GE Consumer & Industrial
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MM200
Motor Management System
COMMUNICATIONS GUIDE

MM200 revision: 1.0x
Manual P/N: 1601-9033-A1
GE publication code: GEK-113402

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QMI # 005094

GE Multilin MM200 Motor Management System Communications Guide for revision 1.0x.

Part number: 1601-9033-A1 (December 2007)

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Communications Guide

Communications interfaces

The MM200 has two communications interfaces:

- RS485
- Fieldbus

NOTE

Setpoint changes related to RS485, DeviceNet, and Profibus, require a power cycle to be activated.

NOTE

External power must be present on the Fieldbus port at power-up, in order to correctly initialize.

RS485 interface (Modbus RTU)

The RS485 interface is a serial two-wire port intended for use as a Modbus RTU slave. The RS485 port has the following characteristics.

- Address: 1 to 254
- Baud rate: 9600 to 115200 bps
- Supported Modbus function codes: 3, 4, 5, 6, 7, 8, 16

Modbus Protocol

The MM200 implements a subset of the Modicon Modbus RTU serial communication standard. The Modbus protocol is hardware-independent. That is, the physical layer can be any of a variety of standard hardware configurations. This includes RS232, RS422, RS485, fibre optics, etc. Modbus is a single master / multiple slave type of protocol suitable for a multi-drop configuration as provided by RS485 hardware. The MM200 Modbus implementation employs two-wire RS485 hardware. Using RS485, up to 32 MM200s can be daisy-chained together on a single communication channel.

The MM200 is always a Modbus slave. It can not be programmed as a Modbus master. Computers or PLCs are commonly programmed as masters.

Both monitoring and control are possible using read and write register commands. Other commands are supported to provide additional functions.

Electrical Interface

The hardware or electrical interface in the MM200 is two-wire RS485. In a two-wire link, data is transmitted and received over the same two wires. Although RS485 two wire communication is bi-directional, the data is never transmitted and received at the same time. This means that the data flow is half duplex.

RS485 lines should be connected in a daisy chain configuration with terminating networks installed at each end of the link (i.e. at the master end and at the slave farthest from the master). The terminating network should consist of a 120 W resistor in series with a 1 nF ceramic capacitor when used with Belden 9841 RS485 wire. Shielded wire should always be used to minimize noise. The shield should be connected to all of the MM200s as well as the master, then grounded at one location only. This keeps the ground potential at the same level for all of the devices on the serial link.

Polarity is important in RS485 communications. The '+' (positive) terminals of every device must be connected together.

Data Frame Format and Data Rate

One data frame of an asynchronous transmission to or from a MM200 typically consists of 1 start bit, 8 data bits, and 1 stop bit. This produces a 10 bit data frame. This is important for transmission through modems at high bit rates (11 bit data frames are not supported by Hayes modems at bit rates of greater than 300 bps).

Modbus protocol can be implemented at any standard communication speed. The MM200 supports operation at 9600, 19200, 38400, 57600, and 115200 baud.

Data Packet Format

A complete request/response sequence consists of the following bytes (transmitted as separate data frames):

Master Request Transmission:

SLAVE ADDRESS: 1 byte
FUNCTION CODE: 1 byte
DATA: variable number of bytes depending on FUNCTION CODE

CRC: 2 bytes

Slave Response Transmission:

SLAVE ADDRESS: 1 byte
FUNCTION CODE: 1 byte
DATA: variable number of bytes depending on FUNCTION CODE
CRC: 2 bytes

SLAVE ADDRESS: This is the first byte of every transmission. This byte represents the user-assigned address of the slave device that is to receive the message sent by the master. Each slave device must be assigned a unique address and only the addressed slave will respond to a transmission that starts with its address. In a master request transmission the SLAVE ADDRESS represents the address of the slave to which the request is being sent. In a slave response transmission the SLAVE ADDRESS represents the address of the slave that is sending the response.

FUNCTION CODE: This is the second byte of every transmission. Modbus defines function codes of 1 to 127.

DATA: This will be a variable number of bytes depending on the FUNCTION CODE. This may be Actual Values, Setpoints, or addresses sent by the master to the slave or by the slave to the master.

CRC: This is a two byte error checking code.

Error Checking

The RTU version of Modbus includes a two byte CRC-16 (16 bit cyclic redundancy check) with every transmission. The CRC-16 algorithm essentially treats the entire data stream (data bits only; start, stop and parity ignored) as one continuous binary number. This number is first shifted left 16 bits and then divided by a characteristic polynomial (1100000000000101B). The 16 bit remainder of the division is appended to the end of the transmission, MSByte first. The resulting message including CRC, when divided by the same polynomial at the receiver will give a zero remainder if no transmission errors have occurred.

If a MM200 Modbus slave device receives a transmission in which an error is indicated by the CRC-16 calculation, the slave device will not respond to the transmission. A CRC-16 error indicates than one or more bytes of the transmission were received incorrectly and thus the entire transmission should be ignored in order to avoid the MM200 performing any incorrect operation.

The CRC-16 calculation is an industry standard method used for error detection. An algorithm is included here to assist programmers in situations where no standard CRC-16 calculation routines are available.

CRC-16 Algorithm

Once the following algorithm is complete, the working register "A" will contain the CRC value to be transmitted. Note that this algorithm requires the characteristic polynomial to be reverse bit ordered. The MSBit of the characteristic polynomial is dropped since it does not affect the value of the remainder. The following symbols are used in the algorithm:

—>: data transfer

A: 16 bit working register

AL: low order byte of A

AH: high order byte of A

CRC: 16 bit CRC-16 value

i, j: loop counters

(+): logical exclusive or operator

Di: i-th data byte (i = 0 to N-1)

G: 16 bit characteristic polynomial = 1010000000000001 with MSbit dropped and bit order reversed

shr(x): shift right (the LSbit of the low order byte of x shifts into a carry flag, a '0' is shifted into the MSbit of the high order byte of x, all other bits shift right one location

The algorithm is:

```
1. FFFF hex -> A
2. 0 -> i
3. 0 -> j
4. Di (+) AL -> AL
5. j+1 -> j
6. shr(A)
7. is there a carry? No: go to 8. Yes: G (+) A -> A
8. is j = 8? No: go to 5. Yes: go to 9.
9. i+1 -> i
10. is i = N? No: go to 3. Yes: go to 11.
11. A -> CRC
```

Timing

Data packet synchronization is maintained by timing constraints. The receiving device must measure the time between the reception of characters. If 3.5 character times elapse without a new character or completion of the packet, then the communication link must be reset (i.e. all slaves start listening for a new transmission from the master). Thus at 9600 baud a delay of greater than 3.5 x 1 / 9600 x 10 x = x 3.65 x ms will cause the communication link to be reset.

MM200 supported functions

The following functions are supported by the MM200:

- FUNCTION CODE 03 - Read Setpoints and Actual Values
- FUNCTION CODE 04 - Read Setpoints and Actual Values
- FUNCTION CODE 05 - Execute Operation
- FUNCTION CODE 06 - Store Single Setpoint
- FUNCTION CODE 07 - Read Device Status
- FUNCTION CODE 08 - Loopback Test
- FUNCTION CODE 10 - Store Multiple Setpoints

Modbus Functions

Function Code 03H

Modbus implementation: Read Holding Registers

MM200 implementation: Read Setpoints

For the MM200 implementation of Modbus, this function code can be used to read any setpoints ("holding registers"). Holding registers are 16 bit (two byte) values transmitted high order byte first. Thus all MM200 Setpoints are sent as two bytes. The maximum number of registers that can be read in one transmission is 125.

The slave response to this function code is the slave address, function code, a count of the number of data bytes to follow, the data itself and the CRC. Each data item is sent as a two byte number with the high order byte sent first.

For example, consider a request for slave 17 to respond with 3 registers starting at address 006B. For this example the register data in these addresses is as follows:

Address	Data
006B	022B
006C	0000
006D	0064

The master/slave packets have the following format:

Table 1: MASTER/SLAVE PACKET FORMAT FOR FUNCTION CODE 03H

MASTER TRANSMISSION	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message for slave 17
FUNCTION CODE	1	03	read registers
DATA STARTING ADDRESS	2	00 6B	data starting at 006B
NUMBER OF SETPOINTS	2	00 03	3 registers = 6 bytes total
CRC	2	76 87	CRC error code

SLAVE RESPONSE	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message from slave 17
FUNCTION CODE	1	03	read registers
BYTE COUNT	1	06	3 registers = 6 bytes
DATA 1 (see definition above)	2	02 2B	value in address 006B
DATA 2 (see definition above)	2	00 00	value in address 006C
DATA 3 (see definition above)	2	00 64	value in address 006D
CRC	2	54 83	CRC error code

Function Code 04H

Modbus Implementation: Read Input Registers

MM200 implementation: Read Actual Values

For the MM200 implementation of Modbus, this function code can be used to read any actual values ("input registers"). Input registers are 16 bit (two byte) values transmitted high order byte first. Thus all MM200 Actual Values are sent as two bytes. The maximum number of registers that can be read in one transmission is 125.

The slave response to this function code is the slave address, function code, a count of the data bytes to follow, the data itself and the CRC. Each data item is sent as a two byte number with the high order byte sent first.

For example, request slave 17 to respond with 1 register starting at address 0008. For this example the value in this register (0008) is 0000.

