

FPS MODBUS TCP & ETHERNET/IP INTERFACE

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PART A: MODBUS TCP

1. GENERAL

The Ethernet interface supports Modbus TCP and EtherNet/IP.

Part A of this manual describes the features of the Modbus TCP version of Ethernet.

2. ETHERNET PROTOCOL

2.1 PROTOCOL SETUP

The protocol type, IP address, IP Mask, and Gateway is set in the *Setup | Hardware | Network Comms* menu.

To enable Modbus TCP communications, select *Modbus TCP*. This provides full access to the FPS parameters as described in the FPS 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.

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.

The FPS 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.

2.4 FILE SYSTEM

The module contains a file system that may be useful for storing files associated with the FPS. 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) The FPS communication address is defined by the *Ethernet IP* setting and is unique for each FPS. The *Network ID* setting is ignored by the FPS. The Modbus broadcast address of 255 is not supported.
- (2) Communications options are mutually exclusive. Selecting *Anybus* or *Modbus TCP* disables the RS-485 interface.
- (3) Select *Anybus* or *Modbus TCP* only if the FPS has the Ethernet option installed (FPS-CTU-04-XX).

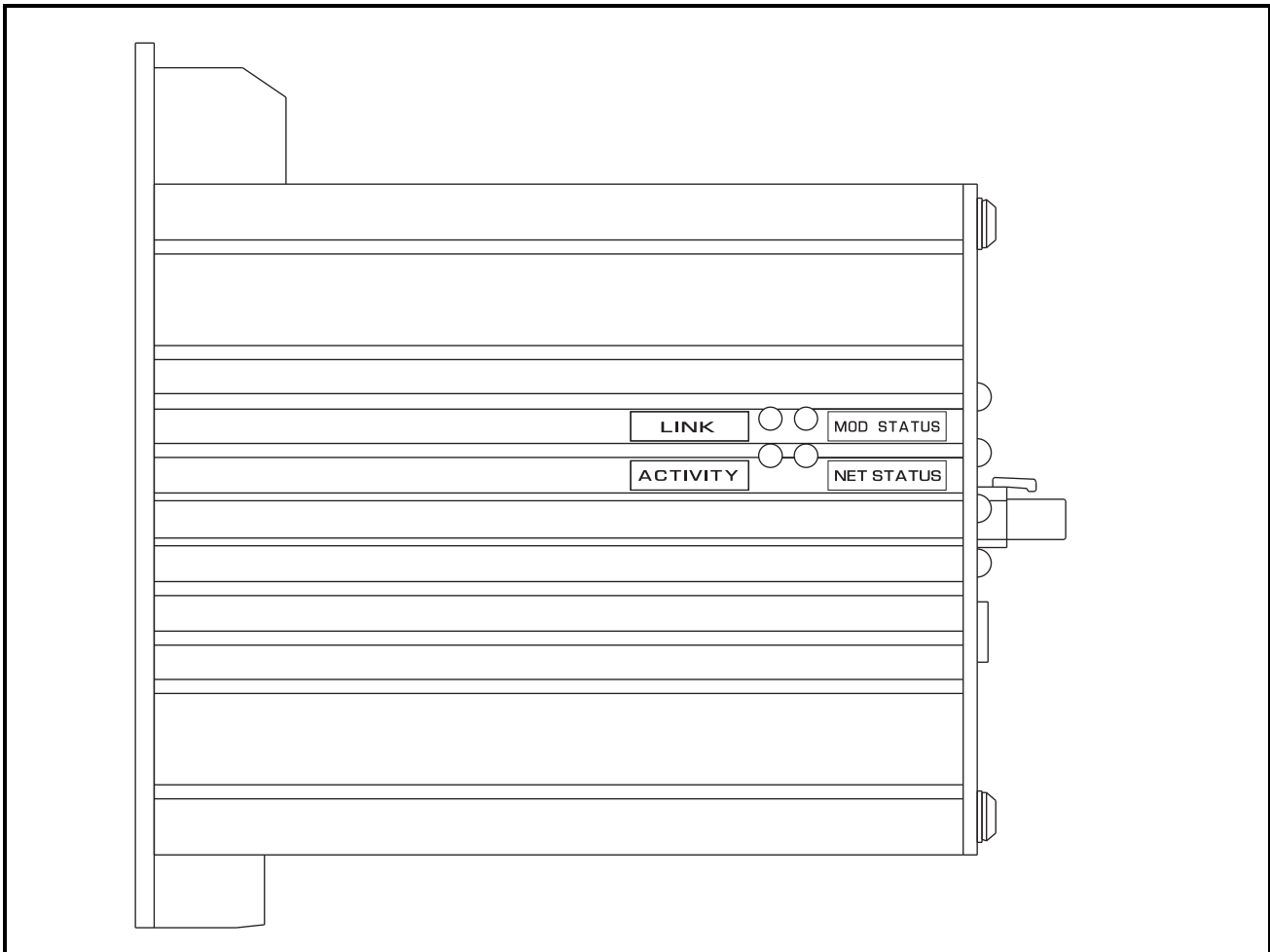


FIGURE 1. FPS-CTU Side View Showing LED's.

3. MODBUS TCP PROTOCOL

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

3.1 FUNCTION CODES SUPPORTED

The FPS 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 operation and are used to read data from the FPS. Function Code 6 and Function Code 16 are used to write data to the FPS. See FPS 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 FPS. 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 that require a transition from OFF to ON.

TABLE 3 SUPPORTED COMMANDS

COMMAND CODE	COIL ADDRESS	ACTION
0	1	None
1	2	Open
2	3	Close
3	4	Reset Trips
4	5	Set Real-Time Clock
5	6	Clear Data-Logging Records
6	7	Clear Trip Counters
7	8	Clear Energy Totals
8	9	Clear Running Hours
9	10	Emergency I ² t Reset
10	11	Select Local Control
11	12	Release Local-Input Control
12	13	Re-enable Temperature Protection
13	14	Remote Trip Set
14	15	Remote Trip Clear
15	16	Remote Alarm Set
16	17	Remote Alarm Clear
17	18	Net Relay Set
18	19	Net Relay Clear

For PLCs not supporting Function Code 5, commands can be issued using Function Code 6 or 16. Commands are written to FPS 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 FPS 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 FPS register 980 (Modbus 40981).

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 FPS register numbers corresponding to the required parameter as listed in the FPS Manual Appendix E. The entered values are accessible from the menu or via communications by reading the register values starting at FPS 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 FPS 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, I/O status, and Message 0 can be read by entering 1110, 1111, and 1112 in the next available user-register locations starting at User Register 6. The resulting values can be read starting at FPS Register 1432 (Modbus 41433).

3.5 TIMEOUT PREVENTION

To prevent a timeout trip on the FPS, 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.

The FPS supports the following Modbus TCP communication error responses:

- 01: Illegal Function—The function code sent to the FPS server is not supported.
- 02: Illegal Data Address—The requested address is not within the data address range in the FPS.
- 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 FPS. The FPS supports Explicit messaging and Polled I/O messaging.

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

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

Section 2 describes the Ethernet setup procedures and general features. Section 3 describes the Polled I/O messaging supported and Section 4 provides a list of Class objects that are supported using Explicit messaging.

2. ETHERNET PROTOCOL

2.1 PROTOCOL SETUP

The protocol type, The Ethernet IP address, and Ethernet Mask is set in the *Setup | Hardware | Network Comms* menu.

