configured using Rockwell Software: RSNetWorx for Device Net (v 2.11.51.00), and
- All personal computer communication interfacing is done using Rockwell Software: RSLinx (v 2.10.00.118).

Figure B.1
Example setup



.

Example 1: RAM Index Setup and Move

This example will explain the steps required to setup and execute a RAM index move using polled I/O messages with the ULTRA 100 Drive with DeviceNet (Indexing Version). Data is sent and received via instances of the Assembly Object. Refer to page D-10 for a description of the Assembly Object instances implemented in the ULTRA 100 Drive with DeviceNet. For purposes of this example, we will assume that the system has already completed a homing routine and the ULTRA 100 Drive with DeviceNet is enabled.

IMPORTANT For the purposes of this example the RAM index will use default value for the Speed, Acceleration and Deceleration of 500 rpm. The Host Index pointer already points to the RAM index, but if another was to be selected then the pointer would need to be modified to point to the required index.

Select Command and Response Assembly Object Data

The type of Polled I/O command and response messages will need to be specified along with the correct setting in the SLC scanner's scan list. The type of polled (and change of state/ cyclic) I/O messages is specified by setting the DNet I/O Format (Parameter 283 Indexing version).

Assembly Object, I/O Format Type

DeviceNet I/O Format	Output (command) Assembly Instance ID used for Polled, Change of State, and Cyclic I/O Messaging	Input (response) Assembly Instance ID used for Polled I/O Messaging	Input (response) Assembly Instance ID used for Change of State and Cyclic Messaging
Type 1	1 (0 Bytes)	2 (4 Bytes)	2 (4 Bytes)
Type 2	3 (2 Bytes)	2 (4 Bytes)	2 (4 Bytes)
Type 3	5 (3 Bytes)	4 (8 Bytes)	2 (4 Bytes)
Type 4	6 (8 Bytes)	4 (8 Bytes)	2 (4 Bytes)

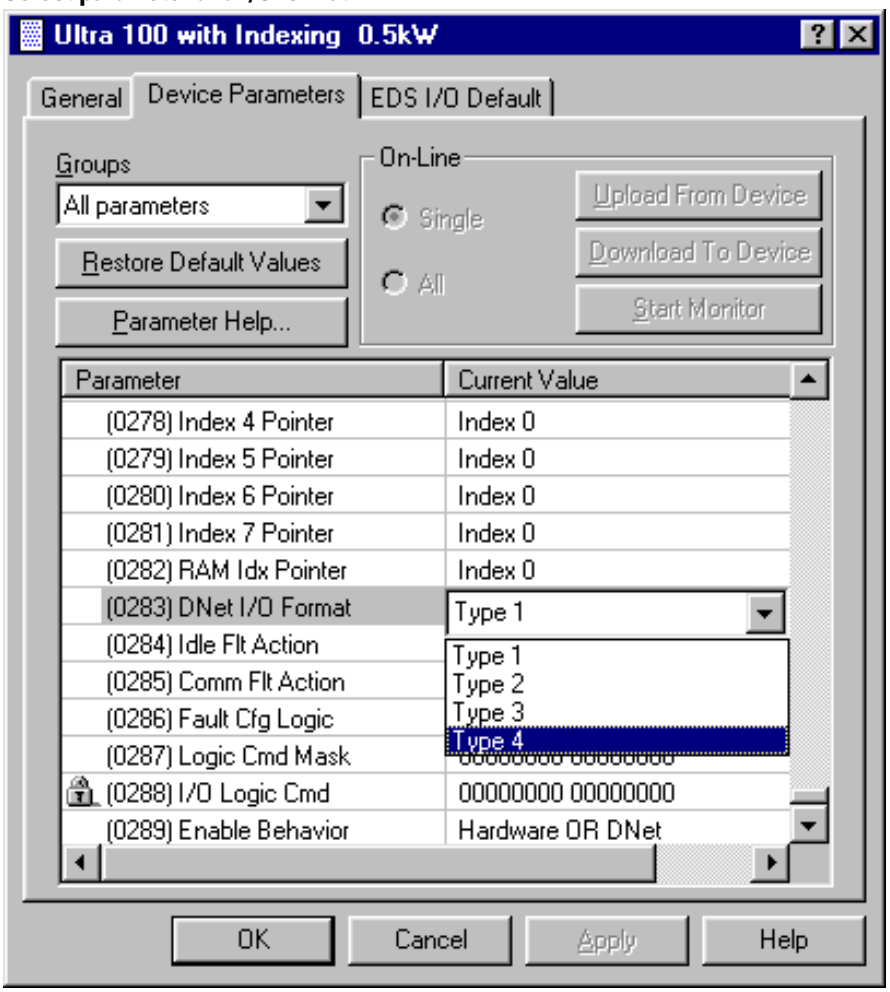
Refer to the Parameter Objects for more information about the DNet I/O Format parameter.

In this example, Type 4 will be used. Figure B.2 shows Type 4 being selected for the DNet I/O Format using Rockwell Software's RSNetWorx for

DeviceNet. If the DNet I/O Format parameter is modified, then the ULTRA 100 Drive with DeviceNet has to be either:

- reset,
- power-cycled, or
- the DeviceNet cable disconnected and reconnected before the new I/O format type is used.

Figure B.2
Select parameter and I/O format



With Type 4 selected for the DNet I/O format, the ULTRA 100 Drive with DeviceNet accepts the following data (8 Bytes) for a Polled I/O command.

Assembly Object,
Output (command) Assembly for Instance ID = 6

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Preset Select B	Preset Select A	Operation Mode Override	Reserved		Follower Enable	Integrator Inhibit	Torque Override
1	Enable	Fault Reset	Start Homing	Remove Command Offset	Disable Serial	Define Home	Start Index	Preset Select C
2	Reserved					Feedback Data Pointer		
3	Write Command Data	Reserved		Command Data Pointer				
4	Command Data Value - Low Byte							
5	Command Data Value - Low Middle Byte							
6	Command Data Value - High Middle Byte							
7	Command Data Value - High Byte							

With Type 4 selected for the DNet I/O format, the ULTRA 100 Drive with DeviceNet sends the following eight bytes in the Polled I/O response.

Assembly Object,
I/O (response) Assembly for Instance ID = 4

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Drive Enabled	At Speed	Negative ILimit	Positive Ilimit	Within Velocity Window	Zero Velocity	Within Position Window	In Position
1	Drive Ready	Brake Active	Axis Homed	Write Data Busy/Ack	Write Data Error	Reserved	Fault Disable	DC Bus Charged
2	Preset Select B	Preset Select A	Operation Mode Override	Reverse Clamp	Forward Clamp	Follower Enable	Integrator Inhibit	Torque Override
3	Enable Active	Fault Reset	Registration Detected	In Dwell	In Motion	Sequence Complete	At Home	Preset Select C
4	Feedback Data Value - Low Byte							
5	Feedback Data Value - Low Middle Byte							
6	Feedback Data Value - High Middle Byte							
7	Feedback Data Value - High Byte							

After selecting Type 4 and cross referencing to the Assembly Object, as described in Appendix D, the data size is determined to be 8 bytes for scanner Tx (transmit) Size and 8 bytes for the scanner Rx (receive) Size. This data

needs to be entered into the I/O parameters of the scanner. Refer to the following Input and Output screens from Rockwell Software's RSNetWorx for DeviceNet for the 1747-SDN Scanner Module.

Figure B.3
Edit I/O Parameters

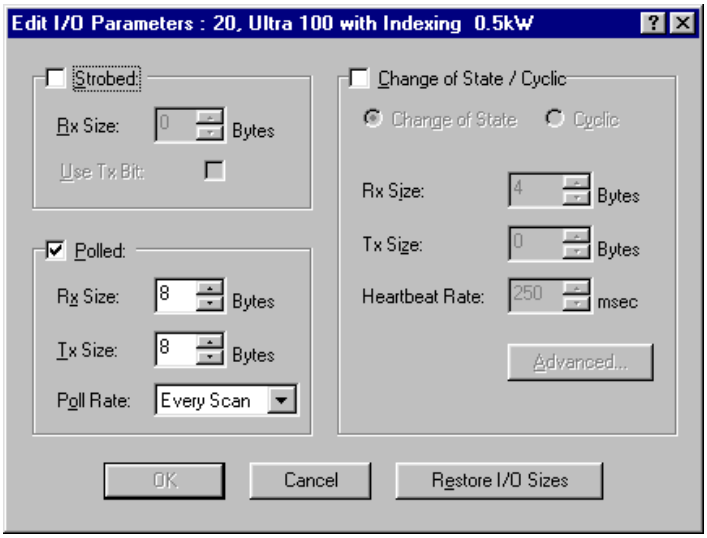


Figure B.4
Input screen of the 1747-SDN Scanner Module

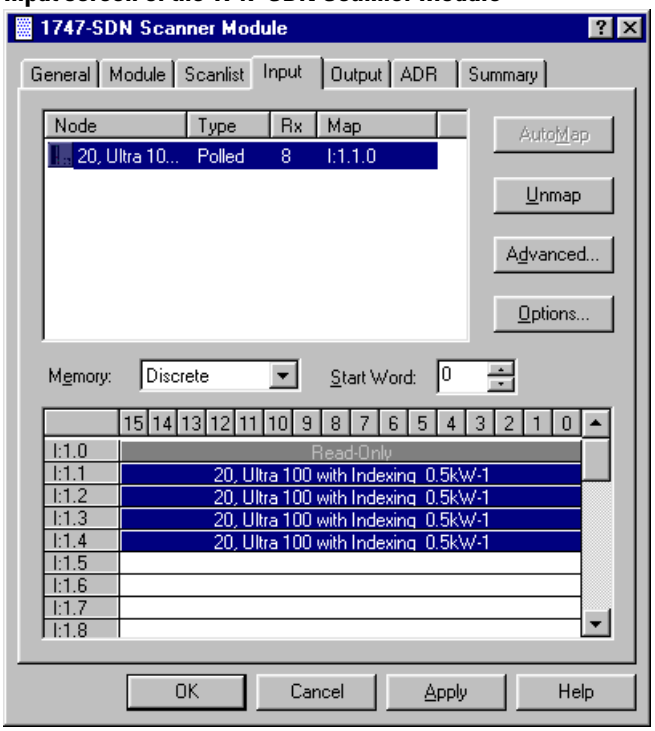
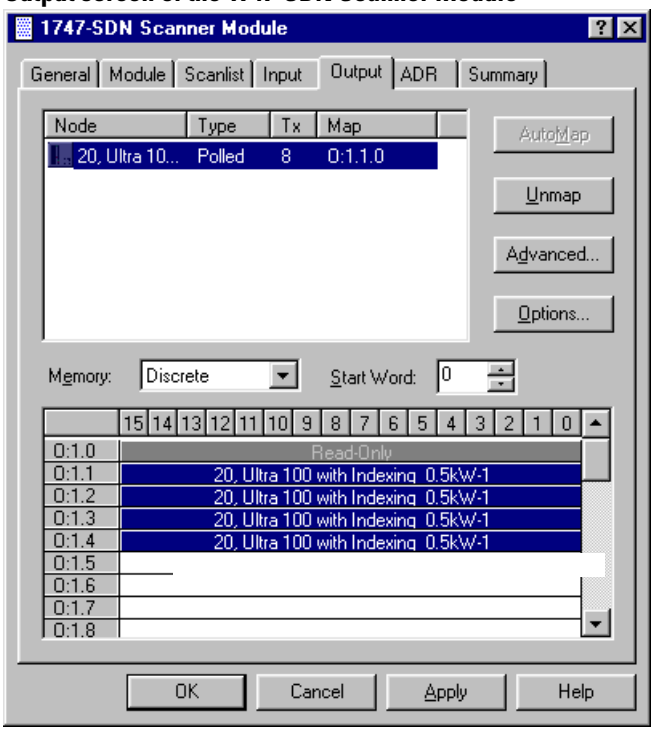


Figure B.5
Output screen of the 1747-SDN Scanner Module



Set the Logic Command Mask (Parameter 287)

Once the I/O format is selected and the correct amount of Receive and Transmit data have been entered the Logic Command Mask needs to be setup. The Logic Command Mask is Parameter 287 and each control point that is to be controlled through DeviceNet needs to be selected.

Figure B.6
Select Logic Command Mask

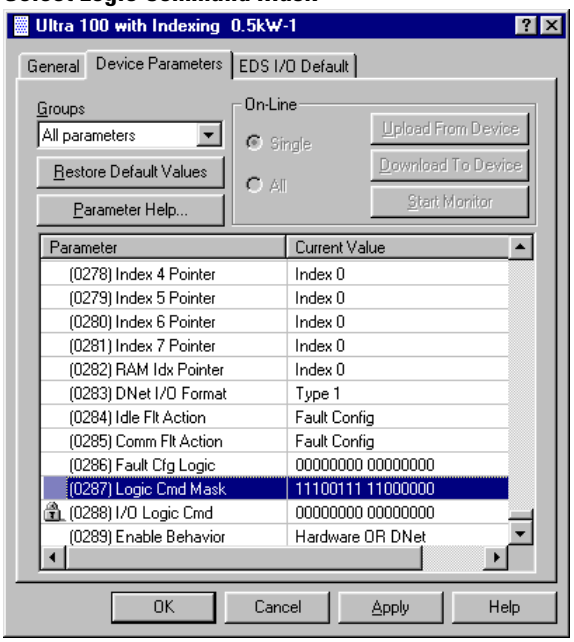
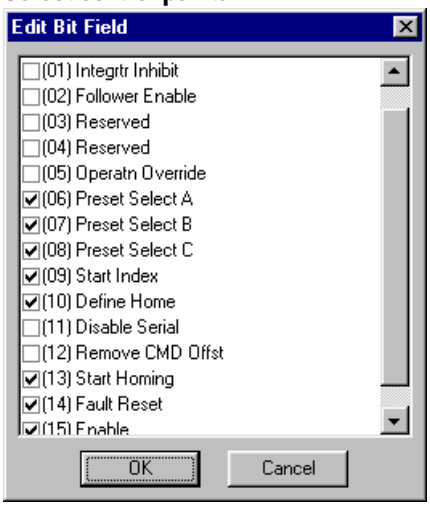


Figure B.7
Select control points



IMPORTANT Default for the Logic Control Mask (Parameter 287) is 0. That is no control points will be used by the Drive when a Polled Message is received by the ULTRA 100 Drive with DeviceNet.

Enable the 1747-SDN Scanner

The scanner module has a module command register located at Word 0 in the output image area for the slot. Bit 0 of Word 0 sets scanner module into either RUN or IDLE mode.

IMPORTANT

1 = RUN

The scanner module maps output data from its scanner output table (MO) and discrete outputs to each device on the network. Inputs are received and mapped into the scanner input table (M1) and discrete inputs. Outputs on the network are under SLC program control.

IMPORTANT

0 = IDLE

The scanner does not map output data to the devices, but keeps network connections to devices open so device failures can be detected. Input data is returned from devices and mapped into the scanner input table (M1) and the discrete inputs. Outputs on the network are not under program control and will be in their configured 'idle state.' The scanner is put into this mode to perform on-line configuration of the scanner database tables.

Figure B.8
Enable the 1747-SDN Scanner

Enable Host Index Control

The first Polled I/O message will set the Host Index Control (Parameter 171) flag true, allowing the Host Index (Parameter 181) pointer to determine which Index the drive will execute when a start index command is given. When the Host Index flag is true and the pointer is set for a specific index, a start index command will be accepted through either a correctly assigned digital input, DeviceNet or through a Host Mode Command (Serial).

The Command Data pointer specifies which command is updated in the ULTRA 100 Drive with DeviceNet when the Write Command Data bit is set high (1). A full list of available command data pointers and corresponding commands are listed in the Assembly Object Command Data table of the Programing Reference, Appendix D on page D-17. Figure B.9 on page B-9 details setting the Command Data Pointer, command data value, and Write

Command data bit. The data is being written to the I/O image table for slot 1 based on the physical location of the scanner module.

Figure B.9
Setting the Command Data Pointer, Command Data Value, and Write Command Data bit

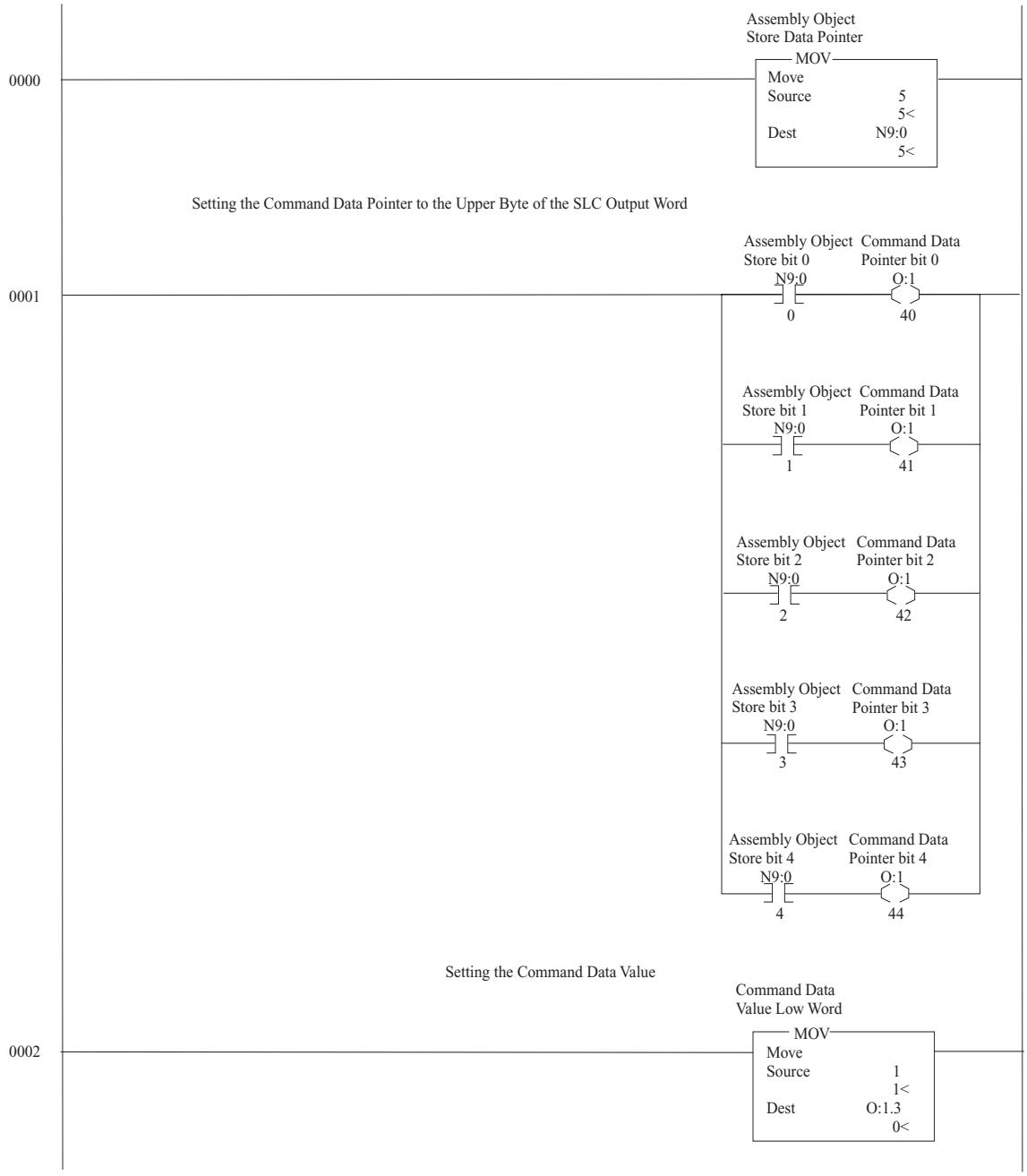


Figure B.9 (continued)
Setting the Command Data Pointer, Command Data Value, and Write Command Data bit

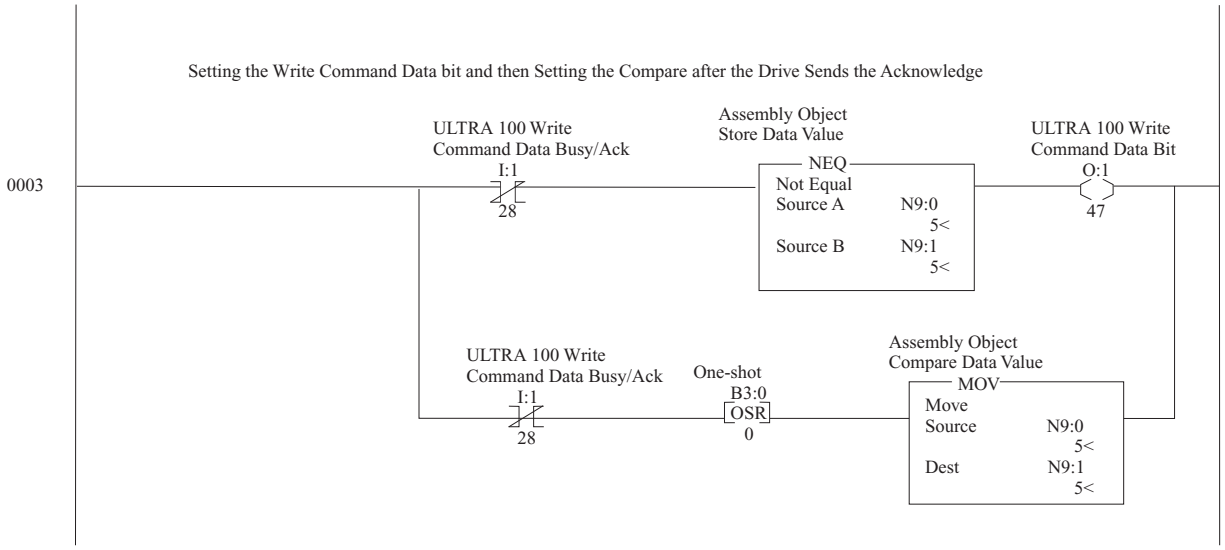
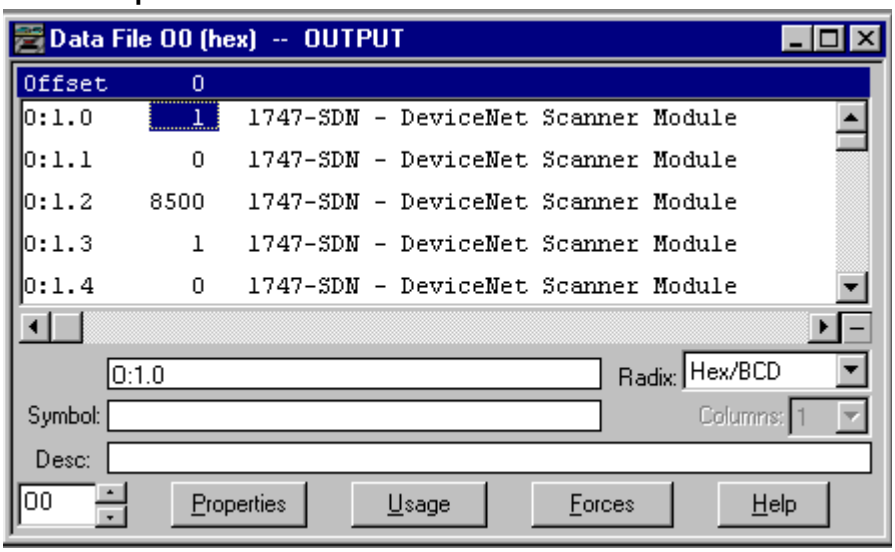


Figure B.10
Data file output



Once the response Write Data Busy/Ack is set low, I:1/28 bit 4 byte 1 of the Response Assembly will be clear (zero). The Write Command Data bit has to be cleared before the Write Data Busy/Ack bit will be cleared by the Drive. When the Drive sets the Write Data Busy/Ack bit low it is ready to receive another Command Data instruction.

Set the RAM Index type for Absolute Move

The next Polled I/O message will set the RAM Index type to be an Absolute move. Figure B.11 details setting the Command Data Pointer, Command Data value, and Write Command Data bit. The data is being written to the I/O image table for slot 1 based on the physical location of the scanner module.

Figure B.11
Setting the Command Data Pointer (7) and Write Command Data bit

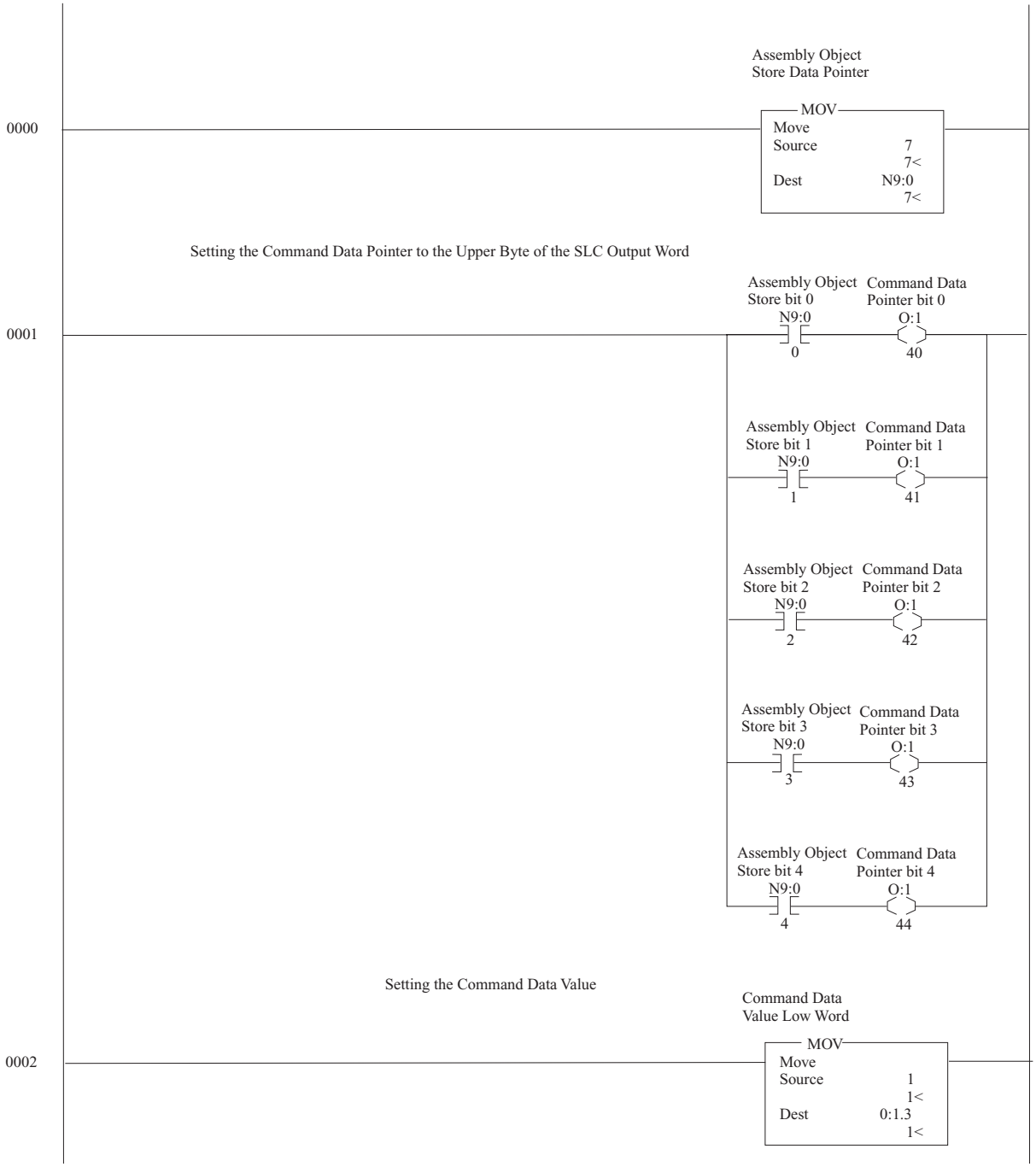


Figure B.11 (continued)
Setting the Command Data Pointer (7) and Write Command Data bit

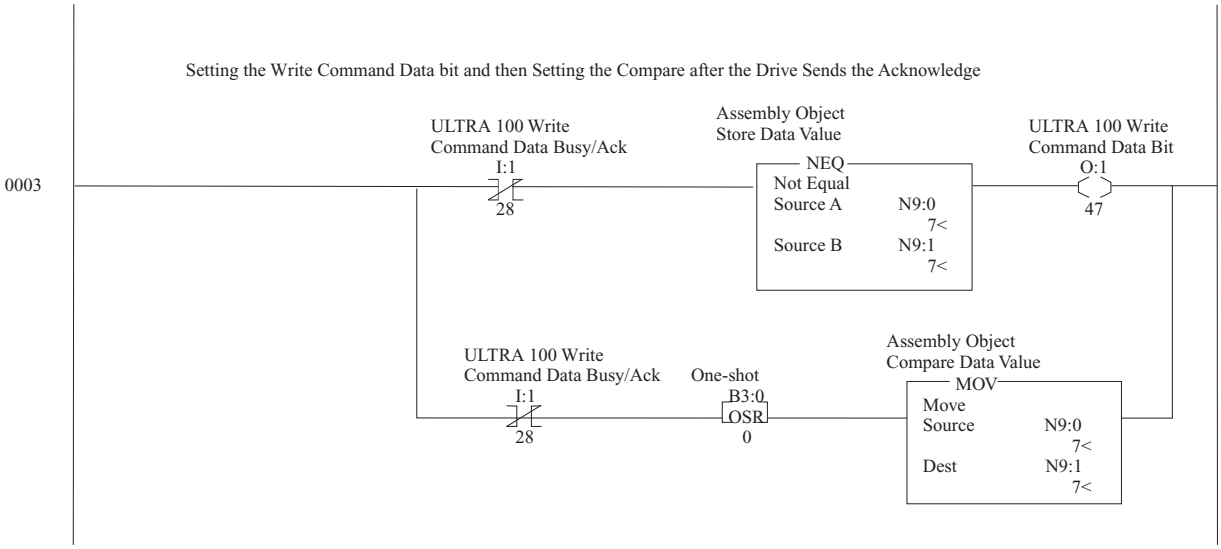
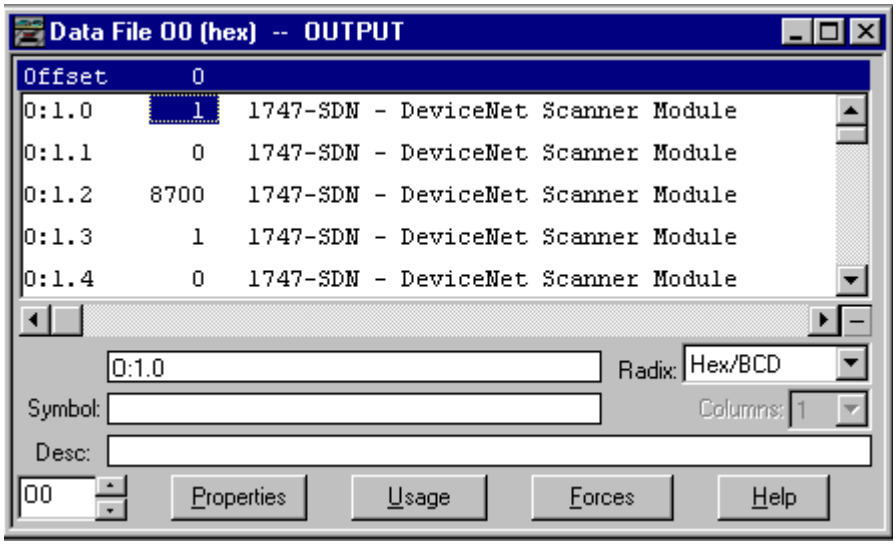


Figure B.12
Data file output



Once the response Write Data Busy/Ack is set low, I:1/28, bit 4 byte 1 of the Response Assembly will be clear (zero). The Write Command Data bit has to be cleared before the Write Data Busy/Ack bit will be cleared by the Drive. When the ULTRA 100 Drive with DeviceNet sets the Write Data Busy/Ack bit low it is ready to receive another Command Data instruction.

Set the RAM Index Position Using User Defined Scaling

The next Polled I/O message will set the absolute position for the RAM Index in counts from a user scaled value. Figure B.13 details setting the Command Data Pointer Command Data Value, and Write Command Data bit. The data is being written to the I/O image table for slot 1 based on the physical location of the scanner module.