Table 2: MASTER/SLAVE PACKET FORMAT FOR FUNCTION CODE 04H

MASTER TRANSMISSION	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message for slave 17
FUNCTION CODE	1	04	read registers
DATA STARTING ADDRESS	2	00 08	data starting at 0008
NUMBER OF ACTUAL VALUES	2	00 01	1 register = 2 bytes
CRC	2	B2 98	CRC error code

SLAVE RESPONSE	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message from slave 17
FUNCTION CODE	1	04	read registers
BYTE COUNT	1	02	1 register = 2 bytes
DATA (see definition above)	2	00 00	value in address 0008
CRC	2	78 F3	CRC error code

Function Code 05H

Modbus Implementation: Force Single Coil

MM200 Implementation: Execute Operation

This function code allows the master to request a MM200 to perform specific command operations.

For example, to request slave 17 to execute operation code 1 (reset), we have the following master/slave packet format:

Table 3: MASTER/SLAVE PACKET FORMAT FOR FUNCTION CODE 05H

MASTER TRANSMISSION	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message for slave 17
FUNCTION CODE	1	05	execute operation
OPERATION CODE	2	00 01	operation code 1
CODE VALUE	2	FF 00	perform function
CRC	2	DF 6A	CRC error code

SLAVE RESPONSE	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message from slave 17
FUNCTION CODE	1	05	execute operation
OPERATION CODE	2	00 01	operation code 1
CODE VALUE	2	FF 00	perform function
CRC	2	DF 6A	CRC error code

The commands that can be performed by the MM200 using function code 05 can also be initiated by using function code 16.

Operation Code	Description
1	Reset
2	Lockout Reset
3	Stop
4	Start A
5	Start B
96	Clear Last Trip Data Prompt
99	Clear Counters
113	Reset Motor Information
114	Auto Mode
115	Manual Mode
116	Manual Inhibit
117	Manual Restore

Function Code 06H

Modbus Implementation: Preset Single Register

MM200 Implementation: Store Single Setpoint

This command allows the master to store a single setpoint into the memory of a MM200 The slave response to this function code is to echo the entire master transmission.

For example, request slave 17 to store the value 2 in setpoint address 04 5C. After the transmission in this example is complete, setpoints address 04 5C will contain the value 01F4. The master/slave packet format is shown below:

Table 4: MASTER/SLAVE PACKET FORMAT FOR FUNCTION CODE 06H

MASTER TRANSMISSION	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message for slave 17
FUNCTION CODE	1	06	store single setpoint
DATA STARTING ADDRESS	2	04 5C	setpoint address 04 5C
DATA	2	00 02	data for setpoint address 04 5C
CRC	2	CB B9	CRC error code

SLAVE RESPONSE	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message from slave 17
FUNCTION CODE	1	06	store single setpoint
DATA STARTING ADDRESS	2	04 5C	setpoint address 04 5C
DATA	2	00 02	data stored in setpoint address 04 5C
CRC	2	CB B9	CRC error code

Function Code 07H

Modbus Implementation: Read Exception Status

MM200 Implementation: Read Device Status

This is a function used to quickly read the status of a selected device. A short message length allows for rapid reading of status. The status byte returned will have individual bits set to 1 or 0 depending on the status of the slave device. For this example, consider the following MM200 general status byte:

The master/slave packets have the following format:

Table 5: Function code 7 bitmask

Bit	Function
0	Alarm
1	Trip
2	Internal fault
3	Auto
4	Contactor A
5	Contactor B
6	Contact output 3
7	Drive available (communications control)

Table 6: MASTER/SLAVE PACKET FORMAT FOR FUNCTION CODE 07H

MASTER TRANSMISSION	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message for slave 17
FUNCTION CODE	1	07	read device status
CRC	2	4C 22	CRC error code

SLAVE RESPONSE	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message from slave 17
FUNCTION CODE	1	07	read device status
DEVICE STATUS (see definition above)	1	2C	status = 00101100 (in binary)
CRC	2	22 28	CRC error code

Function Code 08H

Modbus Implementation: Loopback

Test MM200 Implementation: Loopback Test

This function is used to test the integrity of the communication link. The MM200 will echo the request.

For example, consider a loopback test from slave 17:

Table 7: MASTER/SLAVE PACKET FORMAT FOR FUNCTION CODE 08H

MASTER TRANSMISSION	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message for slave 17
FUNCTION CODE	1	08	loopback test
DIAG CODE	2	00 00	must be 00 00
DATA	2	00 00	must be 00 00
CRC	2	E0 0B	CRC error code

SLAVE RESPONSE	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message from slave 17
FUNCTION CODE	1	08	loopback test
DIAG CODE	2	00 00	must be 00 00
DATA	2	00 00	must be 00 00
CRC	2	E0 0B	CRC error code

Function Code 10H

Modbus Implementation: Preset Multiple Registers

MM200 Implementation: Store Multiple Setpoints

This function code allows multiple Setpoints to be stored into the MM200 memory. Modbus "registers" are 16-bit (two byte) values transmitted high order byte first. Thus all MM200 setpoints are sent as two bytes. The maximum number of Setpoints that can be stored in one transmission is dependent on the slave device. Modbus allows up to a maximum of 60 holding registers to be stored. The MM200 response to this function code is to echo the slave address, function code, starting address, the number of Setpoints stored, and the CRC.

For example, consider a request for slave 17 to store the value 00 02 to setpoint address 04 5C and the value 01 F4 to setpoint address 04 5D. After the transmission in this example is complete, MM200 slave 17 will have the following setpoints information stored:

Address	Data
04 5C	00 02
04 5D	01 F4

The master/slave packets have the following format:

Table 8: MASTER/SLAVE PACKET FORMAT FOR FUNCTION CODE 10H

MASTER TRANSMISSION	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message for slave 17
FUNCTION CODE	1	10	store setpoints
DATA STARTING ADDRESS	2	04 5C	setpoint address 04 5C
NUMBER OF SETPOINTS	2	00 02	2 setpoints = 4 bytes total
BYTE COUNT	1	04	4 bytes of data
DATA 1	2	00 02	data for setpoint address 04 5C
DATA 2	2	01 F4	data for setpoint address 04 5D
CRC	2	31 11	CRC error code

SLAVE RESPONSE	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message from slave 17
FUNCTION CODE	1	10	store setpoints
DATA STARTING ADDRESS	2	04 5C	setpoint address 04 5C
NUMBER OF SETPOINTS	2	00 02	2 setpoints
CRC	2	82 7A	CRC error code

Performing Commands Using Function Code 10H

Commands can be performed using function code 16 as well as function code 5. When using FUNCTION CODE 16, the Command Function register must be written with a value of 5. The Command Operation register must be written with a valid command operation number. The Command Data registers must be written with valid data; this is dependent upon the command operation.

For example, consider a request for slave 17 to perform command operation 1 (RESET): The master/slave packets have the following format:

Table 9: MASTER/SLAVE PACKET FORMAT FOR PERFORMING COMMANDS

MASTER TRANSMISSION	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message for slave 17
FUNCTION CODE	1	10	store multiple setpoints
DATA STARTING ADDRESS	2	00 80	setpoint address 00 80
NUMBER OF SETPOINTS	2	00 02	2 setpoints = 4 bytes total
BYTE COUNT	1	04	4 bytes of data
DATA 1	2	00 05	data for address 00 80
DATA 2	2	00 01	data for address 00 81
CRC	2	7E CE	CRC error code

SLAVE RESPONSE	BYTES	EXAMPLE	DESCRIPTION
SLAVE ADDRESS	1	11	message from slave 17
FUNCTION CODE	1	10	store multiple setpoints
DATA STARTING ADDRESS	2	00 80	setpoint address 00 80
NUMBER OF SETPOINTS	2	00 02	2 setpoints
CRC	2	42 B0	CRC error code

Using the User Definable Memory Map

The MM200 contains a User Definable area in the memory map. This area allows re-mapping of the addresses of any Actual Values or Setpoints registers. The User Definable area has two sections:

1. A Register Index area (memory map addresses 020BH-0287H) that contains 125 Actual Values or Setpoints register addresses.
2. A Register area (memory map addresses 020BH-0287H) that contains the data at the addresses in the Register Index.

Register data that is separated in the rest of the memory map may be re-mapped to adjacent register addresses in the User Definable Registers area. This is accomplished by writing to register addresses in the User Definable Register Index area. This allows for improved throughput of data and can eliminate the need for multiple read command sequences. The User Definable Register Index is stored as a setpoint and therefore it is "remembered" even when the power is removed.

For example, if the values of MOTOR LOAD (register address 014FH; modbus address 30336) and DRIVE STATUS (register address 0135H; modbus address 30310) are required to be read from a MM200, their addresses may be re-mapped as follows:

1. Write 30336 to address 020BH (40524) (User Definable Register Index 0000) using function code 06 or 16.

2. Write 30310 to address 020CH (40525) (User Definable Register Index 0001) using function code 06 or 16.

The MM200PC software can be used to write these locations to the User Definable Register Index using the Setpoints > Modbus Memory Map > User Map screen.

It is now possible to read these two data registers with one read, at addresses 020BH, 020CH. Address 020BH will contain MOTOR LOAD. Address 020CH will contain DRIVE STATUS.

Error Responses

When a MM200 detects an error other than a CRC error, a response will be sent to the master. The MSBit of the FUNCTION CODE byte will be set to 1 (i.e. the function code sent from the slave will be equal to the function code sent from the master plus 128). The following byte will be an exception code indicating the type of error that occurred.

Transmissions received from the master with CRC errors will be ignored by the MM200.