To support EtherNet/IP, select the network type as *Anybus*.

The communication address of the FPS is defined by the *Ethernet IP* setting and is unique. The *Network ID*, *Baud Rate* and *Error Check* settings are ignored.

Communications options are mutually exclusive. The RS-485 interface is disabled when *Anybus* is selected.

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.

The FPS 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, see Section 3.3.

2.4 FILE SYSTEM

The module contains a file system that may be useful for storing files associated with the FPS. 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) The FPS communication address is defined by the *Ethernet IP* setting and is unique for each FPS. The *Network ID* setting is ignored by the FPS. The Modbus broadcast address of 255 is not supported.
- (2) Communications options are mutually exclusive. Selecting *Anybus* or *Modbus TCP* disables the RS-485 interface.
- (3) Select *Anybus* or *Modbus TCP* only if the FPS has the Ethernet option installed (FPS-CTU-04-XX).

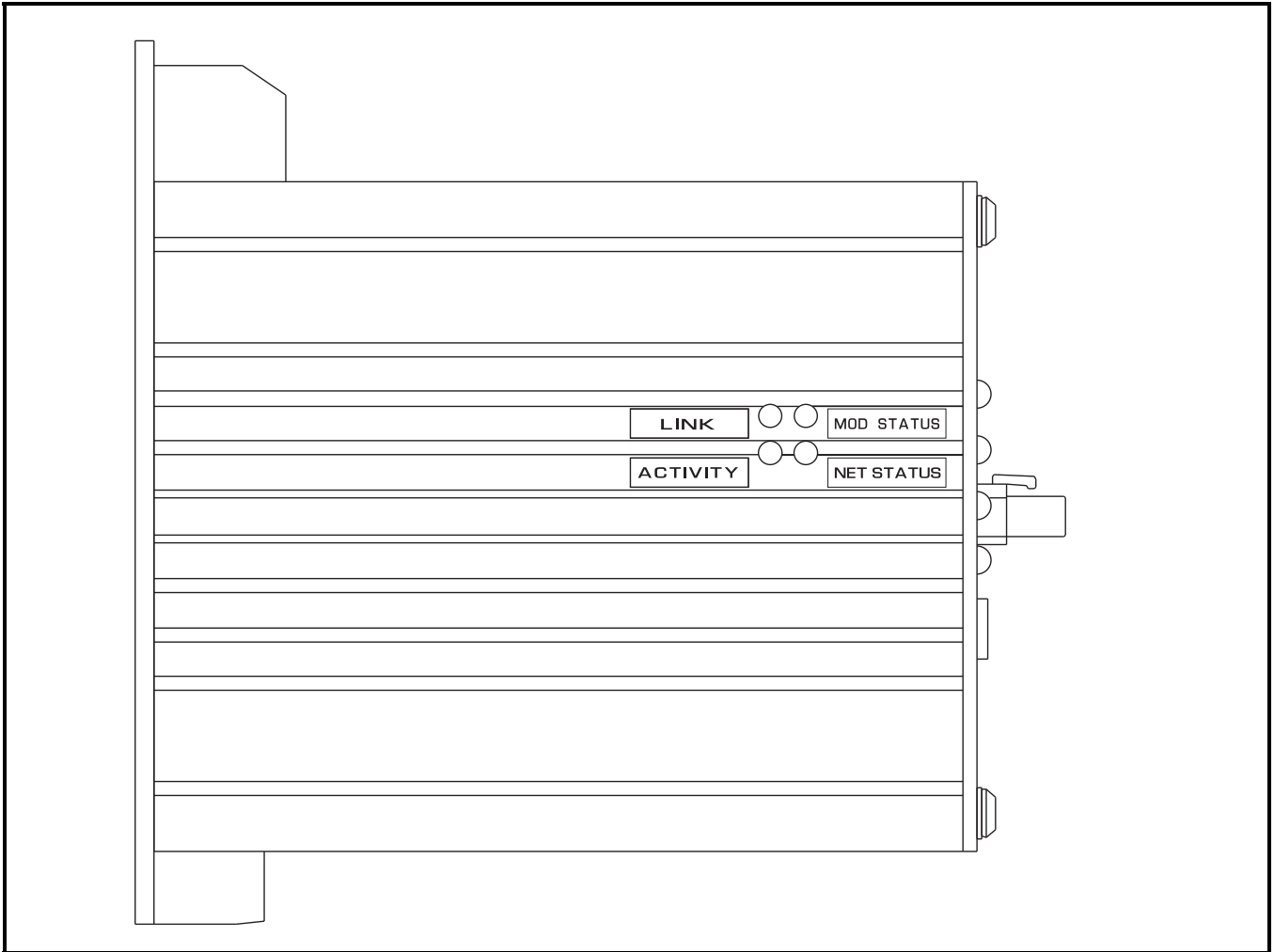


FIGURE 2. FPS-CTU Side View Showing LED's.

3. ETHERNET/IP

This section contains information relative to operation of the Polled I/O messaging feature of EtherNet/IP.

NOTE: The *Anybus* selection is required to support EtherNet/IP.

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

Both INPUT and OUTPUT messages sizes are predefined. The INPUT assembly consists of 64 bytes representing user-defined data. User defined data is configured by entering the required FPS register numbers in the User Defined Register block using the FPS menu system *Setup | Hardware | Network Comms | User Registers* by using SE-Comm-RIS program, or by using Explicit Messaging via Class 0x6A. The format of the data in the assembly is a function of the associated FPS Register. For register definitions and formats see FPS manual Appendix E and F. For example, to access the first four RTD temperatures in RTD Module 1, enter register numbers 918, 919, 920, 921, 922, 923, 924, and 925 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 FPS 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 FPS 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 FPS. This memory has read/write access from the network. Network output is sent to this buffer and the buffer is read by the FPS.

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 FPS COMMAND TABLE

COMMAND CODE	ACTION
0	None
1	Open
2	Close
3	Reset Trips
4	Set RTC
5	Clear Data-Logging Records
6	Clear Trip Counters
7	Clear Energy Totals
8	Clear Running Hours
9	Emergency I ^t Reset
10	Select Local-Input Control
11	Release Local-Input Control
12	Re-enable Temperature Protection
13	Remote Trip Set
14	Remote Trip Clear
15	Remote Alarm Set
16	Remote Alarm Clear
17	Net Relay Set
18	Net Relay Clear

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 FPS 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	FPS Command (Low)
3	FPS Command (High)
4-7	Not Used

3.3 TIMEOUT PREVENTION

The FPS 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 FPS 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 FPS 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

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 communication format for the FPS 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. EXPLICIT MESSAGING

This section describes all of the class objects that are accessed using Explicit Messaging.

