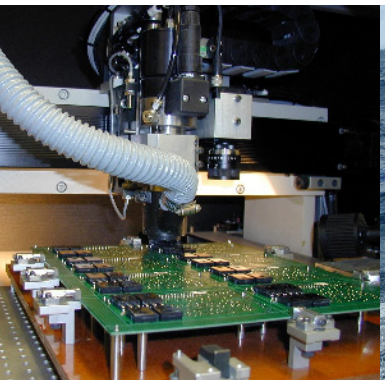
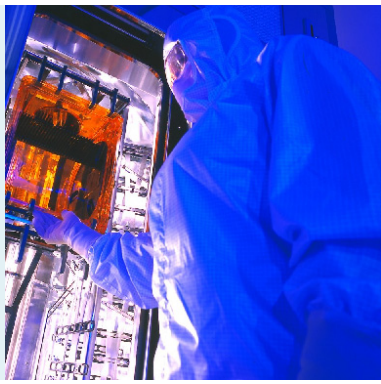
ADVANCED MOTION CONTROLS



Everything's possible.

Modbus Communication

Reference Manual

DigiFlex® Performance™ Servo Drives

Preface

ADVANCED Motion Controls constantly strives to improve all of its products. We review the information in this document regularly and we welcome any suggestions for improvement. We reserve the right to modify equipment and documentation without prior notice.

For the most recent software, the latest revisions of this manual, and copies of compliance and declarations of conformity, visit the company's website at *www.a-m-c.com*. Otherwise, contact the company directly at:

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Agency Compliances

The company holds original documents for the following:

- UL 508c, file number E140173
- Electromagnetic Compatibility, EMC Directive - 2004/108/EC
  EN61000-6-2:2001
  EN61000-6-4:2001
  EN61000-3-2:2000
  EN61000-3-3:1995/A1:2001
- Electrical Safety, Low Voltage Directive - 2006/95/EC
  EN 60 204-1 (IEC 60 204-1)
- Reduction of Hazardous Substances (RoHS), 2011/65/EU

Trademarks

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Related Documentation

- Product datasheet specific for your drive, available for download at www.a-m-c.com.

Attention Symbols

The following symbols are used throughout this document to draw attention to important operating information, special instructions, and cautionary warnings. The section below outlines the overall directive of each symbol and what type of information the accompanying text is relaying.

Note - Pertinent information that clarifies a process, operation, or ease-of-use preparations regarding the product.

Notice - Required instruction necessary to ensure successful completion of a task or procedure.

Caution - Instructs and directs you to avoid damaging equipment.

Warning - Instructs and directs you to avoid harming yourself.

Danger - Presents information you must heed to avoid serious injury or death.

Revision History

Document ID	Revision #	Date	Changes
MNCMMBRF-01	1.0	3/2015	First Release
MNCMMBRF-02	1.1	5/2017	- Added Supported Modbus Exception Codes table

Contents

1 Modbus Communication Protocol

Modbus is an open-standard application-layer messaging protocol, developed by Modicon. It provides master/slave communication between intelligent devices connected on different types of buses or networks. The same communication can be accomplished over a serial line (Modbus RTU) as on an Ethernet network (Modbus TCP).

ADVANCED Motion Controls' drives usually communicate with DriveWare using a proprietary serial protocol. This restricts the possible range of applications that can use the drives, and in particular prevents them from being used directly by Programmable Logic Controllers. Utilizing Modbus makes the drives immediately usable by PLCs.

1.1 Modbus Protocol

The Modbus protocol uses a defined message structure, regardless of the physical layer of the network used to communicate. A master device initiates a "query", and slave devices return a "response" supplying the requested data or taking the requested action. The query can be made to individual devices or broadcast to all connected devices. Responses are only made to individual queries.

1.2 Modbus Command Format and Message Structures

The reference used for Modbus commands in *ADVANCED* Motion Controls' drives is the "Modicon Modbus Protocol Reference Guide" (downloadable from www.modbus.org). Frames are byte streams and have this format:

TABLE 1.1 Modbus Sample Message Format

Device Address	Function Code	Data and Register Information	CRC
3F	01	00 01 00 02	C9 A8

The first byte, 0x3F, is the address. It will normally be in the range 1 to 63. *ADVANCED* Motion Controls' drives do not support serial addresses above 63 and address zero is reserved.

The second byte is the command code, or function code. Table 1.2 lists the available function codes. Certain function codes will contain sub-function codes to allow multiple actions.

TABLE 1.2 Modbus Function Codes

Function Code	Type	Description
01	Read Coil Status	Requests status of discrete coils
02	Read Input Status	Requests status of discrete inputs
03	Read Holding Registers	Requests content of holding registers
04	Read Input Registers	Requests content of input registers
05	Force Single Coil	Writes to a discrete coil
06	Preset Single Register	Writes to a single holding register
08	Diagnostics (Serial only)	See Table 1.12
15	Force Multiple Coils	Writes to multiple coils
16	Preset Multiple Registers	Writes to multiple holding registers
17	Read Slave ID	Requests address of slave device

The last two bytes are the CRC pattern. Bytes between the address and the CRC pattern are addressing information and data, if present. The exact format depends on the specific command type. Some message commands/requests may have a non-existent data field, and the action to be taken will be defined by the function code.

Modbus replies follow the same format as the commands, and similar to the command the reply is command specific. Exception replies are short, consisting of the unit address, the command code with bit 7 set, an exception code, and the CRC. The following exception codes are supported by *ADVANCED* Motion Controls' drives.

TABLE 1.3 Supported Modbus Exception Codes

Exception Code	Name	Description
01	Illegal Function	The function code received is not supported.
02	Illegal Address	The data address received is not valid.
03	Illegal Value	The data value received is not allowable.

1.2.1 Read Coil Status - Function Code 01

TABLE 1.4

Read Coil Status Query
Device Address
Function Code
Address of beginning coil
Total number of coils to be read
CRC

Read Coil Status Response
Device Address
Function Code
Number of data bytes in message
Data from coils (8 coils/bits per byte; most significant bits contain the higher coils. Zeroes will be sent as placeholders if necessary).
CRC

1.2.2 Read Input Status - Function Code 02

TABLE 1.5

Read Input Status Query
Device Address
Function Code
Address of beginning discrete input to be read
Total number of inputs to be read
CRC

Read Input Status Response
Device Address
Function Code
Number of data bytes in message
Data from inputs (8 inputs/bits per byte; most significant bits contain the higher inputs. Zeroes will be sent as placeholders if necessary).
CRC

1.2.3 Read Holding Registers - Function Code 03

TABLE 1.6

Read Holding Registers Query
Device Address
Function Code
Address of beginning register to be read
Total number of registers to be read
CRC

Read Holding Registers Response
Device Address
Function Code

Number of data bytes in message
Data from registers (2 bytes per register)
CRC

1.2.4 Read Input Registers - Function Code 04

TABLE 1.7

Read Input Registers Query
Device Address
Function Code
Address of beginning register to be read
Total number of registers to be read
CRC

Read Input Registers Response
Device Address
Function Code
Number of data bytes in message
Data from registers (2 bytes per register)
CRC

1.2.5 Force Single Coil - Function Code 05

TABLE 1.8

Force Single Coil Query
Device Address
Function Code
Address of coil to write to
Status to write (OFF = 0000, ON = FF00)
CRC

Force Single Coil Response
Device Address
Function Code
Address of coil written to
Status written to coil (OFF = 0000, ON = FF00)
CRC

1.2.6 Preset Single Register - Function Code 06

TABLE 1.9

Preset Single Register Query
Device Address
Function Code
Address of register to write to
Value to write
CRC

Preset Single Register Response
Device Address
Function Code
Address of register written to
Value written to register
CRC

1.2.7 Force Multiple Coils - Function Code 15

TABLE 1.10

Force Multiple Coils Query
Device Address
Function Code
Address of first coil to write to
Total number of coils to write to
Values to write (8 coils/bits per byte; most significant bits contain the higher coils. Zeroes will be sent as placeholders if necessary)
CRC

Force Multiple Coils Response
Device Address
Function Code
Address of first coil written to
Total number of coils written to
CRC

1.2.8 Preset Multiple Registers - Function Code 16

TABLE 1.11

Preset Multiple Registers Query
Device Address
Function Code
Address of first register to write to
Total number of registers to write to
Number of data bytes in message (2 bytes per register)
Values to write
CRC

Preset Multiple Registers Response
Device Address
Function Code
Address of first register written to
Total number of registers written to
CRC

1.3 Diagnostic Commands

The following subset of the diagnostic commands is implemented to check the health of the communication system.

