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MPS MODBUS TCP & ETHERNET/IP INTERFACE

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PART A: MODBUS TCP

1. GENERAL

The Ethernet interface supports Modbus TCP and EtherNet/IP. For firmware revision 2.50 and higher a new version of Modbus TCP has been added in addition to the legacy version. This new version removes MPS register-access limitations and provides full access to all MPS parameters. The new version is compatible with SE-Comm-RIS. For legacy applications, the old functionality is still provided.

Starting with version 2.50, setting the IP address and mask is done using an OPI menu selection and does not require the "IPConfig" configuration software. This applies to both the Modbus TCP and EtherNet/IP versions.

This manual describes the features of the Modbus TCP version of EtherNet/IP. MPS firmware revision 2.5 or higher is required. For EtherNet/IP, see the MPS EtherNet/IP manual.

Section 2 is common for all Ethernet protocols and Section 3 describes the new Modbus TCP implementation.

2. ETHERNET PROTOCOL

This section applies to both legacy and new versions of Modbus TCP, and EtherNet/IP.

2.1 PROTOCOL SETUP

The protocol type, IP address, IP Mask, and default gateway are set in the *Setup* | *Hardware* | *Network Comms* menu.

For new installations requiring Modbus TCP, select *Modbus TCP*. This provides full access to the MPS parameters as described in the MPS manual Appendix E. Multiple-register read and write instructions are supported and write requests do not require a special command sequence. This selection is compatible with SE-Comm-RIS and is recommended for new installations. This mode of operation is described in Section 3.

Starting with MPS Version 2.50 IPConfig(1) is not required because the IP Address, Mask, and gateway are set using the *Ethernet IP* and *Ethernet Mask* menu settings, however, IPConfig can still be used to determine the IP Address, Mask, and gateway settings for connected devices.

2.2 LED INDICATION

The module contains four LED indicators as shown in Fig. 1.

LED 1 - Link

Indicates that the module is connected to an Ethernet network.

TABLE 1 LED 2 - MODULE STATUS

STATE	DESCRIPTION
Steady Off	No Power
Steady Green	Device Operational
Flashing Green	Standby
Flashing Red	Minor Fault
Steady Red	Major Fault
Flashing Green/Red	Self-Test

TABLE 2 LED 3 - NETWORK STATUS

STATE	DESCRIPTION
Steady Off	No Power or No IP Address
Steady Green	Connected
Flashing Green	No Connections
Flashing Red	Connection Timeout
Steady Red	Duplicate IP
Flashing Green/Red	Self-Test

LED 4 - Activity LED

Flashes green each time a packet is received or transmitted.

2.3 COMMUNICATION STATUS AND TIMEOUT

The status of the Ethernet communication module is indicated as "Ethernet: ONLINE" when the module is operating properly, and as "Ethernet: OFFLINE" when the module is not operating properly. Module errors require the module to be reinitialized. The module is initialized on power up or can be initialized using the OPI. To initialize the module using the OPI, first disable the module by selecting *None* in the *Setup* | *Hardware* | *Network Type* menu and then select *Anybus* or *Modbus TCP* to enable the module.

In applications where the MPS start/stop functions are controlled by the network, the MPS can be configured to trip or alarm on loss of communication to the module. This feature is enabled using the *Setup* | *Hardware* | *Network Comms* | *Network Error* menu.

To prevent a timeout trip when using the *Modbus TCP* selection, see Section 3.5.

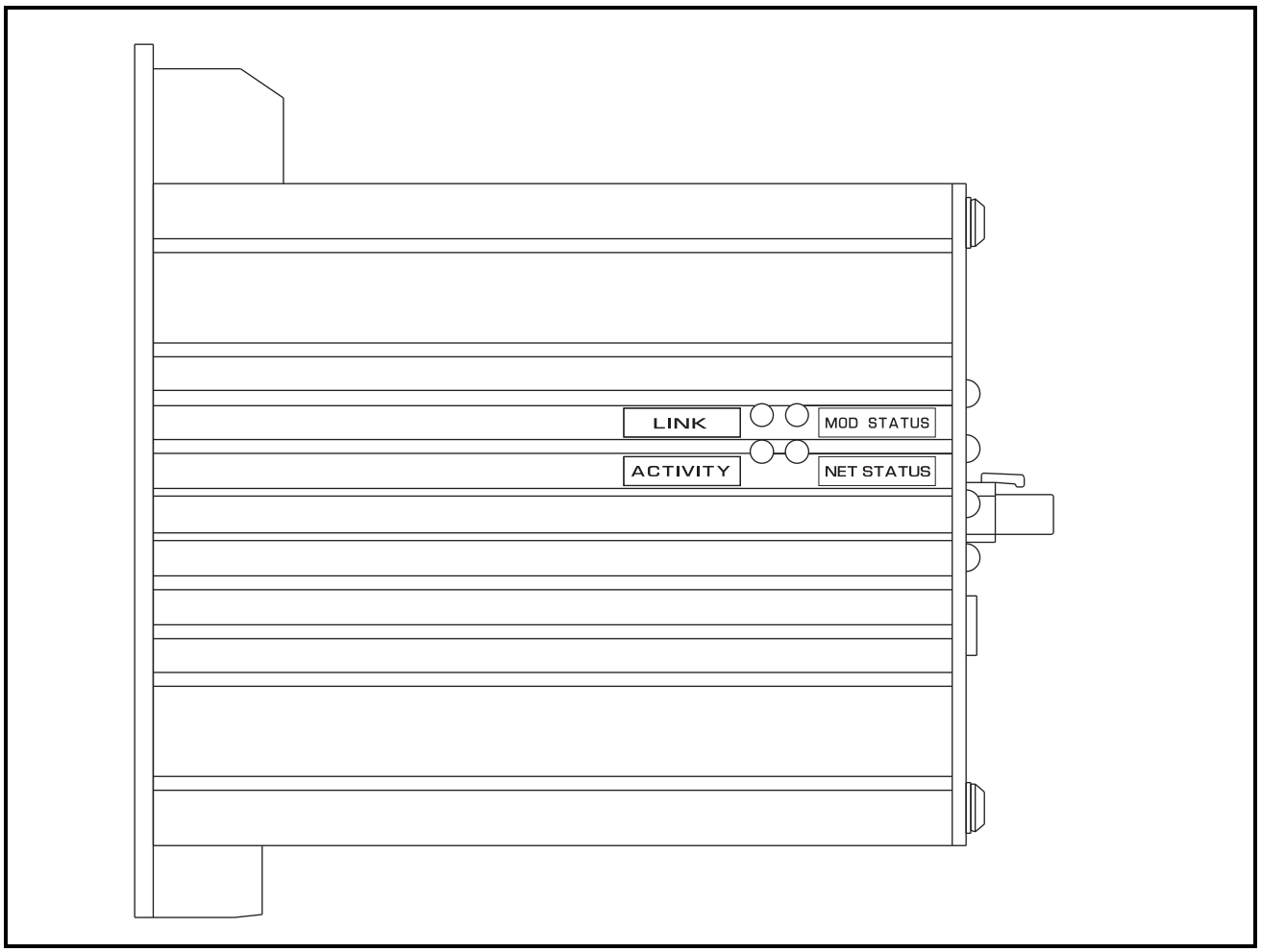

FIGURE 1. MPS-CTU Side View Showing LED's.

2.4 FILE SYSTEM

The module contains a file system that may be useful for storing files associated with the MPS. The file system is a fixed-size storage area with a hierarchical directory structure.

The file system is accessible via FTP, Telnet, HTTP.

The file system is case sensitive. This means that the file 'AnyBus.txt' is not identical to the file 'AnyBus.TXT'. Filenames can be a maximum of 48 characters long. Pathnames can be 256 characters in total, filename included.

NOTES:

(1) Although IPConfig software can still be used to set the IP address, mask, and gateway these settings are temporary and overwritten by the menu-system value when the MPS Ethernet driver is re-started during powerup or when network parameters are changed.

(2) The MPS communication address is defined by the *Ethernet IP* setting and is unique for each MPS. The *Network ID* setting is ignored by the MPS. The Modbus broadcast address of 255 is not supported.

(3) Communications options are mutually exclusive. Selecting *Anybus* or *Modbus TCP* disables the RS-485 interface.

(4) Select *Anybus* or *Modbus TCP* only if the MPS has the Ethernet option installed (MPS-CTU-04-XX).

3. MODBUS TCP PROTOCOL

The MPS implements the Modbus TCP protocol on port 502. The MPS is a slave (server) on the network. It cannot initiate communication. Up to 5 clients can be connected simultaneously to a single MPS server.

3.1 FUNCTION CODES SUPPORTED

The MPS supports the following function codes:

- Read Holding Registers (Function Code 3)
- Read Input Registers (Function Code 4)
- Write Single Register (Function Code 6)
- Write Multiple Registers (Function Code 16)
- Force Single Coil (Function Code 5)

Function Code 3 and Function Code 4 perform the same function and are used to read data from the MPS. Function Code 6 and Function Code 16 are used to write data to the MPS. See MPS Manual Appendix E for the Modbus register list and address definitions. These functions use Modbus address group 4.

Function Code 5 is used to issue commands to the MPS. The command code and action is listed in Table 3. In terms of Modbus, the command code is the coil address (Modbus address group 0). The command is issued by setting the coil to ON at the specified address location. All commands use the ON request to issue the command. For example, to reset trips, the coil at Modbus coil address 00004 is set to ON. Coil commands are "one-shot" commands.

TABLE 3 SUPPORTED COMMANDS

COMMAND CODE	COIL ADDRESS	ACTION
0x0000	00001	STOP
0x0001	00002	START1
0x0002	00003	START2
0x0003	00004	Reset Trips
0x0004	00005	Set Real-Time Clock
0x0005	00006	Clear Data-Logging Records
0x0006	00007	Clear Trip Counters
0x0007	00008	Clear Energy Totals
0x0008	00009	Clear Running Hours
0x0009	00010	Emergency I^2t and Trip Reset
0x000A	00011	Select Local Control
0x000B	00012	De-select Local Control
0x000C	00013	Re-enable Temperature Protection

For PLCs not supporting Function Code 5, commands can be issued using Function Code 6 or 16. Commands are written to MPS register 6 (Modbus register 40007). Use the command codes listed in Table 3. For Function Code 16, the first data element is interpreted as the command code and subsequent bytes are ignored.

3.2 REGISTER DATABASE

Appendix E in the MPS manual contains the Modbus Register Table. The table starts at register 0 (Modbus 40001) and each register is 16-bits wide. Types "long" and "float" are 32-bit values. For both long and float types, the low-order word is transmitted first followed by the high-order word. Word values have the high byte followed by the low byte. Float types are per the IEEE 754 Floating-Point Standard. All bytes of long and float types must be written using one message or an error will result. This does not apply for read commands.

3.3 READING DATA RECORDS

Event record information is located starting at MPS register 973 (Modbus 40974).

Only one event record can be read at a time. Record data is for the record indicated by the Record Selector. To select a record, write the record number to Record Selector with the first message and then read the values in the record with a second message. Record Head points to the next available record. The last event record captured is at Record Head minus one.

The Record Selector must be in the range of 0 to 63. Values outside this range will select record 0.

3.4 USER-DEFINED REGISTERS

User-Defined Registers are used to assemble data in groups in order to minimize the amount of message requests. User-Defined Register values are entered using the *Setup | Hardware |Network Comms | User Register* menu, by using SE-Comm-RIS, or by using network communication messages.

The values entered are the MPS register numbers corresponding to the required parameter as listed in the MPS Manual Appendix E. The entered values are accessible from the menu or via communications by reading the register values starting at MPS register 1400 (Modbus 41401).

The data corresponding to these register values is retrieved by reading the values starting at registers 1432 (Modbus 41433). Data format is a function of the associated MPS register type.