Figure B.13
Setting the Command Data pointer and Math Register

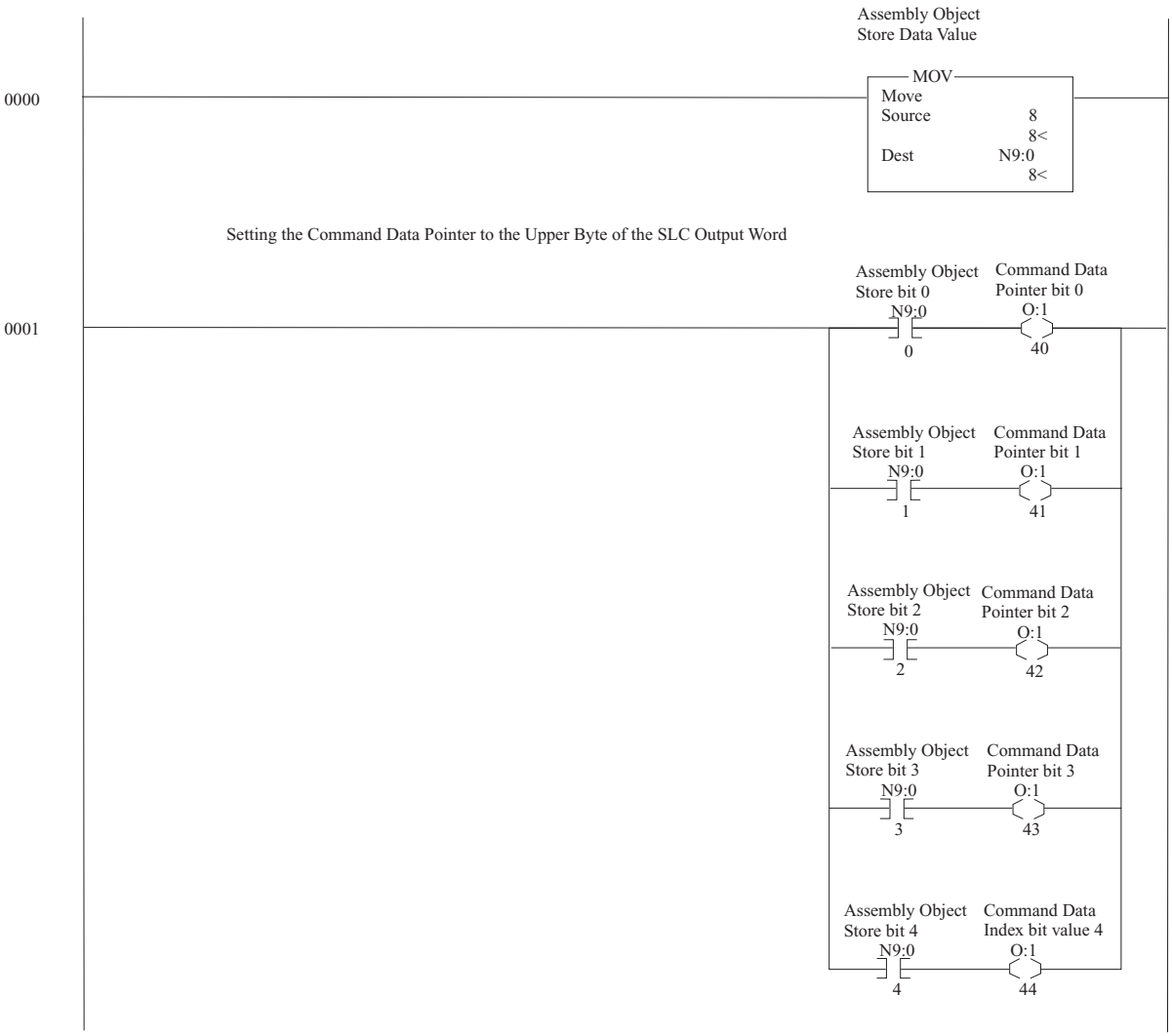
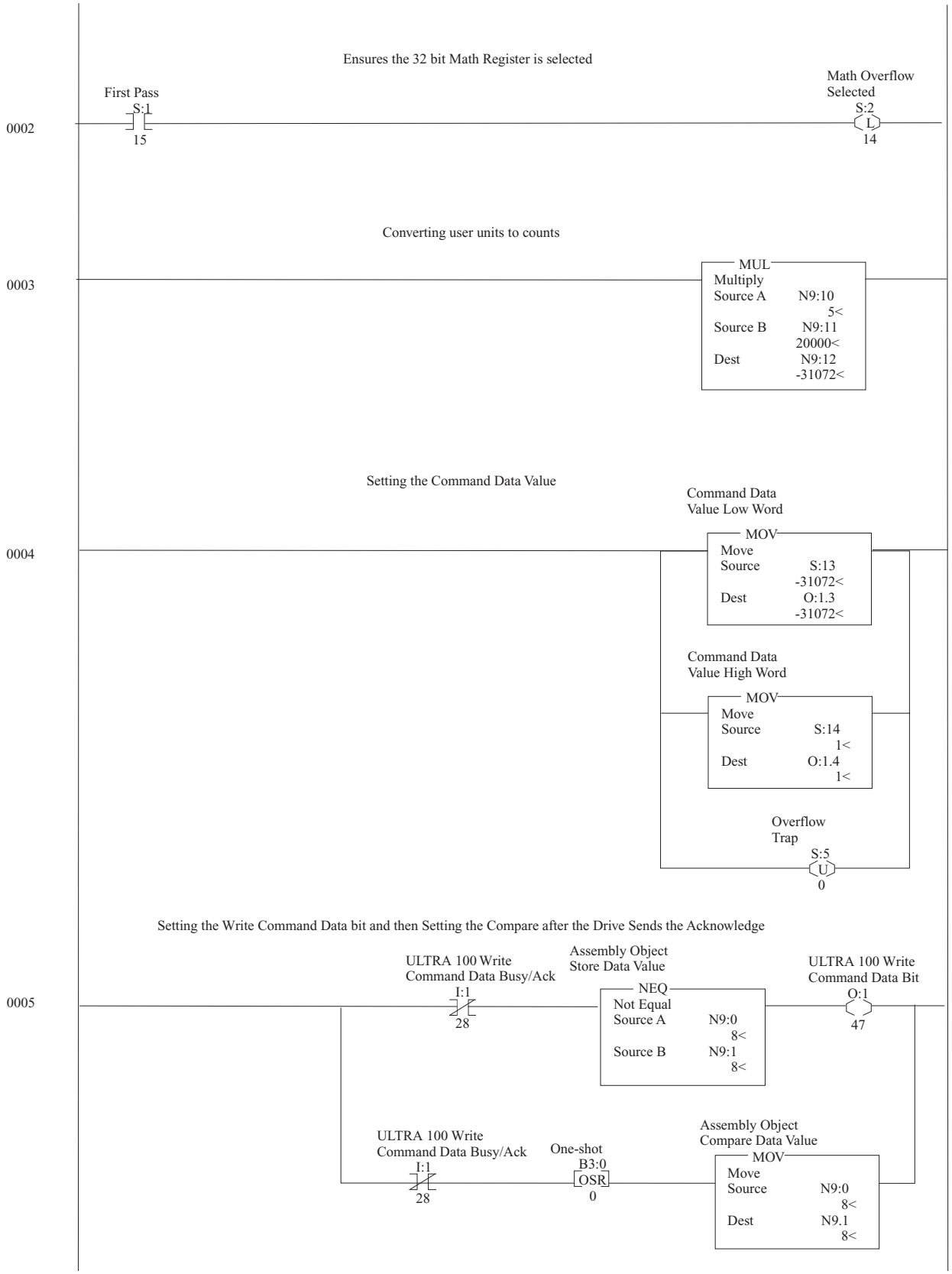


Figure B.13 (continued)
Convert user units, set Command Data Value, and send the Command parameters



These rungs convert a 32-bit (DWord or 4 Byte) position value having user defined scaling into a value in counts that the drive will recognize. The user value (in this case 5) is multiplied with the scale factor (in this case 20,000) for a result of 100,000. For this the 32 bit math register is used and has to be enabled (this is the purpose of rung 0002). The 32 bit result will be moved into the Polled I/O message and the Math Overflow bit reset so the SLC will not fault. The message is then ready to be sent.

Figure B.14
Data file output

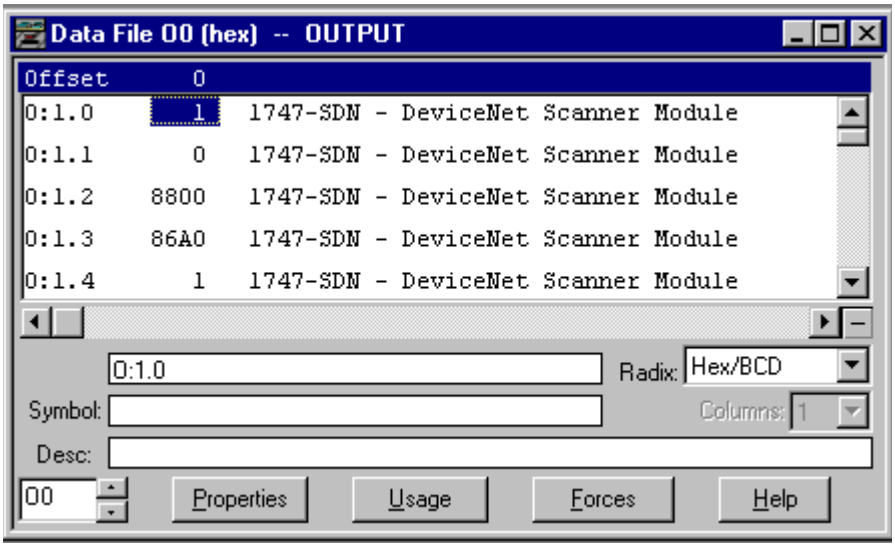
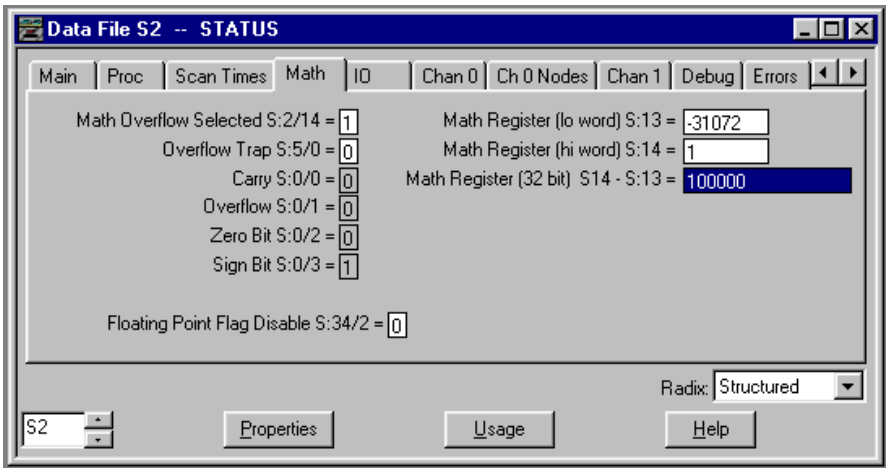


Figure B.15
Math Status



IMPORTANT If a scaling value that is higher than 32,767 is needed the Multiply (MUL) in rung 0003 can be replaced with a Computer (CPT) instruction using multiple multiplies as shown in Figure B-16.

Figure B.16
Multiply output value

Once the response Write Data Busy/Ack is set low, I:1/28 bit 4 byte 1 of the Response Assembly will be clear (zero). The Write Command Data bit has to be cleared before the Write Data Busy/Ack bit will be cleared by the Drive. When the ULTRA 100 Drive with DeviceNet sets the Write Data Busy/Ack bit low it is ready to receive the Start Index Command. The Host Index pointer already points to the RAM index, but if another was to be selected then the Command Data Index of 6 can be used to modify the Host Index pointer in order to point to the required index.

Start Index Command

The next Polled I/O message will set the Start Index Bit High at which time the RAM index will start. The data is being written to the I/O image table for slot 1 based on the physical location of the scanner module.

IMPORTANT The Write Data Busy/Ack needs to be Low before the Start Index command is sent, or previously loaded data may be used for the move. New index data values sent to the ULTRA 100 Drive with DeviceNet while the index move is executing are buffered until the next Start Index command is issued.

Figure B.17
Start Index

Example 2: Display the Current Position in User Units

This example will explain the steps required to read and convert the current motor position using a user defined scale with Polled I/O messaging on the ULTRA 100 Drive with DeviceNet (indexing version). Data is sent and received via instances of the Assembly Object. Refer to page D-10 for a description of the Assembly Object instances implemented in the ULTRA 100 Drive with DeviceNet.

Select Command and Response Assembly Object Data

The type of Polled I/O command and response messages will need to be specified along with the correct setting in the SLC scanner's scan list. The type of polled (and Change of State/ Cyclic) I/O messages is specified by setting the DNet I/O Format (Parameter 283 Indexing version).

Assembly Object, I/O Format Type

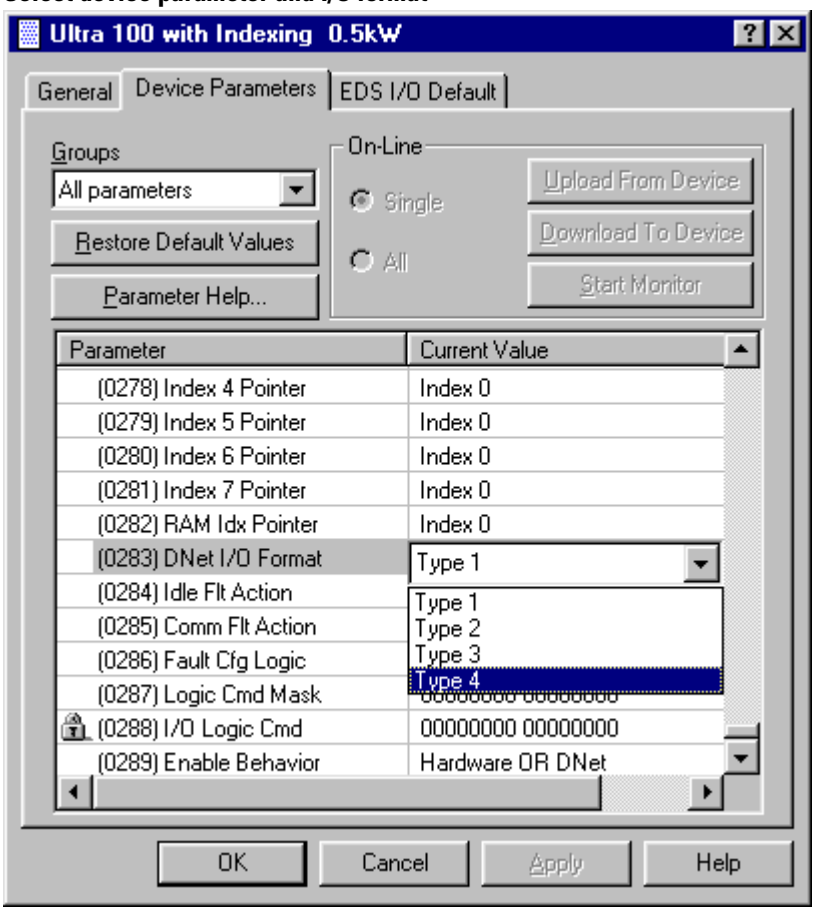
DeviceNet I/O Format	Output (command) Assembly Instance ID used for Polled, Change of State, and Cyclic I/O Messaging	Input (response) Assembly Instance ID used for Polled I/O Messaging	Input (response) Assembly Instance ID used for Change of State and Cyclic Messaging
Type 1	1 (0 Bytes)	2 (4 Bytes)	2 (4 Bytes)
Type 2	3 (2 Bytes)	2 (4 Bytes)	2 (4 Bytes)
Type 3	5 (3 Bytes)	4 (8 Bytes)	2 (4 Bytes)
Type 4	6 (8 Bytes)	4 (8 Bytes)	2 (4 Bytes)

Refer to the Parameter Objects for more information about the DNet I/O Format parameter.

In this example, Type 4 will be used. Figure B.18 shows Type 4 being selected for the DNet I/O Format using Rockwell Software's RSNetWorx for DeviceNet. If the DNet I/O Format parameter is modified, then the ULTRA 100 Drive with DeviceNet has to be either:

- reset,
- power-cycled, or
- the DeviceNet cable disconnected and reconnected for the new I/O Format type to be used.

Figure B.18
Select device parameter and I/O format



With Type 4 selected for the DNet I/O format, the ULTRA 100 Drive with DeviceNet accepts the following data for a Polled I/O command.

Assembly Object,
Output (command) Assembly for Instance ID = 6

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Preset Select B	Preset Select A	Operation Mode Override	Reserved		Follower Enable	Integrator Inhibit	Torque Override
1	Enable	Fault Reset	Start Homing	Remove Command Offset	Disable Serial	Define Home	Start Index	Preset Select C
2	Reserved					Feedback Data Index Pointer		
3	Write Command Data	Reserved		Command Data Index				
4	Command Data Value - Low Byte							
5	Command Data Value - Low Middle Byte							
6	Command Data Value - High Middle Byte							
7	Command Data Value - High Byte							

With Type 4 selected for the DNet I/O format, the ULTRA 100 Drive with DeviceNet sends the following eight bytes in the Polled I/O response.

Assembly Object,
I/O (response) Assembly for Instance ID = 4

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Drive Enabled	At Speed	Negative ILimit	Positive Ilimit	Within Velocity Window	Zero Velocity	Within Position Window	In Position
1	Drive Ready	Brake Active	Axis Homed	Write Data Busy/Ack	Write Data Error	Reserved	Fault Disable	DC Bus Charged
2	Preset Select B	Preset Select A	Operation Mode Override	Reverse Clamp	Forward Clamp	Follower Enable	Integrator Inhibit	Torque Override
3	Enable Active	Fault Reset	Registration Detected	In Dwell	In Motion	Sequence Complete	At Home	Preset Select C
4	Feedback Data Value - Low Byte							
5	Feedback Data Value - Low Middle Byte							
6	Feedback Data Value - High Middle Byte							
7	Feedback Data Value - High Byte							

After selecting Type 4 and cross referencing to the Assembly Objects the data size is determined to be 8 bytes for scanner Tx (Transmit) Size and 8 bytes for the scanner Rx (Receive) Size. This data needs to be entered into the I/O

parameters of the scanner. Refer to the following Input and Output screens from Rockwell Software's RSNetWorx for DeviceNet for the 1747-SDN Scanner Module.

Figure B.19
Edit I/O Parameter

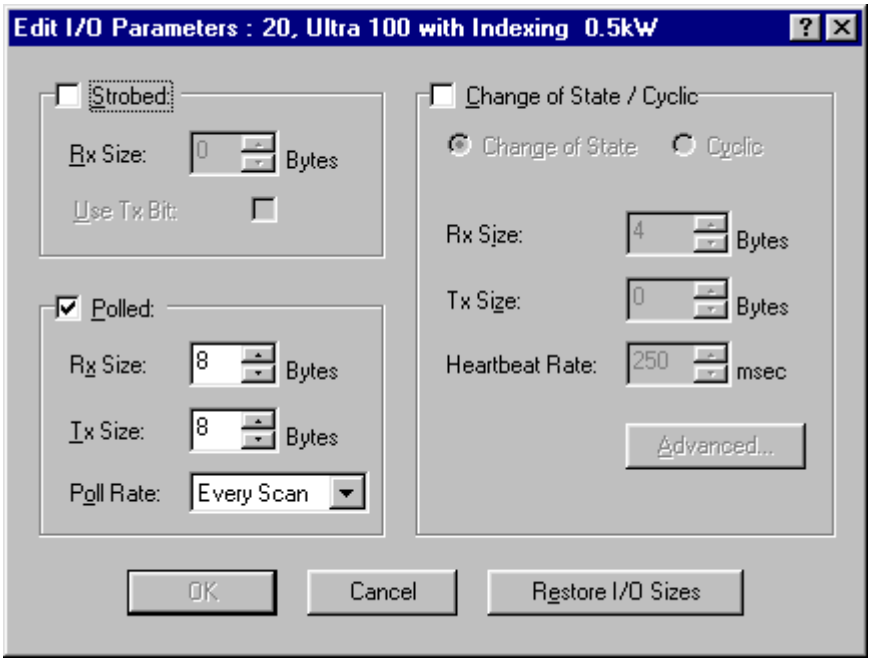


Figure B.20
1747-SDN Scanner Module Input

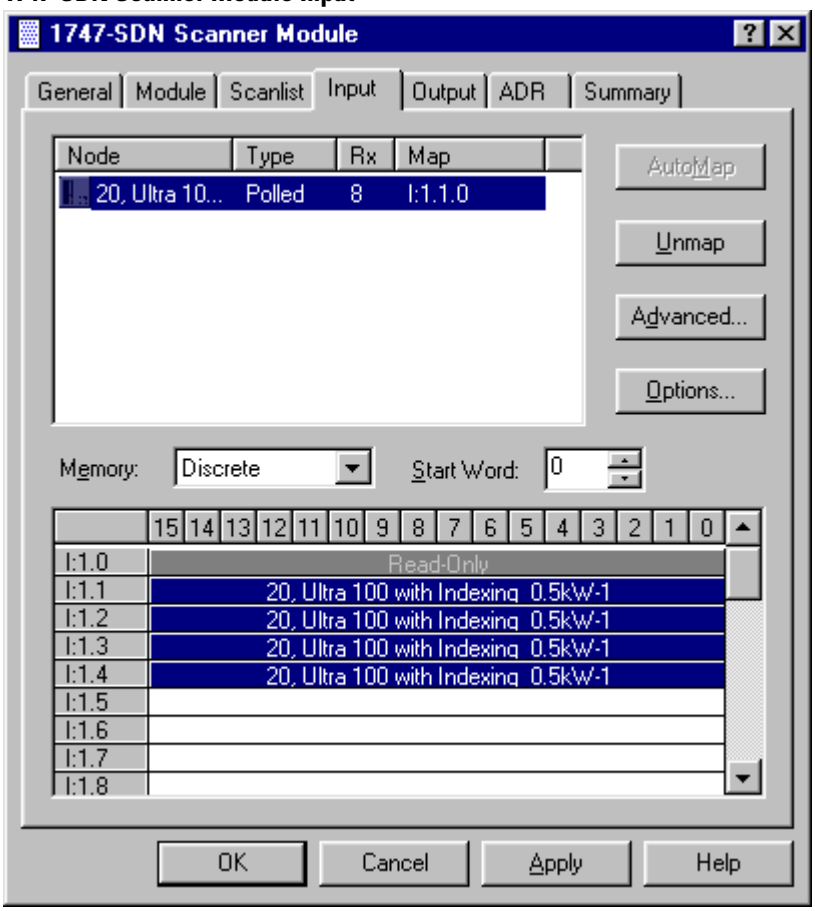
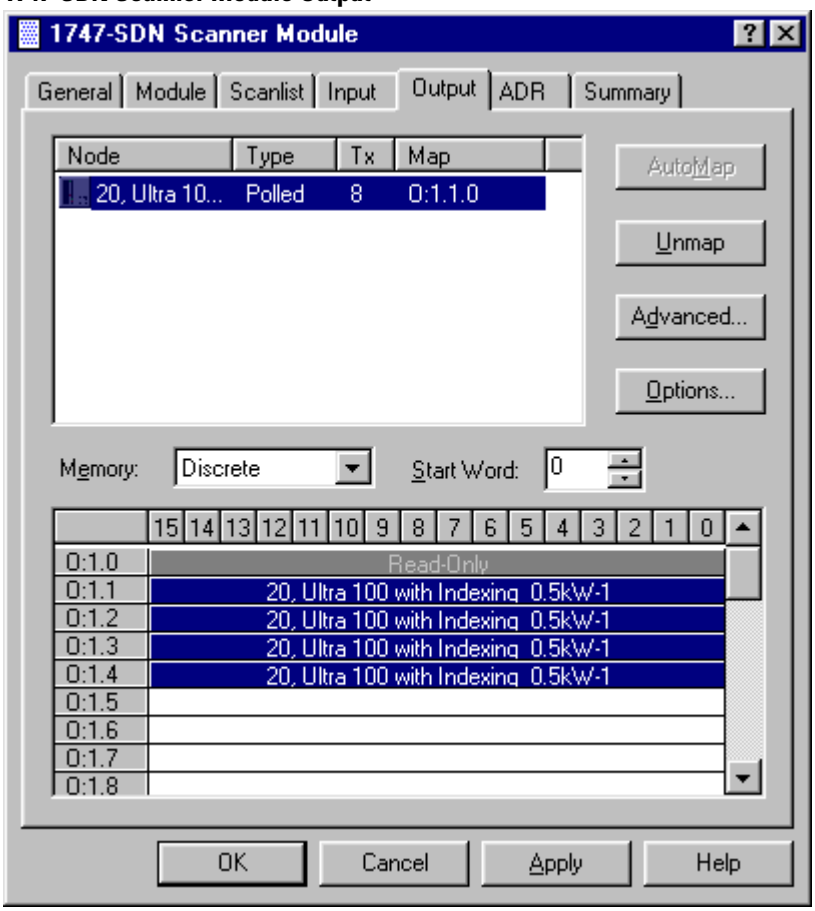


Figure B.21
1747-SDN Scanner Module Output



Enable the 1747-SDN Scanner

The scanner module has a module command register located at Word 0 in the output image area for the slot. Bit 0 of Word 0 sets scanner module into either RUN or IDLE mode.

IMPORTANT

1 = RUN

The scanner module maps output data from its scanner output table (MO) and discrete outputs to each device on the network. Inputs are received and mapped into the scanner input table (M1) and discrete inputs. Outputs on the network are under SLC program control.

IMPORTANT

0 = IDLE

The scanner does not map output data to the devices, but keeps network connections to devices open so device failures can be detected. Input data is returned from devices and mapped into the scanner input table (M1) and the discrete inputs. Outputs on the network are not under program control and will be in their configured 'idle state.' The scanner is put into this mode to perform on-line configuration of the scanner database tables.

Figure B.22
Enable the 1747-SDN Scanner

Read Current Motor Position

A Polled I/O message is sent to the ULTRA 100 Drive with DeviceNet to retrieve the current position data in counts. The Feedback Data Pointer in the Polled I/O command is used to specify what feedback data should be returned in the Polled I/O response from the ULTRA 100 Drive with DeviceNet. A list of available feedback data pointers and corresponding feedback data can be found in the Assembly Object, Feedback Data table of the Programming reference, Appendix D on page D-16. Figure B.23 sets the Feedback Data Pointer to one to select the Motor Position. The Motor Position is returned in I:1.3 and I:1.4 as shown in Figure B.25.

The data can be scaled into a user defined value by placing the data into the 32 bit math register (See MOV instructions in Figure B.23) and performing a Double Divide, with the answer being placed in N9:10. The Math Overflow

bit is reset so the SLC will not generate a fault. Figure B.24 shows the raw data (from I:1.3 and I:1.4) being reassembled in the 32 bit Math Register.

Figure B.23
Set the feedback index and convert values

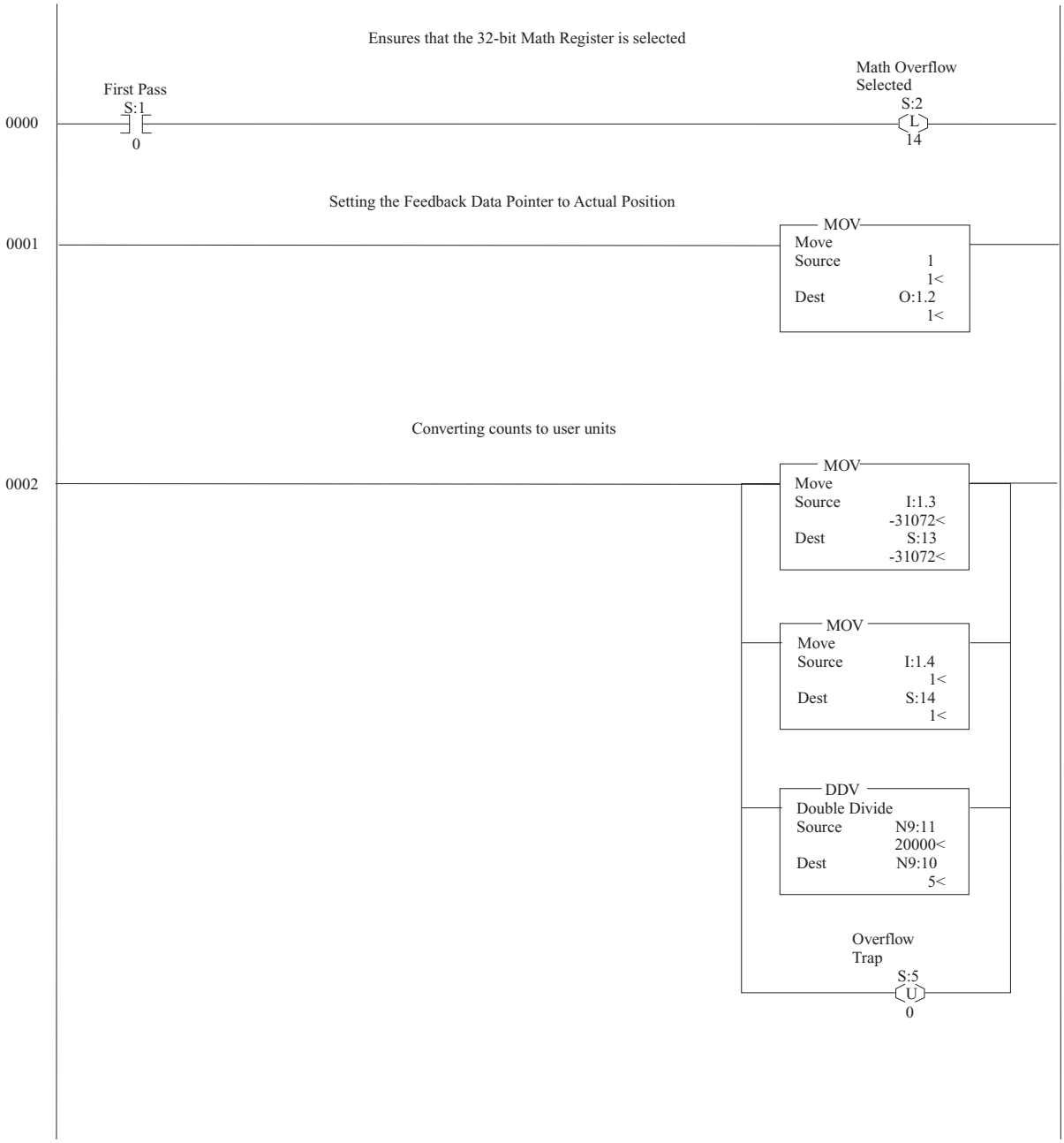


Figure B.24
Math Status

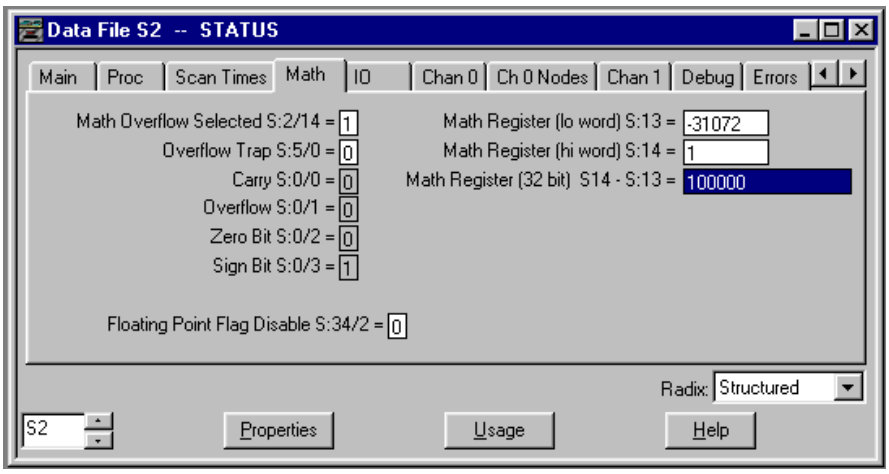
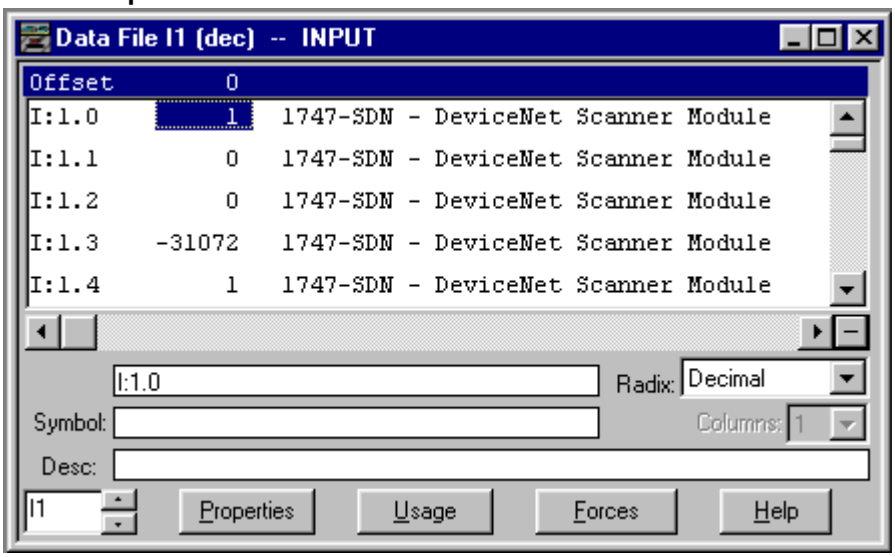


Figure B.25
Data file input



If a scaling value that is higher than 32,767 is needed then Multiple Double Divides are required with byte swapping between the Double Divides. Attention needs to be taken as a 32 bit result from a Double Divide is byte swapped and needs to be swapped back in order to determine the answer in user units.

Figure B.26 like Figure B.23 will use the 32 bit Math register for the first double divide followed by moving the two 16 bit answers into temporary registers. These temporary registers will then be moved back into the 32 bit

Math register and perform a Double Divide. The math overflow bit is reset so the SLC will not generate a fault.