TABLE 1.12 Diagnostic Commands

Sub-function Code		Name
Hex	Dec	
00	00	Return Query Data
0A	10	Clear Diagnostic Counters and Registers
0C	12	Return Bus Communication Error Count (CRC)
0D	13	Return Bus Exception Error Count
0E	14	Return Server Message Count

1.4 Modbus TCP

Modbus TCP is similar in concept to Modbus RTU, except that the commands are hosted over TCP through the standard port 502 rather than sent over a serial interface. Command and reply format is similar to Modbus RTU, without the CRC-16 check fields.

2 Register Definitions

2.1 Format

Modbus communicates with entities which it calls "registers", and a particular command may read from or write to a single register or a block of registers. Mapping between Modbus Registers and *ADVANCED* Motion Controls' commands is done using mapping tables that consist of command name and offset (for single bit access, byte mask is also included).

For 16 bit registers used by Holding and Data registers, each register is mapped by *ADVANCED* Motion Controls' command enumeration and command definition is used directly to access the offset in that command.

For 32 bit registers, access is managed in pairs so that both halves of the 32 bit register have to be read or written with a single access (so a 32 bit write caches the first 16 bits and then collects the second 16 bits to access the 32 bit variable).

For single bit registers using by Coils and Inputs, each register is mapped by *ADVANCED* Motion Controls' command enumeration and command definition is used directly to access the offset in that command. These are packed into a single 32 bit word - 8 bits for the command, 8 bits for the offset, and 16 bits for the byte mask. The assigned field size for each field is sufficient to cover all the register, offset, and bit handlings.

Note that writing to registers that are reserved will have no effect on drive operation, and reading the reserved registers will return a value of zero regardless of the attempted write of different value.

TABLE 2.1 Register Definition Example.

Register Number	Register Name		
Modbus Address	Address (hex)	Units	Data Type
-	-	-	-
Comments: -			

2.2 Definitions

ADVANCED Motion Controls' Modbus protocol consists of two types of coils:

- Level Active - These are standard coils that are level active, range from 1 - 2000. Reading of these coils will return the proper coil level, and it is possible to multiple write to the standard coils.
- Edge Active - These are Meta coils that are action coils and edge triggered, range from 4000 - 6000. Reading of these coils will always return zero, and it is not possible to multiple write to the Meta coils.

2.2.1 Standard Coils

Registers 1-13: Control Word #0 Enables/Disables certain drive functions according to the register definitions below.

1	Software Disable		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
0	0	N/A	Unsigned16
Comments: Causes the bridge to be disabled.			

2	Zero Position Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
1	1	N/A	Unsigned16
Comments: Sets the target position equal to the measured position. Note that only one coil of coils 2-7 can be active at a given time.			

3	Phase Detect		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
2	2	N/A	Unsigned16
Comments: Activates the phase detection routine. Note that only one coil of coils 2-7 can be active at a given time.			

4	Set Position		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
3	3	N/A	Unsigned16
Comments: Causes the position counter to be loaded with the preset position value. Note that only one coil of coils 2-7 can be active at a given time.			

5	Motion Engine Enable		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4	4	N/A	Unsigned16
Comments: Enables the Motion Engine. Note that only one coil of coils 2-7 can be active at a given time.			

6	Home Execute		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
5	5	N/A	Unsigned16
Comments: Causes the homing routine to be active. Note that only one coil of coils 2-7 can be active at a given time.			

7	Commanded Stop		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
6	6	N/A	Unsigned16
Comments: Causes the drive to stop. Note that only one coil of coils 2-7 can be active at a given time.			

8	Capture 1 Arm		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
7	7	N/A	Unsigned16
Comments: A change from 0 to 1 arms/rearms Capture unit 1. A change from 1 to 0 disarms it.			

9	Capture 2 Arm		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
8	8	N/A	Unsigned16
Comments: A change from 0 to 1 arms/rearms Capture unit 2. A change from 1 to 0 disarms it.			

10	Capture 3 Arm		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
9	9	N/A	Unsigned16
Comments: A change from 0 to 1 arms/rearms Capture unit 3. A change from 1 to 0 disarms it.			

11	Commanded Positive Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
10	A	N/A	Unsigned16
Comments: Activates positive limiting.			

12	Commanded Negative Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
11	B	N/A	Unsigned16
Comments: Activates negative limiting.			

13	Reset Events		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
12	C	N/A	Unsigned16
Comments:			
Resets all but the following events: Current Overshoot, Parameter Restore Error, Parameter Store Error, Phase Detection Failure, Software Disable			

Registers 14-16: Reserved

Registers 17-23: Control Word #1

Enables/Disables certain drive functions according to the register definitions below:

17	Gain Parameters Set		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
16	10	N/A	Unsigned16
Comments:			
A change from 0 to 1 selects Gain Set 1. A change from 1 to 0 selects Gain Set 0.			

18	Command Limiter Parameters Set		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
17	11	N/A	Unsigned16
Comments:			
A change from 0 to 1 selects Command Limiter Set 1. A change from 1 to 0 selects Command Limiter Set 0.			

19	Command Source Modifier Set		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
18	12	N/A	Unsigned16
Comments:			
A change from 0 to 1 selects Source Modifier Set 1. A change from 1 to 0 selects Source Modifier Set 0.			

20	Jog Plus		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
19	13	N/A	Unsigned16
Comments:			
Writing a 1 asserts Jog Plus. Writing a 0 deasserts Jog Plus.			

21	Jog Minus		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
20	14	N/A	Unsigned16
Comments:			
Writing a 1 asserts Jog Minus. Writing a 0 deasserts Jog Minus.			

22	Jog Select 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
21	15	N/A	Unsigned16
Comments: Writing a 1 sets bit 0 of the Jog Speed Select, writing a 0 clears it.			

23	Jog Select 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
22	16	N/A	Unsigned16
Comments: Writing a 1 sets bit 1 of the Jog Speed Select, writing a 0 clears it.			

Registers 24-32: Reserved

Register 33: Configuration Select

33	Configuration Select		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
32	20	N/A	Unsigned16
Comments: Defines the active Configuration. 0 = Configuration 0, 1 = Configuration 1.			

Registers 34-48: Reserved

Registers 49-50: Position Limits

49	Measured Position Limits Enabled		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
48	30	N/A	Unsigned16
Comments: Enables the measured position limits.			

50	Target Position Limits Enabled		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
49	31	N/A	Unsigned16
Comments: Enables the target position limits.			

Registers 51-64: Reserved

Registers 65-80: User Bits The following registers toggle the mapped User Bit on or off by assigning a 1 or 0 to the appropriate register. Note that User Bits can be mapped to digital outputs through the configuration software.

