Digital Energy
**Multilin**

# 750/760

## Feeder Management Relay

# COMMUNICATIONS GUIDE

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# 750/760 Feeder Management Relay

# Communications Guide

## 1 Overview

### 1.1 Protocols

The 750/760 Feeder Management Relay communicates with other computerized equipment such as programmable logic controllers, personal computers, or plant master computers using either the AEG Modicon Modbus protocol or the Harris Distributed Network Protocol (DNP), Version 3.0. Following are some general notes:

- The 750/760 relay always act as slave devices meaning that they never initiate communications; they only listen and respond to requests issued by a master computer.
- For Modbus, a subset of the Remote Terminal Unit (RTU) format of the protocol is supported which allows extensive monitoring, programming and control functions using read and write register commands.
- For DNP, the functionality is restricted to monitoring of essential relay data and control of important relay functions. A complete description of the services available via DNP may be found in the *DNP 3.0 Device Profile Document* on page 2–77.

DNP is a complex protocol. As a consequence, it is not possible within the scope of this manual to provide a description of the protocol's operation in anything approaching the detail required to understand how to use it to communicate with the relay. It is strongly recommended that interested users contact the DNP Users Group at http://www.dnp.org to obtain further information:

Members of the DNP Users Group are eligible to receive complete descriptions of all aspects of the protocol. The Users Group also operates a website (http://www.dnp.org) where technical information and support is available.

## 1.2 Physical Layer

Both the Modbus and DNP protocols are hardware-independent so that the physical layer can be any of a variety of standard hardware configurations including RS232, RS422, RS485, fiber optics, etc. The 750/760 includes a front panel RS232 port and two rear terminal RS485 ports, one of which can also be configured as RS422. Data flow is half duplex in all configurations. Refer to the *Serial Communications* section in Chapter 3 of the instruction manual for details on wiring.

Each data byte is transmitted in an asynchronous format consisting of 1 start bit, 8 data bits, 1 stop bit, and possibly 1 parity bit. This produces a 10 or 11 bit data frame. This is important for transmission through modems at high bit rates (11 bit data frames are not supported by many modems at baud rates greater than 300).

The baud rate and parity are independently programmable for each communications port. Baud rates of 300, 1200, 2400, 4800, 9600, and 19200 are available. Even, odd, and no parity are available. See the *Communications* section in Chapter 5 of the instruction manual for further details.

The master device in any system must know the address of the slave device with which it is to communicate. The 750/760 will not act on a request from a master if the address in the request does not match the relay's slave address (unless the address is the broadcast address – see below).

A single setpoint selects the slave address used for all ports with the exception that for the front panel port the relay will accept any address when the Modbus protocol is used. The slave address is otherwise the same regardless of the protocol in use, but note that the broadcast address is 0 for Modbus and 65535 for DNP. The relay recognizes and processes a master request (under conditions that are protocol-specific) if the broadcast address is used but never returns a response.

DNP may be used on, at most, one of the communications ports. Any port(s) not selected to use DNP will communicate using Modbus. The **S1 RELAY SETUP ▷ COMMUNICATIONS ▷ DNP ▷ DNP PORT** setpoint is used to select which port will communicate using DNP.

The maximum time for a 750/760 relay to return a response to any (non-broadcast) master request never exceeds 1 second.

# 2 Modbus Protocol

## 2.1 Description

This section is dedicated to discussion of details of the Modbus protocol. As noted above, specifics of DNP are best obtained directly from the DNP Users Group. Along with the Device Profile Document, the DNP specification provides sufficient information for a user to develop an interface should DNP wish to be used for communications with the relay.

## 2.2 Data Link Layer

Communications takes place in packets which are groups of asynchronously framed byte data. The master transmits a packet to the slave and the slave responds with a packet. The end of a packet is marked by 'dead-time' on the communications line. The following describes general format of both transmit and receive packets. For exact details on packet formatting refer to subsequent sections describing each function code.

The Modbus packet format is a set of five sequential information blocks:

| Block | Size |
|---|---|
| Slave Address | 1 byte |
| Function Code | 1 byte |
| Data | *n* bytes, $n \geq 1$ |
| Cyclic Redundancy Check (CRC) | 2 bytes |
| Dead Time | 3.5 bytes transmission time |

Each block of the Modbus packet is described below:

- **Slave Address**: This is the address of the slave device intended to receive the packet sent by the master and perform the desired action. Each slave device on a communication bus must have a unique address to prevent bus contention. All the relay ports have the same address which is programmable from 1 to 254 (see the *Port Setup* section in Chapter 5 of the instruction manual). Only the addressed slave will respond to a packet that starts with its address. Note that the front port is an exception to this rule; it will act on a message containing any slave address.

  A master transmit packet with a slave address of 0 indicates a broadcast command. All slaves on the communication link will take action based on the packet, but none will respond to the master. Broadcast mode is only recognized when associated with Function Codes 05h, 06h, and 10h. For any other function code, a packet with broadcast mode slave address 0 will be ignored. See *Clock Synchronization of Multiple Relays* on page 2–11 for an example of broadcast mode.

- **Function Code**: This is one of the supported functions codes of the 750/760 which tells the slave what action to perform. See page –6 for complete details. An exception response from the slave is indicated by setting the high order bit of the function code in the response packet. See page –10 for further details.

- **Data**: This will be a variable number of bytes depending on the function code. This may include actual values, setpoints, or addresses sent by the master to the slave or by the slave to the master.

- **Cyclic Redundancy Check (CRC)**: This is a two byte error checking code. The RTU version of Modbus includes a 16-bit cyclic redundancy check (CRC-16) with every packet which is an industry standard method used for error detection. If a GE Multilin Modbus slave device receives a packet in which an error is indicated by the CRC, the slave device will not act upon or respond to the packet thus preventing any erroneous operations. See the following section for a description of how to calculate the CRC.
- **Dead Time**: A packet is terminated when no data is received for a period of 3.5 byte transmission times (about 15 ms at 2400 baud, 2 ms at 19200 baud). Consequently, the transmitting device must not allow gaps between bytes longer than this interval. Once the dead time has expired without a new byte transmission, all slaves start listening for a new packet from the master except for the addressed slave.

## 2.3 CRC-16 Algorithm

The CRC-16 algorithm essentially treats the entire data stream (data bits only; start, stop and parity ignored) as one continuous binary number. This number is first shifted left 16 bits and then divided by a characteristic polynomial (1100000000000101B). The 16 bit remainder of the division is appended to the end of the packet, MSByte first. The resulting packet including CRC, when divided by the same polynomial at the receiver will give a zero remainder if no transmission errors have occurred. This algorithm requires the characteristic polynomial to be reverse bit ordered. The most significant bit of the characteristic polynomial is dropped, since it does not affect the value of the remainder.

| | | |
|---|---|---|
| **Symbols:** | **-->** | data transfer |
| | **A** | 16 bit working register |
| | **$A_{low}$** | low order byte of A |
| | **$A_{high}$** | high order byte of A |
| | **CRC** | 16 bit CRC-16 result |
| | **i, j** | loop counters |
| | **(+)** | logical Exclusive OR operator |
| | **N** | total number of data bytes |
| | **$D_i$** | i-th data byte (i = 0 to N-1) |
| | **G** | 16-bit characteristic polynomial = 1010000000000001(binary) with MSbit dropped and bit order reversed |
| | **shr (x)** | right shift operator (the LSbit of x is shifted into a carry flag, a '0' is shifted into the MSbit of x, all other bits are shifted right one location) |

The CRC algorithm is shown below.

1. FFFF (hex) --> A
2. 0 --> i
3. 0 --> j
4. $D_i$ (+) $A_{low}$ --> $A_{low}$
5. j + 1 --> j
6. shr (A)
7. Is there a carry?
   If No: go to step 8; if Yes: G (+) A --> A and continue.
8. Is j = 8? If No: go to 5; if Yes: continue.
9. i + 1 --> i
10. Is i = N? If No: go to 3; if Yes: continue.

```
11. A --> CRC
```


GE Multilin will provide a C programming language implementation of this algorithm upon request.

## 2.4 Message Timing

Communication message synchronization is maintained by timing constraints. The receiving device must measure the time between the reception of characters. If three and one half character times elapse without a new character or completion of the message, then the communication link must be reset (i.e. all slaves start listening for a new query message from the master). Thus at 1200 baud a delay of greater than $3.5 \times 1 / 1200 \times 10 = 29.2$ ms will cause the communication link to be reset. At 9600 baud a delay of greater than $3.5 \times 1 / 9600 \times 10 = 3.6$ ms will cause the communication link to be reset. Most master query messages will be responded to in less than 50 ms.

# 3 Modbus Functions

## 3.1 Supported Modbus Function Codes

Modbus officially defines function codes from 1 to 127 though only a small subset is generally needed. The 750/760 relays support some of these functions, as summarized below. Subsequent sections describe each function code in detail.

**Table 1: GE Multilin Modbus Function Codes**

| Code | | Definition | Description | Substitute |
|---|---|---|---|---|
| Hex | Dec | | | |
| 01 | 1 | Read Binary Status | Read one or more consecutive binary status bits from the 750/760. | --- |
| 02 | 2 | | | --- |
| 03 | 3 | Read Actual Values Or Setpoints | Read actual value or setpoint registers from one or more consecutive memory map register addresses. | 04h |
| 04 | 4 | | | 03h |
| 05 | 5 | Execute Operation | Perform 750/760 specific operations. | 10h |
| 06 | 6 | Store Single Setpoint | Write a specific value into a single setpoint register. | 10h |
| 10 | 16 | Store Multiple Setpoints | Write specific values into one or more consecutive setpoint registers. | --- |

## 3.2 Function Code 01h/02h: Read Binary Status

These function codes allow the master to read one or more consecutive binary status bits from an 750/760. The status bits are packed into bytes with the first addressed bit occupying the least significant bit position of the first returned byte. Enough bytes are returned to contain all requested status bits. The last byte is zero-padded as required. The maximum number of status bits that can be read in a single request is 1920 (although this greatly exceeds the number of status bits defined in the 750/760).

The addresses of the bits that can be read using these functions are the same as the point indices defined for the DNP Binary Input objects (e.g., address zero references the "Relay In Service" status). Refer to the *DNP 3.0 Device Profile Document* on page 2–77 for the definition of all binary status data. Note that function codes 01H and 02H are identical in their operation.

The following table shows the format of the master and slave packets. The example shows a master device requesting 10 status bit values starting at address 13h from slave device 11; the slave device responds with the bit values 1, 0, 1, 1, 0, 0, 1, 0, 0 and 1 from binary status addresses 13h through 1Ch inclusive. Note that two bytes are required to contain the response data. The first byte contains the first eight data bits stored in the least

significant to the most significant bit position. The second byte contains the last two data bits stored in the least two significant bit positions. Note that the rest of the second byte is zero-filled.

| Master Transmission | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message for slave 11 |
| Function Code | 1 | 01 | read binary status |
| Data Starting Address | 2 | 00 13 | data starting at 0013h |
| Number of Data Bits | 2 | 00 0A | 10 data bits |
| CRC | 2 | 4F 58 | computed CRC error code |

| Slave Response | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message from slave 11 |
| Function Code | 1 | 01 | read binary status |
| Byte Count | 1 | 02 | 2 bytes total |
| Data Bytes (high, low) | 2 | 4D 02 | value in address 0013h |
| CRC (low, high) | 2 | CC AE | computed CRC error code |

## 3.3 Function Code 03h/04h: Read Actual Values / Setpoints

This function code allows the master to read one or more consecutive data registers (actual values or setpoints) from an 750/760. Data registers are always 16 bit (two byte) values transmitted high-order byte first. The maximum number of registers that can be read in a single packet is 120. See the *Memory Map* on page 2–18 for exact details on the data registers.

Since some PLC implementations of Modbus only support one of function codes 03h and 04h, the 750/760 interpretation allows either function code to be used for reading one or more consecutive data registers. The data starting address will determine the type of data being read. Function Codes 03h and 04h are therefore identical.

