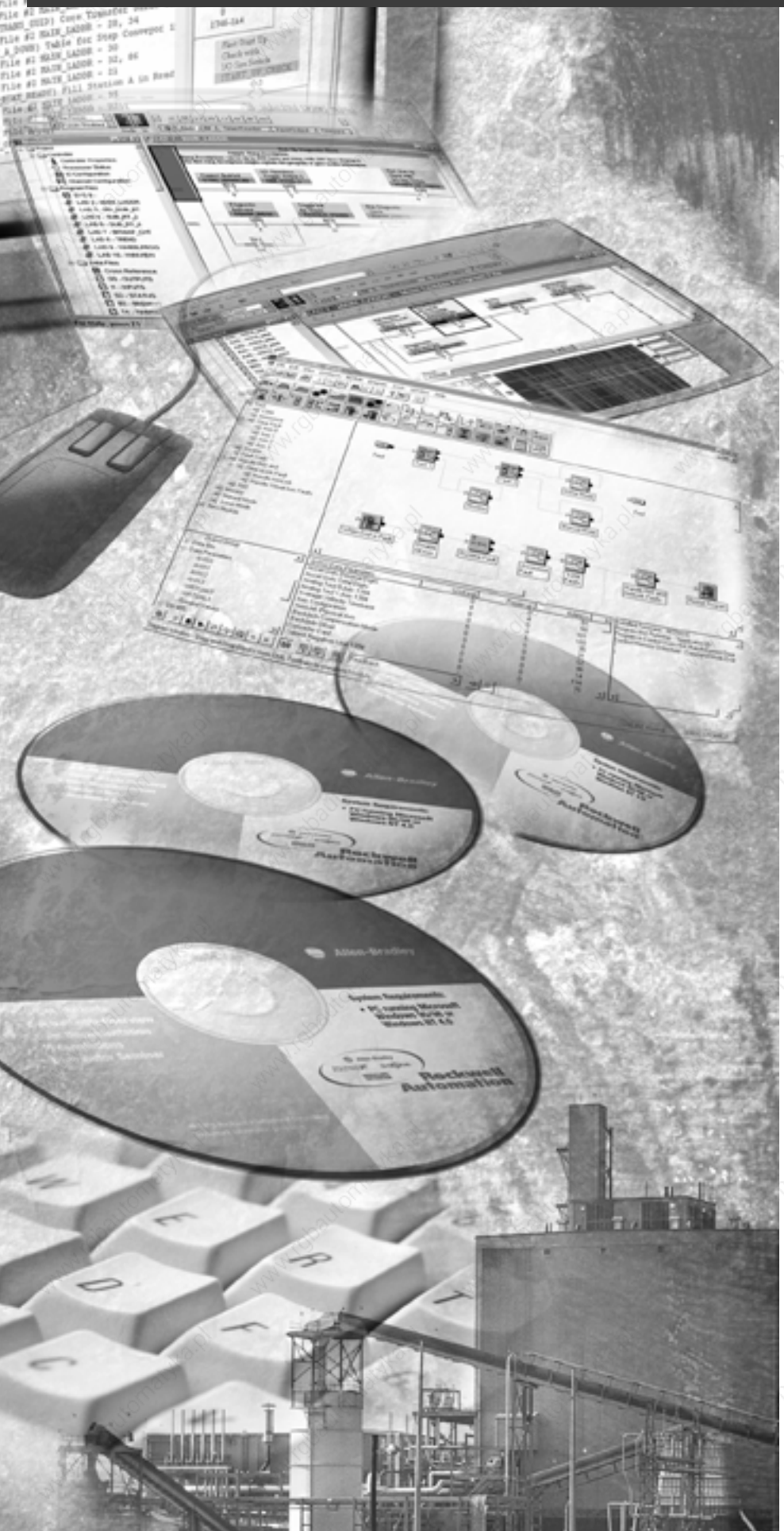


Allen-Bradley

Ultra3000 Digital Servo Drive with DeviceNet

DeviceNet Firmware Version 2.xx

(Catalog Numbers
2098-DSD-005-DN, -005X-DN,
2098-DSD-010-DN, -010X-DN,
2098-DSD-020-DN, -020X-DN,
2098-DSD-030-DN, -030X-DN,
2098-DSD-075-DN, -075X-DN,
2098-DSD-150-DN, -150X-DN
2098-DSD-HV030-DN, -HV030X-DN
2098-DSD-HV050-DN, -HV050X-DN
2098-DSD-HV100-DN, -HV100X-DN
2098-DSD-HV150-DN, -HV150X-DN
2098-DSD-HV220-DN, -HV220X-DN)

Reference Manual

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:

ATTENTION

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 a hazard
- recognize the consequences

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

Preface

Introduction

Read this preface to become familiar with the organization of the manual. In this preface, you will read about the following:

- Who Should Use this Manual
- Purpose of this Manual
- Contents of this Manual
- Related Documentation
- Conventions Used in this Manual
- Allen-Bradley Support

Who Should Use this Manual

This manual is intended for qualified service personnel responsible for setting up and servicing the Ultra3000™ with DeviceNet™. You must have previous experience with and a basic understanding of electrical terminology, programming procedures, networking, required equipment and software, and safety precautions.

Purpose of this Manual

This manual is a reference guide for using DeviceNet to configure, monitor, or control Ultra3000 drives with DeviceNet operating with DeviceNet firmware version 2.*xx*.

Non-Indexing Ultra3000 Drives	Indexing Ultra3000 Drives
2098-DSD-005-DN	2098-DSD-005X-DN
2098-DSD-010-DN	2098-DSD-010X-DN
2098-DSD-020-DN	2098-DSD-020X-DN
2098-DSD-030-DN	2098-DSD-030X-DN
2098-DSD-075-DN	2098-DSD-075X-DN
2098-DSD-150-DN	2098-DSD-150X-DN
2098-DSD-HV030-DN	2098-DSD-HV030X-DN
2098-DSD-HV050-DN	2098-DSD-HV050X-DN
2098-DSD-HV100-DN	2098-DSD-HV100X-DN
2098-DSD-HV150-DN	2098-DSD-HV150X-DN
2098-DSD-HV220-DN	2098-DSD-HV220X-DN

Note: The reference guide to Ultra3000 drives with DeviceNet operating with firmware version 1.xx is listed in the section below entitled *Related Documentation*.

Contents of this Manual

This manual contains the following sections:

Chapter	Title	Contents
	Preface	An overview of this manual.
1	Overview	Describes network activity and drive configuration capabilities.
2	Programming Reference	Configuration data and behaviors implemented in the Ultra3000 Drive with DeviceNet are defined using object modeling

Related Documentation

These publications provide additional information specific to the Ultra3000 Drive with DeviceNet or DeviceNet in general. To obtain a copy, contact your local Rockwell Automation office or distributor, or access the documents on-line at **www.theautomationbookstore.com** or **www.ab.com/manuals/gmc**.

For information about:	Read this document:	Publication Number
A description of the Ultra3000 and Ultra5000™ drives	*Ultra Family Brochure*	2098-BR001*x*-EN-P
How to install Ultraware™	*Ultraware CD Installation Instructions*	2098-IN002*x*-EN-P
How to install and troubleshoot the Ultra3000 drive	*Ultra3000 Digital Servo Drive Installation Manual*	2098-IN003*x*-EN-P
Configure, monitor, or control Ultra3000 drives with DeviceNet operating with firmware version 1.xx	*Ultra3000 Series Digital Servo Drive with DeviceNet Firmware Version 1.xx Reference Manual*	2098-RM001*x*-EN-P
Configuring the Ultra3000 DSD and Ultra5000 IPD using Ultraware	*Ultraware User Manual*	2098-UM001*x*-EN-P
How to use RSNetWorx	*RSNetWorx for DeviceNet Getting Results Manual*	9399-DNETGR

For information about:	Read this document:	Publication Number
A glossary of industrial automation terms and abbreviations	*Allen-Bradley Industrial Automation Glossary*	AG-7.1
How to commission a DeviceNet system.	*DeviceNet Cable System Planning and Installation Manual*	DN-6.7.2
An overview of Allen-Bradley motion controls and systems	*Motion Control Selection Guide*	GMC-SG001*x*-EN-P

A copy of the DeviceNet Specification, Volumes I and II, Release 2.0 may be ordered from the web site **http://www.odva.org** of the Open Device Vendor Association.

Conventions Used in this Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps
- Numbered lists provide sequential steps or hierarchical information
- Words you type or select appear in **bold**.
- When we refer you to another location, the section or chapter name appears in italics
- Software commands and parameters are listed with initial capitals and hardware signals are listed in all capitals (e.g., Enable Behavior parameter, and ENABLE signal).

Allen-Bradley Support

Allen-Bradley offers support services worldwide, with over 75 sales/support offices, 512 authorized distributors and 260 authorized systems integrators located throughout the United States alone, plus Allen-Bradley representatives in every major country in the world.

Local Product Support

Contact your local Allen-Bradley representative for:

- Sales and order support
- Product technical training
- Warranty support
- Support service agreements

Technical Product Assistance

If you need to contact Allen-Bradley for technical assistance, please review the information in this manual or that listed in *Related Documentation* on page P-2 first. Then call your local Allen-Bradley representative. For the quickest possible response, we recommend that you have the catalog numbers of your products available when you call.

Overview

Introduction

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

Features

The Ultra3000 Drive with DeviceNet Interface provides the following features:

- Ultra3000 Drive with DeviceNet implements the Unconnected Message Manager (UCMM) which is used to establish a Group 3 Explicit Message connection. Up to five Group 3 Explicit Messaging connections can be established.
- 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 and the Node Address (0-63, PGM) switches be set to the PGM (program) position.
- User-configurable fault response provides the ability to customize the drive's actions to communication errors.
- Software configuration lets you configure the Ultra3000 Drive with DeviceNet using RSNetWorx™ for DeviceNet (Version 3.00.00 Service Pack 1, or later).
- Customize network activity by configuring the drive to:
  - report only new data using Change-of-State (COS) capability.
  - report data at specific intervals using cyclic operation.
- Autobaud allows the drive to determine the network data rate.
- Supports Automatic Device Replacement (ADR).

Installing, Connecting, & Commissioning Ultra3000 Drives with DeviceNet

This manual serves as a reference for configuring, monitoring, and controlling Ultra3000 Drives with DeviceNet. Refer to the *Ultra3000 Digital Servo Drive Installation Manual* (2098-IN003*x*-EN-P) for information regarding:

- configuring the rotary switches on the front panel of the drive
- wiring the DeviceNet connector
- understanding the DeviceNet LED indicators
- troubleshooting

Parameters and Electronic Data Sheet

The Ultra3000 Drive with DeviceNet contains a set of parameters that are used to configure and monitor the drive. You can perform configuration by changing the values associated with individual parameters. Parameter values may be written and read via DeviceNet. Writing a value to a parameter may configure drive operations such as the acceleration or deceleration rates. Writing a value to a parameter may also configure DeviceNet operations such as which input and output assemblies are to be used for I/O communications with a master (scanner). The parameter set is documented in *Programming Reference* on page 2-1.

Electronic Data Sheet (EDS) files are specially formatted ASCII files that provide all of the information necessary for a configuration tool such as RSNetworx for DeviceNet to access and alter the parameters of a device. The EDS file contains information on the number of parameters in a device and how those parameters are grouped together. Information about each parameter is contained in the file such as parameter min, max, and default values, parameter data format and scaling, and the parameter name and units. You can create or access an EDS file stored in the Ultra3000 Drive with DeviceNet via RSNetworx for DeviceNet (Version 3.00.00 Service Pack 1 or later) or download an EDS file for the Ultra3000 Drive with DeviceNet from Rockwell Automation - Allen-Bradley web-site **www.ab.com/networks/eds**.

DeviceNet Messaging

The Ultra3000 Drive with DeviceNet operates as a slave device on a DeviceNet network. The drive supports Explicit Messages and Polled or Change-of-State/Cyclic I/O Messages of the predefined master/slave connection set. The drive also supports the Unconnected Message Manager (UCMM) so that up to five Group 3 Explicit Message connections may be established with the drive.

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. Each slave device returns I/O data to its master device. The I/O data exchanged over this connection is pre-defined.

Explicit Response/Request Messages

Explicit Request messages are used to perform operations such as reading and writing parameter values. Explicit Response messages indicate the results of the attempt to service an Explicit Request message.

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.

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. A Change-of-State message is sent at a user-configurable heart rate or whenever a data change occurs. A Cyclic message is sent only at a user-configurable rate.

I/O Messaging and Explicit Messaging with DeviceNet

You can configure and monitor the drive with either I/O Messaging or Explicit Messaging. I/O messages are for time-critical, control-oriented data. I/O messages typically are used for moving predefined data repeatedly with minimum protocol overhead. Explicit Messages provide multi-purpose, point-to-point communication paths between two devices. Explicit Messaging typically would not be used to exchange data periodically since I/O Messages have a higher priority and lower protocol overhead than Explicit Messages. However, Explicit Messages have more flexibility by specifying a service to be performed and a specific address.

Although, you can control the drive by writing to various parameters using Explicit Messages, you should consider writing to the Assembly Objects, which buffer the I/O data. Then the drive can be configured to fault if a network communication fault or idle condition occurs. However, you will have to periodically update the Assembly Object to prevent the Explicit Messaging connection from closing. Refer to *Using Explicit Messaging to Control the Ultra3000* on page 2-44.

If you write to a parameter using an Explicit Message, the parameter value will be saved as a working value and in nonvolatile memory. However, if you write to a parameter using an I/O message, you can specify whether the parameter value should be saved in nonvolatile memory or not. Therefore, if a parameter value has to be modified repeatedly, then you should use I/O messaging and not save the parameter value to nonvolatile memory because the nonvolatile memory has a limited number of writes.

ATTENTION

The nonvolatile memory has a limited number of write cycles. Do not save parameter values to nonvolatile memory (NVMEM) unless absolutely necessary. In other words, minimize the number of times parameter values are saved to nonvolatile memory (NVMEM).

Selecting Input and Output Assemblies for I/O Messages

The Ultra3000 Drive with DeviceNet allows you to choose between various Input and Output Assemblies, thereby choosing the data format of the messages that are passed back and forth between the drive and the master (scanner) on 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. You should keep in mind that larger assemblies utilize more network bandwidth. Information on the data format of all the Assemblies is given in *Assembly Object (Class ID 04H)* on page 2-11, and more specifically the following DeviceNet parameters that select input and output assemblies:

- Parameter 7 - I/O Receive Select
- Parameter 8 - Poll Transmit (Xmit) Select
- Parameter 9 - COS/Cyclic Transmit (Xmit) Select

IMPORTANT If you want to control the drive with I/O messages, Parameter 10 - Logic Command Mask must be changed from its default value. Otherwise, if a Logic Command is sent to the drive, the command will be cleared.

Programming Reference

The Ultra3000 Drive with DeviceNet implements a vendor specific device profile - Rockwell Automation Miscellaneous (Device Type: 73hex).

The configuration data and behaviors implemented in the Ultra3000 Drive with DeviceNet are defined using object modeling. The Ultra3000 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.

The following general definitions also may be useful in understanding DeviceNet object modeling:

- Object - A representation of a particular type of data component within the DeviceNet node.
- Instance - A specific occurrence of an Object.
- Attribute - A description of a characteristic or feature of an Object. Attributes provide status information or govern the operation of an Object.
- Service - A function performed by an Object.

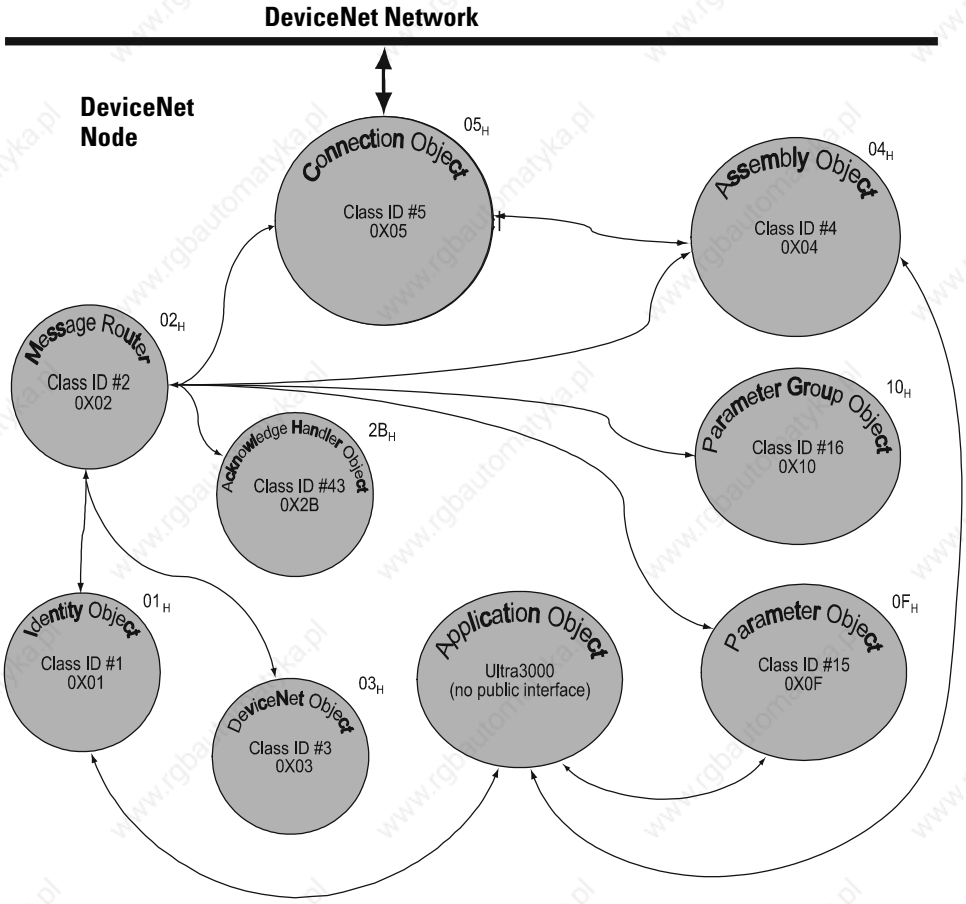
This manual documents the DeviceNet object models implemented in DeviceNet firmware versions 2.*xx* for the Ultra3000 drives.

Object Model

The Object Model diagram on Page 2-2 depicts the objects supported in the Ultra3000 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	2
Message Router	1
DeviceNet	1
Assembly	18
Connection	2 - I/O 6 - Explicit
Parameter	1059 - Indexing Drive 298 - Non-indexing Drive
Parameter Group	16 - Indexing Drive 14 - Non-indexing Drive
Acknowledge Handler	1

Figure 2.1
Object Model



How Objects Affect Behavior

The objects in the Ultra3000 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 Ultra3000 Drive with DeviceNet have the interface listed in the following table.