65	User Bit 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
64	40	N/A	Unsigned16

66	User Bit 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
65	41	N/A	Unsigned16

67	User Bit 2		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
66	42	N/A	Unsigned16

68	User Bit 3		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
67	43	N/A	Unsigned16

69	User Bit 4		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
68	44	N/A	Unsigned16

70	User Bit 5		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
69	45	N/A	Unsigned16

71	User Bit 6		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
70	46	N/A	Unsigned16

72	User Bit 7		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
71	47	N/A	Unsigned16

73	User Bit 8		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
72	48	N/A	Unsigned16

74	User Bit 9		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
73	49	N/A	Unsigned16

75	User Bit 10		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
74	4A	N/A	Unsigned16

76	User Bit 11		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
75	4B	N/A	Unsigned16

77	User Bit 12		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
76	4C	N/A	Unsigned16

78	User Bit 13		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
77	4D	N/A	Unsigned16

79	User Bit 14		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
78	4E	N/A	Unsigned16

80	User Bit 15		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
79	4F	N/A	Unsigned16

Registers 81-96: Reserved

2.2.2 Meta Coils

Meta coils that start sequences require their parameter to be set ON (if it is OFF then the command will be ignored). These Meta coils will read back OFF. Read input registers to see which coil is active.

Registers 4001-4024: Motion Engine Control

4001	Initiate Index/Sequence 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4000	FA0	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4002	Initiate Index/Sequence 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4001	FA1	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4003	Initiate Index/Sequence 2		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4002	FA2	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4004	Initiate Index/Sequence 3		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4003	FA3	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4005	Initiate Index/Sequence 4		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4004	FA4	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4006	Initiate Index/Sequence 5		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4005	FA5	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4007	Initiate Index/Sequence 6		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4006	FA6	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4008	Initiate Index/Sequence 7		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4007	FA7	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4009	Initiate Index/Sequence 8		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4008	FA8	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4010	Initiate Index/Sequence 9		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4009	FA9	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4011	Initiate Index/Sequence 10		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4010	FAA	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4012	Initiate Index/Sequence 11		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4011	FAB	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4013	Initiate Index/Sequence 12		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4012	FAC	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4014	Initiate Index/Sequence 13		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4013	FAD	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4015	Initiate Index/Sequence 14		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4014	FAE	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4016	Initiate Index/Sequence 15		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4015	FAF	N/A	Unsigned16
Comments: Runs the selected Index or Sequence (depends on if drive is in Indexing or Sequencing Mode).			

4017	Abort Active Motion		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4016	FB0	N/A	Unsigned16
Comments:			
No fault, Motion Engine will return to ready for motion start.			

4018	Reserved		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4017	-	N/A	-

4019	Initiate Selected Motion		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4018	FB2	N/A	Unsigned16
Comments:			
When the communication channel is the Motion Select Source, this value will be the motion that is initiated. Otherwise it will be ignored.			

4020	Initiate Dynamic Index		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4019	FB3	N/A	Unsigned16
Comments:			
Initiates a Dynamic Index move.			

4021	Motion Select Source: Hardware		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4020	FB4	N/A	Unsigned16
Comments:			
Sets the Motion Select Source to hardware.			

4022	Motion Select Source: Communication Channel		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4021	FB5	N/A	Unsigned16
Comments:			
Sets the Motion Select Source to the communication channel.			

4023	Indexer Mode		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4022	FB6	N/A	Unsigned16
Comments:			
Sets the drive into Indexer mode.			

4024	Sequencer Mode		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4023	FB7	N/A	Unsigned16
Comments:			
Sets the drive into Sequencer mode.			

Register 4025-4033: Reserved

Register 4034: Drive Status History

4034	Fault Reset		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4033	FC1	N/A	Unsigned16
Comments: Resets all drive faults.			