The slave response to an error (other than CRC error) will be:

SLAVE ADDRESS: 1 byte

FUNCTION CODE: 1 byte (with MSbit set to 1)

EXCEPTION CODE: 1 byte

CRC: 2 bytes

The MM200 implements the following exception response codes:

01 - ILLEGAL FUNCTION

The function code transmitted is not one of the functions supported by the MM200.

02 - ILLEGAL DATA ADDRESS

The address referenced in the data field transmitted by the master is not an allowable address for the MM200.

03 - ILLEGAL DATA VALUE

The value referenced in the data field transmitted by the master is not within range for the selected data address.

Modbus memory map

	Modbus	Hex	Description	Min	Max	Step	Units	Format	Default	Size in Words
ACTUAL VALUES										
PRODUCT INFORMATION										
	30001	0000	Product Device Code	---	---	---	---	F22	N/A	1
	30002	0001	Hardware Revision	---	---	---	---	F15	N/A	1
	30003	0002	Firmware Version	---	---	---	---	F3	N/A	1
	30004	0003	Reserved	---	---	---	---	---	---	1
	30005	0004	Modification Number	---	---	---	---	F1	N/A	1
	30006	0005	Boot Version	---	---	---	---	F3	N/A	1
	30007	0006	Reserved	---	---	---	---	---	---	1
	30008	0007	Serial Number	---	---	---	---	F22	N/A	6
	30014	000D	Order Code	---	---	---	---	F22	N/A	16
	30036	0023	Reserved	---	---	---	---	---	---	1

	Modbus	Hex	Description	Min	Max	Step	Units	Format	Default	Size in Words
	30037	0024	Build Date	---	---	---	---	F22	N/A	6
	30043	002A	Build Time	---	---	---	---	F22	N/A	4
	30047	002E	Original Calibration Date	---	---	---	---	F18	N/A	2
	30049	0030	Last Calibration Date	---	---	---	---	F18	N/A	2
	30051	0032	Reserved	---	---	---	---	---	---	6
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30185	00B8	Reserved							1
LAST TRIP DATA										
	30186	00B9	Cause of Last Trip	---	---	---	---	FC134	N/A	1
	30187	00BA	Reserved	---	---	---	---	---	---	2
	30189	00BC	Reserved	---	---	---	---	---	---	2
	30191	00BE	Reserved	---	---	---	---	---	---	1
	30192	00BF	Pre Trip Ia	---	---	---	A	F10	N/A	2
	30194	00C1	Pre Trip Ib	---	---	---	A	F10	N/A	2
	30196	00C3	Pre Trip Ic	---	---	---	A	F10	N/A	2
	30198	00C5	Reserved	---	---	---	---	---	---	1
	30199	00C6	Reserved	---	---	---	---	---	---	1
	30200	00C7	Reserved	---	---	---	---	---	---	1
	30201	00C8	Pre Trip Motor Load	---	---	---	%	F1	N/A	1
	30202	00C9	Pre Trip Current Unbalance	---	---	---	%	F1	N/A	1
	30203	00CA	Pre Trip Ig	---	---	---	A	F10	N/A	2
	30205	00CC	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30229	00E4	Reserved	---	---	---	---	---	---	1
TRIP COUNTERS										
	30230	00E5	Total Number of Trips	---	---	---	---	F1	N/A	1
	30231	00E6	Reserved	---	---	---	---	---	---	1
	30232	00E7	Overload Trips	---	---	---	---	F1	N/A	1
	30233	00E8	Mechanical Jam Trips	---	---	---	---	F1	N/A	1
	30234	00E9	Undercurrent Trips	---	---	---	---	F1	N/A	1
	30235	00EA	Current Unbalance Trips	---	---	---	---	F1	N/A	1
	30236	00EB	Ground Fault Trips	---	---	---	---	F1	N/A	1
	30237	00EC	Motor Acceleration Trips	---	---	---	---	F1	N/A	1
	30238	00ED	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30256	00FF	Reserved	---	---	---	---	---	---	1
GENERAL TIMERS										
	30257	0100	Number of Motor Starts	---	---	---	---	F1	N/A	1
	30258	0101	Reserved	---	---	---	---	---	---	1
	30259	0102	Motor Running Hours	---	---	---	hrs	F9	N/A	2
	30261	0104	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30269	010C	Reserved	---	---	---	---	---	---	1
START BLOCKS										
	30270	010D	Overload Lockout	---	---	---	---	F1	N/A	1
	30271	010E	Reserved	---	---	---	---	---	---	1

	Modbus	Hex	Description	Min	Max	Step	Units	Format	Default	Size in Words
	30272	010F	Reserved	---	---	---	---	---	---	1
	30273	0110	Restart Block	---	---	---	s	F1	N/A	1
	30274	0111	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30282	0119	Reserved	---	---	---	---	---	---	1
CONTACT/VIRTUAL INPUTS/OUTPUTS STATUS										
	30283	011A	Reserved	---	---	---	---	---	---	2
	30285	011C	Contact Input 7-1 (Bit Field)	---	---	---	---	FC167	N/A	2
	30287	011E	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30297	0128	Reserved	---	---	---	---	---	---	1
	30298	0129	Contact Output 3-1 (Bit Field)	---	---	---	---	FC167	N/A	2
	30300	012B	Reserved	---	---	---	---	---	---	1
	30301	012C	Reserved	---	---	---	---	---	---	1
SECURITY										
	30302	012D	Current Security Access Level	---	---	---	---	F1	N/A	1
	30303	012E	Reserved	---	---	---	---	---	---	1
	30304	012F	Reserved	---	---	---	---	---	---	1
STATUS - MOTOR										
	30305	0130	Motor Status	---	---	---	---	FC129	N/A	1
	30306	0131	Extended Status	---	---	---	---	FC178	N/A	1
	30307	0132	Thermal Cap Used	---	---	---	%	F1	N/A	1
	30308	0133	Time to Overload Trip	---	---	---	s	F20	N/A	2
	30310	0135	Drive Status	---	---	---	---	FC143	N/A	1
	30311	0136	Reserved	---	---	---	---	---	---	1
	30312	0137	Command Status	---	---	---	---	FC128	N/A	1
	30313	0138	Reserved	---	---	---	---	---	---	1
	30314	0139	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30327	0146	Reserved							1
CURRENT METERING										
	30328	0147	Ia	---	---	---	A	F10	N/A	2
	30330	0149	Ib	---	---	---	A	F10	N/A	2
	30332	014B	Ic	---	---	---	A	F10	N/A	2
	30334	014D	Iavg	---	---	---	A	F10	N/A	2
	30336	014F	Motor Load	---	---	---	%	F1	N/A	1
	30337	0150	Current Unbalance	---	---	---	%Ub	F1	N/A	1
	30338	0151	Ig	---	---	---	A	F10	N/A	2
	30340	0153	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30434	01B1	Reserved	---	---	---	---	---	---	1
TEMPERATURE METERING										
	30435	01B2	Thermistor	---	---	---	ohms	F1	N/A	1
	30436	01B3	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30466	01D1	Reserved							1

	Modbus	Hex	Description	Min	Max	Step	Units	Format	Default	Size in Words
MOTOR STARTING LEARNED DATA										
	30467	01D2	Learned Acceleration Time	---	---	---	s	F2	N/A	1
	30468	01D3	Learned Starting Current	---	---	---	A	F10	N/A	2
	30470	01D5	Learned Starting Capacity	---	---	---	%	F1	N/A	1
	30471	01D6	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30504	01F7	Reserved	---	---	---	---	---	---	1
LED STATUS FOR GRAPHICAL AND BASIC CONTROL PANEL										
	30505	01F8	LED Status	---	---	---	---	FC144	N/A	2
	30507	01FA	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30523	020A	Reserved	---	---	---	---	---	---	1
USER MAP VALUES										
	30524	020B	User Map Value 1	---	---	---	---	F1	N/A	1
	30525	020C	User Map Value 2	---	---	---	---	F1	N/A	1
	30526	020D	User Map Value 3	---	---	---	---	F1	N/A	1
	30527	020E	User Map Value 4	---	---	---	---	F1	N/A	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30645	0284	User Map Value 122	---	---	---	---	F1	N/A	1
	30646	0285	User Map Value 123	---	---	---	---	F1	N/A	1
	30647	0286	User Map Value 124	---	---	---	---	F1	N/A	1
	30648	0287	User Map Value 125	---	---	---	---	F1	N/A	1
	30649	0288	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30656	028F	Reserved	---	---	---	---	---	---	1
SELF TEST										
	30657	0290	Internal Fault Cause	---	---	---	---	FC188	N/A	2
	30659	0292	Reserved	---	---	---	---	---	---	2
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30951	03B6	Reserved							1
STATUS BUFFER										
	30952	03B7	Reserved	---	---	---	---	---	---	2
	30954	03B9	Reserved	---	---	---	---	---	---	2
	30956	03BB	Alarm Status 2	---	---	---	---	FC180	N/A	2
	30958	03BD	Alarm Status 1	---	---	---	---	FC179	N/A	2
	30960	03BF	Reserved	---	---	---	---	---	---	2
	30962	03C1	Reserved	---	---	---	---	---	---	2
	30964	03C3	Trip Status 2	---	---	---	---	FC184	N/A	2
	30966	03C5	Trip Status 1	---	---	---	---	FC183	N/A	2
	30968	03C7	Reserved	---	---	---	---	---	---	2
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	30978	03D1	Reserved	---	---	---	---	---	---	2
	30980	03D3	Ctrl Element Status 2	---	---	---	---	FC192	N/A	2
	30982	03D5	Ctrl Element Status 1	---	---	---	---	FC191	N/A	2
	30984	03D7	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼

	Modbus	Hex	Description	Min	Max	Step	Units	Format	Default	Size in Words
	31377	0560	Reserved	---	---	---	---	---	---	1
COMMUNICATION										
	31378	0561	Serial Status	---	---	---	---	FC112	N/A	1
	31379	0562	Reserved	---	---	---	---	---	---	1
	31380	0563	Profibus Status	---	---	---	---	FC112	N/A	1
	31381	0564	DeviceNet Status	---	---	---	---	FC112	N/A	1
	31382	0565	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	32272	08DF	Reserved							1
SETPOINTS										
COMMANDS										
	40001	0000	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40128	007F	Reserved							1
	40129	0080	Command address	0	65535	0	---	F1	0	1
	40130	0081	Command Function	0	65535	0	---	F1	0	1
	40131	0082	Command Data 1	0	65535	0	---	F1	0	1
	40132	0083	Command Data 2	0	65535	0	---	F1	0	1
	40133	0084	Command Data 3	0	65535	0	---	F1	0	1
	40134	0085	Command Data 4	0	65535	0	---	F1	0	1
	40135	0086	Command Data 5	0	65535	0	---	F1	0	1
	40136	0087	Command Data 6	0	65535	0	---	F1	0	1
	40137	0088	Command Data 7	0	65535	0	---	F1	0	1
	40138	0089	Command Data 8	0	65535	0	---	F1	0	1
	40139	008A	Command Data 9	0	65535	0	---	F1	0	1
	40140	008B	Command Data 10	0	65535	0	---	F1	0	1
	40141	008C	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40171	00AA	Reserved							1
COMMUNICATION SETTINGS										
	40172	00AB	Slave Address	1	254	1	---	F1	254	1
	40173	00AC	RS485 Baud Rate	0	4	1	---	FC101	4	1
	40174	00AD	Reserved	---	---	---	---	---	---	1
	40175	00AE	Reserved	---	---	---	---	---	---	1
	40176	00AF	Reserved	---	---	---	---	---	---	1
	40177	00B0	Reserved	---	---	---	---	---	---	1
	40178	00B1	DeviceNet MAC ID	0	63	1	---	F1	63	1
	40179	00B2	DeviceNet Baud Rate	0	2	1	---	FC156	0	1
	40180	00B3	Reserved	---	---	---	---	---	---	1
	40181	00B4	Reserved	---	---	---	---	---	---	2
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40191	00BE	Reserved	---	---	---	---	---	---	1
	40192	00BF	Profibus address	1	125	1	---	F1	125	1
	40193	00C0	Profibus Baud Rate	1	2018	1	---	FC155	2018	1

	Modbus	Hex	Description	Min	Max	Step	Units	Format	Default	Size in Words
	40194	00C1	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40265	0108	Reserved	---	---	---	---	---	---	1
CURRENT SENSING										
	40266	0109	Phase CT Type	0	3	1	---	FC105	0	1
	40267	010A	CT Primary	5	1000	1	A	F1	5	1
	40268	010B	Reserved	---	---	---	---	---	---	1
	40269	010C	High Speed CT Primary	5	1000	1	A	F1	5	1
	40270	010D	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40283	011A	Reserved	---	---	---	---	---	---	1
MOTOR DATA SETUP										
	40284	011B	Reserved	---	---	---	---	---	---	1
	40285	011C	Motor Name	0	10	0	---	F22	3	10
	40295	0126	Starter Type	0	3	1	---	FC139	0	1
	40296	0127	Reserved	---	---	---	---	---	---	1
	40297	0128	Reserved	---	---	---	---	---	---	1
	40298	0129	Motor FLA	5	10001	1	A	F2*	10001	1
	40299	012A	High Speed FLA	5	10001	1	A	F2*	10001	1
	40300	012B	Motor Nameplate Voltage	100	690	1	V	F1	690	1
	40301	012C	Reserved	---	---	---	---	---	---	1
	40302	012D	Reserved	---	---	---	---	---	---	1
	40303	012E	Transfer Time	0	125	1	s	F1	1	1
	40304	012F	High Speed Start Block	0	1	1	---	FC126	1	1
	40305	0130	Reserved	---	---	---	---	---	---	1
	40306	0131	Reserved	---	---	---	---	---	---	1
	40307	0132	Pre-contactor Time	0	60	1	s	F1	0	1
	40308	0133	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40516	0203	Reserved	---	---	---	---	---	---	1
COMMUNICATION SETUP										
	40517	0204	Comms OK Evaluation	0	64	1	---	FC131	1	1
	40518	0205	Reserved	---	---	---	---	---	---	1
	40519	0206	Comm Failure Trip	5	30	5	s	F1*	30	1
	40520	0207	Comm Failure Alarm	5	30	5	s	F1*	30	1
OPEN CONTROL CIRCUIT										
	40521	0208	Open Ctrl Circuit Trip	0	1	1	---	FC126	0	1
	40522	0209	Reserved	---	---	---	---	---	---	1
	40523	020A	Reserved	---	---	---	---	---	---	1
USER MAP ADDRESSES										
	40524	020B	User Map Address 1	30001	43763	1	---	F1	30001	1
	40525	020C	User Map Address 2	30001	43763	1	---	F1	30001	1
	40526	020D	User Map Address 3	30001	43763	1	---	F1	30001	1
	40527	020E	User Map Address 4	30001	43763	1	---	F1	30001	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40645	0284	User Map Address 122	30001	43763	1	---	F1	30001	1

	Modbus	Hex	Description	Min	Max	Step	Units	Format	Default	Size in Words
	40646	0285	User Map Address 123	30001	43763	1	---	F1	30001	1
	40647	0286	User Map Address 124	30001	43763	1	---	F1	30001	1
	40648	0287	User Map Address 125	30001	43763	1	---	F1	30001	1
	40649	0288	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40701	02BC	Reserved	---	---	---	---	---	---	1
THERMAL MODEL SETUP										
	40702	02BD	Overload Pickup Level	101	125	1	x FLA	F3	101	1
	40704	02BF	Cool Time Constant Running	1	1000	1	min	F1	15	1
	40705	02C0	Cool Time Constant Stopped	1	1000	1	min	F1	30	1
	40706	02C1	Hot/Cold Safe Stall Ratio	1	100	1	%	F1	75	1
	40707	02C2	Reserved	---	---	---	---	---	---	1
	40708	02C3	Standard Overload Curve	1	15	1	---	F1	4	1
	40709	02C4	Reserved	---	---	---	---	---	---	1
	40710	02C5	Reserved	---	---	---	---	---	---	1
	40711	02C6	Reserved	---	---	---	---	---	---	1
	40712	02C7	Reserved	---	---	---	---	---	---	1
	40713	02C8	Minimize Reset Time	---	1	---	---	FC126	0	1
	40714	02C9	Overload Reset Mode	0	1	---	---	FC160	1	1
	40715	02CA	Reserved	---	---	---	---	---	---	1
	40716	02CB	Reserved	---	---	---	---	---	---	1
	40717	02CC	Reserved	---	---	---	---	---	---	1
	40718	02CD	Reserved	---	---	---	---	---	---	1
MECHANICAL JAM										
	40719	02CE	Mechanical Jam Level	101	451	1	x FLA	F3*	451	1
	40720	02CF	Mechanical Jam Delay	1	300	1	s	F2	1	1
	40721	02D0	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40824	0337	Reserved	---	---	---	---	---	---	1
THERMISTOR (CPU)										
	40825	0338	Cold Resistance	1	300	1	k ohms	F2	1	1
	40826	0339	Hot Resistance	1	300	1	k ohms	F2	50	1
	40827	033A	Thermistor Alarm	0	1	1	---	FC126	0	1
	40828	033B	Thermistor Trip	0	1	1	---	FC126	0	1
	40829	033C	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40833	0340	Reserved	---	---	---	---	---	---	1
UNDERCURRENT (REQUIRED=IO_A)										
	40834	0341	Undercurrent Alarm Level	1	101	1	%FLA	F1*	101	1
	40835	0342	Undercurrent Alarm Delay	1	60	1	s	F1	1	1
	40836	0343	Undercurrent Trip Level	1	101	1	%FLA	F1*	101	1
	40837	0344	Undercurrent Trip Delay	1	60	1	s	F1	1	1
	40838	0345	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40850	0351	Reserved	---	---	---	---	---	---	1