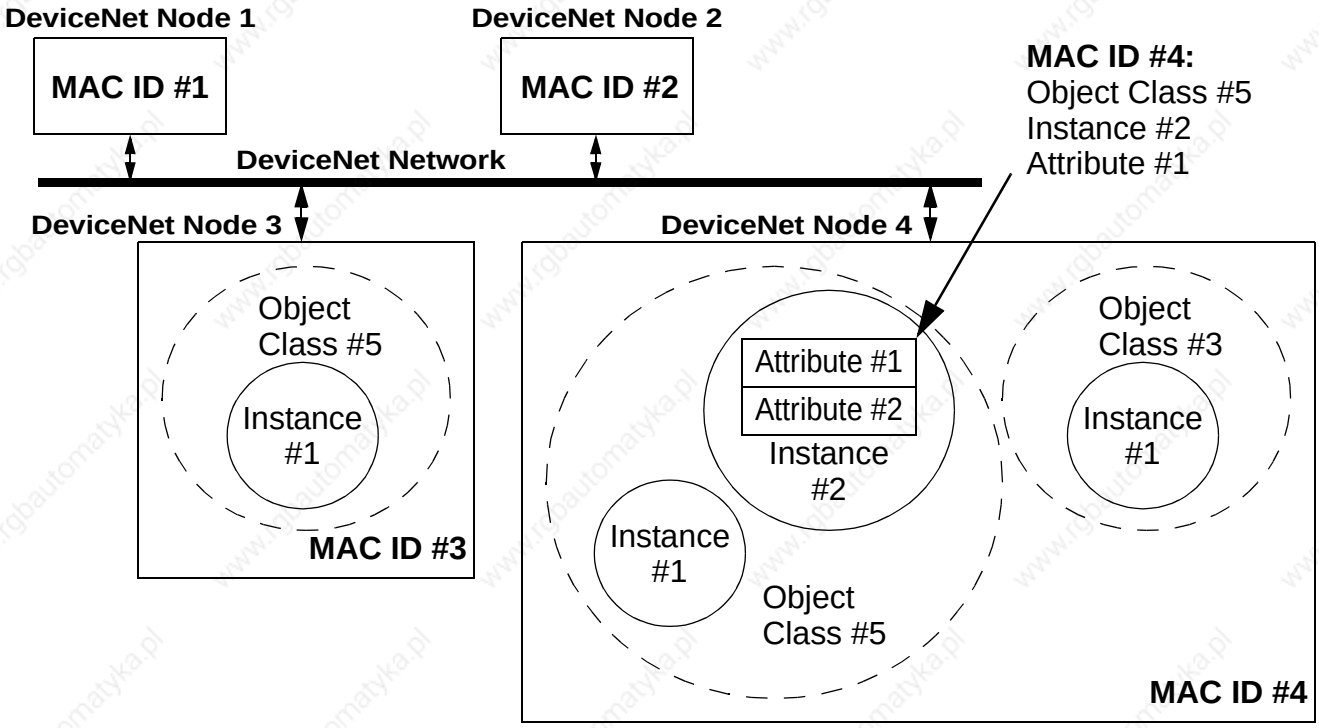
Object	Interface
Message Router	Explicit Messaging Connection Instance
DeviceNet	Message Router
Assembly	I/O Connection or Message Router
Connection	Message Router
Parameter	Message Router
Parameter Group	Message Router
Acknowledge Handler	I/O Connection or Message Router

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. The MAC ID often is referred to as the node address. Each MAC ID is further identified with the following address components:

Component	Description
Class ID	The Class ID is a unique integer value assigned to each Object Class accessible from the network. The Ultra3000 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 Ultra3000 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 2.2
Node Objects



Data Type Definitions

The following mnemonics define the Ultra3000 with DeviceNet data types.

Mnemonic	Description
ARRAY	Sequence of Data
BOOL	Boolean (1 byte)
BYTE	Bit String, (1 byte)
DINT	Signed Double Integer (4 bytes)
DWORD	Bit String, (4 bytes)
EPATH	DeviceNet Path Segments
INT	Signed Integer (2 bytes)
SHORT_STRING	Character String (1 byte length indicator, 1 byte per character)
SINT	Signed Short Integer (1 byte)
UDINT	Unsigned Double Integer (4 bytes)
UINT	Unsigned Integer (2 bytes)
USINT	Unsigned Short Integer (1 byte)
WORD	16-bit Word, (2 bytes)

Identity Object (Class ID 01_H)

This object provides identification and general information about the device.

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,
Instance ID = 1 - 2

Instance ID	Description
1	Ultra3000
2	Ultra3000 Main Firmware

Identity Object,
Attributes of Instance ID = 1 - 2

Attr. ID	Access Rule	Attribute Name	Data 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 Instance 2: 105 = Subcomponent
3		Product Code		Identification of a particular product of an individual vendor	Instance 1: 12 = 2098-DSD-005-DN 13 = 2098-DSD-010-DN 14 = 2098-DSD-020-DN 15 = 2098-DSD-030-DN 16 = 2098-DSD-075-DN 17 = 2098-DSD-150-DN 18 = 2098-DSD-005X-DN 19 = 2098-DSD-010X-DN 20 = 2098-DSD-020X-DN 21 = 2098-DSD-030X-DN 62 = 2098-DSD-075X-DN 63 = 2098-DSD-150X-DN 81 = 2098-DSD-HV030-DN 82 = 2098-DSD-HV050-DN 83 = 2098-DSD-HV100-DN 84 = 2098-DSD-HV150-DN 85 = 2098-DSD-HV220-DN 86 = 2098-DSD-HV030X-DN 87 = 2098-DSD-HV050X-DN 88 = 2098-DSD-HV100X-DN 89 = 2098-DSD-HV150X-DN 90 = 2098-DSD-HV220X-DN Instance 2: 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		Reserved, set to 0
2	Configured	Always = 0
3		Reserved, set to 0
4, 5, 6, 7		Vendor specific
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.

Reset Service

When the Identity Object receives a Reset request, it:

- determines if it can provide the type of reset requested
- responds to the request
- attempts to perform the type of reset requested

The Reset common service has the following object-specific parameter:

Identity Object, Reset Service

Name	Data Type	Description	Semantics of Values
Type	USINT	Type of Reset	0 = Emulate as closely as possible cycling power of the item the Identity Object represents. (default) 1 = Return as closely as possible to the out-of-box configuration, then emulate cycling power as closely as possible.

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	Data 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	Data 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	Data Type	Description	Semantics of Values
1	Set	MAC ID	USINT	Node Address	Range 0-63
	Set is only supported if the MAC ID is programmable. Refer to Ultra3000 Digital Servo Drive Installation Manual listed on page P-2 for Rotary DIP switch data setting.				
2	Set	Baud Rate		Data Rate	0 = 125K, 1 = 250K, 2 = 500K
	Set is only supported if the data rate is programmable. Refer to Ultra3000 Digital Servo Drive Installation Manual listed on page P-2 for Rotary DIP switch data setting.				
3	Set	Bus OFF Interrupt (BOI)	BOOL	Bus-OFF Interrupt	Default = 0
4		Bus OFF Counter	USINT	Number of times Controller Area Network (CAN) went to the bus-OFF state	Range 0-255

DeviceNet Object,
Attributes of Instance ID = 1 (Continued)

Attr. ID	Access Rule	Attribute Name	Data Type	Description	Semantics of Values
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)

Assembly Objects are objects that bind attributes of multiple objects to allow data to or from each object to be sent over a single connection. The Ultra3000 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:

- Output Assemblies are defined as the information that is output by the scanner and consumed by the Ultra3000.
- Input Assemblies are consumed by the scanner or are the scanner's input.

The Ultra3000 with DeviceNet allows you to choose between various Input and Output Assemblies, thereby choosing the data format of the messages that are passed back and forth between the Ultra3000 with DeviceNet and the scanner over the I/O connection. The following parameters select the Assembly Object instances that are exchanged over an I/O messaging connection.

Parameter Instance [1]	Parameter Name	Description
7	I/O Receive Select	Selects the Assembly Object instance that is updated when a Poll/Change-of-State/Cyclic I/O message is received by the drive. See page 2-48 for more information.
8	Poll Transmit (Xmit) Select	Selects the Assembly Object instance that is transmitted by the drive over a Polled I/O connection. See page 2-48 for more information.
9	COS/Cyclic Transmit (Xmit) Select	Selects the Assembly Object instance that is transmitted by the drive over a Change-of-State/Cyclic I/O connection. See page 2-49 for more information.

[1] Refer to the section on the Parameter Object for more information about parameter instances.

IMPORTANT If the above parameters are modified, you must perform one of the following before the modified value(s) are active:

- Close any existing I/O messaging connection(s)
- Power cycle the drive
- Reset the drive
- Remove and reapply DeviceNet power to the drive.

In addition, you 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 Ultra3000. This document 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	Data 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/W = Read/Write
- R/PW = Read/Write Protected.

Refer to the sections *Output Assemblies* on page 2-14 and *Input Assemblies* on page 2-33 for detailed information about the various instances of the Assembly Objects.

Assembly Object, Instance ID = 1 - 18				
ID	**Data Type**	**Access**	**Size (Bytes)**	**Description**
1	Static Output	R/W	1	Handshake Bit, Feedback Data Pointer
2	Static Output	R/W	7	Handshake Bit, Feedback Data Pointer, and Parameter Data Value
3	Static Output	R/PW	2	16 Bit Logic Command
4	Static Output	R/PW	3	16 Bit Logic Command, Handshake Bit, and Feedback Data Pointer
5	Static Output	R/PW	8	16 Bit Logic Command, Handshake Bit, Feedback Data Pointer, and Command Data Value
6	Static Output	R/PW	9	16 Bit Logic Command, Handshake Bit, Feedback Data Pointer, and Parameter Data Value
7	Static Output	R/PW	4	32 Bit Logic Command
8	Static Output	R/PW	5	32 Bit Logic Command, Handshake Bit, and Feedback Data Pointer
9	Static Output	R/PW	11	32 Bit Logic Command, Startup Commutation Done Bit, Feedback Data Pointer, and Parameter Data Value
10	Static Input	RO	4	32 Bit Logic Status
11	Static Input	RO	8	32 Bit Logic Status, and Feedback Data Value
12	Static Input	RO	9	32 Bit Logic Status, Extra Status Byte (with Write Data Status Bits, Handshake Echo Bit, Feedback Data Pointer and Feedback Data Value
13	Static Input	RO	5	32 Bit Logic Status, Extra Status Byte (with Write Data Status Bits, and Handshake Echo Bit)
14	Static Input	RO	8	Alternate 32 Bit Logic Status with Write Data Status Bits (replacing Position Limits Bits), and Feedback Data Value

Assembly Object, Instance ID = 1 - 18				
ID	**Data Type**	**Access**	**Size (Bytes)**	**Description**
15	Static Input	RO	4	Alternate 32 Bit Logic Status with Write Data Status Bits (replacing Position Limit Bits)
16	Static Input	RO	4	Feedback Data Value
17	Static Input	RO	5	Extra Status Byte (with Write Data Status bits, Handshake Echo Bit, and Feedback Data Pointer and Feedback Data Value
18	Static Input	RO	1	Extra Status Byte with Write Data Status Bits, and Handshake Echo Bit

Assembly Object, Attribute of Instances ID = 1 - 18			
Attr ID	**Access Rule**	**Attribute Name**	**Data Type**
3	Set	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.

Output Assemblies

There are nine output assemblies. An Output Assembly can consist of a 16 or 32 bit Logic Command, a Handshake bit, Feedback Data Pointer, and/or a Data Value.

Assembly Object, Instance 1 - Output Assembly Handshake Bit, Feedback Data Pointer								
Byte	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
0			Handshake		Feedback Data Pointer			

Assembly Object,
Instance ID = 2 - Output Assembly
Handshake Bit, Feedback Data Pointer, and Parameter Data Value

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Write Data	Save to NVMEM	Handshake		Feedback Data Pointer			
1	Parameter Instance - Low Byte							
2	Parameter Instance - High Byte							
3	Data Value - Low Byte							
4	Data Value - Low Middle Byte							
5	Data Value - High Middle Byte							
6	Data Value - High Byte							

Assembly Object,
Instance ID = 3 - Output Assembly
16 Bit Logic Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Preset Select 5	Preset Select 4	Preset Select 3	Preset Select 2	Preset Select 1	Preset Select 0	Follower Enable	Integrator Inhibit
1	Enable	Reset Faults	Start Homing	Remove Offset	Disable Serial Communications	Define Home	Start Index	Operation Mode Override

Assembly Object,
Instance ID = 4 - Output Assembly
16 Bit Logic Command, Handshake Bit, and Feedback Data Pointer

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Preset Select 5	Preset Select 4	Preset Select 3	Preset Select 2	Preset Select 1	Preset Select 0	Follower Enable	Integrator Inhibit
1	Enable	Reset Faults	Start Homing	Remove Offset	Disable Serial Communications	Define Home	Start Index	Operation Mode Override
2	Reserved	Reserved	Handshake	Reserved	Feedback Data Pointer			

Assembly Object,
Instance ID = 5 - Output Assembly
16 Bit Logic Command, Handshake Bit, Feedback Data Pointer, and Command Data Value

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Preset Select 5	Preset Select 4	Preset Select 3	Preset Select 2	Preset Select 1	Preset Select 0	Follower Enable	Integrator Inhibit
1	Enable	Reset Faults	Start Homing	Remove Offset	Disable Serial Communications	Define Home	Start Index	Operation Mode Override
2	Write Data	Save to NVMEM	Handshake	Reserved	Feedback Data Pointer			
3	Command Data Pointer							
4	Data Value - Low Byte							
5	Data Value - Low Middle Byte							
6	Data Value - High Middle Byte							
7	Data Value - High Byte							

Assembly Object,
Instance ID = 6 - Output Assembly
16 Bit Logic Command, Handshake Bit, Feedback Data Pointer, and Parameter Data Value

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Preset Select 5	Preset Select 4	Preset Select 3	Preset Select 2	Preset Select 1	Preset Select 0	Follower Enable	Integrator Inhibit
1	Enable	Reset Faults	Start Homing	Remove Offset	Disable Serial Communications	Define Home	Start Index	Operation Mode Override
2	Write Data	Save to NVMEM	Handshake	Reserved	Feedback Data Pointer			
3	Parameter Instance - Low Byte							
4	Parameter Instance - High Byte							
5	Data Value - Low Byte							
6	Data Value - Low Middle Byte							
7	Data Value - High Middle Byte							
8	Data Value - High Byte							

Assembly Object,
Instance ID = 7 - Output Assembly
32 Bit Logic Command

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	Reserved	Abort Homing	Pause Homing	Abort Index	Pause Index	Disable Serial Communications
1	Reserved	Reserved	Preset Select 5	Preset Select 4	Preset Select 3	Preset Select 2	Preset Select 1	Preset Select 0
2	Reserved	Position Strobe	Operation Mode Override	Reserved	Reserved	Follower Enable	Integrator Inhibit	Define Position
3	Enable	Reset Faults	Start Homing	Remove Offset	Reserved	Define Home	Start Index	Reset Drive

Assembly Object,
Instance ID = 8 - Output Assembly
32 Bit Logic Command, Handshake Bit, and Feedback Data Pointer

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	Reserved	Abort Homing	Pause Homing	Abort Index	Pause Index	Disable Serial Communications
1	Reserved	Reserved	Preset Select 5	Preset Select 4	Preset Select 3	Preset Select 2	Preset Select 1	Preset Select 0
2	Reserved	Position Strobe	Operation Mode Override	Reserved	Reserved	Follower Enable	Integrator Inhibit	Define Position
3	Enable	Reset Faults	Start Homing	Remove Offset	Reserved	Define Home	Start Index	Reset Drive
4	Reserved	Reserved	Handshake	Reserved	Feedback Data Pointer			

Assembly Object,
Instance ID = 9 - Output Assembly
32 Bit Logic Command, Startup Commutation Done **Bit, Feedback Data Pointer, and Parameter Data Value**

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Reserved	Reserved	Abort Homing	Pause Homing	Abort Index	Pause Index	Disable Serial Communications
1	Reserved	Reserved	Preset Select 5	Preset Select 4	Preset Select 3	Preset Select 2	Preset Select 1	Preset Select 0
2	Reserved	Position Strobe	Operation Mode Override	Reserved	Reserved	Follower Enable	Integrator Inhibit	Define Position
3	Enable	Reset Faults	Start Homing	Remove Offset	Reserved	Define Home	Start Index	Reset Drive
4	Write Data	Save to NVMEM	Handshake	Reserved	Feedback Data Pointer			
5	Parameter Instance - Low Byte							
6	Parameter Instance - High Byte							
7	Data Value - Low Byte							
8	Data Value - Low Middle Byte							
9	Data Value - High Middle Byte							
10	Data Value - High Byte							

Logic Commands

The first two or four bytes in several Output Assemblies are referred to as the Logic Command. The logic command bits correspond to functions available via the hardware digital inputs on the Ultra3000 Drive with DeviceNet. Parameter 10 - Logic Command Mask allows you to mask off (zero) selected Logic Command bits to prevent the bits activating any functions.

Note: The Logic Command Mask has a default value of zero. Therefore, the Logic Command has no affect unless you modify the Logic Command Mask.

The Enable bit in the logic command is OR'ed or AND'ed with a hardware ENABLE as specified by Parameter 11 - Enable Behavior.

- If the ENABLE function has not been assigned to a hardware input, then the hardware ENABLE is always active.
- If any of the other functions have not been assigned to a hardware input, then the corresponding logic command bit controls the function.
- If a function has been assigned to a hardware input, then the corresponding logic command bit is OR'ed with the hardware input.

IMPORTANT A transition (0 -> 1) on a logic command bit is not recognized if the corresponding hardware input is active.

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

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

Disable Serial Communications

This bit inhibits the drive's Serial Communications port operation.

- 1 = Serial Communications disabled
- 0 = Serial Communications enabled

Pause Index

This bit temporarily pauses an indexing sequence by decelerating to a stop. The state of the input is continuously monitored to determine if the motion should be stopped or if it may continue.

- 0 = Continue Indexing (Inactive)
- 1 = Pause Index

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Abort Index

A transition from zero to one (0 -> 1) terminates an indexing move.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Pause Homing

This bit temporarily pauses a homing sequence by decelerating to a stop. The state of the input is continuously monitored to determine if the motion should be stopped or if it may continue.

- 0 = Continue Homing (Inactive)
- 1 = Pause Homing

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Abort Homing

A transition from zero to one (0 -> 1) terminates a homing sequence.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Preset Select 0 to 5

Preset Select 0 to 2 are used in combination to select a Preset Current, Preset Velocity, Preset Position, or Preset Follower Gearing Ratio. Preset Select 0 to 5 are used in combination to select an Index. The 64 possible binary combinations of the Preset Selects are shown in the following table.

Preset	Preset Select 5	Preset Select 4	Preset Select 3	Preset Select 2	Preset Select 1	Preset Select 0
0	0	0	0	0	0	0
1	0	0	0	0	0	1
2	0	0	0	0	1	0
3	0	0	0	0	1	1
4	0	0	0	1	0	0
5	0	0	0	1	0	1
6	0	0	0	1	1	0
7	0	0	0	1	1	1
. . .	. . .	. . .	. . .	. . .	. . .	. . .
61	1	1	1	1	0	1
62	1	1	1	1	1	0
63	1	1	1	1	1	1

Define Position

When this input becomes active, it sets the Preset Position (parameter 304, 308, 312, 316, 320, 324, 328 or 332) selected by Preset Select 0 to 2, equal to the current drive position.

- 0 = Inactive
- 1 = Active

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Integrator Inhibit

This bit is used to zero the velocity loop integrator.

- 0 = No action
- 1 = Inhibit Integrator

Follower Enable

This bit allows the position loop to track the position command when the drive is in the Follower Mode.

- 0 = Inactive
- 1 = Active

Position Strobe

An inactive state freezes the state of the motor encoder outputs. A transition to an active state causes the drive to output a continuous sequence of encoder counts until the absolute position is reached on an external counter. This input is used in conjunction with the Tracking output function.

- 0 = Inactive
- 1 = Active

Operation Mode Override

This bit selects whether drive uses Parameter 33 - Operation Mode or Parameter 34 - Override Mode (Operation Mode Override) to determine the command source.