Typically, for PLC communications it is desirable to define data assemblies that are grouped by data type (float or integer). A single read can then access all required float values while another read can access the integer values.

For example, to access the three phase currents enter 860, 861, 862, 863, 864, and 865 in User Register 0 to 5. In a similar manner, the trip summary, motor status, starter status, and Message 0 can be read by entering 1096, 1097, 1098, 1104 in the next available user-register locations starting at User Register 6. The resulting values can be read starting at MPS Register 1432 (Modbus 41433).

3.5 TIMEOUT PREVENTION

To prevent a timeout trip on the MPS, a valid Modbus TCP request addressed to the specific slave is required. This can be a read or write request.

3.6 ERROR RESPONSES

Errors can originate from the hardware or communications software. When a hardware error occurs, *"Anybus Error!"* is displayed in the *Metering | Network Status* menu, along with an error code. If errors persist, contact the factory.

The MPS supports the following Modbus TCP communication error responses:

01: Illegal Function—The function code sent to the MPS server is not supported.
02: Illegal Data Address—The requested address is not within the data address range in the MPS.
03: Illegal Data Value—Data value is not within the required range.

4. SPECIFICATIONS

Interface	10BASE-T, 100BASE-T, Cat. 3, 4, 5, UTP, STP
Protocol	Modbus TCP or EtherNet/IP
Baud Rate	10/100 Mbps
Number of Slaves Connected	Up to 254 units
Number of Connections	Up to five
Bus length	100 m (328') per segment

PART B: ETHERNET/IP

1. GENERAL

This document describes the EtherNet/IP features supported by the MPS. The MPS supports Explicit and Polled I/O. It does not support the Unconnected Message Manager (UCMM).

Starting with version 2.50, setting the IP address, mask, and gateway are done using an OPI menu selection and does not require the "IPConfig" configuration software. This applies to both Modbus TCP and EtherNet/IP versions.

2. ETHERNET PROTOCOL

2.1 PROTOCOL SETUP

The protocol type, IP address, IP Mask, and default gateway are set in the *Setup* | *Hardware* | *Network Comms* menu.

For legacy applications or to support EtherNet/IP, select the network type as *Anybus.*

Starting with MPS Version 2.50 IPConfig(1) is not required because the IP Address, Mask, and gateway are set using the *Ethernet IP* and *Ethernet Mask* menu settings, however, IPConfig can still be used to determine the IP Address, Mask, and gateway settings for connected devices.

2.2 LED INDICATION

The module contains four LED indicators as shown in Fig. 2.

LED 1 - Link

Indicates that the module is connected to an Ethernet network.

TABLE 4 LED 2 - MODULE STATUS

STATE	DESCRIPTION
Steady Off	No Power
Steady Green	Device Operational
Flashing Green	Standby
Flashing Red	Minor Fault
Steady Red	Major Fault
Flashing Green/Red	Self-Test

TABLE 5 LED 3 - NETWORK STATUS

STATE	DESCRIPTION
Steady Off	No Power or No IP Address
Steady Green	Connected
Flashing Green	No Connections
Flashing Red	Connection Timeout
Steady Red	Duplicate IP
Flashing Green/Red	Self-Test

LED 4 - Activity LED

Flashes green each time a packet is received or transmitted.

2.3 COMMUNICATION STATUS AND TIMEOUT

The status of the Ethernet communication module is indicated as "Ethernet: ONLINE" when the module is operating properly, and as "Ethernet: OFFLINE" when the module is not operating properly. Module errors require the module to be reinitialized. The module is initialized on power up or can be initialized using the OPI. To initialize the module using the OPI, first disable the module by selecting *None* in the *Setup* | *Hardware* | *Network Type* menu and then select *Anybus* to enable the module.

In applications where the MPS start/stop functions are controlled by the network, the MPS can be configured to trip or alarm on loss of communication to the module. This feature is enabled using the *Setup* | *Hardware* | *Network Comms* | *Network Error* menu.

To prevent a timeout trip when using the *Anybus* selection (legacy Modbus TCP or EtherNet/IP), see Section 3.3.

2.4 FILE SYSTEM

The module contains a file system that may be useful for storing files associated with the MPS. The file system is a fixed-size storage area with a hierarchical directory structure.

The file system is accessible via FTP, Telnet, HTTP.

The file system is case sensitive. This means that the file 'AnyBus.txt' is not identical to the file 'AnyBus.TXT'. Filenames can be a maximum of 48 characters long. Pathnames can be 256 characters in total, filename included.

NOTES:

(1) Although IPConfig software can still be used to set the IP address, mask and gateway, these settings are temporary and overwritten by the menu-system value when the MPS Ethernet driver is re-started during powerup or when network parameters are changed.

(2) The communication address is defined by the MPS *Ethernet IP* setting and is unique for each MPS. The *Network ID* setting is ignored by the MPS. The Modbus broadcast address of 255 is not supported.

(3) Communications options are mutually exclusive. The RS-485 interface is enabled only when Modbus RTU is selected.

(4) Select *Anybus* or *Modbus TCP*, only if the MPS has the Ethernet option installed (MPS-CTU-04-XX).

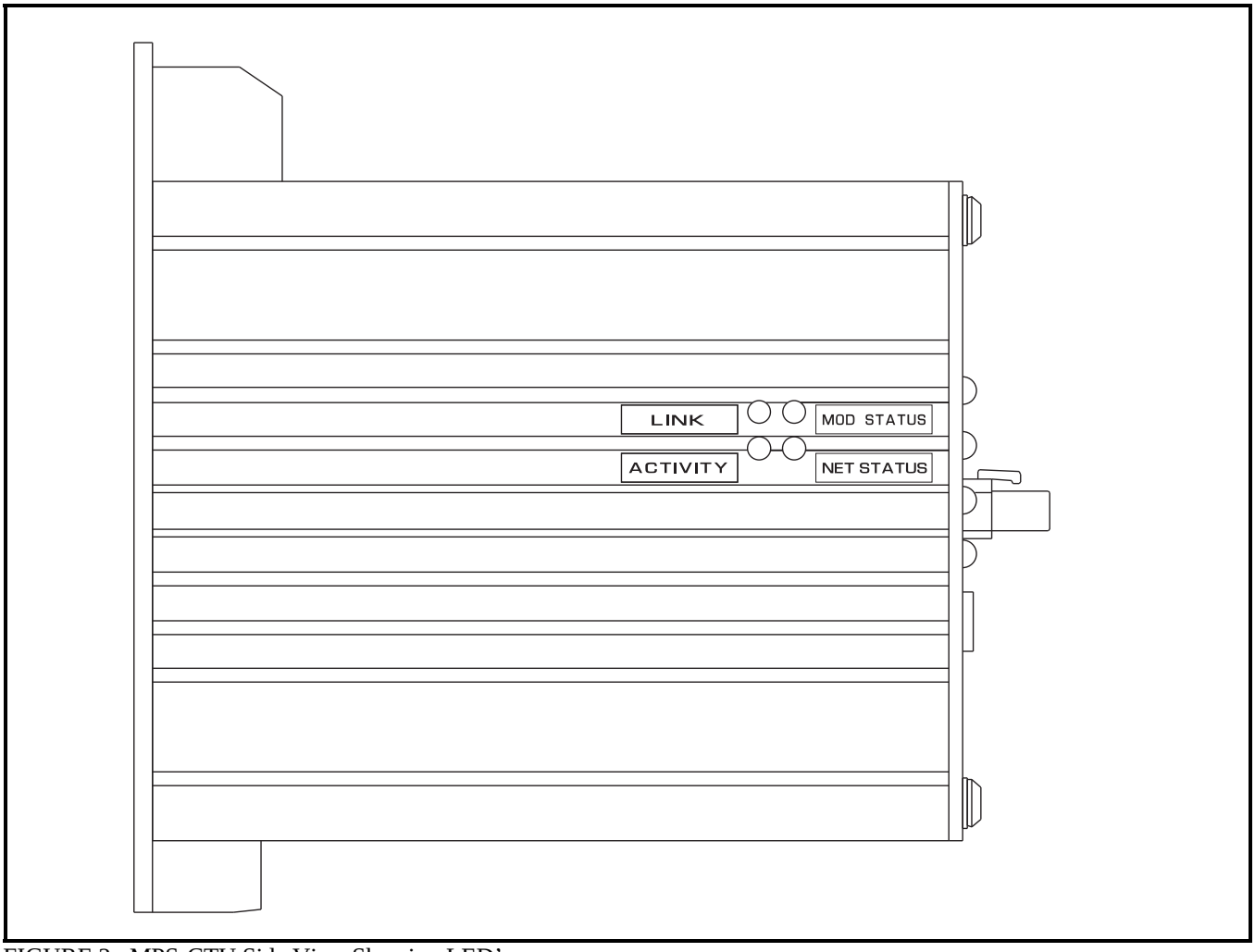

FIGURE 2. MPS-CTU Side View Showing LED's.

3. ETHERNET/IP

This section contains information relative to operation using the *Anybus* protocol selection which supports EtherNet/IP.

The MPS is a slave (server) on the network. It cannot initiate communication.

Up to 5 clients can be connected simultaneously to a single MPS server.

NOTE: The *Anybus* selection is required to support EtherNet/IP and legacy Modbus TCP.

EtherNet/IP uses INPUT and OUTPUT assemblies to transfer data. Input assemblies are used to transfer data from the MPS to the network, and OUTPUT assemblies are used to transfer data from the network to the MPS.

The INPUT assembly consists of 64 bytes representing user-defined data. User defined data is configured by entering the required MPS register numbers in the User Defined Register block using the MPS menu system *Setup | Hardware | Network Comms | User Registers* or by using SE-Comm-RIS program. The format of the data in the assembly is a function of the associated MPS Register. For register definitions and formats see MPS manual Appendix E and F. For example, to access the first four RTD temperatures in RTD Module 1, enter register numbers 902, 903, 904, 905, 906, 907, 908, 909 in the User Defined data area. In the resulting assembly, the first 8 words (16 bytes) will contain the four float values of the RTD temperatures. The remaining values are a function of the corresponding User Register pointers and can be any type. To prevent a read error, unused User Defined data must be set to a valid MPS Register number or zero. Byte order for 16- and 32- bit values follows the convention for the specific protocol and may not be the same as indicated in MPS Appendix E, however, register numbers for float values are still entered in sequence as per the example above.

The OUTPUT area contains a 4-word (8-byte) memory buffer that is used to send control commands to the MPS. This memory has read/write access from the network. Network output is sent to this buffer and the buffer is read by the MPS.

The first word in the buffer (byte 0,1) is the Request Header. This value is used to identify the message as a control-command request. A transition from 0 to 3 indicates a control command. For control commands, the second word is one of the values listed in Table 6.

TABLE 6 MPS COMMAND TABLE

COMMAND CODE	ACTION
0x0000	STOP
0x0001	START1
0x0002	START2
0x0003	Reset Trips
0x0004	Set Real-Time Clock
0x0005	Clear Data-Logging Records
0x0006	Clear Trip Counters
0x0007	Clear Energy Totals
0x0008	Clear Running Hours
0x0009	Emergency I^2t and Trip Reset
0x000A	Select Local Control
0x000B	De-select Local Control
0x000C	Re-enable Temperature Protection

The command buffer should be written using a single message, however, in some cases where a configuration tool is used, individual bytes may be sent as they are entered. For these applications, the low byte of the Request Header must be sent last and only after all other bytes have been entered.

NOTE: It may be more convenient to send control commands using Explicit Messaging. See Section 4.2 Attribute 100.

3.1 ETHERNET/IP INPUT DATA OBJECT READ

INPUT data is read by a GetSingleAttribute service to Class 4, Instance 100, Attribute 3. Byte order for 16- and 32- bit values follows the convention for the EtherNet/IP protocol and is not the same as indicated in MPS Appendix E. In any case, float value registers should be listed as two registers in sequence (902, 903...).