	Modbus	Hex	Description	Min	Max	Step	Units	Format	Default	Size in Words
ACCELERATION										
	40851	0352	Acceleration Alarm Timer	5	2501	1	s	F2*	2501	1
	40852	0353	Acceleration Trip Timer	5	2501	1	s	F2*	2501	1
	40853	0354	Reserved	---	---	---	---	---	---	1
	40854	0355	Reserved	---	---	---	---	---	---	1
	40855	0356	Reserved	---	---	---	---	---	---	1
	40856	0357	Reserved	---	---	---	---	---	---	1
CURRENT UNBALANCE (REQUIRED=IO_A)										
	40857	0358	Current Unbalance Alarm Level	4	41	1	%	F1*	15	1
	40858	0359	Current Unbalance Alarm Delay	1	60	1	s	F1	1	1
	40859	035A	Current Unbalance Trip Level	4	41	1	%	F1*	30	1
	40860	035B	Current Unbalance Trip Delay	1	60	1	s	F1	1	1
	40861	035C	Reserved	---	---	---	---	---	---	1
	40862	035D	Reserved	---	---	---	---	---	---	1
	40863	035E	Reserved	---	---	---	---	---	---	1
	40864	035F	Reserved	---	---	---	---	---	---	1
GROUND FAULT										
	40865	0360	Reserved	---	---	---	---	---	---	1
	40866	0361	CBCT Ground Alarm Level	5	151	1	A	F2*	151	1
	40867	0362	Ground Alarm Delay On Start	0	60	1	s	F1	10	1
	40868	0363	Reserved	---	---	---	---	---	---	1
	40869	0364	CBCT Ground Trip Level	5	151	1	A	F2*	151	1
	40870	0365	Ground Trip Delay On Start	0	100	1	s	F2	0	1
	40871	0366	Ground Alarm Delay On Run	0	60	1	s	F1	10	1
	40872	0367	Ground Trip Delay On Run	0	50	1	s	F2	0	1
	40873	0368	Reserved	---	---	---	---	---	---	1
	40874	0369	Reserved	---	---	---	---	---	---	1
LOAD INCREASE										
	40875	036A	Load Increase Alarm Level	50	151	1	%FLA	F1*	151	1
	40876	036B	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	40911	038E	Reserved	---	---	---	---	---	---	1
MAINTENANCE										
	40912	038F	Drive Greasing Interval	100	50100	100	hrs	F1*	50100	1
	40913	0390	Contactor Inspection Interval	100	65000	100	ops	F1*	65000	1
	40914	0391	Max Motor Stopped Time	10	10010	10	hrs	F1*	10010	1
	40915	0392	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	41039	040E	Reserved							1
CALIBRATION										
	41040	040F	Calibration Date	0	203360302	1	---	F18	0	2
	41042	0411	Calibration Time	0	389757795	1	---	F19	0	2
	41044	0413	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	41105	0450	Reserved							1

	Modbus	Hex	Description	Min	Max	Step	Units	Format	Default	Size in Words
SECURITY										
	41106	0451	Passcode Level 1	11111	55556	1	---	F1*	11111	1
	41107	0452	Passcode Level 2	11111	55556	1	---	F1*	22222	1
	41108	0453	Reserved	---	---	---	---	---	---	1
	41109	0454	Access Switch Level	1	3	1	---	F1	1	1
	41110	0455	Comms Security	0	1	1	---	FC126	0	1
	41111	0456	MCC Setpoint Access	0	1	1	---	FC126	1	1
	41112	0457	Passcode Entry	0	55555	1	---	F1	0	1
	41113	0458	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	41372	055B	Reserved	---	---	---	---	---	---	1
CONTACT INPUT ASSIGNMENT										
	41373	055C	Reserved	---	---	---	---	---	---	1
	41374	055D	Lockout Reset	0	57344	0	---	FC142	0	1
	41375	055E	Access Switch	0	57344	0	---	FC142	0	1
	41376	055F	Field Permissive	0	57344	0	---	FC142	0	1
	41377	0560	Comms Permissive	0	57344	0	---	FC142	0	1
	41378	0561	Forward Limit	0	57344	0	---	FC142	0	1
	41379	0562	Reverse Limit	0	57344	0	---	FC142	0	1
	41380	0563	Remote Reset	0	57344	0	---	FC142	0	1
	41381	0564	MCC Permissive	0	57344	0	---	FC142	0	1
	41382	0565	Hard Wired Start A	0	57344	0	---	FC142	0	1
	41383	0566	Hard Wired Start B	0	57344	0	---	FC142	0	1
	41384	0567	Hard Wired Stop	0	57344	0	---	FC142	0	1
	41385	0568	Hard Wired Permissive	0	57344	0	---	FC142	0	1
	41386	0569	Field Start A	0	57344	0	---	FC142	0	1
	41387	056A	Field Start B	0	57344	0	---	FC142	0	1
	41388	056B	Field Stop	0	57344	0	---	FC142	0	1
	41389	056C	Contactor Status A	0	57344	0	---	FC142	0	1
	41390	056D	Contactor Status B	0	57344	0	---	FC142	0	1
	41391	056E	Auto/Manual Switch	0	57344	0	---	FC142	0	1
	41392	056F	Reserved	---	---	---	---	---	---	1
	41393	0570	Test Switch	0	57344	0	---	FC142	0	1
	41394	0571	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	41475	05C2	Reserved	---	---	---	---	---	---	1
LEDs										
	41476	05C3	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	41495	05D6	USER1 LED Assignment	0	57344	1	---	FC142	0	1
	41496	05D7	USER1 LED Color	0	3	1	---	FC157	1	1
	41497	05D8	USER2 LED Assignment	0	57344	1	---	FC142	0	1
	41498	05D9	USER2 LED Color	0	3	1	---	FC157	1	1
	41499	05DA	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	41514	05E9	Reserved	---	---	---	---	---	---	1

	Modbus	Hex	Description	Min	Max	Step	Units	Format	Default	Size in Words
CONTACT OUTPUTS										
	41515	05EA	Contact Output 1	0	57344	0	---	FC142	0	1
	41516	05EB	Contact Output 2	0	57344	0	---	FC142	0	1
	41517	05EC	Contact Output 3	0	57344	0	---	FC142	0	1
	41518	05ED	Reserved	---	---	---	---	---	---	1
	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
	41571	0622	Reserved	---	---	---	---	---	---	1
AUTO / MANUAL CONTROL										
	41572	0623	Comms Start Ctrl	0	1	1	---	FC126	0	1
	41573	0624	Comms Stop Mode	0	1	1	---	FC172	0	1
	41574	0625	Hard Wired Start Ctrl	0	1	1	---	FC126	0	1
	41575	0626	Hard Wired Stop Mode	0	1	1	---	FC172	0	1
	41576	0627	Hard Wired Stop Actn	0	1	1	---	FC174	0	1
	41577	0628	Hard Wired 2W/3W	0	1	1	---	FC173	1	1
	41578	0629	Field Start Ctrl	0	1	1	---	FC126	0	1
	41579	062A	Field Stop Mode	0	1	1	---	FC172	0	1
	41580	062B	Field Stop Action	0	1	1	---	FC174	0	1
	41581	062C	Field 2W/3W	0	1	1	---	FC173	1	1
	41582	062D	MCC Start Ctrl	0	1	1	---	FC126	0	1
	41583	062E	MCC Stop Mode	0	1	1	---	FC172	0	1
	41584	062F	MCC Stop Action	0	1	1	---	FC174	0	1
	41585	0630	Test Auto Mode	0	2	1	---	FC175	1	1
	41586	0631	Test Manual Mode	0	2	1	---	FC175	0	1
	41587	0632	External Stop Action	0	1	1	---	FC174	0	1
	41588	0633	Auto/Manual Key	0	1	1	---	FC126	0	1

Format codes

Code	Type	Definition
F1	16 bits	UNSIGNED VALUE
Example: 1234 stored as 1234		
F2	16 bits	UNSIGNED VALUE, 1 DECIMAL PLACE
Example: 123.4 stored as 1234		
F3	16 bits	UNSIGNED VALUE, 2 DECIMAL PLACES
Example: 12.34 stored as 1234		
F9	32 bits	UNSIGNED LONG VALUE
1st 16 bits		High Order Word of Long Value
2nd 16 bits		Low Order Word of Long Value
Example: 123456 stored as 123456		
i.e. 1st word: 0001 hex, 2nd word: E240 hex		
F10	32 bits	UNSIGNED LONG VALUE, 1 DECIMAL PLACE
1st 16 bits		UNSIGNED LONG VALUE, 1 DECIMAL PLACE
2nd 16 bits		Low Order Word of Long Value
Example: 12345.6 stored as 123456		
i.e. 1st word: 0001 hex, 2nd word: E240 hex		

Code	Type	Definition
F13	32 bits	2's COMPLEMENT SIGNED LONG VALUE, 1 DECIMAL PLACE
1st 16 bits		High Order Word of Long Value
2nd 16 bits		Low Order Word of Long Value
Example: -12345.6 stored as -123456		
i.e. 1st word: FFFE hex, 2nd word: 1DC0 hex		
F15	16 bits	HARDWARE REVISION
0		Prototype
1		A
2		B
3		C
4		D
5		E
6		F
7		G
8		H
9		I
10		J
11		K
12		L
13		M
14		N
15		O
16		P
17		Q
18		R
19		S
20		T
21		U
22		V
23		W
24		X
25		Y
26		Z
F17	32 bits	UNSIGNED LONG VALUE, 3 DECIMAL PLACES
1st 16 bits		High Order Word of Long Value
2nd 16 bits		Low Order Word of Long Value
Example: 123456 stored as 123456		
i.e. 1st word: 0001 hex, 2nd word: E240 hex		
F20	32 bits	2's COMPLEMENT SIGNED LONG VALUE
1st 16 bits		High Order Word of Long Value
2nd 16 bits		Low Order Word of Long Value
Note: -1 means "Never"		
F22	16 bits	TWO 8-BIT CHARACTERS PACKED INTO 16-BIT UNSIGNED
MSB		First Character
LSB		Second Character
Example: String 'AB' stored as 4142 hex		