- 0 = Parameter 33 - Operation Mode selects the command source
- 1 = Parameter 34 - Override Mode (Operation Mode Override) selects the command source

Reset Drive

The drive resets anytime it receives a logic command with the Reset Drive bit set high (except if the drive is enabled).

- 0 = Reset, or reboot, the hardware and firmware in the drive.
- 1 = Inactive

Start Index

A transition from zero to one (0 -> 1) of the Start Index bit begins an index move if the drive's current Operation Mode is Indexing. A transition is not recognized if a hardware input assigned as Start Index is active.

Note: This output requires an Indexing drive (e.g.,2098-DSD-*xxx*X).

Define Home

A transition from zero to one (0 -> 1) causes the present motor position to be selected as Home position. This means that the position command is set to Parameter 344 - Home Position, and the position feedback is simultaneously set to its appropriate value, according to the position error.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Remove Offset

A transition from zero to one (0 -> 1) causes the offset of the analog command input to be measured (after averaging), and sets Parameter 254 - Analog Velocity Offset and Parameter 256 - Analog Current Offset to the negative of this value.

Start Homing

A transition from zero to one (0 -> 1) initiates the homing routine.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Reset Faults

A transition from zero to one (0 -> 1) resets any detected drive faults.

ATTENTION If an Enable input is active, the drive may be enabled and unexpected motion may occur.

Enable

This bit enables the drive (1 =enable, 0 = disable) depending on the hardware ENABLE and Parameter 11 - Enable Behavior. You can specify this bit to be OR'ed or AND'ed with the hardware ENABLE by setting the Enable Behavior parameter.

- If Enable Behavior is set to 'Hardware OR DNet Input', then either a hardware ENABLE or this bit can enable the drive.
- If Enable Behavior is set to 'Hardware AND DNet Input', both the hardware ENABLE and this bit must be active to enable the drive.

IMPORTANT Parameter 27 - Host Enable can temporarily disable the drive regardless of the hardware ENABLE and Logic Command Enable bit.

Handshake

A Handshake bit is included in some of the Output Assemblies and the bit is echoed in some of the Input Assemblies. An application can toggle the Handshake bit and confirm if the drive received the Output Assembly by monitoring the Handshake Echo bit in the Input Assembly. The drive does not use the Handshake bit for any other purpose.

Feedback Data Pointer

The Feedback Data Pointer, contained in some of the Output Assemblies, selects the Feedback Data Value that the Input Assembly should return. The following table lists the available Feedback Data Values.

Refer to the Parameter Object instances to obtain scaling and units information.

Feedback Data Pointer	Name	Parameter Object Instance	Data Type
0	Position Command	132	DINT
1	Motor Position	134	DINT
2	Motor Velocity	140	DINT (not filtered)
3	Average Current	142	INT
4	Fault Status	123	DWORD
5	Extended Fault Status	124	WORD
6	Input Status	122	DWORD
7	Output Status	121	DWORD
8	Current Command	143	INT
9	Auxiliary Encoder Position	135	DINT
10	Position Error	133	DINT
11	Velocity Error	139	DINT
12	DC Bus Voltage	131	UINT
13	Velocity Command	138	DINT

Parameter Data Value and Command Data Value Fields

The Parameter and Command Data Value fields contained in some of the Output Assemblies allow you to write a parameter value to the drive via I/O messaging. You can use Assemblies 2, 6, and 9 to write a Data Value to the parameter object specified by Parameter Instance - Low Byte and Parameter Instance - High Byte. See *Parameter Object, Instances ID = 1- 1059* on page 47. Assembly 5 also allows you to write a Data Value to a parameter. However, Assembly 5 uses a Command Data Pointer to select one of the parameters listed in the Command Data table. Assembly 5 was implemented because it can be sent in a non-fragmented I/O message. If Assembly 6 is sent via an I/O message, the message is fragmented.

The Write Data bit is used to latch the Data Value that is located in the last four bytes of the Output Assembly. A new data value will be accepted by the drive on a zero to one transition (0 -> 1) of the Write Data bit only if the Write Data Busy/Ack bit (located in the Input Assembly) is low: 0 = idle, 1 = busy. The Write Data Busy/Ack bit is cleared when the Write Data bit is set to zero and the drive is not busy saving the data value. The Write Data and Write Data Busy/Ack bits are ignored if the command assembly is updated via an explicit message. By default, the value is only written to the drive as a

working value and is NOT saved in nonvolatile memory unless the Save To NVMEM bit is set. The working value is lost if the drive is reset or power cycled.

IMPORTANT The nonvolatile memory has a limited number of write cycles. Do not save parameter values to nonvolatile memory (NVMEM) unless absolutely necessary. In other words, minimize the number of times parameter values are saved to nonvolatile memory (NVMEM).

IMPORTANT The drive acts on the Logic Command before reading the Data Value. Therefore, the drive will accept the Logic Command even though the Data Value may be invalid. If an I/O message writes an invalid Data Value, the drive sets the Write Data Error bit in the Input Assembly. If the Data Value is updated via an explicit message, the drive will return an error response if the Data Value is invalid.

Command Data Table

The following table references the Command Data Pointer and Parameter Object Instances for each Ultra3000 with DeviceNet command.

Command Data Pointer	Name	Parameter Object Instance
0	NULL	
1	Reset Faults	22
2	Reset Drive	23
3	Reset Personality	24
4	Reset I Peaks	25
5	Define Home Command	26
6	Host Enable	27
7	Host Control Mode	28
8	Velocity Setpoint	29
9	Current Setpoint	30
10	Setpoint Accel	31
11	Positive I Limit	37
12	Negative I Limit	38
13	Soft Overtravel	39 [1]
14	Positive Soft Position Limit	40 [1]
15	Negative Soft Position Limit, or Acceleration Feedforward Gain - Kaff	41 [1] 111 [2]
16	Positive Decel Distance, or Position Compare 1 Max	42 [1] 112 [2]
17	Negative Decel Distance, or Position Compare 2 Max	43 [1] 113 [2]
18	Zero Speed Limit	44
19	Speed Window	45
20	Up to Speed	46
21	Position Window Size	47
22	Position Window Time	48
23	Position Compare 1 Type	49
24	Position Compare 1 Min	50
25	Position Compare 2 Type	51
26	Position Compare 2 Min	52

[1] These commands are available only to indexing drives.

[2] These commands are available only to non-indexing drives.

Command Data Pointer	Name	Parameter Object Instance
27	Velocity Loop P_Gain	53
28	Velocity Loop I_Gain	54
29	Velocity Loop D_Gain	55
30	Position Loop Kp Gain	56
31	Position Loop Ki Gain	57
32	Position Loop Kd Gain	58
33	Position Loop Kff Gain	59
34	Position Loop Ki Zone	60
35	Low Pass Filter	61
36	Low Pass Bandwidth	62
37	Digital Output Override	95
38	Override Analog Output	101
39	Analog Output Override	102
40	User Current Fault	103
41	User Velocity Limit	104
42	User Velocity Fault	105
43	Velocity Error Limit	106
44	Velocity Error Time	107
45	Position Error Limit	108
46	Position Error Time	109
47	Slew Enable	262
48	Slew Limit	263
49	Master Gear Count 0	264
50	Motor Gear Count 0	265
51	Master Gear Count 1	266
52	Motor Gear Count 1	267
53	Master Gear Count 2	268
54	Motor Gear Count 2	269
55	Master Gear Count 3	270
56	Motor Gear Count 3	271
57	Master Gear Count 4	272
58	Motor Gear Count 4	273
59	Master Gear Count 5	274
60	Motor Gear Count 5	275
61	Master Gear Count 6	276
62	Motor Gear Count 6	277

Command Data Pointer	Name	Parameter Object Instance
63	Master Gear Count 7	278
64	Motor Gear Count 7	279
65	Velocity Preset 0	280
66	Velocity Preset 1	281
67	Velocity Preset 2	282
68	Velocity Preset 3	283
69	Velocity Preset 4	284
70	Velocity Preset 5	285
71	Velocity Preset 6	286
72	Velocity Preset 7	287
73	Limit Preset Accel	288
74	Preset Accel Limit	289
75	Preset Decel Limit	290
76	Current Preset 0	291
77	Current Preset 1	292
78	Current Preset 2	293
79	Current Preset 3	294
80	Current Preset 4	295
81	Current Preset 5	296
82	Current Preset 6	297
83	Current Preset 7	298
84 [3]	Preset Position 0	304
85 [3]	Preset Position 0 Velocity	305
86 [3]	Preset Position 0 Accel	306
87 [3]	Preset Position 0 Decel	307
88 [3]	Preset Position 1	308
89 [3]	Preset Position 1 Velocity	309
90 [3]	Preset Position 1 Accel	310
91 [3]	Preset Position 1 Decel	311
92 [3]	Preset Position 2	312
93 [3]	Preset Position 2 Velocity	313
94 [3]	Preset Position 2 Accel	314
95 [3]	Preset Position 2 Decel	315
96 [3]	Preset Position 3	316
97 [3]	Preset Position 3 Velocity	317
98 [3]	Preset Position 3 Accel	318

Command Data Pointer	Name	Parameter Object Instance
99 [3]	Preset Position 3 Decel	319
100 [3]	Preset Position 4	320
101 [3]	Preset Position 4 Velocity	321
102 [3]	Preset Position 4 Accel	322
103 [3]	Preset Position 4 Decel	323
104 [3]	Preset Position 5	324
105 [3]	Preset Position 5 Velocity	325
106 [3]	Preset Position 5 Accel	326
107 [3]	Preset Position 5 Decel	327
108 [3]	Preset Position 6	328
109 [3]	Preset Position 6 Velocity	329
110 [3]	Preset Position 6 Accel	330
111 [3]	Preset Position 6 Decel	331
112 [3]	Preset Position 7	332
113 [3]	Preset Position 7 Velocity	333
114 [3]	Preset Position 7 Accel	334
115 [3]	Preset Position 7 Decel	335
116 [3]	Homing Type	336
117 [3]	Home Sensor Backoff	338
118 [3]	Homing Velocity	339
119 [3]	Homing Accel/ Decel	340
120 [3]	Home Offset Move	341
121 [3]	Homing Stop Decel	342
122 [3]	Home Sensor Polarity	343
123 [3]	Home Position	344
124 [3]	Homing Creep Velocity	345
125 [3]	Home Sensor Current	346
126 [3]	Start Homing Command	347
127 [3]	Abort Homing Command	348
128 [3]	Pause Homing Command	349
129 [3]	Host Index Number	350
130 [3]	Start Index Command	351
131 [3]	Abort Index Decel	356
132 [3]	Index 0 Type	357
133 [3]	Index 0 Distance/ Position	358
134 [3]	Index 0 Count	359

Command Data Pointer	Name	Parameter Object Instance
135 [3]	Index 0 Dwell	360
136 [3]	Index 0 Registration Distance	361
137 [3]	Index 0 Velocity	362
138 [3]	Index 0 Accel	363
139 [3]	Index 0 Decel	364
140 [3]	Index 0 Pointer	365
141 [3]	Index 0 Terminate	366
142 [3]	Index 1 Type	367
143 [3]	Index 1 Distance/ Position	368
144 [3]	Index 1 Count	369
145 [3]	Index 1 Dwell	370
146 [3]	Index 1 Registration Distance	371
147 [3]	Index 1 Velocity	372
148 [3]	Index 1 Accel	373
149 [3]	Index 1 Decel	374
150 [3]	Index 1 Pointer	375
151 [3]	Index 1 Terminate	376
152 [3]	Index 2 Type	377
153 [3]	Index 2 Distance/ Position	378
154 [3]	Index 2 Count	379
155 [3]	Index 2 Dwell	380
156 [3]	Index 2 Registration Distance	381
157 [3]	Index 2 Velocity	382
158 [3]	Index 2 Accel	383
159 [3]	Index 2 Decel	384
160 [3]	Index 2 Pointer	385
161 [3]	Index 2 Terminate	386
162 [3]	Index 3 Type	387
163 [3]	Index 3 Distance/ Position	388
164 [3]	Index 3 Count	389
165 [3]	Index 3 Dwell	390
166 [3]	Index 3 Registration Distance	391
167 [3]	Index 3 Velocity	392
168 [3]	Index 3 Accel	393
169 [3]	Index 3 Decel	394
170 [3]	Index 3 Pointer	395

Command Data Pointer	Name	Parameter Object Instance
171 [3]	Index 3 Terminate	396
172 [3]	Index 4 Type	397
173 [3]	Index 4 Distance/ Position	398
174 [3]	Index 4 Count	399
175 [3]	Index 4 Dwell	400
176 [3]	Index 4 Registration Distance	401
177 [3]	Index 4 Velocity	402
178 [3]	Index 4 Accel	403
179 [3]	Index 4 Decel	404
180 [3]	Index 4 Pointer	405
181 [3]	Index 4 Terminate	406
182 [3]	Index 5 Type	407
183 [3]	Index 5 Distance/ Position	408
184 [3]	Index 5 Count	409
185 [3]	Index 5 Dwell	410
186 [3]	Index 5 Registration Distance	411
187 [3]	Index 5 Velocity	412
188 [3]	Index 5 Accel	413
189 [3]	Index 5 Decel	414
190 [3]	Index 5 Pointer	415
191 [3]	Index 5 Terminate	416
192 [3]	Index 6 Type	417
193 [3]	Index 6 Distance/ Position	418
194 [3]	Index 6 Count	419
195 [3]	Index 6 Dwell	420
196 [3]	Index 6 Registration Distance	421
197 [3]	Index 6 Velocity	422
198 [3]	Index 6 Accel	423
199 [3]	Index 6 Decel	424
200 [3]	Index 6 Pointer	425
201 [3]	Index 6 Terminate	426
202 [3]	Index 7 Type	427
203 [3]	Index 7 Distance/ Position	428
204 [3]	Index 7 Count	429
205 [3]	Index 7 Dwell	430
206 [3]	Index 7 Registration Distance	431

Command Data Pointer	Name	Parameter Object Instance
207 [3]	Index 7 Velocity	432
208 [3]	Index 7 Accel	433
209 [3]	Index 7 Decel	434
210 [3]	Index 7 Pointer	435
211 [3]	Index 7 Terminate	436
212 [3]	Index 8 Type	437
213 [3]	Index 8 Distance/ Position	438
214 [3]	Index 8 Count	439
215 [3]	Index 8 Dwell	440
216 [3]	Index 8 Registration Distance	441
217 [3]	Index 8 Velocity	442
218 [3]	Index 8 Accel	443
219 [3]	Index 8 Decel	444
220 [3]	Index 8 Pointer	445
221 [3]	Index 8 Terminate	446
222 [3]	Index 9 Type	447
223 [3]	Index 9 Distance/ Position	448
224 [3]	Index 9 Count	449
225 [3]	Index 9 Dwell	450
226 [3]	Index 9 Registration Distance	451
227 [3]	Index 9 Velocity	452
228 [3]	Index 9 Accel	453
229 [3]	Index 9 Decel	454
230 [3]	Index 9 Pointer	455
231 [3]	Index 9 Terminate	456
232 [3]	Index 0 Absolute Direction	997
233 [3]	Index 1 Absolute Direction	998
234 [3]	Index 2 Absolute Direction	999
235 [3]	Index 3 Absolute Direction	1000
236 [3]	Index 4 Absolute Direction	1001
237 [3]	Index 5 Absolute Direction	1002
238 [3]	Index 6 Absolute Direction	1003
239 [3]	Index 7 Absolute Direction	1004
220 [3]	Index 8 Absolute Direction	1005
241 [3]	Index 9 Absolute Direction	1006
242 [3]	Acceleration Feedforward Gain - Kaff	111

Command Data Pointer	Name	Parameter Object Instance
243 [3]	Position Compare 1 Max	112
244 [3]	Position Compare 2 Max	113

[3] These commands are available only to indexing drives.

Input Assemblies

There are nine input assemblies. An input assembly can consist of a 32 bit Logic Status, an Extra Status Byte, and/or a Feedback Data Value.

Assembly Object,
Instance ID = 10 - Input Assembly
32 Bit Logic Status

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Startup Commutation Done	Tracking	Axis Homed	Registered	In Dwell	In Motion	End of Sequence	At Home
1	Position Compare 2	Position Compare 1	At Index 1 Position	At Index 0 Position	Negative Overtravel	Positive Overtravel	Negative Hardware Overtravel	Positive Hardware Overtravel
2	Drive Enabled	Up To Speed	Negative Current Limit	Positive Current Limit	Within Speed Window	Zero Speed	Within Position Window	In Position
3	Drive Ready	Brake Active	Reserved	Reserved	Reserved	Reserved	Fault Disable	DC Bus Charged

Assembly Object,
Instance ID = 11 - Input Assembly
32 Bit Logic Status, and Feedback Data Value

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Startup Commutation Done	Tracking	Axis Homed	Registered	In Dwell	In Motion	End of Sequence	At Home
1	Position Compare 2	Position Compare 1	At Index 1 Position	At Index 0 Position	Negative Overtravel	Positive Overtravel	Negative Hardware Overtravel	Positive Hardware Overtravel
2	Drive Enabled	Up To Speed	Negative Current Limit	Positive Current Limit	Within Speed Window	Zero Speed	Within Position Window	In Position
3	Drive Ready	Brake Active	Reserved	Reserved	Reserved	Reserved	Fault Disable	DC Bus Charged
4	Feedback Data Value - Low Byte							

Assembly Object,
Instance ID = 11 - Input Assembly
32 Bit Logic Status, and Feedback Data Value

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
5	Feedback Data Value - Low Middle Byte							
6	Feedback Data Value - High Middle Byte							
7	Feedback Data Value - High Byte							

Assembly Object,
Instance ID = 12 - Input Assembly
32 Bit Logic Status, Extra Status Byte (with Write Data Status Bits, Handshake Echo Bit, Feedback Data Pointer and Feedback Data Value

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Startup Commutation Done	Tracking	Axis Homed	Registered	In Dwell	In Motion	End of Sequence	At Home
1	Position Compare 2	Position Compare 1	At Index 1 Position	At Index 0 Position	Negative Overtravel	Positive Overtravel	Negative Hardware Overtravel	Positive Hardware Overtravel
2	Drive Enabled	Up To Speed	Negative Current Limit	Positive Current Limit	Within Speed Window	Zero Speed	Within Position Window	In Position
3	Drive Ready	Brake Active	Reserved	Reserved	Reserved	Reserved	Fault Disable	DC Bus Charged
4	Write Data Busy/Ack	Write Data Error	Handshake Echo	Reserved	Feedback Data Pointer			
5	Feedback Data Value - Low Byte							
6	Feedback Data Value - Low Middle Byte							
7	Feedback Data Value - High Middle Byte							
8	Feedback Data Value - High Byte							

Assembly Object,
Instance ID = 13 - Input Assembly
32 Bit Logic Status, Extra Status Byte (with Write Data Status Bits, and Handshake Echo Bit)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Startup Commutation Done	Tracking	Axis Homed	Registered	In Dwell	In Motion	End of Sequence	At Home
1	Position Compare 2	Position Compare 1	At Index 1 Position	At Index 0 Position	Negative Overtravel	Positive Overtravel	Negative Hardware Overtravel	Positive Hardware Overtravel
2	Drive Enabled	Up To Speed	Negative Current Limit	Positive Current Limit	Within Speed Window	Zero Speed	Within Position Window	In Position
3	Drive Ready	Brake Active	Reserved	Reserved	Reserved	Reserved	Fault Disable	DC Bus Charged
4	Write Data Busy/Ack	Write Data Error	Handshake Echo	Reserved	Reserved	Reserved	Reserved	Reserved

Assembly Object,
Instance ID = 14 - Input Assembly
Alternate 32 Bit Logic Status with Write Data Status Bits (replacing Position Limits Bits), and Feedback Data Value

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Startup Commutation Done	Tracking	Axis Homed	Registered	In Dwell	In Motion	End of Sequence	At Home
1	Write Data Busy/Ack	Write Data Error	At Index 1 Position	At Index 0 Position	Negative Overtravel	Positive Overtravel	Negative Hardware Overtravel	Positive Hardware Overtravel
2	Drive Enabled	Up To Speed	Negative Current Limit	Positive Current Limit	Within Speed Window	Zero Speed	Within Position Window	In Position
3	Drive Ready	Brake Active	Reserved	Reserved	Reserved	Reserved	Fault Disable	DC Bus Charged
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							

Assembly Object,
Instance ID = 15 - Input Assembly
Alternate 32 Bit Logic Status with Write Data Status Bits (replacing Position Limit Bits)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Startup Commutation Done	Tracking	Axis Homed	Registered	In Dwell	In Motion	End of Sequence	At Home
1	Write Data Busy/Ack	Write Data Error	At Index 1 Position	At Index 0 Position	Negative Overtravel	Positive Overtravel	Negative Hardware Overtravel	Positive Hardware Overtravel
2	Drive Enabled	Up To Speed	Negative Current Limit	Positive Current Limit	Within Speed Window	Zero Speed	Within Position Window	In Position
3	Drive Ready	Brake Active	Reserved	Reserved	Reserved	Reserved	Fault Disable	DC Bus Charged

Assembly Object,
Instance ID = 16 - Input Assembly
Feedback Data Value

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Feedback Data Value - Low Byte							
1	Feedback Data Value - Low Middle Byte							
2	Feedback Data Value - High Middle Byte							
3	Feedback Data Value - High Byte							

Assembly Object,
Instance ID = 17 - Input Assembly
Extra Status Byte (with Write Data Status bits, Handshake Echo Bit, and Feedback Data Pointer and Feedback Data Value

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Write Data Busy/Ack	Write Data Error	Handshake Echo	Reserved	Feedback Data Pointer			
1	Feedback Data Value - Low Byte							
2	Feedback Data Value - Low Middle Byte							
3	Feedback Data Value - High Middle Byte							
4	Feedback Data Value - High Byte							

Assembly Object,
Instance ID = 18 - Input Assembly
Extra Status Byte with Write Data Status Bits, and Handshake Echo Bit

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Write Data Busy/Ack	Write Data Error	Handshake Echo	Reserved	Reserved	Reserved	Reserved	Reserved

Logic Status

The first four bytes in some of the Input Assemblies are referred to as the Logic Status. The Logic Status consists of 32 bits.