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	205	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	N/A, 0, 999999999	UDINT	2
7	Product Name	Get	Human Readable Identification	“Startco FPS”	SHORT_STRING	

4.2 CONTROL SUPERVISOR CLASS 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 = None 1 = Open 2 = Close 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 I ² t Reset 10 = Select Local-Input Ctrl 11 = Release Local-Input Ctrl 12 = Re-enable Temperature Protection 13= Remote Trip Set 14= Remote Trip Clear 15= Remote Alarm Set 16= Remote Alarm Clear 17= Net Relay Set 18= Net Relay Clear	0, 0, 12	USINT	6
101 (0x65)	Revision	Get	Revision of Firmware 100=1.00	N/A, 100, N/A	UINT	1

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

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
102 (0x66)	System Name	Get/Set	22 characters. Only 20 significant.	“Startco FPS”	SHORT_STRING	750
103 (0x67)	Password	Get/Set	22 characters. Only 4 significant.	“1111”	SHORT_STRING	740
104 (0x68)	Password Timeout	Get/Set	Sets password timeout in minutes.	10, 1, 60	REAL	506/507
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	504
107 (0x6B)	# of OPI's	Get/Set	Selects the number of OPI's connected to the control unit. 0 = 1 OPI 1 = 2 OPI's 2 = 3 OPI's	0, 0, 2	UINT	505
108 (0x6C)	Reserved					
109 (0x6D)	Reserved					
110 (0x6E)	Reserved					
111 (0x6F)	OPI Trips	Get	Number of OPI Comm Trips		UINT	1182
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	524
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	525
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	526
115 (0x73)	CB Control Type	Get/Set	Selects the device control type: 0 = None 1 = Contractor 2 = 2-Coil Device	0, 0, 2	UINT	520
116 (0x74)	CB Trip Source	Get/Set	Defines which trip sources cause the breaker or contractor to open. 0= Disabled 1= Trip1 2= Trip2 3= Trip3 4= Trip1 or Trip2 5= Trip1 or Trip3 6= Trip1 or Trip2 or Trip3 7= Trip2 or Trip3	0, 0, 7	UINT	521
117 (0x75)	CB Trip Sense	Get/Set	Coil supervisor sense location: 0= None 1= CB Contact 2= CB Coil	0, 0, 2	UINT	522

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

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
118 (0x76)	CB Close Sense	Get/Set	Coil supervisor sense location. 0= None 1= CB Contact 2= CB Coil	0, 0, 2	UINT	523
119 (0x77)	CB Close Pulse	Get/Set	Circuit Breaker Close Pulse Width	0.3, 0.1, 5	REAL	527/528
120 (0x78)	CB Open Pulse	Get/Set	Circuit Breaker Open Pulse Width	0.3, 0.1, 5	REAL	529/530
121 (0x79)	OPI Local Control	Get/Set	0 = Enable OPI Control 1 = Disable OPI Control	0, 0, 1	UINT	531
122 (0x7A)	Open Retry	Get/Set	Breaker Open Retry Count	0, 0, 5	UINT	532
123 (0x7B)	Open Count	Get	Number of trips caused by an open key press when control type is set to None.		UINT	1176
124 (0x7C)	RY Status Trips	Get	Number of Contactor Status Trips		UINT	1177
125 (0x7D)	TC Supervisor Trips	Get	Number of Trip-Coil Supervisor Trips		UINT	1178
126 (0x7E)	CC Supervisor Trips	Get	Number of Close-Coil Supervisor Trips		UINT	1179
127(0x7F)	Reserved					
128 (0x80)	RY1 Function	Get/Set	Function Assigned to Relay 1: 0 = None 1 = Trip1 2 = Trip2 3 = Trip3 4 = Alarm1 5 = Alarm2 6 = Alarm3 7 = CB Close 8 = CB-Open 9 = Contractor 10 = Trip1 Pulse 11 = Local 12 = Interlock 13 = Current 14 = Network Run1 15 = Group2 Selected 16 = Watchdog	0, 0, 16	UINT	610
129 (0x81)	RY1 Mode	Get/Set	0 = Fail Safe, 1 = Non Fail Safe	0, 0, 1	UINT	611
130 (0x82)	RY2 Function	Get/ Set	See Attribute 0x80	0, 0, 16	UINT	612
131 (0x83)	RY2 Mode	Get/Set	0 = Fail Safe, 1 = Non Fail Safe	0, 0, 1	UINT	613
132 (0x84)	RY3 Function	Get/ Set	See Attribute 0x80	0, 0, 16	UINT	614
133 (0x85)	RY3 Mode	Get/Set	0 = Fail Safe, 1 = Non Fail Safe	0, 0, 1	UINT	615
134 (0x86)	RY4Function	Get/ Set	See Attribute 0x80	0, 0, 16	UINT	616
135 (0x87)	RY4 Mode	Get/Set	0 = Fail Safe, 1 = Non Fail Safe	0, 0, 1	UINT	617
136 (0x88)	RY5 Function	Get/ Set	See Attribute 0x80	0, 0, 16	UINT	618
137 (0x89)	RY5 Mode	Get/Set	0 = Fail Safe, 1 = Non Fail Safe	0, 0, 1	UINT	619
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	620

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

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
144 (0x90)	TA Summary	Get	FPS Status: Bit0: 1= Current > Threshold Bit1: 1= 3IO Picked Up Bit2: 1= Ph Picked Up Bit3: Reserved Bit4: 1= Trip1 Bit5: 1= Trip2 Bit6: 1= Trip3 Bit7: 1= Alarm1 Bit8: 1= Alarm2 Bit9: 1= Alarm3 Bit10: 1= ETR is ON Bit11: 1= PTC is Open Bit12: 1= Interdock Valid Bit13: 1= Permissive Valid Bit14: 1= Breaker Closed		WORD	1110
145 (0x91)	IO Status	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 Bit 7: Spare Bit 8: Relay 1 Energized Bit 9: Relay 2 Energized Bit 10: Relay 3 Energized Bit 11: Relay 4 Energized Bit 12: Relay 5 Energized		WORD	1111
146 (0x92)	Trip/Alarm Msg 0	Get	Trip and Alarm FIFO. See Main Product Manual Appendix F T90. 255= No trip or alarm.		UINT	1112
147 (0x93)	Trip/Alarm Msg 1	Get	Trip and Alarm FIFO. See Main Product Manual Appendix F T90. 255= No trip or alarm.		UINT	1113
148 (0x94)	Trip/Alarm Msg 2	Get	Trip and Alarm FIFO. See Main Product Manual Appendix F T90. 255= No trip or alarm.		UINT	1114
149 (0x95)	Trip/Alarm Msg 3	Get	Trip and Alarm FIFO. See Main Product Manual Appendix F T90. 255= No trip or alarm.		UINT	1115
150 (0x96)	Trip/Alarm Msg 4	Get	Trip and Alarm FIFO. See Main Product Manual Appendix F T90. 255= No trip or alarm.		UINT	1116
151 (0x97)	Reserved					
152 (0x98)	Reserved					
153 (0x99)	Reserved					
154 (0x9A)	Reserved					
155 (0x9B)	Reserved					
156 (0x9C)	CT Primary	Get/Set	CT Primary Rating (A)	100, 1, 5000	REAL	480/481
157 (0x9D)	EFCT Primary	Get/Set	EFCT Primary Rating (A)	5, 1, 5000	REAL	482/483
158 (0x9E)	System Voltage	Get/Set	Line-to-Line Voltage (kV)	0.6, 0.12, 75	REAL	484/485
159 (0x9F)	Vin Rating	Get/Set	Input Voltage at Rated System Voltage (kV)	0.12, 0.03, 0.6	REAL	486/487