Code	Type	Definition
FC101	16 bits	RS 485 Baud Rate
0		9600 baud
1		19200 baud
2		38400 baud
3		57600 baud
4		115200 baud
FC105	16 bits	CT Type
0		None
1		1 A Secondary
2		5 A Secondary
3		Direct Connect
FC107	16 bits	Supply Frequency
0		60
1		50
FC112	16 bits	Communication Status
0		Error
1		OK
FC126	16 bits	Disabled / Enabled Selection
0		Disabled
1		Enabled
FC128	16 bits	Command Status
0		Manual
1		Auto
2		Manual Inhibit
3		Auto/ Manual
4		Hardwired Auto
5		None
FC129	16 bits	Quick Status Status
Bit 0		Alarm
Bit 1		Trip
Bit 2		Self Test Fault
Bit 3		Auto
Bit 4		Contactor A
Bit 5		Contactor B
Bit 6		Contact Output 3
Bit 7		Drive Available
FC131	16 bits	Comm Fail Mode
1		Serial
2		Reserved
4		Serial & FieldBus
8		Reserved
16		FieldBus
32		Reserved
64		All
FC134	16 bits	Cause of Event
0		No Event/Trip To Date
1		Control Power Lost

Code	Type	Definition
2		Control Power Applied
3		Date or Time Set
4		Reset
5		Lockout Reset
0x8002		Any Trip
0x8042		Thermal O/L Trip
0x8082		Ground Fault Trip
0x80C2		Acceleration Trip
0x8202		Mechanical Jam Trip
0x8242		UnderCurrent Trip
0x8282		Unbalance Trip
0x8442		Comm Fail Trip
0x8742		Hard Wired Trip
0x8782		Field Trip
0x87C2		MCC Trip
0x8842		Emergency Stop
0x8902		Thermistor Trip
0xA002		Any Alarm
0xA042		Thermal Level Alarm
0xA082		Ground Fault Alarm
0xA0C2		Acceleration Alarm
0xA242		UnderCurrent Alarm
0xA282		Unbalance Alarm
0xA842		External Stop Alarm
0xA8C2		Open Ctrl Cct Alarm
0xA902		Thermistor Alarm
0xAB02		Load Increase Alarm
0XAB42		Drive Greasing Alarm
0xAB82		Contactor Inspect Alarm
0xABC2		Max Stopped Alarm
0xAC82		Comm Fail Alarm
0xC002		Any Stop
0xC082		AutoMode
0xC0C2		Manual Mode
0xC102		Auto/Manual Mode Input
0xC182		Contactor A
0xC1C2		Contactor B
0xC202		Forward Limit
0xC302		Level 1 Access
0xC342		Level 2 Access
0xC382		Level 3 Access
0xC3C2		Comms Ctrl Active
0xC402		Hard Wired Ctrl Active
0xC442		Field Ctrl Active
0xC482		MCC Ctrl Active
0xC742		HW Stop
0xC782		Field Stop

Code	Type	Definition
0xC7C2		MCC Stop
0xC802		Access Switch Closed
0xC842		Test Switch Closed
0xC882		Hard Wired Start A
0xC8C2		Hard Wired Start B
0xC902		Start A
0xC942		Start B
0xC982		Field Start A
0xC9C2		Field Start B
0xCA02		Contactor A Status
0xCA42		Contactor B Status
0xCA82		Remote Reset Closed
0xCAC2		Lockout Reset Closed
0xCB42		Pre-Contactor
0xCB82		MCC Start A
0xCBC2		MCC Start B
FC139	16 bits	Starter Type
0		None
1		FV Nonreversing
2		FV Reversing
3		Two Speed
FC142	16 bits	Contact Input/Contact Output Element Assignment
0x0000		OFF
0x0001		ON
0x0040		Contact Inputs
0x8000		Trip
0xA000		Alarm
0xC000		Control
FC143	16 bits	Drive Status
0		Drive Unavailable
1		Available Auto
2		Available Manual
3		Available
4		Running
FC144	32 bits	LED Status
Bit 0		Running Red
Bit 1		Running Green
Bit 2		Stopped Red
Bit 3		Stopped Green
Bit 4		Tripped Red
Bit 5		Tripped Green
Bit 6		Alarm Red
Bit 7		Alarm Green
Bit 8		Auto Red
Bit 9		Auto Green
Bit 10		Manual Red
Bit 11		Manual Green

Code	Type	Definition
Bit 12		Comms OK Red
Bit 13		Comms OK Green
Bit 14		USER1 Red
Bit 15		USER1 Green
Bit 16		USER2 Red
Bit 17		USER2 Green
Bit 20		50% Red
Bit 21		50% Green
Bit 22		80% Red
Bit 23		80% Green
Bit 24		100% Red
Bit 25		100% Green
FC155	16 bits	Profibus Baud Rate
0x0001		9600
0x0002		19200
0x0004		31250
0x0008		45450
0x0010		93750
0x0020		187500
0x0040		500000
0x0080		1500000
FC156	16 bits	DeviceNet Baud Rate
0		125 kbps
1		250 kbps
2		500 kbps
FC157	16 bits	LED Colour
0		None
1		Red
2		Green
3		Orange
FC160	16 bits	Auto/Manual Mode
0		Auto
1		Manual
FC167	32 bits	Contact Input/Output Status
Bit 0		Input/Output 1
Bit 1		Input/Output 2
Bit 2		Input/Output 3
Bit 3		Input/Output 4
Bit 4		Input/Output 5
Bit 5		Input/Output 6
Bit 6		Input/Output 7
FC172	16 bits	Auto/Manual Control Stop Mode
0		Always Enabled
1		Follow Ctrl Mode
FC173	16 bits	Wire Selection
0		2W
1		3W

Code	Type	Definition
FC174	16 bits	Source Stop Action
0		Stop
1		Trip
FC175	16 bits	Test Auto/Manual Mode
0		ON
1		OFF
2		Unaffected
FC178	16 bits	Motor Status
Bit 0		Lockout
Bit 1		Non-Lockout Trip
Bit 4		Running
Bit 5		Precontactor
Bit 6		Starting
Bit 8		Inhibit
Bit 9		Stopped
Bit 10		Self Test Fault
Bit 11		Alarm
Bit 12		Forward
Bit 13		Reverse
Bit 14		Low Speed
Bit 15		High Speed
FC179	32 bits	Alarm Status 1
Bit 0		Any Alarm
Bit 1		Thermal Level Alarm
Bit 2		Ground Fault Alarm
Bit 3		Acceleration Alarm
Bit 9		UnderCurrent Alarm
Bit 10		Unbalance Alarm
FC180	32 bits	Alarm Status 2
Bit 0		Aux U/V Alarm
Bit 1		External Stop Alarm
Bit 3		Open Ctrl Cct Alarm
Bit 4		Thermistor Alarm
Bit 6		External Start A Alarm
Bit 7		External Start B Alarm
Bit 8		Welded Contactor
Bit 12		Load Increase Alarm
Bit 13		Drive Greasing Alarm
Bit 14		Contactor Inspect Alarm
Bit 15		Max Stopped Alarm
Bit 18		Comm Fail Alarm
FC183	32 bits	Trip Status 1
Bit 0		Any Trip
Bit 1		Thermal O/L Trip
Bit 2		Ground Fault Trip
Bit 3		Acceleration Trip
Bit 8		Mechanical Jam Trip

Code	Type	Definition
Bit 9		UnderCurrent Trip
Bit 10		Unbalance Trip
Bit 29		Hard Wired Trip
Bit 30		Field Trip
Bit 31		MCC Trip
FC184	32 bits	Trip Status 2
Bit 1		Emergency Stop
Bit 3		OpenControl Circuit
Bit 4		Thermistor Trip
FC191	32 bits	Ctrl Element Status 1
Bit 0		Any Stop
Bit 1		Thermal Inhibit
Bit 2		AutoMode
Bit 3		Manual Mode
Bit 4		AutoManualMode
Bit 8		Forward Limit
Bit 9		Reverse Limit
Bit 15		Comms Ctrl Active
Bit 16		Hard Wired Ctrl Active
Bit 17		Field Ctrl Active
Bit 18		MCC Ctrl Active

Fieldbus interface

The fieldbus interface is configurable as either Profibus DPV0 or DeviceNet. Both Fieldbus interfaces support control and status – refer to the specific data map below for details.

Note that external power, 5 to 24 VDC, is required for this interface to operate. (Ensure that switches 7 and 8 of the DIPswitch on the communication card, are ON.)

Profibus protocol (DP V0)

To enable the Profibus physical interface, ensure that switches 3 and 4 of the DIP switch on the communications card (on the CPU) are on. The external connections through the Fieldbus interface are as follows.

Table 10: Fieldbus interface external connections (Profibus)

Pin	Connection (external device)
V–	Pin 5
L	Pin 8, line A (negative TX/RX)
C	Common drain
H	Pin 3, line B (positive TX/RX)
V+	Pin 6

The Modbus status (MS) and network status (NS) LEDs indicate the status of the Fieldbus interface.

Table 11: Profibus LED indications

LED	Color	Description
MS	Green	Processor OK
	Off	Processor FAIL
NS	Green	Communications to master OK
	Red	Communications to master FAIL

When used for Profibus, the fieldbus port has the following characteristics.

- Baud rate: 9600, 19200, 31250, 45450, 93750, 187500, 500000, and 1.5M bps
- Address: 1 to 125
- Vendor ID: 3005 (hex)
- Data table size: inputs = 240 bytes, outputs = 240 bytes

Profibus Output Data

Bit	Description
0	Reset
1	Lockout Reset
2	Stop
3	Start A
4	Start B

Commands are actioned on rising edge (0 to 1 transition).