Figure B.26
Multiple double divides with Byte swapping

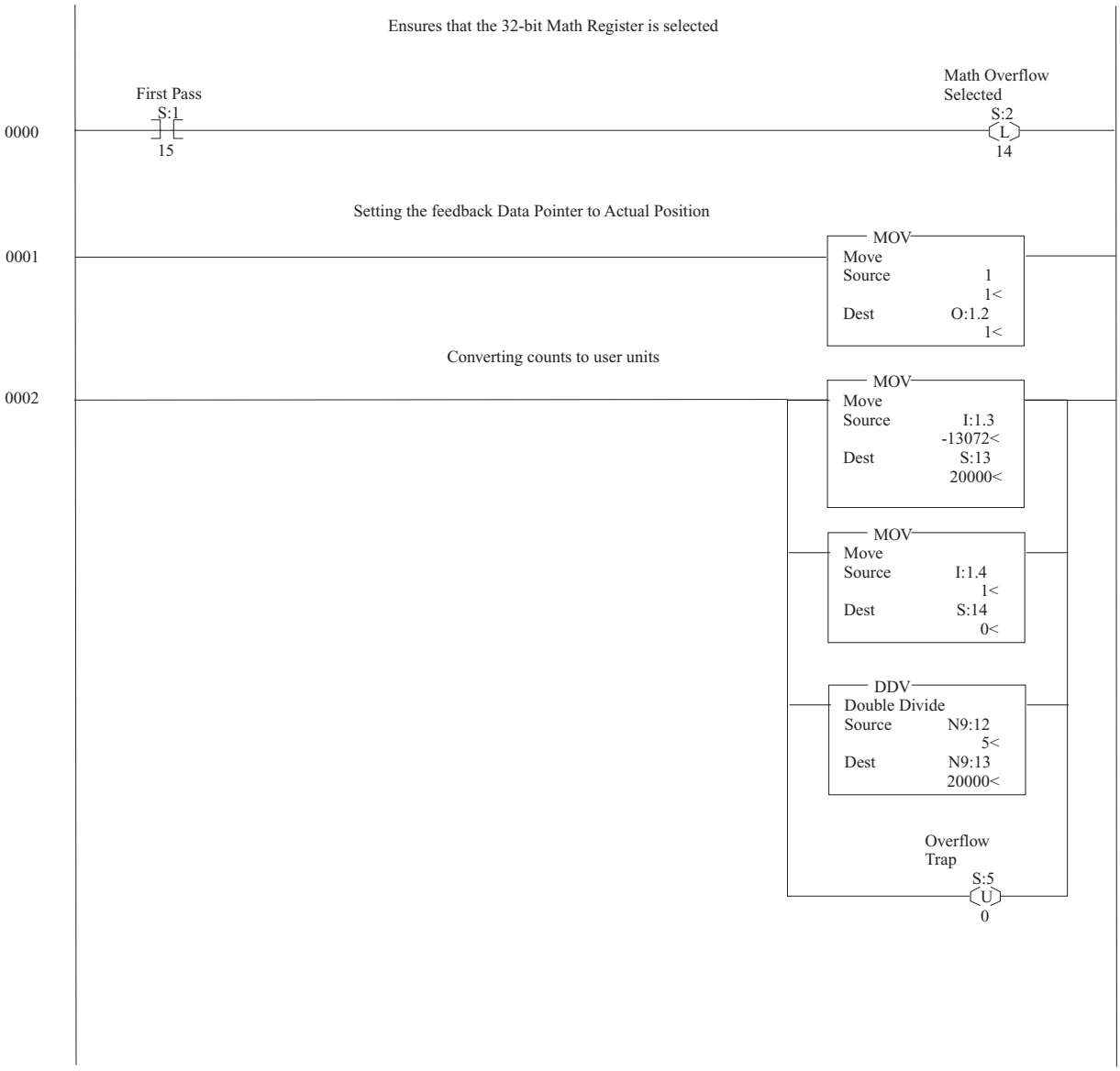
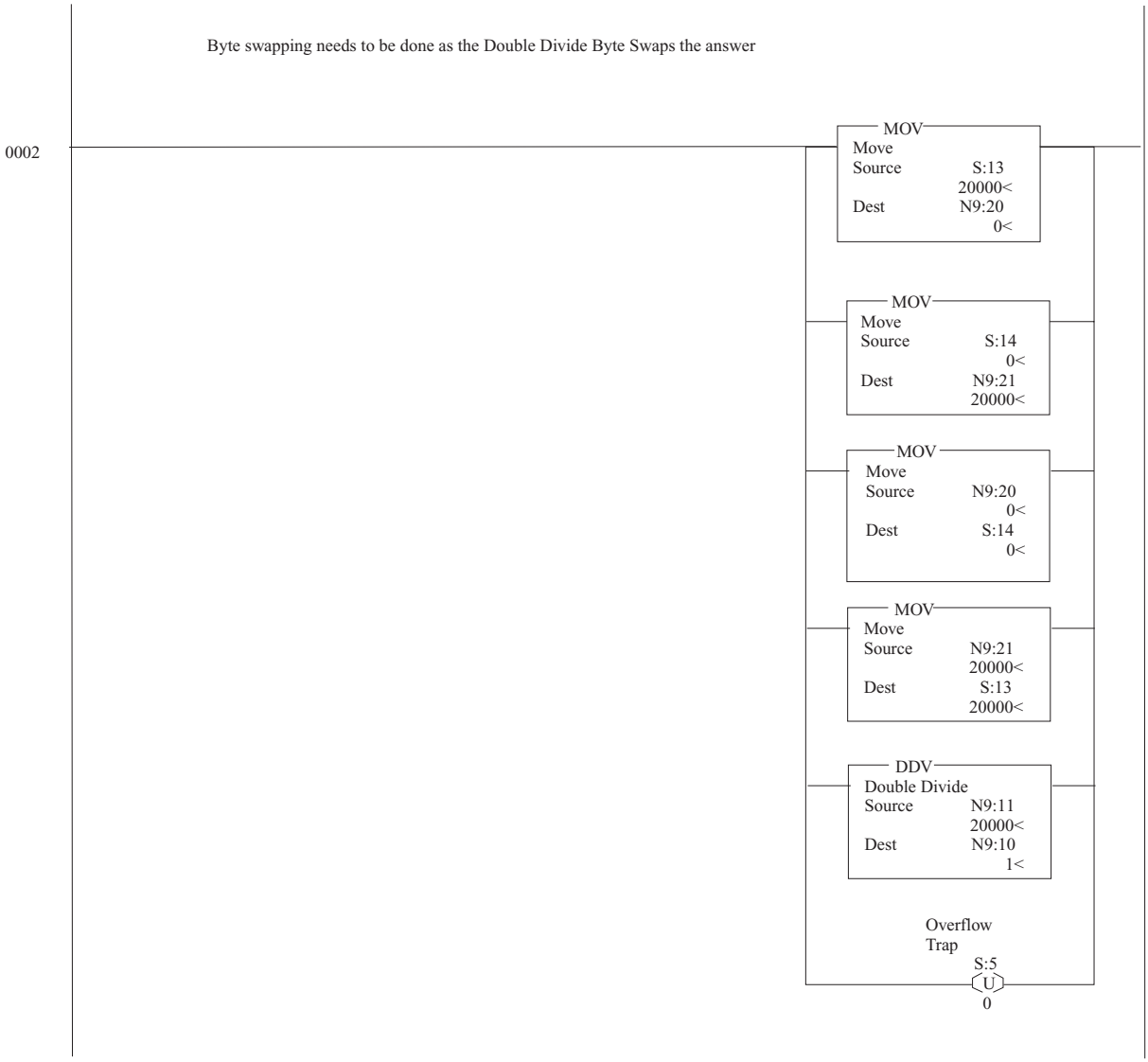


Figure B.26 like Figure B.23 uses the 32 bit Math register for the first double divide. Next, the two 16 bit answers are swapped using temporary registers and then a second Double Divide is performed. The math overflow bit is reset so the SLC will not generate a fault.

Figure B.26 (continued)
Multiple double divides with Byte swapping

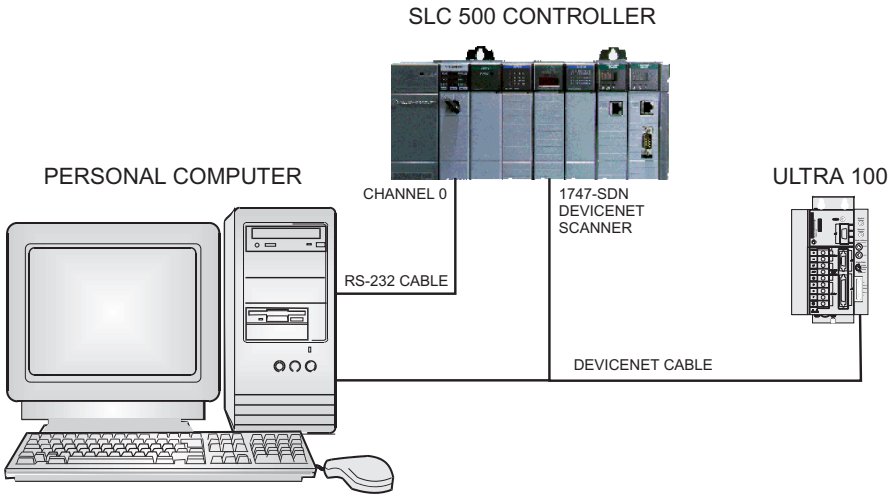


Explicit Message Examples

These example's use a SLC 5/04, 1747-SDN, and an ULTRA 100 Drive with DeviceNet (Indexing version). In addition, these examples assume:

- The DeviceNet Scanner's module is in Slot 1 of the SLC chassis.
- Ladder programming is done using Rockwell Software: RSLogix 500 (v 2.57.00.00),
- The DeviceNet network is configured using Rockwell Software: RSNetWorx for DeviceNet (v 2.11.51.00), and
- All personal computer communication interfacing is done using Rockwell Software: RSLinx (v 2.10.00.118).

Figure C.1
Example setup



.

Example 1: RAM Index Setup and Move

This example will explain the steps required to setup and execute a RAM index move using Explicit messages with the ULTRA 100 Drive with DeviceNet (Indexing Version). Data is sent and received via instances of the Parameter Object. Refer to page D-24 for a description of the Parameter Object instances implemented in the ULTRA 100 Drive with DeviceNet. For purposes of this example, we will assume that the system has already completed a homing routine and the ULTRA 100 Drive with DeviceNet is enabled.

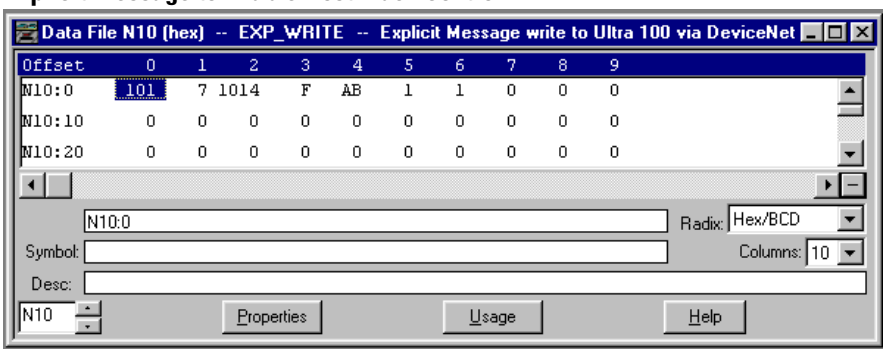
IMPORTANT For the purposes of this example the RAM index will use default value for the Speed, Acceleration, and Deceleration of 500 rpm. The Host Index pointer already points to the RAM index, but if another was to be selected then Parameter 181 would need to be modified to point to the required index.

Enable Host Index Control

The first Explicit Message will enable the Host Index Cntrl (Parameter 171), allowing the Host Index Pointer (Parameter 181) to determine which Index the Drive will execute when a Start Index Command is given. The Start Index Command will be accepted through either a correctly assigned digital input, DeviceNet, or through a Host Mode command (Serial).

The message to be sent is contained in the Integer Data Table N10 from the SLC Memory, beginning at N10:0 (Figure C.2.). The displayed values are in hexadecimal and the table following the figure describes the origins of the value of each word in the Integer Data Table N10.

Figure C.2
Explicit Message to Enable Host Index control



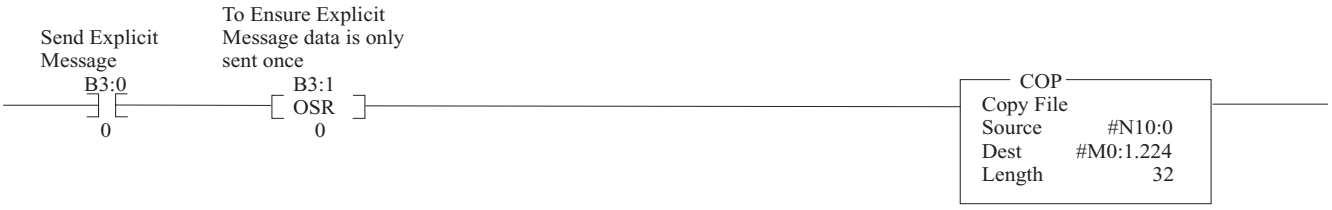
Data Address	Description
N10:0	TXID = 1_H, Command = 01_H (execute)
N10:1	Port = 0_H, Size of Data Field = 7_H (bytes)
N10:2	Service = 10_H (set), MAC ID = 14_H (node address)

Data Address	Description (Continued)
N10:3	Class ID = F_H (parameter object)
N10:4	Instance = AB_H (host index control)
N10:5	Attribute = 1_H (parameter attribute value)
N10:6	Value = 1_H (set flag = 1)

IMPORTANT All examples use the value 01 for the Transmission Identification (TXID) the valid range is from 1-255.

Figure C.3 will send the data from the Integer Data Table N10 in the SLC memory to the scanner module. Even though we are only using 7 words of data (N10:0 to N10:6), it is common practice to copy 32 words of data to the scanner as different types of explicit messages can contain larger data sizes. The scanner will read the data sent by the SLC to M0:1.224 and create an explicit message. The explicit message will be placed in a queue and sent via DeviceNet to the ULTRA 100 Drive with DeviceNet when Network traffic permits.

Figure C.3
Copy data from SLC Processor to DeviceNet Scanner Module



Once the ULTRA 100 Drive with DeviceNet responds to the explicit message, the scanner places the message in a buffer M1:1.224. Once the scanner has a response, the explicit message response ready bit I:1.0/15 is set high. Figure C.4 will copy the response from the scanner's memory into the SLC Integer data table N11 for verification (see Figure C.5). It is common place to copy the entire response buffer, containing 32 words of data as different explicit message responses can contain larger data sizes.

Figure C.4
Read data from DeviceNet Scanner Module to SLC Processor

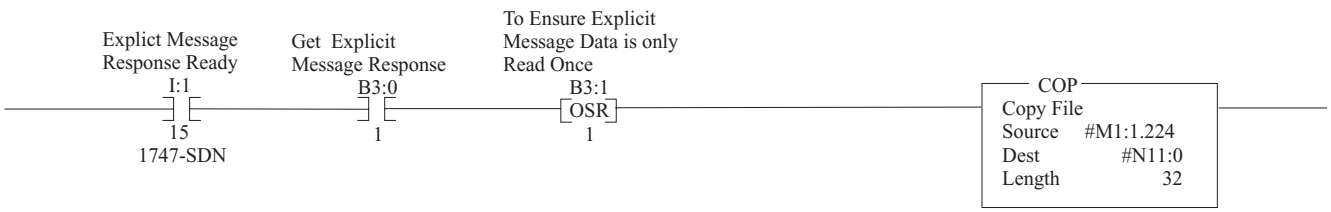
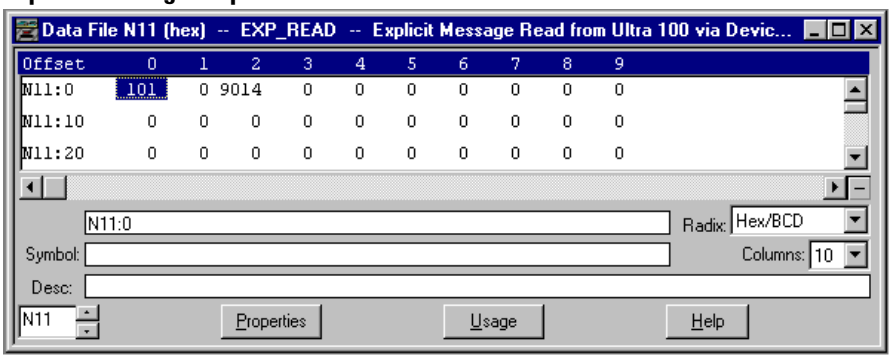


Figure C.5
Explicit Message response from ULTRA 100 via DeviceNet



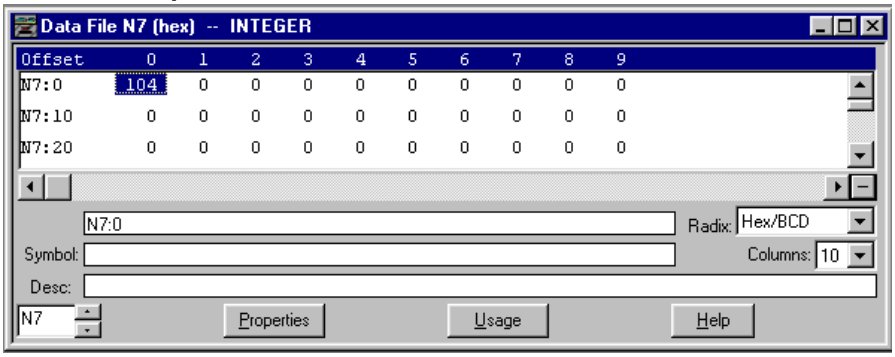
Data Address	Description
N11:0	TXID = 1_H, Status = 01_H (successful transaction)
N11:1	Port = 0_H, Size of Data Field = 0_H (No data sent by the ULTRA 100)
N11:2	Service = 90_H (Successful response to a set), MAC ID = 14_H (node address)

Refer to Transaction header data fields on page A-8 for a list of possible status values returned by the scanner in the lower byte of Word 0 of the Integer Data Table N11 (in this example). A successful transaction is indicated by a status code of one.

A successful set data response will have a 90_H in the upper byte of Word 2. The ULTRA 100 Drive with DeviceNet indicates a successful response by returning the Service byte with the upper bit set to one. The Service byte will be 94_H, if an error response is returned.

Once determined that the message was successful, a clear buffer command must be sent to the DeviceNet scanner module as shown in Figure C.6. Once the scanner has received the clear buffer command the explicit message response ready bit I:1.0/15 is set low.

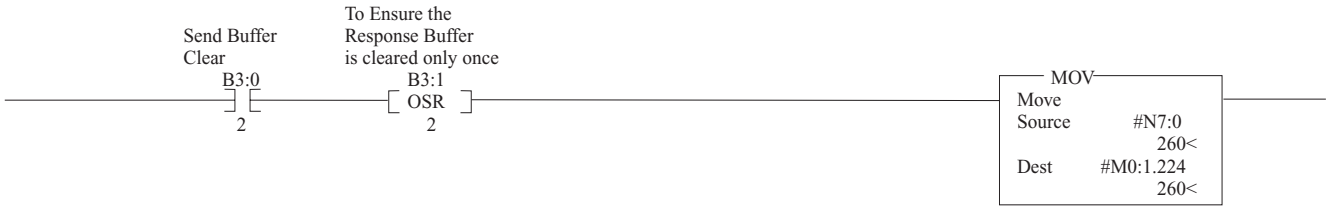
Figure C.6
Clear buffer response from scanner



Data Address	Description
N7:0	TXID = 1_H, Command = 04_H (clear response buffer)

Figure C.7 will send the data from the Integer Data Table N7 in the SLC memory to the scanner module. This will clear the scanner's response buffer and allow the scanner to receive another explicit message.

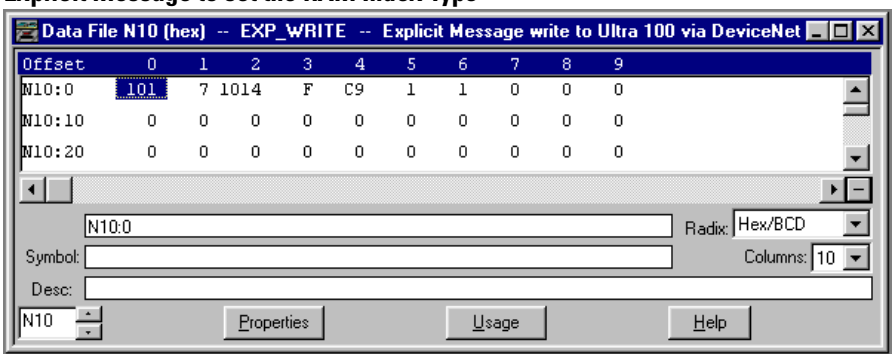
Figure C.7
Clear the DeviceNet Scanner's Response Buffer



Set the RAM Index Type for Absolute Move

This Explicit message will set the type for the RAM index (Parameter 201), the type of indexing move the RAM index will be set up for is an Absolute move. The message to be sent is contained in the Integer Data Table N10 from the SLC Memory, beginning at N10:0 (See Figure C.8). The displayed values are in hexadecimal and the table following the figure describes the origins of the value of each word in the Integer Data Table N10.

Figure C.8
Explicit Message to set the RAM Index Type



Data Address	Description
N10:0	TXID = 1_H, Command = 01_H (execute)
N10:1	Port = 0_H, Size of Data Field = 7_H (bytes)
N10:2	Service = 10_H (set), MAC ID = 14_H (node address)
N10:3	Class ID = F_H (parameter object)
N10:4	Instance = $C9_H$ (RAM index type)
N10:5	Attribute = 1_H (parameter attribute value)
N10:6	Value = 1_H (set flag = 1)

IMPORTANT All examples use the value 01 for the Transmission Identification (TXID) the valid range is from 1-255.

Figure C.9 will send the data from the Integer Data Table N10 in the SLC memory to the scanner module. Even though we are only using 7 words of data (N10:0 to N10:6), it is common practice to copy 32 words of data to the scanner as different types of explicit messages can contain larger data sizes. The scanner will read the data sent by the SLC to M0:1.224 and create an explicit message. The explicit message will be placed in a queue and sent via DeviceNet to the ULTRA 100 Drive with DeviceNet when Network traffic permits.

Figure C.9
Copy data from SLC Processor to DeviceNet Scanner Module

Once the ULTRA 100 Drive with DeviceNet responds to the explicit message, the scanner places the message in a buffer M1:1.224. Once the scanner has a response, the explicit message response ready bit I:1.0/15 is set high. Figure C.10 will copy the response from the scanner's memory into the SLC Integer Data Table N11 for verification (See Figure C.11). It is common place to copy the entire response buffer containing 32 words of data, as different explicit message responses can contain larger data sizes.

Figure C.10
Read data from DeviceNet Scanner Module to SLC Processor

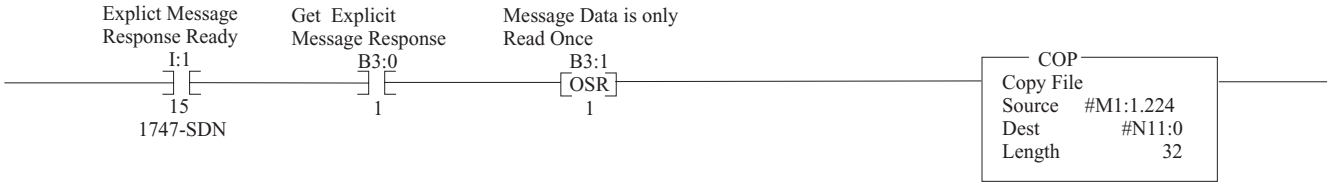
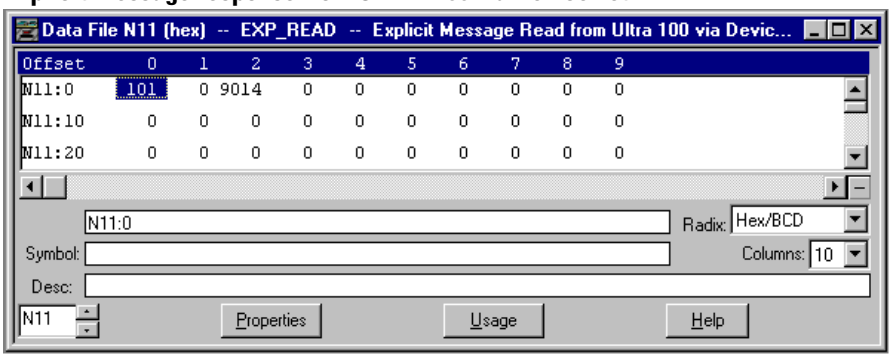


Figure C.11
Explicit Message response from ULTRA 100 via DeviceNet



Data Address	Description
N11:0	TXID = 1_H, Status = 01_H (successful transaction)
N11:1	Port = 0_H, Size of Data Field = 0_H (No data sent by the ULTRA 100)
N11:2	Service = 90_H (Successful response to a set), MAC ID = 14_H (node address)

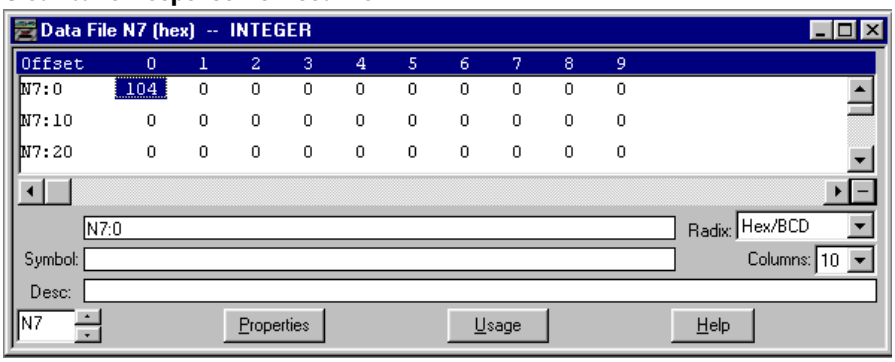
Refer to Transaction header data fields on page A-8 for a list of possible status values returned by the scanner in the lower byte of Word 0 of the Integer Data

Table N11 (in this example). A successful transaction is indicated by a status code of one.

A successful set data response will have a 90_H in the upper byte of Word 2. The ULTRA 100 Drive with DeviceNet indicates a successful response by returning the Service byte with the upper bit set to one. The Service byte will be 94_H, if an error response is returned.

Once determined that the message was successful, a clear buffer command must be sent to the DeviceNet scanner module as shown in Figure C-12. Once the scanner has received the clear buffer command, the explicit message response ready bit I:1.0/15 is set low.

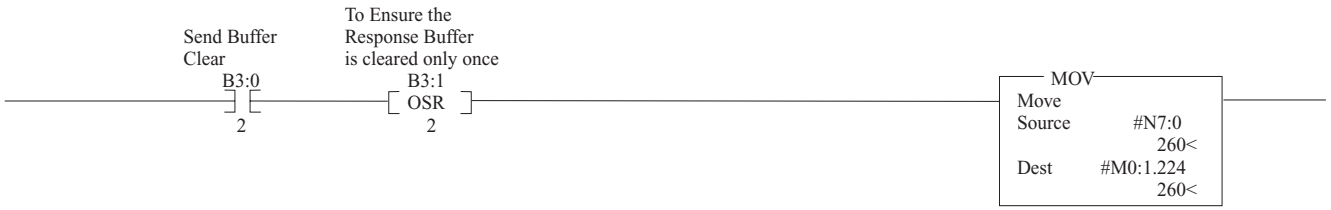
Figure C.12
Clear buffer response from scanner



Data Address	Description
N7:0	TXID = 1_H, Command = 04_H (clear response buffer)

Figure C.13 will send the data from the Integer Data Table N7 in the SLC memory to the scanner module. This will clear the response buffer and allow the scanner to receive another explicit message.

Figure C.13
Clear the DeviceNet Scanner's Response Buffer

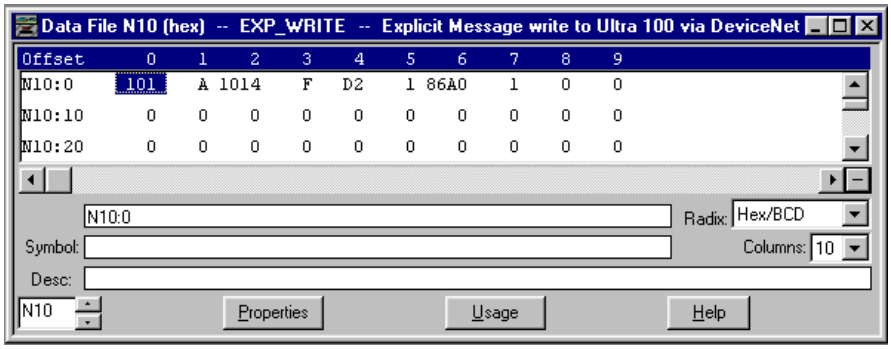


Set the RAM Index Position Using User Defined Scaling

The next explicit message will set the RAM Index position (Parameter 210) in counts for the RAM index based on a user scaled value.

The message to be sent is contained in the Integer Data Table N10 from the SLC Memory, beginning at N10:0 (Figure C.14.). The displayed values are in hexadecimal and the table following the figure describes the origins of the value of each word in the Integer Data Table N10.

Figure C.14
Explicit Message to set the RAM Index Position



Data Address	Description
N10:0	TXID = 1_H, Command = 01_H (execute)
N10:1	Port = 0_H, Size of Data Field = A_H (bytes)
N10:2	Service = 10_H (set), MAC ID = 14_H (node address)
N10:3	Class ID = F_H (parameter object)
N10:4	Instance = $D2_H$ (RAM index distance/position)
N10:5	Attribute = 1_H (parameter attribute value)
N10:6	Lower Word of Data = $86A0_H$
N10:7	Upper Word of Data = 1_H

IMPORTANT All examples use the value 01 for the Transmission Identification (TXID) the valid range is from 1-255.

Figure C.15 shows the conversion of a 32-bit user-scaled position value into one in counts that the drive will recognize. The user value (in this case 5) is multiplied with the scale factor value (in this case 20,000) for a result of 100,000. For this the 32 bit math register is used and has to be enabled (this is the purpose of rung 0000). The 32 bit result will be moved into the Explicit message and the Math Overflow bit reset so the SLC will not fault. The message is then ready to be sent from the Integer Data Table N10 in the SLC memory to the scanner module. Even though we are only using 8 words of

data (N10:0 to N10:7), it is common practice to copy 32 words of data to the scanner as different types of explicit messages can contain larger data sizes. The scanner will read the data sent by the SLC to M0:1.224 and create an explicit message. The explicit message will be placed in a queue and sent via DeviceNet to the ULTRA 100 Drive with DeviceNet when Network traffic permits.

Figure C.15
Setting the absolute position in counts

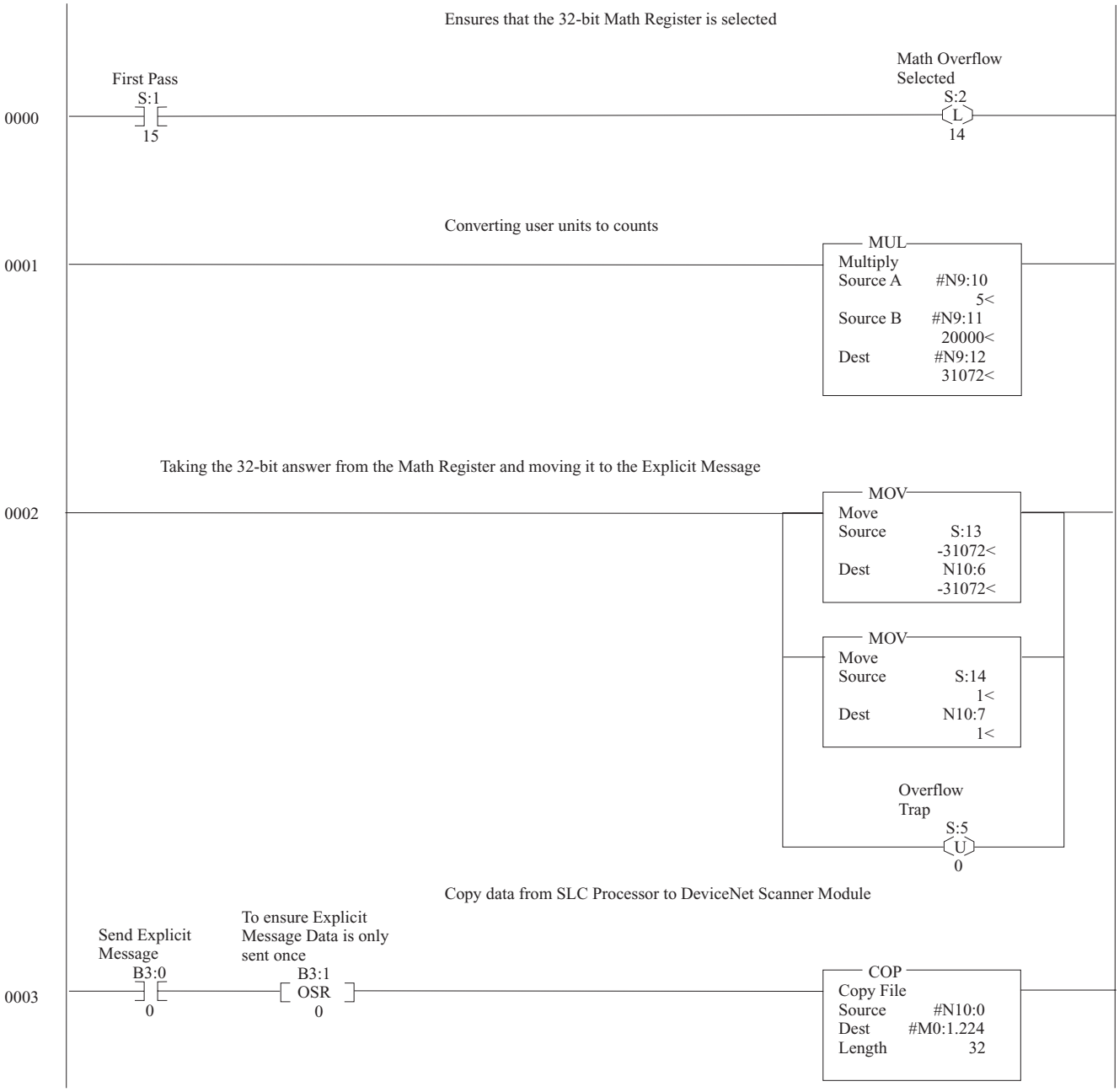
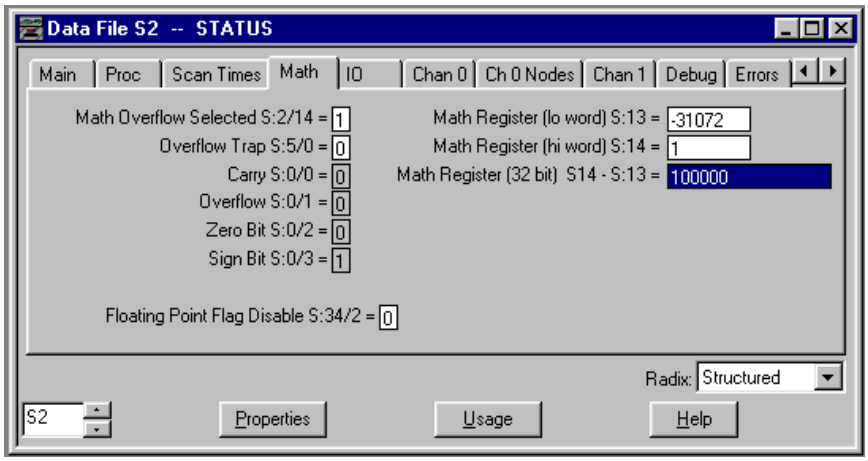


Figure C.16
Math Status



IMPORTANT If a scaling value that is higher than 32,767 is needed, the Multiply (MUL) in rung 0001 can be replaced with a Computer (CPT) instruction using multiple multiplies as shown in Figure C.17.

Figure C.17
Computing multiple multiplys command

Once the ULTRA 100 Drive with DeviceNet responds to the explicit message the scanner places the message in a buffer M1:1.224. Once the scanner has a response the explicit message response ready bit I:1.0/15 is set high. Figure C.18 will copy the response from the scanner's memory into the SLC Integer data table N11 for verification (see See Figure C.19 on page C-12). It is common place to copy the entire response buffer, containing 32 words of data, as different explicit message responses can contain larger data sizes.