3.2 ETHERNET/IP OUTPUT DATA OBJECT WRITE

The OUTPUT assembly (memory buffer) is written using the SetSingleAttribute to assembly Class 4, Instance 150, Attribute 3. The Control Command Assembly is shown in Table 7.

TABLE 7 ETHERNET/IP CONTROL COMMAND ASSEMBLY

BYTE NUMBER	DESCRIPTION
0	Request Header (Low)
1	Request Header (High)
2	MPS Command (Low)
3	MPS Command (High)
4-7	Not used

3.3 TIMEOUT PREVENTION

The MPS can be configured to trip or alarm on loss of communication using the *Setup* | *Hardware* | *Network Comms* menu.

To prevent a trip or alarm, an Explicit Message must be sent to any Class other than the Assembly Class, or new data must be written to the OUTPUT memory buffer at an interval less than the MPS trip time of 3 seconds. The suggested method is to use the Control Command format. At regular intervals write an incrementing value to the Command word (bytes 2,3) while keeping the Request Header word (bytes 0,1) at 0. Keeping the Request Header at 0 prevents the MPS from interpreting the Command data as a valid control command.

Incrementing the Command word ensures that a "changed data" event is posted to indicate valid communications. Reading data from the I/O area of the module is not sufficient to satisfy the time-out timer.

Communication status is displayed in the *Metering* | *Comm* State menu.

Writes to the OUPUT memory buffer are indicated by "Output: NO" or "Output: YES". If the module is receiving output from the network, then "Output YES" will be displayed.

3.4 NETWORK CONFIGURATION FILES

For EtherNet/IP, an eds file is available from www.anybus.com. As part of the network configuration, the input and output assembly size may need to be specified. The INPUT assembly size is fixed at 64 bytes and the OUTPUT assembly size is 8 bytes.

This document does not describe the specific objects required to support the EtherNet/IP protocol. For details on these objects, see the Anybus-S documentation at www.anybus.com.

3.5 RSLOGIX5000 SETUP

Add a Generic Ethernet Module as a New Module to the PLC. The comm. Format for the MPS is Data-INT. The Input Assembly Instance is 100 with a size of 32. The Output Assembly Instance is 150 with a size of 4 and the Configuration Assembly Instance is 1 with a size of 0.

4. CLASSES

4.1 IDENTITY OBJECT 0x01

Identity Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

Identity Class (1), Instance (0) Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE
1	Revision	Get	Revision of this object.	1	UINT
2	Max Instance	Get	Maximum number of instances.	1	UINT

Identity Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modify the specified attribute.

Identity Class (1), Instance (1) Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Vendor ID	Get	Identification of each vendor by number.	691	UINT	
2	Device Type	Get	Communications	12	UINT	
3	Product Code	Get	Platform Type Adapter	201	UINT	0
4	Revision	Get	Major revision must match the EDS value.	4.100	A2 02 C6 C6	
5	Status	Get	Summary status of the device.	0, 0, 255	WORD	
6	Serial Number	Get	Serial Number of the Anybus Module.	N/A, 0, 999999999	UDINT	
7	Product Name	Get	Human Readable Identification	"Startco MPS"	SHORT_ STRING	

4.2 CONTROL SUPERVISOR 0x29

Control Supervisor Class (0x29), Instance (0) Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE
1	Revision	Get	Revision of this object.	1	UINT
2	Max Instance	Get	Maximum number of instances.	1	UINT

Supervisor Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modifies specified attribute.

Supervisor Class (0x29), Instance (1) Attributes

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Comm Register
100 (0x64)	Command	Get/Set	A command "Set" will cause the requested command to be issued. A "Get" will read the last command. 0 = Stop 1 = Start 1 2 = Start 2 3 = Reset Trips 4 = Set RTC 5 = Clear Data Logging Records 6 = Clear Trips Counters 7 = Clear Energy Totals 8 = Clear Running Time 9 = Emergency I²t Reset 10 = Select Local-Input Ctrl 11 = Release Local-Input Ctrl 12 = Re-enable Temperature Protection	0, 0, 12	USINT	
101 (0x65)	DIF Enable	Get/Set	Differential Module Enable	0,0,1	UINT	1277
102 (0x66)	DIF Error Trip Action	Get/Set	DIF Module Error trip action: 0 = Disable 1 = Trip1 2 = Trip2 3 = Trip3 4 = Trip1 & Trip2 5 = Trip1 & Trip3 6 = Trip1 & Trip2 & Trip3 7 = Trip2 & Trip3	0,0,7	UINT	1278
103 (0x67)	DIF Error Alarm Action	Get/Set	DIF Module Error alarm action: 0 = Disable 1 = Alarm1 2 = Alarm2 3 = Alarm3 4 = Alarm1 & Alarm2 5 = Alarm1 & Alarm3 6 = Alarm1 & Alarm2 & Alarm3 7 = Alarm2 & Alarm3	0,0,7	UINT	1279
104 (0x68)	DIF Error Trip Count	Get	Module Error Trip Count		UINT	1194
105(0x69)	Reserved					
106 (0x6A)	Trip Action	Get/Set	OPI Loss Trip Action: 0 = Disable 1 = Trip1 2 = Trip2 3 = Trip3 4 = Trip1 & Trip2 5 = Trip1 & Trip3 6 = Trip1 & Trip2 & Trip3 7 = Trip2 & Trip3	0, 0, 7	UINT	237
107 (0x6B)	# of OPI's	Get/Set	Selects the number of OPI's connected to the control unit.	1, 0, 3	UINT	238
108 (0x6C)	OPI Remote	Get/Set	0 = Enable OPI to Select REMOTE 1 = OPI Cannot Select REMOTE	0, 0, 1	UINT	239
109 (0x6D)	OPI Control	Get/Set	0 = Enable OPI Motor Control 1 = Disable OPI Motor Control	0, 0, 1	UINT	240
110 (0x6E)	OPI Local	Get/Set	0 = Enable OPI to Select LOCAL 1 = OPI Cannot Select LOCAL	0, 0, 1	UINT	241
111 (0x6F)	OPI Trips	Get	Number of OPI Comm Trips		UINT	1185

Supervisor Class (0x29), Instance (1) Attributes (continued)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Comm Register
112 (0x70)	RemGrpDig	Get/ Set	Bind digital start sources to the REMOTE group. 0 = Include in Group 1 = Do Not Include in Group	0, 0, 1	UINT	242
113 (0x71)	RemGrpNet	Get/Set	Bind OPI start sources to the REMOTE group. 0 = Include in Group 1 = Not in Group	0, 0, 1	UINT	243
114 (0x72)	RemGrpOPI	Get/Set	Bind Net start sources to the REMOTE group. 0 = Include in Group 1 = Not in Group	0, 0, 1	UINT	244
115 (0x73)	Starter Type	Get/Set	Selects the starter type: 0 = Protection Only 1 = Full Voltage Non-Reversing 2 = Adjustable-Speed Drive 3 = Soft Start 4 = Full Voltage Reversing 5 = Two Speed * 6 = Reactor/Resistor Closed Transition 7 = Reactor/Resistor Open Transition 8 = Slip Ring 9 = Soft Start With Bypass 10 = Port Winding * 11 = Double Delta * 12 = Autotransformer 13 = Two Winding * 14 = Wye-Delta Open Trans. * 15 = Wye-Delta Closed Trans. * * Uses Full-Load Current 2	0, 0, 15	UINT	248
116 (0x74)	Start Time	Get/Set	See Main Product Manual	20, 0.1, 500	REAL	249/250
117 (0x75)	Start Delay 1	Get/Set	See Main Product Manual	20, 0.1, 500	REAL	251/252
118 (0x76)	Start Delay 2	Get/Set	See Main Product Manual	20, 0.1, 500	REAL	253/254
119 (0x77)	Start Delay 3	Get/Set	See Main Product Manual	20, 0.1, 500	REAL	255/256
120 (0x78)	Backspin Enable	Get/Set	0 = Backspin Timer Enabled 1 = Backspin Timer Disabled	1, 0, 1	UINT	257
121 (0x79)	Backspin Delay	Get/Set	Backspin Delay in Seconds	5, 0.1, 100	REAL	258/259
122 (0x7A)	Sequence Trips	Get	Number of Starter Sequence Trips		UINT	1184
123 (0x7B)	Stop Count	Get	Number of trips caused by STOP when starter type is set to Protection Only.		UINT	1186
124 (0x7C)	RY Status Trips	Get	Number of Contactor Status Trips		UINT	1148
125 (0x7D)	Transfer Type	Get/Set	Soft-Start Transfer Type 0 = Time Transfer 1 = Current Transfer	0, 0, 1	UINT	260
126 (0x7E)	Transfer Level	Get/Set	Level in % FLA	1.25, 1.0, 3.0	REAL	261/262
127(0x7f)	Reserved					

Supervisor Class (0x29), Instance (1) Attributes (Continued)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Comm Register
128 (0x80)	RY1 Function	Get/Set	Function Assigned to Relay 1: 0 = None 1 = Starter RLYA 2 = Starter RLYB 3 = Starter RLYC 4 = Starter RLYD 5 = Trip1 6 = Alarm1 7 = Aux 8 = Interlock 9 = Local 10 = Current Detected 11 = Run Mode 12 = Start Sequence Complete 13 = Thermal Lockout 14 = None 15 = Watchdog 16 = Trip3 17 =Alarm2 18 = Alarm3 19 = Trip1 Pulse 20 = Reduced OC	0, 0, 20	UINT	334
129 (0x81)	RY1 Mode	Get/Set	0 = Fail Safe, 1 = Non Fail Safe	0, 0, 1	UINT	335
130 (0x82)	RY2 Function	Get/ Set	See Attribute 0x80	0, 0, 20	UINT	336
131 (0x83)	RY2 Mode	Get/Set	0 = Fail Safe, 1 = Non Fail Safe	0, 0, 1	UINT	337
132 (0x84)	RY3 Function	Get/ Set	See Attribute 0x80	0, 0, 20	UINT	338
133 (0x85)	RY3 Mode	Get/Set	0 = Fail Safe, 1 = Non Fail Safe	0, 0, 1	UINT	339
134 (0x86)	RY4Function	Get/ Set	See Attribute 0x80	0, 0, 20	UINT	340
135 (0x87)	RY4 Mode	Get/Set	0 = Fail Safe, 1 = Non Fail Safe	0, 0, 1	UINT	341
136 (0x88)	RY5 Function	Get/ Set	See Attribute 0x80	0, 0, 20	UINT	342
137 (0x89)	RY5 Mode	Get/Set	0 = Fail Safe, 1 = Non Fail Safe	0, 0, 1	UINT	343
138 (0x8A)	RY Pulse Time	Get/Set	Specifies the duration of the trip pulse when the RY function is set to "Trip1 Pulse".	0.25, 0.05, 10	REAL	344
144 (0x90)	TA Summary	Get	Trip, Alarm, Status Summary Bit 0: 1 = Trip (Trip1 or Trip3) Bit 1: 1 = Alarm (Alarm 1, 2, 3) Bit 2: 1 = Trip2 Bit 3: 1 = Interlocks Not Valid Bit 4: 1 = Start Lock Active Bit 5: 1 = Stop Input Active		WORD	1096
145 (0x91)	Motor Status	Get	Bit 0: 1 = I > Threshold Bit 1: 1 = 10% < I < 125% for 10 s Bit 2: 1 = Tach at Full Speed Bit 3: 1 = I > 120% FLA Bit 4: 1 = Temperature Bypassed Bit 5: 1 = Reduced OC On		WORD	1097
146 (0x92)	Starter Status	Get	1 = Start 1 2 = Run 1 (Sequence Complete) 3 = Start 2 4 = Run 2 (Sequence Complete) 5 = Stop 6 = Backspin Timer Active		UINT	1098