At Home

This bit indicates that the position command is equal to the Parameter 344 - Home Position.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

End of Sequence

This bit indicates all iterations of the index move have been completed.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

In Motion

This bit indicates an index move is active and the motor is moving.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

In Dwell

Indicates the motor is holding position in an index move and waiting for the commanded dwell time.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Registered

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

Note: The Registration Distance must be larger than the distance required to stop or the move is not adjusted.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Axis Homed

This bit indicates that the homing routine has completed.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Tracking

This bit indicates that the motor position has been output and the encoder outputs are now tracking the motor encoder inputs. This output is used in conjunction with the Position Strobe input function.

Startup Commutation Done

This bit indicates that the drive has completed its commutation initialization algorithm.

Positive Hardware Overtravel

This bit indicates a motor integral limit switch has been encountered in the positive travel direction.

Note: This overtravel is *not* the Positive Hardware Overtravel initiated by a digital input to the drive.

Negative Hardware Overtravel

This bit indicates a motor integral limit switch has been encountered in the negative travel direction.

Note: This overtravel is *not* the Negative Hardware Overtravel initiated by a digital input to the drive.

Positive Overtravel

This bit indicates that the positive soft position limit, Parameter 40, has been exceeded, or the positive overtravel hardware input has become active, or the motor's positive integral limit (if this signal exists) has been reached.

Negative Overtravel

This bit indicates that the negative soft position limit, Parameter 41, has been exceeded, or the negative overtravel hardware input has become active, or the motor's negative integral limit (if this signal exists) has been reached.

At Index 0 Position

An active state indicates the commanded motor position is equal to the position defined by Index 0. This output functions only after the axis has been homed.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

At Index 1 Position

An active state indicates the commanded motor position is equal to the position defined by Index 1. This output functions only after the axis has been homed.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Position Limit 1

An active state indicates the condition defined by Parameter 49 (Position Compare 1 Type), Parameter 50 (Position Compare 1 Min), and Parameter 112 (Position Compare 1 Max), for Position Compare 1 is true. If the drive has not been homed, the Position Limit 1 bit is inactive.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

Position Limit 2

An active state indicates the condition defined by Parameter 51 (Position Compare 2 Type), Parameter 52 (Position Compare 2 Min), and Parameter 113 (Position Compare 2 Max) for Position Compare 2 is true. If the drive has not been homed, the Position Limit 2 bit is inactive.

Note: This output requires an Indexing drive (e.g., 2098-DSD-*xxx*X).

In Position

This bit indicates that the position error has been less than the Parameter 47 - Position Window Size value for longer than the Parameter 48 - Position Window Time value, and the speed is less than the Parameter 44 - Zero Speed Limit setting.

Within Position Window

This bit indicates that the position error has been less than the Parameter 47 - Position Window Size value for longer than the Parameter 48 - Position Window Time value.

Zero Speed

This bit indicates that the speed is less than the Parameter 44 - Zero Speed Limit setting.

Within Speed Window

This bit indicates that the velocity error is less than the Parameter 45 - Speed Window value.

Positive Current Limit

Indicates that the drive current is being limited in the positive direction.

Negative Current Limit

Indicates that the drive current is being limited in the negative direction.

Up To Speed

This bit indicates the motor velocity feedback is greater than the Parameter 46 - Up to Speed value.

Drive Enabled

This bit indicates if the power stage of the drive is enabled. For the power stage to be enabled, the software and/or hardware ENABLE inputs must be active, Parameter 27 - Host Enable must be enabled, and the drive cannot have any 'disabling' faults.

DC Bus Charged

This bit indicates if the DC bus is energized.

Fault Disable

This bit indicates that a fault has occurred that caused the drive to disable.

Brake Active

This bit indicates whether any digital output assigned as a BRAKE output is active. If this bit is zero, then any BRAKE output is inactive and the motor brake is applied. If this bit is one, then any BRAKE output is active, and the motor brake is released so the motor can move.

Drive Ready

Indicates that the drive is operational and does not have a 'disabling' fault.

Handshake Echo

The Handshake Echo bit is included in some of the Input Assemblies. The Handshake Echo bit is zero if the selected Output Assembly does not contain a Handshake bit. An application can toggle the Handshake bit in the Output Assembly and confirm if the drive received the Output Assembly by monitoring the Handshake Echo bit in an Input Assembly. The drive does not use the Handshake bit for any other purpose.

DeviceNet Communication Fault Action

You can configure the Ultra3000 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 Parameter 7 - I/O Receive Select is set to a non-zero value. The Output Assembly may not get updated for a several reasons:

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

By default, the Ultra3000 Drive with DeviceNet will fault and clear the logic command. You can configure the drive to take a different action by configuring the following parameters:

- Idle Fault Action — Parameter 13
- Comm Fault Action — Parameter 14
- Faulted Logic Command — Parameter 15

The Ultra3000 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 you to configure the Ultra3000 Drive with DeviceNet to take one of the following actions if a communication problem occurs that

prevents the Output (command) Assembly Object from being updated:

- Fault/ Zero Data — The Ultra3000 Drive with DeviceNet faults and the logic command is cleared
- Fault/ Hold Last — The Ultra3000 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 Faulted Logic Command parameter specifies the logic command value. The Ultra3000 Drive with DeviceNet does not fault. Refer to *Using the Fault Configured Input* on page 2-43.

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 the Faulted Logic Command. 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 value specified by the Faulted Logic Command — Parameter 15.

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

1. Set the desired value for the Faulted Logic Command.

2. Set the Idle Fault Action parameter and/or the Comm Fault Action parameter to Fault Config.

Using Explicit Messaging to Control the Ultra3000

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, you 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 is not 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 the connection.
- If a marked explicit connection times out based on the EPR, then the fault action will be that configured for Communication Loss over the I/O connection, Comm Fault Action — Parameter 14.
- If a marked explicit connection is deleted, then the fault action will be that configured for Idle over the I/O connection, Faulted Logic Command — Parameter 15.
- 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 Expected Packet Rate (EPR) value reset to zero (0) after being marked, then the connection will become unmarked.

IMPORTANT Do not use Explicit Messaging to set parameter objects that are changed frequently. An Explicit Set causes an NVMEM write. The nonvolatile memory has a limited number of write cycles.

Note: Explicit Get commands have no effect on NVMEM.

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	Data Type	Description
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 timeouts
13	Get	Produced_connection_path_ length	UINT	Number of bytes in the produced_connection_path attribute
14		Produced_connection_path	EPATH	Specifies the Application Object whose data is to be produced by this Connection object
15		Consumed_connection_path_len gth	UINT	Number of bytes in the Consumed_connection_path attribute
16		Consumed_connection_path	EPATH	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 Ultra3000 Drive with DeviceNet configuration data. It supplies a full description of the parameter, including its minimum and maximum 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 = nonvolatile storage save command Bit 3 = params are stored in nonvolatile storage
9		Configuration Assembly Instance	UINT	Instance number of the configuration assembly	0 = configuration assembly not supported

The table *Parameter Instance* on page 2-47 lists the parameter instances implemented in the Ultra3000 Drive with DeviceNet. The table *Parameter Object Instance Attributes* on page 2-97 lists the instance attributes of the parameter object. A parameter value is accessed via Attribute 1 of a parameter instance. Additional information about the parameter object is located beginning on Page 2-99.

IMPORTANT Some parameters cannot be modified while the Ultra3000 Drive with DeviceNet is enabled. The drive returns the error code, 10_h - Device State Conflict, if you attempt to modify one of these parameters while the drive is enabled.

IMPORTANT If Explicit Messages are to be used frequently to change the value of parameter objects, refer to Parameter 114 - Parameter Object Write Behavior. By default, an Explicit Message Set_Attribute_Single service causes a nonvolatile memory (NVMEM) write. However, the nonvolatile memory has a limited number of write cycles. Change Parameter 114 - Parameter Object Write Behavior to 1 - No NVMEM Writes to prevent writing the nonvolatile memory. Parameter values will continue to be written to volatile memory (RAM).

- Parameters 22–26, 63, 347–349, and 351 (which have a No Action (0) selection) are not saved in volatile or non-volatile memory.
- Parameters 27–30, 95, 101–102, and 350 are not saved in non-volatile memory, but are saved in volatile memory.

Note: Explicit Get commands have no effect on NVMEM.

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
1	Set	Drive Name	SHORT_ STRING	1 byte length indicator, 1 byte per character		The name of the drive, up to 32 characters long.
2	Get	Main Firmware Version	SHORT_ STRING	1 byte length indicator, 1 byte per character		The version of drive firmware, in the format XX.YY.ZZ, where: • XX = major revision • YY = minor revision • ZZ = maintenance revision (not displayed if zero).
3	Get	DN-SW Node Address	USINT	1		DeviceNet Node Address (Mac_ID) switch setting.
4	Get	DN-SW Data Rate	USINT	1		DeviceNet Data Rate switch setting. 0 - 125 kps 1 - 250 kps 2 - 500 kps 3 - Autobaud 4 - Programmable 5 - Programmable 6 - Programmable 7 - Programmable 8 - Programmable 9 - Programmable

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
5	Set	DN-NV Node Address	USINT	1		The programmed nonvolatile DeviceNet Node Address (Mac_ID). Range: 0 to 63 Default: 63
6	Set	DN-NV Data Rate	USINT	1		The programmed nonvolatile DeviceNet Data Rate. 0 - 125 kps (default) 1 - 250 kps 2 - 500 kps 3 - Autobaud
7	Set	I/O Receive Select	USINT	1		Selects the output (consumed) assembly that is updated when a Polled, Change-of-State, or Cyclic I/O Message is received by the drive. If the value is modified, you have to either close any existing I/O Messaging connection(s), power cycle the drive, reset the drive, or remove and reapply DeviceNet power for the drive to use the modified value. Refer to the Assembly Object for information on the data format. 0 - No Data Consumed (default) 1 - Assembly Instance 1 2 - Assembly Instance 2 3 - Assembly Instance 3 4 - Assembly Instance 4 5 - Assembly Instance 5 6 - Assembly Instance 6 7 - Assembly Instance 7 8 - Assembly Instance 8 9 - Assembly Instance 9
8	Set	Poll Transmit (Xmit) Select	USINT	1		Selects the input (produced) assembly that is transmitted by the drive over a Polled I/O Messaging connection. If the value is modified, you have to either close any existing I/O Messaging connection(s), power cycle the drive, reset the drive, or remove and reapply DeviceNet power for the drive to use the modified value. Refer to the Assembly Object for information on the data format. 0 - Assembly Instance 10 (default) 1 - Assembly Instance 11 2 - Assembly Instance 12 3 - Assembly Instance 13 4 - Assembly Instance 14 5 - Assembly Instance 15 6 - Assembly Instance 16 7 - Assembly Instance 17 8 - Assembly Instance 18

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
9	Set	COS/Cyclic Transmit (Xmit) Select	USINT	1		Selects the response (produced) assembly that is transmitted by the drive over a Change-of-State, or Cyclic I/O Messaging connection. If the value is modified, you have to either close any existing I/O Messaging connection(s), power cycle the drive, reset the drive, or remove and reapply DeviceNet power for the drive to use the modified value. Refer to the Assembly Object for information on the data format. 0 - Assembly Instance 10 (default) 1 - Assembly Instance 13 2 - Assembly Instance 15
10	Set	Logic Command Mask	DWORD	4		Masks bits of the logic command sent via Polled, Cyclic, and Change-of-State I/O messages. If a bit is clear (zero) in the Logic Command Mask, then the corresponding bit in the logic command will be cleared. The Logic Command Mask can not be modified while the drive is enabled. Bit 0 = Disable Serial Bit 1 = Pause Index Bit 2 = Abort Index Bit 3 = Pause Homing Bit 4 = Abort Homing Bit 5 = Reserved Bit 6 = Reserved Bit 7 = Reserved Bit 8 = Preset Select 0 Bit 9 = Preset Select 1 Bit 10 = Preset Select 2 Bit 11 = Preset Select 3 Bit 12 = Preset Select 4 Bit 13 = Preset Select 5 Bit 14 = Reserved Bit 15 = Reserved Bit 16 = Define Position Bit 17 = Integrator Inhibit Bit 18 = Follower Enable Bit 19 = Reserved Bit 20 = Reserved Bit 21 = Operation Mode Override Bit 22 = Position Strobe Bit 23 = Reserved Bit 24 = Reset Drive Bit 25 = Start Index Bit 26 = Define Home Bit 27 = Reserved Bit 28 = Remove CMD Offset Bit 29 = Start Homing Bit 30 = Fault Reset Bit 31 = Enable Drive Default: 0x00000000

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
11	Set	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 have to be active. 0 - Hardware OR DNet Input (default) 1 - Hardware Enable AND DNet Input
12	Set	Change-of-State Mask	DWORD	4		The Change-of-State mask is used with Change-of-State I/O messaging. If a particular bit is set (one) in 'Change-of-State Mask', then a Change-of-State I/O message will be produced whenever the corresponding bit in Parameter 16 - DNet I/O Status changes value. Otherwise, a Change-of-State I/O message will not be produced. Bit 0 = At Home Bit 1 = End of Sequence Bit 2 = In Motion Bit 3 = In Dwell Bit 4 = Registered Bit 5 = Axis Homed Bit 6 = Tracking Bit 7 = Startup Commutation Done Bit 8 = Positive Hardware Overtravel (Motor Integral Limit) Bit 9 = Negative Hardware Overtravel (Motor Integral Limit) Bit 10 = Positive Overtravel Bit 11 = Negative Overtravel Bit 12 = At Index 0 Position Bit 13 = At Index 1 Position Bit 14 = Position Compare 1/Write Data Error Bit 15 = Position Compare 2/Write Data Busy Bit 16 = In Position Bit 17 = Within Position Window Bit 18 = Zero Speed Bit 19 = Within Speed Window Bit 20 = Positive Current Limit Bit 21 = Negative Current Limit Bit 22 = Up to Speed Bit 23 = Drive Enabled Bit 24 = DC Bus Charged Bit 25 = Fault Disable Bit 26 = Reserved Bit 27 = Reserved Bit 28 = Reserved Bit 29 = Reserved Bit 30 = Brake Bit 31 = Ready Default: 0x0fffffff

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
13	Set	Idle Fault Action	USINT	1		Determines the action the drive should take if the master sends a zero length I/O message to the drive, which may occur if a PLC™ (master) is set to program mode. No action is taken if the Parameter 7 - I/O Receive Select specifies an I/O command message that does not have a logic command. 0 - Fault / Zero Data (default) 1 - Fault / Hold Last Data 2 - Zero Data 3 - Hold Last Data 4 - Fault Configuration (Use data specified by Parameter 15 - Faulted Logic Command).
ATTENTION 		If you change the Idle Fault Action parameter's value, the user application may not be able to control the product after a fault. Risk of severe bodily injury or equivalent damage exists. The Idle Fault Action parameter allows you 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 the sections *DeviceNet Communication Fault Action* on page 2-42 and *Using the Fault Configured Input* on page 2-43.				
14	Set	Comm Fault Action	USINT	1		Determines the action the drive should take if the drive detects a network failure while an I/O messaging connection is active. No action is taken if the Parameter 7 - I/O Receive Select specifies an I/O command message that does not have a logic command. 0 - Fault / Zero Data (default) 1 - Fault / Hold Last Data 2 - Zero Data 3 - Hold Last Data 4 - Fault Configuration (Use data specified by Parameter 15 - Faulted Logic Command).
ATTENTION 		If you change the Comm Fault Action parameter's value, the user application may not be able to control the product after a fault. Risk of severe bodily injury or equivalent damage exists. The Comm Fault Action parameter allows you 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 the sections *DeviceNet Communication Fault Action* on page 2-42 and *Using the Fault Configured Input* on page 2-43.				

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
15	Set	Faulted Logic Command	DWORD	4		Provides the logic command data to the drive when the drive receives an invalid I/O message or detects a network failure while an I/O messaging connection is active. Bit 0 = Disable Serial Bit 1 = Pause Index Bit 2 = Abort Index Bit 3 = Pause Homing Bit 4 = Abort Homing Bit 5 = Reserved Bit 6 = Reserved Bit 7 = Reserved Bit 8 = Preset Select 0 Bit 9 = Preset Select 1 Bit 10 = Preset Select 2 Bit 11 = Preset Select 3 Bit 12 = Preset Select 4 Bit 13 = Preset Select 5 Bit 14 = Reserved Bit 15 = Reserved Bit 16 = Define Position Bit 17 = Integrator Inhibit Bit 18 = Follower Enable Bit 19 = Reserved Bit 20 = Reserved Bit 21 = Operation Mode Override Bit 22 = Position Strobe Bit 23 = Reserved Bit 24 = Reset Drive Bit 25 = Start Index Bit 26 = Define Home Bit 27 = Reserved Bit 28 = Remove CMD Offset Bit 29 = Start Homing Bit 30 = Fault Reset Bit 31 = Enable Drive Default: 0x00000000

IMPORTANT The Faulted Logic Command does not affect those bits that have been masked off by Parameter 10 - Logic Command Mask. Otherwise, the unmasked Faulted Logic Command bits are OR'ed with the corresponding hardware inputs. The Enable bit may be configured to be OR'ed and AND'ed with the hardware Enable input, refer to Parameter 11 - Enable Behavior.