The following table shows the format of the master and slave packets. The example shows a master device requesting 3 register values starting at address 200h from slave device 11; the slave device responds with the values 555, 0, and 100 from registers 200h, 201h, and 202h respectively.

| Master Transmission | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message for slave 11 |
| Function Code | 1 | 03 | read register values |
| Data Starting Address | 2 | 02 00 | data starting at 0200h |
| Number of Registers | 2 | 00 03 | 3 registers = 6 bytes total |
| CRC (low, high) | 2 | 06 E3 | computed CRC error code |

| Slave Response | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message from slave 11 |
| Function Code | 1 | 03 | read register values |
| Byte Count | 1 | 06 | 3 values = 6 bytes total |
| Data #1 (high, low) | 2 | 02 2B | value in address 0200h |

| Slave Response | Bytes | Example | Description |
|---|---|---|---|
| Data #2 (high, low) | 2 | 00 00 | value in address 0201h |
| Data #3 (high, low) | 2 | 00 64 | value in address 0202h |
| CRC (low, high) | 2 | C8 BA | computed CRC error code |

## 3.4 Function Code 05h: Execute Operation

This function code allows the master to perform various operations in the 750/760. Operations are shown in the *Summary of Operation Codes for Function 05h* table.

The following table shows the format of the master and slave packets. The example shows a master device requesting the slave device 11 to perform a reset. The 'high' and 'low' Code Value bytes always have the values FFh and 00h, respectively and are a remnant of the original Modbus definition of this function code.

| Master Transmission | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message for slave 11 |
| Function Code | 1 | 05 | execute operation |
| Operation Code | 2 | 00 01 | remote reset |
| Code Value | 2 | FF 00 | perform operation |
| CRC (low, high) | 2 | DF 6A | computed CRC error code |

| Slave Response | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message from slave 11 |
| Function Code | 1 | 05 | execute operation |
| Operation Code | 2 | 00 01 | remote reset |
| Code Value | 2 | FF 00 | perform operation |
| CRC (low, high) | 2 | DF 6A | computed CRC error code |

**Table 2: Summary of Operation Codes for Function 05h**

| Operation Code | Definition | Description |
|---|---|---|
| 0000h | No Operation | Does not do anything. |
| 0001h | Reset | Performs the same function as the front panel RESET key. |
| 0002h | Open Breaker | Performs the same function as the front panel OPEN key. The 760 must be in Remote Mode for this operation to be effective. |
| 0003h | Close Breaker | Performs the same function as the front panel CLOSE key. The 760 must be in Remote Mode for this operation to be effective. |
| 0004h | Set Time | Sets the internal clock time. See page –11 for details. |
| 0005h | Set Date | Sets the internal clock date. See page –11 for details. |
| 0006h | Trigger Trace Memory | Performs the same function as the logic input function **TRIGGER TRACE MEMORY**. |
| 0007h | Clear Energy Use Data | Performs the same function as **CLEAR ENERGY USE DATA** command. |

Table 2: Summary of Operation Codes for Function 05h

| Operation Code | Definition | Description |
|---|---|---|
| 0008h | Clear Max Demand Data | Performs the same function as the **CLEAR MAX DMD DATA** command. |
| 0009h | Clear Event Recorder Data | Performs the same function as the **CLEAR EVENT RECORDER DATA** command. |
| 000Ah | Reset Trip Counter Data | Performs the same function as the **RESET TRIP COUNTER DATA** command. |
| 000Bh | Reset Arcing Current Data | Performs the same function as the **RESET ARCING CURRENT DATA** command. |
| 000Ch | Display Override Packet | Displays the 40 character (20 register) *Override_Packet* (addresses 10B1 to 10C4 hex) for the time specified in *Override_Time* (address 10B0 hex). |
| 000Dh | Trigger Data Logger | Performs the same function as the logic input function **TRIGGER DATA LOGGER**. |
| 000Eh | Reset Trace Memory | Resets the Trace Memory oscillography data by clearing the number of captured events to zero. |
| 000Fh | Reset Data Logger | Resets the Data Logger by clearing the number of captured events to zero. |
| 0010h | Reset Ar Count Data | Resets the Autoreclose Count by setting the **AR SHOT COUNT** to zero. |
| 0011h | Reset Ar Rate Data | Resets the Autoreclose Shot Rate by setting **AR SHOT RATE** to zero. |

## 3.5 Function Code 06H: Store Single Setpoint

This function code allows the master to modify the contents of a single setpoint register in a 750/760. Setpoint registers are always 16 bit (two byte) values transmitted high-order byte first (see the *Memory Map* on page 2–18 for details). The following table shows the format of the master and slave packets. It shows a master device storing the value 200 at memory map address 1100h to slave device 11.

| Master Transmission | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message for slave 11 |
| Function Code | 1 | 06 | store single setpoint |
| Data Starting Address | 2 | 11 00 | data starting at 1100h |
| Data | 2 | 00 C8 | data for address 1100h |
| CRC (low, high) | 2 | 8F F0 | computed CRC error code |

| Slave Response | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message from slave 11 |
| Function Code | 1 | 06 | store single setpoint value |
| Data Starting Address | 2 | 11 00 | data starting at 1100h |
| Data | 2 | 00 C8 | data for address 1100h |
| CRC (low, high) | 2 | 8F F0 | computed CRC error code |

## 3.6 Function Code 10H: Store Multiple Setpoints

This function code allows the master to modify the contents of a one or more consecutive setpoint registers in a 750/760. Setpoint registers are 16 bit (two byte) values transmitted high-order byte first. The maximum number of setpoint registers that can be stored in a single packet is 60. The table below shows the format of the master and slave packets. It shows a master device storing the value 200 at memory map address 1100h, and the value 1 at memory map address 1101h to slave device 11.

| Master Transmission | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message for slave 11 |
| Function Code | 1 | 10 | store multiple setpoint value |
| Data Starting Address | 2 | 11 00 | data starting at 1100h |
| Number of Setpoints | 2 | 00 02 | 2 setpoints = 4 bytes total |
| Byte Count | 1 | 04 | 4 bytes of data |
| Data #1 | 2 | 00 C8 | data for address 1100h |
| Data #2 | 2 | 00 01 | data for address 1101h |
| CRC (low, high) | 2 | 27 01 | computed CRC error code |

| Slave Response | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message from slave 11 |
| Function Code | 1 | 10 | store multiple setpoint value |
| Data Starting Address | 2 | 11 00 | data starting at 1100h |
| Number of Setpoints | 2 | 00 02 | 2 setpoints = 4 bytes total |
| CRC (low, high) | 2 | 46 64 | computed CRC error code |

## 3.7 Exception Responses

Programming or operation errors happen because of illegal data in a packet, hardware or software problems in the slave device, etc. These errors result in an exception response from the slave. The GE Multilin 750/760 implements the error codes listed below. The slave detecting one of these errors sends a response packet to the master with the high-order bit of the function code set to 1. The following table shows the format of the master and slave packets. The example shows a master device sending the unsupported function code 39h to slave device 11.

| Master Transmission | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message for slave 11 |
| Function Code | 1 | 39 | unsupported function code |
| CRC (low, high) | 2 | CD F2 | computed CRC error code |

| Slave Response | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message from slave 11 |
| Function Code | 1 | B9 | return unsupported function code |
| Data Starting Address | 2 | 11 00 | data starting at 1100h |
| Number of Setpoints | 2 | 00 02 | 2 setpoints = 4 bytes total |
| CRC (low, high) | 2 | 93 | computed CRC error code |

**Table 3: Exception Response Error Codes**

| Error Code | Modbus Definition | GE Multilin Implementation |
|---|---|---|
| 01 | Illegal Function | The function code of the master query message is not supported by the slave. |
| 02 | Illegal Data Address | The address referenced in the data field of the master query message is not an address supported by the slave. |
| 03 | Illegal Data Value | The value referenced in the data field of the master query message is not allowable in the addressed slave location. |
| 04 | Failure In Associated Device | An external device connected to the addressed slave device has failed and the data requested cannot be sent. This response will be returned if a GE Multilin device connected to the RS485 external device port of the 745 has failed to respond to the 750/760. |
| 05* | Acknowledge | The addressed slave device has accepted and is processing a long duration command. Poll for status. |
| 06* | Busy, Rejected Message | The message was received without error, but the slave device is engaged in processing a long duration command. Retransmit later, when the slave device may be free. |
| 07* | Nak - Negative Acknowledge | The message was received without error, but the request could not be performed, because this version of the 750/760 does not have the requested operation available. |

* Some Modbus implementations may not support these exception responses

## 3.8 Clock Synchronization of Multiple Relays

The time and date of multiple relays on the same communication link can be synchronized so that time stamping of events on different relays can be correlated. The following procedure describes how to synchronize the clocks of multiple relays. Since the clock is accurate to 1 minute per month, performing this procedure every 10 minutes will result in synchronization accuracy of ±10 ms.

1. Store values for the date and time setpoints Set Date and Set Time at locations 1006h and 1008h in the Memory Map respectively into each slave device.
2. Broadcast (via slave address 0) the Set Date operation code via function code 05h to all connected slaves to synchronize the dates.
3. Broadcast (via slave address 0) the Set Time operation code via function code 05h to all connected slaves to synchronize the times. If synchronizing to an external clock source then this command should be sent when the time is equal to the value stored in Set Time.

The following table shows the format of the master and slave packets for a master device storing the date of June 10, 1994 and time of 2:15:30 PM to slave device 11 as required by step one of the procedure.

| Master Transmission | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message for slave 11 |
| Function Code | 1 | 10 | store multiple setpoints |
| Data Starting Address | 2 | 10 06 | data at address 1100h |
| Number Of Setpoints | 2 | 00 04 | 4 setpoints = 8 bytes total |
| Byte Count | 1 | 08 | 8 bytes of data |
| Data #1 | 2 | 06 0A | month = 06h (June), day = 0Ah (10) |
| Data #2 | 2 | 07 CA | Year = 07CAh (1994) |
| Data #3 | 2 | 0E 0F | Time (hr:min) = 0Eh:0Fh (14:15) |
| Data #4 | 2 | 75 30 | Time (ms) = 7530h (30000 ms = 30 s) |
| CRC (Low, High) | 2 | 37 0C | computed CRC error code |

| Slave Response | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message from slave 11 |
| Function Code | 1 | 10 | store multiple setpoints |
| Data Starting Address | 2 | 10 06 | data starting at 1006h |
| Number of Bytes | 2 | 00 08 | 4 setpoints = 8 bytes total |
| CRC (low, high) | 2 | 27 9B | computed CRC error code |

The following table shows the format of the master and slave packets for a master device sending the Store Time operation code to all slave devices on the communications link as required by step three of the procedure.

| Master Transmission | Bytes | Example | Description |
|---|---|---|---|
| Slave Address | 1 | 11 | message for slave 11 |
| Function Code | 1 | 05 | execute operation |
| Operation Code | 2 | 00 04 | set time |
| Code Value | 2 | FF 00 | perform operation |
| CRC (Low, High) | 2 | CC 2A | computed CRC error code |

| Slave Response | Bytes | Example | Description |
|---|---|---|---|
| No response from slave. | | | |

# 4 Modbus Memory Map

## 4.1 Reading the Event Recorder

All Event Recorder data can be read from Modbus registers found in the address range 2000h to 20FFh.

The 'Number of Events Since Last Clear' register at address 2001h is incremented by one every time a new event occurs. The register is cleared to zero when the Event Recorder is cleared. When a new event occurs, it is assigned an 'event number' which is equal to the incremented value of this register; the newest event will have an event number equal to the Number of Events. This register can be used to determine if any new events have occurred by periodically reading the register to see if the value has changed. If the Number of Events has increased then there are new events available.

Only the data for a single event can be read from the Modbus memory map in a single data packet. The 'Event Number Selector' register at address 2000h selects the event number for which data can be read from the memory map. For example, to read the data for event number 123, the value 123 must first be written to this register. All the data for event number 123 can now be read from the 'Event Record Data' registers at addresses 2010h to 2029h. Only the last 128 events are actually stored in the relay's memory. Attempting to retrieve data for elder events that are not stored will result in a Modbus exception response when writing to the 'Event Number Selector'.

The following example illustrates how information can be retrieved from the Event Recorder:

A SCADA system polls the Number of Events register once every minute. It now reads a value of 27 from the register when previously the value was 24 which means that three new events have occurred. The SCADA system writes a value of 25 to the Event Number Selector register. It then reads the data for event number 25 from the Event Record Data registers and stores the data to permanent memory for retrieval by an operator. The system now writes the value 26 to the selector and then reads the data for event number 26. Finally, the value 27 is written to the selector followed by reading the data for this event. All the data for the new events has now been retrieved by the SCADA system so it resumes polling the Number of Events register.