Figure C.18
Read data from DeviceNet Scanner Module to SLC Processor

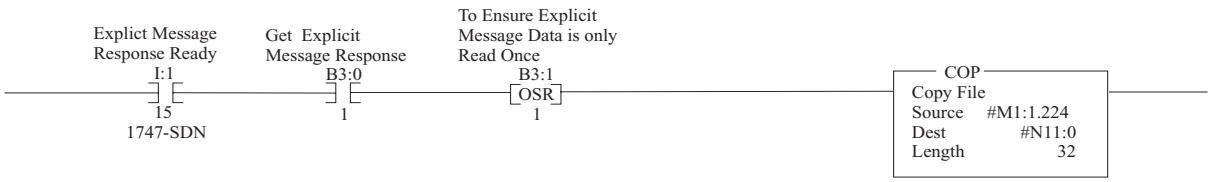
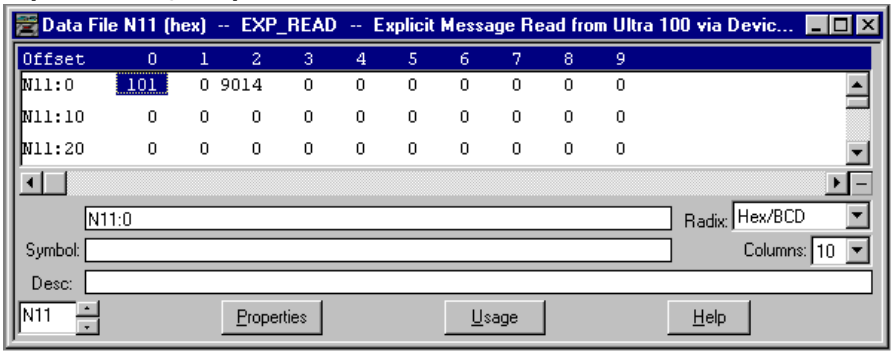


Figure C.19
Explicit Message response from ULTRA 100 via DeviceNet



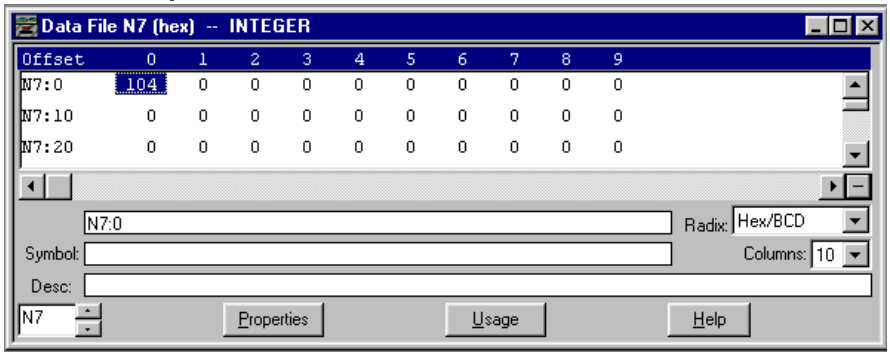
Data Address	Description
N11:0	TXID = 1_H, Status = 01_H (successful transaction)
N11:1	Port = 0_H, Size of Data Field = 0_H (No data sent by the ULTRA 100)
N11:2	Service = 90_H (Successful response to a set), MAC ID = 14_H (node address)

Refer to Transaction header data fields on page A-8 for a list of possible status values returned by the scanner in the lower byte of Word 0 of the Integer Data Table N11 (in this example). A successful transaction is indicated by a status code of one.

A successful set data response will have a 90_H in the upper byte of Word 2. The ULTRA 100 Drive with DeviceNet indicates a successful response by returning the Service byte with the upper bit set to one. The Service byte will be 94_H, if an error response is returned.

Once determined that the message was successful, a clear buffer command must be sent to the DeviceNet scanner module as shown in Figure C.20. Once the scanner has received the clear buffer command, the explicit message response ready bit I:1.0/15 is set low.

Figure C.20
Clear buffer response from scanner

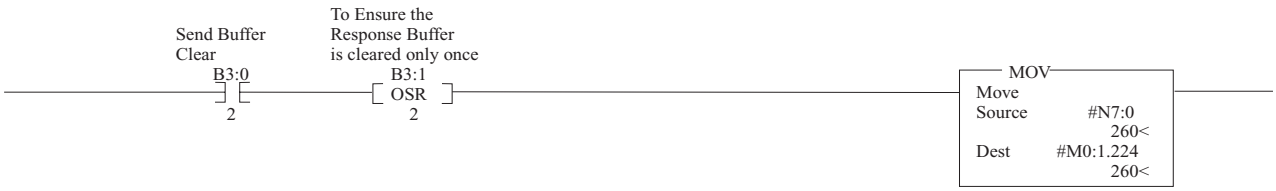


Data Address	Description
N7:0	TXID = 1_H, Command = 01_H (successful transaction)

Figure C.21 will send the data from the Integer Data Table N7 in the SLC memory to the scanner module. This will clear the scanners's response buffer and allow the scanner to receive another explicit message.

Start Index Command

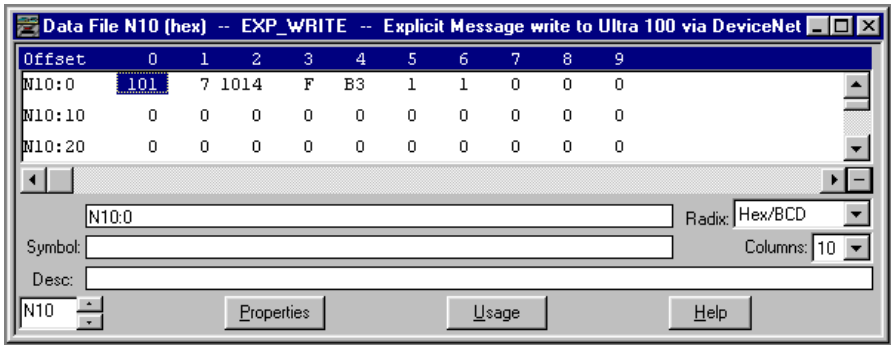
Figure C.21
Clear the DeviceNet Scanner's Response Buffer



This next Explicit message will be the start index command and the move will be initiated when the message reaches the ULTRA 100 Drive with DeviceNet. The message to be sent is contained in the Integer Data Table N10 from the SLC Memory, beginning N10:0 (See Figure C.22). The displayed values are in

hexadecimal and the table following the figure describes the origins of the value of each word in the Integer Data Table N10.

Figure C.22
Explicit Message to send the Start Index Command



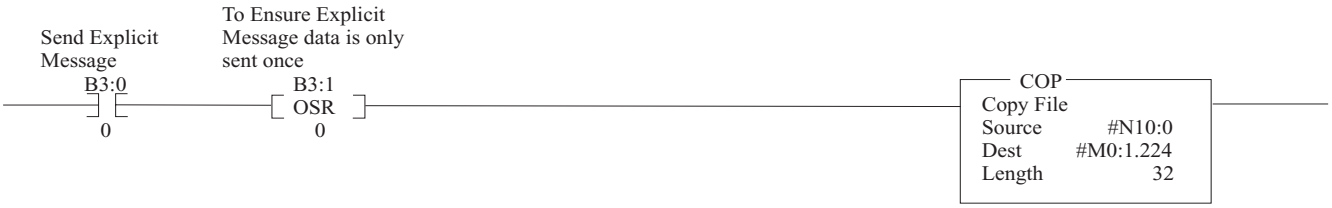
Data Address	Description
N10:0	TXID = 1_H, Command = 01_H (execute)
N10:1	Port = 0_H, Size of Data Field = 7_H (bytes)
N10:2	Service = 10_H (set), MAC ID = 14_H (node address)
N10:3	Class ID = F_H (parameter object)
N10:4	Instance = $B3_H$ (start index command)
N10:5	Attribute = 1_H (parameter attribute value)
N10:6	Value = 1_H (set flag = 1)

IMPORTANT All examples use the value 01 for the Transmission Identification (TXID) the valid range is from 1-255.

Figure C.23 will send the data from the Integer Data Table N10 in the SLC memory to the scanner module. Even though we are only using 7 words of data (N10:0 to N10:6), it is common practice to copy 32 words of data to the scanner as different types of explicit messages can contain larger data sizes. The scanner will read the data sent by the SLC to M0:1.224 and create an explicit message. The explicit message will be placed in a queue and sent via DeviceNet to the ULTRA 100 Drive with DeviceNet when Network traffic permits.

IMPORTANT Once the Explicit message is received by the ULTRA 100 Drive with DeviceNet the move will start even if the Acknowledgment has not been received by the SLC.

Figure C.23
Copy data from SLC Processor to DeviceNet Scanner Module



Once the ULTRA 100 Drive with DeviceNet responds to the explicit message, the scanner places the message in a buffer M1:1.224. Once the scanner has a response, the explicit message response ready bit I:1.0/15 is set high. Figure C.24 will copy the response from the scanner's memory into the SLC Integer Data Table N11 for verification (See Figure C.25). It is common place to copy the entire response buffer containing 32 words of data as different explicit message responses can contain larger data sizes.

Figure C.24
Read data from DeviceNet Scanner Module to SLC Processor

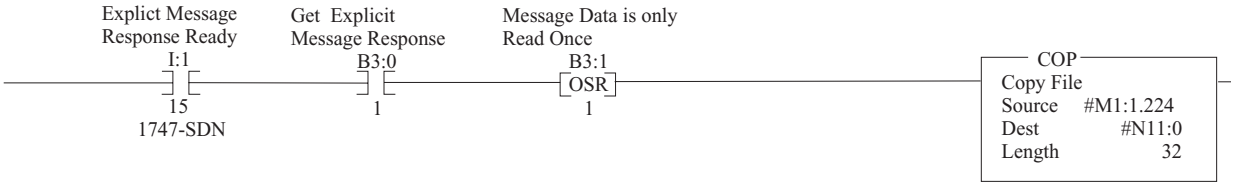
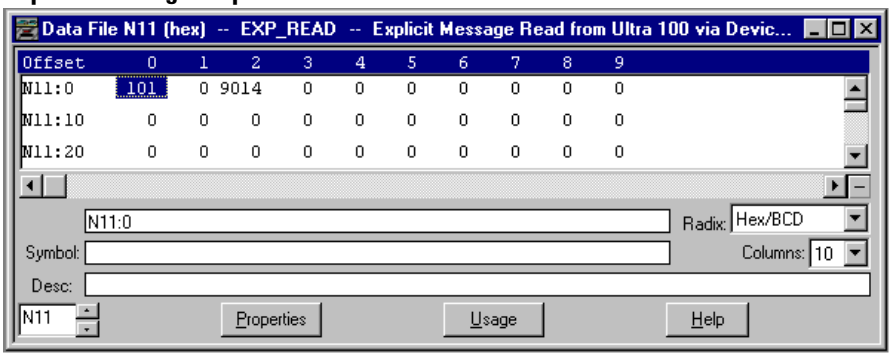


Figure C.25
Explicit Message response from ULTRA 100 via DeviceNet



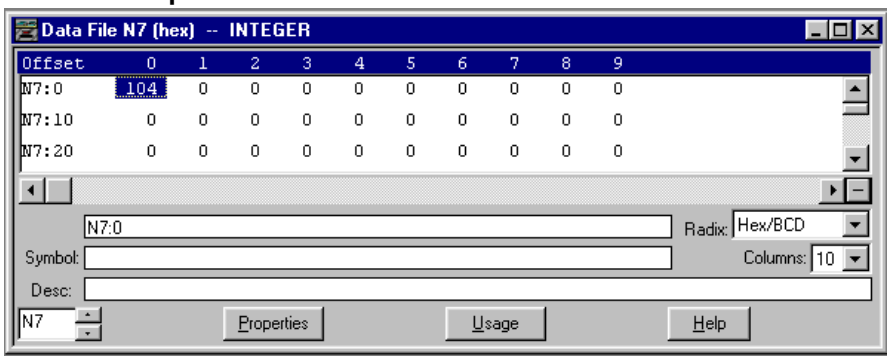
Data Address	Description
N11:0	TXID = 1_H, Status = 01_H (successful transaction)
N11:1	Port = 0_H, Size of Data Field = 0_H (No data sent by the ULTRA 100)
N11:2	Service = 90_H (Successful response to a set), MAC ID = 14_H (node address)

Refer to Transaction header data fields on page A-8 for a list of possible status values returned by the scanner in the lower byte of Word 0 of the Integer Data Table N11 (in this example). A successful transaction is indicated by a status code of one.

A successful set data response will have a 90_H in the upper byte of Word 2. The ULTRA 100 Drive with DeviceNet indicates a successful response by returning the Service byte with the upper bit set to one. The Service byte will be 94_H, if an error response is returned.

Once determined that the message was successful, a clear buffer command must be sent to the DeviceNet scanner module. As shown in Figure C.26, once the scanner has received the clear buffer command, the explicit message response ready bit I:1.0/15 is set low.

Figure C.26
Clear buffer response from scanner



Data Address	Description
N7:0	TXID = 1_H, Status = 01_H (successful transaction)

Figure C.27 will send the data from the Integer Data Table N7 in the SLC memory to the Scanner Module. This will clear the response buffer and allow the scanner to receive another explicit message.

Figure C.27
Clear the DeviceNet Scanner's Response Buffer

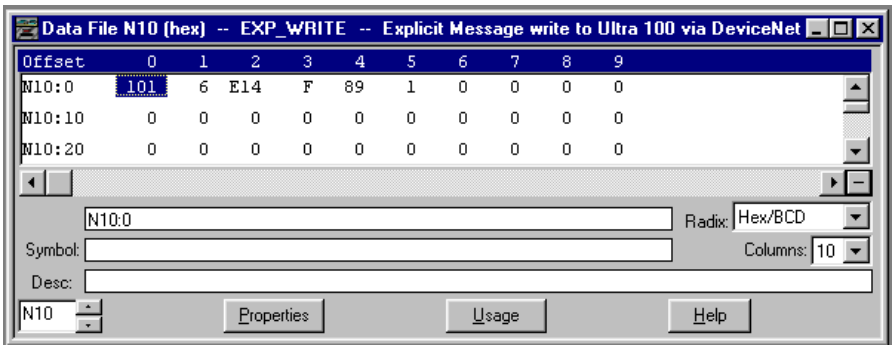
Example 2: Display the Current Position in User Units

This example will explain the steps required to read and convert the current motor position using a user defined scale with the ULTRA 100 Drive with DeviceNet (Indexing Version). Data is sent and received via instances of the Parameter Object. Refer to Parameter Object, Instances ID 1-289 on page D-25 for a description of the Parameter Object instances implemented in the ULTRA 100 Drive with DeviceNet.

Read the Current Motor Position

The Explicit Message will request the Current Motor Position (Parameter 137). The 32 bit response will be divided allowing the 16 bit answer available for interpretation. The message to be sent is contained in the Integer Data Table N10 from the SLC Memory, beginning at N10:0 (See Figure C.28). The displayed values are in hexadecimal and the table following the figure describes the origins of the value of each word in the Integer Data Table N10.

Figure C.28
Explicit Message to read the Current Motor Position



Data Address	Description
N10:0	TXID = 1_H, Command = 01_H (execute)
N10:1	Port = 0_H, Size of Data Field = 6_H (bytes)
N10:2	Service = $0E_H$ (get), MAC ID = 14_H (node address)
N10:3	Class ID = F_H (parameter object)
N10:4	Instance = 89_H (motor position)
N10:5	Attribute = 1_H (parameter attribute value)

IMPORTANT All examples use the value 01 for the Transmission Identification (TXID) the valid range is from 1-255.

Figure C.29 will send the data from the Integer Data Table N10 in the SLC memory to the scanner module. Even though we are only using 6 words of data (N10:0 to N10:5), it is common practice to copy 32 words of data to the

scanner as different types of explicit messages can contain larger data sizes. The scanner will read the data sent by the SLC to M0:1.224 and create an explicit message. The explicit message will be placed in a queue and sent via DeviceNet to the ULTRA 100 Drive with DeviceNet when Network traffic permits.

Figure C.29
Copy data from SLC Processor to DeviceNet Scanner Module

Once the ULTRA 100 Drive with DeviceNet responds to the explicit message, the scanner places the message in a buffer M1:1.224. Once the scanner has a response, the explicit message response ready bit I:1.0/15 is set high. Figure C.30 will copy the response from the scanner's memory into the SLC Integer Data Table N11 for verification (See Figure C.31). It is common place to copy the entire response buffer containing 32 words of data as different explicit message responses can contain larger data sizes.

The Motor position is located in N11:3 and N11:4 as shown in Figure C.32. The motor position can be scaled into a user defined value by placing the data into the 32 bit math register (See MOV instructions in Figure C.30) and performing a Double Divide, with the answer being placed in N9:10. The Math Overflow bit is reset so the SLC will not generate a fault. Figure C.31 shows the raw data (from N11:3 and N11:4) being reassembled in the 32 bit Math Register.

Figure C.30
Read data from DeviceNet Scanner Module to SLC Processor Current Motor

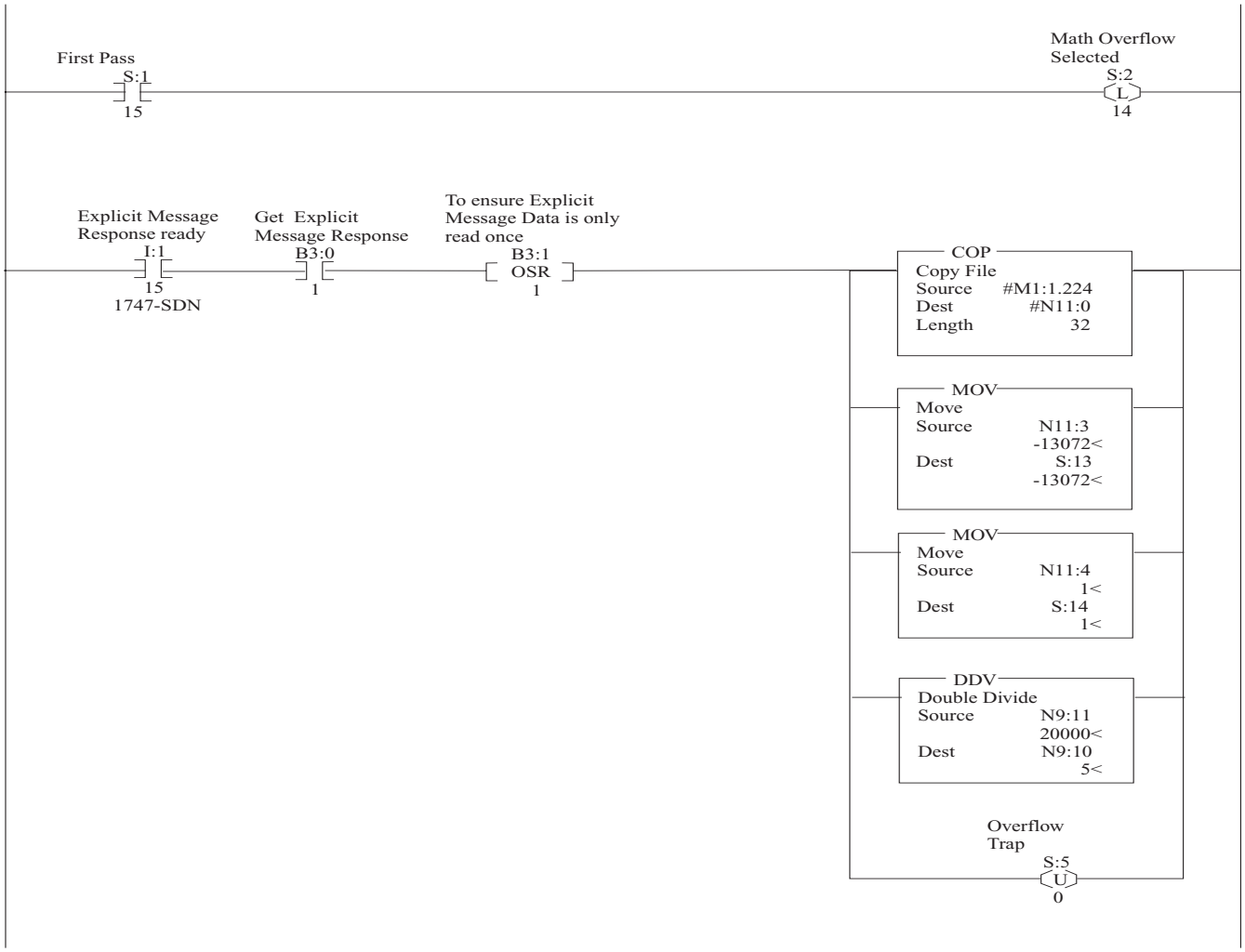


Figure C.31
Position in the Math Register

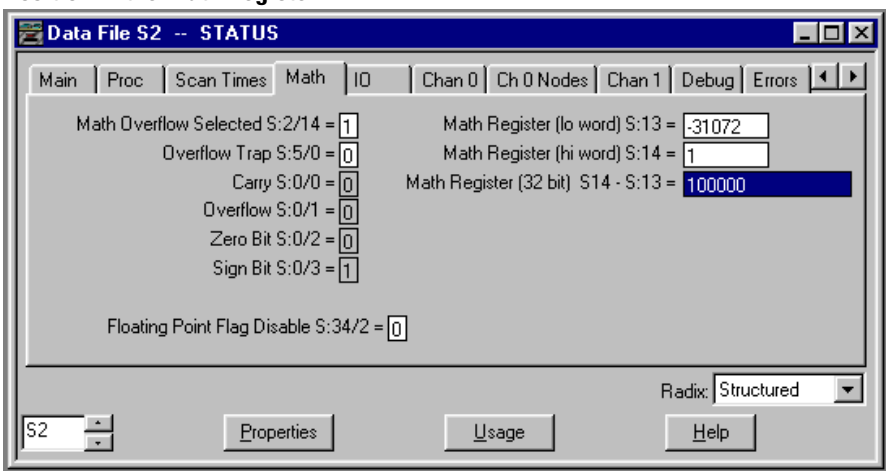
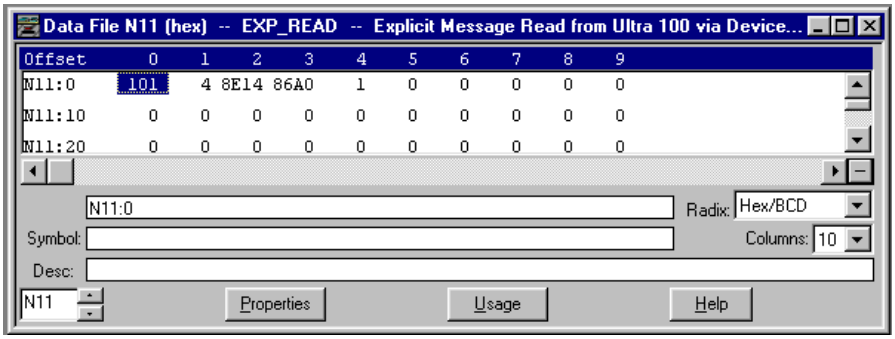


Figure C.32
Explicit Message response from ULTRA 100 via DeviceNet



Data Address	Description
N11:0	TXID = 1_H, Status = 01_H (successful transaction)
N11:1	Port = 0_H, Size of Data Field = 4_H (4 bytes of data sent by the ULTRA 100)
N11:2	Service = $8E_H$ (Successful response to a set), MAC ID = 14_H (node address)
N11:3	Lower Byte of Data = $86A0_H$
N11:4	Upper Byte of Data = 1_H

Refer to Transaction header data fields on page A-8 for a list of possible status values returned by the scanner in the lower byte of Word 0 of the Integer Data Table N11 (in this example). A successful transaction is indicated by a status code of one.

A successful Get data response will have a $8E_H$ in the upper byte of Word 2. The ULTRA 100 with DeviceNet indicates a successful response by returning the Service byte with the upper bit set to one. The Service byte will be 94_H, if an error response is returned.

If a scaling value that is higher than 32,767 is needed then Multiple Double Divides are required with byte swapping between the Double Divides. Attention needs to be taken as a 32 bit result from a Double Divide is byte swapped and needs to be swapped back in order to determine the answer in user units, as shown in Figure C.33.

Figure C.33 like Figure C.30 uses the 32 bit Math register for the first double divide. Next, the two 16 bit answers are swapped using temporary registers and then a second Double Divide is performed. The math overflow bit is reset so the SLC will not generate a fault.

Figure C.33
Multiple double divides with Byte swapping

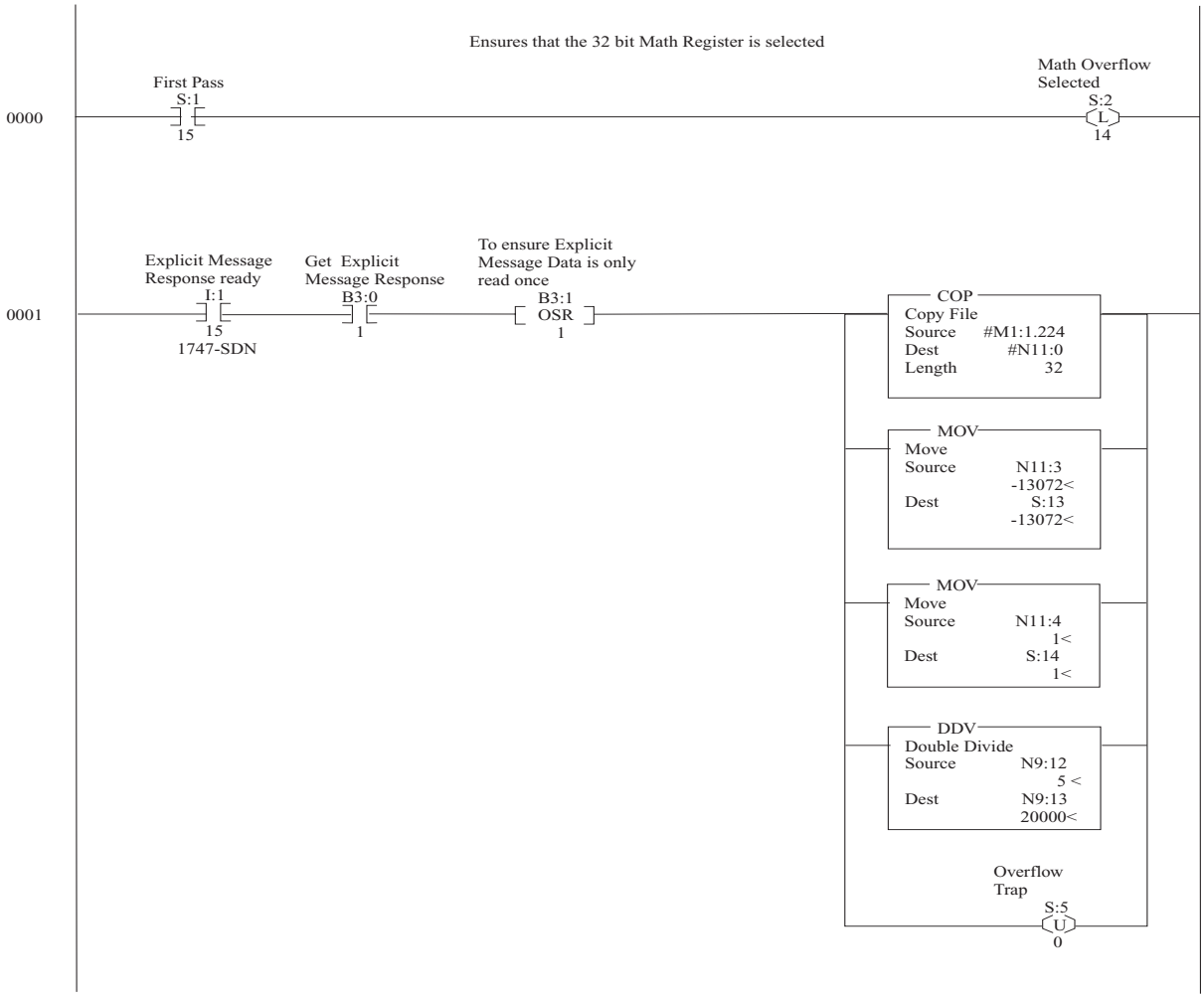

Ensures that the 32 bit Math Register is selected
First Pass
S:1
15
Math Overflow
Selected
S:2
L
14
0000
0001
Explicit Message
Response ready
I:1
15
1747-SDN
Get Explicit
Message Response
B3:0
1
To ensure Explicit
Message Data is only
read once
B3:1
OSR
1
COP
Copy File
Source #M1:1.224
Dest #N11:0
Length 32
MOV
Move
Source N11:3
-13072<
Dest S:13
-13072<
MOV
Move
Source N11:4
1<
Dest S:14
1<
DDV
Double Divide
Source N9:12
5 <
Dest N9:13
20000<
Overflow
Trap
S:5
U
0

Figure C.33 (continued)
Multiple double divides with Byte swapping

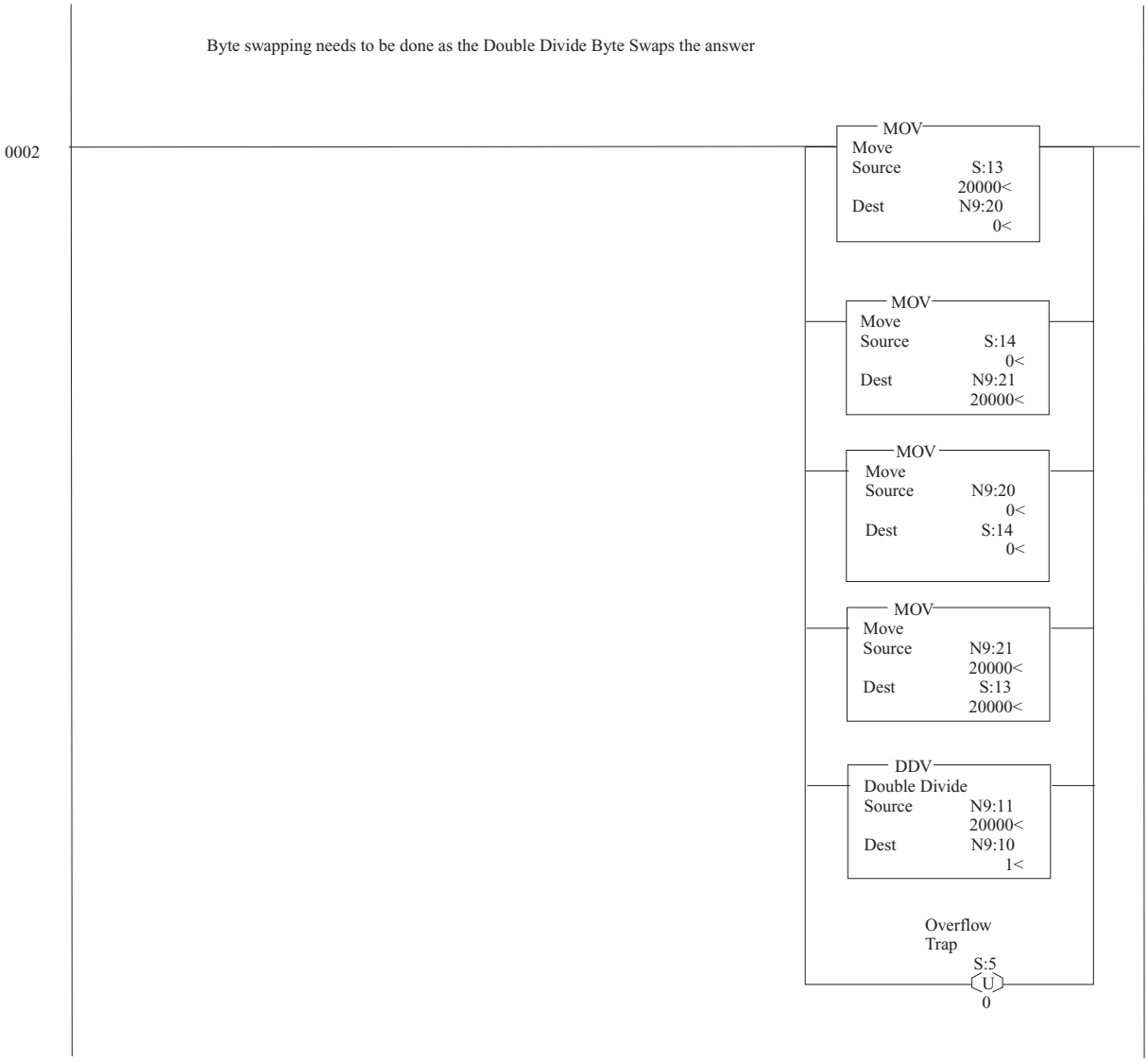
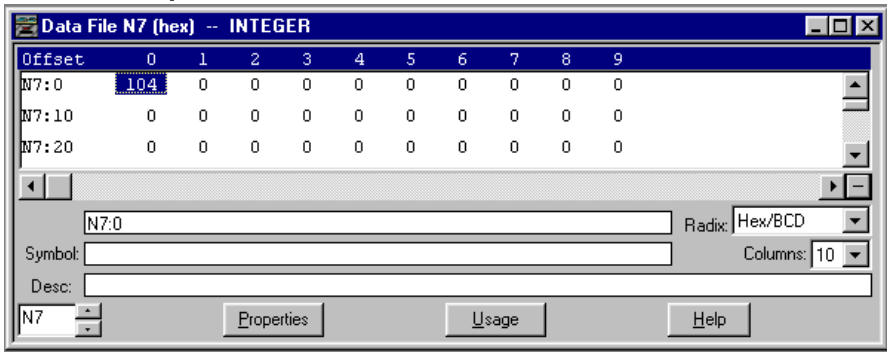


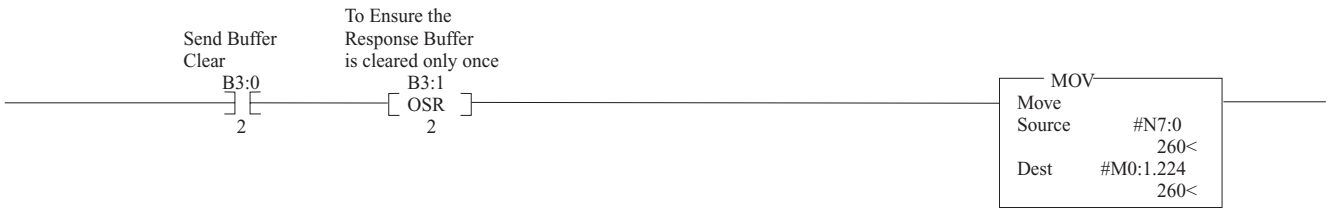
Figure C.34
Clear buffer response from scanner



Data Address	Description
N7:0	TXID = 1_H, Command = 04_H (clear response buffer)

Figure C.35 will send the data from the Integer Data Table N7 in the SLC memory to the scanner module. This will clear the scanner's response buffer and allow the scanner to receive another explicit message.