**Parameter Object,
Instances ID = 1- 1059**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
16	Get	DNet I/O Status	DWORD	4		'DNet I/O Status' is the Logic Status field that can be sent via Polled, Change-of-State, and Cyclic I/O messages. The Logic Status is part of several different input (response) assemblies. Refer to the Assembly Object. Bit 0 = At Home Bit 1 = End of Sequence Bit 2 = In Motion Bit 3 = In Dwell Bit 4 = Registered Bit 5 = Axis Homed Bit 6 = Tracking Bit 7 = Startup Commutation Done Bit 8 = Positive Hardware Overtravel (Motor Integral Limit) Bit 9 = Negative Hardware Overtravel (Motor Integral Limit) Bit 10 = Positive Overtravel Bit 11 = Negative Overtravel Bit 12 = At Index 0 Position Bit 13 = At Index 1 Position Bit 14 = Position Compare 1/Write Data Error Bit 15 = Position Compare 2/Write Data Busy Bit 16 = In Position Bit 17 = Within Position Window Bit 18 = Zero Speed Bit 19 = Within Speed Window Bit 20 = Positive Current Limit Bit 21 = Negative Current Limit Bit 22 = Up to Speed Bit 23 = Drive Enabled Bit 24 = DC Bus Charged Bit 25 = Fault Disable Bit 26 = Reserved Bit 27 = Reserved Bit 28 = Reserved Bit 29 = Reserved Bit 30 = Brake Bit 31 = Ready

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
17	Get	Logic Command	DWORD	4		The logic command being used by the drive. Any bits masked by the Logic Command Mask will be clear (0). Refer to the Logic Command field in the output (command) assemblies for the bit definition. Bit 0 = Disable Serial Bit 1 = Pause Index Bit 2 = Abort Index Bit 3 = Pause Homing Bit 4 = Abort Homing Bit 5 = Reserved Bit 6 = Reserved Bit 7 = Reserved Bit 8 = Preset Select 0 Bit 9 = Preset Select 1 Bit 10 = Preset Select 2 Bit 11 = Preset Select 3 Bit 12 = Preset Select 4 Bit 13 = Preset Select 5 Bit 14 = Reserved Bit 15 = Reserved Bit 16 = Define Position Bit 17 = Integrator Inhibit Bit 18 = Follower Enable Bit 19 = Reserved Bit 20 = Reserved Bit 21 = Operation Mode Override Bit 22 = Position Strobe Bit 23 = Reserved Bit 24 = Reset Drive Bit 25 = Start Index Bit 26 = Define Home Bit 27 = Reserved Bit 28 = Remove CMD Offset Bit 29 = Start Homing Bit 30 = Fault Reset Bit 31 = Enable Drive
18	Set	Serial Address	USINT	1		The drive's serial communications port address. If the Serial Address is modified, then the drive must be reset for the drive to use the new address. Range: 0 to 253 Default: 0

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
19	Set	Broadcast Address	USINT	1		The address used by a host PC to issue a single broadcast command to all connected Ultra3000 drives. The drive does not send a response to commands received with the broadcast address. If the Broadcast Address is modified, then the drive must be reset for the drive to use the new address. Note: If a drive's Broadcast Address and Serial Address are set to the same value, the drive will treat all serial commands as normal, point-to-point commands, and will send a response to all commands it processes. Range: 0 to 255 Default: 255
20	Set	Serial Baud Rate	USINT	1		The baud rate for the drive's serial communications port. If the baud rate is modified, then the drive must be reset for the drive to use the new baud rate. 0 - 1200 1 - 2400 2 - 4800 3 - 9600 4 - 19200 5 - 38400 (default)
21	Set	Frame Format	USINT	1		The packet frame format for the drive's serial communications port. If the frame format is modified, then the drive must be reset for the drive to use the new frame format. 0 - 7 Data Bits, Even Parity, 1 Stop Bit 1 - 7 Data Bits, Odd Parity, 1 Stop Bit 2 - 8 Data Bits, No Parity, 1 Stop Bit (default) 3 - 8 Data Bits, Even Parity, 1 Stop Bit 4 - 8 Data Bits, Odd Parity, 1 Stop Bit
22	Set	Reset Faults	USINT	1		Resets any drive faults. Motion may occur after clearing drive faults if the drive is enabled. 0 - No Action (default) 1 - Reset
23	Set	Reset Drive	USINT	1		Resets, or reboots, the hardware and firmware in the drive. 0 - No Action (default) 1 - Reset Note: Set is not allowed if the drive is enabled.
24	Set	Reset Personality	USINT	1		Resets the drive's parameters by reinitializing them to factory default settings. Stored faults in the fault history remain unchanged. 0 - No Action (default) 1 - Reset Note: The drive is reset after the parameters are reinitialized. Note: Set is not allowed if the drive is enabled.

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
25	Set	Reset I Peaks	USINT	1		Resets the peak value parameters to zero: Peak Positive Position Error (Peak +Posn Error), Peak Negative Position Error (Peak -Posn Error), Positive Peak Current, and Negative Peak current. 0 - No Action (default) 1 - Reset
26	Set	Define Home Command	USINT	1		Causes the present motor position to be selected as Home position. The position command is set to the Home Position value, and the position feedback is simultaneously set to its appropriate value, according to the position error. 0 - No Action (default) 1 - Execute Command
27	Set	Host Enable	USINT	1		Sets or returns the drive's Host Enable flag. If set to 'Enable' and the ENABLE input is active, the drive is enabled. If set to 'Disable' or the ENABLE input is not active, the drive is disabled. By default, Host Enable is enabled. If the drive is reset or power cycled, the 'Host Enable' is automatically set to 'ENABLE'. The Host Enable setting is not saved in nonvolatile memory. 0 - Disable 1 - Enable (default)
ATTENTION 		The Host Enable parameter allows you to temporarily disable the drive. Do not assume that the drive is permanently disabled via the Host Enable parameter. Failure to comply may result in personal injury and/or equipment damage.				
28	Set	Host Control Mode	USINT	1		Temporarily puts the drive into various tuning and special operating modes. The Host Control Mode setting is not saved in nonvolatile memory. 0 - Normal Mode (default) 1 - Setpoint Velocity 2 - Setpoint Current 3 - Host Index Mode (Indexing Only) 4 - Autotuning 5 - Step Velocity 6 - Step Position
29	Set	Velocity Setpoint	DINT	4	Cnts / Sec	The velocity command value used when the Host Contrl Mode is 'Setpoint Velocity'. The drive will ramp up, or ramp down, to the Velocity Setpoint at the rate of acceleration set by Parameter 31 - Setpoint Accel. The Velocity Setpoint is not saved in nonvolatile memory. Range: -0x7fffffff to 0x7fffffff Default: 0

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
30	Set	Current Setpoint	INT	2	Amps / 128	The current command value used when Parameter 28 - Host Control Mode is set to 2 - Setpoint Current. The Current Setpoint setting is not saved in nonvolatile memory. Range: -32767 to 32767 Default: 0
31	Set	Setpoint Accel	UDINT	4	Cnts / Sec^2	The maximum rate of acceleration (or deceleration) the drive will use to ramp up (or down) when the drive is in Setpoint Velocity mode and the Velocity Setpoint is changed. Range: 0 to 0x7fffffff Default: 100000
32	Set	Motor Forward Direction	USINT	1		Determines the positive motor direction. 0 - Normal (default) - A positive direction move increases the encoder count. 1 - Reverse - A positive direction move decreases the encoder count. Note: Set is not allowed if the drive is enabled.
33	Set	Operation Mode	USINT	1		The drive's command source and operating mode. 0 - Analog Velocity Input (default) 1 - Analog Current Input 2 - Preset Velocity 3 - Preset Current 4 - Follower: Auxiliary Encoder 5 - Follower: Step / Direction 6 - Follower: Step Up / Step Down 7 - Indexing (Indexing Drive only) 8 - Analog Position (Indexing Drive only) 9 - Preset Position (Indexing Drive only) Note: Set is not allowed if the drive is enabled.
34	Set	Override Mode	USINT	1		The drive's command source and operating mode used when the Operation Mode Override input is active. 0 - Analog Velocity Input (default) 1 - Analog Current Input 2 - Preset Velocity 3 - Preset Current 4 - Follower: Auxiliary Encoder 5 - Follower: Step / Direction 6 - Follower: Step Up / Step Down 7 - Indexing (Indexing Drive only) 8 - Analog Position (Indexing Drive only) 9 - Preset Position (Indexing Drive only) Note: Set is not allowed if the drive is enabled.

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
35	Set	(Machine Cycle) Position Rollover	USINT	1		Enables or disables the machine cycle position rollover function. If enabled the position feedback will rollover when it's value reaches the Machine Cycle Size. 0 - Disable (default) 1 - Enable Note: This parameter is automatically set to Enable (1) and cannot be changed when Single-Turn Absolute mode is active (refer to Parameter 231 - Single-Turn Absolute). Note: Set is not allowed if the drive is enabled.
36	Set	Machine Cycle Size	UDINT	4	Cnts	The position feedback will rollover at the Machine Cycle Size if Parameter 35, Position Rollover parameter is set to 1 - Enable. For example, if Machine Cycle Size is set to 1000, then the position feedback will range between 0 to 999. Range: 100 to 0x7fffffff Default: 0x7fffffff Note: This parameter is automatically set to One Revolution (in counts) and cannot be changed when Single-Turn Absolute mode is active (refer to Parameter 231 - Single-Turn Absolute). Note: Set is not allowed if the drive is enabled.
37	Set	Positive I Limit	USINT	1	%	The positive current limit value. The value is a percentage of the lesser of the intermittent (peak) drive current rating and intermittent (peak) motor current rating. During runtime, the drive limits positive current to the lesser of the: • Positive Current Limit, • Analog Current Limit input, • Intermittent Current rating of the drive, or • Intermittent Current rating of the motor. Range: 0 to 100 Default: 100

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
38	Set	Negative I Limit	USINT	1	%	The negative current limit value. The value is a percentage of the lesser of the intermittent (peak) drive current rating and intermittent (peak) motor current rating. During runtime, the drive limits positive current to the lesser of the: • Negative Current Limit, • Analog Current Limit input, • Intermittent Current rating of the drive, or • Intermittent Current rating of the motor. Range: 0 to 100 Default: 100
39	Set	Soft Overtravel	USINT	1		Enables or disables the software overtravel limit checking. 0 - Disable (default) 1 - Enable Note: This parameter instance is not available to non-indexing drives. If invoked, a non-indexing drive returns Reserved as the parameter name. Note: The Soft Overtravel does not operate unless the drive was previously homed.
40	Set	Positive Soft Position Limit	DINT	4	Cnts	The absolute position that will cause a deceleration to zero velocity when exceeded in the positive direction. Range: -0x7fffffff to 0x7fffffff Default: 0x7fffffff Note: This parameter instance is not available to non-indexing drives. If invoked, a non-indexing drive returns Reserved as the parameter name. Note: The Positive Soft Position Limit does not operate unless the drive was previously homed.
41	Set	Negative Soft Position Limit	DINT	4	Cnts	The absolute positive that will cause a deceleration to zero velocity when exceeded in the negative direction. Range: -0x7fffffff to 0x7fffffff Default: -0x7fffffff (0x80000001) Note: This parameter instance is not available to non-indexing drives. If invoked, a non-indexing drive returns Reserved as the parameter name. Note: The Negative Soft Position Limit does not operate unless the drive was previously homed.

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
42	Set	Positive Decel Distance	DINT	4	Cnts	The distance that an axis will travel when an overtravel limit has been reached in the positive direction. Range: 0 to 0x7fffffff Default: 0 Note: This parameter instance is not available to non-indexing drives. If invoked, a non-indexing drive returns Reserved as the parameter name.
43	Set	Negative Decel Distance	DINT	4	Cnts	The distance that an axis will travel when an overtravel limit has been reached in the negative direction. Range: 0 to 0x7fffffff Default: 0 Note: This parameter instance is not available to non-indexing drives. If invoked, a non-indexing drive returns Reserved as the parameter name.
44	Set	Zero Speed Limit	UDINT	4	Cnts / Sec	A +/- range, or window, around zero velocity. If the motor feedback velocity falls within this range, the Zero Speed flag will be (or remain) set. Range: 0 to 0x7fffffff Default: 500
45	Set	Speed Window	UDINT	4	Cnts / Secs	A +/- range, or window, around the velocity command. If the motor feedback velocity falls within this range, the Speed Window flag will be (or remain) set. Range: 0 to 0x7fffffff Default: 1000
46	Set	Up to Speed	UDINT	4	Cnts / Secs	If the motor feedback velocity is greater than or equal to this value, the Up to Speed flag will be (or remain) set. Range: 0 to 0x7fffffff Default: 100000
47	Set	Position Window Size	UDINT	4	Cnts	The maximum amount of position error which will permit the In Position and the In Position Window flags to be (or remain) set. Range: 0 to 0x7fffffff Default: 20
48	Set	Position Window Time	USINT	1	mSec	The minimum length of time the position error must be less than the Position Window Size value, for the In Position and the In Position Window flags to be (or remain) set. Range: 1 to 255 Default: 20

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
49	Set	Position Compare 1 Type	USINT	1		Selects the type of comparison that will determine if the Position Compare 1 flag should be set. 0 - Greater Than (default) - The flag will be set if the motor feedback position is greater than the Position Compare 1 Min value. 1 - Less Than - The flag will be set if the motor feedback position is less than the Position Compare 1 Min value. 2 - Within Window - The flag will be set if the motor feedback position is greater than Position Compare 1 Min and less than Parameter 112 - Position Compare 1 Max. 3 - Outside Window - The flag will be set if the motor feedback position is less than Position Compare 1 Min or more than Position Compare 1 Max. Note: The Position Compare 1 Type does not operate unless the drive was previously homed.
50	Set	Position Compare 1 Min	DINT	4	Cnts	The position that will be compared to the motor (auxiliary) feedback position to determine if the Position Compare 1 flag should be set. Range: -0x7fffffff to 0x7fffffff Default: 0
51	Set	Position Compare 2 Type	USINT	1		Selects the type of comparison that will determine if the Position Compare 2 flag should be set. 0 - Greater Than (default) - The flag will be set if the motor feedback position is greater than the Position Compare 2 Min value. 1 - Less Than - The flag will be set if the motor feedback position is less than the Position Compare 2 Min value. 2 - Within Window - The flag will be set if the motor feedback position is greater than Position Compare 2 Min and Less than Parameter 113 - Position Compare 2 Max. 3 - Outside Window - The flag will be set if the motor feedback position is less than Position Compare 2 Min or more than Position Compare 2 Max. Note: The Position Compare 2 Type does not operate unless the drive was previously homed.
52	Set	Position Compare 2 Min	DINT	4	Cnts	The position that will be compared to the motor (auxiliary) feedback position to determine if the Position Compare 2 flag should be set. Range: -0x7fffffff to 0x7fffffff Default: 0

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
53	Set	Velocity Loop P_Gain	UINT	2		The proportional gain for the velocity loop. The P gain generates a control signal proportional to the velocity error. Increasing the P gain improves response time and increases the stiffness of the system. Too high a P gain value causes instability; too low a P gain value results in loose or sloppy system dynamics. Range: 0 to 4000 Default: 200
54	Set	Velocity Loop I_Gain	UINT	2		Integral gain for the velocity loop. The I gain generates a control signal proportional to the integral of the velocity error. I gain improves the steady-state velocity performance of the system. Increasing the integral gain generally increases the ultimate positioning accuracy of the system. However excessive integral gain results in system instability. Range: 0 to 4000 Default: 66
55	Set	Velocity Loop D_Gain	INT	2		Derivative gain value for the velocity loop. The D gain generates a control signal proportional to measured acceleration. Positive D gain reduces velocity overshoot, and negative D gain should be used only in systems that exhibit mechanical resonance. Range: -1000 to 1000 Default: 0
56	Set	Position Loop Kp Gain	UINT	2	1/128	Proportional gain for the position loop. The Kp gain generates a control signal proportional to the position error. Kp gain changes the position loop bandwidth and the settling time of the position loop. Range: 0 to 4095 Default: 512
57	Set	Position Loop Ki Gain	UINT	2	1/128	Integral gain for the position loop. Ki gain generates a control signal proportional to the integral of the velocity error. Range: 0 to 4095 Default: 0
58	Set	Position Loop Kd Gain	UINT	2	1/128	Derivative gain for the position loop. The Kd gain generates a control signal proportional to measured velocity. Kd provides damping to the position loop, which can reduce overshoot. Range: 0 to 4095 Default: 0
59	Set	Position Loop Kff Gain	UINT	2		Feedforward gain for the position loop. The Kff gain generates a feed forward signal proportional to the commanded speed. Kff gain reduces position following error. However high values can cause position overshoot. Range: 0 to 200 Default: 100

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
60	Set	Position Loop Ki Zone	UDINT	4	Cnts	The region around the commanded position where integral gain is active. If the position error is greater than Ki Zone, the integrator is not active. Range: 0 to 0x7fffffff Default: 1000
61	Set	Low Pass Filter	USINT	1		Selects whether to enable or disable the drive's low pass filter. 0 - Disable 1 - Enable (default)
62	Set	Low Pass Bandwidth	UINT	2	Hz	The bandwidth of the low pass filter. This value indicates the cutoff frequency of the low pass filter. The filter reduces noise generated by encoder resolution or mechanical resonance in the system. Range: 1 to 992 Default: 150
63	Set	Start Autotune Command	USINT	1		Starts autotuning if the drive is enabled and Parameter 28, Host Control Mode is set to 4 - Autotuning. 0 - No Action (default) 1 - Execute Command
64	Set	Tuning Direction	USINT	1		Select the direction in which the motor rotates during autotuning. 0 - Bi-Directional (default) 1 - Forward Only 2 - Reverse Only
65	Set	Autotune Maximum Distance	UDINT	4	Cnts	The maximum distance the motor will turn when performing autotuning. The autotune distance should be set as large as the application permits, so that the autotune algorithm is able to collect sufficient data to compute new tuning gains. Range: 1 to 0x7fffffff Default: 1000000
66	Set	Autotune Step Current	USINT	1	%	The current the drive will command when performing autotuning. The value is a percentage of the lesser of the intermittent (peak) drive current rating and intermittent (peak) motor current rating. The autotune current is normally set to 10%, but may need to be increased in the presence of large inertias or high friction. In these systems, higher settings ensure that the autotune algorithm is able to collect sufficient data to compute new tuning gains. Range: 1 to 100 Default: 10
67	Set	Tune Position Step	UINT	2	Cnts	The amplitude of the drive's commanded position step (square wave) during manual position tuning. Range: 1 to 32767 Default: 500