The data for an event should be straightforward to interpret from the information given in the Memory Map except for the 'Cause of Event' register. Data format F24 describes the event cause register which contains several 'fields' of information. The 'Event Type' field determines how to interpret the remainder of the register. Interpreting the event cause register is most easily described with several examples.

| Event Cause Register Value | Event Cause Interpretation |
|---|---|
| 1003h | Breaker Opened |
| 3501h | A-C Phase Time Overcurrent 1 Trip |
| 8501h | A-C Phase Time Overcurrent 1 Dropout |
| 4212h | B Overvoltage 1 Alarm |
| 6514h | User Input A Asserted via Contact Input |
| 7009h | Clock Not Set |

## 4.2 Reading Trace Memory

All Trace Memory waveform data can be read from Modbus registers found in the address range 2100h to 215Fh. Familiarity with the Trace Memory settings is required to understand this section; refer to the *Trace Memory* section in Chapter 5 of the instruction manual for details.

The 'Number of Trace Memory Triggers Since Last Clear' register is incremented by one every time a new Trace Memory is triggered. This register is cleared to zero when Trace Memory is cleared. When a new trigger occurs, the associated waveform data is assigned a 'Trace Memory Number' which is equal to the incremented value of this register; the newest data will have a number equal to the Number of Trace Memory Triggers. This register can be used to determine if any new data has been captured by periodically reading it to see if the value has changed; if the Number of Trace Memory Triggers has increased then there is new data available.

The Trace Memory Buffer Organization setpoint determines the number of samples that are captured per channel for each separate trigger. This setpoint also determines how many data triggers are stored in memory. For example if the setting is 4x1024 then there are 1024 samples per channel per trigger and the last three data triggers can be read from memory. Note that only 64 samples of one data channel for a single waveform can be read from the Modbus memory map in a single data packet. The 'Trace Memory Selectors' registers determine which waveform data can be read from the memory map.

The 'Trace Memory Number Selector' determines which Trace Memory can be read. For example, to read the data for Trace Memory number 3, the value 3 must first be written to this register. Data for Trace Memory number 3 can now be read from the 'Trace Memory Information' registers at addresses 2111h to 2119h. These registers include a trigger cause (see the previous section for a description of the data format), a trigger time and date stamp, and the sampling frequency. There is also the 'Start Index' and 'Trigger Index' which determine how to 'unravel' the data samples; see the description of the circular data structure below.

The 'Trace Memory Channel Selector' determines which data channel samples can be read from the 'Trace Memory Samples' registers at addresses 2120h to 215Fh; refer to format F26 for a complete listing of the available data channels. For example, to read Vc voltage samples a value of 6 is written to this register. Note that this register also determines the data format of the samples.

The 'Trace Memory Sample Selector' (TMSS) determines which block of 64 samples can be read from the 'Trace Memory Samples' registers. The number of samples stored for one channel is variable and depends on the 'Buffer Organization' setpoint. The 'Number of Trace Memory Samples Stored' register indicates the number of samples that have already been accumulated for the selected Trace Memory Number; this register may have a value less than the total number of samples that can be stored if a trigger just occurred and there are an appreciable number of post-trigger samples to capture.

The samples are stored in a circular buffer; the figure below shows how a waveform might be stored for one channel. The 'Trace Memory Start Index' determines where the waveform begins in the buffer. Likewise, the 'Trace memory Trigger Index' determines where the trigger point is. In this example the Start Index is 96 and the Trigger Index is 224; note that the indices are always a multiple of sixteen.

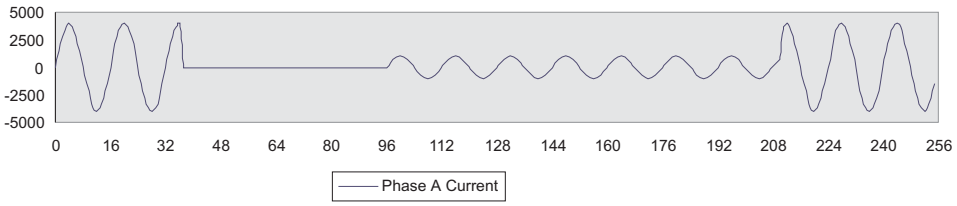


**FIGURE 2–1: Trace Memory Circular Buffer**

The following example illustrates how information can be retrieved from Trace Memory:

1. A SCADA system polls the Number of Trace Memory Triggers register once every minute. It now reads a value of 4 from the register where previously the value was 3 which means that a new data has been captured. The SCADA system proceeds with the following steps to read all the waveform data. After these steps it resumes polling the Number of Trace Memory Triggers register.
2. Read the **TRACE MEMORY BUFFER ORGANIZATION** setpoint
3. Write a value of 4 to the Trace Memory Number Selector.
4. Read all the Trace Memory Information registers and store to SCADA memory.
5. Set variables TMCS and TMSS to 0.
6. Write TMCS to Trace Memory Channel Selector.
7. Write TMSS to Trace Memory Sample Selector.
8. Read 64 samples from Trace Memory Samples and store to SCADA memory.
9. Increment TMSS by 64.
10. If TMSS < Total Number of Samples then go to Step 5.
11. Increment CS by 1.
12. If TMCS < total number of channels available then go to Step 4.
13. Done.

All the Trace Memory data for the most recent trigger is now stored to SCADA memory. The SCADA software could now 'unravel' the circular buffers using the Start Index and Trigger Index registers that were read in Step 3 and store them permanently to file or perhaps generate a graphical picture.

## 4.3 Reading the Data Logger

All Data Logger information can be read from Modbus registers 2200h to 225fh. Familiarity with the Data Logger settings is required to understand this section; refer to the *Data Logger* section in Chapter 5 of the instruction manual for details. Reading the Data Logger is very similar to reading Trace Memory and the description for the latter should be used with note of the exceptions described below.

The data channels in the Data Logger are programmable and are determined by the Channel 1 to 8 Source setpoints. These setpoints determine the format of data samples for a given channel.

In Continuous mode:

- The Number of Data Log Triggers Since Last Clear is always equal to one.
- The Data Logger only maintains one buffer of 4096 samples for each channel. Since the buffer is being continuously updated the 'Data Log Start Index' will change once the buffer is full and new data is added (overwriting old data and thus moving the location of the starting index). At slow sampling rates this is less important but when sampling is performed at a high rate it is very likely that the start index will move between subsequent reads of the memory map.
- The "Data Log Trigger Index" will always index the last sample added to the buffer. Thus, it too, will also be quickly and continuously changing if the sampling rate is high.
- The "Data Log Trigger Cause" will be set to zero and the time and date are when the last sample data was written to the buffer.

## 4.4 Accessing Data via the User Map

The 750/760 has a powerful feature, called the User Map, which allows a computer to read up to 120 non-consecutive data registers (setpoints or actual values) by using one Modbus packet. It is often necessary for a master computer to continuously poll various values in each of the connected slave relays. If these values are scattered throughout the memory map, reading them would require numerous transmissions and would burden the communication link. The User Map can be programmed to join any memory map address to one in the block of consecutive User Map locations, so that they can be accessed by reading these consecutive locations.

The User Map feature consists of User Map Addresses #1 to #120 at locations 0180h to 01F7h in the Memory Map. These are the setpoints which store the memory map addresses of the values that are to be accessed. The data registers are read from the User Map Values #1 to #120 at locations 0100h to 0177h in the Memory Map. Reading the register at the location of User Map Value #1 returns the value at the address stored in User Map Address #1, User Map Value #2 the value at User Map Address #2, and so on. Storing registers is not allowed using the User Map.

The following table shows the register addresses to store in the User Map Addresses #1 to #6 so that several different data registers can be read in one continuous block from User Map Value #1 to #6. Reading the User Map Values is done via function code 03h or 04h.


The User Memory Map is only intended to be used to *read* data in a proficient manner for the master computer. The communication system should not be configured in a manner that generates *writes* to these locations continuously, as these settings are stored in the EEPROM that has a maximum of 100000 program/erase cycles.

Table 4: User Map Register Addresses

| Data Register Description | Values to Store in User Map Addresses | Locations in User Map Values to Read Data |
|---|---|---|
| General Status | Store 0200h at 0180h | 0100h |
| Active Condition | Store 0210h at 0181h | 0101h |
| Phase A RMS Current | Store 0300h at 0182h | 0102h |
| Phase B RMS Current | Store 0301h at 0183h | 0103h |
| Phase C RMS Current | Store 0302h at 0184h | 0104h |
| Phase CT Primary | Store 1100h at 0185h | 0105h |

## 4.5 Memory Map Organization

The 750/760 Memory Map describes all the data registers that can be accessed via serial communications. The Memory Map address range is grouped into several categories as outlined in the following table. All memory map locations are two byte (16 bit) values. The remaining pages of this chapter list all locations of the Memory Map. Addresses for all locations are shown in hexadecimal. Consult the range, step, units, and the data format (listed after the memory map) to interpret register values.

NOTE

Many Modbus communications drivers add 40001d to the actual address of the register addresses. For example, if address 0h was to be read, then 40001d would be the address required by the Modbus communications driver; similarly, if address 320h (800d) was to be read, then 40801d would be the address required by the Modbus communications driver.

Table 5: Memory Map Organization

| Memory Map Section | Address Range | Description |
|---|---|---|
| Product ID | 0000h to 007Fh | Identification and revision information. |
| Commands | 0080h to 00FFh | Substitute command locations. Read and write access. |
| User Map | 0100h to 01FFh | User Map Values and Addresses. See the previous section for details. |
| Actual Values | 0200h to 0FFFh | Actual values data. Read Only. |
| Setpoints | 1000h to 1FFFh | Setpoints data. Read and Write. |
| Event Recorder, Trace Memory, and Data Logger | 2000h to 2FFFh | See relevant sections in this chapter for details. |
| Reserved | 3000h to 3FFFh | Reserved for future use. |
| Factory Service Data | 4000h to FFFFh | Reserved. |

## 4.6 Memory Map

The 750/760 memory map is shown in the following table.