Supervisor Class (0x29), Instance (1) Attributes (Continued)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
147 (0x93)	Digital Inputs	Get	Bit 0: IN1 Voltage Detected Bit 1: IN2 Voltage Detected Bit 2: IN3 Voltage Detected Bit 3: IN4 Voltage Detected Bit 4: IN5 Voltage Detected Bit 5: IN6 Voltage Detected Bit 6: IN7 Voltage Detected		WORD	1099
148 (0x94)	Relay Outputs	Get	Bit 0: Relay 1 Energized Bit 1: Relay 2 Energized Bit 2: Relay 3 Energized Bit 3: Relay 4 Energized Bit 4: Relay 5 Energized		WORD	1100
149..151	Reserved					
152 (0x98)	Trip/Alarm Msg 0	Get	Trip and Alarm FIFO. See Main Product Manual Appendix F T27. 255= No trip or alarm.		UINT	1104
153 (0x99)	Trip/Alarm Msg 1	Get	Trip and Alarm FIFO. See Main Product Manual Appendix F T27. 255= No trip or alarm.		UINT	1105
154 (0x9A)	Trip/Alarm Msg 2	Get	Trip and Alarm FIFO. See Main Product Manual Appendix F T27. 255= No trip or alarm.		UINT	1106
155 (0x9B)	Trip/Alarm Msg 3	Get	Trip and Alarm FIFO. See Main Product Manual Appendix F T27. 255= No trip or alarm.		UINT	1107
156 (0x9C)	Trip/Alarm Msg 4	Get	Trip and Alarm FIFO. See Main Product Manual Appendix F T27. 255= No trip or alarm.		UINT	1108
157 (0x9d)	Revision	Get	Revision of Firmware 100 = 1.00	N/A, 100, N/A	UINT	1
158 (0x9e)	System Name	Get/Set	22 characters. Only 20 significant.	"Startco MPS"	SHORT_ STRING	600
159 (0x9f)	Password	Get/Set	22 characters. Only 4 significant.	"1111"	SHORT_ STRING	590

4.3 OVERLOAD CLASS 0x2C

Overload Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

Overload Class (0x2C), Instance (0) Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE
1	Revision	Get	Revision of this object.	1	UINT
2	Max Instance	Get	Maximum number of instances.	1	UINT

Overload Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modify specified attribute.

Overload Class (0x2C), Instance (1) Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
100 (0x64)	Trip Action	Get/Set	0 = Disable 1 = Trip1 2 = Trip2 3 = Trip3 4 = Trip1 & Trip2 5 = Trip1 & Trip3 6 = Trip1 & Trip2 & Trip3 7 = Trip2 & Trip3	1, 0, 7	UINT	8
101 (0x65)	Thermal Model	Get/Set	0 = NEMA 1 = I^2t	0, 0, 1	UINT	9
102 (0x66)	Start Inhibit	Get/Set	Inhibits Start if I^2t < Thermal Lockout Level 0 = Enable 1 = Disable	1, 0, 1	UINT	10
103 (0x67)	K-Factor	Get/Set	Used in I^2t Algorithm	6, 1, 10	REAL	11/12
104 (0x68)	LR Current	Get/Set	Locked Rotor Current (x FLA)	6, 1, 10	REAL	12/14
105 (0x69)	LR Time Cold	Get/Set	Locked Rotor Time Cold (s)	10, 0.2, 100	REAL	15/16
106 (0x6A)	LR Time Hot	Get/Set	Locked Rotor Time Hot (s)	5, 0.2, 100	REAL	17/18
107 (0x6B)	Cooling Factor	Get/Set	Multiples of Running Time Constant	2, 0.1, 50	REAL	19/20
108 (0x6C)	Thermal Lock Level	Get/Set	Thermal Reset/Inhibit Level per Unit	0.3, 0.1, 0.9	REAL	21/22
109 (0x6D)	Overload Alarm	Get/Set	Level where Alarm Occurs	1.0, 0.5, 1.0	REAL	23/24
110 (0x6E)	Alarm Action	Get/Set	0 = Disable 1 = Alarm1 2 = Alarm2 3 = Alarm3 4 = Alarm1 & Alarm2 5 = Alarm1 & Alarm3 6 = Alarm1 & Alarm2 & Alarm3 7 = Alarm2 & Alarm3	1, 0, 7	UINT	25
111 (0x6F)	V Connection	Get/Set	Voltage Input Connection 0 = None 1 = 1PT 2 = 2PT 3 = 3PT	0, 0, 3	UINT	209
112 (0x70)	CT Primary	Get/Set	CT Primary Rating (A)	100, 1, 5000	REAL	210/211
113 (0x71)	EFCT Primary	Get/Set	EFCT Primary Rating (A)	5, 1, 5000	REAL	212/213
114 (0x72)	Vin Rating	Get/Set	Input Voltage at Rated System Voltage (kV)	0.12, 0.03, 0.6	REAL	214/215
115 (0x73)	Frequency	Get/Set	System Frequency: 0 = 50, 1 = 60 Hz	1, 0, 1	UINT	224
116 (0x74)	FLA Rating 1	Get/Set	Full-Load Current #1	100, 1, 5000	REAL	225/226
117 (0x75)	System Voltage	Get/Set	Line-to-Line Voltage (kV)	0.6, 0.12, 25	REAL	227/228
118 (0x76)	Sync Speed	Get/Set	Motor Synchronous Speed (RPM)	1800, 100, 10k	REAL	229/230
119 (0x77)	Service Factor	Get/Set	Motor Service Factor	1, 1, 1.25	REAL	233/234
120 (0x78)	FLA Rating 2	Get/Set	Full-Load Current #2	100, 1, 5000	REAL	235/236
121 (0x79)	Trip Count	Get	Counts Overload Trips		UINT	1132
122 (0x7A)	Run-Mode Delay	Get/Set	Time delay defines when motor is in run mode.	10, 5, 60	REAL	216/217
123(0x7B)	SPH Trip Action	Get/Set	Starts Per Hour Trip Action.	0,0,7	UINT	1270
124(0x7C)	SPH Alarm Action	Get/Set	Starts Per Hour Alarm Action	0,0,7	UINT	1271

Overload Class (0x2C), Instance (1) Attributes (Continued)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
125(0x7D)	Starts Per Hour	Get/Set	Starts Per Hour setting: 0= 1 Start Per Hour 9= 10 Starts Per Hour	4,0,9	UINT	1272
126(0x7E)	Time Between Starts	Get/Set	Time in minutes between starts.	0,0,500	REAL	1273/1274
127(0x7F)	SPH Trip Count	Get	Number of SPH trips.		UINT	1193
128(0x80)	Overload Reset Type	Get/Set	Thermal Overload Reset Type	0,0,2	UINT	26
144 (0x90)	I_A	Get	Phase A Current (A)		REAL	860/861
145 (0x91)	I_B	Get	Phase B Current (A)		REAL	862/863
146 (0x92)	I_C	Get	Phase C Current (A)		REAL	864/865
147 (0x93)	$3I_O$	Get	Ground-Fault Current (A)		REAL	866/867
148 (0x94)	V_{ab}	Get	Line-to-Line Voltage (kV)		REAL	868/869
149 (0x95)	V_{bc}	Get	Line-to-Line Voltage (kV)		REAL	870/871
150 (0x96)	V_{ca}	Get	Line-to-Line Voltage (kV)		REAL	872/873
151 (0x97)	S	Get	Apparent Power (kVA)		REAL	874/875
152 (0x98)	Q	Get	Reactive Power (kVAC)		REAL	876/877
153 (0x99)	P	Get	Real Power (kW)		REAL	878/879
154 (0x9A)	PF	Get	Power Factor	–1 to +1	REAL	880/881
155 (0x9B)	Used I^2t	Get	Used Thermal Capacity (%)		REAL	882/883
156 (0x9C)	Thermal Trend	Get	Thermal Trend (%)		REAL	886/887
157 (0x9D)	+Seq I	Get	Positive Sequence Current (Pu)		REAL	888/889
158 (0x9E)	-Seq I	Get	Negative Sequence Current (Pu)		REAL	890/891
159 (0x9F)	Unbalance I	Get	Current Unbalance (Pu)		REAL	892/893
160 (0xA0)	Frequency	Get	Frequency (from Vab)		REAL	966/967
161 (0xA1)	-Seq V	Get	Negative Sequence Voltage (Pu)		REAL	896/897
162 (0xA2)	Unbalance V	Get	Voltage Unbalance (Pu)		REAL	898/899
163 (0xA3)	Run Time	Get	Running Time in Seconds		UDINT	1210
164 (0xA4)	KWs	Get	KW Seconds		LREAL	1212..15
165 (0xA5)	KVAs	Get	KVA Seconds		LREAL	1216..19
166 (0xA6)	KVARs	Get	KVAR Seconds		LREAL	1220..23
167(0xA7)	DIF Ia	Get	Differential Current, Phase A		REAL	1224/1225
168(0xA8)	DIF Ib	Get	Differential Current, Phase B		REAL	1226/1227
168(0xA9)	DIF Ic	Get	Differential Current, Phase C		REAL	1228/1229

4.4 SET POINT CLASS 0x64

Set Point Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

Set Point Class (0x64), Instance (0) Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE
1	Revision	Get	Revision of this object.	5	UINT
2	Max Instance	Get	Maximum number of instances.	22	UINT

Set Point Object Instances

Set Point Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modifies specified attribute.

The set point class consists of seven attributes. Each set-point instance may use some or all of these attributes.

Attribute 1 - Trip Action

Specifies the action to take on a trip.

0 = Disable
1 = Trip1 (1)
2 = Trip2
3 = Trip3
4 = Trip1 & Trip2
5 = Trip1 & Trip3
6 = Trip1 & Trip2 & Trip3
7 = Trip2 & Trip3

Attribute 2 - Alarm Action

Specifies the action to take on an alarm.

0 = Disable
1 = Alarm1
2 = Alarm2
3 = Alarm3
4 = Alarm1 & Alarm2
5 = Alarm1 & Alarm3
6 = Alarm1 & Alarm2 & Alarm3
7 = Alarm2 & Alarm3

Attribute 3 - Trip Level

Attribute 4 - Trip Delay

Attribute 5 - Alarm Level

Attribute 6 - Alarm Delay

Attribute 7 - Trip Counter for the set point

(1) Initiates a STOP when a starter function is enabled

Class 0x64, Instance 1 - Overcurrent

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	1, 0, 7	UINT	32
3	Trip Level	Get/Set	10, 1, 15	REAL	33/34
4	Trip Delay	Get/Set	0.1, 0, 10	REAL	35/36
7	Trip Count	Get		UINT	1130

Class 0x64, Instance 2 - Aux. Overcurrent

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	1, 0, 7	UINT	40
3	Trip Level	Get/Set	10, 1, 15	REAL	41/42
4	Trip Delay	Get/Set	0.1, 0, 10	REAL	43/44
7	Trip Count	Get		UINT	1131

Class 0x64, Instance 3 - Earth Fault

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	1, 0, 7	UINT	48
2	Alarm Action	Get/Set	1, 0, 7	UINT	58
3	Trip Level	Get/Set	0.4, 0.05, 1	REAL	50/51
4	Trip Delay	Get/Set	0.25, 0, 100	REAL	52/53
5	Alarm Level	Get/Set	0.20, 0.05, 1	REAL	54/55
6	Alarm Delay	Get/Set	1, 0, 100	REAL	56/57
7	Trip Count	Get		UINT	1133

Class 0x64, Instance 4 - Jam

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	1, 0, 7	UINT	64
2	Alarm Action	Get/Set	1, 0, 7	UINT	73
3	Trip Level	Get/Set	6, 1, 10	REAL	65/66
4	Trip Delay	Get/Set	5, 1, 100	REAL	67/68
5	Alarm Level	Get/Set	3, 1, 10	REAL	69/70
6	Alarm Delay	Get/Set	5, 1, 100	REAL	71/72
7	Trip Count	Get		UINT	1136