Figure C.35
Clear the DeviceNet Scanner's Response Buffer



Programming Reference

The ULTRA 100 Drive with DeviceNet implements a vendor-specific device profile - Rockwell Automation Miscellaneous (Device Type: 73hex) which is similar to the DeviceNet Generic Device Type (Device Type: 00hex).

The configuration data and behaviors implemented in the ULTRA 100 Drive with DeviceNet are defined using object modeling. The ULTRA 100 Drive with DeviceNet is modeled as a collection of objects. An Object is a collection of related attributes and services. An attribute is an externally visible characteristic or feature of an object, while a service is a procedure an object can perform.

This term	Means
Object	Representation of a particular type of data component within the DeviceNet node.
Instance	Specific occurrence of an Object.
Service	Function preformed by an Object.
Attribute	Description of a characteristic or feature of an Object. They provide status information or govern the operation of an Object.

Object Model

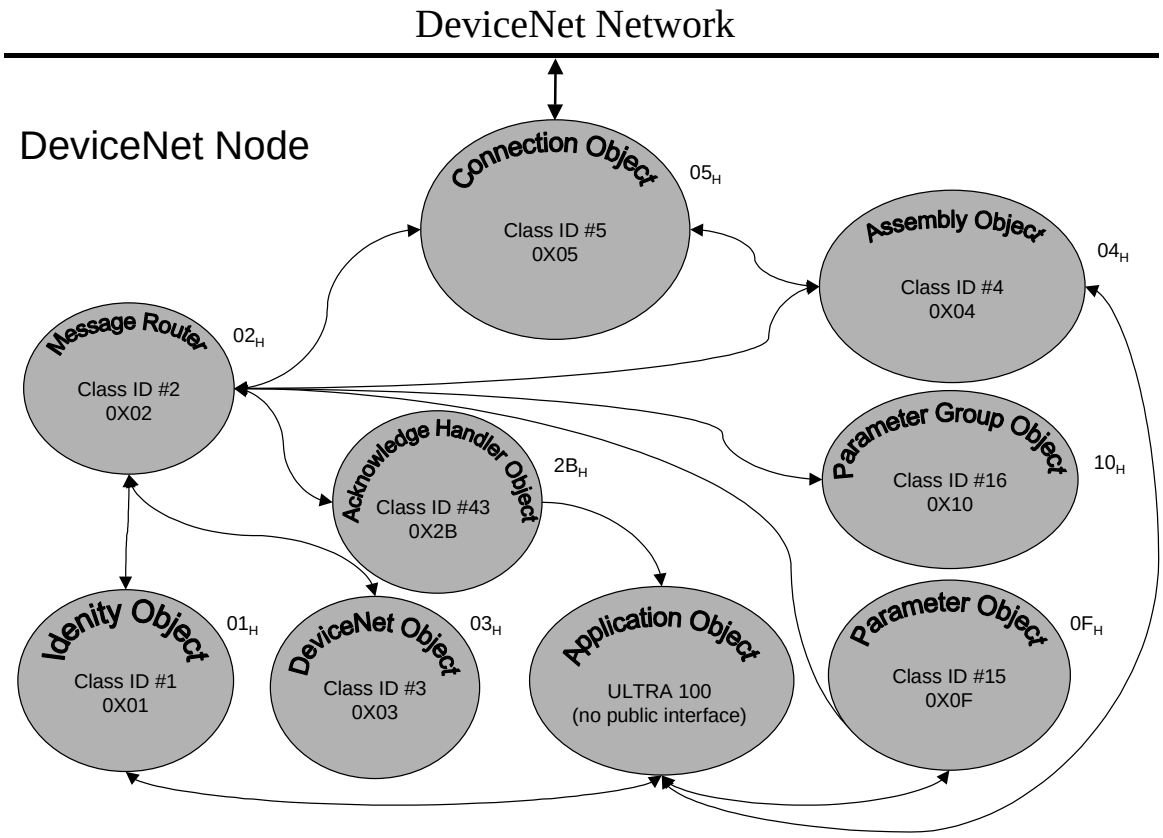
The Object Model represents the objects supported in the ULTRA 100 Drive with DeviceNet.

The following table indicates:

- The object classes present in this device, and
- The number of instances present in each class.

Object Class	Number of Instances
Identity	5
Message Router	1
DeviceNet	1
Assembly	6
Connection	2 I/O and 6 explicit
Parameter	Indexing Drive - 289, Non-indexing Drive - 185
Parameter Group	Indexing Drive - 25, Non-indexing Drive - 14
Acknowledge Handler	1

Figure D.1
Object Model



How Objects Affect Behavior

The objects in the ULTRA 100 Drive with DeviceNet affect it's behavior as shown in the table below.

Object	Effect on Behavior
Message Router	No effect
DeviceNet	Configures port attributes (node address, data rate, and BOI)
Assembly	Defines I/O data format
Connection	Contains the number of logical ports into or out of the device
Parameter	Provides a public interface to the device configuration data
Parameter Group	Provides an aid to device configuration
Acknowledge Handler	Manages the reception of message acknowledgments

The Defined Object Interface

The objects in the ULTRA 100 Drive with DeviceNet have the interface listed in the following table.

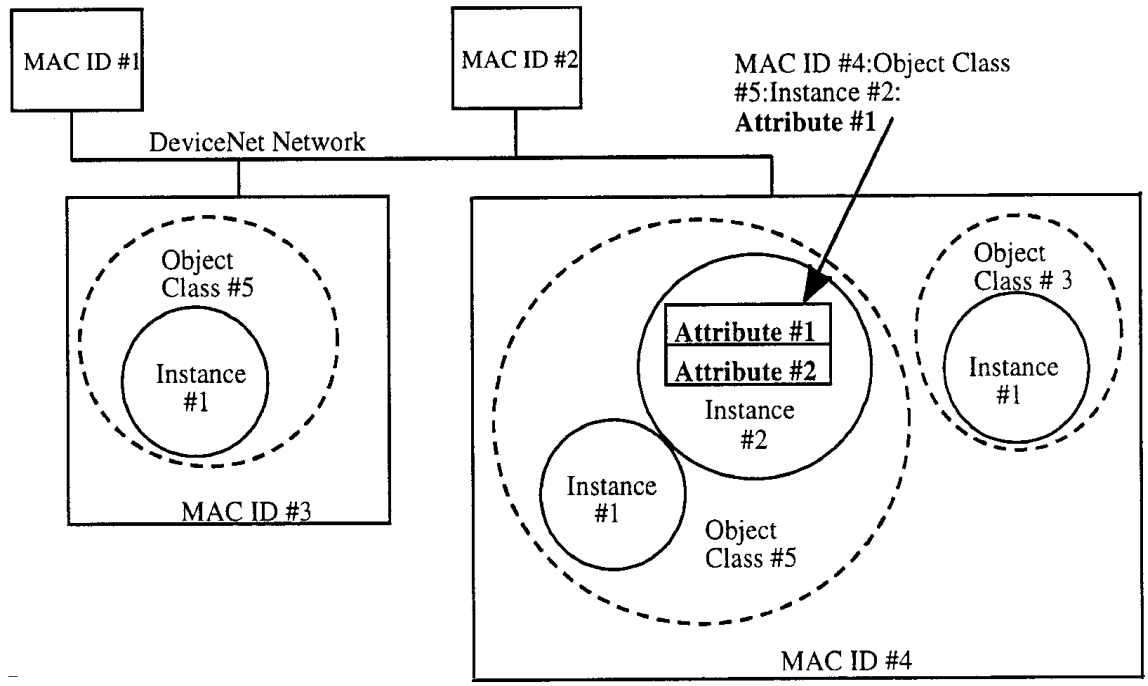
Object	Interface
Message Router	Explicit Messaging Connection Instance
DeviceNet	Message Router
Assembly	I/O Connection or Message Router
Connection	Message Router
Parameter	Message Router
Parameter Group	Message Router
Acknowledge Handler	I/O Connection or Message Router

Object Addressing

The Media Access Control Identifier (MAC ID) is the common basis for logically addressing separate physical components across DeviceNet. The MAC ID is a unique integer assigned to each DeviceNet node that distinguishes it specifically from among other nodes on the same network and also is referred to as the node address.

Component	Description
Class ID	The Class ID is a unique integer value assigned to each Object Class accessible from the network. The ULTRA 100 supports an 8-bit Class ID.
Instance ID	The Instance ID is a unique identification assigned to an Object Instance that identifies it among all Instances of the same Class. It is also possible to address the Class itself by utilizing the Instance ID value zero (0). The ULTRA 100 supports an 16-bit Instance ID.
Attribute ID	The Attribute ID is a unique identification assigned to a Class attribute and/or Instance attribute.

Figure D.2
Node Objects



Data Type Definitions

Mnemonic	Description
WORD	16-bit word, (2 bytes)
UINT	Unsigned integer (2 bytes)
INT	Signed integer (2 bytes)
BOOL	Boolean (1 byte)
SINT	Signed Short integer (1 byte)
DINT	Signed Double integer (4 bytes)
USINT	Unsigned Short integer (1 byte)
UDINT	Unsigned Double integer (4 bytes)
SHORT_STRING	Character string (1 byte per character, 1 byte length indicator)
BYTE	Bit string, (1 byte)
DWORD	Bit string, (4 bytes)

Identity Object (Class ID 01_H)

This object supports identification, information about the device, and reset service. The interface card implements five Identity Objects; one for the whole device and four that represent various firmware components.

Identity Object,
Attribute for Instance ID = 0 (Class Attributes)

Attr ID	Access Rule	Attribute Name	Type	Description	Semantics of Values
2	Get	Max Instance	UINT	Maximum instance number of an object currently created in this class level of the device.	The largest instance number of a created object at this class hierarchy level.

Identity Object,
Instances ID 1-5

Instance ID	Description
1	ULTRA 100
2	ULTRA 100 Main Firmware
3	ULTRA 100 Boot Firmware
4	ULTRA 100 DeviceNet Interface Board Boot Firmware
5	ULTRA 100 DeviceNet Interface Board Main Firmware

Identity Object,
Attributes of Instances ID 1-5

Attr. ID	Access Rule	Attribute Name	Type	Description	Semantics of Values
1	Get	Vendor ID	UINT	Identification of each vendor by number	01 = Rockwell Automation/ Allen-Bradley
2		Device Type		Indication of general type of product.	Instance 1: 115 = Rockwell Automation Miscellaneous 105 = Returned by Instance #2-5 (sub-component)
3		Product code		Identification of a particular product of an individual vendor	Instance 1: 06 = 1398-DDM-005-DN 07 = 1398-DDM-009-DN 08 = 1398-DDM-019-DN 09 = 1398-DDM-005X-DN 10 = 1398-DDM-009X-DN 11 = 1398-DDM-019X-DN Instances 2-5: 01 = (Firmware)
4		Revision Major Minor	STRUCT of: USINT USINT	Revision of the item the Identity Object represents.	 Major Revision Minor Revision
5		Status	WORD	This attribute represents the current status of the entire device. Its value changes as the state of the device changes.	See table: Identity Object, Status Description of Attribute ID #5
6		Serial Number	UDINT	Serial number of device	Unique identifier for each device.
7		Product Name	SHORT_ STRING	Readable identification	Unique identifier for each product.

Identity Object,
Status Description of Attribute ID #5

Bit (s)	Description	Semantics of Values
0	Owned	TRUE = device has an owner
1		0 = Reserved
2	Configured	Always = 0
3		0 = Reserved
4, 5, 6, 7		Vendor specific

Identity Object,
Status Description of Attribute ID #5 (Continued)

Bit (s)	Description	Semantics of Values
8	Minor recoverable fault	Always = 0
9	Minor unrecoverable fault	Always = 0
10	Major recoverable fault	TRUE if self diagnosis detects a major fault
11	Major unrecoverable fault	Always = 0
12, 13		Reserved, set to 0
14, 15		

Identity Object,
Common Services

Service Code	Implemented for		Service Name	Service Description
	Class	Instance		
$0E_H$	Yes	Yes	Get_Attribute_Single	Returns the contents of the specified attribute.
05_H	No		Reset	Invokes the Reset service for the device.
11_H	Yes	n/a	Find_Next_Object_ Instance	Causes the specified Class to search and return a list of instance IDs of existing instances of the Identity object.

Message Router Object (Class ID 02_H)

The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device.

Message Router Object,
Attributes of Instance ID = 1

Attr. ID	Access Rule	Attribute Name	Type	Description	Semantics of Values
2	Get	Number Available	UINT	Maximum number of connections supported	Count of the max number of connections supported
3		Number active		Number of connections currently used by system components	Current count of the number of connections allocated to system communication
4		Active connections	ARRAY of: UINT	A list of the connection IDs of the currently active connections	Array of system connection IDs

Message Router Object,
Common Services

Service Code	Service Name	Service Description
$0E_H$	Get_Attribute_Single	Returns the contents of the specified attribute

DeviceNet Object (Class ID 03_H)

The DeviceNet Object provides configuration and status attributes of a DeviceNet port.

DeviceNet Object,
Attribute of Instance ID = 0 (Class Attribute)

Attr. ID	Access Rule	Attribute Name	Type	Description	Semantics of Values
1	Get	Revision	UINT	Revision of the DeviceNet object Class definition upon which the implementation is based.	= 2

DeviceNet Object,
Attributes of Instance ID = 1

Attr. ID	Access Rule	Attribute Name	Type	Description	Semantics of Values
1	Set	MAC ID	USINT	Node Address	Range 0-63
2		Baud Rate		Data Rate	0 = 125K, 1 = 250K, 2 = 500K
"Set" is only supported if the MAC ID and Data Rate are programmable. Refer to Setting rotary DIP switches to node address and data rate on page 4-1					
3	Set	Bus OFF interrupt (BOI)	BOOL	Bus-OFF Interrupt	Default = 0
4		Bus OFF Counter	USINT	Number of times CAN went to the bus-OFF state	Range 0-255
5	Get	Allocation information	STRUCT of: BYTE USINT	Allocation Choice (1 byte) + Master MAC ID (1 byte)	Refer to the DeviceNet Object definition in the DeviceNet Specification Range 0-63, 255 Modified via Allocate only.
6		MAC ID Switch Changed	BOOL	The Node Address Switch(es) have changed since last power-up/ reset.	0 = No Change 1 = Change since last Reset or power-up
7		Baud Rate Switch Changed		The Baud Rate Switch(es) have changed since last power-up/ reset.	0 = No Change 1 = Change since last Reset or power-up
8		MAC ID Switch Value	USINT	Actual value of Node Address switch(es) or EEPROM value if programmable.	Range 0-63
9		Baud Rate Switch Value		Actual value of Baud Rate switch(es), EEPROM value if programmable, or operating value after an autobaud was completed.	Range 0-2

**DeviceNet Object,
Common Services**

Service Code	Service Name	Service Description
$0E_H$	Get_Attribute_Single	Returns the contents of the specified attribute.
10_H	Set_Attribute_Single	Modifies the specified attribute.

**DeviceNet Object,
Class Specific Services**

Service Code	Service Name	Service Description
$4B_H$	Allocate_Master/ Slave_Connection_Set	Requests the use of the Predefined Master/Slave Connection Set.
$4C_H$	Release_Group_2_ Identifier_Set	Indicates that the specified Connections within the Predefined Master/Slave Connection Set are no longer desired. These connections are to be released (deleted).

Assembly Object (Class ID 04_H)

The DeviceNet Specification defines Assembly Objects as objects that "bind attributes of multiple objects to allow data to or from each object to be sent over a single connection." The ULTRA 100 Drive with DeviceNet uses Assembly Objects to send data to and from a Master (scanner) device over an I/O connection. The terms "Input" and "Output" are defined from the scanner's point of view. ULTRA 100 Drive with DeviceNet Output Assemblies are defined as the information that is "output" by the scanner and consumed by the ULTRA 100. Input Assemblies are the status information that is consumed by the scanner or are the scanner's "input." The ULTRA 100 Drive with DeviceNet allows the user to choose between various Input and Output Assemblies, thereby choosing the data format of the messages that are passed back and forth between the ULTRA 100 Drive with DeviceNet and the scanner on the I/O connection.

In addition, the user can send explicit messages to the Input and Output Assemblies. "Explicit message writes" to an Output Assembly, can perform control functions. Therefore, "explicit message writes" are only allowed when the Master (scanner) is not actively controlling the drive via I/O messaging and the "message write" is done through a connection with a time-out value not equal to zero. After a write, any time-out or closure of the connection may cause the drive to fault. Refer to Using Explicit Messaging to Control the ULTRA 100 on page D-22. This manual may refer to "Input and Output Assemblies" as "response" and "command" Assemblies respectively.

**Assembly Object,
Attributes of Instance ID = 0 (Class Attributes)**

Attr. ID	Access Rule	Attribute Name	Type	Description	Semantics of Values
1	Get	Revision	UINT	Revision of this object.	The current value assigned to this attribute is two (02).
2		Max Instance		Maximum instance number of an object currently created in this class level of the device.	The largest instance number of a created object at this class hierarchy level.

The following Assembly Objects are implemented in the drive and buffer I/O in the following fashion (RO = Read Only, R/PW = Read/Write Protected).

**Assembly Object,
Instance ID = 1 - 6**

ID	Type	Access	Description
1	Static Output	N/A	Null
2	Static Input	RO	Logic (Drive) Status
3	Static Output	R/PW	Logic Command
4	Static Input	RO	Logic Status and Feedback Data
5	Static Output	R/PW	Logic Command and Feedback Data Pointer
6		R/PW	Logic Command, Feedback Data Pointer, Command Data

**Assembly Object,
Attribute of Instances ID 1 - 6**

Attr ID	Access Rule	Attribute Name	Type
3	Get	Data	ARRAY

**Assembly Object,
Common Services**

Service Code	Implemented for		Service Name	Service Description
	Class	Instance		
$0E_H$	Yes	Yes	Get_Attribute_Single	Returns the contents of the specified attribute.
$10E_H$	No		Set_Attribute_Single	Modifies an attribute value.

Parameter DNet I/O Format (Parameter 283 - Index Drive, Parameter 179 - Non-indexing Drive) must be programmed to select the appropriate assemblies to be sent over an I/O connection. The choice of which Input and Output Assembly to use should be based on what sort of information is appropriate in a particular system. The Assembly Object, I/O Format Type Selection Table lists the input and output assemblies exchanged over an I/O messaging connection.

Assembly Object, I/O Format Type

DeviceNet I/O Format	Output (command) Assembly Instance ID used for Polled, Change of State, and Cyclic I/O Messaging	Input (response) Assembly Instance ID used for Polled I/O Messaging	Input (response) Assembly Instance ID used for Change of State and Cyclic Messaging
Type 1	1 (0 bytes)	2 (4 bytes)	2 (4 bytes)
Type 2	3 (2 bytes)	2 (4 bytes)	2 (4 bytes)
Type 3	5 (3 bytes)	4 (8 bytes)	2 (4 bytes)
Type 4	6 (8 bytes)	4 (8 bytes)	2 (4 bytes)

Refer to the Parameter Objects for more information about the DNet I/O Format parameter.

IMPORTANT If the DNet I/O Format parameter is modified, the user has to either power cycle the Drive, reset the Drive, or remove and reapply DeviceNet power for the Drive to use the modified value.

The following tables describe the data format of the Output (command) data Assemblies.

Assembly Object, Output (command) Assembly for Instance ID = 1

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
(No data)								

Assembly Object, Output (command) Assembly for Instance ID = 3

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Preset Select B	Preset Select A	Operation Mode Override	Reserved		Follower Enable	Integrator Inhibit	Torque Override
1	Enable	Fault Reset	Start Homing	Remove Command Offset	Disable Serial	Define Home	Start Index	Preset Select C

Assembly Object,
Output (command) Assembly for Instance ID = 5

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Preset Select B	Preset Select A	Operation Mode Override	Reserved		Follower Enable	Integrator Inhibit	Torque Override
1	Enable	Fault Reset	Start Homing	Remove Command Offset	Disable Serial	Define Home	Start Index	Preset Select C
2	Reserved					Feedback Data Pointer		

Assembly Object,
Output (command) Assembly for Instance ID = 6

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Preset Select B	Preset Select A	Operation Mode Override	Reserved		Follower Enable	Integrator Inhibit	Torque Override
1	Enable	Fault Reset	Start Homing	Remove Command Offset	Disable Serial	Define Home	Start Index	Preset Select C
2	Reserved					Feedback Data Pointer		
3	Write Command Data	Reserved		Command Data Pointer				
4	Command Data Value - Low byte							
5	Command Data Value - Low Middle byte							
6	Command Data Value - High Middle byte							
7	Command Data Value - High byte							

Additional information regarding configuration, application, and use of the Drive can be found in the *ULTRA 100 Series Drives Installation Manual* (Pub 1398-5.2).

Logic Command

The first 16-bits in the Output (command) Assemblies are referred to as the logic command. The logic command bits correspond to functions available via the hardware digital inputs on the ULTRA 100 Drive with DeviceNet. The ENABLE bit in the logic command is 'OR'ed or 'AND'ed with the hardware ENABLE input as specified by the Enable Behavior parameter (Parameter 185 - Non-indexing Drive, Parameter 289 - Indexing Drive). If a function has not been assigned to any of the hardware inputs, the corresponding logic command bit exclusively controls the function. If a function has been assigned to a hardware input, the corresponding logic command bit is 'OR'ed with the hardware input. Bits in the logic command can be masked off by using the

Logic Command Mask parameter (Parameter 183 - Non-indexing Drive, Parameter 287 - Indexing Drive). If a bit in the Logic Command Mask is zero (0), then the corresponding bit in the logic command will be set to zero inside the ULTRA 100. All of the logic command bits will be masked off (set to zero) unless the Logic Command Mask parameter is changed from the default value of zero (0).

IMPORTANT A transition on a logic command bit will not be recognized if the corresponding hardware input is active. Refer to the description for the ENABLE bit for more information regarding the interaction between the logic command ENABLE bit and the hardware Enable input.

IMPORTANT Toggling more than one bit at one time may produce indeterminate behavior.

For example, changing the Presets and transitioning the Start Index from 0 to 1 may cause the previously selected Index Preset to be executed.

Torque Override

This bit is used to force the drive into Torque Mode.
1 = Torque Mode
0 = Torque Override Input is low

Integrator Inhibit

This bit is used zero the velocity loop integrator.
1 = Inhibit Integrator
0 = Non-Inhibit Integrator

Follower Enable

This bit is used to allow the position loop to track the Position Command when the Drive is set to a Position Follower Mode.

Operation Mode Override

1 = The Override Command Source (Parameter 114) is selected as the command source and the Override Drive Mode (Parameter 115) is selected as the drive mode.
0 = Command Source (Parameter 112) and Drive Mode (Parameter 113) are selected as the command source and drive mode.

Selection Table of Presets

These bits are used to select a Velocity Preset, Torque Preset, or Index Select

Preset	Select		
	C	B	A
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

Start Index

A rising edge (transition from 0 to 1) of the Start Index bit begins an indexing move if the Drive's current Operation Mode is indexing (command source = indexing). The Drive Mode (Parameter 113) should be set to Velocity Mode or else the velocity loop will be bypassed. A transition will not be recognized if a hardware input configured as a Start Index is already active. This option is only available on an Indexing Drive.

Define Home

A rising edge (transition from 0 to 1) causes the present motor position to be selected as Home Position (Parameter 185). This means that the position command is set to the Home Position, and the position feedback is simultaneously set to its appropriate value according to the position error. This option is only available on an Indexing Drive.

Disable Serial

This bit inhibits the serial communications port operation on the Drive.
1 = Serial communications disabled
0 = Serial communications enabled

Remove COMMAND Offset

A rising edge (transition from 0 to 1) causes the offset of the Analog COMMAND Input to be measured (after averaging), and the Torque COMMAND Input Offset and Velocity COMMAND Input Offset parameters are set to the negative of this value to help reduce drift.

Start Homing

A rising edge (transition from 0 to 1) causes the Drive to initiate the homing routine. This option is only available on an Indexing Drive.

Fault Reset

A rising edge (transition from 0 to 1) will reset any detected Drive faults. If the Drive Enable is high (1) the Drive will enable and unexpected motion may happen.

Enable

The Enable bit enables the Drive (1 = enable, 0 = disable) depending on the Hardware Enable input and the Enable Behavior parameter (Parameter 185 - Non-index Drive and Parameter 289 - Indexing Drive). The Enable bit can be configured to be 'OR'ed or 'AND'ed with the hardware enable by setting the Enable Behavior parameter. If the Enable Behavior parameter is set to Hardware OR DNet, then only one enable input has to be activated to enable the drive. Otherwise, both enable inputs have to be activated to enable the drive. The Host Control Mode (Parameter 169) can temporarily disable the drive regardless of the hardware enable input and DeviceNet enable bit.

Feedback Data Pointer

The third byte in assemblies 5 and 6 contains a feedback data pointer that selects the feedback data value. Refer to Assembly Object, Input (response) Assembly for Instance ID = 4 on page D-19.

Assembly Object, Feedback Data

Feedback Data Pointer	Description	Data Type
0	Commanded Position	DINT
1	Actual Position	
2	Actual Velocity	
3	Average Current	DINT (a sign extended INT)
4	Fault Status	DWORD

Command Data

The command data pointer defines which command data should be updated in the drive. The command data pointer selects one of the command data listed in Assembly Object, Command Data table. The Write Command Data bit is used to latch the command data value that is located in the last four bytes of the Output (command) Assembly. A new command data value will be accepted by the drive on the rising edge of the Write Command Data bit (transition from 0 to 1) if the Write Data Busy/Ack bit (located in the Input (response) Assembly - Instance 4) is low: 1 = busy, 0 = idle. The Write Data Busy/Ack bit will be cleared when the Write Command Data bit is set to zero (0) and the ULTRA 100 Drive with DeviceNet is not busy saving the command data. The Write Command Data and Write Data Busy/Ack bits are ignored if the command Assembly is updated via an explicit message.

IMPORTANT If Assembly Object Instance ID 6 is updated via an I/O or explicit message, the drive will act on the logic command before reading the command data value. Therefore, the drive will accept the logic command even though the command data value may be invalid. If the Assembly Object is updated via an I/O message, the ULTRA 100 Drive with DeviceNet sets the Write Data Error bit in the Input (response) Assembly if the command data value is invalid. If the Assembly Object is updated via an explicit message, the Drive will return an error response if the command data value is invalid.

Assembly Object, Command Data			
Command Data Pointer	**Command Data Description**	**Data Type**	**Parameter Number**
0x00	Null	-	
0x01	Host Setpoint Control Enable	USINT	170
0x02	Host Velocity Setpoint	DINT	172
0x03	Host Torque Setpoint	INT	173
0x04	Host Setpoint Acceleration	UDINT	174
0x05	Host Index Control Indexing Drive only	USINT	171
0x06	Host Index Indexing Drive only		181
0x07	RAM Index Type Indexing Drive only		201

Assembly Object, Command Data (Continued)			
Command Data Pointer	**Command Data Description**	**Data Type**	**Parameter Number**
0x08	RAM Index Distance/Position Indexing Drive only	DINT	210
0x09	RAM Index Registration Distance Indexing Drive only	UDINT	219
0x0A	RAM Index Velocity Indexing Drive only		228
0x0B	RAM Index Acceleration Indexing Drive only		237
0x0C	RAM Index Deceleration Indexing Drive only		246
0x0D	RAM Index Dwell Time Indexing Drive only	UINT	255
0x0E	RAM Index Count Indexing Drive only		264
0x0F	RAM Index Termination Indexing Drive only	USINT	273
0x10	RAM Index Pointer Indexing Drive only		282

The following two tables describe the data format of the Input (response) Assemblies.

Assembly Object,
Input (response) Assembly for Instance ID = 2

Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0	Drive Enabled	At Speed	Negative ILimit	Positive Ilimit	Within Velocity Window	Zero Velocity	Within Position Window	In Position
1	Drive Ready	Brake Active	Axis Homed	Reserved			Fault Disable	DC Bus Charged
2	Preset Select B	Preset Select A	Operation Mode Override	Reverse Clamp	Forward Clamp	Follower Enable	Integrator Inhibit	Torque Override
3	Enable Active	Fault Reset	Registration Detected	In Dwell	In Motion	Sequence Complete	At Home	Preset Select C

Assembly Object,
Input (response) Assembly for Instance ID = 4

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Drive Enabled	At Speed	Negative ILimit	Positive Ilimit	Within Velocity Window	Zero Velocity	Within Position Window	In Position
1	Drive Ready	Brake Active	Axis Homed	Write Data Busy/ Ack	Write Data Error	Reserved	Fault Disable	DC Bus Charged
2	Preset Select B	Preset Select A	Operation Mode Override	Reverse Clamp	Forward Clamp	Follower Enable	Integrator Inhibit	Torque Override
3	Enable Active	Fault Reset	Registration Detected	In Dwell	In Motion	Sequence Complete	At Home	Preset Select C
4	Feedback Data Value - Low byte							
5	Feedback Data Value - Low Middle byte							
6	Feedback Data Value - High Middle byte							
7	Feedback Data Value - High byte							

Logic Status Definitions

The first four (4) bytes of the Input (response) Assemblies are referred to the logic (or Drive) status

Brake Active

This bit indicates whether the BRAKE relay is closed. When the BRAKE relay is Open, the brake is being applied. When the BRAKE relay is Closed, the brake is released.

Drive Ready

This bit indicates that the drive does not have any disabling faults.
1 = Drive operational
0 = Drive faulted

Torque Override

This bit indicates whether the drive mode is in torque override mode.
1 = Torque Mode
0 = Normal operation

This bit reflects the state of the Torque Override input bit. Recall that an input bit may be set via an assigned hardware input or a DeviceNet message.

Integrator Inhibit

This bit indicates whether the velocity loop integrator is inhibited and reflects the state of the Integrator Inhibit input.

Follower Enable

This indicates whether the follower enable input is active and the position loop is allowed to track the position command when the drive is set to a Position Follower mode. This bit reflects the state of the Follower Enable input.

Operation Mode Override

1 = The Override Command Source selects the command source and the Override Drive Mode selects the drive mode
0 = Command Source and Drive Mode select the command source and drive mode. This bit reflects the state of the Operation Mode Override input.

Preset Select A, B, C

These bits indicate the state of the Preset Select inputs. If the drive is executing an index, these bits do not necessarily indicate which index is executing.

At Home

This bit indicates that the position command is equal to the Home Position (Parameter 185). This bit does not pertain to a Non-indexing Drive.

Sequence Complete

This bit indicates that all iterations of an index have been completed. This bit does not pertain to a Non-indexing Drive.

In Motion

This bit indicates when the motor is moving the commanded index distance or registration distance. This bit does not pertain to a Non-indexing Drive.

In Dwell

This bit indicates when the motor is holding position and waiting the commanded index dwell time. This bit does not pertain to a non-indexing drive.

Registration Detected

This bit indicates whether the Registration Sensor has been detected and the move has been adjusted, for this iteration of the index. The Registration

Distance must be larger than the deceleration distance or the move will not be adjusted. This bit does not pertain to a Non-indexing Drive.

Fault Reset

This bit indicates whether the Fault Reset input is high.

Enable Active

This bit indicates whether the drive is enabled.
1 = Enabled
0 = Disabled

DeviceNet Communication Fault Action

The user can configure the ULTRA 100 Drive with DeviceNet to perform a specific action if the Output (command) Assembly is not periodically updated after the I/O (or explicit) messaging connection has been established and the DNet I/O Format parameter is configured for Type 2, Type 3, or Type 4. The Output Assembly may not get updated for a several reasons:

- the messaging connection is closed,
- the scanner (Master) is placed into program mode, or the
- DeviceNet cable is unplugged.

By default, the ULTRA 100 Drive with DeviceNet will fault and clear the logic command unless Type 1 has been selected for the DNet I/O format. The user can configure the Drive to take a different action by configuring the following parameters:

- Idle Fault Action — Parameter 284 - indexing, 180 - non-indexing Drive,
- Comm Fault Action — Parameter 285 - indexing, 181 - non-indexing Drive, and
- Fault Config Logic — Parameter 286 - indexing, 182 - non-indexing Drive.

The ULTRA 100 Drive with DeviceNet will execute the Idle Fault Action if the Master (scanner) sends I/O idle messages (zero-length messages). The Comm Fault Action will be invoked if a communication fault occurs such as the DeviceNet cable being unplugged. The Idle Fault Action and Comm Fault Action parameters allow the user to configure the ULTRA 100 Drive with

DeviceNet to take one of the following actions if a communication problem occurs and prevents Output (command) Assembly object from being updated:

- Fault/ Zero Data — The ULTRA 100 Drive with DeviceNet faults and the logic command is cleared,
- Fault/ Hold Last — The ULTRA 100 Drive with DeviceNet faults and the last logic command received is latched,
- Zero Data — The logic command is cleared,
- Hold Last — The last logic command received is latched,
- Fault Configure — The Fault Config Logic parameter specifies the logic command value. The ULTRA 100 Drive with DeviceNet does not fault. Refer to Using the Fault Configured Input on page D-61

Using Explicit Messaging to Control the ULTRA 100

Explicit messages provide multi-purpose, point-to-point communication paths between two devices. It is possible to control the Drive through explicit messaging on DeviceNet by following particular guidelines and by writing to various Assembly Objects that are buffering the I/O data. Although, it is possible to control the Drive by writing to various parameter objects, the user should consider using the Assembly Objects for controlling the Drive. The guidelines are as follows:

- Write to the various Assembly Objects that are buffering the I/O data.
- Write access to any Assembly Object will not be allowed if the message is passed through a connection whose expected packet rate (EPR) is zero or if I/O data is being sent over an I/O messaging connection.
- The Drive marks any explicit connection after allowing a write to an Assembly Object through it.
- If a marked explicit connection times out based on the EPR, then the I/O fault action will be that configured for Communication Loss over the I/O connection.
- If a marked explicit connection is deleted, then the I/O fault action will be that configured for Idle over the I/O connection.
- Multiple explicit connections can write/overwrite the control I/O if they meet the guidelines specified. Each connection will be marked individually within the Drive
- If the Drive gets allocated/re-allocated by a controller such that valid I/O data is being sent to the Drive, or if an Idle condition from the allocating controller is transitioned back to valid data, then all marked explicit connections will be reset to unmarked and future writes blocked.
- If a marked connection has its EPR value reset to zero (0) after being marked, then the connection will become unmarked.

DeviceNet Connection Object (Class ID 05_H)

The Connection Object manages the internal resources associated with both I/O and Explicit Messaging Connections. The specific instance generated by the Connection Class is referred to as a Connection Instance or a Connection Object. A Connection Object within a particular module actually represents one of the end-points of a connection.