2.2.3 Discrete Inputs

Registers 10001-10008: Drive Bridge Status

10001	Bridge Enabled		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
0	0	N/A	Unsigned16

10002	Dynamic Brake Enabled		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
1	1	N/A	Unsigned16

10003	Stop Enabled		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
2	2	N/A	Unsigned16

10004	Positive Stop Enabled		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
3	3	N/A	Unsigned16

10005	Negative Stop Enabled		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4	4	N/A	Unsigned16

10006	Positive Torque Inhibit Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
5	5	N/A	Unsigned16

10007	Negative Torque Inhibit Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
6	6	N/A	Unsigned16

10008	External Brake Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
7	7	N/A	Unsigned16

Registers 10009-10016: Reserved

Registers 10017-10023: Drive Protection Status

10017	Drive Reset		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
16	10	N/A	Unsigned16

10018	Drive Internal Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
17	11	N/A	Unsigned16

10019	Short Circuit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
18	12	N/A	Unsigned16

10020	Over Current		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
19	13	N/A	Unsigned16

10021	Under Voltage		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
20	14	N/A	Unsigned16

10022	Over Voltage		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
21	15	N/A	Unsigned16

10023	Drive Over Temperature		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
22	16	N/A	Unsigned16

Registers 10024-10032: Reserved

Registers 10033-10046: System Protection Status

10033	Parameter Restore Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
32	20	N/A	Unsigned16

10034	Parameter Store Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
33	21	N/A	Unsigned16

10035	Invalid Hall State		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
34	22	N/A	Unsigned16

10036	Phase Sync. Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
35	23	N/A	Unsigned16

10037	Motor Over Temperature		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
36	24	N/A	Unsigned16

10038	Phase Detection Fault		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
37	25	N/A	Unsigned16

10039	Feedback Sensor Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
38	26	N/A	Unsigned16

10040	Motor Over Speed		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
39	27	N/A	Unsigned16

10041	Max Measured Position		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
40	28	N/A	Unsigned16

10042	Min Measured Position		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
41	29	N/A	Unsigned16

10043	Comm. Channel Error (Node Guarding)		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
42	2A	N/A	Unsigned16

10044	PWM & Dir Broken Wire		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
43	2B	N/A	Unsigned16

10045	Motion Engine Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
44	2C	N/A	Unsigned16

10046	Motion Engine Abort		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
45	2D	N/A	Unsigned16

Registers 10047-10048: Reserved

Registers 10049-10064: Drive/System Status 1

10049	Log Entry Missed		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
48	30	N/A	Unsigned16

10050	Software Disable		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
49	31	N/A	Unsigned16

10051	User Disable		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
50	32	N/A	Unsigned16

10052	User Positive Inhibit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
51	33	N/A	Unsigned16

10053	User Negative Inhibit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
52	34	N/A	Unsigned16

10054	Current Limiting		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
53	35	N/A	Unsigned16

10055	Continuous Current		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
54	36	N/A	Unsigned16

10056	Current Loop Saturated		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
55	37	N/A	Unsigned16

10057	User Under Voltage		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
56	38		Unsigned16

10058	User Over Voltage		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
57	39	N/A	Unsigned16

10059	Non-Sinusoidal Commutation		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
58	3A	N/A	Unsigned16

10060	Phase Detect Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
59	3B	N/A	Unsigned16

10061	Motion Engine Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
60	3C	N/A	Unsigned16

10062	User Auxiliary Disable		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
61	3D	N/A	Unsigned16

10063	Shunt Regulator Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
62	3E	N/A	Unsigned16

10064	Phase Detect Done		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
63	3F	N/A	Unsigned16

Registers 10065-10080: Drive/System Status 2

10065	Zero Velocity		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
64	40	N/A	Unsigned16

10066	At Command		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
65	41	N/A	Unsigned16

10067	Velocity Following Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
66	42	N/A	Unsigned16

10068	Positive Target Velocity Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
67	43	N/A	Unsigned16

10069	Negative Target Velocity Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
68	44	N/A	Unsigned16

10070	Command Limiter Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
69	45	N/A	Unsigned16

10071	In Home Position		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
70	46	N/A	Unsigned16

10072	Position Following Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
71	47	N/A	Unsigned16

10073	Max Target Position Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
72	48	N/A	Unsigned16

10074	Min Target Position Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
73	49	N/A	Unsigned16

10075	Set Position Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
74	4A	N/A	Unsigned16

10076	Reserved		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
75	4B	N/A	Unsigned16

10077	Homing Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
76	4C	N/A	Unsigned16

10078	Safe Torque Off Status		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
77	4D	N/A	Unsigned16

10079	Homing Complete		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
78	4E	N/A	Unsigned16

10080	Zero Position Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
79	4F	N/A	Unsigned16

Registers 10081-10086: Reserved

Registers 10087-10093: Drive/System Status 3

10087	Commanded Stop		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
86	56	N/A	Unsigned16

10088	User Stop		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
87	57	N/A	Unsigned16

10089	Capture 1 Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
88	58	N/A	Unsigned16

10090	Capture 2 Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
89	59	N/A	Unsigned16

10091	Capture 3 Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
90	5A	N/A	Unsigned16

10092	Commanded Positive Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
91	5B	N/A	Unsigned16

10093	Commanded Negative Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
92	5C	N/A	Unsigned16

Registers 10094-10096: Reserved

Registers 10097-10099: Active Configuration Status

10097	Absolute Position Valid		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
96	60	N/A	Unsigned16

10098	Positive Stop Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
97	61	N/A	Unsigned16

10099	Negative Stop Active		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
98	62	N/A	Unsigned16

Registers 10100-10112: Reserved

Registers 10113-10128: Digital Input Values

Corresponds to the state of the digital inputs (post active level). The number of inputs available will depend on the drive model.

10113	Digital Input 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
112	70	N/A	Unsigned16

10114	Digital Input 2		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
113	71	N/A	Unsigned16

10115	Digital Input 3		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
114	72	N/A	Unsigned16

10116	Digital Input 4		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
115	73	N/A	Unsigned16

10117	Digital Input 5		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
116	74	N/A	Unsigned16

10118	Digital Input 6		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
117	75	N/A	Unsigned16

10119	Digital Input 7		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
118	76	N/A	Unsigned16

10120	Digital Input 8		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
119	77	N/A	Unsigned16

10121	Digital Input 9		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
120	78	N/A	Unsigned16

10122	Digital Input 10		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
121	79	N/A	Unsigned16

10123	Digital Input 11		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
122	7A	N/A	Unsigned16

10124	Digital Input 12		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
123	7B	N/A	Unsigned16

10125	Digital Input 13		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
124	7C	N/A	Unsigned16

10126	Digital Input 14		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
125	7D	N/A	Unsigned16

10127	Digital Input 15		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
126	7E	N/A	Unsigned16

10128	Digital Input 16		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
127	7F	N/A	Unsigned16

Registers 10129-10144: Digital Output Values Corresponds to the state of the digital outputs (pre active level). The number of outputs available will depend on the drive model.

10129	Digital Output 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
128	80	N/A	Unsigned16

10130	Digital Output 2		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
129	81	N/A	Unsigned16

10131	Digital Output 3		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
130	82	N/A	Unsigned16

10132	Digital Output 4		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
131	83	N/A	Unsigned16

10133	Digital Output 5		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
132	84	N/A	Unsigned16

10134	Digital Output 6		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
133	85	N/A	Unsigned16

10135	Digital Output 7		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
134	86	N/A	Unsigned16

10136	Digital Output 8		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
135	87	N/A	Unsigned16

10137	Digital Output 9		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
136	88	N/A	Unsigned16

10138	Digital Output 10		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
137	89	N/A	Unsigned16

10139	Digital Output 11		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
138	8A	N/A	Unsigned16

10140	Digital Output 12		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
139	8B	N/A	Unsigned16

10141	Digital Output 13		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
140	8C	N/A	Unsigned16

10142	Digital Output 14		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
141	8D	N/A	Unsigned16

10143	Digital Output 15		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
142	8E	N/A	Unsigned16

10144	Digital Output 16		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
143	8F	N/A	Unsigned16

Registers 10145-10192: Reserved

Register 10193: Active Configuration

10193	Active Configuration		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
192	C0	N/A	Unsigned16
Comments: Defines the active Configuration. 0 = Configuration 0, 1 = Configuration 1.			

Registers 10194-10224: Reserved

Registers 10225-10227: Active Mode Enum

10225	Homing Mode		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
224	E0	N/A	Unsigned16

10226	Jog Mode		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
225	E1	N/A	Unsigned16

10227	Motion Engine Mode		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
226	E2	N/A	Unsigned16

2.2.4 Input Registers (16 bit)

Registers 30001-30002: Active Mode/Configuration Status

30001	Active Mode Status		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
0	0	N/A	Unsigned16

Comments:

Defines the active Mode. The bit values are broken up as defined below.

Bits 0:15

0: Standby Mode

1: Homing Mode

2: Jog Mode

3: Motion Engine Mode

30002	Active Configuration Status		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
1	1	N/A	Unsigned16

Comments:

Defines the active Configuration. The bit values are broken up as defined below.

Bits 0:15

0: Gain Set 0

1: Gain Set 1

2: Command Limiter Set 0

3: Command Limiter Set 1

4: Source Modifier Set 0

5: Source Modifier Set 1

Registers 30003-30005: Motion Engine Status

30003	Active Sequence		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
2	2	N/A	Unsigned16

Comments:

Displays the active Sequence (0 to 15) when using Motion Engine Sequencing.

Bits 0:7

0: Bit 0 of active Sequence #

1: Bit 1 of active Sequence #

...

7: Bit 7 of active Sequence #

30004	Reserved		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
3	3	N/A	-

30005	Motion Engine Status		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
4	4	N/A	Unsigned16

Comments:

Defines the present state of the Motion Engine.

Value	Motion Engine State
0	Inactive
1	Waiting for Motion Start (Motion Engine is enabled and ready for an index)
2	Executing Motion (Index is currently running)
3	Program Load in Progress (Motion Engine is not ready for commanded index)
4	Program Load Failure - CRC Error (Problem loading Index. Must reset Motion Engine to continue)
5	Invalid Data Parameter (Problem loading Index. Must reset Motion Engine to continue)
6	Invalid Op-Code (Problem loading Index. Must reset Motion Engine to continue)
7	Halt Asserted (Motion has been interrupted)
8	Invalid Reference Frame (Problem with index parameters)
9	Invalid Bridge State (Bridge must be enabled to begin indexed motion)
10	Invalid Op-code for Dynamic Motion (Problem with index parameters)
11	User Defined Fault
12	Single Step Complete
13	Break Point Active

Registers 30006-30012: Drive Status

30006	Drive Bridge Status		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
5	5	N/A	Unsigned16
Comments: The function of each bit is given in Table 2.2 below.			

30007	Drive Protection Status		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
6	6	N/A	Unsigned16
Comments: The function of each bit is given in Table 2.2 below.			

30008	System Protection Status		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
7	7	N/A	Unsigned16
Comments: The function of each bit is given in Table 2.2 below.			

30009	Drive/System Status 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
8	8	N/A	Unsigned16
Comments: The function of each bit is given in Table 2.2 below.			

30010	Drive/System Status 2		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
9	9	N/A	Unsigned16
Comments: The function of each bit is given in Table 2.2 below.			

30011	Drive/System Status 3		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
10	A	N/A	Unsigned16
Comments: The function of each bit is given in Table 2.2 below.			

30012	Active Configuration Status		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
11	B	N/A	Unsigned16
Comments: The function of each bit is given in Table 2.2 below.			