Profibus DP-Diagnostics

MM200 supports bot slave mandatory and slave specific diagnostic data.

Table 12: System Standard Diagnostics Bytes 1 through 6

Byte	Description
0	Station Status 1
1	Station Status 2
2	Station Status 3
3	Diagnostic Master Address
4	Identification Number (High Byte)
5	Identification Number (Low Byte)

The extended diagnosis for the relay is composed of 49 bytes (bytes 7 to 55) and contains diagnostic information according to the following table, with bit descriptions listed in the following pages.

Address (By Bytes)	Description	Format
6	No. of Extended Diagnostic Bytes	Unsigned
7-10	Reserved	
11-14	Trip Status 2	FC184
15-18	Trip Status 1	FC183
19-22	Reserved	
23-26	Alarm Status 2	FC180
27-30	Alarm Status 1	FC179
31-46	Reserved	
47-50	Ctrl Element Status 2	FC192
51-54	Ctrl Element Status 1	FC191

Profibus Input Data

Category	Address (By Bytes)	Description	Format
Status-Motor	0	Motor Status	FC129
	2	Extended Status	FC178
	4	Thermal Cap Used	F1
	6	Time to Overload Trip	F20
	10	Overload Lockout	F1
	12	Reserved	NA
	14	Reserved	NA
	16	Reserved	F1
	18	Reserved	NA
	20	Reserved	NA
	22	Reserved	NA
	24	Reserved	NA
	26	Reserved	NA
Learned	28	Learned Acceleration Time	F2
	30	Learned Starting Current	F10
	34	Learned Starting Capacity	F1
Counters	36	Number of Motor Starts	F1
	38	Reserved	NA
	40	Motor Running Hours	F9
	44	Reserved	NA
	46	Reserved	NA

Category	Address (By Bytes)	Description	Format
	48	Reserved	NA
	50	Reserved	NA
	52	Reserved	NA
	54	Reserved	NA
	56	Reserved	NA
	58	Reserved	NA
Current Metering	60	Ia	F10
	64	Ib	F10
	68	Ic	F10
	72	Reserved	NA
	74	Reserved	NA
	76	Reserved	NA
	78	Iavg	F10
	82	Igrd	F10
	86	Motor Load	F1
	88	I Unb	F1
	90	Reserved	NA
	92	Reserved	NA
	94	Reserved	NA
	96	Reserved	NA
	98	Reserved	NA
	100	Reserved	NA
	102	Reserved	NA
	104	Reserved	NA
	106	Reserved	NA
	108	Reserved	NA
	110	Reserved	NA
	112	Reserved	NA
	114	Reserved	NA
	116	Reserved	F3
	118	Reserved	NA
	120	Reserved	NA
	122	Reserved	NA
	126	Reserved	NA
	128	Reserved	NA
	132	Reserved	NA
	134	Reserved	NA
	138	Reserved	NA
	140	Reserved	NA
	142	Reserved	NA
	146	Reserved	NA
	148	Reserved	NA
	150	Reserved	NA
	152	Reserved	NA
	154	Reserved	NA
	156	Reserved	NA
	158	Reserved	NA

Category	Address (By Bytes)	Description	Format
	160	Reserved	NA
	162	Reserved	NA
	164	Reserved	NA
	166	Reserved	NA
	168	Reserved	NA
	170	Reserved	NA
	172	Reserved	NA
	174	Reserved	NA
	176	Reserved	NA
	178	Reserved	NA
Last Trip Data	180	Cause of Last Trip	FC134
	182	Reserved	NA
	186	Reserved	NA
	190	Pre Trip Ia	F10
	194	Pre Trip Ib	F10
	198	Pre Trip Ic	F10
	202	Pre Trip Motor Load	F1
	204	Pre Trip Current Unbalance	F1
	206	Pre Trip Igrd	F10
	210	Reserved	NA
	212	Reserved	NA
	214	Reserved	NA
	216	Reserved	NA
	218	Reserved	NA
	220	Reserved	NA
	222	Reserved	NA
	224	Reserved	NA
	226	Reserved	NA
	228	Reserved	NA
	232	Reserved	NA
	236	Reserved	NA
	238	Reserved	NA

DeviceNet protocol

To enable the DeviceNet physical interface, ensure that switches 1 and 2 of the DIP switch communications card (on the CPU) are on. The external connections through the fieldbus interface are as follows.

Table 13: Fieldbus interface external connections (DeviceNet)

Path	Connection (external)	Wire color
V–	Pin 3, CAN_GND	Black
L	Pin 2, CAN_L	Blue
C	Pin 5, CAN_SHLD	Bare
H	Pin 7, CAN_H	White
V+	Pin 9, CAN_V	Red

The Modbus status (MS) and network status (NS) LEDs indicate the status of the Fieldbus interface.

Table 14: DeviceNet LED indications

LED	LED operation	Description
MS	Green on, red on, green on	Device self-test
	Flashing green	Device in standby state
	Green on	Device operational
	Flashing red	Recoverable fault
	Red on	Unrecoverable fault
NS	Flashing green	Online, not connected
	Green on	Online, connected
	Flashing red	Connection timeout
	Red on	Critical link failure
	Red and green	Network access detected

When used for DeviceNet, the fieldbus port has the following characteristics.

- Baud rate: 125, 250, and 500 kbps
- MAC ID: 0 to 63
- Vendor ID: 928
- Product Code: 0x4D39
- Message types: poll, and explicit messaging

DeviceNet Communications

The device profile is an extension of the Communications Adapter Device Profile (0xC0). It is a group 2 only server. The MAC ID and baud rate are programmable through the EnerVista MM200 Setup software. The MM200 supports the following DeviceNet object classes.

CLASS	OBJECT
01H	Identify
02H	Message Router
03H	DeviceNet
05H	Connection
64H	IO Data
A0H	Generic Data - Polling/Explicit
B1H	Explicit Control Writes
B0H	Analog Data - Explicit

The MM200 supports poll and explicit messaging types.

The Poll function will return 38 bytes of status and metering data as described in User Object Class A0h, Instance 01h, Attribute 01h.

USINT, UINT, UDINT and DINT, stated in this document, stand for the following data types :

USINT = Unsigned integer byte

UINT = Unsigned integer word

UDINT = Unsigned integer double word

DINT = Signed integer double word

Identity Object (Class Code 01H)

Table 15: Identity Object, Class Code 01h, Services:

CODE	SERVICES AVAILABLE TO THIS OBJECT	
	NAME	DESCRIPTION
0x05	Reset	Reset the device to power up configuration
0x0E	Get_Attribute_Single	Returns the contents of the given attribute

Table 16: Identity Object, Class Code 01h, Attributes:

ATTRIBUTE	ACCESS	NAME/DESCRIPTION	DATA TYPE	VALUE
01h	Get	Revision of Identity Object	UINT	1

Table 17: Identity Object, Class Code 01h, Instance 01h, Attributes:

ATTRIBUTE	ACCESS	NAME/DESCRIPTION	DATA TYPE	VALUE
01h	Get	Vendor ID	UINT	928
02h	Get	Device Type	UINT	12
03h	Get	Product Code	UINT	0x4D39
04h	Get	Revision (Major, Minor)	2USINT	1.00
07h	Get	Product Name	SHORTSTRING	MM200 MOTOR MANAGEMENT RELAY

Message Router (Class Code 02H)

The message router (class code 2) object provides a messaging connection point through which a client may address a service to any object or instance residing in the physical device. There is no external visible interface to the message router object.

DeviceNet Object (Class Code 03H)

Table 18: Identity Object, Class Code 03h, Services:

CODE	SERVICES AVAILABLE TO THIS OBJECT	
	NAME	DESCRIPTION
0x0E	Get_Attribute_Single	Returns the contents of the given attribute

Table 19: Identity Object, Class Code 03h, Attributes:

ATTRIBUTE	ACCESS	NAME/DESCRIPTION	DATA TYPE	VALUE
01h	Get	Revision of DeviceNet Object	UINT	1

Table 20: Identity Object, Class Code 03h, Instance 01h, Attributes:

ATTRIBUTE	ACCESS	NAME/ DESCRIPTION	DATA TYPE	VALUE
01h	Get	Vendor ID	UINT	928 (to be defined)
02h	Get	Baud Rate	USINT	0 = 125 kbps 1 = 250 kbps 2 = 500 kbps
05h	Get	Allocation Choice	USINT	Bit 0: Explicit Messaging Bit 1: polled I/O Bit 6: acknowledge suppression
		Master/s MAC ID	USINT	0 to 63: address; 255 = unallocated

DeviceNet Connection Object (Class Code 05H)

Table 21: Connection Object, Class Code 05h, Services:

CODE	SERVICES AVAILABLE TO THIS OBJECT	
	NAME	DESCRIPTION
0x05	Reset	Reset the device to power up configuration
0x0E	Get_Attribute_Single	Returns the contents of the given attribute
0x10	Set_Attribute_Single	Sets the contents of the given attribute

Table 22: Connection Object, Class Code 05h, Instance 01h (Explicit Message Connection):