DeviceNet Connection Object, Instance ID 1 - 10

Instance ID	Instances
1	Group 2 Explicit Message Connection
2	Poll I/O Connection
4	Change of State or Cyclic I/O Connection
6-10	Group 3 Explicit Message Connections

DeviceNet Connection Object, Attributes of Instances ID 1 - 10

Attr ID	Access Rule	Attribute Name	Type	Description	Semantics of Values
1	Get	State	USINT	State of the Connection	
2		Instance Type		I/O or Message Connection	
3		Transport_class_trigger	BYTE	Defines the behavior of the Connection	
4		Produced_connection_id	UINT	CAN identifier to transmit on	
5		Consumed_connection_id		CAN identifier to receive on	
6		Initial_comm_characteristics	BYTE	Defines the Message Group(s) associated with this Connection	
7		Produced_connection_size	UINT	Maximum number of bytes transmitted across this Connection	
8		Consumed_connection_size		Maximum number of bytes received across this Connection	
9	Set	Expected_packet_rate		Defines timing associated with this Connection	
12		Watchdog_timeout_action	USINT	Defines how to handle Inactivity/Watchdog time-outs	
13	Get	Produced_connection_path_length	UINT	Number of bytes in the produced_connection_path attribute	
14		Produced_connection_path	Array of USINT	Specifies the Application Object whose data is to be produced by this Connection object	
15		Consumed_connection_path_length	UINT	Number of bytes in the Consumed_connection_path attribute	
16		Consumed_connection_path	Array of USINT	Specifies the Application Object(s) that are to receive the data consumed by this Connection	
17	Set	Production_inhibit_time	UINT	Defines minimum time between new data production for COS connections.	

**DeviceNet Connection Object,
Common Services**

Service Code	Service Name	Service Description
$0E_H$	Get_Attribute_Single	Returns the contents of the specified attribute.
10_H	Set_Attribute_Single	Modifies the specified attribute.
05_H	Reset	Used to reset the Inactivity/Watchdog Timer associated with a Connection Object

Parameter Object (Class ID $0F_H$)

The DeviceNet Parameter Object provides the interface to the ULTRA 100 Drive with DeviceNet configuration data. It supplies a full description of the parameter, including its min/max values and a readable text string describing the parameter. The instances start at one and increment with no gaps.

**Parameter Object,
Attributes for Instance ID = 0 (Class Attributes)**

Attr ID	Access Rule	Name	Data Type	Description	Semantics of Values
1	Get	Revision	UINT	Revision of this object	Current value = 01
2		Max Instances		Maximum instance number of an object currently created in this class level of the device	The largest instance number of a created object at this class hierarchy level
8		Parameter Class Descriptor	WORD	Bit field that describe parameters	Bit 0 = supports parameter instances Bit 1 = full attributes Bit 2 = non-volatile storage save command Bit 3 = params are stored in non-volatile storage
9		Configuration Assembly Instance	UINT	Instance number of the configuration assembly	0 = configuration assembly not supported

The table "Parameter Object Attributes" on Page D-61 lists the instance attributes of the parameter object. The following table "Parameter Object Instances" lists the parameter instances implemented in the ULTRA 100 Drive with DeviceNet. A parameter value is accessed via Attribute 1 of a parameter instance. Additional information about the parameter object is located after the table "Parameter Object Attributes."

IMPORTANT Some parameters can not be modified while the ULTRA 100 Drive with DeviceNet is enabled. The Drive will return the error code, "10_h - Device state conflict," if you try to modify one of these parameters while the Drive is enabled.

**Parameter Object,
Instances ID 1-289**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
1	Get	DN-SW Node Address	USINT	1		DeviceNet Node Address (Mac_ID) switch setting.
2		DN-SW Baud Rate				DeviceNet Baud Rate (Data Rate) switch setting. 0 - 125 kbps 1 - 250 kbps 2 - 500 kbps 3 - Autobaud 4 - Autobaud 5 - Autobaud 6 - Autobaud 7 - Autobaud
3	Get/Set	DN-NV Node Addr				The programmed nonvolatile DeviceNet Node Address (Mac_ID). 0 - 63
4		DN-NV Baud Rate				The programmed nonvolatile DeviceNet Baud Rate. 0 - 125 kbps 1 - 250 kbps 2 - 500 kbps 3 - Autobaud
5		Chg of State Msk (bit definition)	DWORD	4		The change of state mask is used when a master has allocated the change of state I/O message connection. If a particular bit is set (one) in 'Chg of State Msk', then a change of state I/O message will be produced whenever the corresponding bit in 'Parameter 6 - DNet I/O Status' changes value. If a bit is clear (zero) in 'Chg of State Msk', then a change of state I/O message will not be produced if the corresponding bit in 'Parameter 6 - DNet I/O Status' changes.
6	Get	DNet I/O Status (bit definition)				'DNet I/O Status' is the same information sent by the polled, change of state, and cyclic I/O messages. "DNet I/O Status" is equivalent to the Logic Status field in the input (response) assemblies. Refer to Assembly Object, Input (response) Assembly for Instance ID = 2 on page D-18.
7		Drive Main Version	UINT	2		The version number of the main firmware loaded in the drive's regulator card. Major, Minor Revision = Value/100
8		Drive Boot Version				The version number of the boot firmware loaded in the drive's regulator card. Major revision = Int (Value/100) Minor revision = Remainder (Value/100)
9		Product Type	USINT			Identifies the drive product type. 9 - DeviceNet (TM), Micro-size Non-indexing Drive 11 - DeviceNet (TM), Micro-size Indexing Drive
10		Powerup Status				The status of the drive during power up testing. 0 - successful power-up

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
11	Get/Set	Motor ID	UINT	2		Sets or gets the motor in the drive's motor parameter table currently being used. The setting 0 (0000) indicates that no motor has been selected, and the setting 65535 (FFFF) indicates motor parameters were set individually and not read from the drive's motor parameter table. Refer to the ULTRA 100 Series Drive manual for a list of motor IDs and corresponding motors. • If the Motor ID is modified, the drive will automatically reset. This will result in all DeviceNet message connections to be closed. The drive reset ensures that all parameters related to the new Motor ID are properly initialized. • A value of 65535 for the Motor ID selects a custom motor as defined by Parameters 45 to 55 and 57 to 61. If one or more of the motor parameters are modified, the user has to reset or power cycle the drive to activate the modified parameters.
12	Get/Set	Pos Loop P_Gain	UINT	2	1/128	Sets or returns the Kp gain for the position loop. The Kp gain generates a control signal proportional to the position error. Kp gain affects the response time to a command signal and the position loop bandwidth. Range: 0 to 4095 Default: 512 (4.00)
13	Get/Set	Pos Loop I_Gain	UINT		1/128	Sets or returns the Ki gain for the position loop. The Ki gain generates a control signal proportional to the integral of the velocity error. Integral gain eliminates steady state position error, and affects the ability to reject load disturbances. Range: 0 to 4095 Default: 0
14		Pos Loop D_Gain			1/128	Sets or returns the Kd gain for the position loop. The Kd gain generates a control signal proportional to measured velocity. It provides damping to the position loop, which can reduce overshoot. Range: 0 to 4095 Default: 0
15		Pos Loop FF_Gain				Sets or returns the Kff gain for the position loop. The Kff gain generates a feed forward signal proportional to the commanded speed. It can be used to reduce steady state position error while moving. Range: 0 to 200 Default: 100
16		Pos Loop I_Zone			Cnts	Sets or returns the maximum position error which the position loop's integrator is still active. If the position error is greater than the Integrator Zone, the integrator is reset. Range: 0 to 32767 Default: 1000
17		Pos Window Size				Sets or returns the maximum position error which allows the In-Position flag to remain set. Range: 0 to 32767 Default: 20
18		Pos Window Time	USINT	1	mS	Sets or returns the minimum time which the position error must be less than the Position Window Size to set the In-Position flag. Range: 1 to 255 Default: 20

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
19	Get/Set	Pos Error Limit	UDINT	4	Cnts	Sets or returns the maximum position error which allows the Excess Position Error flag to remain clear. Position Error Limit may be referred to as Following Error Limit. Range: 1 to 0x7FFFFFFF Default: 8000
20		Pos Error Time	UINT	2	mS	Sets or returns the minimum time which the position error must be greater than the Position Error Limit to cause an Excessive Following Error fault. Range: 1 to 65535 Default: 100
21		Master Rot Dir	USINT	1		Sets or returns the rotation direction of the master encoder in follower mode, and the polarity of the direction input in the Step/Direction mode. Master Rotation Direction may be referred to as Follower Input Rotation and follower mode may be referred to as Master Encoder mode. 0 - Forward Direction (default) 1 - Reverse Direction
22		Slew Rate	UDINT	4	rpm/ sec	Sets or returns the acceleration limit for the motor when used in a follower mode and if the slew rate is active - Slew Enable. The slew rate indicates the limit of rate of change in speed the drive allows when the master changes speed. rpm/sec Range: 0 to 0x7FFFFFFF Default: 2000
23		Slew Enable	USINT	1		Sets or returns the flag which indicates if the slew rate (limit) is used in follower mode. 0 - Disable (default) 1 - Enable
24		Gear Ratio Cmd				Transfers the gear ratio defined by Parameter 25 - "Buffered Gear Ratio - Motor" and Parameter 26 - "Buffered Gear Ratio - Master" to the drive. The gear ratio (ratio between motor encoder counts and master counts) is used for the master (follower input) mode. Writing to Parameters 25 and 26 does not modify the active gear ratio in the drive. Parameter 27 - "Active Gear Ratio - Motor" and Parameter 28 - "Active Gear Ratio - Master" returns the actual gear ratio currently being used by the drive. 0 - No action 1 - Transfer Buffered Gear Ratio If Parameter 25 is equal to zero (0), then writing a one (1) to the Gear Ratio Cmd will produce an error response.

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
25	Get/Set	Buf Gr Ratio-Mtr	INT	2	Cnts	Parameter 25 (motor counts) and Parameter 26 - "Buffered Gear Ratio - Master" (master counts) define the buffered ratio between motor and master counts used for the master (follower input) mode. Writing to this parameter does not modify the active gear ratio in the drive. The buffered ratio has to be transferred to the active gear ratio by writing a one to Parameter 24 - "Gear Ratio Command" before any changes to the "Buffered Gear Ratio" become effective. Range: -32767 to +32767 Do not use zero (0). Default: 1
26		Buf GrRatio Master				Parameter 26 (master counts) and Parameter 25 - "Buffered Gear Ratio - Motor" (motor counts) define the buffered ratio between motor and master counts used for the master (follower input) mode. Writing to this parameter does not modify the active gear ratio in the drive. The buffered ratio has to be transferred to the active gear ratio by writing a one to Parameter 24 - "Gear Ratio Command" before any changes to the "Buffered Gear Ratio" become effective. Range: 1 to 32767 Default: 1
27	Get	Active Gear-Mtr				Parameter 27 (motor counts) and Parameter 28 - "Active Gear Ratio - Master" (master counts) define the active ratio between motor and master counts used for the master (follower input) mode.
28		Active Gear-Mstr				Parameter 28 (master counts) and Parameter 27 - "Active Gear Ratio - Motor" (motor counts) define the active ratio between motor and master counts used for the master (follower input) mode.
29	Get/Set	Vel Loop P_Gain	UINT			Sets or returns the proportional gain (P gain) for the velocity loop. The proportional gain generates a control signal proportional to the velocity error. P gain affects the response time to a command signal and the velocity loop bandwidth. Range: 0 to 1000 Default: 200
30		Vel Loop I_Gain				Sets or returns the integral gain (I gain) for the velocity loop. The I gain generates a control signal proportional to the integral of the velocity error. I gain eliminates steady state velocity error, and affects the ability to reject load disturbances. Range: 0 to 1000 Default: 66
31	Get	Reserved	USINT	1		

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
32	Get/Set	Zero Vel Window	UDINT	4	rpm/ 65536	Sets or returns the maximum motor velocity which allows the Zero Velocity flag to remain set. Range: 0 to 0x7FFFFFFF Default: 0x30000 (3.00 rpm)
33		Velocity Window				Sets or returns the maximum motor velocity error which allows the Velocity Window flag to remain set. Range: 0 to 0x7FFFFFFF Default: 0xA0000 (10 rpm)
34		Vel Overspd Lim				Sets or returns the minimum motor velocity which causes the Overspeed fault to occur. Range: 0 to 0x7FFFFFFF
35		At Speed Value				Sets or returns the minimum motor velocity which causes the At Speed flag to be set. Range: 0 to 0x7FFFFFFF Default: 0x7D00000 (2000 rpm)
36	Get	Reserved	USINT	1		
37	Get/Set	Vel Error Limit	UDINT	4	rpm/ 65536	Sets or returns the minimum velocity error which allows the Excess Velocity Error flag to remain clear. Range: 0 to 0x7FFFFFFF Default: 0x3E80000 (1000 rpm)
38		Vel Error Time	UINT	2	mS	Sets or returns the minimum time which the velocity error must be greater than the Velocity Error Limit to cause an Excess Velocity Error fault. Range: 1 to 65535 Default: 1000
39		Low Pass Bndwdth			Hz	Sets or returns the cutoff frequency of the low pass filter. Range: 1 to 992 Default: 150
40		LowPass Filter	USINT	1		Sets or returns the flag which indicates if the low pass filter is used in the control loop. 1 - Enable (default) 0 - Disable
41		Positive I Limit	UINT	2	Amps/ 128	Sets or returns the user specified positive current limit for the drive. The drive limits the actual drive current to the minimum of this value, the peak rating of the drive, the peak rating of the motor, and the Forward Current Limit (+ILIMIT) analog input. Range: 0 to 32767
42		Negative I Limit				Sets or returns the user specified negative current limit for the drive. The drive limits the actual drive current to the minimum of this value, the peak rating of the drive, the peak rating of the motor, and the Reverse Current Limit (-ILIMIT) analog input. Range: 0 to 32767
43		Fault Current				Sets or returns the user specified average current faulting value. This parameter is provided to allow a faulting current value which is less than the capacity of the drive and motor. Range: 0 to 32767

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
44	Get/Set	Dynamic PWM Freq	USINT	1		Sets or returns the flag which indicates if the PWM frequency changes with the speed and current demands of the motor. Normally, the drive automatically adjusts the PWM frequency between its full frequency and 1/2 frequency, depending on the operating conditions. For example, at low speeds and low currents, the PWM frequency is set to 1/2 times the normal frequency. Disabling PWM frequency changes forces full frequency operation at all times which makes the audible noise quieter. 0 - Enable (default) 1 - Disable
45	Get/Set* (Set not supported if Motor ID is not equal to 65535)	Encoder Lines	UINT	2		Sets or returns the number of lines on the motor encoder.
46		Max Motor Speed	UDINT	4	rpm/ 65536	Sets or returns the maximum safe operating speed of the motor. The maximum speed value is used to limit speed-related parameters.
47		Motor Cont Curr	UINT	2	Amps/ 128	Sets or returns the continuous current rating of the motor.
48		Motor Peak Curr				Sets or returns the peak current rating of the motor. The output current of the drive will be limited to or below this value. The drive limits the actual drive current to the minimum of this value, the peak rating of the drive, and the Forward Current Limit (+ILIMIT) and Reverse Current Limit (-ILIMIT) analog inputs.
49		Torque Const Kt			Nm/ Amp/ 4096	Sets or returns the sine wave torque constant (Kt) of the motor. The Kt value is used to automatically scale the loop gain of the velocity loop, so that gain settings are consistent for all drive / motor combinations. The autotune algorithm also uses the Kt value to estimate load inertia.
50		Rotor Inertia Jm			kg-cm2 / 64	Sets or returns the motor's rotor inertia (Jm) excluding the load. The Jm value is used to automatically scale the loop gain of the velocity loop, so that gain settings are consistent for all drive / motor combinations. The autotune algorithm also uses the Jm value to estimate load inertia.
51		Back EMF Cnst Ke			V/ krpm/ 256	Sets or returns the nominal back EMF constant (Ke) of the motor.
52		Winding Res			Ohms/ 256	Sets or returns the nominal phase to phase resistance of the motor winding. The resistance value is used by the current regulator to automatically scale its tuning parameters, and is critical to current regulation.
53		Winding Ind			mH/ 256	Sets or returns the phase to phase inductance of the motor windings.

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
54	Get/Set* (Set not supported if Motor ID is not equal to 65535)	Thermostat	USINT	1		Sets or returns the flag which indicates if the motor contains an overtemperature protection thermostat. If parameter set present, then the drive will generate a Motor Overtemp fault if the thermostat inputs to the drive are in an open state. 0 - Not Preset 1 - Preset
55		Commuta-tion Type				Sets or returns the commutation type of the motor. 0 - Induction Motor 1 - 6 step ABS/ Index 2 - 8 step ABS/ Index 3 - Hall/ Index 4 - Hall/ Hall
56	Get/Set	Thermal Protect				Sets or returns the flag which indicates if drive will use an I2T formula to generate a Motor Thermal Protection fault if the motor continuous current level is exceeded for a period of time. The Thermal Time Constant is used by the formula to protect the motor. 0 - Disable 1 - Enable (default)

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
57	Get/Set* (Set not supported if Motor ID is not equal to 65535)	Thermal Constant	UINT	2	Secs	Sets or returns the thermal time constant for protecting the motor. An estimate of the motor power dissipation, after filtering using the time constant value, will be compared against the continuous torque current capability of the motor. The thermal time constant of the motor is measured by stabilizing the motor temperature at its rated condition, disabling the drive, and measuring the time for the hottest part of the motor winding to drop 63% of the difference from ambient.
58		Pole Count	USINT	1		Sets or returns the number of poles in the motor. The pole count is used for commutation of the motor. 0 - 2 Poles 1 - 4 Poles 2 - 6 Poles 3 - 8 Poles
59		Hall Offset	UINT	2	Degs	Sets or returns the offset of the Hall-effect sensor alignment with respect to the motor windings. The Hall offset is defined as the location of the Hall signals with respect to the back-EMF signals of the motor. A Hall offset of zero degrees corresponds to the center of the A=1, B=1, C=0 state being located where the R-phase line-to-neutral back-EMF signal crosses zero.
60		Index Offset				Sets or returns the offset of the motor encoder index alignment with respect to the rotor. The index offset is defined as the location of the index pulse with respect to the back-EMF signals of the motor. An offset of zero degrees corresponds to the index being located where the R-phase line-to-neutral back-EMF signal crosses zero.
61		Motor Forwrd Dir	USINT	1		Sets or returns the motor's forward direction when viewed from the end of the shaft. 0 - Clockwise 1 - Counterclockwise

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
62	Get/Set	Dig Input 1 Cnfg	DWORD	4		Sets or returns which flag is (or flags are) controlled by digital input one. If no bits are set for an input, it is unassigned. The Digital Input list describes the available digital input assignments. Bit 0: Disable Serial communications Bit 16: Torque Override Bit 17: Integrator Inhibit Bit 18: Follower Enable Bit 19: Forward Enable Bit 20: Reverse Enable Bit 21: Operation Mode Override Bit 22: Preset Select Line A Bit 23: Preset Select Line B Bit 24: Preset Select Line C Bit 25: Start Index Bit 26: Define Home Bit 27: Registration (Not available with Parameters 62 and 64) Bit 28: Remove COMMAND Offset Bit 29: Start Homing Bit 30: Fault Reset The Preset Select lines can be used together or separately to select the desired preset. Unassigned Preset Select lines are set to 0. The select codes are as follows: Preset CBA 0 000 Bits 25, 26, 27, and 29 are 1 001 "Reserved" on Non-indexing 2 010 Drives. 3 011 4 100 5 101 6 110 7 111
63		Dig Input 2 Cnfg				
64		Dig Input 3 Cnfg				
65	Get	Reserved	USINT	1		

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
66	Get/Set	Flt Reset Config	WORD	2		Sets or returns the flags which are controlled by the Fault Reset digital input. If no bits are set for the input, it is unassigned. The Digital Input list describes the available digital input assignments. Sets or returns which flag is (or flags are) controlled by digital input one. If no bits are set for an input, it is unassigned. The Digital Input list describes the available digital input assignments. Bit 0: Torque Override Bit 1: Integrator Inhibit Bit 2: Follower Enable Bit 3: Forward Enable Bit 4: Reverse Enable Bit 5: Operations Mode Override Bit 6: Preset Select Line A Bit 7: Preset Select Line B Bit 8: Preset Select Line C Bit 9: Start Index Bit 10: Define Home Bit 11: Reserved Bit 12: Remove COMMAND Offset Bit 13: Start Homing Bit 14: Fault Reset The Preset Select lines can be used together or separately to select the desired preset. Unassigned Preset Select lines are set to 0. The select codes are as follows: Preset CBA 0 000 1 001 2 010 3 011 4 100 5 101 6 110 7 111 Bits 9, 10, and 13 are "Reserved" on non-indexing Drives.

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
67		Dig Outpt 1 Cnfg	DWORD	4		Sets or returns which flag is (or flags are) monitored on digital output. If no bits are set for an output, it is unassigned. The Digital Output list describes the available digital output assignments. Bit 0: At Home (Reserved on Non-indexing Drives) Bit 1: Sequence Complete (Reserved on Non-indexing Drives) Bit 2: In Motion (Reserved on Non-indexing Drives) Bit 3: In Dwell (Reserved on Non-indexing Drives) Bit 4: Registration Detected (Reserved on Non-indexing Drives) Bit 5: Axis Homed (Pertains to indexing Drives) Bit 16: In-Position Bit 17: Within Position Window Bit 18: Zero Speed Bit 19: Within Speed Window Bit 20: Positive ILimit Bit 21: Negative ILimit Bit 22: At Speed Bit 23: Drive Enabled Bit 24: DC Bus Charged Bit 25: Disabling Fault
68		Dig Outpt 2 Cnfg				
69	Get	Reserved	USINT	1		
70						

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
71	Get/Set	Brake On Delay	INT	2	mS	Sets or returns the time delay between enabling the drive, and activating the BRAKE output. Negative values indicate the time that the BRAKE is active before enabling the drive. Range: -32767 to +32767 Default: 0
72		Brake Off Delay				Sets or returns the time delay between disabling the drive, and deactivating the BRAKE output. Negative values indicate the time that the BRAKE is inactive before disabling the drive. Range: -32767 to +32767 Default: 0
73		Limit Anlg Accel	USINT	1		Sets or returns the flag which indicates that acceleration limits are enabled. This flag is only used while the drive is in velocity mode and the Command Source is set to analog COMMAND input. 0 - Disable (default) 1 - Enable
74		Anlg Accel Limit	UDINT	4	rpm/ sec	Sets or returns the acceleration value used when the analog COMMAND input changes. This limit is only used while the drive is in velocity mode and the Command Source is set to analog COMMAND input. Range: 0 to 0x7FFFFFFF Default: 2000
75		Anlg Decel Limit			rpm/ sec	Sets or returns the deceleration value used when the analog COMMAND input changes. This limit is only used while the drive is in velocity mode and the Command Source is set to analog COMMAND input. Range: 0 to 0x7FFFFFFF Default: 2000
76		Pos CMD In Offst	INT	2	mV	Sets or returns the offset applied to the COMMAND analog input when being used for position command. Range: -10000 to +10000
77		Pos CMD In Scale			Counts /Volt	Sets or returns the scale applied to the COMMAND analog input when being used for position command. Range: -32767 to +32767 Default: 1000
78		Vel CMD In Offst			mV	Sets or returns the offset applied to the COMMAND analog input when being used for velocity command. Range: -10000 to +10000 Default: 0
79		Vel CMD In Scale			% /100	Sets or returns the scale applied to the COMMAND analog input when being used for velocity command. The input scale is represented as a percentage of the Maximum Velocity COMMAND Input Scale. Range: -10000 to +10000 (-100% to 100%)

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
80	Get	MaxVel CMD Scale	UINT	2	rpm/V	Returns maximum scale for the Velocity COMMAND Input. Range: 1 to 32767
81	Get/Set	Tor CMD In Offst	INT		mV	Sets or returns the offset applied to the COMMAND analog input when being used for torque command. Range: -10000 to +10000 Default: 0
82		Tor CMD In Scale			% /100	Sets or returns the scale applied to the COMMAND analog input when being used for torque command. The input scale is represented as a percentage of the Maximum Torque COMMAND Input Scale. Range: -10000 to +10000
83	Get	MaxTrq CMD Scale	UINT		Amps/ V / 256	Returns maximum scale for the Torque COMMAND Input. Range: 1 to 32767
84	Get/Set	Anlg Out1 Cnfg	USINT	1		Sets or returns which drive signal is monitored on analog output one (1). The Drive Signal list describes the available analog output assignments. 00 Current Command 01 Current - Average Command 02 Current - Positive Peak 03 Current - Negative Peak 04 Positive ILimit 05 Negative ILimit 06 Motor Velocity 07 Velocity Command 08 Velocity Error 09 Motor Position OA (10) Position Command - Slewed OB (11) Position Error OC (12) Position - Peak Positive Error OD (13) Position - Peak Negative Error 14 (20) Master Position 15 (21) Position Loop Output 16 (22) Velocity Loop Output 17 (23) Filter Output 18 (24) Notch Output 19 (25) R Phase Current 1A (26) T Phase Current 1B (27) Torque Current 1C (28) Field Current 1D (29) Torque Voltage 1E (30) Field Voltage 1F (31) Command Analog Input 20 (32) Bus Voltage
85		Anlg Out1 Offset	INT	2	mV	Sets or returns the offset applied to Analog output one (1). Range: -10000 to +10000
86		Anlg Out1 Scale				Sets or returns the scale applied to the specified Analog output. Range: -32767 to +32767

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
87	Get	Reserved	USINT	1		
88						
89						
90	Get/Set	Analog Out Mode				Sets or returns the analog output override control flag to allow the user to write the outputs directly. 0 - Normal (default) 1 - Override
91		Anlg Out1 Ovride	INT	2	mV	Sets or returns the value to write to analog output one (1) when Analog Output Override is enabled. Range: -10000 to +10000
92	Get	Reserved	USINT	1		
93	Get/Set	Limit Preset Acc				Sets or returns the flag which indicates that acceleration limits are enabled. This flag is only used while the drive is in velocity mode and the Command Source is set to Preset input. 0 - Disable 1 - Enable (default)
94		Preset Acc Limit	UDINT	4	rpm/ sec	Sets or returns the acceleration value used when the preset velocity changes. This limit is only used while the drive is in velocity mode and the Command Source is set to Preset input. The Preset Acceleration Limit is not used in the drive if the Limit Preset Acceleration parameter is disabled. Range: 0 to 0x7FFFFFFF Default: 500
95		Preset Dec Limit				Sets or returns the deceleration value used when the preset velocity changes. This limit is only used while the drive is in velocity mode and the Command Source is set to Preset input. The Preset Deceleration Limit is not used in the drive if the Limit Preset Acceleration parameter is disabled. Range: 0 to 0x7FFFFFFF Default: 500
96	Get/Set	Vel Preset 0	DINT	4	rpm/ 65536	Sets or returns the command velocity level used when the drive is configured with Presets as the Command Source and Velocity as the Drive Mode. A particular velocity preset is selected via the Preset Select Digital Inputs. Range: 0x80000001 to 0x7FFFFFFF (-32768 to +32768 rpm) Default: 0
97		Vel Preset 1				
98		Vel Preset 2				
99		Vel Preset 3				
100		Vel Preset 4				
101		Vel Preset 5				
102		Vel Preset 6				
103		Vel Preset 7				

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
104	Get/Set	Torque Preset 0	INT	2	Amps/ 128	Sets or returns the command torque level used when the drive is configured with Presets as the Command Source, and Torque as the Drive Mode. A particular torque preset is selected via the Preset Select Digital Inputs. Range: 0x8001 to 0x7FFF (-256 to +256 Amps) Default: 0
105		Torque Preset 1				
106		Torque Preset 2				
107		Torque Preset 3				
108		Torque Preset 4				
109		Torque Preset 5				
110		Torque Preset 6				
111		Torque Preset 7				
112		Command Source	USINT	1		Sets or returns the signal used for the drive's command source. Only certain combinations of Command Source and Drive Mode are valid. 00 - Analog COMMAND Input (default) 01 - Presets 02 - Master Encoder 03 - Step/Direction 04 - Step+/ Step- 05 - Indexing (Indexing Drive only) 06 - Analog Position (Indexing Drive only)
113		Drive Mode				Sets or returns the flag which indicates if the velocity control loop is active. Certain Command Sources require the velocity loop to be active in order to properly execute. 0 - Velocity (default) 1 - Torque
114		Override Cmd Src				Sets or returns the command source which is selected when the Override Drive Mode Select digital input is set active. Only certain combinations of Override Command Source and Override Drive Mode are valid. If the drive's configured Command Source is set to a following mode (Master Encoder, Step/Direction, or Step+/Step-), the Override command source should not be set to a different following mode or unexpected results may occur. 00 - Analog COMMAND Input (default) 01 - Presets 02 - Master Encoder 03 - Step/Direction 04 - Step+/ Step- 05 - Indexing (Indexing Drive only) 06 - Analog Position (Indexing Drive only)

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
115	Get/Set	Overide Drv Mode	USINT	1		Sets or returns the flag which indicates if the velocity control loop is active when the Override Drive Mode Select digital input is set active. Certain Override Command Sources require the velocity loop to be active in order to properly execute. 0 - Velocity (default) 1 - Torque
116		Enc Outpt Config				Sets or returns the divisor for the motor encoder quadrature output. 0 - Divide by 1 (default) 1 - Divide by 2 2 - Divide by 4 3 - Divide by 8
117		Change Direction				Sets or returns the flag which indicates if the normal direction has been changed (reversed). 0 - Normal (default) 1 - Reversed
118		Tuning/ Oper Mode				Sets or returns the operating mode for the drive. Usually, the drive is in Normal mode. However, the mode can be changed for tuning. 0 - Normal (default) 1 - AutoTune 2 - Manual tuning - Velocity 3 - Manual Tuning - Position

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
119	Get	Tuning Status	WORD	2		Returns the status bits for the various operating modes. Bit 0 - AutoTune Complete Bit 1 - Encoder Alignment Complete Bit 2 - Motor Index Detected Bit 3 - Master Index Detected Bit 4 - Motor Encoder Resolution Determined Bit 5 - Master Encoder Resolution Determined Bit 6 - AutoTune Failed
120	Get/Set	Autotune Max Cur	UINT		Amps/ 128	Sets or returns the maximum current used in the AutoTune algorithm. Range: 1 to 32767
121		Autotune Max Dis	UDINT	4	Cnts	Sets or returns the maximum distance the motor can travel in the AutoTune algorithm. Range: 1 to 0x7FFFFFFF Default: 800000
122		MTune Pos Period	UINT	2	mS	Sets or returns the period of the square wave used in the position step manual tuning mode. Range: 1 to 32767 Default: 400
123		ManTune Pos Step			Cnts	Sets or returns the amplitude of the square wave used in the position step manual tuning mode. Range: 1 to 32767 Default: 400
124		MTune Vel Period			mS	Sets or returns the period of the square wave used in the velocity step manual tuning mode. Range: 1 to 32767 Default: 400
125		ManTune Vel Step	UDINT	4	rpm/ 65536	Sets or returns the amplitude of the square wave used in the velocity step manual tuning mode. Range: 0 to 0x7FFFFFFF Default: 0xC80000 (200 rpm)
126		Tuning Direction	USINT	1		Sets or returns the flag which indicates the direction the motor rotates during tuning. 0 - Bi-directional (default) 1 - Forward 2 - Reverse

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
127	Get	Drive Status	DWORD	4		Returns the status of various flags in the drive. Bit 0 - In-Position Bit 1 - Within Position Window Bit 2 - Zero Speed Bit 3 - Within Velocity Window Bit 4 - Positive ILimit Bit 5 - Negative ILimit Bit 6 - At Speed Bit 7 - Drive Enabled Bit 8 - DC Bus Charged Bit 9 - Fault Disable Bit 14 - Brake Active Bit 15 - Drive Ready Bit 16 - Torque Override Bit 17 - Integrator Inhibit Bit 18 - Follower Enable Bit 19 - Forward Clamp Bit 20 - Reverse Clamp Bit 21 - Operation Mode Override Bit 22 - Preset Select A Bit 23 - Preset Select B Bit 24 - Preset Select C Bit 25 - Start Index Bit 26 - Define Home Bit 27 - Registration Bit 28 - Remove CMD offset Bit 29 - Start Homing Bit 30 - Fault Reset Bit 31 - Enable Active

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
128	Get	Fault Status	DWORD	4		Returns the present state of the possible fault conditions. Bit 0 - +24V fuse blown Bit 1 - +5V fuse blown Bit 2 - Encoder fuse blown Bit 3 - Motor Overtemperature, Thermostat Bit 4 - IPM Fault (Overtemperature / Overcurrent / Short Circuit) Bit 5 - Channel IM Line Break Bit 6 - Channel BM Line Break Bit 7 - Channel AM Line Break Bit 8 - Bus Undervoltage Bit 9 - Bus Overvoltage Bit 10 - Illegal Hall State Bit 11 - Sub processor Unused Interrupt Bit 12 - Main processor Unused Interrupt Bit 13 - DeviceNet Communication Fault Bit 16 - Excessive Average Current Bit 17 - Motor Overspeed Bit 18 - Excessive Following Error Bit 19 - Motor Encoder State Error Bit 20 - Master Encoder State Error Bit 21 - Motor Thermal Protection Bit 22 - IPM Thermal Protection Bit 23 - Excess Velocity Error Bit 24 - Commutation Angle Error Bit 26 - Axis Not Homed Bit 27 - Enabled with No Motor Selected Bit 28 - Invalid Motor Selected Bit 31 - CPU Communications Error

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
129	Get	Output Status	DWORD	4		Returns the expanded output status. Bit 0 - At Home (Indexing Drives only) Bit 1 - Sequence Complete (Indexing Drives only) Bit 2 - In Motion (Indexing Drives only) Bit 3 - In Dwell (Indexing Drives only) Bit 4 - Registration Detected (Indexing Drives only) Bit 5 - Axis Homed (Indexing Drives only) Bit 16 - In-Position Bit 17 - Within Position Window Bit 18 - Zero Speed Bit 19 - Within Velocity Window Bit 20 - Positive ILimit Bit 21 - Negative ILimit Bit 22 - At Speed Bit 23 - Drive Enabled Bit 24 - DC Bus Charged Bit 25 - Fault Disable Bit 30 - Brake Active Bit 31 - Drive Ready
130		Dig Input States	WORD	2		Returns the present state of the digital inputs. Bit 0 - RESET FAULTS Input State Bit 1 - ENABLE Input State Bit 2 - INPUT1 Input State Bit 3 - INPUT2 Input State Bit 4 - INPUT3 Input State
131		Dig Outpt States				Returns the present state of the digital outputs. Bit 0 - READY Output State Bit 1 - BRAKE Output State Bit 2 - OUTPUT1 Output State Bit 3 - OUTPUT2 Output State
132		Analog CMD Input	INT		mV	Returns the analog COMMAND input value before the scale and offset are applied. Range: -10000 to +10000
133		+ILimit Inpt Val			Amps/ 128	Returns the +ILIMIT input value.
134		-ILimit Inpt Val			Amps/ 128	Returns the -ILIMIT input value.
135		Analog Output 1			mV	Returns analog output value one (1). Range: -10000 to +10000
136		Reserved	USINT	1		

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
137	Get	Motor Position	DINT	4	Cnts	Returns the value of the motor encoder register.
138		Master Position				Returns the value of the master input register.
139		Position Command				Returns the position command input to the position loop, which is the master position, after gearing and slew rate limiting.
140		Position Error				Returns the difference between the Position Command and the Motor Position.
141		Peak +Pos Error				Returns the maximum amount the Motor Position lagged the Position Command.
142		Peak -Pos Error				Returns the maximum amount the Position Command lagged the Motor Position.
143		Velocity Command			rpm/ 65536	Returns the command value to the velocity loop.
144		Motor Velocity				Returns the feedback value to the velocity loop.
145		Velocity Error				Returns the difference between Velocity Command and Motor Velocity.
146		Current Command	INT	2	Amps/ 128	Returns the output of the velocity loop after filtering and current limiting.
147		Average Current				Returns the average output of the velocity control loop after filtering and current limiting.
148		Pos Peak Current				Returns the positive peak output of the velocity control loop.
149		Neg Peak Current				Returns the negative peak output of the velocity control loop.
150		DC Bus Voltage	UINT		Volts	Returns the measured voltage of the DC bus.
151		Field Current	INT		Amps/ 128	Returns the actual field-producing current of the motor.
152		Torque Current				Returns the actual torque-producing current of the motor.
153		R-Phase Current				Returns the current in the R-phase of the motor.
154		T-Phase Current				Returns the current in the T-phase of the motor.
155		Field Voltage			Volts/ 128	Returns the field-producing voltage of the motor.
156		Torque Voltage				Returns the torque-producing voltage of the motor.