TABLE 2.2 Drive Status Bitfield Definitions

Bit	Drive Bridge Status	Drive Protection Status	System Protection Status	Drive System Status 1	Drive System Status 2	Drive System Status 3	Active Configuration Status
0	Bridge Enabled	Drive Reset	Parameter Restore Error	Log Entry Missed	Zero Velocity	Reserved	Absolute Position Valid
1	Dynamic Brake Enabled	Drive Internal Error	Parameter Store Error	Software Disable	At Command	Reserved	Positive Stop Active
2	Stop Enabled	Short Circuit	Invalid Hall State	User Disable	Velocity Following Error	Reserved	Negative Stop Active
3	Positive Stop Enabled	Current Overshoot	Phase Sync. Error	User Positive Inhibit	Positive Target Velocity Limit	Reserved	Reserved
4	Negative Stop Enabled	Drive Under Voltage	Motor Over Temperature	User Negative Inhibit	Negative Target Velocity Limit	Reserved	Reserved
5	Positive Torque Inhibit Active	Drive Over Voltage	Phase Detection Fault	Current Limiting	Command Limiter Active	Reserved	Reserved
6	Negative Torque Inhibit Active	Drive Over Temperature	Feedback Sensor Error	Continuous Current Foldback	In Home Position	Commanded Stop	Reserved
7	External Brake Active	Reserved	Motor Over Speed	Current Loop Saturated	Position Following Error	User Stop	Reserved
8	Reserved	Reserved	Max Measured Position	User Under Voltage	Max Target Position Limit	Capture 1 Active	Reserved
9	Reserved	Reserved	Min Measured Position	User Over Voltage	Min Target Position Limit	Capture 2 Active	Reserved
10	Reserved	Reserved	Comm. Error (Node Guarding)	Non-Sinusoidal Commutation	Set Position Active	Capture 3 Active	Reserved
11	Reserved	Reserved	PWM & Dir Broken Wire	Phase Detect Active	Reserved	Commanded Positive Limit	Reserved
12	Reserved	Reserved	Motion Engine Error	Motion Engine Active	Homing Active	Commanded Negative Limit	Reserved
13	Reserved	Reserved	Motion Engine Abort	User Auxiliary Disable	Safe Torque Off Status	Reserved	Reserved
14	Reserved	Reserved	Reserved	Shunt Regulator Active	Homing Complete	Reserved	Reserved
15	Reserved	Reserved	Reserved	Phase Detect Done	Zero Position Error	Reserved	Reserved

Register 30013: Power Bridge Value

30013	DC Bus Voltage		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
12	C	DV1	Integer16
Comments: Contains a value corresponding to the DC Bus Voltage. See "Appendix A" for unit conversions.			

Registers 30014-30015: Current Values

30014	Current Demand - Torque		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
13	D	DC1	Integer16
Comments: Contains the value of the demand current (torque-producing). See "Appendix A" for unit conversions.			

30015	Current Measured - Torque		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
14	E	DC1	Integer16
Comments: Contains the value of the measured current (torque-producing). See "Appendix A" for unit conversions.			

Registers 30016-30019: Analog Input Values

30016	Analog Input 1 Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
15	F	DAI	Integer16
Comments: Contains a value corresponding to the voltage present on Analog Input 1. See "Appendix A" for unit conversion.			

30017	Analog Input 2 Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
16	10	DAI	Integer16
Comments: Contains a value corresponding to the voltage present on Analog Input 2. See "Appendix A" for unit conversion.			

30018	Analog Input 3 Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
17	11	DAI	Integer16
Comments: Contains a value corresponding to the voltage present on Analog Input 3. See "Appendix A" for unit conversion.			

30019	Analog Input 4 Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
18	12	DAI	Integer16
Comments: Contains a value corresponding to the voltage present on Analog Input 4. See "Appendix A" for unit conversion.			

Registers 30020-30021: Analog Output Values

30020	Analog Output 1 Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
19	13	DAO	Integer16
Comments: Contains a value corresponding to the value of Analog Output 1. Analog Outputs have a range of 0 to 10 volts. See "Appendix A" for unit conversion.			

30021	Analog Output 2 Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
20	14	DAO	Integer16
Comments: Contains a value corresponding to the value of Analog Output 2. Analog Outputs have a range of 0 to 10 volts. See "Appendix A" for unit conversion.			

Register 30022: Digital Input Values

30022	Digital Inputs (Post Active Level)		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
21	15	N/A	Unsigned16
Comments: Bit field corresponding to the state of the Digital Inputs. Number of actual inputs is dependent on drive model. Bit field definitions are as follows: 0: Digital Input 1 1: Digital Input 2 ... 15: Digital Input 16			

Register 30023: Digital Output Values

30023	Digital Outputs (Pre Active Level)		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
22	16	N/A	Unsigned16
Comments: Bit field corresponding to the state of the Digital Outputs. Number of actual outputs is dependent on drive model. Bit field definitions are as follows: 0: Digital Output 1 1: Digital Output 2 ... 15: Digital Output 16			

Registers 30024-30035: Reserved

Registers 30036-30037: Gearing Input Values

30036	Gear Ratio Denominator		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
35	23	counts	Unsigned16
Comments: Value corresponding to the denominator of the gear ratio input counts.			

30037	Gear Ratio Numerator		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
36	24	counts	Unsigned16
Comments: Value corresponding to the numerator of the gear ratio input counts.			

Registers 30038-30099: Reserved

2.2.5 Input Registers (32 bit)

Registers 30252-30254: Velocity Values

30252	Velocity Measured Post-Filter		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
251	FB	DS1	Integer32
Comments: Contains the measured velocity after the feedback cutoff filter. See "Appendix A" for unit conversion.			

30254	Velocity Demand		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
253	FD	DS1	Integer32
Comments: Contains the current velocity demand when the drive is in velocity mode. See "Appendix A" for unit conversion.			

30256	Velocity Loop Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
255	FF	DS1	Integer32
Comments: Contains the error between the target velocity and the measured velocity. This is equivalent to target velocity minus measured velocity. When the current commanded velocity is reached, the velocity loop error will be zero. See "Appendix A" for unit conversion.			

Registers 30258-30266: Position Values

30258	Position Measured		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
257	101	counts	Integer32
Comments: Contains the current measured position in counts.			

30260	Position Target		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
259	103	counts	Integer32
Comments: Contains the current commanded position when the drive is used in position mode.			

30262	Position Demand		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
261	105	counts	Integer32
Comments: Contains the current position demand in counts.			

30264	Position Loop Error		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
263	107	counts	Integer32
Comments: Contains the error between the target position (in counts) and the measured position (in counts). This is equivalent to target position (counts) minus measured position (counts). When the current commanded position is reached, the position loop error will be zero.			

30266	Position Index Capture Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
265	109	counts	Integer32
Comments: Contains the position of the last encoder index captured by the drive. Requires encoder with index.			

Register 30268: Feedback Sensor Value

30268	Primary Encoder Counts		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
267	10B	counts	Integer32
Comments: Contains the current number of encoder counts from the primary encoder. It is an absolute value in that it does not depend on the current load measured position or home values.			

Registers 30270-30272: Auxiliary Encoder Values

30270	Auxiliary Encoder Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
269	10D	counts	Integer32
Comments: Contains the raw number of counts seen on the auxiliary encoder input. This value resets to zero when the drive is power-cycled.			

30272	Auxiliary Position Index Capture Count		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
271	10F	counts	Integer32
Comments: Contains the position of the last auxiliary encoder index captured by the drive. Requires auxiliary encoder with index.			

Registers 30274-30278: Capture Values The capture values have units that vary with the operating mode of the drive. For these parameters, refer to Table for the correct unit selection.

TABLE 2.3 Capture Units

Drive Operation Mode	Units
Current (Torque)	DC2
Velocity	DS1
Position (Around Velocity Or Current)	counts

30274	Capture 'A' Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
273	111	See Table 2.3	Integer32
Comments: Capture A capture value. See Appendix for unit conversion.			

30276	Capture 'B' Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
275	113	See Table 2.3	Integer32
Comments: Capture B capture value. See Appendix for unit conversion.			

30278	Capture 'C' Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
277	115	See Table 2.3	Integer32
Comments: Capture C capture value. See Appendix for unit conversion.			