**Table 6: Modbus Memory Map (Sheet 1 of 39)**

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| **PRODUCT ID (read only)** | | | | | |
| 0000 | GE Multilin Product Device Code | --- | --- | F1 | --- |
| 0001 | Hardware Revision | 1 to 26 | --- | F13 | --- |
| 0002 | Software Revision | --- | --- | F14 | --- |
| 0003 | Version Number | 000 to 999 | --- | F1 | --- |
| 0004 | Bootware Revision | --- | --- | F14 | --- |
| 0005 | Installed Options | --- | --- | F15 | --- |
| 0006 | Serial Number (4 words) | --- | --- | F33 | --- |
| 000A | Date Of Manufacture (2 words) | --- | --- | F23 | --- |
| **ETHERNET OPTIONS [10] (read/write)** | | | | | |
| 0040 | IP Address | --- | --- | F91 | 000.000.000.000 |
| 0048 | IP Subnet Mask | --- | --- | F91 | 255.255.255.000 |
| 0050 | IP Default Gateway | --- | --- | F91 | 000.000.000.000 |
| **COMMANDS (read/write)** | | | | | |
| 0080 | Command Operation Code | --- | --- | F19 | 0 |
| 0081[1] | Simulate Front Panel Key Press | --- | --- | F55 | --- |
| 0088 | Communications Port Passcode (4 words) | --- | --- | F33 | --- |
| **VIRTUAL INPUTS (read/write)** | | | | | |
| 0090 | Reserved | | | | |
| 0091 | Virtual Input 1 | --- | --- | F66 | Not Asserted |
| 0092 | Virtual Input 2 | --- | --- | F66 | Not Asserted |
| 0093 | Virtual Input 3 | --- | --- | F66 | Not Asserted |
| 0094 | Virtual Input 4 | --- | --- | F66 | Not Asserted |
| 0095 | Virtual Input 5 | --- | --- | F66 | Not Asserted |
| 0096 | Virtual Input 6 | --- | --- | F66 | Not Asserted |
| 0097 | Virtual Input 7 | --- | --- | F66 | Not Asserted |
| 0098 | Virtual Input 8 | --- | --- | F66 | Not Asserted |
| 0099 | Virtual Input 9 | --- | --- | F66 | Not Asserted |
| 009A | Virtual Input 10 | --- | --- | F66 | Not Asserted |
| 009B | Virtual Input 11 | --- | --- | F66 | Not Asserted |
| 009C | Virtual Input 12 | --- | --- | F66 | Not Asserted |
| 009D | Virtual Input 13 | --- | --- | F66 | Not Asserted |
| 009E | Virtual Input 14 | --- | --- | F66 | Not Asserted |
| 009F | Virtual Input 15 | --- | --- | F66 | Not Asserted |
| 00A0 | Virtual Input 16 | --- | --- | F66 | Not Asserted |
| 00A1 | Virtual Input 17 | --- | --- | F66 | Not Asserted |
| 00A2 | Virtual Input 18 | --- | --- | F66 | Not Asserted |
| 00A3 | Virtual Input 19 | --- | --- | F66 | Not Asserted |
| 00A4 | Virtual Input 20 | --- | --- | F66 | Not Asserted |
| **SET TIME AND DATE (read/write)** | | | | | |
| 00F0[1] | Set Time (2 words) | --- | --- | F22 | --- |
| 00F2[1] | Set Date (2 words) | --- | --- | F23 | --- |
| **USER MAP VALUES (read only)** | | | | | |
| 0100 | User Map Value #1 | --- | --- | --- | --- |
| 0101 | User Map Value #2 | --- | --- | --- | --- |
| 0102 | User Map Value #3 | --- | --- | --- | --- |
| 0103 | User Map Value #4 | --- | --- | --- | --- |
| 0104 | User Map Value #5 | --- | --- | --- | --- |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 2 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 0105 | User Map Value #6 | --- | --- | --- | --- |
| 0106 | User Map Value #7 | --- | --- | --- | --- |
| 0107 | User Map Value #8 | --- | --- | --- | --- |
| 0108 | User Map Value #9 | --- | --- | --- | --- |
| 0109 | User Map Value #10 | --- | --- | --- | --- |
| 010A | User Map Value #11 | --- | --- | --- | --- |
| 010B | User Map Value #12 | --- | --- | --- | --- |
| 010C | User Map Value #13 | --- | --- | --- | --- |
| 010D | User Map Value #14 | --- | --- | --- | --- |
| 010E | User Map Value #15 | --- | --- | --- | --- |
| 010F | User Map Value #16 | --- | --- | --- | --- |
| 0110 | User Map Value #17 | --- | --- | --- | --- |
| 0111 | User Map Value #18 | --- | --- | --- | --- |
| 0112 | User Map Value #19 | --- | --- | --- | --- |
| 0113 | User Map Value #20 | --- | --- | --- | --- |
| 0114 | User Map Value #21 | --- | --- | --- | --- |
| 0115 | User Map Value #22 | --- | --- | --- | --- |
| 0116 | User Map Value #23 | --- | --- | --- | --- |
| 0117 | User Map Value #24 | --- | --- | --- | --- |
| 0118 | User Map Value #25 | --- | --- | --- | --- |
| 0119 | User Map Value #26 | --- | --- | --- | --- |
| 011A | User Map Value #27 | --- | --- | --- | --- |
| 011B | User Map Value #28 | --- | --- | --- | --- |
| 011C | User Map Value #29 | --- | --- | --- | --- |
| 011D | User Map Value #30 | --- | --- | --- | --- |
| 011E | User Map Value #31 | --- | --- | --- | --- |
| 011F | User Map Value #32 | --- | --- | --- | --- |
| 0120 | User Map Value #33 | --- | --- | --- | --- |
| 0121 | User Map Value #34 | --- | --- | --- | --- |
| 0122 | User Map Value #35 | --- | --- | --- | --- |
| 0123 | User Map Value #36 | --- | --- | --- | --- |
| 0124 | User Map Value #37 | --- | --- | --- | --- |
| 0125 | User Map Value #38 | --- | --- | --- | --- |
| 0126 | User Map Value #39 | --- | --- | --- | --- |
| 0127 | User Map Value #40 | --- | --- | --- | --- |
| 0128 | User Map Value #41 | --- | --- | --- | --- |
| 0129 | User Map Value #42 | --- | --- | --- | --- |
| 012A | User Map Value #43 | --- | --- | --- | --- |
| 012B | User Map Value #44 | --- | --- | --- | --- |
| 012C | User Map Value #45 | --- | --- | --- | --- |
| 012D | User Map Value #46 | --- | --- | --- | --- |
| 012E | User Map Value #47 | --- | --- | --- | --- |
| 012F | User Map Value #48 | --- | --- | --- | --- |
| 0130 | User Map Value #49 | --- | --- | --- | --- |
| 0131 | User Map Value #50 | --- | --- | --- | --- |
| 0132 | User Map Value #51 | --- | --- | --- | --- |
| 0133 | User Map Value #52 | --- | --- | --- | --- |
| 0134 | User Map Value #53 | --- | --- | --- | --- |
| 0135 | User Map Value #54 | --- | --- | --- | --- |
| 0136 | User Map Value #55 | --- | --- | --- | --- |
| 0137 | User Map Value #56 | --- | --- | --- | --- |
| 0138 | User Map Value #57 | --- | --- | --- | --- |
| 0139 | User Map Value #58 | --- | --- | --- | --- |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 3 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 013A | User Map Value #59 | --- | --- | --- | --- |
| 013B | User Map Value #60 | --- | --- | --- | --- |
| 013C | User Map Value #61 | --- | --- | --- | --- |
| 013D | User Map Value #62 | --- | --- | --- | --- |
| 013E | User Map Value #63 | --- | --- | --- | --- |
| 013F | User Map Value #64 | --- | --- | --- | --- |
| 0140 | User Map Value #65 | --- | --- | --- | --- |
| 0141 | User Map Value #66 | --- | --- | --- | --- |
| 0142 | User Map Value #67 | --- | --- | --- | --- |
| 0143 | User Map Value #68 | --- | --- | --- | --- |
| 0144 | User Map Value #69 | --- | --- | --- | --- |
| 0145 | User Map Value #70 | --- | --- | --- | --- |
| 0146 | User Map Value #71 | --- | --- | --- | --- |
| 0147 | User Map Value #72 | --- | --- | --- | --- |
| 0148 | User Map Value #73 | --- | --- | --- | --- |
| 0149 | User Map Value #74 | --- | --- | --- | --- |
| 014A | User Map Value #75 | --- | --- | --- | --- |
| 014B | User Map Value #76 | --- | --- | --- | --- |
| 014C | User Map Value #77 | --- | --- | --- | --- |
| 014D | User Map Value #78 | --- | --- | --- | --- |
| 014E | User Map Value #79 | --- | --- | --- | --- |
| 014F | User Map Value #80 | --- | --- | --- | --- |
| 0150 | User Map Value #81 | --- | --- | --- | --- |
| 0151 | User Map Value #82 | --- | --- | --- | --- |
| 0152 | User Map Value #83 | --- | --- | --- | --- |
| 0153 | User Map Value #84 | --- | --- | --- | --- |
| 0154 | User Map Value #85 | --- | --- | --- | --- |
| 0155 | User Map Value #86 | --- | --- | --- | --- |
| 0156 | User Map Value #87 | --- | --- | --- | --- |
| 0157 | User Map Value #88 | --- | --- | --- | --- |
| 0158 | User Map Value #89 | --- | --- | --- | --- |
| 0159 | User Map Value #90 | --- | --- | --- | --- |
| 015A | User Map Value #91 | --- | --- | --- | --- |
| 015B | User Map Value #92 | --- | --- | --- | --- |
| 015C | User Map Value #93 | --- | --- | --- | --- |
| 015D | User Map Value #94 | --- | --- | --- | --- |
| 015E | User Map Value #95 | --- | --- | --- | --- |
| 015F | User Map Value #96 | --- | --- | --- | --- |
| 0160 | User Map Value #97 | --- | --- | --- | --- |
| 0161 | User Map Value #98 | --- | --- | --- | --- |
| 0162 | User Map Value #99 | --- | --- | --- | --- |
| 0163 | User Map Value #100 | --- | --- | --- | --- |
| 0164 | User Map Value #101 | --- | --- | --- | --- |
| 0165 | User Map Value #102 | --- | --- | --- | --- |
| 0166 | User Map Value #103 | --- | --- | --- | --- |
| 0167 | User Map Value #104 | --- | --- | --- | --- |
| 0168 | User Map Value #105 | --- | --- | --- | --- |
| 0169 | User Map Value #106 | --- | --- | --- | --- |
| 016A | User Map Value #107 | --- | --- | --- | --- |
| 016B | User Map Value #108 | --- | --- | --- | --- |
| 016C | User Map Value #109 | --- | --- | --- | --- |
| 016D | User Map Value #110 | --- | --- | --- | --- |
| 016E | User Map Value #111 | --- | --- | --- | --- |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 4 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 016F | User Map Value #112 | --- | --- | --- | --- |
| 0170 | User Map Value #113 | --- | --- | --- | --- |
| 0171 | User Map Value #114 | --- | --- | --- | --- |
| 0172 | User Map Value #115 | --- | --- | --- | --- |
| 0173 | User Map Value #116 | --- | --- | --- | --- |
| 0174 | User Map Value #117 | --- | --- | --- | --- |
| 0175 | User Map Value #118 | --- | --- | --- | --- |
| 0176 | User Map Value #119 | --- | --- | --- | --- |
| 0177 | User Map Value #120 | --- | --- | --- | --- |
| **USER MAP ADDRESSES (read/write)** | | | | | |
| 0180 | User Map Address #1 | 0000 to FFFF | hex | F1 | 0 |
| 0181 | User Map Address #2 | 0000 to FFFF | hex | F1 | 0 |
| 0182 | User Map Address #3 | 0000 to FFFF | hex | F1 | 0 |
| 0183 | User Map Address #4 | 0000 to FFFF | hex | F1 | 0 |
| 0184 | User Map Address #5 | 0000 to FFFF | hex | F1 | 0 |
| 0185 | User Map Address #6 | 0000 to FFFF | hex | F1 | 0 |
| 0186 | User Map Address #7 | 0000 to FFFF | hex | F1 | 0 |
| 0187 | User Map Address #8 | 0000 to FFFF | hex | F1 | 0 |
| 0188 | User Map Address #9 | 0000 to FFFF | hex | F1 | 0 |
| 0189 | User Map Address #10 | 0000 to FFFF | hex | F1 | 0 |
| 018A | User Map Address #11 | 0000 to FFFF | hex | F1 | 0 |
| 018B | User Map Address #12 | 0000 to FFFF | hex | F1 | 0 |
| 018C | User Map Address #13 | 0000 to FFFF | hex | F1 | 0 |
| 018D | User Map Address #14 | 0000 to FFFF | hex | F1 | 0 |
| 018E | User Map Address #15 | 0000 to FFFF | hex | F1 | 0 |
| 018F | User Map Address #16 | 0000 to FFFF | hex | F1 | 0 |
| 0190 | User Map Address #17 | 0000 to FFFF | hex | F1 | 0 |
| 0191 | User Map Address #18 | 0000 to FFFF | hex | F1 | 0 |
| 0192 | User Map Address #19 | 0000 to FFFF | hex | F1 | 0 |
| 0193 | User Map Address #20 | 0000 to FFFF | hex | F1 | 0 |
| 0194 | User Map Address #21 | 0000 to FFFF | hex | F1 | 0 |
| 0195 | User Map Address #22 | 0000 to FFFF | hex | F1 | 0 |
| 0196 | User Map Address #23 | 0000 to FFFF | hex | F1 | 0 |