ATTRIBUTE	ACCESS	NAME/DESCRIPTION	DATA TYPE	VALUE
01h	Get	State	USINT	0x03
02h	Get	Instance type	USINT	0x00
03h	Get	Export class trigger	USINT	0x83
04h	Get	Produced connection ID	UINT	10xxxxxx011, xxxxxx - MAC ID
05h	Get	Consumed connection ID	UINT	10xxxxxx100, xxxxxx - MAC ID
06h	Get	Initial comm. characteristics	USINT	0x21
07h	Get	Produced connection size	UINT	0x00EF
08h	Get	Consumed connection size	UINT	0x00EF
09h	Get/Set	Expected package rate	UINT	0x0000
0Ch	Get/Set	Watchdog timeout action	USINT	0 = transition to time-out 1 = auto delete 2 = auto reset 3 = deferred delete
0Dh	Get	Produced path length	UINT	0x0000
0Eh	Get	Produced path	USINT [6]	<null>
0Fh	Get	Consumed path length	UINT	0x0000
10h	Get	Consumed path	USINT [6]	<null>
11h	Get	Production inhibit timer	UINT	0x0000

Table 23: Connection Object, Class Code 05h, Instance 04h (Polled Input/Output Connection):

ATTRIBUTE	ACCESS	NAME/DESCRIPTION	DATA TYPE	VALUE
01h	Get	State	USINT	0x03
02h	Get	Instance type	USINT	0x01
03h	Get	Export class trigger	USINT	0x82
04h	Get	Produced connection ID	UINT	MAC ID
05h	Get	Consumed connection ID	UINT	MAC ID
06h	Get	Initial comm. characteristics	USINT	0x01
07h	Get	Produced connection size	UINT	0x0026
08h	Get	Consumed connection size	UINT	0x0020
09h	Get/Set	Expected package rate	UINT	0x0000
0Ch	Get/Set	Watchdog timeout action	USINT	0x00
0Dh	Get	Produced path length	UINT	0x0006
0Eh	Get	Produced path	USINT [6]	0x206424013001
0Fh	Get	Consumed path length	UINT	0x0006
10h	Get	Consumed path	USINT [6]	0x206424013002
11h	Get	Production inhibit timer	UINT	0x0000

I/O Data Polled Object (Class Code 64H)

Table 24: I/O Data Polled Object, Class Code 64h, Services:

CODE	SERVICES AVAILABLE TO THIS OBJECT	
	NAME	DESCRIPTION
0x0E	Get_Attribute_Single	Returns the contents of the given attribute
0x10	Set_Attribute_Single	Sets the contents of the given attribute

Table 25: I/O Data Polled Object, Class Code 64h, Attributes:

ATTRIBUTE	ACCESS	NAME/DESCRIPTION	DATA TYPE	VALUE
01H	Get	Revision of I/O Data Polled Object	UINT	1

Table 26: Data Polled Object, Class Code 64h, Instances 01h

ATTRIBUTE	ACCESS	NAME/DESCRIPTION	SIZE IN BYTES
01H	Get	Motor Data (Poll Group)	38

Table 27: Data Polled Object, Class Code 64h, Instances 02h

ATTRIBUTE	ACCESS	NAME/DESCRIPTION	SIZE IN BYTES
02H	Set	Reserved	32

DATA FORMAT, MOTOR DATA		
ITEM DESCRIPTION	**SIZE IN BYTES**	**FORMAT**
Motor status	1	FC129 (low byte only)
Motor load (%)	2	F1
Cause of last trip	2	FC134
Thermal capacity used (%)	2	F1
Average phase current (A)	4	F10
Ground current (A)	4	F10
Reserved	2	NA
Reserved	4	NA
Reserved	2	NA
Contact Input Status	8	BIT per input
Contact Output Status	4	BIT per output

DeviceNet Motor Data - Poll, Explicit Object (Class Code A0H)

Table 28: Motor Data Object, Class Code A0h, Services:

CODE	SERVICES AVAILABLE TO THIS OBJECT	
	NAME	**DESCRIPTION**
0x0E	Get_Attribute_Single	Returns the contents of the given attribute

Table 29: Motor Data Object, Class Code A0h, Attributes:

ATTRIBUTE	ACCESS	NAME/DESCRIPTION	DATA TYPE	VALUE
01H	Get	Revision of Motor Data Object	UINT	1

Table 30: Motor Data Object, Class Code A0h, Instance 01h, Attributes, Get Access:

ATTRIBUTE	NAME/DESCRIPTION	SIZE IN BYTES	FORMAT
01H	Motor Data (Poll group 1)	38	See below
02H	Digital Data	9	See below
03H	Summary of Motor Data	7	See below
04H	Reserved	NA	NA
05H	Motor status	1	FC129 (low byte only)
06H	Motor load (%)	2	F1
07H	Cause of last trip	2	FC134
08H	Thermal capacity used (%)	2	F1
09H	Current metering	8	See below
0AH	Reserved	2	NA
0BH	Reserved	6	NA
0CH	Contact Input Status	8	BIT per input
0DH	Contact Output Status	4	BIT per output
0EH	Reserved	3	NA

DATA FORMAT, DIGITAL DATA		
ITEM DESCRIPTION	**SIZE IN BYTES**	**FORMAT**
Motor status	1	FC129 (low byte only)
Contact Input Status	8	BIT per input

DATA FORMAT, SUMMARY OF MOTOR DATA		
ITEM DESCRIPTION	**SIZE IN BYTES**	**FORMAT**
Motor status	1	FC129 (low byte only)
Motor load (%)	2	F1
Cause of last trip	2	FC134
Thermal capacity used (%)	2	F1

DATA FORMAT, MOTOR DATA		
ITEM DESCRIPTION	**SIZE IN BYTES**	**FORMAT**
Motor status	1	FC129 (low byte only)
Motor load (%)	2	F1
Cause of last trip	2	FC134
Thermal capacity used (%)	2	F1
Average phase current (A)	4	F10
Ground current (A)	4	F10
Reserved	2	NA
Reserved	4	NA
Reserved	2	NA
Contact Input Status	8	BIT per input
Contact Output Status	4	BIT per output

DATA FORMAT, CURRENT METERING		
ITEM DESCRIPTION	**SIZE IN BYTES**	**FORMAT**
Average phase current (A)	4	F10
Ground current (A)	4	F10

DeviceNet - Explicit Motor Analog Data Object, Class Code B0H, Services

Table 31: Explicit Motor Analog Data Object, Class Code B0h, Services:

CODE	SERVICES AVAILABLE TO THIS OBJECT	
	NAME	**DESCRIPTION**
0x0E	Get_Attribute_Single	Returns the contents of the given attribute

Table 32: Explicit Motor Analog Data Object, Class Code B0h, Attributes:

ATTRIBUTE	DESCRIPTION	SIZE IN BYTES
01H Currents	Currents	20
02H	Reserved	6
03H	Motor load	4
04H	Reserved	8
05H	Reserved	8
06H	Reserved	6
07H	Reserved	2
08H	Reserved	14
09H	Reserved	12
0AH	Reserved	3
0BH	Reserved	12
0CH	Learned data	10
0DH	Motor statistics	8
0EH	Cause of trip	2
0FH	Reserved	8
10H Currents	Last pre-trip currents	16
11H	Last pre-trip motor load	4
12H	Reserved	6
13H	Reserved	6
14H	Reserved	2
15H	Reserved	12
16H	Trip diagnostic data	12
17H	Alarm diagnostic data	12
18H	Start block status data	18
19H	All actual values	211

Table 33: Data Formats, Explicit Motor Analog Data Object

ATTRIBUTE		ITEM DESCRIPTION	SIZE IN BYTES	FORMAT
01H	Currents	Ia	4	F10
		Ib	4	F10
		Ic	4	F10
		Iavg	4	F10
		Igrd	4	F10
03H	Motor load	Motor Load	2	F1
		I Unb	2	F1
0CH	Learned data	Learned Acceleration Time	2	F2
		Learned Starting Current	4	F10
		Learned Starting Capacity	2	F1
		Reserved	2	NA
0DH	Motor Statistics	Number of Motor Starts	2	F1
		Reserved	2	NA
		Motor Running Hours	4	F9
0EH	Cause of Trip	Cause of Last Trip	2	FC134
10H	Last pre-trip currents	Pre Trip Ia	4	F10
		Pre Trip Ib	4	F10
		Pre Trip Ic	4	F10
		Pre Trip Igrd	4	F10
11H	Last pre-trip motor load	Pre Trip Motor Load	2	F3
		Pre Trip Current Unbalance	2	F1
16H	Trip diagnostic data	Reserved	4	NA
		Trip Status 2	4	FC184
		Trip Status 1	4	FC183
17H	Alarm diagnostic data	Reserved	4	NA
		Alarm Status 2	4	FC180
		Alarm Status 1	4	FC179
18H		Start Timer 1	2	F1
		Start Timer 2	2	F1
		Start Timer 3	2	F1
		Start Timer 4	2	F1
		Start Timer 5	2	F1
		Overload Lockout Block	2	F1
		Overload Restart Block	2	F1
19H	All of the above items from attributes 01H-18H			

DeviceNet - Explicit Motor Object, Class Code B1H

Table 34: Explicit Motor Control Object, Class Code B1h, Services:

CODE	SERVICES AVAILABLE TO THIS OBJECT	
	NAME	DESCRIPTION
0x10	Set_Attribute_Single	Sets the contents of the given attribute

Table 35: Explicit Motor Control Object, Class Code B1h, Attributes:

ATTRIBUTE	ACCESS	DESCRIPTION	DATA TYPE	VALUE
01H	Set	Control Command	BYTE	See below

Table 36: Data Value, Class B1h

VALUE	DESCRIPTION
1	Reset
2	Lockout Reset
3	Stop
4	Start A
5	Start B

Commands are actioned on rising edge (0 to 1 transition).