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
68	Set	Tune Position Period	UINT	2	mSec	The period of the drive's commanded position step (square wave) during manual position tuning. Range: 1 to 32767 Default: 500
69	Set	Tune Velocity Step	UDINT	4	Cnts / Sec	The amplitude of the drive's commanded velocity step (square wave) during manual velocity tuning. Range: 1 to 0x7fffffff Default: 10000
70	Set	Tune Velocity Period	UINT	2	mSec	The period of the drive's command velocity step (square wave) during manual velocity tuning. Range: 1 to 32767 Default: 500
71	Set	Motor Encoder Interpolation	USINT	1		The amount of interpolation to be used with sine/cosine encoders. For example, if the interpolation is set to x256, the drive interpolates 256 counts for every 1/4 line of the input sinusoid. 0 - x4 1 - x8 2 - x16 3 - x32 4 - x64 5 - x128 6 - x256 (default) 7 - x512 8 - x1024 Note: Set is not allowed if the drive is enabled.
72	Set	Position Feedback Source	USINT	1		The source for position loop feedback. 0 - Motor Encoder (default) 1 - Auxiliary Encoder Note: This parameter instance is not available to non-indexing drives. If invoked, a non-indexing drive returns Reserved as the parameter name.
73	Set	Encoder Output Signal	USINT	1		Specifies the type of encoder output from the drive. 0 - Buffered (default) - The encoder input is passed through the drive directly, without interpolation or division. 1 - Divided - The encoder input is divided and then output. 2 - Interpolated - The interpolated encoder counts are output.
74	Set	Motor Encoder Divider	UINT	2		The amount of division used for generating the encoder output signal. For example, if the Divider is set to 4, the encoder output frequency will be 1/4th the encoder input frequency. This parameter is only active if Divided is selected as the Encoder Output Signal. Range: 1 to 1000 Default: 4

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
75	Set	Maximum Encoder Output Frequency	USINT	1		The encoder output frequency limit. This parameter is active only if Divided or Interpolated is selected as the Encoder Output Signal. 0 - 500 kHz (default) 1 - 1 MHz 2 - 4 MHz 3 - 8 MHz
76	Set	Marker Output Gating	USINT	1		Allows the drive to produce and use a more precise marker signal. 0 - Not Gated - The drives uses and outputs the normal marker input as received from the encoder. (default) 1 - Gated with A and B - The marker output of the drive is the logical AND of the marker input from the encoder and the A and B inputs. This produces a more precise marker signal for homing.
77	Set	Auxiliary Encoder Load Count	UINT	2	Cnts	The Auxiliary Encoder Motor Count and Auxiliary Encoder Load Count parameters specify the ratio of encoder counts between the motor encoder and the load encoder. The parameters are active only if the The Position Feedback Source is selected to be Auxiliary Encoder. Range: 1 to 32767 Default: 1
78	Set	Auxiliary Encoder Motor Count	INT	2	Cnts	The Auxiliary Encoder Motor Count and Auxiliary Encoder Load Count parameters specify the ratio of encoder counts between the motor encoder and the load encoder. The parameters are active only if the Position Feedback Source is selected to be Auxiliary Encoder. Range: -32767 to 32767 Default: 1
79	Set	Auxiliary Encoder Type	USINT	1		The type of auxiliary encoder. 0 - Rotary Encoder (default) 1 - Linear Encoder
80	Set	Auxiliary Encoder Lines/Rev	UINT	2		Auxiliary encoder lines per revolution. This parameter is used only if the auxiliary encoder is a rotary encoder. Range: 100 to 64000 Default: 2000
81	Set	Auxiliary Encoder Lines/ Meter	UDINT	4		Auxiliary encoder lines per meter of travel. This parameter is used only if the auxiliary encoder is a linear encoder. Range: 4000 to 10000000 Default: 10000

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
82	Set	Digital Input 1 Configuration	DWORD	4		Each digital input configuration parameter assigns one or more functions to the corresponding Digital Input. Selecting a function will cause that function to become active when the associated Digital Input becomes active. If no functions are selected by a digital input configuration parameter, then the corresponding Digital Input is unassigned. Bit 0 = Disable Serial Input Bit 1 = Pause Index Bit 2 = Abort Index Bit 3 = Pause Homing Bit 4 = Abort Homing Bit 6 = Positive Hardware Overtravel Bit 7 = Negative Hardware Overtravel Bit 8 = Preset Select 0 Bit 9 = Preset Select 1 Bit 10 = Preset Select 2 Bit 11 = Preset Select 3 Bit 12 = Preset Select 4 Bit 13 = Preset Select 5 Bit 16 = Define Position Bit 17 = Integrator Inhibit Bit 18 = Follower Enable Bit 19 = Forward Enable Bit 20 = Reverse Enable Bit 21 = Operation Mode Override Bit 22 = Position Strobe Bit 23 = Home Sensor Bit 24 = Reset Drive Bit 25 = Start Index Bit 26 = Define Home Position Bit 27 = Registration Bit 28 = Remove Command Offset Bit 29 = Start Homing Bit 30 = Fault Reset Bit 31 = Enable Drive Defaults: Parameter 82 = 0x80000000 Parameters 83-89 = 0x00000000 Note: Set is not allowed if the drive is enabled.
83	Set	Digital Input 2 Configuration	DWORD	4		
84	Set	Digital Input 3 Configuration	DWORD	4		
85	Set	Digital Input 4 Configuration	DWORD	4		
86	Set	Digital Input 5 Configuration	DWORD	4		
87	Set	Digital Input 6 Configuration	DWORD	4		
88	Set	Digital Input 7 Configuration	DWORD	4		
89	Set	Digital Input 8 Configuration	DWORD	4		

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
90	Set	Digital Output 1 Configuration	DWORD	4		Each digital output configuration parameter assigns one or more functions to the corresponding Digital Output (or Relay Output). Selecting a function will cause the Digital Output to become active when the associated function becomes active. If no functions are selected by a digital output configuration parameter, then the corresponding Digital Output (or Relay Output) is unassigned. Bit 0 = At Home Bit 1 = End of Sequence Bit 2 = In Motion Bit 3 = In Dwell Bit 4 = Registered Bit 5 = Axis Homed Bit 6 = Tracking Bit 7 = Startup Commutation Done Bit 8 = Positive Hardware Overtravel (Motor Integral Limit) Bit 9 = Negative Hardware Overtravel (Motor Integral Limit) Bit 10 = Positive Overtravel Bit 11 = Negative Overtravel Bit 12 = At Index 0 Position Bit 13 = At Index 1 Position Bit 14 = Position Compare 1 Bit 15 = Position Compare 2 Bit 16 = In Position Bit 17 = Within Position Window Bit 18 = Zero Speed Bit 19 = Within Speed Window Bit 20 = Positive Current Limit Bit 21 = Negative Current Limit Bit 22 = Up to Speed Bit 23 = Drive Enabled Bit 24 = DC Bus Charged Bit 25 = Fault Disable Bit 26 = Reserved Bit 27 = Reserved Bit 28 = Reserved Bit 29 = Reserved Bit 30 = Brake Bit 31 = Ready Default = 0x00000000 Note: Set is not allowed if the drive is enabled.
91	Set	Digital Output 2 Configuration	DWORD	4		
92	Set	Digital Output 3 Configuration	DWORD	4		
93	Set	Digital Output 4 Configuration	DWORD	4		
94	Set	Relay Output Configuration	DWORD	4		

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
95	Set	Digital Output Override	WORD	2		Allows you to write (override) selected digital output(s). If one or more of the Override bits are set to a one, then the Output and Relay State bits will determine whether the overridden digital outputs are active or inactive. For example, if the Digital Output Override parameter is set to 0x0044, then Digital Output 3 will be active. The Digital Output Override setting is not saved in nonvolatile memory. Bit 0 = Output 1 Override Bit 1 = Output 2 Override Bit 2 = Output 3 Override Bit 3 = Output 4 Override Bit 4 = Relay Override Bit 5 = Reserved Bit 6 = Reserved Bit 7 = Reserved Bit 8 = Output 1 State Bit 9 = Output 2 State Bit 10 = Output 3 State Bit 11 = Output 4 State Bit 12 = Relay State Range: 0 to 0x1fff Default: 0
96	Set	Brake On Delay	INT	2	mSec	The time delay between enabling the drive and activating a Brake output which releases the motor brake. Negative values indicate the time that the function is activated before enabling the drive. Range: -32767 to 32767 Default: 0
97	Set	Brake Off Delay	INT	2	mSec	The time delay between disabling the drive and deactivating a Brake output to apply the motor brake. If a drive fault occurs when a negative is assigned to the Brake Off Delay, the drive is disabled and the Brake is deactivated simultaneously. Range: -32767 to 32767 Default: 0
98	Set	Analog Output Configuration	USINT	1		Selects a drive signal to be assigned to the analog output. 0 - Unassigned (default) 1 - Position Command 2 - Position Error 7 - Position Feedback 16 - Current Command 17 - Average Current 22 - Velocity Feedback 23 - Velocity Command 24 - Velocity Error 36 - Current Feedback

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
99	Set	Analog Output Scale	INT	2		The analog output scale in units per volt. The units is dependent on the signal selected by the Parameter 98 - Analog Output Configuration. Parameter 110 - Analog Output Position Scale is used to scale the analog output if a position signal is selected and the Analog Output Scale is zero. Range: -32767 to 32767 Default: 0
100	Set	Analog Output Offset	INT	2	mV	The offset applied to the analog output. Range: -10000 to 10000 Default: 0
101	Set	Override Analog Output	USINT	1		The analog output override control flag determines if you can write to the analog output directly. The Override Analog Output setting is not saved in nonvolatile memory. 0 - Normal (default) 1 - Override
102	Set	Analog Output Override	INT	2	mV	Sets the analog output value when Parameter 101, Override Analog Output is set to 1 - Override. The Analog Output Override setting is not saved in nonvolatile memory. Range: -10000 to 10000 Default: 0
103	Set	User Current Fault	UINT	2	Amps / 128	The current level that will generate a fault when exceeded by the average current. The drive automatically protects itself and the motor when the average current exceeds the drive or motor current ratings, and this protection cannot be disabled. However, you can specify a lower current fault level with this parameter. Range: 0 to 32767 Default: 32640
104	Set	User Velocity Limit	UDINT	4	Cnts / Sec	The minimum velocity that will generate a User Velocity fault. The drive automatically protects the motor from exceeding its ratings, and this protection cannot be disabled. However, you can specify a lower velocity fault level with this parameter. Range: 0 to 0x7fffffff Default: 100000
105	Set	User Velocity Fault	USINT	1		Determines if the User Velocity fault detection is enabled (turned on) or disabled. 0 - Disable (default) 1 - Enable
106	Set	Velocity Error Limit	USINT	1	% of max motor speed	The minimum velocity error which triggers the Velocity Error fault. Range: 1 to 100 Default: 25

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
107	Set	Velocity Error Time	UINT	2	mSec	The minimum time which the velocity error must be greater than the Velocity Error Limit to cause a Velocity Error Fault. Range: 0 to 65535 Default: 1000
108	Set	Position Error Limit	UDINT	4	Cnts	The minimum position error which triggers the Following Error fault. Range: 0 to 0x7fffffff Default: 8000
109	Set	Position Error Time	UINT	2	mSec	The minimum time during which the position error must be greater than the Position Error Limit to cause a Following Error fault. Range: 0 to 65535 Default: 100
110	Set	Analog Output Position Scale	DINT	4	Cnts/V	This parameter is used to scale the analog output when Parameter 98 - Analog Output Configuration selects a position signal and Parameter 99 - Analog Output Scale is equal to zero. Range: -0x7fffffff to 0x7fffffff Default: 0
111	Set	Acceleration Feedforward Gain - Kaff	UINT	2	%	Acceleration feedforward gain for the position loop. The Kaff gain generates a feed forward signal proportional to the commanded acceleration. Kaff gain reduces position following error. However, high values can cause position overshoot. Range: 0 to 200 Default: 0
112	Set	Position Compare 1 Max	DINT	4	Cnts	The position that will be compared to the motor (auxiliary) feedback position to determine if the Position Compare 1 flag should be set. Range: -0x7fffffff to 0x7fffffff Default: 0
113	Set	Position Compare 2 Max	DINT	4	Cnts	The position that will be compared to the motor (auxiliary) feedback position to determine if the Position Compare 2 flag should be set. Range: -0x7fffffff to 0x7fffffff Default: 0

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
114	Set	Parameter Object Write Behavior	USINT	1		Determines whether the Set_Attribute_Single (write) service to a parameter object will cause the parameter value to be saved to both nonvolatile (NVMEM) and volatile (RAM) memory or just to volatile memory. By default, most parameter values are written to both volatile and nonvolatile memory. However, if the Parameter Object Write Behavior is set to 1 - No NVMEM Writes, then parameter values are only written to volatile memory. 0 - Writes to NVMEM (default) 1 - No NVMEM Writes Note: This parameter (114) does not affect how parameter values are saved when an I/O or explicit message writes a parameter value via an Assembly Object. Note: This parameter (114) is always written to both volatile and nonvolatile memory. Setting this parameter to 1 - No NVMEM Writes allows a user to frequently change parameter values without exceeding the nonvolatile memory's limited number of write cycles. Typically, a user will not modify this parameter. Note: Some parameter values are not saved to nonvolatile memory. Example: Parameter 22 - Reset Faults, Parameter 27 - Host Enable, Parameter 29 - Velocity Setpoint.
115-119	Get	Reserved	USINT	1		Default: 0

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
120	Get	Operating Mode	USINT	1		The operating mode that the drive is currently in. 0 = Analog Velocity Input 1 = Analog Current Input 2 = Preset Velocity 3 = Preset Current 4 = Follower - Auxiliary Encoder 5 = Follower - Step / Direction 6 = Follower - Step Up / Step Down 7 = Indexing 8 = Analog Position 9 = Preset Position 10 - 15 = Reserved 16 = Setpoint Velocity 17 = Setpoint Current 18 = Host Index Mode 19 = Autotuning 20 = Step Velocity 21 = Step Position 22 = Encoder Index Alignment 23 = Commutation Diagnostics 24 = Motor Feedback Diagnostics 25 = Motor Marker Diagnostics 26 = Auxiliary Feedback Diagnostics 27 = Auxiliary Marker Diagnostics 28 - 31 = Reserved 32 = Disabled 33 = Fault Decel 34 = Homing 35 = Reserved 36 = Commutation Startup 37 = Start/Stop

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
121	Get	Output Status	DWORD	4		Various output status flags in the drive. Bit 0 = At Home Bit 1 = End of Sequence Bit 2 = In Motion Bit 3 = In Dwell Bit 4 = Registered Bit 5 = Axis Homed Bit 6 = Tracking Bit 7 = Startup Commutation Done Bit 8 = Positive Hardware Overtravel (Motor Integral Limit) Bit 9 = Negative Hardware Overtravel (Motor Integral Limit) Bit 10 = Positive Overtravel Bit 11 = Negative Overtravel Bit 12 = At Index 0 Position Bit 13 = At Index 1 Position Bit 14 = Position Compare 1 Bit 15 = Position Compare 2 Bit 16 = In Position Bit 17 = Within Position Window Bit 18 = Zero Speed Bit 19 = Within Speed Window Bit 20 = Positive Current Limit Bit 21 = Negative Current Limit Bit 22 = Up to Speed Bit 23 = Drive Enabled Bit 24 = DC Bus Charged Bit 25 = Fault Disable Bit 26 = Reserved Bit 27 = Reserved Bit 28 = Reserved Bit 29 = Reserved Bit 30 = Brake Bit 31 = Ready

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
122	Get	Input Status	DWORD	4		The present state of the digital inputs. Bit 0 = Disable Serial Input Bit 1 = Pause Index Bit 2 = Abort Index Bit 3 = Pause Homing Bit 4 = Abort Homing Bit 6 = Positive Hardware Overtravel Bit 7 = Negative Hardware Overtravel Bit 8 = Preset Select 0 Bit 9 = Preset Select 1 Bit 10 = Preset Select 2 Bit 11 = Preset Select 3 Bit 12 = Preset Select 4 Bit 13 = Preset Select 5 Bit 16 = Define Position Bit 17 = Integrator Inhibit Bit 18 = Follower Enable Bit 19 = Forward Enable Bit 20 = Reverse Enable Bit 21 = Operation Mode Override Bit 22 = Position Strobe Bit 23 = Home Sensor Bit 24 = Reset Drive Bit 25 = Start Index Bit 26 = Define Home Position Bit 27 = Registration Bit 28 = Remove Command Offset Bit 29 = Start Homing Bit 30 = Fault Reset Bit 31 = Enable Drive

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
123	Get	Fault Status	DWORD	4		The Fault Status and Extended Fault Status parameters provide the present state of the possible fault conditions. Bit 0 = Absolute Feedback Memory (Nonvolatile Memory Endurance Exceeded) Bit 1 = Absolute Feedback Overspeed (Position Change Exceeds Position Rollover / 2) Bit 2 = Absolute Feedback Range Exceeded Bit 3 = Motor Overtemp Bit 4 = IPM Fault Bit 6 = Encoder Channel B Line Break Bit 7 = Encoder Channel A Line Break Bit 8 = Bus Undervoltage Bit 9 = Bus Overvoltage Bit 10 = Bad Hall State Bit 11 = Home Search Failed Bit 12 = Home Position Outside Limits Bit 13 = Network Communication Bit 14 = Electrical Cycle Bit 16 = User Current Fault Bit 17 = Motor Overspeed Bit 18 = Following Error Bit 19 = Motor Encoder Bit 20 = Auxiliary Encoder Bit 21 = Motor Thermal Protection Bit 22 = IPM Thermal Protection Bit 23 = Excessive Velocity Error Bit 24 = Sensor Unassigned Bit 25 = Motor Speed Limit Bit 26 = Axis Not Homed Bit 27 = Motor Parameter Error Bit 28 = Excessive Encoder Output Frequency Bit 29 = Encoder Communication Bit 30 = Encoder Data Error Bit 31 = Sincos Encoder Frequency Too High
124	Get	Extended Fault Status	WORD	2		The Fault Status and Extended Fault Status parameters provide the present state of the possible fault conditions. Bit 0 = Position Outside Modulus (Absolute Position Exceeds Position Rollover Bit 1 = Ground Short Circuit Bit 2 = Soft-Starting Fault Bit 3 = Internal Overtemperature Bit 4 = AC Input Phase Loss Bit 5 = Reserved Bit 6 = Self-sensing Error

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
125	Get	Tuning Status	BYTE	1		Status bits for the autotune procedure. Bit 0 = Autotune Done Bit 1 = Reserved Bit 2 = Reserved Bit 3 = Autotune Speed Too Low Bit 4 = Autotune Timeout Bit 5 = Distance Limit Reached Bit 6 = Autotune Failed
126	Get	Digital Input States	WORD	2		The present state of the digital hardware inputs. Bit 0 = Input 1 State Bit 1 = Input 2 State Bit 2 = Input 3 State Bit 3 = Input 4 State Bit 4 = Input 5 State Bit 5 = Input 6 State Bit 6 = Input 7 State Bit 7 = Input 8 State
127	Get	Digital Output States	WORD	2		The present state of the digital hardware outputs. Bit 0 = Output 1 State Bit 1 = Output 2 State Bit 2 = Output 3 State Bit 3 = Output 4 State Bit 4 = Relay State
128	Get	Encoder Signals	WORD	2		The preset state of the encoder signals. Bit 0 = Auxiliary Encoder Z Bit 1 = Auxiliary Encoder B Bit 2 = Auxiliary Encoder A Bit 3 = Motor Encoder S3 Bit 4 = Motor Encoder S2 Bit 5 = Motor Encoder S1 Bit 6 = Motor Encoder Z Bit 7 = Motor Encoder B Bit 8 = Motor Encoder A Bit 9 = Motor Thermostat Bit 10 = Negative Overtravel Bit 11 = Positive Overtravel
129	Get	Analog Command Input Value	INT	2	mV	The Analog Command Input value before any the scale and offset are applied.
130	Get	Analog Output Value	INT	2	mV	The Analog Output value.
131	Get	DC Bus Voltage	UINT	2	Volts	The measured voltage of the DC bus.
132	Get	Position Command	DINT	4	Cnts	The commanded motor position which is input to the position loop.
133	Get	Position Error	DINT	4	Cnts	The difference between commanded motor position (Position Command) and actual motor position (Motor Position).
134	Get	Motor Position	DINT	4	Cnts	Actual motor position.
135	Get	Auxiliary Encoder Position	DINT	4	Cnts	Auxiliary encoder position.