| 0197 | User Map Address #24 | 0000 to FFFF | hex | F1 | 0 |
| 0198 | User Map Address #25 | 0000 to FFFF | hex | F1 | 0 |
| 0199 | User Map Address #26 | 0000 to FFFF | hex | F1 | 0 |
| 019A | User Map Address #27 | 0000 to FFFF | hex | F1 | 0 |
| 019B | User Map Address #28 | 0000 to FFFF | hex | F1 | 0 |
| 019C | User Map Address #29 | 0000 to FFFF | hex | F1 | 0 |
| 019D | User Map Address #30 | 0000 to FFFF | hex | F1 | 0 |
| 019E | User Map Address #31 | 0000 to FFFF | hex | F1 | 0 |
| 019F | User Map Address #32 | 0000 to FFFF | hex | F1 | 0 |
| 01A0 | User Map Address #33 | 0000 to FFFF | hex | F1 | 0 |
| 01A1 | User Map Address #34 | 0000 to FFFF | hex | F1 | 0 |
| 01A2 | User Map Address #35 | 0000 to FFFF | hex | F1 | 0 |
| 01A3 | User Map Address #36 | 0000 to FFFF | hex | F1 | 0 |
| 01A4 | User Map Address #37 | 0000 to FFFF | hex | F1 | 0 |
| 01A5 | User Map Address #38 | 0000 to FFFF | hex | F1 | 0 |
| 01A6 | User Map Address #39 | 0000 to FFFF | hex | F1 | 0 |
| 01A7 | User Map Address #40 | 0000 to FFFF | hex | F1 | 0 |
| 01A8 | User Map Address #41 | 0000 to FFFF | hex | F1 | 0 |
| 01A9 | User Map Address #42 | 0000 to FFFF | hex | F1 | 0 |
| 01AA | User Map Address #43 | 0000 to FFFF | hex | F1 | 0 |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 5 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 01AB | User Map Address #44 | 0000 to FFFF | hex | F1 | 0 |
| 01AC | User Map Address #45 | 0000 to FFFF | hex | F1 | 0 |
| 01AD | User Map Address #46 | 0000 to FFFF | hex | F1 | 0 |
| 01AE | User Map Address #47 | 0000 to FFFF | hex | F1 | 0 |
| 01AF | User Map Address #48 | 0000 to FFFF | hex | F1 | 0 |
| 01B0 | User Map Address #49 | 0000 to FFFF | hex | F1 | 0 |
| 01B1 | User Map Address #50 | 0000 to FFFF | hex | F1 | 0 |
| 01B2 | User Map Address #51 | 0000 to FFFF | hex | F1 | 0 |
| 01B3 | User Map Address #52 | 0000 to FFFF | hex | F1 | 0 |
| 01B4 | User Map Address #53 | 0000 to FFFF | hex | F1 | 0 |
| 01B5 | User Map Address #54 | 0000 to FFFF | hex | F1 | 0 |
| 01B6 | User Map Address #55 | 0000 to FFFF | hex | F1 | 0 |
| 01B7 | User Map Address #56 | 0000 to FFFF | hex | F1 | 0 |
| 01B8 | User Map Address #57 | 0000 to FFFF | hex | F1 | 0 |
| 01B9 | User Map Address #58 | 0000 to FFFF | hex | F1 | 0 |
| 01BA | User Map Address #59 | 0000 to FFFF | hex | F1 | 0 |
| 01BB | User Map Address #60 | 0000 to FFFF | hex | F1 | 0 |
| 01BC | User Map Address #61 | 0000 to FFFF | hex | F1 | 0 |
| 01BD | User Map Address #62 | 0000 to FFFF | hex | F1 | 0 |
| 01BE | User Map Address #63 | 0000 to FFFF | hex | F1 | 0 |
| 01BF | User Map Address #64 | 0000 to FFFF | hex | F1 | 0 |
| 01C0 | User Map Address #65 | 0000 to FFFF | hex | F1 | 0 |
| 01C1 | User Map Address #66 | 0000 to FFFF | hex | F1 | 0 |
| 01C2 | User Map Address #67 | 0000 to FFFF | hex | F1 | 0 |
| 01C3 | User Map Address #68 | 0000 to FFFF | hex | F1 | 0 |
| 01C4 | User Map Address #69 | 0000 to FFFF | hex | F1 | 0 |
| 01C5 | User Map Address #70 | 0000 to FFFF | hex | F1 | 0 |
| 01C6 | User Map Address #71 | 0000 to FFFF | hex | F1 | 0 |
| 01C7 | User Map Address #72 | 0000 to FFFF | hex | F1 | 0 |
| 01C8 | User Map Address #73 | 0000 to FFFF | hex | F1 | 0 |
| 01C9 | User Map Address #74 | 0000 to FFFF | hex | F1 | 0 |
| 01CA | User Map Address #75 | 0000 to FFFF | hex | F1 | 0 |
| 01CB | User Map Address #76 | 0000 to FFFF | hex | F1 | 0 |
| 01CC | User Map Address #77 | 0000 to FFFF | hex | F1 | 0 |
| 01CD | User Map Address #78 | 0000 to FFFF | hex | F1 | 0 |
| 01CE | User Map Address #79 | 0000 to FFFF | hex | F1 | 0 |
| 01CF | User Map Address #80 | 0000 to FFFF | hex | F1 | 0 |
| 01D0 | User Map Address #81 | 0000 to FFFF | hex | F1 | 0 |
| 01D1 | User Map Address #82 | 0000 to FFFF | hex | F1 | 0 |
| 01D2 | User Map Address #83 | 0000 to FFFF | hex | F1 | 0 |
| 01D3 | User Map Address #84 | 0000 to FFFF | hex | F1 | 0 |
| 01D4 | User Map Address #85 | 0000 to FFFF | hex | F1 | 0 |
| 01D5 | User Map Address #86 | 0000 to FFFF | hex | F1 | 0 |
| 01D6 | User Map Address #87 | 0000 to FFFF | hex | F1 | 0 |
| 01D7 | User Map Address #88 | 0000 to FFFF | hex | F1 | 0 |
| 01D8 | User Map Address #89 | 0000 to FFFF | hex | F1 | 0 |
| 01D9 | User Map Address #90 | 0000 to FFFF | hex | F1 | 0 |
| 01DA | User Map Address #91 | 0000 to FFFF | hex | F1 | 0 |
| 01DB | User Map Address #92 | 0000 to FFFF | hex | F1 | 0 |
| 01DC | User Map Address #93 | 0000 to FFFF | hex | F1 | 0 |
| 01DD | User Map Address #94 | 0000 to FFFF | hex | F1 | 0 |
| 01DE | User Map Address #95 | 0000 to FFFF | hex | F1 | 0 |
| 01DF | User Map Address #96 | 0000 to FFFF | hex | F1 | 0 |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 6 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 01E0 | User Map Address #97 | 0000 to FFFF | hex | F1 | 0 |
| 01E1 | User Map Address #98 | 0000 to FFFF | hex | F1 | 0 |
| 01E2 | User Map Address #99 | 0000 to FFFF | hex | F1 | 0 |
| 01E3 | User Map Address #100 | 0000 to FFFF | hex | F1 | 0 |
| 01E4 | User Map Address #101 | 0000 to FFFF | hex | F1 | 0 |
| 01E5 | User Map Address #102 | 0000 to FFFF | hex | F1 | 0 |
| 01E6 | User Map Address #103 | 0000 to FFFF | hex | F1 | 0 |
| 01E7 | User Map Address #104 | 0000 to FFFF | hex | F1 | 0 |
| 01E8 | User Map Address #105 | 0000 to FFFF | hex | F1 | 0 |
| 01E9 | User Map Address #106 | 0000 to FFFF | hex | F1 | 0 |
| 01EA | User Map Address #107 | 0000 to FFFF | hex | F1 | 0 |
| 01EB | User Map Address #108 | 0000 to FFFF | hex | F1 | 0 |
| 01EC | User Map Address #109 | 0000 to FFFF | hex | F1 | 0 |
| 01ED | User Map Address #110 | 0000 to FFFF | hex | F1 | 0 |
| 01EE | User Map Address #111 | 0000 to FFFF | hex | F1 | 0 |
| 01EF | User Map Address #112 | 0000 to FFFF | hex | F1 | 0 |
| 01F0 | User Map Address #113 | 0000 to FFFF | hex | F1 | 0 |
| 01F1 | User Map Address #114 | 0000 to FFFF | hex | F1 | 0 |
| 01F2 | User Map Address #115 | 0000 to FFFF | hex | F1 | 0 |
| 01F3 | User Map Address #116 | 0000 to FFFF | hex | F1 | 0 |
| 01F4 | User Map Address #117 | 0000 to FFFF | hex | F1 | 0 |
| 01F5 | User Map Address #118 | 0000 to FFFF | hex | F1 | 0 |
| 01F6 | User Map Address #119 | 0000 to FFFF | hex | F1 | 0 |
| 01F7 | User Map Address #120 | 0000 to FFFF | hex | F1 | 0 |
| **SYSTEM STATUS (read only actual values)** | | | | | |
| 0200 | General Status | --- | --- | F21 | --- |
| 0201 | 760 Operation Status | --- | --- | F44 | --- |
| 0202 | Communications Port Setpoint Access Status | --- | --- | F30 | --- |
| 0203 | Reserved | | | | |
| 0204 | Contact Input Status | --- | --- | F46 | --- |
| 0205 | Coil Monitor Status | --- | --- | F47 | --- |
| 0206 | Output Relay Status | --- | --- | F40 | --- |
| 0207 | Date (2 words) | --- | --- | F23 | --- |
| 0209 | Time (2 words) | --- | --- | F22 | --- |
| 020B | Active Setpoint Group | --- | --- | F79 | --- |
| 020C | Edit Setpoint Group | --- | --- | F79 | --- |
| 020D | Major Failure Code | --- | --- | F24 | --- |
| 020E | Diagnostic Code | --- | --- | F1 | --- |
| 020F | Diagnostic Code | --- | --- | F1 | --- |
| **ACTIVE CONDITION QUEUE (read only)** | | | | | |
| 0210 | Active Condition #1 | --- | --- | F24 | --- |
| 0211 | Active Condition #2 | --- | --- | F24 | --- |
| 0212 | Active Condition #3 | --- | --- | F24 | --- |
| 0213 | Active Condition #4 | --- | --- | F24 | --- |
| 0214 | Active Condition #5 | --- | --- | F24 | --- |
| 0215 | Active Condition #6 | --- | --- | F24 | --- |
| 0216 | Active Condition #7 | --- | --- | F24 | --- |
| 0217 | Active Condition #8 | --- | --- | F24 | --- |
| 0218 | Active Condition #9 | --- | --- | F24 | --- |
| 0219 | Active Condition #10 | --- | --- | F24 | --- |
| 021A | Active Condition #11 | --- | --- | F24 | --- |
| 021B | Active Condition #12 | --- | --- | F24 | --- |
| 021C | Active Condition #13 | --- | --- | F24 | --- |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 7 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 021D | Active Condition #14 | --- | --- | F24 | --- |
| 021E | Active Condition #15 | --- | --- | F24 | --- |
| 021F | Active Condition #16 | --- | --- | F24 | --- |
| 0220 | Active Condition #17 | --- | --- | F24 | --- |
| 0221 | Active Condition #18 | --- | --- | F24 | --- |
| 0222 | Active Condition #19 | --- | --- | F24 | --- |
| 0223 | Active Condition #20 | --- | --- | F24 | --- |
| 0224 | Active Condition #21 | --- | --- | F24 | --- |
| 0225 | Active Condition #22 | --- | --- | F24 | --- |
| 0226 | Active Condition #23 | --- | --- | F24 | --- |
| 0227 | Active Condition #24 | --- | --- | F24 | --- |
| 0228 | Active Condition #25 | --- | --- | F24 | --- |
| 0229 | Active Condition #26 | --- | --- | F24 | --- |
| 022A | Active Condition #27 | --- | --- | F24 | --- |
| 022B | Active Condition #28 | --- | --- | F24 | --- |
| 022C | Active Condition #29 | --- | --- | F24 | --- |
| 022D | Active Condition #30 | --- | --- | F24 | --- |
| 022E | Active Condition #31 | --- | --- | F24 | --- |
| 022F | Active Condition #32 | --- | --- | F24 | --- |
| **LATCHED CONTACT INPUT STATE (read only)** | | | | | |
| 0230 | Contact Input Status (Closed Contacts Latched until read via Communications) | --- | --- | F46 | --- |
| **LATCHED OUTPUT RELAY STATE (read only)** | | | | | |
| 0231[8] | Output Relay Status (Asserted Outputs Latched until read via Comms) | --- | --- | F40 | --- |
| **LOGIC INPUT STATES (read only actual values)** | | | | | |
| 0241 | Logic Input 1 State | --- | --- | F69 | --- |
| 0242 | Logic Input 2 State | --- | --- | F69 | --- |
| 0243 | Logic Input 3 State | --- | --- | F69 | --- |
| 0244 | Logic Input 4 State | --- | --- | F69 | --- |
| 0245 | Logic Input 5 State | --- | --- | F69 | --- |
| 0246 | Logic Input 6 State | --- | --- | F69 | --- |
| 0247 | Logic Input 7 State | --- | --- | F69 | --- |
| 0248 | Logic Input 8 State | --- | --- | F69 | --- |
| 0249 | Logic Input 9 State | --- | --- | F69 | --- |
| 024A | Logic Input 10 State | --- | --- | F69 | --- |
| 024B | Logic Input 11 State | --- | --- | F69 | --- |
| 024C | Logic Input 12 State | --- | --- | F69 | --- |
| 024D | Logic Input 13 State | --- | --- | F69 | --- |
| 024E | Logic Input 14 State | --- | --- | F69 | --- |
| 024F | Logic Input 15 State | --- | --- | F69 | --- |
| 0250 | Logic Input 16 State | --- | --- | F69 | --- |
| 0251 | Logic Input 17 State | --- | --- | F69 | --- |
| 0252 | Logic Input 18 State | --- | --- | F69 | --- |
| 0253 | Logic Input 19 State | --- | --- | F69 | --- |
| 0254 | Logic Input 20 State | --- | --- | F69 | --- |
| **AUTORECLOSE STATUS - 760 ONLY (read only actual values)** | | | | | |
| 0260 | Autoreclose Shot Number | --- | --- | F1 | --- |
| 0261 | Autoreclose Shots Remaining | --- | --- | F1 | --- |
| 0262 | Manual Close Blocking | --- | --- | F30 | --- |
| 0263 | Reserved | --- | --- | --- | --- |
| 0264[8] | Recloses per hour | --- | --- | F1 | --- |
| 0270[8] | Reclosure Count | --- | --- | F1 | --- |