2.2.6 Holding Registers (16 bit)

Register 40001: User Bit Control

40001	User Bit Control		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
0	0	N/A	Unsigned16

Comments:

Toggles the User Bits on or off by assigning a 1 or 0 to the appropriate bit. See below for bit assignment. Note that User Bits can be mapped to digital outputs through the configuration software.

0: User Bit 0

1: User Bit 1

...

15: User bit 15

Registers 40002-40009: Reserved

Registers 40010-40011: User Voltage Protection Parameters

40010	Over Voltage Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
9	9	DV1	Integer16

Comments:

Contains the over voltage limit specified for the drive. Must be set lower than the drive over voltage hardware shutdown point and greater than the Nominal DC Bus Voltage. See "Appendix A" for unit conversion.

40011	Under Voltage Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
10	A	DV1	Integer16

Comments:

Contains the under voltage limit specified for the drive. Must be set above the drive under voltage hardware shutdown point and less than the Nominal DC Bus Voltage. See "Appendix A" for unit conversion.

Registers 40012-40015: Auxiliary Input Parameters

40012	Auxiliary Input - Input Counts: Config 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
11	B	N/A	Unsigned16

Comments:

Contains a value corresponding to the number of input counts in the input/output ratio used for Encoder Following and Step and Direction modes in Configuration 0.

40013	Auxiliary Input - Output Counts: Config 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
12	C	N/A	Integer16

Comments:

Contains a value corresponding to the output in the input/output ratio used for Encoder Following and Step and Direction modes in Configuration 0. Encoder Following can be used only when the Position Loop is closed. However, Step and Direction can be used to control position, velocity, or current. Therefore, the scaling value used is mode dependent.

40014	Auxiliary Input - Input Counts: Config 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
13	D	N/A	Unsigned16

Comments:

Contains a value corresponding to the number of input counts in the input/output ratio used for Encoder Following and Step and Direction modes in Configuration 1.

40015	Auxiliary Input - Output Counts: Config 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
14	E	N/A	Integer16

Comments:

Contains a value corresponding to the output in the input/output ratio used for Encoder Following and Step and Direction modes in Configuration 1. Encoder Following can be used only when the Position Loop is closed. However, Step and Direction can be used to control position, velocity, or current. Therefore, the scaling value used is mode dependent.

Register 40016: Motion Engine Configuration

40016	Motion Engine Startup Motion		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
15	F	N/A	Unsigned16

Comments:

Defines the startup behavior when running a Motion Engine Index upon power-up. The bit values are broken up as defined below:

Bits 0:2

0: Indexer Mode

1-7: Reserved

Bits 3:4

0: Motion initiated via digital inputs

1: Motion initiated via network commands

Bits 5:8

Defines the index number to load on power-up

Bits 9:15

0: Motion will not immediately start

1: Motion will automatically start if the Motion Engine is configured to be enabled on power-up

2-7: Reserved

Register 40017: Reserved

Register 40018: Stored Motion Select

40018	Stored Motion Select		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
17	11	N/A	-
Comments:			
Modbus internal register used by coil 40019.			

Registers 40019-40046: Dynamic Index Data

40019	Move Index		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
18	12	N/A	Unsigned16
Comments:			
When defining a Dynamic Index, this value should be set to 0x0020.			

40020	Move Type		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
19	13	N/A	Unsigned16
Comments:			
Defines the type of move. 0x0008: Absolute 0x0018: Relative			

40021	Repeat Count		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
20	14	N/A	Unsigned16
Comments:			
Specifies the number of times to repeat the move. Only valid for relative moves.			

40022	Dwell Time		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
21	15	milliseconds (ms)	Unsigned16
Comments:			
Specifies the time after the move is complete before the Index Done status becomes active.			

40023	Position Target - Word 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
22	16	counts	Unsigned16
Comments:			
The least significant word in the 2-word (32-bit) position command. Depending on the assigned move type, will apply to an absolute or relative position target.			

40024	Position Target - Word 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
23	17	counts	Unsigned16
Comments: The most significant word in the 2-word (32-bit) position command. Depending on the assigned move type, will apply to an absolute or relative position target.			

40025	Max Velocity - Word 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
24	18	DS3	Unsigned16
Comments: The least significant word in the 4-word (64-bit) maximum velocity value. See "Appendix A" for unit conversion.			

40026	Max Velocity - Word 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
25	19	DS3	Unsigned16
Comments: The second word in the 4-word (64-bit) maximum velocity value. See "Appendix A" for unit conversion.			

40027	Max Velocity - Word 2		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
26	1A	DS3	Unsigned16
Comments: The third word in the 4-word (64-bit) maximum velocity value. See "Appendix A" for unit conversion.			

40028	Max Velocity - Word 3		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
27	1B	DS3	Unsigned16
Comments: The most significant word in the 4-word (64-bit) maximum velocity value. See "Appendix A" for unit conversion.			

40029	Max Acceleration - Word 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
28	1C	DA5	Unsigned16
Comments: The least significant word in the 2-word (32-bit) maximum acceleration value. See "Appendix A" for unit conversion.			

40030	Max Acceleration - Word 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
29	1D	DA5	Unsigned16
Comments: The most significant word in the 2-word (32-bit) maximum acceleration value. See "Appendix A" for unit conversion.			

40031	Max Deceleration - Word 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
30	1E	DA5	Unsigned16
Comments: The least significant word in the 2-word (32-bit) maximum deceleration value. See "Appendix A" for unit conversion.			

40032	Max Deceleration - Word 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
31	1F	DA5	Unsigned16
Comments: The most significant word in the 2-word (32-bit) maximum deceleration value. See "Appendix A" for unit conversion.			

Registers 40033-40046: Reserved

Registers 40047-40048: Current Loop Control Parameters

40047	Torque Current Loop Proportional Gain		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
46	2E	N/A	Integer16
Comments: Contains the value of proportional gain for the current loop. This value is calculated from the gain value as follows: $Gain \times 2^9 = Value\ to\ the\ drive$			

40048	Torque Current Loop Integral Gain		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
47	2F	N/A	Integer16
Comments: Contains the value of integral gain for the current loop. This value is calculated from the gain value as follows: $Gain \times 2^9 = Value\ to\ the\ drive$			

Register 40049: Position Limits

40049	Position Limits Control		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
48	30	N/A	Unsigned16
Comments: Defines if the position limits are enabled or not. 3 = Enable limits, 0 = Disable Limits.			

Registers 40050-40099: Reserved

2.2.7 Holding Registers (32 bit)

Registers 40252-40262: Velocity Loop Control Parameters

40252	Velocity Loop Proportional Gain: Set 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
251	FB	N/A	Integer32

Comments:

Contains a value that corresponds to the proportional loop gain of the velocity loop for Gain Set 0. This value can be calculated from the gain value as follows:

(Velocity Loop Proportional Gain) x $((2^{16} * V_{vel} * R_{ppv}) / (2 * C_{pk}))$, where:

(0 ≤ Velocity Proportional Gain ≤ 98.3)

V_{vel} = (Switching Frequency / 2)

R_{ppv} = Interpolation Value

C_{pk} = Peak Current

40254	Velocity Loop Integral Gain: Set 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
253	FD	N/A	Integer32

Comments:

Contains a value that corresponds to the integral loop gain of the velocity loop for Gain Set 0. This value can be calculated from the gain value as follows:

(Velocity Loop Integral Gain) x $(2^{32} * R_{ppv}) / (2 * C_{pk})$, where

(1 ≤ Velocity Loop Integral Gain ≤ 15)

R_{ppv} = Interpolation Value

C_{pk} = Peak Current

40256	Velocity Loop Derivative Gain: Set 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
255	FF	N/A	Integer32

Comments:

Contains a value that corresponds to the derivative loop gain of the velocity loop for Gain Set 0. This value can be calculated from the gain value as follows:

(Velocity Loop Derivative Gain) x $((2^{16} * (V_{vel})^2 * R_{ppv}) / (2 * C_{pk}))$, where

(1 ≤ Velocity Loop Derivative Gain ≤ $6 * 10^{-7}$)

V_{vel} = (Switching Frequency / 2)

R_{ppv} = Interpolation Value

C_{pk} = Peak Current

40258	Velocity Loop Acceleration Feed Forward Gain: Set 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
257	101	N/A	Integer32

Comments:

Contains a value that corresponds to the velocity loop acceleration feed forward gain for Gain Set 0.