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
157	GET	Motor Thermal Filter	INT	2	% / 128	Returns the output of the motor thermal protection filter. If Parameter 56 - Thermal Protect is enabled, the drive will fault when the filter output reaches 12800 (100%).
158		Reserved	USINT	1		
159		Fault History 1				Parameters 159 to 168 returns the most recent faults detected in the drive. Fault History 1 is the most recent and 10 is the least recent. Valuefault number Hex (Dec) 00 No Fault 01 +24VDC Fuse Blown 02 +5VDC Fuse Blown 03 Encoder Power Fuse Blown 04 Motor Overtemperature, Thermostat 05 IPM Fault (Overtemperature / Overcurrent / Short Circuit) 06 Channel IM Line Break 07 Channel BM Line Break 08 Channel AM Line Break 09 Bus Undervoltage 0A (10) Bus Overvoltage 0B (11) Illegal Hall State 0D (13) Main processor Unused Interrupt 0E (14) DeviceNet Communication Fault 11 (17) Excessive Average Current 12 (18) Motor Overspeed 13 (19) Excessive Following Error 14 (20) Motor Encoder State Error 15 (21) Master Encoder State Error 16 (22) Motor Thermal Protection 17 (23) IPM Thermal Protection 18 (24) Excess Velocity Error 19 (25) Commutation Angle Error 1B (27) Axis not Homed 1C (28) Enabled with No Motor Selected 1D (29) Motor Selection not in Table 1E (30) Personality Write Error 1F (31) Service Write Error 20 (32) CPU Communications Error 33 (51) Program Memory Boot Block Error 34 (52) Program Memory Main Block Error 35 (53) Uninitialized Personality EEPROM Error 36 (54) Personality EEPROM Read Error 37 (55) Personality EEPROM Data Corruption Error 38 (56) Main Processor Watchdog Error 3A (58) Main Processor RAM Error
160		Fault History 2				
161		Fault History 3				
162		Fault History 4				
163		Fault History 5				
164		Fault History 6				
165		Fault History 7				
166		Fault History 8				
167		Fault History 9				
168		Fault History 10				

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
168 continued	GET	Fault History 10	USINT	1		3C (60) Uninitialized Service EEPROM Error 3D (61) Service EEPROM Read Error 3E (62) Service EEPROM Data Corruption Error 3F (63) Main Processor A/D Converter Error 41 (65) ANALOG1 Output Error 42 (66) Gate Array Error 4A (74) Personality EEPROM Write Error 4B (75) Service EEPROM Write Error 4C (76) Software Clock Error 4E (78) Sine Table Generation Error 4F (79) Personality Data Out Of Range 50 (80) Service Data Out Of Range 51 (81) Motor Block Checksum Error 52 (82) Mask ROM Checksum Error 53 (83) Personality EEPROM Mismatch 54 (84) Service EEPROM Mismatch 57 (87) Option Board Boot Block Error 58 (88) Option Board Main Block Error 59 (89) Option Board Interface Incompatibility- Upgrade Option Board Firmware 5A (90) Option Board Interface Incompatibility- Upgrade Drive Firmware 5B (91) Option Board Vendor Identification Not Initialized 5C (92) DeviceNet(TM) Serial Number Not Initialized 5D (93) Option Board NVMEM Error 5E (94) Option Board Dual Port Error
169	Get/Set	Host Contrl Mode	USINT	1		Sets or returns the host drive enable flag. If set to Enable Drive and the ENABLE input is active, the drive is enabled. If set to Disable Drive or the ENABLE input is not active, the drive is disabled. By default, the "Host Control Mode" is enabled. If the drive is disabled and the drive is reset or power cycled, the "Host Control Mode" is re-enabled. 0 - Disable 1 - Enable (default)

The “Host Contrl Mode” parameter allows the user to enable/disable the drive. In addition, the drive has to be enabled via a hardware digital input or/ and DeviceNet Logic Command for the drive to be enabled. By default, the “Host Contrl Mode” is enabled. If the drive is disabled and the drive is reset or power cycled, the “Host Contrl Mode” is re-enabled. Most of the “Command” parameters 169-181 are intended for initial start up of the drive or for debugging the drive and application.

ATTENTION

Do not assume that a device will be permanently disabled via the “Host Contrl Mode” parameter.

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
170	Get/Set	Host Setpnt Ctrl	USINT	1		Sets or returns the setpoint control enable flag. If Host Setpoint Control is enabled, then command input specified by Command Source (or Override Command Source) is overridden. The drive will use the Host Velocity Setpoint if the drive mode (Drive Mode / Override Drive Mode) is Velocity. Otherwise, the drive will use the Host Torque Setpoint. 0 - Disable (default) 1 - Enable
171		Host Index Cntr/ (indexing Drive) Reserved (non-indexing Drive)				Sets or returns the host indexing control enable flag. When the flag is active, the drive is in host indexing mode (with the velocity loop active). Host Index selects the active index number. Drive Mode, Command Source, Override Drive Mode, and Override Command Source are bypassed in the drive.\0 - 0 0 - Disable (default) 1 - Enable
172		Host Vel Setpnt	DINT	4	rpm/ 65536	Sets or returns the velocity command value used when the drive mode (Drive Mode / Override Drive Mode) is Velocity, and the Host Setpoint Control is Enabled. Range: 0x80000001 to 0x7FFFFFFF Default: 0
173		Host Torq Setpnt	INT	2	Amps/ 128	Sets or returns the torque command value used when the drive mode (Drive Mode / Override Drive Mode) is Torque, and the Host Setpoint Control is Enabled. Range: -32767 to 32767 Default: 0
174		Host Acc Setpnt	UDINT	4	rpm/ sec	Sets or returns the acceleration value used when the Host Velocity Setpoint changes, and the Host Setpoint Control is Enabled. Range: 0 to 0x7FFFFFFF Default: 2000
175		Reset Personalty	USINT	1		Resets the personality EEPROM to its factory default settings. 0 - No action (default) 1 - Reset
176		Reset Drive				Resets the drive hardware and reboots the drive's processors. 0 - No action (default) 1 - Reset
177		Reset Faults				Resets the fault detection circuitry. 0 - No action (default) 1 - Reset
178	Get/Set	Reset I Peaks	USINT	1		Resets the peak detection firmware for positive peak position error, negative peak position error, positive peak current, and negative peak current. 0 - No action (default) 1 - Reset

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
Additional parameters for Non-indexing and Indexing Drives are listed in the "New Parameter" table. Refer to New Parameters on page D-58. The following Parameter Instances are only implemented in Indexing Drives.						
179	Get/Set	Start Index Cmd	USINT	1		Starts executing the selected index. An error is returned if the drive is not in a mode to accept it (Host Index Control Mode or configured as a Command Source). An error is also returned if an index is already executing. 0 - No action (default) 1 - Execute Command
180		Start Homing Cmd				Initiates the homing sequence. 0 - No action (default) 1 - Execute Command
181		Host Index				Sets or returns the index which is selected for execution when Host Index Control is enabled. 00 - Index 0 01 - Index 1 02 - Index 2 03 - Index 3 04 - Index 4 05 - Index 5 06 - Index 6 07 - Index 7 08 - RAM Index
182		Homing Velocity	DINT	4	rpm/ 65536	Sets or returns the velocity used for homing. The sign of the velocity specifies the direction of motion during homing. Range: 0x80000001 to 0x7FFFFFFF Default: 0x1F740000 (500 rpm)
183		Homing Accel/Dec	UDINT		rpm/ sec	Sets or returns the acceleration and deceleration used for homing. Range: 1 to 0x7FFFFFFF Default: 500
184		Home Offset Move	DINT		Cnts	Sets or returns the offset move distance for homing. The offset move distance specifies how far the axis will be from the marker (or sensor for Home to Sensor) after the homing procedure is complete. Range: 0x80000001 to 0x7FFFFFFF Default: 0
185		Home Position				Sets or returns the home position. This value is used as the home position when the Define Home input is activated, or at the completion of a homing procedure. Range: 0x80000001 to 0x7FFFFFFF Default: 0

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
186	Get/Set	Homing Type	USINT	1		Sets or returns the homing type. 00 - Home to sensor / then forward to marker 01 - Home to marker 02 - Home to sensor 03 - Home to sensor / then backward to marker
187		Auto-Start Home				Sets or returns the Auto-start homing flag. When the flag is active, the drive will begin executing the homing procedure on the activation of the Enable input. 0 - Disable Auto-start Homing (default) 1 - Enable Auto-start Homing After Reset Only 2 - Enable Auto-start Homing
188		Home Sens Bckoff				Sets or returns the Home Sensor Back-off flag. When the flag is active, Home Sensor Back-off allows the drive to start motion in the direction opposite that specified by the Homing Velocity, in case the homing procedure is started with the Sensor input active. Motion will continue in the reverse direction (adhering to the homing acceleration, deceleration, and velocity), until the Sensor input is detected inactive, at which point the normal homing procedure will take over. This capability does not apply if Home to Marker is selected as the homing type. 00 - Disable Home Sensor Back-off flag 01 - Enable Home Sensor Back-off flag (default)
189		Homing Creep Vel	UDINT	4	rpm/ 65536	Sets or returns the "creep" velocity used for homing. This velocity is only used in the "Home to sensor then back to marker" home type. The parameter represents the absolute value of the velocity used to search for the marker after the sensor is found, and the direction of motion is reversed. The homing direction is determined by the home velocity parameter. Range: 0 to 0x7FFFFFFF Default: 0x140000 (20 rpm)
190	Get	Selected Index	USINT	1		Returns the number of the selected index. 0 - Index 0 1 - Index 1 2 - Index 2 3 - Index 3 4 - Index 4 5 - Index 5 6 - Index 6 7 - Index 7 8 - RAM Index
191		Index Count	UINT	2		Returns the remaining iterations of the selected index.

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
192	Get/Set	Auto-Start Index	USINT	1		Sets or returns the Auto-start indexing flag. When the flag is active, the drive will begin executing the selected index on the activation of the Enable input. 0 - Disable (default) 1 - Enable
193		Index 0 Type				Sets or returns the type of index. Parameter 193 - Index 0 Type Parameter 194 - Index 1 Type Parameter 195 - Index 2 Type Parameter 196 - Index 3 Type Parameter 197 - Index 4 Type Parameter 198 - Index 5 Type Parameter 199 - Index 6 Type Parameter 200 - Index 7 Type Parameter 201 - RAM Index Type 0 - Incremental (default) 1 - Absolute 2 - Registration
194		Index 1 Type				
195		Index 2 Type				
196		Index 3 Type				
197		Index 4 Type				
198		Index 5 Type				
199		Index 6 Type				
200		Index 7 Type				
201		RAM Index Type				

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
202	Get/Set	Index 0 Dist/Pos	DINT	4	Cnts	Sets or returns the distance or position the motor will travel (to) for an index. Parameter 202 - Index 0 Distance/Position Parameter 203 - Index 1 Distance/Position Parameter 204 - Index 2 Distance/Position Parameter 205 - Index 3 Distance/Position Parameter 206 - Index 4 Distance/Position Parameter 207 - Index 5 Distance/Position Parameter 208 - Index 6 Distance/Position Parameter 209 - Index 7 Distance/Position Parameter 210 - RAM Index Distance/Position Range: 0x80000001 to 0x7FFFFFFF Default: 0
203		Index 1 Dist/Pos				
204		Index 2 Dist/Pos				
205		Index 3 Dist/Pos				
206		Index 4 Dist/Pos				
207		Index 5 Dist/Pos				
208		Index 6 Dist/Pos				
209		Index 7 Dist/Pos	DINT			
210		RAM Idx Dist/Pos				
211		Index 0 Reg Dist	UDINT			Sets or returns the distance the motor will travel after detecting the registration input for an index. Parameter 211 - Index 0 Registration Distance Parameter 212 - Index 1 Registration Distance Parameter 213 - Index 2 Registration Distance Parameter 214 - Index 3 Registration Distance Parameter 215 - Index 4 Registration Distance Parameter 216 - Index 5 Registration Distance Parameter 217 - Index 6 Registration Distance Parameter 218 - Index 7 Registration Distance Parameter 219 - RAM Index Registration Distance Range: 0 to 0x7FFFFFFF Default: 0
212		Index 1 Reg Dist				
213		Index 2 Reg Dist				
214		Index 3 Reg Dist				
215		Index 4 Reg Dist				
216		Index 5 Reg Dist				
217		Index 6 Reg Dist				
218		Index 7 Reg Dist				
219		RAM Idx Reg Dist				

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
220	Get/Set	Index 0 Velocity	UDINT	4	rpm/ 65536	Sets or returns the velocity used for an index. Parameter 220 - Index 0 Velocity Parameter 221 - Index 1 Velocity Parameter 222 - Index 2 Velocity Parameter 223 - Index 3 Velocity Parameter 224 - Index 4 Velocity Parameter 225 - Index 5 Velocity Parameter 226 - Index 6 Velocity Parameter 227 - Index 7 Velocity Parameter 228 - RAM Index Velocity Range: 0 to 0x7FFFFFFF Default: 0x1F40000 (500 rpm)
221		Index 1 Velocity				
222		Index 2 Velocity				
223		Index 3 Velocity				
224		Index 4 Velocity				
225		Index 5 Velocity				
226		Index 6 Velocity				
227		Index 7 Velocity				
228		RAM Idx Velocity				
229		Index 0 Accel			rpm/ sec	Sets or returns the acceleration used for an index. Parameter 229 - Index 0 Acceleration Parameter 230 - Index 1 Acceleration Parameter 231 - Index 2 Acceleration Parameter 232 - Index 3 Acceleration Parameter 233 - Index 4 Acceleration Parameter 234 - Index 5 Acceleration Parameter 235 - Index 6 Acceleration Parameter 236 - Index 7 Acceleration Parameter 237 - RAM Index Acceleration Range: 1 to 0x7FFFFFFF Default: 500
230		Index 1 Accel				
231		Index 2 Accel				
232		Index 3 Accel				
233		Index 4 Accel				
234		Index 5 Accel				
235		Index 6 Accel				
236		Index 7 Accel				
237		RAM Index Accel				

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
238	Get/Set	Index 0 Decel	UDINT	4	rpm/ sec	Sets or returns the deceleration used for an index. Parameter 238 - Index 0 Deceleration Parameter 239 - Index 1 Deceleration Parameter 240 - Index 2 Deceleration Parameter 241 - Index 3 Deceleration Parameter 242 - Index 4 Deceleration Parameter 243 - Index 5 Deceleration Parameter 244 - Index 6 Deceleration Parameter 245 - Index 7 Deceleration Parameter 246 - RAM Index Deceleration Range: 1 to 0x7FFFFFFF Default: 500
239		Index 1 Decel				
240		Index 2 Decel				
241		Index 3 Decel				
242		Index 4 Decel				
243		Index 5 Decel				
244		Index 6 Decel				
245		Index 7 Decel				
246		RAM Index Decel				
247		Index 0 Dwell	UINT	2	mS	Sets or returns the dwell time used for an index. Parameter 247 - Index 0 Dwell Parameter 248 - Index 1 Dwell Parameter 249 - Index 2 Dwell Parameter 250 - Index 3 Dwell Parameter 251 - Index 4 Dwell Parameter 252 - Index 5 Dwell Parameter 253 - Index 6 Dwell Parameter 254 - Index 7 Dwell Parameter 255 - RAM Index Dwell Range: 0 to 65535 Default: 0
248		Index 1 Dwell				
249		Index 2 Dwell				
250		Index 3 Dwell				
251		Index 4 Dwell				
252		Index 5 Dwell				
253		Index 6 Dwell				
254		Index 7 Dwell				
255		RAM Index Dwell				

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
256	Get/Set	Index 0 Count	UINT	2		Sets or returns the batch count used for the index. Parameter 256 - Index 0 Count Parameter 257 - Index 1 Count Parameter 258 - Index 2 Count Parameter 259 - Index 3 Count Parameter 260 - Index 4 Count Parameter 261 - Index 5 Count Parameter 262 - Index 6 Count Parameter 263 - Index 7 Count Parameter 264 - RAM Index Count Range: 0 to 65535 Default: 1
257		Index 1 Count				
258		Index 2 Count				
259		Index 3 Count				
260		Index 4 Count				
261		Index 5 Count				
262		Index 6 Count				
263		Index 7 Count				
264		RAM Index Count				

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
265	Get/Set	Index 0 Terminat	USINT	1		Sets or returns the termination instruction for an index. Parameter 265 - Index 0 Termination Parameter 266 - Index 1 Termination Parameter 267 - Index 2 Termination Parameter 268 - Index 3 Termination Parameter 269 - Index 4 Termination Parameter 270 - Index 5 Termination Parameter 271 - Index 6 Termination Parameter 272 - Index 7 Termination Parameter 273 - RAM Index Termination 0 - Stop (default) 1 - Start another index immediately 2 - Start another index at next Start Index transition
266		Index 1 Terminat				
267		Index 2 Terminat				
268		Index 3 Terminat				
269		Index 4 Terminat				
270		Index 5 Terminat				
271		Index 6 Terminat				
272		Index 7 Terminat				
273		RAM Idx Terminat				
274		Index 0 Pointer				Sets or returns the index number to be executed when another index terminates. Parameter 274 - Index 0 Pointer Parameter 275 - Index 1 Pointer Parameter 276 - Index 2 Pointer Parameter 277 - Index 3 Pointer Parameter 278 - Index 4 Pointer Parameter 279 - Index 5 Pointer Parameter 280 - Index 6 Pointer Parameter 281 - Index 7 Pointer Parameter 282 - RAM Index Pointer 0 - Index 0 (default) 1 - Index 1 2 - Index 2 3 - Index 3 4 - Index 4 5 - Index 5 6 - Index 6 7 - Index 7 8 - RAM Index
275		Index 1 Pointer				
276		Index 2 Pointer				
277		Index 3 Pointer				
278		Index 4 Pointer				
279		Index 5 Pointer				
280		Index 6 Pointer				
281		Index 7 Pointer				
282		RAM Idx Pointer				
New Parameters: See the next table for more detailed information. These parameters are numbered 179 to 185 in non-indexing drives.						
283	Get/Set	DNet I/O Format	USINT	1		
284		Idle Flt Action				

**Parameter Object,
Instances ID 1-289 (Continued)**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units/ Scale	Command Description
285	Get/Set	Comm Flt Action	USINT	1		
286		Fault Cfg Logic	WORD	2		
287		Logic Cmd Mask				
288		I/O Logic Cmd				
289		Enable behavior	USINT	1		

* Set_Attribute service not supported if Parameter Instance 11 - Motor ID is not equal to 65535

New Parameters

The following table provides information on the new parameters recently added to the firmware. Two parameter numbers are listed in each row. The first parameter number corresponds to the indexing version of the drive and the second number within parenthesis corresponds to the non-indexing version of the drive.

# Index (#)non-Index	Access Rule	Parameter Name	Data Type	Data Size (bytes)	Units/ Scale	Command Description
283 (179)	Get/Set	DNet I/O Format	USINT	1		Selects the command and response assemblies to be used with polled I/O. Also, selects the command assembly to be used with change of state and cyclic I/O. If the value is modified, the user has to either power cycle the drive, reset the drive, or remove and reapply DeviceNet power for the drive to use the modified value. 0 - Type 1 (default) 1 - Type 2 2 - Type 3 3 - Type 4
284 (180)		Idle Flt Action		1		Determines the action the drive should take if the drive detects that the PLC is set to program mode. No action is taken if DNet I/O Format is set to Type 1. 0 - Fault/ Zero Data (default) 1 - Fault/ Hold Last 2 - Zero data 3 - Hold Last 4 - Fault Configuration

ATTENTION

If you change this parameter's value, the user application may not be able to control the product after a fault.

Risk of severe bodily injury or equipment damage exists. The "Idle Flt Action" parameter allows the user to change the default configuration that would allow the module and associated drive to continue to operate if communication is lost.

Precautions should be taken to assure that your settings for these parameters and your application do not create bodily injury or equipment damage. Refer to Using the Fault Configured Input on page D-61.

285 (181)		Comm Flt Action	USINT	1		Determines the action the Drive should take if the Drive detects a network failure. No action is taken if DN Poll I/O Type is set to Type 1. 0 - Fault/Zero Data (default 1 - Fault/Hold Last 2 - Zero Data 3 - Hold Last 4 - Fault Config

# Index (#)non-Index	Access Rule	Parameter Name	Data Type	Data Size (bytes)	Units/ Scale	Command Description
ATTENTION 			If you change this parameter's value, the user application may not be able to control the product after a fault. Risk of severe bodily injury or equipment damage exists. The "Comm Flt Action" parameter allows the user to change the default configuration that would allow the module and associated drive to continue to operate if communication is lost. Precautions should be taken to assure that your settings for these parameters and your application do not create a hazard of bodily injury or equipment damage. See "Using the Fault Configured Input" on page 61.			
286 (182)		Fault Cfg Logic	WORD	2		Provides the logic command data to the drive when drive is instructed to use the value from the Fault Cfg Logic parameter. Refer to the Logic Command field in the output (command) assemblies for the bit definition. Bit 0 = Torque Override Bit 1 = Integrator Inhibit Bit 2 = Follower Enable Bit 3 = Reserved Bit 4 = Reserved Bit 5 = Operation Mode Override Bit 6 = Preset Select A Bit 7 = Preset Select B Bit 8 = Preset Select C Bit 9 = Start Index Bit 10 = Define Home Bit 11 = Disable Serial Bit 12 = Remove Command Offset Bit 13 = Start Homing Bit 14 = Fault Reset Bit 15 = Enable Default: 0x0000
IMPORTANT			The Fault Cfg Logic will not affect those bits that have been masked off by the Logic Mask parameter, otherwise the unmasked Fault Cfg Logic bits are 'OR'ed with the corresponding hardware inputs. The Enable bit may be configured to be 'OR'ed or 'And'ed with the hardware Enable input.			

# Index (#)non-Index	Access Rule	Parameter Name	Data Type	Data Size (bytes)	Units/ Scale	Command Description
287 (183)		Logic Cmd Mask	WORD	2		Used to mask off certain logic command bits from DeviceNet polled, cyclic, and change of state I/O messages. The logic mask can not be modified while the ULTRA 100 is enabled. Refer to the Logic Command field in the output (command) assemblies for the bit definition. Bit 0 = Torque Override Bit 1 = Integrator Inhibit Bit 2 = Follower Enable Bit 3 = Reserved Bit 4 = Reserved Bit 5 = Operation Mode Override Bit 6 = Preset Select A Bit 7 = Preset Select B Bit 8 = Preset Select C Bit 9 = Start Index Bit 10 = Define Home Bit 11 = Disable Serial Bit 12 = Remove Command Offset Bit 13 = Start Homing Bit 14 = Fault Reset Bit 15 = Enable Default: 0x0000
288 (184)		I/O Logic Cmd				The logic command being used by the drive. Any bits masked off by the Logic Cmd Mask will be clear (0). Refer to the Logic Command field in the output (command) assemblies for the bit definition. Bit 0 = Torque Override Bit 1 = Integrator Inhibit Bit 2 = Follower Enable Bit 3 = Reserved Bit 4 = Reserved Bit 5 = Operation Mode Override Bit 6 = Preset Select A Bit 7 = Preset Select B Bit 8 = Preset Select C Bit 9 = Start Index Bit 10 = Define Home Bit 11 = Disable Serial Bit 12 = Remove Command Offset Bit 13 = Start Homing Bit 14 = Fault Reset Bit 15 = Enable
289 (185)		Enable Behavior	USINT	1		Used to determine if the drive can be enabled with either the DeviceNet enable or hardware enable; or if both enables are required. 0 - Hardware OR DNet Input (default) 1 - Hardware AND DNet Input

Using the Fault Configured Input

You can select a constant value for the logic command in the event of a controller (scanner) mode change or error. This constant value is referred to as Fault Configured input. When the controller is placed in program mode or a DeviceNet network fault occurs, the logic command to the drive can be set to automatically switch to the constant value set in the Fault Cfg Logic parameter.

If you intend to use the Fault Configured Input, you must do the following:

1. Set the desire value for the Fault Cfg Logic parameter.
2. Set the Idle Flt Action parameter and/or the Comm Flt Action parameter to Fault Cfg.

Parameter Object
Attributes for Instance ID = 1 - 289

Attr ID	Access Rule	Stub/ Full	Name	Data Type	Description
1	①	Stub	Parameter Value	Data type specified in Descriptor, Data type and Data Size	Actual value of parameter. It can be read from or written to. This attribute is read-only if bit 4 of Attribute #4 is TRUE.
2	Get		Link Path Size	USINT	Size of Link Path attribute. If this attribute is 0, then no link is specified. Number of BYTEs in attribute 3.
3			Link Path	ARRAY of path segments	Path to the object from where this parameter value is retrieved. The link path is limited to 255 BYTEs.
			Segment type/port	BYTE	
			Segment Address	Path (format depends on data contained in segment type/port)	
4			Descriptor	WORD	Descriptor of parameter. "Parameter Object Bit Definitions for Instance Attribute 4" on page 63
5			Data Type	USINT	Data type code. "Parameter Object Data Types for Instance Attribute 5" on page 63
6			Data Size	USINT	Number of BYTEs in attribute 1, Parameter Value

Parameter Object
Attributes for Instance ID = 1 - 289 (Continued)

Attr ID	Access Rule	Stub/ Full	Name	Data Type	Description
7	Get	Full	Parameter Name	SHORT_ STRING	A human readable string representing the parameter name. For example, "Vel Loop P-Gain" The maximum number of characters is 16. (The first byte is a length code.)
8			Units String		Engineering unit string. The maximum number of characters is 4. (The first byte is a length code.)
9					The maximum number of characters is 64. (The first byte is a length code.) Always returns 0.
10			Minimum Value	Same as attribute 1	The minimum valid actual value to which attribute 1, Parameter Value can be set.
11			Maximum Value		The maximum valid actual value to which attribute 1, Parameter Value can be set
12			Default Value		The actual value attribute 1, Parameter Value should be set to when the user wants the default for the parameter.
13			Scaling Multiplier	UINT	Multiplier for scaling formula
14			Scaling Divisor		Divisor for scaling formula
15			Scaling Base		Base for scaling formula
16			Scaling Offset		Offset for scaling formula
17			Multiplier Link		Parameter object instance number of multiplier source.
18			Divisor Link		Parameter object instance number of base source.
19			Base Link		Parameter object instance number of offset source.
20			Offset Link		Parameter object instance number of offset source.
21			Decimal Precision	USINT	Specifies number of decimal places to use when displaying the scaled engineering value. Also used to determine actual increment value so that incrementing a value causes a change in scaled engineering value to this precision.

① The access rule is defined in bit 4 of instance attribute 4, the Descriptor. If bit 4 is 0 the access rule is Set and the Parameter Value can be read and written. If bit 4 is 1, the access rule is Get and the Parameter Value can only be read.
② Data type specified in instance attributes 4 (Descriptor), 5 (Data Type) and 6 (Data Size).

Parameter Object
Bit Definitions for Instance Attribute 4

Bit	Definition	Value
0	Supports settable path	0 = Link path can not be set. 1 = Link path can be set.
1	Supports enumerated strings	0 = Enumerated strings are not supported. 1 = Enumerated strings are supported and may be read with the Get_Enum_String service.
2	Supports scaling	0 = Scaling not supported. 1 = Scaling is supported. The scaling attributes are implemented and the value presented is in engineering units.
3	Supports scaling links	0 = Scaling links not supported. 1 = The values for the scaling attributes may be retrieved from other parameter object instances.
4	Read only parameter	0 = Parameter value attribute can be written (set) and read (get). Access rule is set. 1 = Parameter value attribute can only be read. Access rule is get.
5	Monitor parameter	0 = Parameter value attribute is not updated in real time by the device. 1 = Parameter value attribute is updated in real time by the device.
6	Supports extended precision scaling	0 = Extended precision scaling is not supported. 1 = Extended precision scaling should be implemented and the value presented to the user in engineering units.

Parameter Object
Data Types for Instance Attribute 5

Attr. ID	Definition	Data Type Description	Scaling Supported
1	WORD	16-bit word (2 bytes)	No
2	UINT	Unsigned integer (2 bytes)	Yes
3	INT	Signed integer (2 bytes)	Yes
4	BOOL	Boolean (1 byte)	No
5	SINT	Signed Short integer (2 bytes)	Yes
6	DINT	Signed Double integer (4 bytes)	Yes
8	USINT	Unsigned Short integer (1 byte)	Yes
9	UDINT	Unsigned Double Integer (4 bytes)	Yes
24	BYTE	8-bit string (1 byte)	No
25	DWORD	32-bit string (4 bytes)	No

Parameter Object Common Services

Service Code	Implemented for:		Service Name
	Class	Instance	
0x01	No	Yes	Get_Attribute_All
0x0E	Yes	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

Get_Attribute_All Response

At the instance level, the order of attributes returned in the Get_Attributes_All response is as follows:

Class Attribute ID	Attribute Name and Default Value
1	Parameter Value
2	Link Path Size
3	Link Path
4	Descriptor
5	Data Type
6	Data Size
7	Parameter Name String, default character count = 0
8	Units String, default character count = 0
9	Help String, default character count = 0
10	Minimum Value default = 0
11	Maximum Value default = 0
12	Default Value default = 0
13	Scaling Multiplier Default = 1
14	Scaling Divisor Default = 1
15	Scaling Base Default = 1
16	Scaling Offset Default = 0
17	Multiplier Link Default = 0
18	Divisor Link Default = 0
19	Base Link Default = 0
20	Offset Link Default = 0
21	Decimal Precision Default = 0

Parameter Object Specific Services

Service Code	Service Name	Service Description
$4B_H$	Get_Enum_String	Use this service to read enumerated strings from the Parameter Instance. See DeviceNet Specification Vol 2: Object Library, Parameter Object.

Enumerated strings are human-readable strings that describe either a bit or a value depending on the data type of instance attribute 1, the Parameter Value. If the data type is a BYTE, WORD, or DWORD the enumerated string is a bit enumerated string. If the data type is INT, USINT, or UINT the enumerated string is a value enumerated string. Any other data type does not have enumerated strings.

The table below describes the Get_Enum_String request service attribute.

Name	Data Type	Description of Attribute
Enumerated String Number	USINT	Number of enumerated string to retrieve (MAX value is 255).

- If the string to be returned is a bit enumerated string, then the enumerated string number represents a bit position and the Get_Enum_String service returns a string from that bit.
- If the string to be returned is a value enumerated string, then the enumerated string number represents a value and the Get_Enum_String service returns a string for that value.

The enumerated string is returned in the form of a SHORT_STRING with a maximum number of characters of 16.

Parameter Group Object (Class ID 10_H)

The Parameter Group Object identifies groups of parameters in a device. By grouping parameters, a DeviceNet software tool can provide a convenient access to related sets of parameters. There is one instance for each of the device's parameter groups. This Object is intended primarily to be used by a DeviceNet software tool to create an EDS file.

IMPORTANT The Parameter Group object does not return parameter values.

Parameter Group Object
Attribute for Instance ID = 0 (Class Attribute)

Attr ID	Access Rule	Attribute Name	Type	Description	Semantics of Values
2	Get	Max Instance	UINT	Maximum instance number of an object currently created in this class level of the device.	The largest instance number of a created object at this class hierarchy level.