[1][2][3][4][5][6][7][8][9][10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 8 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 0271[8] | Reclosure Count Last Reset Date (2 words) | --- | --- | F23 | --- |
| **LAST TRIP DATA (read only actual values)** | | | | | |
| 02E0 | Date of Last Trip (2 words) | --- | --- | F23 | --- |
| 02E2 | Time of Last Trip (2 words) | --- | --- | F22 | --- |
| 02E4 | Cause of Last Trip | --- | --- | F24 | --- |
| 02E5 | Last Trip Phase A Current | 0 to 65535 | A | F1 | --- |
| 02E6 | Last Trip Phase B Current | 0 to 65535 | A | F1 | --- |
| 02E7 | Last Trip Phase C Current | 0 to 65535 | A | F1 | --- |
| 02E8 | Last Trip Ground Current | 0 to 65535 | A | F1 | --- |
| 02E9 | Last Trip A-N (A-B) Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 02EA | Last Trip B-N (B-C) Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 02EB | Last Trip C-N (C-A) Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 02EC | Last Trip System Frequency | 0.00 to 65.00 | Hz | F3 | --- |
| 02ED | Last Trip Analog Input | 0 to 65535 | units | F1 | --- |
| 02EE | Last Trip Neutral Current | 0 to 65535 | A | F1 | --- |
| 02EF[3] | Last Trip Sensitive Ground Current | 0.00 to 655.35 | A | F3 | --- |
| 02F0[5] | Last Trip Neutral Voltage | 0.00 to 655.35 | kV | F3 | --- |
| **CURRENT AND VOLTAGE (read only actual values)** | | | | | |
| 02FE[5] | Neutral Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 02FF[3] | Sensitive Ground Current | 0.00 to 655.35 | A | F3 | --- |
| 0300 | Phase A RMS Current | 0 to 65535 | A | F1 | --- |
| 0301 | Phase B RMS Current | 0 to 65535 | A | F1 | --- |
| 0302 | Phase C RMS Current | 0 to 65535 | A | F1 | --- |
| 0303 | Percent of Load-to-Trip | 0 to 2000 | % | F1 | --- |
| 0304 | Ground Current | 0 to 65535 | A | F1 | --- |
| 0305 | A-N RMS Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 0306 | B-N RMS Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 0307 | C-N RMS Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 0308 | A-B RMS Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 0309 | B-C RMS Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 030A | C-A RMS Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 030B[3] | Reserved for Polarizing Current | --- | --- | --- | --- |
| 030C | Average Current | 0 to 65535 | A | F1 | --- |
| 030D | Average Line Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 030E | Average Phase Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 030F | Neutral Current | 0 to 65535 | A | F1 | --- |
| **FREQUENCY AND THREE-PHASE POWER (read only actual values)** | | | | | |
| 0310[2] | Three-Phase Real Power | –30000 to 30000 | kW | F86 | --- |
| 0311[2] | Three-Phase Reactive Power | –30000 to 30000 | kvar | F86 | --- |
| 0312[2] | Three-Phase Apparent Power | 0 to 30000 | kVA | F86 | --- |
| 0313 | Three-Phase Power Factor | –0.99 to +1.00 | --- | F6 | --- |
| 0314 | System Frequency | 0.00 to 65.00 | Hz | F3 | --- |
| 0315[1] | System Frequency Decay Rate | –10.00 to 10.00 | Hz/s | F6 | --- |
| 0316[1] | Auto Ranging Power / Energy Multiplier | 1 to 100 | --- | F1 | --- |
| **SYNCHRONIZING VOLTAGE (read only actual values)** | | | | | |
| 0318 | Synchronizing RMS Voltage | 0.00 to 655.35 | kV | F3 | --- |
| 0319 | Synchronizing RMS Voltage Frequency | 0.00 to 65.00 | Hz | F3 | --- |
| 031A | Synchronizing Voltage Difference | 0.00 to 655.35 | kV | F3 | --- |
| 031B | Synchronizing Phase Difference | 0 to 359 | ° | F1 | --- |
| 031C | Synchronizing Frequency Difference | 0.00 to 65.00 | Hz | F3 | --- |
| 031D | Synchronizing Voltage Angle | 0 to 359 | ° Lag | F1 | --- |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 9 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| **ENERGY USE (read only actual values)** | | | | | |
| 0320[2] | Positive Watthours (2 words) | 0 to 4e9 | kWh | F86 | --- |
| 0322 | Positive Watthour Cost (2 words) | 0 to 4e9 | $ | F7 | --- |
| 0324[2] | Negative Watthours (2 words) | 0 to 4e9 | kWh | F86 | --- |
| 0326 | Negative Watthour Cost (2 words) | 0 to 4e9 | $ | F7 | --- |
| 0328[2] | Positive Varhours (2 words) | 0 to $4 \times 10^9$ | kvarh | F86 | --- |
| 032A[2] | Negative Varhours (2 words) | 0 to $4 \times 10^9$ | kvarh | F86 | --- |
| 032C | Energy Use Data Last Reset (2 words) | --- | --- | F23 | --- |
| **LAST DEMAND (read only actual values)** | | | | | |
| 0330 | Last Phase A Current Demand | 0 to 65535 | A | F1 | --- |
| 0331 | Last Phase B Current Demand | 0 to 65535 | A | F1 | --- |
| 0332 | Last Phase C Current Demand | 0 to 65535 | A | F1 | --- |
| 0333[2] | Last Real Power Demand | –30000 to 30000 | kW | F86 | --- |
| 0334[2] | Last Reactive Power Demand | –30000 to 30000 | kvar | F86 | --- |
| 0335[2] | Last Apparent Power Demand | 0 to 30000 | kVA | F86 | --- |
| **MAXIMUM DEMAND (read only actual values)** | | | | | |
| 0340 | Maximum Phase A Current Demand | 0 to 65535 | A | F1 | --- |
| 0341 | Maximum Phase A Current Date (2 words) | --- | --- | F23 | --- |
| 0343 | Maximum Phase A Current Time (2 words) | --- | --- | F22 | --- |
| 0345 | Maximum Phase B Current Demand | 0 to 65535 | A | F1 | --- |
| 0346 | Maximum Phase B Current Date (2 words) | --- | --- | F23 | --- |
| 0348 | Maximum Phase B Current Time (2 words) | --- | --- | F22 | --- |
| 034A | Maximum Phase C Current Demand | 0 to 65535 | A | F1 | --- |
| 034B | Maximum Phase C Current Date (2 words) | --- | --- | F23 | --- |
| 034D | Maximum Phase C Current Time (2 words) | --- | --- | F22 | --- |
| 034F[2] | Maximum Real Power Demand | –30000 to 30000 | kW | F86 | --- |
| 0350 | Maximum Real Power Date (2 words) | --- | --- | F23 | --- |
| 0352 | Maximum Real Power Time (2 words) | --- | --- | F22 | --- |
| 0354[2] | Maximum Reactive Power Demand | –30000 to 30000 | kvar | F86 | --- |
| 0355 | Maximum Reactive Power Date (2 words) | --- | --- | F23 | --- |
| 0357 | Maximum Reactive Power Time (2 words) | --- | --- | F22 | --- |
| 0359[2] | Maximum Apparent Power Demand | 0 to 30000 | kVA | F86 | --- |
| 035A | Maximum Apparent Power Date (2 words) | --- | --- | F23 | --- |
| 035C | Maximum Apparent Power Time (2 words) | --- | --- | F22 | --- |
| 035E | Demand Data Last Reset (2 words) | --- | --- | F23 | --- |
| **SINGLE-PHASE POWER (read only actual values)** | | | | | |
| 0360[1] | Phase A Real Power | –30000 to 30000 | kW | F86 | --- |
| 0361[1] | Phase A Reactive Power | –30000 to 30000 | kvar | F86 | --- |
| 0362[1] | Phase A Apparent Power | 0 to 30000 | kVA | F86 | --- |
| 0363[1] | Phase A Power Factor | –0.99 to +1.00 | --- | F6 | --- |
| 0364[1] | Phase B Real Power | –30000 to 30000 | kW | F86 | --- |
| 0365[1] | Phase B Reactive Power | –30000 to 30000 | kvar | F86 | --- |
| 0366[1] | Phase B Apparent Power | 0 to 30000 | kVA | F86 | --- |
| 0367[1] | Phase B Power Factor | –0.99 to +1.00 | --- | F6 | --- |
| 0368[1] | Phase C Real Power | –30000 to 30000 | kW | F86 | --- |
| 0369[1] | Phase C Reactive Power | –30000 to 30000 | kvar | F86 | --- |
| 036A[1] | Phase C Apparent Power | 0 to 30000 | kVA | F86 | --- |
| 036B[1] | Phase C Power Factor | –0.99 to +1.00 | --- | F6 | --- |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 10 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| **ANALOG INPUT (read only actual values)** | | | | | |
| 0370 | Analog Input | 0 to 65535 | Units | F1 | --- |
| 0371 | Analog Input Fast Rate of Change | --- | Units / min. | F5 | --- |
| 0372 | Analog Input Slow Rate of Change | --- | Units / hr. | F5 | --- |
| **TRIP COUNTERS (read only actual values)** | | | | | |
| 0380 | Breaker Trips | 0 to 65535 | --- | F1 | --- |
| 0381 | Ground Overcurrent Trips | 0 to 65535 | --- | F1 | --- |
| 0382 | Neutral Overcurrent Trips | 0 to 65535 | --- | F1 | --- |
| 0383 | One Phase Overcurrent Trips | 0 to 65535 | --- | F1 | --- |
| 0384 | Two Phase Overcurrent Trips | 0 to 65535 | --- | F1 | --- |
| 0385 | Three Phase Overcurrent Trips | 0 to 65535 | --- | F1 | --- |
| 0386 | Trip Counters Last Reset Date (2 words) | --- | --- | F23 | --- |
| 0388 | Negative Sequence Overcurrent Trips | 0 to 65535 | --- | F1 | --- |
| 0389[3] | Sensitive Ground Overcurrent Trips | 0 to 65535 | --- | F1 | --- |
| **TOTAL ARCING CURRENT (read only actual values)** | | | | | |
| 03A0 | Total Arcing Current Phase A | 0 to 65535 | $kA^2$-cyc | F1 | --- |
| 03A1 | Total Arcing Current Phase B | 0 to 65535 | $kA^2$-cyc | F1 | --- |
| 03A2 | Total Arcing Current Phase C | 0 to 65535 | $kA^2$-cyc | F1 | --- |
| 03A3 | Total Arcing Current Last Reset (2 words) | --- | --- | F23 | --- |
| **FAULT LOCATION 0 (read only actual values)** | | | | | |
| 03B0 | Date of Fault 0 (2 words) | --- | --- | F23 | --- |