Class 0x64, Instance 5 - Current Unbalance (I)

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	1, 0, 7	UINT	80
2	Alarm Action	Get/Set	1, 0, 7	UINT	89
3	Trip Level	Get/Set	0.25, 0.05, 1	REAL	81/82
4	Trip Delay	Get/Set	15, 1, 100	REAL	83/84
5	Alarm Level	Get/Set	0.10, 0.05, 1	REAL	85/86
6	Alarm Delay	Get/Set	10, 1, 100	REAL	87/88
7	Trip Count	Get		UINT	1134

Class 0x64, Instance 6 - Phase Reverse (I)

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	96
2	Alarm Action	Get/Set	0, 0, 7	UINT	95
4	Phase Reverse Delay	Get/Set	2, 1, 100	REAL	97/98
7	Trip Count	Get		UINT	1144

Class 0x64, Instance 7 - Phase Loss (I)

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	1, 0, 7	UINT	99
4	Phase Loss Delay	Get/Set	5, 1, 100	REAL	100/101
7	Trip Count	Get		UINT	1143

Class 0x64, Instance 8 - Voltage Unbalance

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	1, 0, 7	UINT	104
2	Alarm Action	Get/Set	1, 0, 7	UINT	113
3	Trip Level	Get/Set	0.1, 0.05, 1	REAL	105/106
4	Trip Delay	Get/Set	15, 1, 100	REAL	107/108
5	Alarm Level	Get/Set	0.05, 0.05, 1	REAL	109/110
6	Alarm Delay	Get/Set	10, 1, 100	REAL	111/112
7	Trip Count	Get		UINT	1135

Class 0x64, Instance 9 - Phase Reverse (V)

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	120
4	Phase Reverse Delay	Get/Set	2, 1, 100	REAL	121/122
7	Trip Count	Get		UINT	1146

Class 0x64, Instance 0x0A - Phase Loss (V)

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	123
4	Phase Loss Delay	Get/Set	5, 1, 100	REAL	124/125
7	Trip Count	Get		UINT	1145

Class 0x64, Instance 0x0B - Undercurrent

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	128
2	Alarm Action	Get/Set	0, 0, 7	UINT	137
3	Trip Level	Get/Set	0.5, 0.1, 1	REAL	129/130
4	Trip Delay	Get/Set	10, 1, 100	REAL	131/132
5	Alarm Level	Get/Set	0.8, 0.1, 1	REAL	133/134
6	Alarm Delay	Get/Set	20, 1, 100	REAL	135/136
7	Trip Count	Get		UINT	1137

Class 0x64, Instance 0x0C - PTC Temperature

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	144
2	Alarm Action	Get/Set	0, 0, 7	UINT	145
7	Trip Count	Get		UINT	1145

Class 0x64, Instance 0x0D - Overvoltage

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	1, 0, 7	UINT	176
2	Alarm Action	Get/Set	1, 0, 7	UINT	185
3	Trip Level	Get/Set	1.2, 1, 1.4	REAL	177/178
4	Trip Delay	Get/Set	5, 1, 500	REAL	179/180
5	Alarm Level	Get/Set	1.1, 1, 1.4	REAL	181/182
6	Alarm Delay	Get/Set	5, 1, 500	REAL	183/184
7	Trip Count	Get		UINT	1138

Class 0x64, Instance 0x0E - Undervoltage

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	192
2	Alarm Action	Get/Set	0, 0, 7	UINT	201
3	Trip Level	Get/Set	0.7, 0.5, 1	REAL	193/194
4	Trip Delay	Get/Set	5, 1, 500	REAL	195/196
5	Alarm Level	Get/Set	0.8, 0.5, 1	REAL	197/198

Class 0x64, Instance 0x0E – Undervoltage (continued)

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
6	Alarm Delay	Get/Set	5, 1, 500	REAL	199/200
7	Trip Count	Get		UINT	1139

Class 0x64, Instance 0x0F - Underfrequency

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	1230
2	Alarm Action	Get/Set	0, 0, 7	UINT	1248
3	Trip Level	Get/Set	45, 30, 80	REAL	1231/1232
4	Trip Delay	Get/Set	5, 0.5, 500	REAL	1233/1234
5	Alarm Level	Get/Set	48, 30, 80	REAL	1235/1236
6	Alarm Delay	Get/Set	1, 0.5, 500	REAL	1237/1238
7	Trip Count	Get		UINT	1188

Class 0x64, Instance 0x10 - Overfrequency

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	1239
2	Alarm Action	Get/Set	0, 0, 7	UINT	1249
3	Trip Level	Get/Set	65, 30, 80	REAL	1240/1241
4	Trip Delay	Get/Set	5, 0.5, 500	REAL	1242/1243
5	Alarm Level	Get/Set	62, 30, 80	REAL	1244/1245
6	Alarm Delay	Get/Set	1, 0.5, 500	REAL	1246/1247
7	Trip Count	Get		UINT	1189

Class 0x64, Instance 0x11 - Power Factor Quadrant 4

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	166
2	Alarm Action	Get/Set	0, 0, 7	UINT	175
3	Trip Level	Get/Set	0.8, 0.5, 1	REAL	167/168
4	Trip Delay	Get/Set	5, 0.2, 500	REAL	169/170
5	Alarm Level	Get/Set	0.9, 0.5, 1	REAL	171/172
6	Alarm Delay	Get/Set	5, 0.2, 500	REAL	173/174
7	Trip Count	Get		UINT	1187

Class 0x64, Instance 0x12 - Power Factor Quadrant 3

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	1250
2	Alarm Action	Get/Set	0, 0, 7	UINT	1259
3	Trip Level	Get/Set	0.8, 0.5, 1	REAL	1251/1252
4	Trip Delay	Get/Set	5, 0.2, 500	REAL	1253/1254
5	Alarm Level	Get/Set	0.9, 0.5, 1	REAL	1255/1256
6	Alarm Delay	Get/Set	5, 0.2, 500	REAL	1257/1258
7	Trip Count	Get		UINT	1192

Class 0x64, Instance 0x13 - Differential

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	1280
2	Alarm Action	Get/Set	0, 0, 7	UINT	1289
3	Trip Level	Get/Set	1, 0.1, 15	REAL	1281/1282
4	Trip Delay	Get/Set	0.1, 0, 10	REAL	1283/1284
5	Alarm Level	Get/Set	0.5, 0.1, 15	REAL	1285/1286
6	Alarm Delay	Get/Set	0.1, 0, 10	REAL	1287/1288
7	Trip Count	Get		UINT	1195

Class 0x64, Instance 0x14 – Reduced Overcurrent

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	45
3	Trip Level	Get/Set	2, 1, 15	REAL	46/47
7	Trip Count	Get		UINT	1196

Class 0x64, Instance 0x15 – Underpower

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	1070
2	Alarm Action	Get/Set	0, 0, 7	UINT	1079
3	Trip Level	Get/Set	0.8, 0.1, 1.0	REAL	1071/1072
4	Trip Delay	Get/Set	5, 0.5, 500	REAL	1073/1074
5	Alarm Level	Get/Set	0.2, 0.1, 1.0	REAL	1075/1076
6	Alarm Delay	Get/Set	1, 0.5, 500	REAL	1077/1078
7	Trip Count	Get		UINT	1197

Class 0x64, Instance 0x16 – Reversepower

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Trip Action	Get/Set	0, 0, 7	UINT	1080
2	Alarm Action	Get/Set	0, 0, 7	UINT	1089
3	Trip Level	Get/Set	0.2, 0.1, 1.0	REAL	1081/1082
4	Trip Delay	Get/Set	5, 0.5, 500	REAL	1083/1084
5	Alarm Level	Get/Set	0.2, 0.1, 1.0	REAL	1085/1086
6	Alarm Delay	Get/Set	1, 0.5, 500	REAL	1087/1088
7	Trip Count	Get		UINT	1198

4.5 Acceleration Class 0x65

Motor speed is measured using a digital tach connected to Digital Input 8, or a 4–20 mA speed sensor. This class defines parameters for speed protection.

Acceleration Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

Acceleration Class (0x65), Instance (0) Attributes

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type
1	Revision	Get	Revision of this object.	1	UINT
2	Max Instance	Get	Maximum number of instances.	1	UINT

Acceleration Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.
Set_Attribute_Single: Modifies specified attribute.

Instance 1 Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Accel Action	Get/Set	Specifies the action to take on a trip. 0 = Disable 1 = Trip1(1) 2 = Trip2 3 = Trip3 4 = Trip1 & Trip2 5 = Trip1 & Trip3 6 = Trip1 & Trip2 & Trip3 7 = Trip2 & Trip3 (1) Initiates a STOP when a starter function is enabled.	0, 0, 7	UINT	152
2	Speed1	Get/Set	Motor must reach Speed1 in the time defined by Time1. (%FS)	30, 1, 100	REAL	153/154

Instance 1 Attributes (continued)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
3	Time1	Get/Set	Defines the time when Speed1 must be reached. (s)	5, 1, 1000	REAL	155/156
4	Speed2	Get/Set	Motor must reach Speed2 in the time defined by Time2. (%FS)	60, 1, 100	REAL	157/158
5	Time2	Get/Set	Defines the time when Speed2 must be reached. (s)	10, 1, 1000	REAL	159/160
6	Speed3	Get/Set	Motor must reach Speed3 in the time defined by Time3. (%FS)	90, 1, 100	REAL	161/164
7	Time3	Get/Set	Defines the time when Speed3 must be reached. (s)	15, 1, 1000	REAL	163/164
8	Tach Enable	Get/Set	Enables speed measurement even if protection is disabled. 0 = Enabled, 1 = Disabled	1, 0, 1	UINT	330
9	Pulses Per Rev	Get/Set	Sets the number of pulses per revolution for digital tach.	60, 1, 100	REAL	331/332
10 (0x0A)	Tach Speed	Get	Motor Speed from Tach		REAL	900/901
11 (0x0B)	Trip Count	Get	Counts Number of Accel Trips		UINT	1147

4.6 DIGITAL INPUT CLASS 0X66

Digital Input Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

Digital Input Class (0x66), Instance (0) Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE
1	Revision	Get	Revision of this object.	1	UINT
2	Max Instance	Get	Maximum number of instances.	7	UINT

Digital Input Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.
Set_Attribute_Single: Modifies specified attribute.

The digital-input class consists of 5 attributes.

Attribute 1 - Function

Selects the function of the digital input.

0 = Input not used
1 = Start1 (N.O. Contact)
2 = Start2 (N.O. Contact)
3 = Stop (N.C. Contact)
4 = Starter RLYA contactor status
5 = Starter RLYB contactor status
6 = Starter RLYC contactor status
7 = Starter RLYD contactor status
8 = Interlock (N.C.)
9 = Trip1 (N.C.)
10 = Reset (N.O.)
11 = Local Select
12 = Local Start1
13 = Local Start2
14 = 2-Wire Start1
15 = 2-Wire Start2
16 = FLA2 Select
17 = Limit1 Select
18 = Limit2 Select
19 = Reduced OC

Attribute 2 - Bypass Enable/Disable

Attribute applies when the input function is trip. When enabled, the input is bypassed for the time defined by the Bypass Delay when a motor is started using starter control. 0 = Enable, 1 = Disable

Attribute 3 - Bypass Delay

Defines the Trip bypass time duration on start.

Attribute 4 - Trip Delay

Applies only to the trip function.

Attribute 5 - Trip Count

The trip counter only applies to the trip function.