Parameter Group Object
Attributes for Instances 1- (n)

Attr ID	Access Rule	Attribute Name	Type	Description	Semantics of Values
1	Get	group Name String	SHORT_ STRING	A human-readable string representing the group name (e.g., Setup, Frequency Set)	Maximum number of characters = 16
2		Number of members in group	UINT	Number of parameters in group.	
3		1st Parameter Number in group		Parameter Instance Number	
4		2nd Parameter Number in group			
n		(n-2)th Parameter Number in group			

Parameter Group Object
Group Instance ID 1- 25

Parameter Group Instance	Parameter Group Name	Parameter Number	Parameter Name
1	DeviceNet	1	DN-SW Node Address
		2	DN-SW Baud Rate
		3	DN-NV Node Addr
		4	DN-NV Baud Rate
		5	Chg of State Mask
		6	DNet I/O Status
	Non-Index Drive parameter numbers in parenthesis ()	283 (179)	DNet I/O Format
		284 (180)	Idle Flt Action
		285 (181)	Comm Flt Action
		286 (182)	Fault Cfg Logic
		287 (183)	Logic Cmd Mask
		288 (184)	I/O Logic Cmd
		289 (185)	Enable Behavior
2	Position Loop	12	Pos Loop P_Gain
		13	Pos Loop I_Gain
		14	Pos Loop D_Gain
		15	Pos Loop FF_Gain
		16	Pos Loop I_Zone
		17	Pos Window Size
		18	Pos Window Time
		19	Pos Error Limit
		20	Pos Error Time
		21	Master Rot Dir
		22	Slew Rate
		23	Slew Enable
		24	Gear Ratio Cmd
		25	Buf Gr Ratio-Mtr
		26	Buf GrRatio-Mstr
		27	Active Gear-Mtr
		28	Active Gear-Mstr

Parameter Group Object
Group Instance ID 1- 25 (Continued)

Parameter Group Instance	Parameter Group Name	Parameter Number	Parameter Name
3	Velocity Loop	29	Vel Loop P_Gain
		30	Vel Loop I_Gain
		31	Reserved
		32	Zero Vel Window
		33	Velocity Window
		34	Vel Overspd Lim
		35	At Speed Value
		36	Reserved
		37	Vel Error Limit
		38	Vel Error Time
4	Torque Current	39	Low Pass Bndwdth
		40	LowPass Filter
		41	Positive I Limit
		42	Negative I Limit
		43	Fault Current
		44	Dynamic PWM Freq
5	Motor Data	11	Motor ID
		45	Encoder Lines
		46	Max Motor Speed
		47	Motor Cont Curr
		48	Motor Peak Curr
		49	Torque Constant Kt
		50	Rotor Inertia Jm
		51	Back EMF Const Ke
		52	Winding Res
		53	Winding Ind
		54	Thermostat
		55	Commutation Type
		56	Thermal Protect
		57	Thermal Constant
		58	Pole Count
		59	Hall Offset
		60	Index Offset
		61	Motor Forwrd Dir

Parameter Group Object
Group Instance ID 1- 25 (Continued)

Parameter Group Instance	Parameter Group Name	Parameter Number	Parameter Name
6	Digital I/O	62	Dig Input 1 Cnfg
		63	Dig Input 2 Cnfg
		64	Dig Input 3 Cnfg
		65	Reserved
		66	Flt Reset Config
		67	Dig Outpt 1 Cnfg
		68	Dig Outpt 2 Cnfg
		69	Reserved
		70	Reserved
		71	Brake On Delay
		72	Brake Off Delay
7	Analog I/O	73	Limit Anlg Accel
		74	Anlg Accel Limit
		75	Anlg Decel Limit
		76	Pos CMD In Offst
		77	Pos CMD In Scale
		78	Vel CMD In Offst
		79	Vel CMD In Scale
		80	MaxVel CMD Scale
		81	Tor CMD In Offst
		82	Tor CMD In Scale
		83	MaxTrq CMD Scale
		84	Anlg Outpt1 Cnfg
		85	Anlg Out1 Offset
		86	Anlg Out1 Scale
		87	Reserved
		88	Reserved
		89	Reserved
		90	Analog Out Mode
		91	Anlg Out1 Ovride
		92	Reserved

Parameter Group Object
Group Instance ID 1- 25 (Continued)

Parameter Group Instance	Parameter Group Name	Parameter Number	Parameter Name
8	Presets	93	Limit Preset Acc
		94	Preset Acc Limit
		95	Preset Dec Limit
		96	Vel Preset 0
		97	Vel Preset 1
		98	Vel Preset 2
		99	Vel Preset 3
		100	Vel Preset 4
		101	Vel Preset 5
		102	Vel Preset 6
		103	Vel Preset 7
		104	Torque Preset 0
		105	Torque Preset 1
		106	Torque Preset 2
		107	Torque Preset 3
		108	Torque Preset 4
		109	Torque Preset 5
		110	Torque Preset 6
		111	Torque Preset 7
9	Operating Mode	112	Command Source
		113	Drive Mode
		114	Override CMD Scr
		115	Override Drv Mode
		116	Enc Outpt Config
		117	Change Direction
10	Tuning	118	Tuning/Oper Mode
		119	Tuning Status
		120	Autotune Max Cur
		121	Autotune Max Dis
		122	MTune Pos Period
		123	ManTune Pos Step
		124	MTune Vel Period
		125	ManTune Vel Step
		126	Tuning Direction

Parameter Group Object
Group Instance ID 1- 25 (Continued)

Parameter Group Instance	Parameter Group Name	Parameter Number	Parameter Name
11	Runtime Status	127	Drive Status
		128	Fault Status
		129	Output Status
		130	Dig Input States
		131	Dig Outpt States
12	Runtime Data	132	Analog CMD Input
		133	+ILimit Inpt Val
		134	-ILimit Inpt Val
		135	Analog Output 1
		136	Reserved
		137	Motor Position
		138	Master Position
		139	Position Command
		140	Position Error
		141	Peak +Pos Error
		142	Peak -Pos Error
		143	Velocity Command
		144	Motor Velocity
		145	Velocity Error
		146	Current Command
		147	Average Current
		148	Pos Peak Current
		149	Neg Peak Current
		150	DC Bus Voltage
		151	Field Current
		152	Torque Current
		153	R-Phase Current
		154	T-Phase Current
		155	Field Voltage
		156	Torque Voltage
		157	Motor Thermal Filter
		158	Reserved

Parameter Group Object
Group Instance ID 1- 25 (Continued)

Parameter Group Instance	Parameter Group Name	Parameter Number	Parameter Name
13	Fault History	159	Fault History #1
		160	Fault History #2
		161	Fault History #3
		162	Fault History #4
		163	Fault History #5
		164	Fault History #6
		165	Fault History #7
		166	Fault History #8
		167	Fault History #9
		168	Fault History #10
14	Commands	169	Host Contrl Mode
		170	Host Setpnt Ctrl
	Indexing only (otherwise reserved)	171	Host Index Cntrl
		172	Host Vel Setpnt
		173	Host Torq Setpnt
		174	Host Acc Setpnt
		175	Reset Personalty
		176	Reset Drive
		177	Reset Faults
		178	Reset I Peaks
The following parameters are reserved for Indexing Drives only			
		179	Start Index Cmd
		180	Start Homing Cmd
		181	Host Index
15	Homing	182	Homing Velocity
		183	Homing Accel/Dec
		184	Home Offset Move
		185	Home Position
		186	Homing Type
		187	Auto Start Home
		188	Home Sens Bckoff
		189	Homing Creep Vel

Parameter Group Object
Group Instance ID 1- 25 (Continued)

Parameter Group Instance	Parameter Group Name	Parameter Number	Parameter Name
16	Indexing	190	Selected Index
		191	Index Count
		192	Auto-Start Index
17	Index 0	193	Index 0 Type
		202	Index 0 Dist/Pos
		211	Index 0 Reg Dist
		220	Index 0 Velocity
		229	Index 0 Accel
		238	Index 0 Decel
		247	Index 0 Dwell
		256	Index 0 Count
		265	Index 0 Terminat
		274	Index 0 Pointer
18	Index 1	194	Index 1 Type
		203	Index 1 Dist/Pos
		212	Index 1 Reg Dist
		221	Index 1 Velocity
		230	Index 1 Accel
		239	Index 1 Decel
		248	Index 1 Dwell
		257	Index 1 Count
		266	Index 1 Terminat
		275	Index 1 Pointer
19	Index 2	195	Index 2 Type
		204	Index 2 Dist/Pos
		213	Index 2 Reg Dist
		222	Index 2 Velocity
		231	Index 2 Accel
		240	Index 2 Decel
		249	Index 2 Dwell
		258	Index 2 Count
		267	Index 2 Terminat
		276	Index 2 Pointer

Parameter Group Object
Group Instance ID 1- 25 (Continued)

Parameter Group Instance	Parameter Group Name	Parameter Number	Parameter Name
20	Index 3	196	Index 3 Type
		205	Index 3 Dist/Pos
		214	Index 3 Reg Dist
		223	Index 3 Velocity
		232	Index 3 Accel
		241	Index 3 Decel
		250	Index 3 Dwell
		259	Index 3 Count
		268	Index 3 Terminat
		277	Index 3 Pointer
21	Index 4	197	Index 4 Type
		206	Index 4 Dist/Pos
		215	Index 4 Reg Dist
		224	Index 4 Velocity
		233	Index 4 Accel
		242	Index 4 Decel
		251	Index 4 Dwell
		260	Index 4 Count
		269	Index 4 Terminat
		278	Index 4 Pointer
22	Index 5	198	Index 5 Type
		207	Index 5 Dist/Pos
		216	Index 5 Reg Dist
		225	Index 5 Velocity
		234	Index 5 Accel
		243	Index 5 Decel
		252	Index 5 Dwell
		261	Index 5 Count
		270	Index 5 Terminat
		279	Index 5 Pointer

Parameter Group Object
Group Instance ID 1- 25 (Continued)

Parameter Group Instance	Parameter Group Name	Parameter Number	Parameter Name
23	Index 6	199	Index 6 Type
		208	Index 6 Dist/Pos
		217	Index 6 Reg Dist
		226	Index 6 Velocity
		235	Index 6 Accel
		244	Index 6 Decel
		253	Index 6 Dwell
		262	Index 6 Count
		271	Index 6 Terminat
		280	Index 6 Pointer
24	Index 7	200	Index 7 Type
		209	Index 7 Dist/Pos
		218	Index 7 Reg Dist
		227	Index 7 Velocity
		236	Index 7 Accel
		245	Index 7 Decel
		254	Index 7 Dwell
		263	Index 7 Count
		272	Index 7 Terminat
		281	Index 7 Pointer
25	RAM Index	201	RAM Index Type
		210	RAM Idx Dist/Pos
		219	RAM Idx Reg Dist
		228	RAM Idx Velocity
		237	RAM Index Accel
		246	RAM Index Decel
		255	RAM Index Dwell
		264	RAM Index Count
		273	RAM Idx Terminat
		282	RAM Idx Pointer

Parameter Group Object
Common Services

Service Code	Service Name	Service Description
$0E_H$	Get_Attribute_Single	Returns the contents of the specified attribute.

Acknowledge Handler Object (Class ID $2B_H$)

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

Acknowledge Handler Object
Attributes for Instance ID = 1

Attr ID	Access Rule	Attribute Name	Type	Description	Semantics of Values
1	Set	Acknowledge Timer	UINT	Time to wait for acknowledge before resending	Range 1-65,535 ms (0 invalid) default = 16
2	Get/Set	Retry Limit	USINT	Number of Ack Time-outs to wait before informing the producing application of a RetryLimit_Reached event.	Range 0-255 default = 1
3	Set (Inactive) Get (Active)	COS Producing connection Instance	UINT	Connection Instance that contains the path of the producing I/O application object that will be notified of Ack Handler events.	Connection Instance ID

Acknowledge Handler Object
Common Services

Service Code	Service Name	Service Description
$0E_H$	Get_Attribute_Single	Returns the contents of the specified attribute.
10_H	Set_Attribute_Single	Used to modify an Acknowledge Handler object attribute value.

Problem Solving

To solve problems that can occur, you need to understand:

- the physical DeviceNet layout,
- the devices on the network, and
- how all the pieces work together.

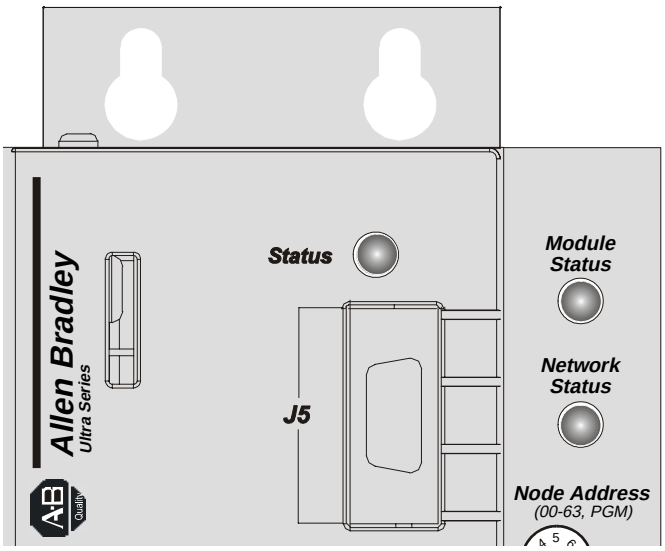
Operator-level diagnostics

The manuals that belong to devices on the network, can usually isolate any problems to a specific region of the network and then the specific device causing the problem. Diagnostic tools and device indicators help identify the operational state of devices and network communications problems.

LED displays

The following diagram and tables show the meaning of the Module Status LED and Network Status bi-colored LEDs. Use these status indicators at power-up and during operation to check the state of the device and status of the DeviceNet network.

Figure E.1
Module Status and Network Status LEDs



Module Status

LED Viewed:	If LED:	State:	Indicates:	Action:
Module Status LED	Off	Not powered	No power	There is no power going to the device
	Steady-green	Operational	Normal operation	Normal operation - no action needed
	Flashing-green	Device is in stand-by	Processing or waiting for input	Normal operation - no action needed
	Flashing-red	Recoverable fault	Not operational	Power cycle or reset the Ultra 100 with DeviceNet
	Steady-red	Unrecoverable fault	ULTRA 100 problem	1. Check ULTRA 100 for power-up error using ULTRA Master. 2. Replace ULTRA 100.
	Flashing-red/ green	Self testing	Self-test in progress	The device is in self test, wait.

Network Status

LED Viewed:	If LED:	State:	Indicates:	Action:
Network Status LED	Off	• Not powered • Not on-line	• No power going to the device • Failed Duplicate MAC ID check	1. Check the Module Status LED to verify that ULTRA 100 is powered. 2. Check that one or more nodes are communicating on the network. 3. Check that at least one other node on the network is operational and the data rate is the same as the ULTRA 100.
	Flashing-green	• On-line • Not connected	• Passed Duplicate MAC ID check • No connection established	No action is needed. The LED is flashing to signify that there are no open communication connections between the ULTRA 100 and any other device. Any connection (I/O or explicit message) made to the ULTRA 100 over DeviceNet will cause the LED to stop flashing and remain Steady-ON for the duration of any open connection.
	Steady-green	• On-line • Connected	One or more connections established	No action needed.
	Flashing-red	• On-line • Time-out	I/O connection timed out	1. Re-initiate I/O messaging by the master controller. 2. Reduce traffic or errors on the network so that messages can get through within the necessary time frame.
	Steady-red	Network Failure	• Failed Duplicate MAC ID check • Bus-off	1. Ensure that all nodes have unique addresses. 2. If all node addresses are unique, examine network for correct media installation. 3. Ensure that all nodes have the same Data Rate.

Node Problems

Particular attention should be given to the task of setting initial addresses and data rates. A survey of the network should be made to ensure all assignments are known. Some nodes can be logically assigned to a group of devices, but physically located away from those devices. One incorrect node can cause other nodes to appear to be Bus-off (Steady-red LED). If a node goes Bus-off and the device is reset only to go Bus-off again, the problem is likely not with the device, but rather the setting of the address, data rate, or a network-wide problem related to topology, grounding, intermittent power/data connections, or electrical noise. If a scanner goes Bus-off, nodes will not reallocate (Flashing-green or red) even if they are functioning correctly.

Device Failure - LED Status Check

A Steady-red Module Status LED can mean an error. If the Network Status LED goes Steady-red at power-up, it could mean there is a Duplicate MAC ID. The user response should be to test all devices for unique addresses. If a Steady-red LED remains on after the Duplicate MAC ID test shows all devices to have a unique node addresses, it means a Bus-off error.

1. Check data rate settings.
2. If symptom persists, replace node address (with another address and correct data rate).
3. If symptom persists, replace tee tap.
4. If symptom persists, check topology.
5. If symptom persists, check power for noise with oscilloscope or power disturbance analyzer.

Scanner Problems

If using a scanner, check the scan list, data rate and addresses of devices. Verify series and revision of the scanner is the latest. If the scanner is Bus-off, recycle

the 24V supply and then reset the scanner. If the scanner goes Bus-off again, the problem is some combination of:

- defective node device,
- incorrect node data rate,
- bad network topology,
- faulty wiring,
- faulty scanner,
- faulty power supply,
- bad grounding, and/or
- electrical noise.

Wiring Problems

Various situations in and around cables can cause problems on the DeviceNet network. Things to check are:

- cables for excessive twisting, tension, or breaks along their span and at connectors,
- cable proximity to extreme temperature
- cable proximity to motors, relays, contactors, solenoids, or power wiring,
- connections at junction boxes for lead dress, and
- connectors for contamination by foreign material.

Power Supply Problems

If a single power supply is used, add up the current requirements of all devices drawing power from the network. This total should be considered the minimum current rating in selecting the power supply used. In addition check:

- length and current level in trunk and drop cables,
- size and length of the cable supplying power to the trunk,
- voltage measured at the middle and ends of the network, and
- noise in network power measured with an oscilloscope.

Cable Installation and Design Problems

Cable installation and design has to do with the physical layout and connections on the network. Walk the network if possible to determine the actual layout and connections. Network management software displays only a logical record of the network. Ensure that you have a diagram of the physical layout and a record of the following information on the layout.

Cable Checks	Power Checks
Number of nodes	Terminator locations and size
Individual drop lengths	Break the earth ground of the V- and Shield and verify >1.0 Mohm to frame ground with power supply off
Branched drop length	Use a multi-meter to check for short circuit between CAN_H and CAN_L, or CAN (H or L) to Shield, V- or V+
Cumulative drop length	Total power load and at its distribution points
Total trunk length	Spot check power for noise
Power supply cable length and gauge	

Adjusting the Physical Network Configuration

Some ways to help improve the efficiency of you physical network configuration are:

- shorten the overall length of the cable system,
- move the power supply in the direction of an overloaded cable section,
- move devices from an overloaded cable section to a less loaded section,
- move higher current loads closer to the power supply,
- add another power supply to an overloaded network, and
- move the power supply from the end to the middle of the network.

Specifications

The ULTRA 100 Drive with DeviceNet has a printed circuit assembly inside that uses a standard DeviceNet 5-pin device connector to accept an open connector off a DeviceNet cable from a DeviceNet network.

DeviceNet Features

The ULTRA 100 Drive with DeviceNet has its own microprocessor. It also has a watchdog timer that is enabled when power is turned on. The microprocessor must be able to reset the timer within a specified period, or it will shut down the ULTRA 100 Drive with DeviceNet and the bi-color Module Status LED will display steady red. Diagnostics will be run at start-up on the CPU, EPROM, and RAM. If there is a fault during diagnostics the Module Status LED will display a steady red. When all requirements are met, the Module Status LED will display a steady green.

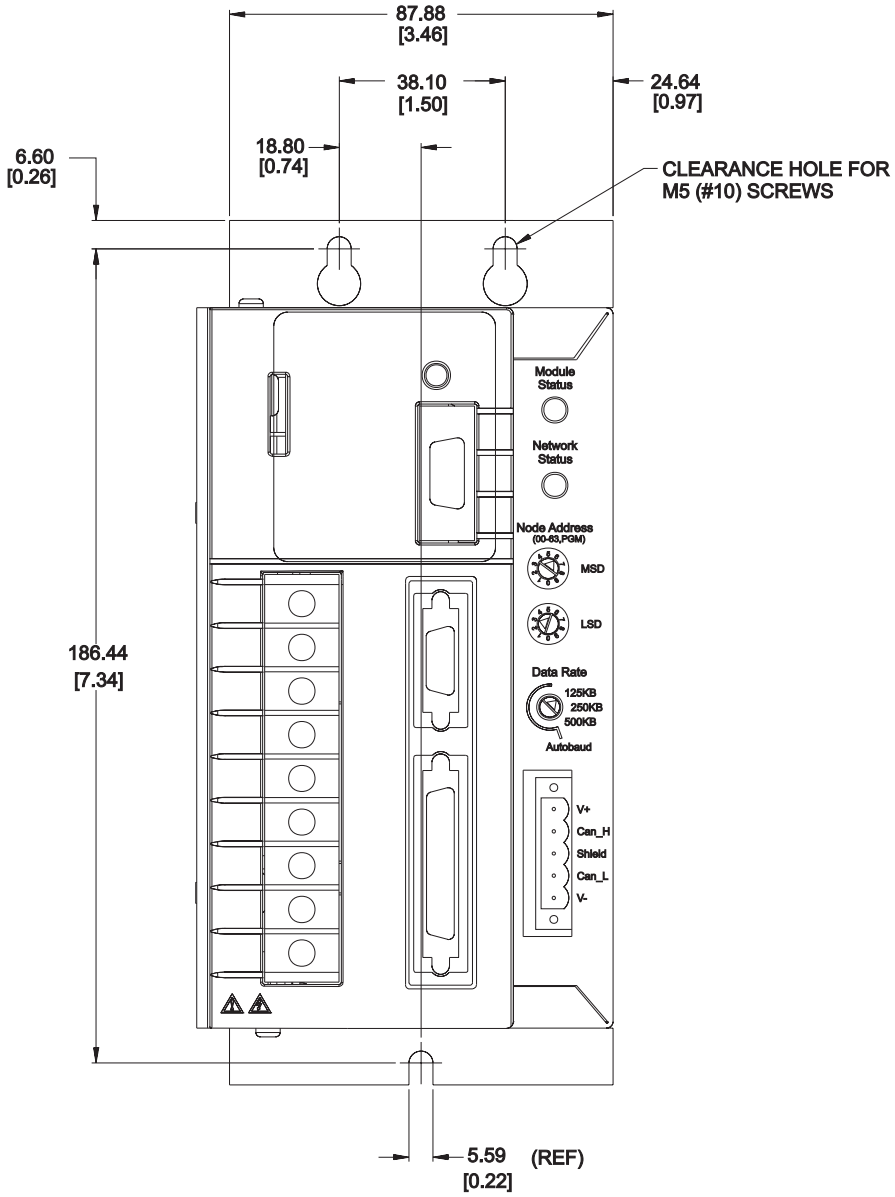
DeviceNet data for an ULTRA 100 Drive with DeviceNet

Power Consumption	DeviceNet current draw 60mA
Data Rates (baud)	125k per second 250k per second 500k per second
Messaging capabilities	Explicit, Polled I/O, Change of State, and Cyclic Messaging
Status Indication	Module Status: Bi-color (red/green) LED Network Status : Bi-color (red/green) LED
Network Address	00-63 (63 default)

Physical Data for an ULTRA 100 Drive with DeviceNet

	DDM-005(X) DN	**DDM-009(X) DN**	**DDM-019(X) DN**
Weight	1.84 kg (4.1 lbs)	2.19 kg (4.8 lbs)	2.14 kg (4.7 lbs)
Environmental Conditions	Operating Temperature:	0° to 55° C (32° to 131° F)	
	Storage Temperature:	-40° to 70° C (-40° to 158° F)	
	Relative Humidity:	5% to 95% non-condensing 50% max @ 40° C (104° F)	

Figure F.1
ULTRA 100 Drive with DeviceNet DDM-005-DN (front)



NOTES:

1. Dimensions are in millimeters with inches in brackets.
2. Allow 76.2 mm [3.00] clearance in front of unit for cables.
3. Allow 12.7 mm [.50] clearance on both sides of unit.

Figure F.2
ULTRA 100 Drive with DeviceNet DDM-005-DN (side and bottom)

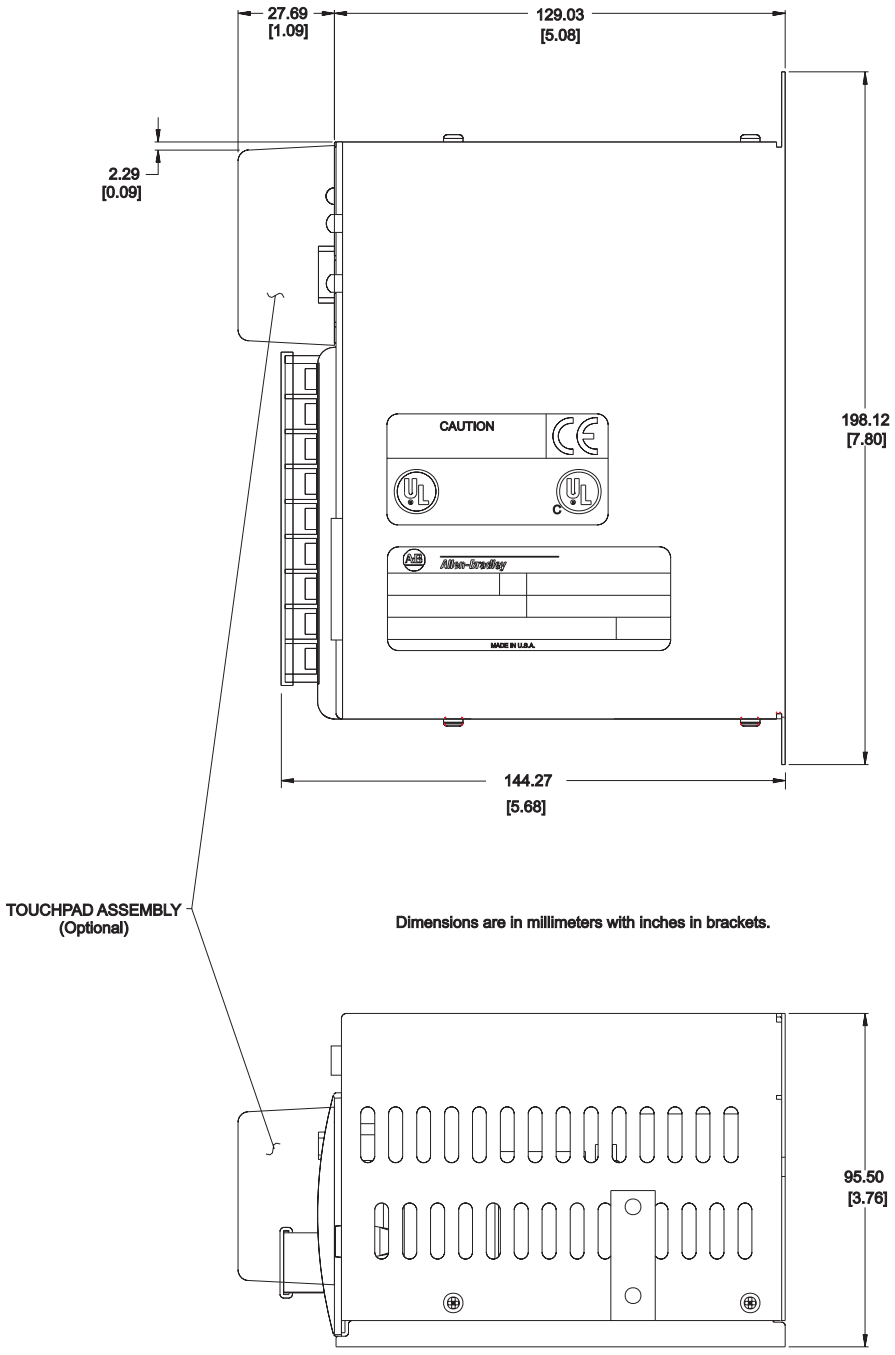
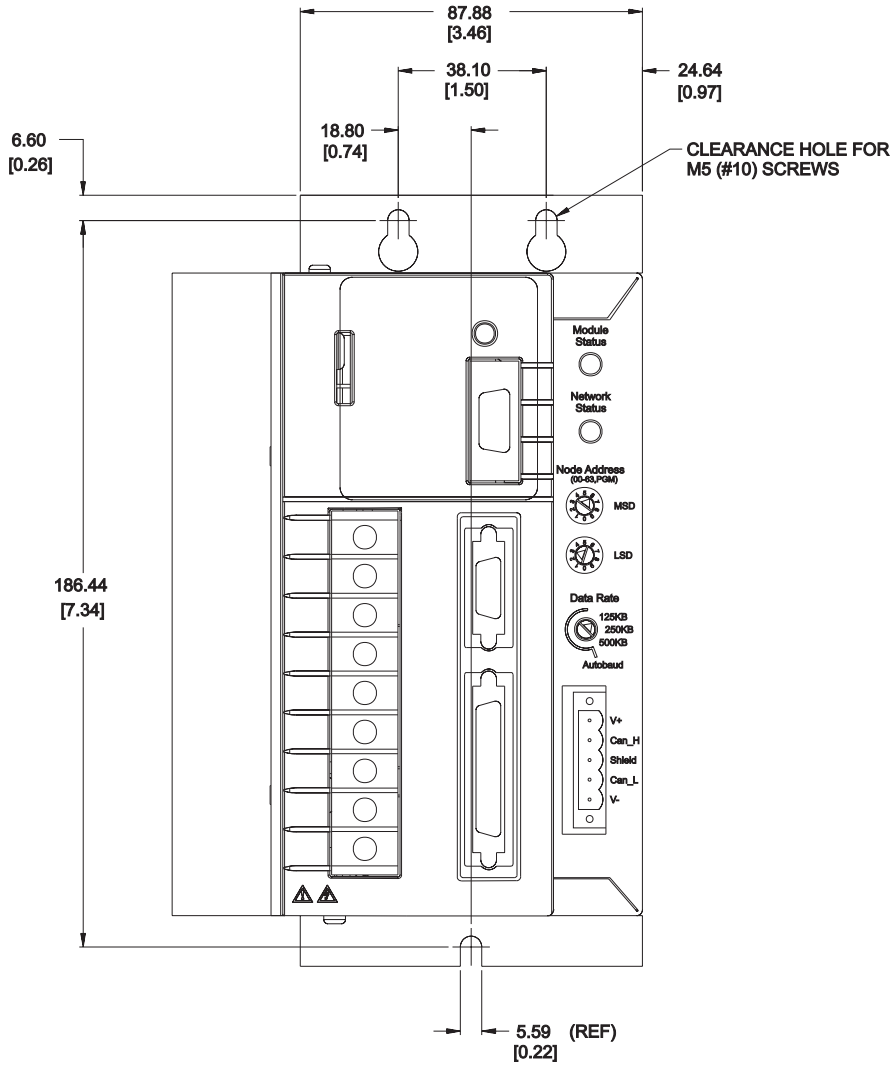
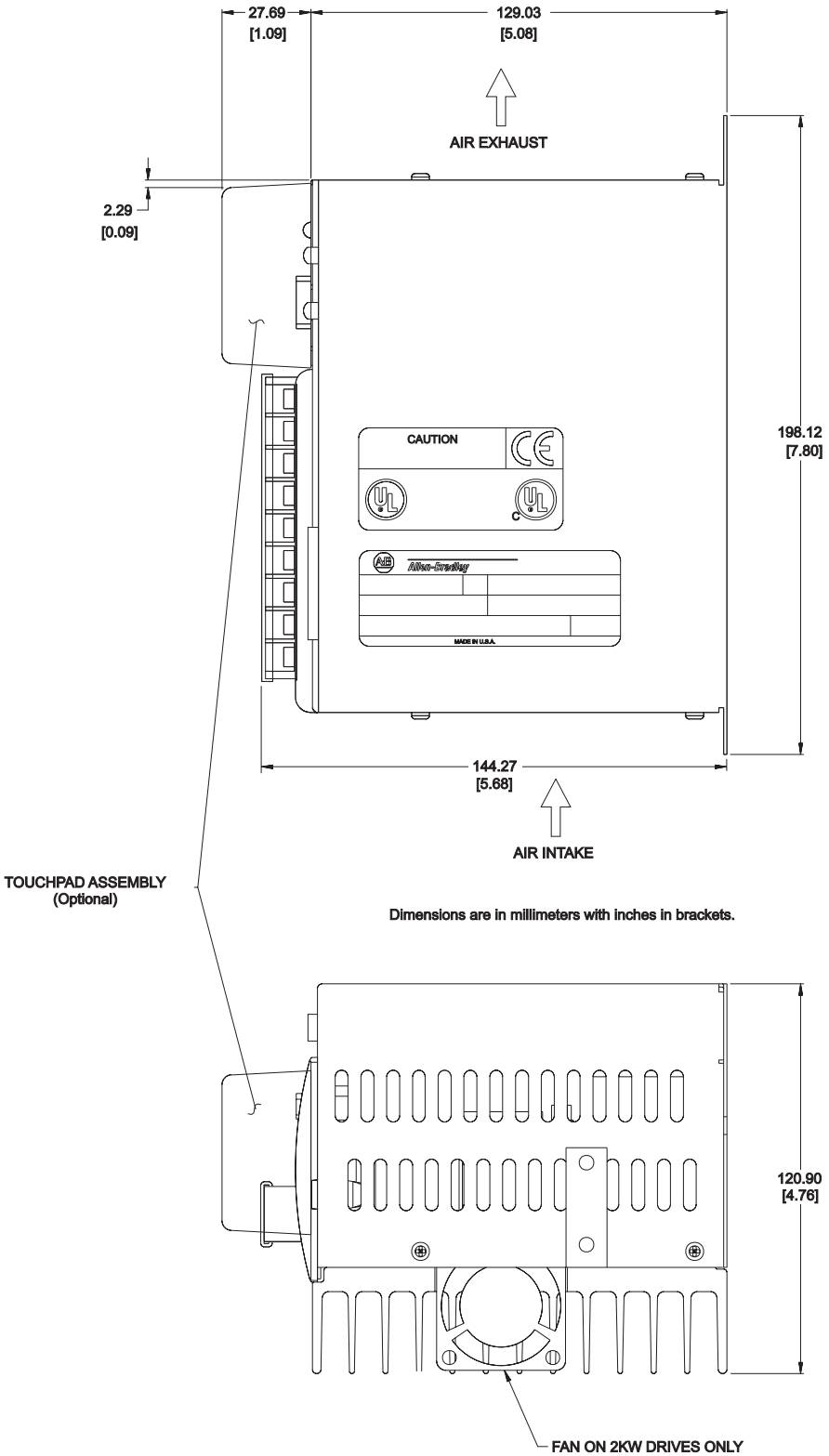


Figure F.3
ULTRA 100 Drive with DeviceNet DDM-009(X)-DN and DDM-019(X)-DN (front)



NOTES:
1. Dimensions are in millimeters with inches in brackets.
2. Allow 76.2 mm [3.00] clearance in front of unit for cables.
3. Allow 12.7 mm [.50] clearance on both sides of unit.

Figure F.4
ULTRA 100 Drive with DeviceNet DDM-009(X)-DN and DDM-019(X)-DN (side and bottom)



www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 1398-5.4 - December 1999
Supersedes Publication 1398-5.4 — May 1999

Part Number 0013-1067-003 Rev B