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
136	Get	Peak -Position Error	DINT	4	Cnts	The negative peak Position Error.
137	Get	Peak +Position Error	DINT	4	Cnts	The positive peak Position Error.
138	Get	Velocity Command	DINT	4	Cnts / Sec	The commanded motor velocity which is input to the velocity loop.
139	Get	Velocity Error	DINT	4	Cnts / Sec	The difference between command motor velocity (Motor Velocity) and actual velocity (Motor Velocity).
140	Get	Motor Velocity	DINT	4	Cnts / Sec	Actual motor velocity (filtered value).
141	Get	Analog Current Limit	INT	2	Amps / 128	The current limit specified by the analog current limit input.
142	Get	Average Current	INT	2	Amps / 128	The average value of the Current Command.
143	Get	Current Command	INT	2	Amps / 128	The commanded current.
144	Get	Current Feedback	INT	2	Amps / 128	The actual current in the motor producing torque in a rotary motor or force in a linear motor.
145	Get	Negative Peak Current	INT	2	Amps / 128	The negative peak, as recorded by the peak detection algorithm.
146	Get	Positive Peak Current	INT	2	Amps / 128	The positive peak, as recorded by the peak detection algorithm.
147	Get	Drive Temp	UINT	2	%	The drive temperature as a percentage of the trip point.
148	Get	Motor Temp	UINT	2	% / 128	The motor temperature as a percentage of the trip point.
149	Get	Encoder Temp	USINT	1	Deg C	The encoder temperature if Parameter 191, Auto Motor Identification is set to Enable and a smart encoder is detected.

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
150 152 154 156 158 160 162 164 166 168 170 172 174 176 178 180 182 184 186 188	Get	Fault History 1 through Fault History 20	USINT	1		Returns the most recent faults detected in the drive. Fault History 0 is the most recent, 19 is the oldest. 0 - No Fault 1 - Absolute Feedback Memory 2 - Absolute Feedback Overspeed 3 - Absolute Feedback Range Exceeded 4 - Motor Overtemp 5 - IPM Fault 7 - Channel B Line Break 8 - Channel A Line Break 9 - Bus Undervoltage 10 - Bus Overvoltage 11 - Bad Hall State 12 - Home Search Failed 13 - Home Position Outside Limits 14 - Network communication 15 - Electrical Cycle 17 - User Current Fault 18 - Motor Overspeed 19 - Following Error 20 - Motor Encoder 21 - Auxiliary Encoder 22 - Motor Thermal Protection 23 - IPM Thermal Protection 24 - Excessive Velocity Error 25 - Sensor Unassigned 26 - Motor Speed Limit 27 - Axis Not Homed 28 - Motor Parameter Error 29 - Excessive Encoder Output Frequency 30 - Encoder Communication 31 - Encoder Data Error 32 - Sincos Encoder Frequency Too High 33 - Position Outside Modulus 34 - Ground Short Circuit 35 - Soft-Starting Fault 36 - Internal Overtemperature 37 - AC Input Phase Loss 39 - Self-sensing Error 51 - Boot FW Checksum 52 - Main FW Checksum 53 - User NV Uninitialized 54 - NVMEM Read Error 55 - User NV Checksum 56 - Watchdog Timeout 57 - Gate Array Watchdog 60 - Manufacture NV Uninitialized 62 - Manufacture NV Checksum 74 - NVMEM Write Error 82 - Bus Error 87 - Illegal Event 88 - Breakpoint Interrupt 89 - DeviceNet Board Checksum 93 - Serial Number 95 - Dual Port Error 96 - Unused Interrupt 97 - Spurious Interrupt 98 - Divide by Zero 99 - Illegal Instruction

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
151 153 155 157 159 161 163 165 167 169 171 173 175 177 179 181 183 185 187 189	Get	Fault Time 1 through Fault Time 20	UDINT	4	10 * Min	The time when the corresponding Fault History value occurred. The time is based on an internal service clock that runs only when the drive is powered.
190	Get	Motor Parameter Source	BYTE	1		Indicates where the drive retrieves the motor parameter values. Bit 0 = Nonvolatile Memory Bit 1 = Smart Encoder Bit 2 = Motor File
191	Set	Auto Motor Identification	USINT	1		Specifies if the drive should read the motor parameters from an intelligent motor encoder or from NVRAM. 0 - Enable - read parameters from encoder (default) 1 - Disable - read parameters from NVRAM Note: Set is not allowed if the drive is enabled.
192	Set	Motor Model	SHORT_ STRING	1 byte length indicator, 1 byte per character		The model name of the motor, up to 32 characters long. The drive does not use the name Motor Model, other than as a user interface display. Note: Set is not allowed if the drive is enabled.
193	Set	Self-Sensing Current	USINT	1	%	The current the drive will command when performing self-sensing startup. The value is a percentage of the lesser of the intermittent (peak) drive current rating and the intermittent (peak) motor current rating. The self-sensing current is normally set to 16, but may need to be increased in the presence of large inertias or high friction. In these systems, higher settings will ensure that the self-sensing startup algorithm will be able to complete. Range: 1 to 100 Default: 16

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
194	Set	Motor Flag	USINT	1		Indicates if the drive is configured for a standard or custom motor. The pre-configured motor database in Ultraware supplies parameters for standard motors. The drive does not use this parameter for configuration via Parameter Object Set. 0 - Custom Motor (default) 1 - Standard Motor Note: Set is not allowed if the drive is enabled.
195	Set	Motor Type	USINT	1		The type of motor connected to the drive. 0 - Rotary Motor (default) 1 - Linear Motor Note: Set is not allowed if the drive is enabled.
196	Set	Torque Constant Kt	UINT	2	N-m/A / 4096	The torque constant for a rotary motor (Active if Parameter Instance 195 = 0). Range: 1 to 65535 Default: 2458 Note: Set is not allowed if the drive is enabled.
197	Set	Force Constant Kf	UINT	2	N/A / 16	The force constant for a linear motor (Active if Parameter Instance 195 = 1). Range: 1 to 65535 Default: 16 Note: Set is not allowed if the drive is enabled.
198	Set	Rotary Inertia Jm	UDINT	4	kg-cm^2 / 65536	The rotor inertia for a rotary motor (Active if Parameter Instance 195 = 0). Range: 1 to 0x0ffffffff Default: 49807 Note: Set is not allowed if the drive is enabled.
199	Set	Linear Motor Mass	UDINT	4	kg / 65536	Mass of the moving part (rotor) of a linear motor (Active if Parameter Instance 195 = 1). Range: 1 to 0x0ffffffff Default: 65536 Note: Set is not allowed if the drive is enabled.
200	Set	Total Mass	UDINT	4	kg / 65536	The mass of the load and moving part of a linear motor (Active if Parameter Instance 195 = 1). Range: 0 to 0x0ffffffff Default: 0 Note: Set is not allowed if the drive is enabled.
201	Set	Poles/ Revolution	USINT	1		The number of motor poles per revolution (Active if Parameter Instance 195 = 0). Range: 2 to 100 (even numbers only) Default: 8 Note: Set is not allowed if the drive is enabled.

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
202	Set	Electrical Cycle Length	UINT	2	meter / 10000	Length of an electrical cycle for a linear motor (Active if Parameter Instance 195 = 1). Range: 100 to 10000 Default: 300 Note: Set is not allowed if the drive is enabled.
203	Set	Integral Limits	USINT	1		Indicates whether the motor provides built in feedback for travel limits. 0 - No (default) 1 - Yes Note: Set is not allowed if the drive is enabled.
204	Set	Rated Motor Voltage	UINT	2	Volts	The rated voltage of the motor, in units of AC RMS Volts. Range: 100 to 1000 Default: 230 Note: Set is not allowed if the drive is enabled.
205	Set	Motor Resistance	UINT	2	Ohms / 256	The phase to phase resistance of the motor stator. Range: 1 to 65535 Default: 998 Note: Set is not allowed if the drive is enabled.
206	Set	Motor Inductance	UINT	2	mH / 256	The phase-phase inductance of the motor stator. Range: 1 to 65535 Default: 6144 Note: Set is not allowed if the drive is enabled.
207	Set	Flux Saturation 0	USINT	1		The motor flux saturation value at 12.5% of motor peak current. The value is scaled so that 255 indicates no saturation, and 64 indicates 75% saturation. Range: 1 to 255 Default: 255 Note: Set is not allowed if the drive is enabled.
208	Set	Flux Saturation 1	USINT	1		The motor flux saturation value at 25% of motor peak current. The value is scaled so that 255 indicates no saturation, and 64 indicates 75% saturation. Range: 1 to 255 Default: 255 Note: Set is not allowed if the drive is enabled.

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
209	Set	Flux Saturation 2	USINT	1		The motor flux saturation value at 37.5% of motor peak current. The value is scaled so that 255 indicates no saturation, and 64 indicates 75% saturation. Range: 1 to 255 Default: 255 Note: Set is not allowed if the drive is enabled.
210	Set	Flux Saturation 3	USINT	1		The motor flux saturation value at 50% of motor peak current. The value is scaled so that 255 indicates no saturation, and 64 indicates 75% saturation. Range: 1 to 255 Default: 255 Note: Set is not allowed if the drive is enabled.
211	Set	Flux Saturation 4	USINT	1		The motor flux saturation value at 62.5% of motor peak current. The value is scaled so that 255 indicates no saturation, and 64 indicates 75% saturation. Range: 1 to 255 Default: 255 Note: Set is not allowed if the drive is enabled.
212	Set	Flux Saturation 5	USINT	1		The motor flux saturation value at 75% of motor peak current. The value is scaled so that 255 indicates no saturation, and 64 indicates 75% saturation. Range: 1 to 255 Default: 255 Note: Set is not allowed if the drive is enabled.
213	Set	Flux Saturation 6	USINT	1		The motor flux saturation value at 87.5% of motor peak current. The value is scaled so that 255 indicates no saturation, and 64 indicates 75% saturation. Range: 1 to 255 Default: 255 Note: Set is not allowed if the drive is enabled.
214	Set	Flux Saturation 7	USINT	1		The motor flux saturation value at 100% of motor peak current. The value is scaled so that 255 indicates no saturation, and 64 indicates 75% saturation. Range: 1 to 255 Default: 255 Note: Set is not allowed if the drive is enabled.

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
215	Set	Maximum Rotary Speed	UINT	2	RPM	The maximum speed of a rotary motor (Active if Parameter Instance 195 = 0). Range: 300 to 32767 Default: 3500 Note: Set is not allowed if the drive is enabled.
216	Set	Maximum Linear Speed	UINT	2	m/s / 256	The maximum speed of a linear motor (Active if Parameter Instance 195 = 1). Range: 32 to 32767 Default: 256 Note: Set is not allowed if the drive is enabled.
217	Set	Motor Peak Current	UINT	2	Amps / 128	The peak (intermittent) current rating of the motor. Range: 1 to 32767 Default: 2560 Note: Set is not allowed if the drive is enabled.
218	Set	Motor Continuous Current	UINT	2	Amps / 128	The continuous current rating of the motor. Range: 1 to 32767 Default: 640 Note: Set is not allowed if the drive is enabled.
219	Set	Motor Encoder Type	USINT	1		Type of motor encoder. 0 - None (not supported) 1 - Incremental (default) 2 - Sine/Cosine 3 - SRS/SRM Note: Set is not allowed if the drive is enabled.
220	Set	Commutation Type	USINT	1		The type of motor commutation. The drive only supports sinusoidal commutation. 0 - Brush 1 - Trapezoidal 2 - Sinusoidal (default) Note: Set is not allowed if the drive is enabled.
221	Set	Motor Startup Type	USINT	1		Type of motor startup for sinusoidal commutation. 0 - Self-Sensing 1 - Hall Inputs (default) 2 - Serial Note: Set is not allowed if the drive is enabled.
222	Set	Hall Offset	UINT	2	Degs	Hall offset, in units of electrical degrees. Range: 0 to 359 Default: 0 Note: Set is not allowed if the drive is enabled.

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
223	Set	Encoder Lines Per Rev	UINT	2		The number of encoder lines per revolution on a rotary motor encoder (Active if Parameter Instance 195 = 0). Range: 100 to 64000 Default: 2000 Note: Set is not allowed if the drive is enabled.
224	Set	Encoder Lines Per Meter	UDINT	4		The number of encoder lines per meter of travel on a linear motor encoder (Active if Parameter Instance 195 = 1). Range: 4000 to 10000000 Default: 100000 Note: Set is not allowed if the drive is enabled.
225	Set	Thermostat	USINT	1		Indicates whether the motor has a built-in thermostat. 0 - Not Present (default) 1 - Present Note: Set is not allowed if the drive is enabled.
226	Set	Thermal Protection	USINT	1		Determines if the motor thermal protection algorithm is enabled or disabled. 0 - Disable 1 - Enable (default) Note: Set is not allowed if the drive is enabled.
227	Set	Motor Rth(w-e)	UDINT	4	C/W/ 65536	Thermal resistance of the motor from winding to encoder. Range: 1 to 0x7fffffff Default: 0x7fffffff Note: Set is not allowed if the drive is enabled.
228	Set	Motor Cth(w-e)	UDINT	4	W-s/C / 256	Thermal capacitance of the motor from winding to encoder. Range: 1 to 0x7fffffff Default: 1 Note: Set is not allowed if the drive is enabled.
229	Set	Motor Rth(w-a)	UDINT	4	C/W / 65536	Thermal resistance of the motor from winding to ambient. Range: 1 to 0x7fffffff Default: 57672 Note: Set is not allowed if the drive is enabled.
230	Set	Motor Cth(w-a)	UDINT	4	W-s/C / 256	Thermal capacitance of the motor from winding to ambient. Range: 1 to 0x7fffffff Default: 0x4cb00 Note: Set is not allowed if the drive is enabled.

**Parameter Object,
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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
231	Set	Single-Turn Absolute	USINT	1		Enables absolute position functionality when a single-turn absolute (SRS) encoder is used as a feedback device. 0 - Disable (default) 1 - Enable Note: Enabling this parameter automatically overrides the following when the motor has a single-turn absolute feedback device: • Parameter 35 - Position Rollover • Parameter 36 - Machine Cycle Size Note: Set is not allowed if the drive is enabled.
232-252	Get	Reserved	USINT	1		Default: 0
253	Set	Analog Velocity Scale	INT	2	%	Analog velocity scale applied to the analog input when used for the velocity command. The scale is in units of percentage of maximum motor speed per 10 Volts. Range: -200 to 200 Default: 100
254	Set	Analog Velocity Offset	INT	2	mV	Analog velocity offset applied to the analog input when used for the velocity command. Range: -10000 to 10000 Default: 0
255	Set	Analog Current Scale	INT	2	%	Analog current scale applied to the analog input when used for the current command. The scale is in units of percentage of the minimum of the motor intermittent current rating and drive intermittent current rating, per 10 Volts. Range: -400 to 400 Default: 100
256	Set	Analog Current Offset	INT	2	mV	Analog current offset applied to the analog input when used for the current command. Range: -10000 to 10000 Default: 0
257	Set	Analog Position Scale	INT	2	Cnts / V	Analog position scale applied to the analog input when used for the position command. The scale is in units of counts/Volt. Range: -32767 to 32767 Default: 1000
258	Set	Analog Position Offset	INT	2	mV	Analog position offset applied to the analog input when used for the position command. Range: -10000 to 10000 Default: 0
259	Set	Limit Analog Accel	USINT	1		Indicates if the analog acceleration limits are enabled or disabled when the drive is in Analog Velocity Input mode 0 - Disable (default) 1 - Enable

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
260	Set	Analog Accel Limit	UDINT	4	Cnts / Sec^2	The acceleration limit used when the drive is in Analog Velocity Input mode and Parameter 259, Limit Analog Accel is set to 1 - Enable. Range: 0 to 0x7fffffff Default: 100000
261	Set	Analog Decel Limit	UDINT	4	Cnts / Sec^2	The deceleration limit used when the drive is in Analog Velocity Input mode and Parameter 259, Limit Analog Accel is set to 1 - Enable. Range: 0 to 0x7fffffff Default: 100000
262	Set	Slew Enable	USINT	1		Used to enable or disable the Gear Slew Rate. 0 - Disable (default) 1 - Enable
263	Set	Slew Limit	UDINT	4	Cnts / Sec^2	Slew rate (acceleration/deceleration limit) used for gearing. Range: 0 to 0x7fffffff Default: 100000
264	Set	Master Gear Count 0	UINT	2	Cnts	Master encoder counts for preset gear ratio 0. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. Range: 1 to 32767 Default: 1
265	Set	Motor Gear Count 0	INT	2	Cnts	Motor encoder counts for preset gear ratio 0. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. This value should be nonzero. Range: -32767 to 32767 Default: 1
266	Set	Master Gear Count 1	UINT	2	Cnts	Master encoder counts for preset gear ratio 1. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. Range: 1 to 32767 Default: 1
267	Set	Motor Gear Count 1	INT	2	Cnts	Motor encoder counts for preset gear ratio 1. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. This value should be nonzero. Range: -32767 to 32767 Default: 1
268	Set	Master Gear Count 2	UINT	2	Cnts	Master encoder counts for preset gear ratio 2. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. Range: 1 to 32767 Default: 1
269	Set	Motor Gear Count 2	INT	2	Cnts	Motor encoder counts for preset gear ratio 2. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. This value should be nonzero. Range: -32767 to 32767 Default: 1

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Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
270	Set	Master Gear Count 3	UINT	2	Cnts	Master encoder counts for preset gear ratio 3. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. Range: 1 to 32767 Default: 1
271	Set	Motor Gear Count 3	INT	2	Cnts	Motor encoder counts for preset gear ratio 3. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. This value should be nonzero. Range: -32767 to 32767 Default: 1
272	Set	Master Gear Count 4	UINT	2	Cnts	Master encoder counts for preset gear ratio 4. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. Range: 1 to 32767 Default: 1
273	Set	Motor Gear Count 4	INT	2	Cnts	Motor encoder counts for preset gear ratio 4. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. This value should be nonzero. Range: -32767 to 32767 Default: 1
274	Set	Master Gear Count 5	UINT	2	Cnts	Master encoder counts for preset gear ratio 5. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. Range: 1 to 32767 Default: 1
275	Set	Motor Gear Count 5	INT	2	Cnts	Motor encoder counts for preset gear ratio 5. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. This value should be nonzero. Range: -32767 to 32767 Default: 1
276	Set	Master Gear Count 6	UINT	2	Cnts	Master encoder counts for preset gear ratio 6. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. Range: 1 to 32767 Default: 1
277	Set	Motor Gear Count 6	INT	2	Cnts	Motor encoder counts for preset gear ratio 6. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. This value should be nonzero. Range: -32767 to 32767 Default: 1
278	Set	Master Gear Count 7	UINT	2	Cnts	Master encoder counts for preset gear ratio 7. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. Range: 1 to 32767 Default: 1