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

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
160 (0xA0)	V Connection	Get/Set	Voltage Input Connection 0= None 1= 1PT 2= 2PT 3= 3PT / DIRECT	0,0,3	UINT	488/489
161 (0xA1)	Frequency	Get/Set	System Frequency 0 = 50 Hz, 1= 60 Hz	1, 0, 1	UINT	489
162 (0xA2)	Set-Point Group	Get/Set	Selects Set Point Group 0= Group1 1= Group2	0, 0, 1	UINT	490
163 (0xA3)	I ₂ /I ₁ Threshold	Get/Set	Unbalance Threshold	0.25, 0.10, 0.50	REAL	491/ 492
164 (0xA4)	Reserved					
165 (0xA5)	Reserved					
166 (0xA6)	Reserved					
167 (0xA7)	Reserved					
168 (0xA8)	Reserved					
169 (0xA9)	Reserved					
170 (0xAA)	Reserved					
171 (0xAB)	Reserved					
172 (0xAC)	Reserved					
173 (0xAD)	Reserved					
174 (0xAE)	Reserved					
175 (0xAF)	Reserved					
176 (0xB0)	I _a	Get	Phase A Current (A)		REAL	860/861
177 (0xB1)	I _b	Get	Phase B Current (A)		REAL	862/863
178 (0xB2)	I _c	Get	Phase C Current (A)		REAL	864/865
179 (0xB3)	I _{ave}	Get	Average Current (A)		REAL	866/867
180 (0xB4)	I _{CT}	Get	EF CT Current (A)		REAL	868/869
181 (0xB5)	3I _O	Get	Calculated 3I _O (A)		REAL	870/871
182 (0xB6)	V _{ab}	Get	Line-Line Voltage (KV)		REAL	872/873
183 (0xB7)	V _{bc}	Get	Line-Line Voltage (KV)		REAL	874/875
184 (0xB8)	V _{ca}	Get	Line-Line Voltage (KV)		REAL	876/877
185 (0xB9)	V _a	Get	Line-Line Voltage (KV)		REAL	878/879
186 (0xBA)	V _b	Get	Line-Line Voltage (KV)		REAL	880/881
187 (0xBB)	V _c	Get	Line-Line Voltage (KV)		REAL	882/883
188 (0xBC)	S	Get	Apparent Power (KVA)		REAL	884/885
189 (0xBD)	Q	Get	Reactive Power (KVAR)		REAL	886/887
190 (0xBE)	P	Get	Real Power (KW)		REAL	888/889
191 (0xBF)	PF	Get	Power Factor		REAL	890/891
192 (0xC0)	Used I ² T	Get	Used Thermal Capacity (‰)		REAL	892/893
193 (0xC1)	Thermal Trend	Get	Thermal Trend (‰)		REAL	894/895
194 (0xC2)	Overload Time	Get	Overload Trip/ Reset Time (m)		REAL	896/897
195 (0xC3)	+SeqI	Get	Positive Sequence Current (pu)		REAL	898/899
196 (0xC4)	-SeqI	Get	Negative Sequence Current (pu)		REAL	900/901
197 (0xC5)	Unbalance I	Get	Current Unbalance (pu)		REAL	902/903
198 (0xC6)	+SeqV	Get	Positive Sequence Voltage (KV)		REAL	904/905
199 (0xC7)	-SeqV	Get	Negative Sequence Voltage (KV)		REAL	906/907
200 (0xC8)	Unbalance V	Get	Voltage Unbalance (pu)		REAL	908/909
201 (0xC9)	Analog I _n	Get	Analog Input (nA)		REAL	910/911
202 (0xCA)	Frequency	Get	Frequency of Voltage		REAL	912/913
203 (0xCB)	Run Time	Get	Running Time (s)		UDINT	914/915
204 (0xCC)	HS Frequency	Get	High-Speed Input Frequency		REAL	916/917
205 (0xCD)	KWs	Get	KW seconds		REAL	950/953
206 (0xCE)	KVAs	Get	KVA seconds		REAL	954/957
207 (0xCF)	KVARs	Get	KVAR seconds		REAL	958/961

4.3 OVERLOAD CLASS 0x2C

Overload Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modify specified attribute.

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

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Revision	Get	Revision of this object.	1	UINT	
2	Max Instance	Get	Maximum number of instances.	1	UINT	
100 (0x64)	Reset Type	Get/Set	Specifies Type of Reset: 0= Normal 1= Autoreset 2= Rapid	0, 0, 2	UINT	44
100 (0x65)	Reset Level	Get/Set	Specifies Reset Level	0.3, 0.1, 0.9	REAL	45/46

Overload Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modify specified attribute.

Overload Class 0x2C, Instance 1 Attributes - Group 1

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)	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	9
102 (0x66)	Reserved					
103 (0x67)	Pickup	Get/Set	O/L Curve Pickup Level	1, 0.1, 1.25	REAL	11/12
104 (0x68)	Reserved					
105 (0x69)	H-Factor	Get/Set	Hot Factor Multiplier For I < 100%	0.5, 0.1, 1.0	REAL	15/16
106 (0x6A)	C-Factor	Get/Set	Time-Constant Multiplier When Cooling	2, 1, 10	REAL	17/18
107 (0x6B)	Time Constant	Get/Set	Thermal Time Constant In Minutes	10, 1, 60	REAL	19/20
108 (0x6C)	Alarm Level	Get/Set	Level Where Alarm Occurs	1.0, 0.5, 1.0	REAL	21/22
109 (0x6D)	Trip Count	Get	Counts Number of Trips		UINT	1130

Overload Class 0x2C, Instance 2 Attributes – Group 2

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	26
101 (0x65)	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	27
102 (0x66)	Reserved					
103 (0x67)	Pickup	Get/Set	O/L Curve Pickup Level	1, 0.1, 1.25	REAL	29/30
104 (0x68)	Reserved					
105 (0x69)	H-Factor	Get/Set	Hot Factor Multiplier For I < 100%	0.5, 0.1, 1.0	REAL	33/34
106 (0x6A)	C-Factor	Get/Set	Time-Constant Multiplier when Cooling	2, 1, 10	REAL	35/36
107 (0x6B)	Time Constant	Get/Set	Thermal Time Constant in Minutes	10, 1, 60	REAL	37/38
108 (0x6C)	Alarm Level	Get/Set	Level Where Alarm Occurs	1.0, 0.5, 1.0	REAL	39/40
109 (0x6D)	Trip Count	Get	Counts Number of Trips		UINT	1131

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	Number of last instance.	20	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

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

Class 0x64, Instance 1 - Definite-Time Overcurrent, Group 1

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	70
2	Alarm Action	Get/Set	0, 0, 7	UINT	71
3	Trip Level	Get/Set	10, 1, 15	REAL	72/73
4	Trip Delay	Get/Set	0.05, 0, 10	REAL	74/75
5	Alarm Level	Get/Set	10, 0.1, 15	REAL	76/77
6	Alarm Delay	Get/Set	0.05, 0, 10	REAL	78/79
7	Trip Count	Get/Set		UINT	1134

Class 0x64, Instance 2 - Definite-Time Overcurrent, Group 2

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	84
2	Alarm Action	Get/Set	0, 0, 7	UINT	85
3	Trip Level	Get/Set	10, 1, 15	REAL	86/87
4	Trip Delay	Get/Set	0.05, 0, 10	REAL	88/89
5	Alarm Level	Get/Set	10, 0.1, 15	REAL	90/91
6	Alarm Delay	Get/Set	0.05, 0, 10	REAL	92/93
7	Trip Count	Get/Set		UINT	1135