(Velocity Loop Acceleration Feed Forward Gain) x $((2^{16} * (V_{vel})^2 * R_{ppv}) / (2 * C_{pk}))$, where

$(1 \leq$ Velocity Loop Derivative Gain $\leq 6 * 10^{-7})$

V_{vel} = (Switching Frequency / 2)

R_{ppv} = Interpolation Value

C_{pk} = Peak Current

40260	Velocity Loop Proportional Gain: Set 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
259	103	N/A	Integer32

Comments:

Contains a value that corresponds to the proportional loop gain of the velocity loop for Gain Set 1. This value can be calculated from the gain value as follows:

(Velocity Loop Proportional Gain) x $((2^{16} * V_{vel} * R_{ppv}) / (2 * C_{pk}))$, where:

$(0 \leq$ Velocity Proportional Gain $\leq 98.3)$

V_{vel} = (Switching Frequency / 2)

R_{ppv} = Interpolation Value

C_{pk} = Peak Current

40262	Velocity Loop Integral Gain: Set 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
261	105	N/A	Integer32

Comments:

Contains a value that corresponds to the integral loop gain of the velocity loop for Gain Set 1. This value can be calculated from the gain value as follows:

(Velocity Loop Integral Gain) x $(2^{32} * R_{ppv}) / (2 * C_{pk})$, where

$(1 \leq$ Velocity Loop Integral Gain $\leq 15)$

R_{ppv} = Interpolation Value

C_{pk} = Peak Current

Registers 40264-40266: Velocity Limits

40264	Motor Over Speed Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
263	107	DS1	Integer32
Comments: Contains a value corresponding to the motor over speed limit set in the drive. When the velocity of the motor meets or exceeds this value, the drive will indicate a motor over speed condition is present. See "Appendix A" for unit conversion.			

40266	Zero Speed Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
265	109	DS1	Integer32
Comments: Contains a value corresponding to the motor zero speed limit set in the drive. When the velocity of the motor reaches this value or LOWER, the drive will indicate that is has reached a zero speed condition. See "Appendix A" for unit conversion.			

Registers 40268-40286: Position Loop Control Parameters

40268	Position Loop Proportional Gain: Set 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
267	10B	N/A	Integer32

Comments:

Contains a value corresponding to the position loop proportional gain for Gain Set 0. This value can be calculated from the gain value using the following formula:

(Position Loop Proportional Gain) x 2^{32}, where

($0 \leq$ Gain ≤ 0.5)

40270	Position Loop Integral Gain: Set 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
269	10D	N/A	Integer32

Comments:

Contains a value corresponding to the position loop integral gain for Gain Set 0. This value can be calculated from the gain value using the following formula:

(Position Loop Integral Gain) x (2^{41} / V_{pos}), where

($0 \leq$ Gain ≤ 9.766)

V_{pos} = (Switching Frequency / 2)

40272	Position Loop Derivative Gain: Set 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
271	10F	N/A	Integer32

Comments:

Contains a value corresponding to the position loop derivative gain for Gain Set 0. This value can be calculated from the gain value using the following formula:

(Position Loop Derivative Gain) x $(2^{28} * V_{pos})$, where

$(0 \leq Gain \leq 0.0008)$

V_{pos} = (Switching Frequency / 2)

40274	Position Loop Velocity Feed Forward Gain: Set 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
273	111	N/A	Integer32

Comments:

Contains a value corresponding to the position loop velocity feed forward gain for Gain Set 0. This value can be calculated from the gain value using the following formula:

(Position Loop Velocity Feed Forward Gain) x $(2^{28} * V_{pos})$, where

$(0 \leq Gain \leq 0.0008)$

V_{pos} = (Switching Frequency / 2)

40276	Position Loop Acceleration Feed Forward Gain: Set 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
275	113	N/A	Integer32

Comments:

Contains a value corresponding to the position loop acceleration feed forward gain for Gain Set 0. This value can be calculated from the gain value using the following formula:

(Position Loop acceleration Feed Forward Gain) x $(2^{28} * (V_{pos})^2)$, where

$(0 \leq Gain \leq 8 \times 10^{-8})$

V_{pos} = (Switching Frequency / 2)

40278	Position Loop Proportional Gain: Set 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
277	115	N/A	Integer32

Comments:

Contains a value corresponding to the position loop proportional gain for Gain Set 1. This value can be calculated from the gain value using the following formula:

(Position Loop Proportional Gain) x 2^{32}, where

$(0 \leq Gain \leq 0.5)$

40280	Position Loop Integral Gain: Set 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
279	117	N/A	Integer32

Comments:

Contains a value corresponding to the position loop integral gain for Gain Set 1. This value can be calculated from the gain value using the following formula:

(Position Loop Integral Gain) x (2^{41} / V_{pos}), where

($0 \leq$ Gain ≤ 9.766)

V_{pos} = (Switching Frequency / 2)

40282	Position Loop Derivative Gain: Set 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
281	119	N/A	Integer32

Comments:

Contains a value corresponding to the position loop derivative gain for Gain Set 1. This value can be calculated from the gain value using the following formula:

(Position Loop Derivative Gain) x ($2^{28} * V_{pos}$), where

($0 \leq$ Gain ≤ 0.0008)

V_{pos} = (Switching Frequency / 2)

40284	Position Loop Velocity Feed Forward Gain: Set 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
283	11B	N/A	Integer32

Comments:

Contains a value corresponding to the position loop velocity feed forward gain for Gain Set 1. This value can be calculated from the gain value using the following formula:

(Position Loop Velocity Feed Forward Gain) x ($2^{28} * V_{pos}$), where

($0 \leq$ Gain ≤ 0.0008)

V_{pos} = (Switching Frequency / 2)

40286	Position Loop Acceleration Feed Forward Gain: Set 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
285	11D	N/A	Integer32

Comments:

Contains a value corresponding to the position loop acceleration feed forward gain for Gain Set 1. This value can be calculated from the gain value using the following formula:

(Position Loop acceleration Feed Forward Gain) x ($2^{28} * (V_{pos})^2$), where

($0 \leq$ Gain $\leq 8 \times 10^{-8}$)

V_{pos} = (Switching Frequency / 2)

Registers 40288-40308: Position Limits

40288	Measured Position Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
287	11F	counts	Integer32
Comments: Replacement value for the measured position when the Set Position event is triggered. This allows you to redefine the current measured position (e.g. reset to zero).			

40290	Home Position Value		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
289	121	counts	Integer32
Comments: Position value of the home position. When the measured position reaches this position, within the In-Home Position Window, the At-Home event becomes active.			

40292	Max Measured Position Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
291	123	counts	Integer32
Comments: Maximum allowed measured position. The Max Measured Position event will become active if the measured position exceeds this value.			

40294	Min Measured Position Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
293	125	counts	Integer32
Comments: Minimum allowed measured position. The Min Measured Position event will become active if the measured position exceeds this value.			

40296	At Home Position Window		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
295	127	counts	Integer32
Comments: Defines a window around the Home Position Value, such that when the measured position is within this window, the At-Home event will be active.			

40298	In Position Window		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
297	129	counts	Integer32
Comments: Defines a window around the target position, such that when the measured position is within this window, the At Command event will be active.			