Class 0x66, Instance 1 - Input 1

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Function	Get/Set	0, 0, 19	UINT	264
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	265
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	266/267
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	268/269
5	Trip Counter	Get		UINT	1149

Class 0x66, Instance 2 - Input 2

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Function	Get/Set	0, 0, 19	UINT	274
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	275
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	276/277
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	278/279
5	Trip Counter	Get		UINT	1150

Class 0x66, Instance 3 - Input 3

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Function	Get/Set	0, 0, 19	UINT	284
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	285
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	286/287
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	288/289
5	Trip Counter	Get		UINT	1151

Class 0x66, Instance 4 - Input 4

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Function	Get/Set	0, 0, 19	UINT	294
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	295
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	296/297
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	298/299
5	Trip Counter	Get		UINT	1152

Class 0x66, Instance 5 - Input 5

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Function	Get/Set	0, 0, 19	UINT	304
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	305
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	306/307
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	308/309
5	Trip Counter	Get		UINT	1153

Class 0x66, Instance 6 - Input 6

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Function	Get/Set	0, 0, 19	UINT	314
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	315
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	316/317
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	318/319
5	Trip Counter	Get		UINT	1154

Class 0x66, Instance 7 - Input 7

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	Function	Get/Set	0, 0, 19	UINT	324
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	325
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	326/327
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	328/329
5	Trip Counter	Get		UINT	1155

4.7 Analog I/O Class 0x67

Analog I/O Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.

Analog I/O Class (0x67), Instance (0) Attributes

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type
1	Revision	Get	Revision of this object.	1	UINT
2	Max Instance	Get	Maximum number of instances.	1	UINT

Analog I/O Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.
Set_Attribute_Single: Modifies specified attribute.

Analog I/O Class (0x67), Instance (1) Attributes

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Comm Register
1	Analog In Type	Get/Set	Defines the analog-input type: 0 = Disabled 1 = Generic (Trip1, Alarm1 enabled) 2 = Asd Sets Sampling Frequency 3 = Motor speed	0, 0, 3	UINT	350
2	High Trip	Get/Set	Sets high trip level for generic input type. (mA)	16, 0.1, 20	REAL	351/352
3	Low Trip	Get Set	Sets low trip level for generic input type. (mA)	7, 0.1, 20	REAL	353/354
4	Trip Delay	Get/Set	Applies to generic type. (s)	5, 0.01, 100	REAL	355/356
5	High Alarm	Get/Set	Sets high alarm level for generic input type. (mA)	14, 0.1, 20	REAL	357/358
6	Low Alarm	Get/Set	Sets low alarm level for generic input type. (mA)	9, 0.1, 20	REAL	359/360
7	Alarm Delay	Get/Set	Applies to generic type. (s)	1, 0.01, 100	REAL	361/362
8	ASD_4mA	Get/Set	Applies to type 2 input. Frequency corresponding to 4 mA input. (Hz)	10, 0, 70	REAL	363/364
9	ASD_20mA	Get/Set	Applies to type 2 input. Frequency corresponding to 20 mA input. (%FS)	10, 0, 70	REAL	365/366
10 (0x0A)	Tach_4mA	Get/Set	Applies to type 3 input. % Speed corresponding to 4 mA input. (%FS)	10, 0, 100	REAL	367/368
11 (0x0B)	Tach_20mA	Get/Set	Applies to type 3 input. % Speed corresponding to 20 mA input. (%FS)	100, 0, 100	REAL	369/370

Analog I/O Class (0x67), Instance (1) Attributes (Continued)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
12 (0x0C)	Out Param	Get/Set	Specifies the analog output parameter: 0 = Phase Current 1 = Earth Leakage 2 = Thermal Capacity 3 = Max Stator RTD 4 = Max Bearing RTD 5 = Max Load RTD 6 = Max Ambient RTD 7 = Voltage 8 = Unbalance (I) 9 = Power Factor 10 = Real Power 11 = Reactive Power 12 = Apparent Power 13 = Zero (4 mA) 14 = Full Scale (20 mA) 15= Speed 16 = Differential Current	0, 0, 16	UINT	373/374
13 (0x0D)	Reading	Get	Analog Input Reading (mA)	0, 0, 20	REAL	884/885
14 (0x0E)	High Trips	Get	Input-High Trip Count		UINT	1140
15 (0x0F)	Low Trips	Get	Input-Low Trip Count		UINT	1141

4.8 RTD MODULE CLASS 0x68

RTD Module Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modifies specified attribute.

Class 0x68, Instance 0, Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Revision Number	Get	Revision number of this class	1	UINT	
2	Max Instance	Get	Maximum number of RTD modules	3	UINT	
100 (0x64)	Modules Used	Get/Set	Specifies the number of RTD modules used	0, 0, 3	UINT	390
101 (0x65)	Sensor Trip Action	Get/Set	Specifies trip action to take on a sensor error. 0 = Disable Trips 1 = Trip1(1) 2 = Trip2 3 = Trip3 4 = Trip1 & Trip2 5 = Trip1 & Trip3 6 = Trip1 & Trip2 & Trip3 7 = Trip2 & Trip3 (1) Initiates a STOP when a starter function is enabled.	0, 0, 7	UINT	388

Class 0x68, Instance 0, Attributes (Continued)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
102 (0x66)	Sensor Alarm Action	Get/Set	Specifies alarm action to take on a sensor error. 0 = Disable Alarms 1 = Alarm1 2 = Alarm2 3 = Alarm3 4 = Alarm1 & Alarm2 5 = Alarm1 & Alarm3 6 = Alarm1 & Alarm2 & Alarm3 7 = Alarm2 & Alarm3	1, 0, 7	UINT	379
103 (0x67)	Module Error Trip Action	Get/Set	Specifies trip action to take on a module error. Action list is the same as Attribute 9.	0, 0, 7	UINT	389
104 (0x68)	Module Error Alarm Action	Get/Set	Specifies alarm action to take on a module error. Action list is the same as Attribute A.	1, 0, 7	UINT	380
105 (0x69)	Module1 Comm Trip Count	Get	Number of module1 communication-error trips.		UINT	1180
106 (0x6A)	Module2 Comm Trip Count	Get	Number of module2 communication-error trips.		UINT	1181
107 (0x6B)	Module3 Comm Trip Count	Get	Number of module3 communication-error trips.		UINT	1182
108 (0x6C)	Sensor Trip Count	Get	Number of RTD Sensor Trips		UINT	1183
109 (0x6D)	HMC Enable	Get/Set	Hot Motor Compensation control. 0 = Enable, 1 = Disable		UINT	550
110 (0x6E)	HMC Max Bias	Get/Set	Stator temperature (°C) where compensation ends at 100% I^2t.	150, 40, 200	REAL	551/552
111 (0x6F)	HMC Min Bias	Get/Set	Stator temperature (°C) where compensation begins at 0% I^2t.	40, 40, 200	REAL	553/554
112 (0x70)	Max Stator Temp	Get	Max Stator Temperature (°C)		REAL	950/951
113 (0x71)	Max Bearing Temp	Get	Max Bearing Temperature (°C)		REAL	952/953
114 (0x72)	Max Load Temp	Get	Max Load Temperature (°C)		REAL	954/955
115 (0x73)	Max Amb Temp	Get	Max Ambient Temperature (°C)		REAL	956/957
116 (0x74)	Min Stator Temp	Get	Min Stator Temperature (°C)		REAL	958/959
117 (0x75)	Min Bearing Temp	Get	Min Bearing Temperature (°C)		REAL	960/961
118 (0x76)	Min Load Temp	Get	Min Load Temperature (°C)		REAL	962/963
119 (0x77)	Min Ambient Temp	Get	Min Ambient Temperature (°C)		REAL	964/965
120 (0x78)	Temperature Trip Action	Get/Set	Specifies trip action to take on a sensor error. 0 = Disable Trips 1 = Trip1(1) 2 = Trip2 3 = Trip3 4 = Trip1 & Trip2 5 = Trip1 & Trip3 6 = Trip1 & Trip2 & Trip3 7 = Trip2 & Trip3 (1) Initiates a STOP when a starter function is enabled.	1, 0, 7	UINT	548

Class 0x68, Instance 0, Attributes (Continued)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
121 (0x79)	Temperature Alarm Action	Get/Set	Specifies alarm action to take on a sensor error. 0 = Disable Alarms 1 = Alarm1 2 = Alarm2 3 = Alarm3 4 = Alarm1 & Alarm2 5 = Alarm1 & Alarm3 6 = Alarm1 & Alarm2 & Alarm3 7 = Alarm2 & Alarm3	1, 0, 7	UINT	549

RTD Module Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modifies specified attribute.

Object Instance Attributes 1 to 8 define the RTD type. Selecting an RTD will enable trip and alarm set points. The trip action is fixed as Trip1 and the alarm action is fixed as Alarm1.

0 = RTD Disabled
1 = Platinum 100 ohm
2 = Nickel 100 ohm
3 = Nickel 120 ohm
4 = Copper 10 ohm

Object Instance Attributes 0x09 to 0x10 define the RTD function.

0 = Stator
1 = Bearing
2 = Load
3 = Ambient

Object Instance Attributes 0x11 to 0x20 define the trip and alarm settings in degrees C. The trip action is fixed as Trip1 and the alarm action is fixed as Alarm1.

Object Instance Attributes 0x21 to 0x28 define an 18-character name.

Object Instance Attributes 0x29 to 0x30 are temperature readings.

Object Instance Attributes 0x31 to 0x38 are the trip counters for each of the RTD's.

Class 0x68, Instance 1

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	RTD #1 Type	Get/Set	0, 0, 4	UINT	391
2	RTD #2 Type	Get/Set	0, 0, 4	UINT	392
3	RTD #3 Type	Get/Set	0, 0, 4	UINT	393
4	RTD #4 Type	Get/Set	0, 0, 4	UINT	394
5	RTD #5 Type	Get/Set	0, 0, 4	UINT	395
6	RTD #6 Type	Get/Set	0, 0, 4	UINT	396
7	RTD #7 Type	Get/Set	0, 0, 4	UINT	397
8	RTD #8 Type	Get/Set	0, 0, 4	UINT	398
9	RTD #1 Function	Get/Set	0, 0, 3	UINT	415
10 (0x0A)	RTD #2 Function	Get/Set	0, 0, 3	UINT	416
11 (0x0B)	RTD #3 Function	Get/Set	0, 0, 3	UINT	417
12 (0x0C)	RTD #4 Function	Get/Set	0, 0, 3	UINT	418
13 (0x0D)	RTD #5 Function	Get/Set	0, 0, 3	UINT	419
14 (0x0E)	RTD #6 Function	Get/Set	0, 0, 3	UINT	420
15 (0x0F)	RTD #7 Function	Get/Set	0, 0, 3	UINT	421

Class 0x68, Instance 1 (continued)