Class 0x64, Instance 3 – 3I₀ Definite-Time Earth Fault, Group 1

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	120
2	Alarm Action	Get/Set	0, 0, 7	UINT	121
3	Trip Level	Get/Set	10, 0.1, 15	REAL	122/123
4	Trip Delay	Get/Set	0.05, 0, 10	REAL	124/125
5	Alarm Level	Get/Set	10, 0.1, 15	REAL	126/127
6	Alarm Delay	Get/Set	0.05, 0, 10	REAL	128/129
7	Trip Count	Get		UINT	1138

Class 0x64, Instance 4 – 3I₀ Definite-Time Earth Fault, Group 2

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	136
2	Alarm Action	Get/Set	0, 0, 7	UINT	137
3	Trip Level	Get/Set	10, 0.1, 15	REAL	138/139
4	Trip Delay	Get/Set	0.05, 0, 10	REAL	140,141
5	Alarm Level	Get/Set	10, 0.1, 15	REAL	142/143
6	Alarm Delay	Get/Set	0.05, 0, 10	REAL	144/145
7	Trip Count	Get		UINT	1139

Class 0x64, Instance 5 – EFCT Definite-Time, Group 1

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	150
2	Alarm Action	Get/Set	0, 0, 7	UINT	151
3	Trip Level	Get/Set	0.4, 0.01, 1	REAL	152/153
4	Trip Delay	Get/Set	0.25, 0, 100	REAL	154/155
5	Alarm Level	Get/Set	0.2, 0.01, 1	REAL	156/157
6	Alarm Delay	Get/Set	1, 0, 100	REAL	158/159
7	Trip Count	Get		UINT	1140

Class 0x64, Instance 6 - EFCT Definite-Time, Group 2

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	167
3	Trip Level	Get/Set	0.4, 0.01, 1	REAL	168/169
4	Trip Delay	Get/Set	0.25, 0, 100	REAL	170/171
5	Alarm Level	Get/Set	0.2, 0.01, 1	REAL	172/173
6	Alarm Delay	Get/Set	1, 0, 100	REAL	174/175
7	Trip Count	Get		UINT	1141

Class 0x64, Instance 7 – Unbalance (I)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	1, 0, 7	UINT	180
2	Alarm Action	Get/Set	1, 0, 7	UINT	181
3	Trip Level	Get/Set	0.25, 0.05, 1	REAL	182/183
4	Trip Delay	Get/Set	15, 1, 100	REAL	184/185
5	Alarm Level	Get/Set	0.10, 0.05, 1	REAL	186/187
6	Alarm Delay	Get/Set	10, 1, 100	REAL	188/189
7	Trip Count	Get		UINT	1142

Class 0x64, Instance 8 – Phase Loss (I)

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	193
4	Trip Delay	Get/Set	5, 1, 100	REAL	194/195
6	Alarm Delay	Get/Set	2, 1, 100	REAL	196/197
7	Trip Count	Get		UINT	1143

Class 0x64, Instance 9 – Phase Reverse (I)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	198
2	Alarm Action	Get/Set	0, 0, 7	UINT	199
4	Trip Delay	Get/Set	5, 1, 100	REAL	200/201
6	Alarm Delay	Get/Set	2, 1, 100	REAL	202/203
7	Trip Count	Get		UINT	1144

Class 0x64, Instance 0x0A – Unbalance (V)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	1, 0, 7	UINT	214
2	Alarm Action	Get/Set	1, 0, 7	UINT	215
3	Trip Level	Get/Set	0.25, 0.05, 1	REAL	216/217
4	Trip Delay	Get/Set	15, 1, 100	REAL	218/219
5	Alarm Level	Get/Set	0.10, 0.05, 1	REAL	220/221
6	Alarm Delay	Get/Set	10, 1, 100	REAL	222/223
7	Trip Count	Get		UINT	1145

Class 0x64, Instance 0x0B – Phase Loss (V)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	224
2	Alarm Action	Get/Set	0, 0, 7	UINT	225
4	Trip Delay	Get/Set	5, 1, 100	REAL	226/227
6	Alarm Delay	Get/Set	2, 1, 100	REAL	228/229
7	Trip Count	Get		UINT	1146

Class 0x64, Instance 0x0C – Phase Reverse (V)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	234
2	Alarm Action	Get/Set	0, 0, 7	UINT	235
4	Trip Delay	Get/Set	5, 1, 100	REAL	236/237
6	Alarm Delay	Get/Set	2, 1, 100	REAL	238/239
7	Trip Count	Get		UINT	1147

Class 0x64, Instance 0x0D - Undervoltage

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	242
2	Alarm Action	Get/Set	0, 0, 7	UINT	243
3	Trip Level	Get/Set	0.7, 0.5, 1	REAL	244/245
4	Trip Delay	Get/Set	5, 1, 500	REAL	246/247
5	Alarm Level	Get/Set	0.8, 0.5, 1	REAL	248/249
6	Alarm Delay	Get/Set	5, 1, 500	REAL	250/251
7	Trip Count	Get		UINT	1149

Class 0x64, Instance 0x0E - Overvoltage

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	1, 0, 7	UINT	254
2	Alarm Action	Get/Set	1, 0, 7	UINT	255
3	Trip Level	Get/Set	1.2, 1, 1.4	REAL	256/257
4	Trip Delay	Get/Set	5, 1, 500	REAL	258/259
5	Alarm Level	Get/Set	1.1, 1, 1.4	REAL	260/261
6	Alarm Delay	Get/Set	5, 1, 500	REAL	262/263
7	Trip Count	Get		UINT	1148

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	270
2	Alarm Action	Get/Set	0, 0, 7	UINT	271
3	Trip Level	Get/Set	45, 30, 80	REAL	272/273
4	Trip Delay	Get/Set	5, 1, 500	REAL	274/275
5	Alarm Level	Get/Set	48, 30, 80	REAL	276/277
6	Alarm Delay	Get/Set	1, 1, 500	REAL	278/279
7	Trip Count	Get		UINT	1150

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	280
2	Alarm Action	Get/Set	0, 0, 7	UINT	281
3	Trip Level	Get/Set	65, 30, 80	REAL	282/283
4	Trip Delay	Get/Set	5, 1, 500	REAL	284/285
5	Alarm Level	Get/Set	62, 30, 80	REAL	286/287
6	Alarm Delay	Get/Set	1, 1, 500	REAL	288/289
7	Trip Count	Get		UINT	1151

Class 0x64, Instance 0x11 - Power Factor Lag

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	294
2	Alarm Action	Get/Set	0, 0, 7	UINT	295
3	Trip Level	Get/Set	0.8, 0.5, 1	REAL	296/297
4	Trip Delay	Get/Set	5, 1, 500	REAL	298/299
5	Alarm Level	Get/Set	0.9, 0.5, 1	REAL	300/301
6	Alarm Delay	Get/Set	10, 1, 500	REAL	302/303
7	Trip Count	Get		UINT	1152

Class 0x64, Instance 0x12 - Power Factor Lead

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	304
2	Alarm Action	Get/Set	0, 0, 7	UINT	305
3	Trip Level	Get/Set	0.8, 0.5, 1	REAL	306/307
4	Trip Delay	Get/Set	5, 1, 500	REAL	308/309
5	Alarm Level	Get/Set	0.9, 0.5, 1	REAL	310/311
6	Alarm Delay	Get/Set	10, 1, 500	REAL	312/313
7	Trip Count	Get		UINT	1153

Class 0x64, Instance 0x13 – PTC Temperature

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	324
2	Alarm Action	Get/Set	0, 0, 7	UINT	325
3					
4					
5					
6					
7	Trip Count	Get			1157

Class 0x64, Instance 0x14 - Reversepower

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	0, 0, 7	UINT	204
2	Alarm Action	Get/Set	0, 0, 7	UINT	205
3	Trip Level	Get/Set	0.1, 0.1, 1	REAL	206/207
4	Trip Delay	Get/Set	5, 0.5, 500	REAL	208/209
5	Alarm Level	Get/Set	0.1, 0.1, 1	REAL	210/211
6	Alarm Delay	Get/Set	1, 0.5, 500	REAL	212/213
7	Trip Count	Get		UINT	1190

4.5 INVERSE CURVE CLASS 0x65

Inverse Curve Object Class Services

Get_Attribute_Single: Returns contents of specified attribute.