| 03B2 | Time of Fault 0 (2 words) | --- | --- | F22 | --- |
| 03B4 | Type of Fault 0 | --- | --- | F76 | --- |
| 03B5 | Distance to Fault 0 | –327.68 to 327.67 | km, mi | F52 | --- |
| 03B6 | Line Z1 to Fault 0 (magnitude) | 0.00 to 655.35 | ohms | F53 | --- |
| **FAULT LOCATION 1 (read only actual values)** | | | | | |
| 03B8 | Date of Fault 1 (2 words) | --- | --- | F23 | --- |
| 03BA | Time of Fault 1 (2 words) | --- | --- | F22 | --- |
| 03BC | Type of Fault 1 | --- | --- | F76 | --- |
| 03BD | Distance to Fault 1 | –327.68 to 327.67 | km | F52 | --- |
| 03BE | Line Z1 to Fault 1 (magnitude) | 0.00 to 655.35 | ohms | F53 | --- |
| **FAULT LOCATION 2 (read only actual values)** | | | | | |
| 03C0 | Date of Fault 2 (2 words) | --- | --- | F23 | --- |
| 03C2 | Time of Fault 2 (2 words) | --- | --- | F22 | --- |
| 03C4 | Type of Fault 2 | --- | --- | F76 | --- |
| 03C5 | Distance to Fault 2 | –327.68 to 327.67 | km | F52 | --- |
| 03C6 | Line Z1 to Fault 2 (magnitude) | 0.00 to 655.35 | ohms | F53 | --- |
| **FAULT LOCATION 3 (read only actual values)** | | | | | |
| 03C8 | Date of Fault 3 (2 words) | --- | --- | F23 | --- |
| 03CA | Time of Fault 3 (2 words) | --- | --- | F22 | --- |
| 03CC | Type of Fault 3 | --- | --- | F76 | --- |
| 03CD | Distance to Fault 3 | –327.68 to 327.67 | km | F52 | --- |
| 03CE | Line Z1 to Fault 3 (magnitude) | 0.00 to 655.35 | ohms | F53 | --- |
| **FAULT LOCATION 4 (read only actual values)** | | | | | |
| 03D0 | Date of Fault 4 (2 words) | --- | --- | F23 | --- |
| 03D2 | Time of Fault 4 (2 words) | --- | --- | F22 | --- |
| 03D4 | Type of Fault 4 | --- | --- | F76 | --- |
| 03D5 | Distance to Fault 4 | –327.68 to 327.67 | km | F52 | --- |
| 03D6 | Line Z1 to Fault 4 (magnitude) | 0.00 to 655.35 | ohms | F53 | --- |
| **FAULT LOCATION 5 (read only actual values)** | | | | | |
| 03D8 | Date of Fault 5 (2 words) | --- | --- | F23 | --- |
| 03DA | Time of Fault 5 (2 words) | --- | --- | F22 | --- |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 11 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 03DC | Type of Fault 5 | --- | --- | F76 | --- |
| 03DD | Distance to Fault 5 | –327.68 to 327.67 | km | F52 | --- |
| 03DE | Line Z1 to Fault 5 (magnitude) | 0.00 to 655.35 | ohms | F53 | --- |
| **FAULT LOCATION 6 (read only actual values)** | | | | | |
| 03E0 | Date of Fault 6 (2 words) | --- | --- | F23 | --- |
| 03E2 | Time of Fault 6 (2 words) | --- | --- | F22 | --- |
| 03E4 | Type of Fault 6 | --- | --- | F76 | --- |
| 03E5 | Distance to Fault 6 | –327.68 to 327.67 | km | F52 | --- |
| 03E6 | Line Z1 to Fault 6 (magnitude) | 0.00 to 655.35 | ohms | F53 | --- |
| **FAULT LOCATION 7 (read only actual values)** | | | | | |
| 03E8 | Date of Fault 7 (2 words) | --- | --- | F23 | --- |
| 03EA | Time of Fault 7 (2 words) | --- | --- | F22 | --- |
| 03EC | Type of Fault 7 | --- | --- | F76 | --- |
| 03ED | Distance to Fault 7 | –327.68 to 327.67 | km | F52 | --- |
| 03EE | Line Z1 to Fault 7 (magnitude) | 0.00 to 655.35 | ohms | F53 | --- |
| **FAULT LOCATION 8 (read only actual values)** | | | | | |
| 03F0 | Date of Fault 8 (2 words) | --- | --- | F23 | --- |
| 03F2 | Time of Fault 8 (2 words) | --- | --- | F22 | --- |
| 03F4 | Type of Fault 8 | --- | --- | F76 | --- |
| 03F5 | Distance to Fault 8 | –327.68 to 327.67 | km | F52 | --- |
| 03F6 | Line Z1 to Fault 8 (magnitude) | 0.00 to 655.35 | ohms | F53 | --- |
| **FAULT LOCATION 9 (read only actual values)** | | | | | |
| 03F8 | Date of Fault 9 (2 words) | --- | --- | F23 | --- |
| 03FA | Time of Fault 9 (2 words) | --- | --- | F22 | --- |
| 03FC | Type of Fault 9 | --- | --- | F76 | --- |
| 03FD | Distance to Fault 9 | –327.68 to 327.67 | km | F52 | --- |
| 03FE | Line Z1 to Fault 9 (magnitude) | 0.00 to 655.35 | ohms | F53 | --- |
| **CURRENT PHASE ANGLES (read only actual values)** | | | | | |
| 0400 | Phase A Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 0401 | Phase B Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 0402 | Phase C Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 0403 | Neutral Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 0404 | Ground Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 0405[3] | Reserved | --- | --- | --- | --- |
| 0406[3] | Sensitive Ground Current Angle | 0 to 359 | ° Lag | F1 | --- |
| **VOLTAGE PHASE ANGLES (read only actual values)** | | | | | |
| 0410 | Phase A-N Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| 0411 | Phase B-N Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| 0412 | Phase C-N Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| 0413 | Phase A-B Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| 0414 | Phase B-C Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| 0415 | Phase C-A Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| 0416[5] | Neutral Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| **SYMMETRICAL COMPONENTS (read only actual values)** | | | | | |
| 0420 | Positive Sequence Current Magnitude | 0 to 65535 | A | F1 | --- |
| 0421 | Positive Sequence Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 0422 | Negative Sequence Current Magnitude | 0 to 65535 | A | F1 | --- |
| 0423 | Negative Sequence Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 0424 | Zero Sequence Current Magnitude | 0 to 65535 | A | F1 | --- |
| 0425 | Zero Sequence Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 0426 | Positive Sequence Voltage Magnitude | 0.00 to 600.00 | kV | F3 | --- |
| 0427 | Positive Sequence Voltage Angle | 0 to 359 | ° Lag | F1 | --- |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 12 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 0428 | Negative Sequence Voltage Magnitude | 0.00 to 600.00 | kV | F3 | --- |
| 0429 | Negative Sequence Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| 042A | Zero Sequence Voltage Magnitude | 0.00 to 600.00 | kV | F3 | --- |
| 042B | Zero Sequence Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| **PROTECTION FUNCTION STATES (read only)** | | | | | |
| 0600 | Reserved | | | | |
| 0601[2] | Phase Time Overcurrent 1 | --- | --- | F49 | --- |
| 0602[2] | Phase Instantaneous Overcurrent 1 | --- | --- | F49 | --- |
| 0603[2] | Phase Instantaneous Overcurrent 2 | --- | --- | F49 | --- |
| 0604[2] | Ground Time Overcurrent | --- | --- | F49 | --- |
| 0605[2] | Ground Instantaneous Overcurrent | --- | --- | F49 | --- |
| 0606[2] | Neutral Time Overcurrent 1 | --- | --- | F49 | --- |
| 0607[2] | Neutral Time Overcurrent 2 | --- | --- | F49 | --- |
| 0608[2] | Neutral Instantaneous Overcurrent 1 | --- | --- | F49 | --- |
| 0609[2] | Neutral Instantaneous Overcurrent 2 | --- | --- | F49 | --- |
| 060A[2] | Phase Directional is Reverse | --- | --- | F49 | --- |
| 060B[2] | Neutral Directional is Reverse | --- | --- | F49 | --- |
| 060C | Manual Close Blocking | --- | --- | F49 | --- |
| 060D | Cold Load Pickup Blocking | --- | --- | F49 | --- |
| 060E | Bus Undervoltage 1 | --- | --- | F49 | --- |
| 060F | Bus Undervoltage 2 | --- | --- | F49 | --- |
| 0610 | Line Undervoltage 3 | --- | --- | F49 | --- |
| 0611 | Line Undervoltage 4 | --- | --- | F49 | |
| 0612 | Overvoltage 1 | --- | --- | F49 | --- |
| 0613 | Overvoltage 2 | --- | --- | F49 | --- |
| 0614 | Underfrequency 1 | --- | --- | F49 | --- |
| 0615 | Underfrequency 2 | --- | --- | F49 | --- |
| 0616 | Phase Current Level | --- | --- | F49 | --- |
| 0617 | Neutral Current Level | --- | --- | F49 | --- |
| 0618 | Power Factor 1 | --- | --- | F49 | --- |
| 0619 | Power Factor 2 | --- | --- | F49 | --- |
| 061A | Synchrocheck Block (Not In Sync) | --- | --- | F49 | --- |
| 061B | Current Demand | --- | --- | F49 | --- |
| 061C | Real Power Demand | --- | --- | F49 | --- |
| 061D | Reactive Power Demand | --- | --- | F49 | --- |
| 061E | Apparent Power Demand | --- | --- | F49 | --- |
| 061F | Analog Input Threshold 1 | --- | --- | F49 | --- |
| 0620 | Analog Input Threshold 2 | --- | --- | F49 | --- |
| 0621 | Analog Input Rate of Change 1 | --- | --- | F49 | --- |
| 0622 | Analog Input Rate of Change 2 | --- | --- | F49 | --- |
| 0623 | Overfrequency | --- | --- | F49 | --- |
| 0624 | Trip Counter | --- | --- | F49 | --- |
| 0625 | Arcing Current | --- | --- | F49 | --- |
| 0626 | VT Failure | --- | --- | F49 | --- |
| 0627 | Breaker Failure | --- | --- | F49 | --- |
| 0628 | Breaker Operation Failure | --- | --- | F49 | --- |
| 0629 | Trip Coil Monitor | --- | --- | F49 | --- |
| 062A | Close Coil Monitor | --- | --- | F49 | --- |
| 062B | User Input A | --- | --- | F49 | --- |
| 062C | User Input B | --- | --- | F49 | --- |
| 062D | User Input C | --- | --- | F49 | --- |