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
16 (0x10)	RTD #8 Function	Get/Set	0, 0, 3	UINT	422
17 (0x11)	RTD #1 Trip Level	Get/Set	130, 40, 200	REAL	446/447
18 (0x12)	RTD #1 Alarm Level	Get/Set	110, 40, 200	REAL	448/449
19 (0x13)	RTD #2 Trip Level	Get/Set	130, 40, 200	REAL	450/451
20 (0x14)	RTD #2 Alarm Level	Get/Set	110, 40, 200	REAL	452/453
21 (0x15)	RTD #3 Trip Level	Get/Set	130, 40, 200	REAL	454/455
22 (0x16)	RTD #3 Alarm Level	Get/Set	110, 40, 200	REAL	456/457
23 (0x17)	RTD #4 Trip Level	Get/Set	130, 40, 200	REAL	458/459
24 (0x18)	RTD #4 Alarm Level	Get/Set	110, 40, 200	REAL	460/461
25 (0x19)	RTD #5 Trip Level	Get/Set	130, 40, 200	REAL	462/463
26 (0x1A)	RTD #5 Alarm Level	Get/Set	110, 40, 200	REAL	464/465
27 (0x1B)	RTD #6 Trip Level	Get/Set	130, 40, 200	REAL	466/467
28 (0x1C)	RTD #6 Alarm Level	Get/Set	110, 40, 200	REAL	468/469
29 (0x1D)	RTD #7 Trip Level	Get/Set	130, 40, 200	REAL	470/471
30 (0x1E)	RTD #7 Alarm Level	Get/Set	110, 40, 200	REAL	472/473
31 (0x1F)	RTD #8 Trip Level	Get/Set	130, 40, 200	REAL	474/475
32 (0x20)	RTD #8 Alarm Level	Get/Set	110, 40, 200	REAL	476/477
33 (0x21)	RTD #1 Name	Get/Set	RTD M1 #1	SHORT_ STRING	610..619
34 (0x22)	RTD #2 Name	Get/Set	RTD M1 #2	SHORT_ STRING	620..629
35 (0x23)	RTD #3 Name	Get/Set	RTD M1 #3	SHORT_ STRING	630..639
36 (0x24)	RTD #4Name	Get/Set	RTD M1 #4	SHORT_ STRING	640..649
37 (0x25)	RTD #5 Name	Get/Set	RTD M1 #5	SHORT_ STRING	650..659
38 (0x26)	RTD #6 Name	Get/Set	RTD M1 #6	SHORT_ STRING	660..669
39 (0x27)	RTD #7 Name	Get/Set	RTD M1 #7	SHORT_ STRING	670..679
40 (0x28)	RTD #8 Name	Get/Set	RTD M1 #8	SHORT_ STRING	680..689
41 (0x29)	RTD #1 Temp RDG	Get		REAL	902/903
42 (0x2A)	RTD #2 Temp RDG	Get		REAL	904/905

Class 0x68, Instance 1 (continued)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
43 (0x2B)	RTD #3 Temp RDG	Get		REAL	906/907
44 (0x2C)	RTD #4 Temp RDG	Get		REAL	908/909
45 (0x2D)	RTD #5 Temp RDG	Get		REAL	910/911
46 (0x2E)	RTD #6 Temp RDG	Get		REAL	912/913
47 (0x2F)	RTD #7 Temp RDG	Get		REAL	914/915
48 (0x30)	RTD #8 Temp RDG	Get		REAL	916/917
49 (0x31)	RTD #1 Trip Cntr	Get		UINT	1156
50 (0x32)	RTD #2 Trip Cntr	Get		UINT	1157
51 (0x33)	RTD #3 Trip Cntr	Get		UINT	1158
52 (0x34)	RTD #4 Trip Cntr	Get		UINT	1159
53 (0x35)	RTD #5 Trip Cntr	Get		UINT	1160
54 (0x36)	RTD #6 Trip Cntr	Get		UINT	1161
55 (0x37)	RTD #7 Trip Cntr	Get		UINT	1162
56 (0x38)	RTD #8 Trip Cntr	Get		UINT	1163

Class 0x68, Instance 2

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	RTD #1 Type	Get/Set	0, 0, 4	UINT	399
2	RTD #2 Type	Get/Set	0, 0, 4	UINT	400
3	RTD #3 Type	Get/Set	0, 0, 4	UINT	401
4	RTD #4 Type	Get/Set	0, 0, 4	UINT	402
5	RTD #5 Type	Get/Set	0, 0, 4	UINT	403
6	RTD #6 Type	Get/Set	0, 0, 4	UINT	404
7	RTD #7 Type	Get/Set	0, 0, 4	UINT	405
8	RTD #8 Type	Get/Set	0, 0, 4	UINT	406
9	RTD #1 Function	Get/Set	0, 0, 3	UINT	423
10 (0x0A)	RTD #2 Function	Get/Set	0, 0, 3	UINT	424
11 (0x0B)	RTD #3 Function	Get/Set	0, 0, 3	UINT	425
12 (0x0C)	RTD #4 Function	Get/Set	0, 0, 3	UINT	426
13 (0x0D)	RTD #5 Function	Get/Set	0, 0, 3	UINT	427
14 (0x0E)	RTD #6 Function	Get/Set	0, 0, 3	UINT	428
15 (0x0F)	RTD #7 Function	Get/Set	0, 0, 3	UINT	429
16 (0x10)	RTD #8 Function	Get/Set	0, 0, 3	UINT	430
17 (0x11)	RTD #1 Trip Level	Get/Set	130, 40, 200	REAL	478
18 (0x12)	RTD #1 Alarm Level	Get/Set	110, 40, 200	REAL	480
19 (0x13)	RTD #2 Trip Level	Get/Set	130, 40, 200	REAL	482/483
20 (0x14)	RTD #2 Alarm Level	Get/Set	110, 40, 200	REAL	484/485
21 (0x15)	RTD #3 Trip Level	Get/Set	130, 40, 200	REAL	486/487
22 (0x16)	RTD #3 Alarm Level	Get/Set	110, 40, 200	REAL	488/489
23 (0x17)	RTD #4 Trip Level	Get/Set	130, 40, 200	REAL	490/491
24 (0x18)	RTD #4 Alarm Level	Get/Set	110, 40, 200	REAL	492/493
25 (0x19)	RTD #5 Trip Level	Get/Set	130, 40, 200	REAL	494/495
26 (0x1A)	RTD #5 Alarm Level	Get/Set	110, 40, 200	REAL	496/497
27 (0x1B)	RTD #6 Trip Level	Get/Set	130, 40, 200	REAL	498/499
28 (0x1C)	RTD #6 Alarm Level	Get/Set	110, 40, 200	REAL	500/501
29 (0x1D)	RTD #7 Trip Level	Get/Set	130, 40, 200	REAL	502/503
30 (0x1E)	RTD #7 Alarm Level	Get/Set	110, 40, 200	REAL	504/505
31 (0x1F)	RTD #8 Trip Level	Get/Set	130, 40, 200	REAL	506/507
32 (0x20)	RTD #8 Alarm Level	Get/Set	110, 40, 200	REAL	508/509
33 (0x21)	RTD #1 Name	Get/Set	RTD M2 #1	SHORT_ STRING	690..699
34 (0x22)	RTD #2 Name	Get/Set	RTD M2 #2	SHORT_ STRING	700..709

Class 0x68, Instance 2 (Continued)

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
35 (0x23)	RTD #3 Name	Get/Set	RTD M2 #3	SHORT_ STRING	710..719
36 (0x24)	RTD #4Name	Get/Set	RTD M2 #4	SHORT_ STRING	720..729
37 (0x25)	RTD #5 Name	Get/Set	RTD M2 #5	SHORT_ STRING	730..739
38 (0x26)	RTD #6 Name	Get/Set	RTD M2 #6	SHORT_ STRING	740..749
39 (0x27)	RTD #7 Name	Get/Set	RTD M2 #7	SHORT_ STRING	750..759
40 (0x28)	RTD #8 Name	Get/Set	RTD M2 #8	SHORT_ STRING	760..769
41 (0x29)	RTD #1 Temp RDG	Get		REAL	918/919
42 (0x2A)	RTD #2 Temp RDG	Get		REAL	920/921
43 (0x2B)	RTD #3 Temp RDG	Get		REAL	922/923
44 (0x2C)	RTD #4 Temp RDG	Get		REAL	924/925
45 (0x2D)	RTD #5 Temp RDG	Get		REAL	926/927
46 (0x2E)	RTD #6 Temp RDG	Get		REAL	928/929
47 (0x2F)	RTD #7 Temp RDG	Get		REAL	930/931
48 (0x30)	RTD #8 Temp RDG	Get		REAL	932/933
49 (0x31)	RTD #1 Trip Cntr	Get		UINT	1164
50 (0x32)	RTD #2 Trip Cntr	Get		UINT	1165
51 (0x33)	RTD #3 Trip Cntr	Get		UINT	1166
52 (0x34)	RTD #4 Trip Cntr	Get		UINT	1167
53 (0x35)	RTD #5 Trip Cntr	Get		UINT	1168
54 (0x36)	RTD #6 Trip Cntr	Get		UINT	1169
55 (0x37)	RTD #7 Trip Cntr	Get		UINT	1170
56 (0x38)	RTD #8 Trip Cntr	Get		UINT	1171

Class 0x68, Instance 3

Attribute Number	Attribute Name	Services	Default, Minimum, Maximum	Data Type	Comm Register
1	RTD #1 Type	Get/Set	0, 0, 4	UINT	407
2	RTD #2 Type	Get/Set	0, 0, 4	UINT	408
3	RTD #3 Type	Get/Set	0, 0, 4	UINT	409
4	RTD #4 Type	Get/Set	0, 0, 4	UINT	410
5	RTD #5 Type	Get/Set	0, 0, 4	UINT	411
6	RTD #6 Type	Get/Set	0, 0, 4	UINT	412
7	RTD #7 Type	Get/Set	0, 0, 4	UINT	413
8	RTD #8 Type	Get/Set	0, 0, 4	UINT	414
9	RTD #1 Function	Get/Set	0, 0, 3	UINT	431
10 (0x0A)	RTD #2 Function	Get/Set	0, 0, 3	UINT	432
11 (0x0B)	RTD #3 Function	Get/Set	0, 0, 3	UINT	433
12 (0x0C)	RTD #4 Function	Get/Set	0, 0, 3	UINT	434
13 (0x0D)	RTD #5 Function	Get/Set	0, 0, 3	UINT	435
14 (0x0E)	RTD #6 Function	Get/Set	0, 0, 3	UINT	436
15 (0x0F)	RTD #7 Function	Get/Set	0, 0, 3	UINT	437
16 (0x10)	RTD #8 Function	Get/Set	0, 0, 3	UINT	438
17 (0x11)	RTD #1 Trip Level	Get/Set	130, 40, 200	REAL	510/511
18 (0x12)	RTD #1 Alarm Level	Get/Set	110, 40, 200	REAL	512/513
19 (0x13)	RTD #2 Trip Level	Get/Set	130, 40, 200	REAL	514/515
20 (0x14)	RTD #2 Alarm Level	Get/Set	110, 40, 200	REAL	516/517
21 (0x15)	RTD #3 Trip Level	Get/Set	130, 40, 200	REAL	518/519
22 (0x16)	RTD #3 Alarm Level	Get/Set	110, 40, 200	REAL	520/521
23 (0x17)	RTD #4 Trip Level	Get/Set	130, 40, 200	REAL	522/523