Inverse Curve 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.	4	UINT

Inverse Curve Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute.

Set_Attribute_Single: Modifies specified attribute

The inverse curve class consists of five attributes.

Attribute 1 - Trip Action

Specifies the action to take on a trip.

- 0 = Disable Trip
- 1 = Trip1
- 2 = Trip2
- 3 = Trip3
- 4 = Trip1 & Trip2
- 5 = Trip1 & Trip3
- 6 = Trip1 & Trip2 & Trip3
- 7 = Trip2 & Trip3

Attribute 2 – Curve

- 0 = IEC Normal Inverse A
- 1 = IEC Very Inverse B
- 2 = IEC Extreme Inverse C

- 3 = IEC Short Inverse A
- 4 = IEC Long Inverse B
- 5 = IEEE Moderate Inverse
- 6 = IEEE Very Inverse
- 7 = IEEE Extreme Inverse

Attribute 3 – Multiplier

Adjusts the trip time for the selected curve type.

Attribute 4 – Pickup

Sets the threshold current in multiples of CT rating.

Attribute 5 – Trip Count

Trip counter for the set point.
 For curve formulas, see the FPS product manual.

Class 0x65, Instance 1 – Phase Inverse, Group 1

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	1, 0, 7	UINT	50
2	Curve	Get/Set	0, 0, 7	UINT	51
3	Multiplier	Get/Set	0.2, 0.05, 1	REAL	52/53
4	Pickup	Get/Set	2, 0.1, 10	REAL	54/55
5	Trip Count	Get		UINT	1132

Class 0x65, Instance 2 – Phase Inverse, Group 2

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	1, 0, 7	UINT	60
2	Curve	Get/Set	0, 0, 7	UINT	61
3	Multiplier	Get/Set	0.2, 0.05, 1	REAL	62/63
4	Pickup	Get/Set	2, 0.1, 10	REAL	64/65
5	Trip Count	Get		UINT	1133

Class 0x65, Instance 3 – 3I₀ Inverse, Group 1

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	1, 0, 7	UINT	100
2	Curve	Get/Set	0, 0, 7	UINT	101
3	Multiplier	Get/Set	0.2, 0.05, 1	REAL	102/103
4	Pickup	Get/Set	2, 0.1, 10	REAL	104/105
5	Trip Count	Get		UINT	1136

Class 0x65, Instance 4 – 3I₀ Inverse, Group 2

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Trip Action	Get/Set	1, 0, 7	UINT	110
2	Curve	Get/Set	0, 0, 7	UINT	111
3	Multiplier	Get/Set	0.2, 0.05, 1	REAL	112/113
4	Pickup	Get/Set	2, 0.1, 10	REAL	114/115
5	Trip Count	Get		UINT	1137

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 = None
- 1 = Group 2 Select
- 2 = Local Control Select
- 3 = Permissive
- 4 = 3-Wire Close
- 5 = 2-Wire Close
- 6 = 3-Wire Close Local
- 7 = 2-Wire Close Local
- 8 = 52a Close Status
- 9 = 52b Open Status
- 10 = Reserved 10
- 11 = Reserved 11
- 12 = Reserved 12
- 13 = Interlock
- 14 = Trip1
- 15 = Reset

- 16 = Positive-Edge Trigger
- 17 = Negative-Edge Trigger
- 18 = Transition Trigger

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 breaker or contactor is closed. 0 = Enable, 1 = Disable

Attribute 3 - Bypass Delay

Defines the Trip bypass time duration on close.

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, 18	UINT	540
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	541
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	542/543
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	544/545
5	Trip Counter	Get		UINT	1158

Class 0x66, Instance 2 - Input 2

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Function	Get/Set	0, 0, 18	UINT	550
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	551
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	552/553
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	554/555
5	Trip Counter	Get		UINT	1159

Class 0x66, Instance 3 - Input 3

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Function	Get/Set	0, 0, 18	UINT	560
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	561
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	562/563
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	564/565
5	Trip Counter	Get		UINT	1160

Class 0x66, Instance 4 - Input 4

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Function	Get/Set	0, 0, 18	UINT	570
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	571
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	572/573
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	574/575
5	Trip Counter	Get		UINT	1161

Class 0x66, Instance 5 - Input 5

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Function	Get/Set	0, 0, 18	UINT	580
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	581
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	582/583
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	584/585
5	Trip Counter	Get		UINT	1162

Class 0x66, Instance 6 - Input 6

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Function	Get/Set	0, 0, 18	UINT	590
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	591
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	592/593
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	594/595
5	Trip Counter	Get		UINT	1163

Class 0x66, Instance 7 - Input 7

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
1	Function	Get/Set	0, 0, 18	UINT	600
2	Bypass Enable/Disable	Get/Set	1, 0, 1	UINT	601
3	Bypass Delay	Get/Set	5, 0.5, 100	REAL	602/603
4	Trip Delay	Get/Set	0.1, 0.01, 100	REAL	604/605
5	Trip Counter	Get		UINT	1164

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 = Metering 1 = Protection (Trip1, Alarm1 Enabled)	0, 0, 3	UINT	630
2	Trip Action	Get/Set	Sets Trip Action for High and Low Trips	0, 0, 7	UINT	631
3	Alarm Action	Get/Set	Sets Alarm Actions for High and Low Alarms.	0, 0, 7	UINT	632

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

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
4	High Trip	Get/Set	Sets high trip level for generic input type. (mA)	16, 0.1, 20	REAL	633/634
5	Low Trip	Get Set	Sets low trip level for generic input type. (mA)	7, 0.1, 20	REAL	635/636
6	Trip Delay	Get/Set	Applies to generic type. (s)	5, 0.01, 100	REAL	637/638
7	High Alarm	Get/Set	Sets high alarm level for generic input type. (mA)	14, 0.1, 20	REAL	639/640
8	Low Alarm	Get/Set	Sets low alarm level for generic input type (mA)	9, 0.1, 20	REAL	641/642
9	Alarm Delay	Get/Set	Applies to Generic Type (s)	1, 0.01, 100	REAL	643/644
10 (0x0A)	Out Param	Get/Set	Specifies the analog output parameter: 0 = Phase Current 1 = Earth Leakage 2 = Thermal Capacity 3 = Max Group A RTD 4 = Max Group B RTD 5 = Max Group C 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)	0, 0, 14	UINT	650
11 (0x0B)	High Trips	Get	Input-High Trip Count		UINT	1155
12 (0x0C)	Low Trips	Get	Input-Low Trip Count		UINT	1156