40300	Position Following Error Window		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
299	12B	counts	Integer32
Comments: The maximum allowed position error (difference between target position and measured position), prior to setting the “Position Following Error” event (active in position mode only).			

40302	Max Target Position Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
301	12D	counts	Integer32
Comments: Maximum allowed target position. The Max Target Position event will become active if the target position exceeds this value.			

40304	Min Target Position Limit		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
303	12F	counts	Integer32
Comments: Minimum allowed target position. The Min Target Position event will become active if the target position exceeds this value.			

40306	Reserved		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
305	-	-	-

40308	Position Loop Integrator Decay Active Window		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
307	133	counts	Integer32
Comments: Contains a value that corresponds to the position loop integrator decay active window.			

Registers 40310-40320: Jog Parameters

40310	Maximum Jog Acceleration		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
309	135	DA4	Integer32
Comments: Sets the maximum acceleration for the selected Jog. See "Appendix A" for unit conversion.			

40312	Maximum Jog Deceleration		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
311	137	DA4	Integer32
Comments: Sets the maximum deceleration for the selected Jog. See "Appendix A" for unit conversion.			

40314	Jog Speed 0		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
313	139	DS1	Integer32
Comments: Sets the target speed for Jog 0. See "Appendix A" for unit conversion.			

40316	Jog Speed 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
315	13B	DS1	Integer32
Comments: Sets the target speed for Jog 1. See "Appendix A" for unit conversion.			

40318	Jog Speed 2		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
317	13D	DS1	Integer32
Comments: Sets the target speed for Jog 2. See "Appendix A" for unit conversion.			

40320	Jog Speed 3		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
319	13F	DS1	Integer32
Comments: Sets the target speed for Jog 3. See "Appendix A" for unit conversion.			

Register 40322: Interface Inputs The units for interface inputs are dependent upon the function the interface input is assigned to as given in Table 2.4. See "Appendix A" for details on unit conversion.

TABLE 2.4 Interface Input Units

Interface Input Function	Units
Position Command Source	counts
Velocity Command Source	DS1
Torque/Current Command Source	DC2
Position Feedback Source	counts
Velocity Feedback Source	DS1
Motor Temperature Source	DT1

40322	Interface Input 1		
Modbus Address	**Address (hex)**	**Units**	**Data Type**
321	141	See Table 2.4	Integer32
Comments: Defines the value used with Interface Input 1.			

Appendix A

A.1 Drive Units

Table A.1 below shows scaling factors and formulas for converting physical units to drive units.

TABLE A.1 Drive Units and Scaling Factors

Abbreviation	Drive Unit Type	Physical Units	Data Type	Scaling Factor
DA1	Acceleration	counts/s^2	Integer32/Unsigned32	$2^{34}/K_S^2$
DA2	Acceleration	counts/s^2	Unsigned48	$2^{34}/K_I K_S^2$
DA3	Acceleration	counts/s^2	Integer32	$2^{28}/(K_{MS}\ K_S)$
DA4	Acceleration	counts/s^2	Integer32	$2^{(18)}/(K_S^2)$
DA5	Acceleration	counts/s^2	Unsigned48	$2^{28}/K_{DS}\ K_S$
DC1	Current	A	Integer16	$2^{13}/K_P$
DC2	Current	A	Integer32	$2^{15}/K_P$
DJ1	Jerk	A/s	Unsigned48	$2^{32}/(\ K_P\ K_S)$
DG1	Angle	degrees	Integer16/Unsigned16	$2^{16}/360$
DS1	Speed/Velocity	counts/s	Integer32	$2^{17}/K_I K_S$
DS2	Speed/Velocity	counts/s	Unsigned48	$2^{17}/K_S$
DS3	Speed/Velocity	counts/s	Integer64	$2^{33}/K_S$
DS4	Speed/Velocity	counts/s	Unsigned32	$2^{17}/K_S$
DV1	Voltage	V	Integer16	$2^{14}/(1.05\ K_{OV})$
DPV	Phase Voltage	V	Integer16	$2^{14}/K_B$
DAI	Analog Input Voltage	V	Integer16	$2^{14}/20$
DAO	Analog Output Voltage	V	Integer16	$2^{14}/10$
DT1	Temperature	°C	Integer32	2^{16}
PBC	Power Board Current	A	Unsigned16	10
PBV	Power Board Voltage	V	Unsigned16	10
PBT	Power Board Time	s	Unsigned16	100
PBF	Power Board Frequency	Hz	Unsigned32	65.536
SF1	Scale Factor 1	-	-	2^{14}

1.Multiply physical units by the scaling factor to obtain drive units. Divide drive units by the scaling factor to obtain physical units.

The drive units used for a parameter depend upon the parameter type and size. Drive units must be rounded to the nearest integer and then converted to a hexadecimal base of the appropriate data type before they are written to the drive. When converting to a signed integer data type, use two's complement for representation of negative numbers (see Conversion Example 2). Some scaling factors involve drive dependent constants. These constants are given in Table A.2, along with details on determining their values.

TABLE A.2 Drive Dependent Conversion Constants

Constant	Value
K_B	DC Bus Voltage in volts. This value can be read from Register 30013.
K_{DS}	Maximum dynamic index speed (in counts/s). This value can be read from Registers 40025-40028.
K_I	Feedback interpolation value. Only applies to drives that support 1 V_{pp} Sin/Cos feedback. For all other drives, K_I = 1.
K_{OV}	The hardware defined, DC bus, over-voltage limit of the drive in volts.
K_P	The maximum rated peak current of the drive in amps. For example, 20 for the DPRALTE-**020**B080.
K_S	Switching frequency of the drive in Hz. This value can be found on the drive datasheet.

A.1.1 Conversion Example 1

Drive: DPRALTE-020B080
Feedback: 1000 Line Incremental Encoder

To specify a Motor Over Speed Limit (Regiser 40264) of 10,000 RPM, first convert to the appropriate physical unit as shown below, keeping in mind that counts have a quadrature resolution (4X) over lines.

$$10{,}000\frac{\text{rev}}{\text{min}}\times\frac{1000\,\text{lines}}{1\,\text{rev}}\times\frac{4\,\text{counts}}{1\,\text{line}}\times\frac{1\,\text{min}}{60\,\text{sec}}=666{,}666.7\frac{\text{counts}}{\text{sec}}.$$

Motor Over Speed is of data type Integer32 and uses DS1 drive units. Taking the appropriate 32-bit scaling factor from Table A.1 yields

$$666{,}666.7\times\frac{2^{17}}{K_I K_S}=666{,}666.7\times\frac{2^{17}}{1\times 20{,}000}=4369066.9,$$

where K_I = 1 because we are not dealing with 1 V_{PP} Sin/Cos feedback. Rounding this to the nearest integer and converting to a hexadecimal base then results in

$$4369067_{10}=42\text{AAAB}_{16}.$$

Now, to apply the setting, a value of 42AAABh would be written to Register 40264.

A.1.2 Conversion Example 2

To set a temperature parameter to 23°F first convert to the appropriate physical unit as shown below.

$$\frac{5}{9}(23-32)=-5\ ^{\circ}\text{C}.$$

Referring to Table A.1, the appropriate scaling factor yields

$$-5\times 2^{16}=-327680.$$

Because the resulting integer value is negative, two's complement notation will be used to represent its hexadecimal equivalent. To obtain the two's complement, the positive version of the desired number should be subtracted from 2^N, where N is the number of bits in the data type. Temperature parameters use the data type Integer32 so the calculation is as follows.

$$2^N-327680=2^{32}-327680=4294639616$$

$$4294639616_{10}=\text{FFFB0000}_{16}$$

The final step would be to write a value of FFFB0000h to the appropriate parameter.

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***ADVANCED* Motion Controls® Modbus Communication**
Reference Manual
MNCMMBRF-02

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