Class 0x68, Instance 3 (continued)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
24 (0x18)	RTD #4 Alarm Level	Get/Set	110, 40, 200	REAL	524/525
25 (0x19)	RTD #5 Trip Level	Get/Set	130, 40, 200	REAL	526/527
26 (0x1A)	RTD #5 Alarm Level	Get/Set	110, 40, 200	REAL	528/529
27 (0x1B)	RTD #6 Trip Level	Get/Set	130, 40, 200	REAL	530/531
28 (0x1C)	RTD #6 Alarm Level	Get/Set	110, 40, 200	REAL	532/533
29 (0x1D)	RTD #7 Trip Level	Get/Set	130, 40, 200	REAL	534/535
30 (0x1E)	RTD #7 Alarm Level	Get/Set	110, 40, 200	REAL	536/537
31 (0x1F)	RTD #8 Trip Level	Get/Set	130, 40, 200	REAL	538/539
32 (0x20)	RTD #8 Alarm Level	Get/Set	110, 40, 200	REAL	540/541
33 (0x21)	RTD #1 Name	Get/Set	RTD M3 #1	SHORT_ STRING	770..779
34 (0x22)	RTD #2 Name	Get/Set	RTD M3 #2	SHORT_ STRING	780..789
35 (0x23)	RTD #3 Name	Get/Set	RTD M3 #3	SHORT_ STRING	790..799
36 (0x24)	RTD #4Name	Get/Set	RTD M3 #4	SHORT_ STRING	800..809
37 (0x25)	RTD #5 Name	Get/Set	RTD M3 #5	SHORT_ STRING	810..819
38 (0x26)	RTD #6 Name	Get/Set	RTD M3 #6	SHORT_ STRING	820..829
39 (0x27)	RTD #7 Name	Get/Set	RTD M3 #7	SHORT_ STRING	830..839
40 (0x28)	RTD #8 Name	Get/Set	RTD M3 #8	SHORT_ STRING	840..849
41 (0x29)	RTD #1 Temp RDG	Get		REAL	934..935
42 (0x2A)	RTD #2 Temp RDG	Get		REAL	936..937
43 (0x2B)	RTD #3 Temp RDG	Get		REAL	938..939
44 (0x2C)	RTD #4 Temp RDG	Get		REAL	940..941
45 (0x2D)	RTD #5 Temp RDG	Get		REAL	942..943
46 (0x2E)	RTD #6 Temp RDG	Get		REAL	944..945
47 (0x2F)	RTD #7 Temp RDG	Get		REAL	946/947
48 (0x30)	RTD #8 Temp RDG	Get		REAL	948/949
49 (0x31)	RTD #1 Trip Cntr	Get		UINT	1172
50 (0x32)	RTD #2 Trip Cntr	Get		UINT	1173
51 (0x33)	RTD #3 Trip Cntr	Get		UINT	1174
52 (0x34)	RTD #4 Trip Cntr	Get		UINT	1175
53 (0x35)	RTD #5 Trip Cntr	Get		UINT	1176
54 (0x36)	RTD #6 Trip Cntr	Get		UINT	1177
55 (0x37)	RTD #7 Trip Cntr	Get		UINT	1178
56 (0x38)	RTD #8 Trip Cntr	Get		UINT	1179

4.9 RTC CLASS 0x69

RTC Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

RTC Class (0x69), Instance (0) Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE
1	Revision	Get	Revision of this object.	1	UINT
2	Max Instance	Get	Maximum number of instances.	1	UINT

RTC Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modifies specified attribute.

RTC Class (0x69), Instance (1) Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	IRIG Hrs Offset	Get/Set	RTC Hrs = IRIG Hrs + IRIG Hr Offset	0, 0, 30	REAL	568/569
2	IRIG Min Offset	Get/Set	RTC Min = IRIG Min + IRIG Min Offset	0, 0, 23	REAL	570/571
3	RTC Date	Get	Number of Days Since 1972-01-01		DATE	574/575
4	RTC Time	Get	Number of Milliseconds Since 00:00:00:00.000		TIME OF DAY	576/577
5	RTC Set	Get/Set (1)	String Used to Set the Date and Time YY/MM/DD-HH:MM:SS		SHORT_ STRING	580/589

(1) Time value is not activated until a SET RTC command is issued using Class 0x29, Instance 1, Attribute 0x64.

4.10 USER REGISTER CLASS 0x6A

This object defines the communication registers that generate the data for Assembly Class 4, Instance 0x64, Attribute 3. Register values are defined in Appendix E of the Main Product Manual. Each register in Appendix E defines a 16-bit value.

User Register Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

User Register Class (0x6A), Instance (0) Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE
1	Revision	Get	Revision of this object.	1	UINT
2	Max Instance	Get	Maximum number of instances.	1	UINT

User Register Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modifies specified attribute.

User Register Class (0x6A), Instance (1) Attributes

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Register 1	Get/Set	User Register Value	0, 0, 1246	UINT	1400
2	Register 2	Get/Set	User Register Value	0, 0, 1246	UINT	1401
3	Register 3	Get/Set	User Register Value	0, 0, 1246	UINT	1402
4	Register 4	Get/Set	User Register Value	0, 0, 1246	UINT	1403
5	Register 5	Get/Set	User Register Value	0, 0, 1246	UINT	1404
6	Register 6	Get/Set	User Register Value	0, 0, 1246	UINT	1405
7	Register 7	Get/Set	User Register Value	0, 0, 1246	UINT	1406
8	Register 8	Get/Set	User Register Value	0, 0, 1246	UINT	1407
9	Register 9	Get/Set	User Register Value	0, 0, 1246	UINT	1408
10	Register 10	Get/Set	User Register Value	0, 0, 1246	UINT	1409
11	Register 11	Get/Set	User Register Value	0, 0, 1246	UINT	1410

User Register Class (0x6A), Instance (1) Attributes (continued)

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Comm Register
12	Register 12	Get/Set	User Register Value	0, 0, 1246	UINT	1411
13	Register 13	Get/Set	User Register Value	0, 0, 1246	UINT	1412
14	Register 14	Get/Set	User Register Value	0, 0, 1246	UINT	1413
15	Register 15	Get/Set	User Register Value	0, 0, 1246	UINT	1414
16	Register 16	Get/Set	User Register Value	0, 0, 1246	UINT	1415
32	Register 32	Get/Set	User Register Value	0, 0, 1246	UINT	1431

4.11 Data Logging Class 0x6B

This object is used to access one of 64 data-logging records. The Record Selector value defines the record that is displayed. Record Head indicates the record number for the latest record.

Data Logging Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

Data Logging Class (0x6B), Instance (0) Attributes

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type
1	Revision	Get	Revision of this object.	1	UINT
2	Max Instance	Get	Maximum number of instances.	1	UINT

Data Logging Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modifies specified attribute.

Data Logging Class (0x6B), Instance (1) Attributes

Attribute Number	Attribute Name	Services	Description	Default, Minimum, Maximum	Data Type	Comm Register
1	Record Count	Get	Number of captured records since the last time the event records were cleared.	0, 0, 65535	UINT	973
2	Record Head	Get	Points to next record. Latest record at Record Head minus 1.	0, 0, 63	UINT	974
3	Record Selector	Get/Set	Selects the record for which the data is displayed in this instance.	0, 0, 63	UINT	975
4	Record Date	Get	The date when the record was captured.	0, 0, 65535	DATE	976/977
5	Record Time	Get	Time-of-Day the record was captured.	0, 0, 86399999	TOD	978/979
6	Record Type	Get	Specifies the trigger source: 0 = Record Empty 1 = Triggered by start 2 = Triggered by trip	0, 0, 2	UINT	980
7	Trip Code	Get	See Main Product Manual Appendix F T27 for a list of trip codes. 255 = No Trip or Alarm	0, 0, 255	UINT	981
8	IA	Get	Phase A Current (A)[(1)]		Real	982
9	IB	Get	Phase B Current (A)[(1)]		Real	984

Data Logging Class (0x6B), Instance (1) Attributes (continued)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
10 (0x0A)	IC	Get	Phase C Current (A)(1)		Real	986
11 (0x0B)	3IA	Get	Ground-Fault Current (A)(1)		Real	988
12 (0x0C)	Vab	Get	Line-to-Line Voltage (kV)(1)		Real	990
13 (0x0D)	Vbc	Get	Line-to-Line Voltage (kV)(1)		Real	992
14 (0x0E)	Vca	Get	Line-to-Line Voltage (kV)(1)		Real	994
15 (0x0F)	Frequency	Get	Frequency in Hz		Real	1053/1054
16 (0x10)	S	Get	Apparent Power (kVA)		Real	1055/1056
17 (0x11)	P	Get	Real Power (kW)		Real	1057/1058
18 (0x12)	Q	Get	Reactive Power (kVAR)		Real	1059/1060
19 (0x13)	PF	Get	Power Factor (-1, +1)		Real	1061/1062
20 (0x14)	Ain	Get	Analog Input (mA)		Real	996/997
21 (0x15)	Unbalance I	Get	Current Unbalance (pu)(1)		Real	998/999
22 (0x16)	Unbalance V	Get	Voltage Unbalance (pu)(1)		Real	1000/1001
23 (0x17)	Start Time	Get	Start time in seconds. Only valid for start-type records.		UINT	1002
24 (0x18)	I^2t Used	Get	For start records this is the I^2t used during a start.		REAL	1003/1004
32 (0x20)	M1 RTD1	Get	RTD Temperature Reading (ºC)		REAL	1005/1006
33 (0x21)	M1 RTD2	Get	RTD Temperature Reading (ºC)		REAL	1007/1008
34 (0x22)	M1 RTD3	Get	RTD Temperature Reading (ºC)		REAL	1009/1010
35 (0x23)	M1 RTD4	Get	RTD Temperature Reading (ºC)		REAL	1011/1012
36 (0x24)	M1 RTD5	Get	RTD Temperature Reading (ºC)		REAL	1013/1014
37 (0x25)	M1 RTD6	Get	RTD Temperature Reading (ºC)		REAL	1015/1016
38 (0x26)	M1 RTD7	Get	RTD Temperature Reading (ºC)		REAL	1017/1018
39 (0x27)	M1 RTD8	Get	RTD Temperature Reading (ºC)		REAL	1019/1020
40 (0x28)	M2 RTD1	Get	RTD Temperature Reading (ºC)		REAL	1021/1022
41 (0x29)	M2 RTD2	Get	RTD Temperature Reading (ºC)		REAL	1023/1024
42 (0x2A)	M2 RTD3	Get	RTD Temperature Reading (ºC)		REAL	1025/1026
43 (0x2B)	M2 RTD4	Get	RTD Temperature Reading (ºC)		REAL	1027/1028
44 (0x2C)	M2 RTD5	Get	RTD Temperature Reading (ºC)		REAL	1029/1030
45 (0x2D)	M2 RTD6	Get	RTD Temperature Reading (ºC)		REAL	1031/1032
46 (0x2E)	M2 RTD7	Get	RTD Temperature Reading (ºC)		REAL	1033/1034
47 (0x2F)	M2 RTD8	Get	RTD Temperature Reading (ºC)		REAL	1035/1036
48 (0x30)	M3 RTD1 (2)	Get	RTD Temperature Reading (ºC)		REAL	1037/1038
49 (0x31)	M3 RTD2 (3)	Get	RTD Temperature Reading (ºC)		REAL	1039/1040
50 (0x32)	M3 RTD3 (4)	Get	RTD Temperature Reading (ºC)		REAL	1041/1042
51 (0x33)	M3 RTD4 (5)	Get	RTD Temperature Reading (ºC)		REAL	1043/1044
52 (0x34)	M3 RTD5 (5)	Get	RTD Temperature Reading (ºC)		REAL	1045/1046
53 (0x35)	M3 RTD6 (5)	Get	RTD Temperature Reading (ºC)		REAL	1047/1048
54 (0x36)	M3 RTD7 (5)	Get	RTD Temperature Reading (ºC)		REAL	1049/1050
55 (0x37)	M3 RTD8 (5)	Get	RTD Temperature Reading (ºC)		REAL	1051/1052

(1) For start records, current and unbalance are maximum values recorded during the start. Voltages are the minimum values recorded during the start.
(2) Phase A differential current for firmware > 2.30
(3) Phase B differential current for firmware > 2.30
(4) Phase C differential current for firmware > 2.30
(5) Ignore this value for firmware > 2.30

5. HARDWARE SPECIFICATIONS

Interface 10Base-T, 100Base-T,
Cat. 3, 4, 5, UTP, STP
Protocol .....EtherNet/IP or Modbus TCP
Baud Rate.....10/100 Mbps
Number of Slaves Connected.....Up to 254 units
Number of Connections/Slave .....Up to five
Bus length .....100 m (328') per segment

APPENDIX A
MPS MODBUS TCP & ETHERNET/IP INTERFACE REVISION HISTORY

MANUAL RELEASE DATE	MANUAL REVISION
June 11, 2015	1-B-061115
March 31, 2014	1-A-033114

MANUAL REVISION HISTORY

REVISION 1-B-061115

Added RTD Module Set Point Class, Instance 0, Attributes 120 and 121.

REVISION 1-A-033114

Updated Set Point Class, Instance 0 default, minimum and maximum.
Added Underpower and Reversepower instances.