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, 1	UINT	328
101 (0x65)	Sensor Trip Action	Get/Set	Specifies trip action to take on a sensor error. 0 = Disable Trips 1 = Trip1 2 = Trip2 3 = Trip3 4 = Trip1 & Trip2 5 = Trip1 & Trip3 6 = Trip1 & Trip2 & Trip3 7 = Trip2 & Trip3 A Trip initiates an OPEN when a CB Control is enabled.	0, 0, 7	UINT	331

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	332
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	329
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	330
105 (0x69)	Module1 Comm Trip Count	Get	Number of Module1 Communication-Error Trips		UINT	1173
106 (0x6A)	Reserved					
107 (0x6B)	Reserved					
108 (0x6C)	Sensor Trip Count	Get	Number of RTD Sensor Trips		UINT	1174
109 (0x6D)	Reserved					
110 (0x6E)	Reserved					
111 (0x6F)	Reserved					
112 (0x70)	Max GrpA Temp	Get	Max Group A Temperature (°C)		REAL	934/935
113 (0x71)	Max GrpB Temp	Get	Max Group B Temperature (°C)		REAL	936/937
114 (0x72)	Max GrpC Temp	Get	Max Group C Temperature (°C)		REAL	938/939
115 (0x73)	Max Amb Temp	Get	Max Ambient Temperature (°C)		REAL	940/941
116 (0x74)	Min GrpA Temp	Get	Min Group A Temperature (°C)		REAL	942/943
117 (0x75)	Min GrpB Temp	Get	Min Group B Temperature (°C)		REAL	944/945
118 (0x76)	Min GrpC Temp	Get	Min Group C Temperature (°C)		REAL	946/947
119 (0x77)	Min Ambient Temp	Get	Min Ambient Temperature (°C)		REAL	948/949
120 (0x78)	UTemp Trip	Get/Set	Trip Level Selection	4, 0, 8	UINT	314
121 (0x79)	UTemp Alarm	Get/Set	Alarm Level Selection	4, 0, 8	UINT	315
122 (0x7A)	UTemp Trip Action	Get/Set	Trip Action	0, 0, 7	UINT	316
123 (0x7B)	UTemp Alarm Action	Get/Set	Trip Action	0, 0, 7	UINT	317
124 (0x7C)	UTemp Trip Count	Get	Undertemperature Trip Count		UINT	1191

RTD Module Object Instance Services

Get_Attribute_Single: Returns contents of specified attribute. 1 = Group B
 2 = Group C
 Set_Attribute_Single: Modifies specified attribute. 3 = Ambient

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 = Group A

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	336
2	RTD #2 Type	Get/Set	0, 0, 4	UINT	337
3	RTD #3 Type	Get/Set	0, 0, 4	UINT	338
4	RTD #4 Type	Get/Set	0, 0, 4	UINT	339
5	RTD #5 Type	Get/Set	0, 0, 4	UINT	340
6	RTD #6 Type	Get/Set	0, 0, 4	UINT	341
7	RTD #7 Type	Get/Set	0, 0, 4	UINT	342
8	RTD #8 Type	Get/Set	0, 0, 4	UINT	343
9	RTD #1 Function	Get/Set	0, 0, 3	UINT	344
10 (0x0A)	RTD #2 Function	Get/Set	0, 0, 3	UINT	345
11 (0x0B)	RTD #3 Function	Get/Set	0, 0, 3	UINT	346
12 (0x0C)	RTD #4 Function	Get/Set	0, 0, 3	UINT	347
13 (0x0D)	RTD #5 Function	Get/Set	0, 0, 3	UINT	348
14 (0x0E)	RTD #6 Function	Get/Set	0, 0, 3	UINT	349
15 (0x0F)	RTD #7 Function	Get/Set	0, 0, 3	UINT	350
16 (0x10)	RTD #8 Function	Get/Set	0, 0, 3	UINT	351
17 (0x11)	RTD #1 Trip Level	Get/Set	130, 40, 200	REAL	352/353
18 (0x12)	RTD #1 Alarm Level	Get/Set	110, 40, 200	REAL	354/355
19 (0x13)	RTD #2 Trip Level	Get/Set	130, 40, 200	REAL	356/357
20 (0x14)	RTD #2 Alarm Level	Get/Set	110, 40, 200	REAL	358/359
21 (0x15)	RTD #3 Trip Level	Get/Set	130, 40, 200	REAL	360/361
22 (0x16)	RTD #3 Alarm Level	Get/Set	110, 40, 200	REAL	362/363
23 (0x17)	RTD #4 Trip Level	Get/Set	130, 40, 200	REAL	364/365
24 (0x18)	RTD #4 Alarm Level	Get/Set	110, 40, 200	REAL	366/367
25 (0x19)	RTD #5 Trip Level	Get/Set	130, 40, 200	REAL	368/369
26 (0x1A)	RTD #5 Alarm Level	Get/Set	110, 40, 200	REAL	370/371
27 (0x1B)	RTD #6 Trip Level	Get/Set	130, 40, 200	REAL	372/373
28 (0x1C)	RTD #6 Alarm Level	Get/Set	110, 40, 200	REAL	374/375
29 (0x1D)	RTD #7 Trip Level	Get/Set	130, 40, 200	REAL	376/377
30 (0x1E)	RTD #7 Alarm Level	Get/Set	110, 40, 200	REAL	378/379
31 (0x1F)	RTD #8 Trip Level	Get/Set	130, 40, 200	REAL	380/381
32 (0x20)	RTD #8 Alarm Level	Get/Set	110, 40, 200	REAL	382/383
33 (0x21)	RTD #1 Name	Get/Set	RTD M1 #1	SHORT_STRING	384..393
34 (0x22)	RTD #2 Name	Get/Set	RTD M1 #2	SHORT_STRING	394..403
35 (0x23)	RTD #3 Name	Get/Set	RTD M1 #3	SHORT_STRING	404..413
36 (0x24)	RTD #4Name	Get/Set	RTD M1 #4	SHORT_STRING	414..423
37 (0x25)	RTD #5 Name	Get/Set	RTD M1 #5	SHORT_STRING	424..433
38 (0x26)	RTD #6 Name	Get/Set	RTD M1 #6	SHORT_STRING	434..443
39 (0x27)	RTD #7 Name	Get/Set	RTD M1 #7	SHORT_STRING	444..453
40 (0x28)	RTD #8 Name	Get/Set	RTD M1 #8	SHORT_STRING	454..463
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

Class 0x68, Instance 1 (continued)

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
49 (0x31)	RTD #1 Trip Cntr	Get		UINT	1165
50 (0x32)	RTD #2 Trip Cntr	Get		UINT	1166
51 (0x33)	RTD #3 Trip Cntr	Get		UINT	1167
52 (0x34)	RTD #4 Trip Cntr	Get		UINT	1168
53 (0x35)	RTD #5 Trip Cntr	Get		UINT	1169
54 (0x36)	RTD #6 Trip Cntr	Get		UINT	1170
55 (0x37)	RTD #7 Trip Cntr	Get		UINT	1171
56 (0x38)	RTD #8 Trip Cntr	Get		UINT	1172

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	726/727
2	IRIG Min Offset	Get/Set	RTC Min = IRIG Min + IRIG Min Offset	0, 0, 23	REAL	724/725
3	RTC Date	Get	Number of Days Since 1972-01-01		DATE	720/721
4	RTC Time	Get	Number of Milliseconds Since 00:00:00:00.000	0, 0, 86399999	TIME OF DAY	722/723
5	RTC Set	Get/Set ⁽¹⁾	String Used to Set the Date and Time YY/MM/DD-HH:MM:SS		SHORT_STRING	728..737

⁽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 100, Attribute 3. Register values are defined in Appendix E of the Main Product Manual. Each register in Appendix E defines a 16-bit value. For example, to configure an assembly to read the first four RTD

temperatures in RTD Module 1, enter register numbers 918, 919, 920, 921, 922, 923, 924, and 925. The first 16 bytes of the resulting INPUT assembly will contain the RTD data and the remaining bytes do not contain any valid data.