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
279	Set	Motor Gear Count 7	INT	2	Cnts	Motor encoder counts for preset gear ratio 7. The preset gear ratio is defined by the ratio of the Master Gear Count and the Motor Gear Count. This value should be nonzero. Range: -32767 to 32767 Default: 1
280 281 282 283 284 285 286 287	Set	Velocity Preset 0 Velocity Preset 1 Velocity Preset 2 Velocity Preset 3 Velocity Preset 4 Velocity Preset 5 Velocity Preset 6 Velocity Preset 7	DINT	4	Cnts / Sec	If the drive is in Velocity Preset mode, then Preset Select Lines 0, 1, and 2 will select the Preset Velocity parameter used for the velocity command. Range: -0x7fffffff to 0x7fffffff Default: 0
288	Set	Limit Preset Accel	USINT	1		Indicates if the analog acceleration limits are enabled or disabled when the drive is in Preset Velocity Input mode 0 - Disable 1 - Enable (default)
289	Set	Preset Accel Limit	UDINT	4	Cnts / Sec^2	The acceleration limit used when the drive is in Preset Velocity Input mode and Parameter 288, Limit Preset Accel is set to 1 - Enable (default). Range: 0 to 0x7fffffff Default: 100000
290	Set	Preset Decel Limit	UDINT	4	Cnts / Sec^2	The deceleration limit used when the drive is in Preset Velocity Input mode and Parameter 288, Limit Preset Accel is set to 1 - Enable (default). Range: 0 to 0x7fffffff Default: 100000

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
291	Set	Current Preset 0	INT	2	Amps / 128	If the drive is in Current Preset mode, then Preset Select Lines 0, 1, and 2 will select the Preset Current parameter used for the current command. Range: -32767 to 32767 Default: 0
292		Current Preset 1				
293		Current Preset 2				
294		Current Preset 3				
295		Current Preset 4				
296		Current Preset 5				
297		Current Preset 6				
298		Current Preset 7				
299-303	Get	Reserved	USINT	1		Default: 0
304	Set	Preset Position 0	DINT	4	Cnts	If the drive is in Position Preset mode, then Preset Select Lines 0, 1, and 2 select the Preset Position, Preset Position Velocity, Preset Position Accel, and Preset Position Decel parameters used during the position move. Range: -0x7fffffff to 0x7fffffff Default: 0
305	Set	Preset Position 0 Velocity	UDINT	4	Cnts / Sec	The velocity used during a Preset Position 0 move. Range: 0 to 0x7fffffff Default: 100000
306	Set	Preset Position 0 Accel	UDINT	4	Cnts / Sec^2	The acceleration rate used to change to a higher velocity during a Preset Position 0 move. Range: 0 to 0x7fffffff Default: 100000
307	Set	Preset Position 0 Decel	UDINT	4	Cnts / Sec^2	The deceleration rate used to change to a lower velocity during a Preset Position 0 move. Range: 0 to 0x7fffffff Default: 100000
308	Set	Preset Position 1	DINT	4	Cnts	If the drive is in Position Preset mode, then Preset Select Lines 0, 1, and 2 select the Preset Position, Preset Position Velocity, Preset Position Accel, and Preset Position Decel parameters used during the position move. Range: -0x7fffffff to 0x7fffffff Default: 0
309	Set	Preset Position 1 Velocity	UDINT	4	Cnts / Sec	The velocity used during a Preset Position 1 move. Range: 0 to 0x7fffffff Default: 100000

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
310	Set	Preset Position 1 Accel	UDINT	4	Cnts / Sec^2	The acceleration rate used to change to a higher velocity during a Preset Position 1 move. Range: 0 to 0x7fffffff Default: 100000
311	Set	Preset Position 1 Decel	UDINT	4	Cnts / Sec^2	The deceleration rate used to change to a lower velocity during a Preset Position 1 move. Range: 0 to 0x7fffffff Default: 100000
312	Set	Preset Position 2	DINT	4	Cnts	If the drive is in Position Preset mode, then Preset Select Lines 0, 1, and 2 select the Preset Position, Preset Position Velocity, Preset Position Accel, and Preset Position Decel parameters used during the position move. Range: -0x7fffffff to 0x7fffffff Default: 0
313	Set	Preset Position 2 Velocity	UDINT	4	Cnts / Sec	The velocity used during a Preset Position 2 move. Range: 0 to 0x7fffffff Default: 100000
314	Set	Preset Position 2 Accel	UDINT	4	Cnts / Sec^2	The acceleration rate used to change to a higher velocity during a Preset Position 2 move. Range: 0 to 0x7fffffff Default: 100000
315	Set	Preset Position 2 Decel	UDINT	4	Cnts / Sec^2	The deceleration rate used to change to a lower velocity during a Preset Position 2 move. Range: 0 to 0x7fffffff Default: 100000
316	Set	Preset Position 3	DINT	4	Cnts	If the drive is in Position Preset mode, then Preset Select Lines 0, 1, and 2 select the Preset Position, Preset Position Velocity, Preset Position Accel, and Preset Position Decel parameters used during the position move. Range: -0x7fffffff to 0x7fffffff Default: 0
317	Set	Preset Position 3 Velocity	UDINT	4	Cnts / Sec	The velocity used during a Preset Position 3 move. Range: 0 to 0x7fffffff Default: 100000
318	Set	Preset Position 3 Accel	UDINT	4	Cnts / Sec^2	The acceleration rate used to change to a higher velocity during a Preset Position 3 move. Range: 0 to 0x7fffffff Default: 100000
319	Set	Preset Position 3 Decel	UDINT	4	Cnts / Sec^2	The deceleration rate used to change to a lower velocity during a Preset Position 3 move. Range: 0 to 0x7fffffff Default: 100000

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
320	Set	Preset Position 4	DINT	4	Cnts	If the drive is in Position Preset mode, then Preset Select Lines 0, 1, and 2 select the Preset Position, Preset Position Velocity, Preset Position Accel, and Preset Position Decel parameters used during the position move. Range: -0x7fffffff to 0x7fffffff Default: 0
321	Set	Preset Position 4 Velocity	UDINT	4	Cnts / Sec	The velocity used during a Preset Position 4 move. Range: 0 to 0x7fffffff Default: 100000
322	Set	Preset Position 4 Accel	UDINT	4	Cnts / Sec^2	The acceleration rate used to change to a higher velocity during a Preset Position 4 move. Range: 0 to 0x7fffffff Default: 100000
323	Set	Preset Position 4 Decel	UDINT	4	Cnts / Sec^2	The deceleration rate used to change to a lower velocity during a Preset Position 4 move. Range: 0 to 0x7fffffff Default: 100000
324	Set	Preset Position 5	DINT	4	Cnts	If the drive is in Position Preset mode, then Preset Select Lines 0, 1, and 2 select the Preset Position, Preset Position Velocity, Preset Position Accel, and Preset Position Decel parameters used during the position move. Range: -0x7fffffff to 0x7fffffff Default: 0
325	Set	Preset Position 5 Velocity	UDINT	4	Cnts / Sec	The velocity used during a Preset Position 5 move. Range: 0 to 0x7fffffff Default: 100000
326	Set	Preset Position 5 Accel	UDINT	4	Cnts / Sec^2	The acceleration rate used to change to a higher velocity during a Preset Position 5 move. Range: 0 to 0x7fffffff Default: 100000
327	Set	Preset Position 5 Decel	UDINT	4	Cnts / Sec^2	The deceleration rate used to change to a lower velocity during a Preset Position 5 move. Range: 0 to 0x7fffffff Default: 100000
328	Set	Preset Position 6	DINT	4	Cnts	If the drive is in Position Preset mode, then Preset Select Lines 0, 1, and 2 select the Preset Position, Preset Position Velocity, Preset Position Accel, and Preset Position Decel parameters used during the position move. Range: -0x7fffffff to 0x7fffffff Default: 0
329	Set	Preset Position 6 Velocity	UDINT	4	Cnts / Sec	The velocity used during a Preset Position 6 move. Range: 0 to 0x7fffffff Default: 100000

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
330	Set	Preset Position 6 Accel	UDINT	4	Cnts / Sec^2	The acceleration rate used to change to a higher velocity during a Preset Position 6 move. Range: 0 to 0x7fffffff Default: 100000
331	Set	Preset Position 6 Decel	UDINT	4	Cnts / Sec^2	The deceleration rate used to change to a lower velocity during a Preset Position 6 move. Range: 0 to 0x7fffffff Default: 100000
332	Set	Preset Position 7	DINT	4	Cnts	If the drive is in Position Preset mode, then Preset Select Lines 0, 1, and 2 select the Preset Position, Preset Position Velocity, Preset Position Accel, and Preset Position Decel parameters used during the position move. Range: -0x7fffffff to 0x7fffffff Default: 0
333	Set	Preset Position 7 Velocity	UDINT	4	Cnts / Sec	The velocity used during a Preset Position 7 move. Range: 0 to 0x7fffffff Default: 100000
334	Set	Preset Position 7 Accel	UDINT	4	Cnts / Sec^2	The acceleration rate used to change to a higher velocity during a Preset Position 7 move. Range: 0 to 0x7fffffff Default: 100000
335	Set	Preset Position 7 Decel	UDINT	4	Cnts / Sec^2	The deceleration rate used to change to a lower velocity during a Preset Position 7 move. Range: 0 to 0x7fffffff Default: 100000
336	Set	Homing Type	USINT	1		Selects the type of homing operation the drive will perform when the homing procedure is started. 0 - Home to Sensor, Forward to Marker (default) 1 - Home to Marker 2 - Home to Sensor 3 - Home to Sensor, Backward to Marker 4 - Home to Current Setting 5 - Home to Current Setting, Backward to Marker
337	Set	Auto-Start Home	USINT	1		Determines if the drive will begin the homing procedure automatically when the drive is enabled. 0 - Auto-start homing inactive (default) 1 - Auto-start homing active only if not homed 2 - Auto-start homing always active

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
338	Set	Home Sensor Backoff	USINT	1		Causes the drive to move in the direction opposite the direction specified by the Homing Velocity setting, when the homing procedure is started with the Sensor input active. Motion will continue in the reverse direction (moving at the Homing Accel, Homing Decel, and Homing Velocity settings), until the Sensor input is detected inactive, at which point the normal homing procedure will take over. Controls whether the drive backs off the sensor if the sensor is active at the start of the homing operation. Note: This parameter does not apply if 'Home to Marker' is selected as the Homing Type. 0 - Disable (default) 1 - Enable
339	Set	Homing Velocity	DINT	4	Cnts / Sec	The commanded velocity used during homing. The sign of the parameter value specifies the direction of motion during homing. Range: -0x7fffffff to 0x7fffffff Default: 100000
340	Set	Homing Accel/ Decel	UDINT	4	Cnts / Sec^2	The acceleration and deceleration rate used during homing. Range: 0 to 0x7fffffff Default: 100000
341	Set	Home Offset Move	DINT	4	Cnts	The distance the motor position will be from the home position after the homing procedure is complete. Range: -0x7fffffff to 0x7fffffff Default: 0
342	Set	Homing Stop Decel	UDINT	4	Cnts / Sec^2	The deceleration rate used to bring the motor to a stop when a homing procedure is terminated with the Stop Homing input or the Stop Homing command. Range: 0 to 0x7fffffff Default: 100000
343	Set	Home Sensor Polarity	USINT	1		Specifies the digital input state that the drive uses to determine if the Home Sensor input is active. 0 - Inactive to active transition (default) 1 - Active to inactive transition
344	Set	Home Position	DINT	4	Cnts	This value is used as the home position when the Define Home input is activated, or at the completion of a homing procedure. Range: -0x7fffffff to 0x7fffffff Default: 0
345	Set	Homing Creep Velocity	UDINT	4	Cnts / Sec	For the Homing Type selection 3 - Home to Sensor, Backward to Marker - this velocity is used to travel back to the marker after the drive finds the sensor edge. Range: 0 to 0x7fffffff Default: 10000

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
346	Set	Home Sensor Current	UINT	2	Amps / 128	Current value used when homing to a current setting. If the commanded current is equal to or greater than this value, the homing sequence is terminated or changed to searching for a marker. Range: 1 to 32767 Default: 128
347	Set	Start Homing Command	USINT	1		Initiates the homing procedure. 0 - No Action (default) 1 - Execute Command
348	Set	Abort Homing Command	USINT	1		Stops execution of the homing procedure. 0 - No Action (default) 1 - Execute Command
349	Set	Pause Homing Command	USINT	1		Pauses execution of the homing procedure. 0 - No Action (default) 1 - Continue Homing 2 - Pause Homing
350	Set	Host Index Number	USINT	1		The index that the drive will execute if you initiate a Start Index while Parameter 28, Host Control Mode is set to 3 - Host Index Mode (Indexing Only). The Host Index Number setting is not saved in nonvolatile memory. Range: 0 to 63 Default: 0
351	Set	Start Index Command	USINT	1		Starts executing an index if the drive is enabled and in an index control mode. An error may be returned if the drive can not execute an index move or if an index is already executing. 0 - No Action (default) 1 - Execute Command
352	Get	Index Status	WORD	2		Returns the status of an index move. Bit 0 = Start Index Execution Bit 1 = Start New Index Execution Bit 2 = Index Run - In Accel or Constant Velocity Bit 3 = In Decel Bit 4 = In Dwell Bit 5 = Move Adjusted by Registration Bit 6 = End of Batch Count Bit 7 = Negative Distance Index Bit 8 = Registration Input Seen Bit 9 = Not Homed - Absolute index started before homing Bit 10 = Aborting Index - Index is being aborted, initiated from a digital input Bit 11 = Blended to Index - Previous index ended with a nonzero velocity Bit 12 = Reversing Direction Bit 13 = Sensor Unassigned - Registration index with no sensor assigned Bit 14 = Overtravel Limit - Index is being aborted, initiated from an overtravel limit

**Parameter Object,
Instances ID = 1- 1059**

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
353	Get	Selected Index	USINT	1		The selected index. Range: 0 to 63
354	Get	Index Count	UINT			The number of iterations remaining in the execution of the index. Range: 0 to 65535
355	Set	Auto-Start Index	USINT	1		Determines if the drive will begin executing the selected index whenever the drive is enabled. 0 - Disable (default) 1 - Enable
356	Set	Abort Index Decel	UDINT	4	Cnts / Sec^2	The deceleration rate used to stop motion when the Abort (Stop) input terminates an index move. Range: 0 to 0x7fffffff Default: 100000
357 and 367, 377, …, 967, 977, 987	Set	Index 0 Type and Index n Type where n = 1-63	USINT	1		Selects the type of index move. 0 - Incremental (default) 1 - Absolute 2 - Registration 3 - Jog
358 and 368, 378, …, 968, 978, 988	Set	Index 0 Distance/ Position and Index n Distance/Position where n = 1-63	DINT	4	Cnts	For Incremental and Registration index moves, specifies the relative distance of travel. For Absolute moves, specifies the final position of the index move. For a Jog index move, specifies the maximum distance of travel. Range: -0x7fffffff to 0x7fffffff Default: 1000
359 and 369, 379, …, 969, 979, 989	Set	Index 0 Count and Index n Count where n = 1-63	UINT	2		The number of times the index move will execute. If it is set to zero (0), the index move will be executed continuously. Range: 0 to 65535 Default: 1
360 and 370, 380, …, 970, 980, 990	Set	Index 0 Dwell and Index n Dwell where n = 1-63	UINT	2	mSec	The amount of time the drive holds position before continuing to the next index. Range: 0 to 65535 Default: 0
361 and 371, 381, …, 971, 981, 991	Set	Index 0 Registration Distance and Index n Registration Distance where n = 1-63	UDINT	4	Cnts	For Registration index moves, specifies the relative distance of travel after a registration digital input is detected. Range: 0 to 0x7fffffff Default: 1000
362 and 372, 382, …, 972, 982, 992	Set	Index 0 Velocity and Index n Velocity where n = 1-63	UDINT	4	Cnts / Sec	The commanded velocity used when executing the index. Range: 0 to 0x7fffffff Default: 100000

Parameter Object, Instances ID = 1- 1059

Parameter Instance	Access Rule	Parameter Name	Data Type	Data Size (Bytes)	Units / Scale	Description
363 and 373, 383, …, 973, 983, 993	Set	Index 0 Accel and Index n Accel where n = 1-63	UDINT	4	Cnts / Sec^2	The acceleration rate used to change to higher velocity during the index move. Range: 0 to 0x7fffffff Default: 100000
364 and 374, 384, …, 974, 984, 994	Set	Index 0 Decel and Index n Decel where n = 1-63	UDINT	4	Cnts / Sec^2	The deceleration rate used to change to a lower velocity during the index move. Range: 0 to 0x7fffffff Default: 100000
365 and 375, 385, …, 975, 976, 995	Set	Index 0 Pointer and Index n Pointer where n = 1-63	USINT	1		Specifies the next index move to execute if the Index 0 Terminate parameter is not set to 'Stop'. Range: 0 to 63 Default: 0
366 and 376, 386, …, 976, 986, 996	Set	Index 0 Terminate and Index n Terminate where n = 1-63	USINT	1		The drive's action when the index move has completed. 0 - Stop 1 - Start Next Index immediately 2 - Wait for Start - 'Start Index' active transition required to start next index. 3 - Index Without Stop - execute the next index without stopping. The dwell time is ignored and a 'Start Index' is not required.
997 through 1059	Set	Index 0 Absolute Direction and Index n Absolute Direction where n = 1-63	USINT	1		For absolute index moves, the direction of the travel when: • Parameter 35 - Position Rollover = 1 - Enable, or • Single-turn Absolute mode is active (refer to Parameter 231 - Single-Turn Absolute). 0 - Bi-directional (default) - moves to the desired position using the shortest path. 1 - Forward Uni-directional - moves to the desired position going forward. 2 - Reverse Uni-directional - moves to the desired position going reverse.

Parameter Object Instance Attributes

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 DeviceNet path	Path to the object from where this parameter value is retrieved. The link path is limited to 255 BYTEs.
			Segment Type/Port	BYTE	Refer to the DeviceNet Specification listed in *Related Documentation* on page P-2 for a description of the data type: Segment Type/Port.
			Segment Address	EPATH	Path (format depends on data contained in segment type/port)
4			Descriptor	WORD	Descriptor of parameter. *Bit Definitions for Instance Attribute 4* on page 2-99
5			Data Type	USINT	Data type code. *Data Types for Instance Attribute 5* on page 2-99
6			Data Size	USINT	Number of BYTEs in Attribute 1, Parameter Value

Parameter Object
Instance Attributes (Continued)

Attr ID	Access Rule	Stub/ Full	Name	Data Type	Description
7	Get	Full	Parameter Name	SHORT_ STRING [2]	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			Help String		The maximum number of characters is 64. (The first byte is a length code.)
10			Minimum Value	Data type specified in Descriptor, Data type and Data Size [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 you want the default for the parameter.
13			Scaling Multiplier	UINT [2]	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 divisor source.
19			Base Link		Parameter object instance number of base source.
20			Offset Link		Parameter object instance number of offset source.
21			Decimal Precision	USINT [2]	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 Definitions for Instance Attribute 4* on page 2-99:
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 *Data Type Definitions* on page 2-5.

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 is presented in engineering units.

Parameter Object
Data Types for Instance Attribute 5

Data Type Name	Data Type Code (in Hex)	Data Type Description
SINT	C2	Signed 8-bit integer value
INT	C3	Signed 16-bit integer value
DINT	C4	Signed 32-bit integer value
USINT	C6	Unsigned 8-bit integer value
UINT	C7	Unsigned 16-bit integer value
UDINT	C8	Unsigned 32-bit integer value
BYTE	D1	bit string, 8-bit
WORD	D2	bit string, 16-bit
DWORD	D3	bit string, 32-bit
SHORT_STRING	DA	Character string (1 byte per character, 1 byte length indicator)

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 describing 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.

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 Instance Attributes

Attr ID	Access Rule	Attribute Name	Data 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 is 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.

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Publication 2098-RM004A-EN-P – August 2002

0013-2058-001-01