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 0	Get/Set	User Register Value	0, 0, 1189	UINT	1400
2	Register 1	Get/Set	User Register Value	0, 0, 1189	UINT	1401
3	Register 2	Get/Set	User Register Value	0, 0, 1189	UINT	1402
4	Register 3	Get/Set	User Register Value	0, 0, 1189	UINT	1403
5	Register 4	Get/Set	User Register Value	0, 0, 1189	UINT	1404
6	Register 5	Get/Set	User Register Value	0, 0, 1189	UINT	1405
7	Register 6	Get/Set	User Register Value	0, 0, 1189	UINT	1406
8	Register 7	Get/Set	User Register Value	0, 0, 1189	UINT	1407
9	Register 8	Get/Set	User Register Value	0, 0, 1189	UINT	1408
10	Register 9	Get/Set	User Register Value	0, 0, 1189	UINT	1409
11	Register 10	Get/Set	User Register Value	0, 0, 1189	UINT	1410
12	Register 11	Get/Set	User Register Value	0, 0, 1189	UINT	1411
13	Register 12	Get/Set	User Register Value	0, 0, 1189	UINT	1412
14	Register 13	Get/Set	User Register Value	0, 0, 1189	UINT	1413
15	Register 14	Get/Set	User Register Value	0, 0, 1189	UINT	1414
16	Register 15	Get/Set	User Register Value	0, 0, 1189	UINT	1415
17	Register 16	Get/Set	User Register Value	0, 0, 1189	UINT	1416
18	Register 17	Get/Set	User Register Value	0, 0, 1189	UINT	1417
19	Register 18	Get/Set	User Register Value	0, 0, 1189	UINT	1418
20	Register 19	Get/Set	User Register Value	0, 0, 1189	UINT	1419
21	Register 20	Get/Set	User Register Value	0, 0, 1189	UINT	1420
22	Register 21	Get/Set	User Register Value	0, 0, 1189	UINT	1421
23	Register 22	Get/Set	User Register Value	0, 0, 1189	UINT	1422
24	Register 23	Get/Set	User Register Value	0, 0, 1189	UINT	1423
25	Register 24	Get/Set	User Register Value	0, 0, 1189	UINT	1424
26	Register 25	Get/Set	User Register Value	0, 0, 1189	UINT	1425
27	Register 26	Get/Set	User Register Value	0, 0, 1189	UINT	1426
28	Register 27	Get/Set	User Register Value	0, 0, 1189	UINT	1427
29	Register 28	Get/Set	User Register Value	0, 0, 1189	UINT	1428
30	Register 29	Get/Set	User Register Value	0, 0, 1189	UINT	1429
31	Register 30	Get/Set	User Register Value	0, 0, 1189	UINT	1430
32	Register 31	Get/Set	User Register Value	0, 0, 1189	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	980
2	Record Head	Get	Points to next record. Latest record at Record Head minus 1.	0, 0, 63	UINT	981
3	Record Selector	Get/Set	Selects the record for which the data is displayed in this instance.	0, 0, 63	UINT	982
4	Record Date	Get	The date when the record was captured.	0, 0, 65535	DATE	983/984
5	Record Time	Get	Time-of-Day the record was captured.	0, 0, 86399999	TOD	985/986
6	Record Type	Get	Specifies the trigger source: 0= Record Empty 1= Trip Record 2= + Edge Record 3= - Edge Record 4= +/- Edge Record	0, 0, 4	UINT	987
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	988
8	IA	Get	Phase A Current (A)		REAL	989/990
9	IB	Get	Phase B Current (A)		REAL	991/992
10 (0x0A)	IC	Get	Phase C Current (A)		REAL	993/994
11 (0x0B)	I _{CT}	Get	Ground-Fault Current (A)		REAL	995/996
12 (0x0C)	3I ₀	Get	Calculated Residual		REAL	997/998
13 (0x0D)	V _{ab}	Get	Line-to-Line Voltage (kV)		REAL	999/1000
14 (0x0E)	V _{bc}	Get	Line-to-Line Voltage (kV)		REAL	1001/1002
15 (0x0F)	V _{ca}	Get	Line-to-Line Voltage (kV)		REAL	1003/1004
16 (0x10)	V _a	Get	Line-to-Ground Voltage (kV)		REAL	1005/1006
17 (0x11)	V _b	Get	Line-to-Ground Voltage (kV)		REAL	1007/1008
18 (0x12)	V _c	Get	Line-to-Ground Voltage (kV)		REAL	1009/1010
19 (0x13)	A _{in}	Get	Analog Input		REAL	1011/1012
20 (0x14)	Unbalance (I)	Get	Current Unbalance (pu)		REAL	1013/1014
21 (0x15)	Unbalance (V)	Get	Current Unbalance (pu)		REAL	1015/1016
22 (0x16)	I ² T Used	Get	Used I ² T Overload (pu)		REAL	1017/1018

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

ATTRIBUTE NUMBER	ATTRIBUTE NAME	SERVICES	DESCRIPTION	DEFAULT, MINIMUM, MAXIMUM	DATA TYPE	COMM REGISTER
23 (0x17)	Frequency	Get	Frequency in Hz		REAL	1019/1020
24 (0x18)	S	Get	Apparent Power (kVA)		REAL	1021/1022
25 (0x19)	P	Get	Real Power (kW)		REAL	1023/1024
26 (0x1A)	Q	Get	Reactive Power (kVAR)		REAL	1025/1026
27 (0x1B)	PF	Get	Power Factor (-1, +1)		REAL	1027/1028
28 (0x1C)	M1 RTD1	Get	RTD Temperature Reading (°C)		REAL	1029/1030
29 (0x1D)	M1 RTD2	Get	RTD Temperature Reading (°C)		REAL	1031/1032
30 (0x1E)	M1 RTD3	Get	RTD Temperature Reading (°C)		REAL	1033/1034
31 (0x1F)	M1 RTD4	Get	RTD Temperature Reading (°C)		REAL	1035/1036
32 (0x2A)	M1 RTD5	Get	RTD Temperature Reading (°C)		REAL	1037/1038
33 (0x21)	M1 RTD6	Get	RTD Temperature Reading (°C)		REAL	1039/1040
34 (0x22)	M1 RTD7	Get	RTD Temperature Reading (°C)		REAL	1041/1042
35 (0x23)	M1 RTD8	Get	RTD Temperature Reading (°C)		REAL	1043/1044

5. HARDWARE SPECIFICATIONS

Interface 10Base-T, 100Base-T,
 Cat. 3, 4, 5, UTP, STP
 Protocol EtherNet/IP and Modbus TCP
 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

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

MANUAL RELEASE DATE	MANUAL REVISION
April 15, 2014	1-A-041514

MANUAL REVISION HISTORY

REVISION 1-A-041514

- Added Open Retry to Supervisor Class 0x29, Instance 1.
- Updated Set Point Class 0x64, Instance 0 default, minimum and maximum.
- Added PTC Temperature and Reversepower instances.