[1 2 3 4 5 6 7 8 9 10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 13 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 062E | User Input D | --- | --- | F49 | --- |
| 062F | User Input E | --- | --- | F49 | --- |
| 0630 | User Input F | --- | --- | F49 | --- |
| 0631 | User Input G | --- | --- | F49 | --- |
| 0632 | User Input H | --- | --- | F49 | --- |
| 0633 | Negative Sequence Instantaneous Overcurrent | --- | --- | F49 | --- |
| 0634 | Negative Sequence Time Overcurrent | --- | --- | F49 | --- |
| 0635 | Negative Sequence Overvoltage | --- | --- | F49 | --- |
| 0636 | Undervoltage Restoration | --- | --- | F49 | --- |
| 0637 | Underfrequency Restoration | --- | --- | F49 | --- |
| 0638[1] | Phase Time Overcurrent 2 | --- | --- | F49 | --- |
| 0639[1] | Frequency Decay | --- | --- | F49 | --- |
| 063A[3] | Negative Sequence Directional is Reverse | --- | --- | F49 | --- |
| 063B[3] | Sensitive Ground Instantaneous Overcurrent | --- | --- | F49 | --- |
| 063C[3] | Sensitive Ground Time Overcurrent | --- | --- | F49 | --- |
| 063D[3] | Sensitive Ground Directional is Reverse | --- | --- | F49 | --- |
| 063E[5] | Reverse Power (requires Mod 008) | --- | --- | F49 | --- |
| 063F[5] | Neutral Displacement | --- | --- | F49 | --- |
| 0640[5] | Pulse Output Positive Watthours | --- | --- | F49 | --- |
| 0641[5] | Pulse Output Negative Watthours | --- | --- | F49 | --- |
| 0642[5] | Pulse Output Positive Varhours | --- | --- | F49 | --- |
| 0643[5] | Pulse Output Negative Varhours | --- | --- | F49 | --- |
| 0644[6] | Ground Directional is Reverse | --- | --- | F49 | --- |
| 0645[7] | Reserved for MOD 010 | --- | --- | F49 | --- |
| 0646[8] | User Input I | --- | --- | F49 | --- |
| 0647[8] | User Input J | --- | --- | F49 | --- |
| 0648[8] | User Input K | --- | --- | F49 | --- |
| 0649[8] | User Input L | --- | --- | F49 | --- |
| 064A[8] | User Input M | --- | --- | F49 | --- |
| 064B[8] | User Input N | --- | --- | F49 | --- |
| 064C[8] | User Input O | --- | --- | F49 | --- |
| 064D[8] | User Input P | --- | --- | F49 | --- |
| 064E[8] | User Input Q | --- | --- | F49 | --- |
| 064F[8] | User Input R | --- | --- | F49 | --- |
| 0650[8] | User Input S | --- | --- | F49 | --- |
| 0651[8] | User Input T | --- | --- | F49 | --- |
| 0652[8] | Autoreclose Rate Supervision | --- | --- | F49 | --- |
| 0653[8] | Restricted Earth Fault | --- | --- | F49 | --- |
| **750/760 SETUP (read/write setpoints)** | | | | | |
| 1000 | Reserved | | | | |
| 1001 | Flash Message Time | 0.5 to 10.0 | s | F2 | 4.0 s |
| 1002 | Default Message Timeout | 10 to 900 | s | F1 | 300 s |
| 1003 | Default Message Intensity (25, 50, 75, or 100) | 25 to 100 | % | F1 | 25% |
| 1004[1] | Display Filter Constant | 0 to 255 | --- | F1 | 0 |
| 1005 | Reserved | | | | |
| 1006 | Set Date (2 words) | --- | --- | F23 | 01/01/2000 |
| 1008 | Set Time (2 words) | --- | --- | F22 | 00:00:00.000 |
| 100A | 760 Operation | --- | --- | F29 | Not Ready |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 14 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 100B[2] | IRIG-B Signal Type | --- | --- | F43 | None |
| 100C | Encrypted Passcode (4 words) | --- | --- | F33 | "AIKFBAIK" |
| **EVENT RECORDER SETUP (read/write setpoints)** | | | | | |
| 1010 | Event Recorder Function | --- | --- | F30 | Enabled |
| 1011 | Recording of Trip Events | --- | --- | F30 | Enabled |
| 1012 | Recording of Alarm Events | --- | --- | F30 | Enabled |
| 1013 | Recording of Control Events | --- | --- | F30 | Disabled |
| 1014 | Recording of Logic Input Events | --- | --- | F30 | Enabled |
| 1015 | Recording of Pickup Events | --- | --- | F30 | Enabled |
| 1016 | Recording of Dropout Events | --- | --- | F30 | Enabled |
| 1017[8] | Recording of Set Time/Date Events | --- | --- | F30 | Enabled |
| **TRACE MEMORY SETUP (read/write setpoints)** | | | | | |
| 1018 | Buffer Organization [10] | --- | --- | F92 | 16 x 512 |
| 1019 | Trigger Position | 0 to 100 | % | F1 | 25% |
| 101A | Trigger Source | --- | --- | F82 | Pickup & Trip |
| **DEFAULT MESSAGES (read/write setpoints)** | | | | | |
| 1020 | Number Of Messages Selected (read only) | 0 to 20 | --- | F1 | 3 |
| 1021 | Default Message #1 | --- | --- | F32 | --- |
| 1022 | Default Message #2 | --- | --- | F32 | --- |
| 1023 | Default Message #3 | --- | --- | F32 | --- |
| 1024 | Default Message #4 | --- | --- | F32 | --- |
| 1025 | Default Message #5 | --- | --- | F32 | --- |
| 1026 | Default Message #6 | --- | --- | F32 | --- |
| 1027 | Default Message #7 | --- | --- | F32 | --- |
| 1028 | Default Message #8 | --- | --- | F32 | --- |
| 1029 | Default Message #9 | --- | --- | F32 | --- |
| 102A | Default Message #10 | --- | --- | F32 | --- |
| 102B | Default Message #11 | --- | --- | F32 | --- |
| 102C | Default Message #12 | --- | --- | F32 | --- |
| 102D | Default Message #13 | --- | --- | F32 | --- |
| 102E | Default Message #14 | --- | --- | F32 | --- |
| 102F | Default Message #15 | --- | --- | F32 | --- |
| 1030 | Default Message #16 | --- | --- | F32 | --- |
| 1031 | Default Message #17 | --- | --- | F32 | --- |
| 1032 | Default Message #18 | --- | --- | F32 | --- |
| 1033 | Default Message #19 | --- | --- | F32 | --- |
| 1034 | Default Message #20 | --- | --- | F32 | --- |
| 1035 | Default Message #21 | --- | --- | F32 | --- |
| 1036 | Default Message #22 | --- | --- | F32 | --- |
| 1037 | Default Message #23 | --- | --- | F32 | --- |
| 1038 | Default Message #24 | --- | --- | F32 | --- |
| 1039 | Default Message #25 | --- | --- | F32 | --- |
| 103A | Default Message #26 | --- | --- | F32 | --- |
| 103B | Default Message #27 | --- | --- | F32 | --- |
| 103C | Default Message #28 | --- | --- | F32 | --- |
| 103D | Default Message #29 | --- | --- | F32 | --- |
| 103E | Default Message #30 | --- | --- | F32 | --- |
| **USER TEXT MESSAGES (read/write setpoints)** | | | | | |
| 1040 | User Text Message 1 (20 words) | --- | --- | F33 | "Text 1" |
| 1054 | User Text Message 2 (20 words) | --- | --- | F33 | "Text 2" |
| 1068 | User Text Message 3 (20 words) | --- | --- | F33 | "Text 3" |
| 107C | User Text Message 4 (20 words) | --- | --- | F33 | "Text 4" |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 15 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 1090 | User Text Message 5 (20 words) | --- | --- | F33 | "Text 5" |
| **OVERRIDE MESSAGE (read/write setpoints)** | | | | | |
| 10B0 | Override Message Display Time | 0 to 9000 | s | F1 | 0 s |
| 10B1 | Override Message (20 words) | --- | --- | F33 | "This is a test" |
| **COMMUNICATIONS (read/write setpoints)** | | | | | |
| 10D0 | Slave Address | 1 to 254 | --- | F1 | 254 |
| 10D1 | COM1 Baud Rate | --- | --- | F31 | 9600 |
| 10D2 | COM1 Parity | --- | --- | F27 | None |
| 10D3 | COM1 Communication Hardware | --- | --- | F17 | RS485 |
| 10D4 | Front Panel RS232 Baud Rate | --- | --- | F31 | 9600 |
| 10D5 | Front Panel RS232 Parity | --- | --- | F27 | None |
| 10D6 | Reserved | | | | |
| 10D7 | Reserved | | | | |
| 10D8 | COM2 Baud Rate | --- | --- | F31 | 9600 |
| 10D9 | COM2 Parity | --- | --- | F27 | None |
| 10DA | DNP Port | --- | --- | F62 | None |
| 10DB | DNP Point Mapping | --- | --- | F30 | Disabled |
| **DATA LOGGER (read/write setpoints)** | | | | | |
| 10E0 | Sample Rate | --- | --- | F74 | 1 cycle |
| 10E1 | Continuous Mode | --- | --- | F30 | Disabled |
| 10E2 | Buffer Organization | --- | --- | F81 | 16 x 256 |
| 10E3 | Trigger Position | 0 to 100 | % | F1 | 25% |
| 10E4 | Trigger Source | --- | --- | F82 | Pickup & Trip |
| 10E5 | Channel 1 Source | --- | --- | F77 | $I_a$ |
| 10E6 | Channel 2 Source | --- | --- | F77 | $I_b$ |
| 10E7 | Channel 3 Source | --- | --- | F77 | $I_c$ |
| 10E8 | Channel 4 Source | --- | --- | F77 | $I_g$ |
| 10E9 | Channel 5 Source | --- | --- | F77 | $V_{an}$ |
| 10EA | Channel 6 Source | --- | --- | F77 | $V_{bn}$ |
| 10EB | Channel 7 Source | --- | --- | F77 | $V_{cn}$ |
| 10EC | Channel 8 Source | --- | --- | F77 | Frequency |
| **DNP COMMUNICATIONS (read/write setpoints)** | | | | | |
| 10F0[8] | Transmission Delay | 0 to 65000 | ms | F1 | 0 ms |
| 10F1[8] | Data Link Confirmation Mode | --- | --- | F89 | Never |
| 10F2[8] | Data Link Confirmation Timeout | 1 to 65000 | ms | F1 | 1000 ms |
| 10F3[8] | Data Link Confirmation Retries | 0 to 100 | --- | F1 | 3 |
| 10F4[8] | Select/Operate Arm Timer Duration | 1 to 65000 | ms | F1 | 10000 ms |
| 10F5[8] | Write Time Interval | 0 to 65000 | ms | F1 | 0 ms |
| 10F6[8] | Inhibit Cold Restart | --- | --- | F30 | Disabled |
| 10F7[9] | 3 Key Reset of Max Demand Values | --- | --- | F30 | Disabled |
| **SYSTEM SETUP (read/write setpoints)** | | | | | |
| 1100 | Phase CT Primary | 1 to 50000 | A | F1 | 1000 A |
| 1101 | Reserved | | | | |
| 1102 | Ground CT Primary | 1 to 50000 | A | F1 | 50 A |
| 1103 | Bus VT Connection Type | --- | --- | F28 | Wye |
| 1104 | Bus Nominal VT Secondary Voltage | 50.0 to 240.0 | V | F2 | 120.0 V |
| 1105 | Bus VT Ratio | 1.0 to 5000.0 | xxx: 1 | F2 | 120.0:1 |
| 1106 | Nominal Frequency | 25 to 60 | Hz | F1 | 60 Hz |
| 1107 | Cost of energy | 1.0 to 25.0 | ¢/kWh | F2 | 5.0 ¢/kWh |
| 1108[3] | Polarizing CT Primary | 1 to 50000 | A | F1 | 200 A |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 16 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 1109 | Line VT Connection | --- | --- | F18 | $V_{bn}$ |
| 110A | Line Nominal VT Secondary Voltage | 50.0 to 240.0 | V | F2 | 120.0 V |
| 110B | Line VT Ratio | 1.0 to 5000.0 | xxx: 1 | F2 | 120.0:1 |
| 110C[1] | Phase Sequence | --- | --- | F83 | ABC |
| 110D[3] | Sensitive Ground CT Primary | 1 to 50000 | A | F1 | 1000 A |
| **LOGIC INPUT ASSERTED LOGIC (read/write setpoints)** | | | | | |
| 1140[2] | Logic Input 1 Asserted Logic | --- | --- | F63 | Contact Close |
| 1141[2] | Logic Input 2 Asserted Logic | --- | --- | F63 | Contact Close |
| 1142[2] | Logic Input 3 Asserted Logic | --- | --- | F63 | Contact Close |
| 1143[2] | Logic Input 4 Asserted Logic | --- | --- | F63 | Contact Close |
| 1144[2] | Logic Input 5 Asserted Logic | --- | --- | F63 | Contact Close |
| 1145[2] | Logic Input 6 Asserted Logic | --- | --- | F63 | Contact Close |
| 1146[2] | Logic Input 7 Asserted Logic | --- | --- | F63 | Contact Close |
| 1147[2] | Logic Input 8 Asserted Logic | --- | --- | F63 | Contact Close |
| 1148[2] | Logic Input 9 Asserted Logic | --- | --- | F63 | Contact Close |
| 1149[2] | Logic Input 10 Asserted Logic | --- | --- | F63 | Contact Close |
| 114A[2] | Logic Input 11 Asserted Logic | --- | --- | F63 | Contact Close |
| 114B[2] | Logic Input 12 Asserted Logic | --- | --- | F63 | Contact Close |
| 114C[2] | Logic Input 13 Asserted Logic | --- | --- | F63 | Contact Close |
| 114D[2] | Logic Input 14 Asserted Logic | --- | --- | F63 | Contact close |
| 114E[1] | Logic Input 15 Asserted Logic | --- | --- | F64 | Disabled |
| 114F[1] | Logic Input 16 Asserted Logic | --- | --- | F64 | Disabled |
| 1150[1] | Logic Input 17 Asserted Logic | --- | --- | F64 | Disabled |
| 1151[1] | Logic Input 18 Asserted Logic | --- | --- | F64 | Disabled |
| 1152[1] | Logic Input 19 Asserted Logic | --- | --- | F64 | Disabled |
| 1153[1] | Logic Input 20 Asserted Logic | --- | --- | F64 | Disabled |
| **BREAKER FUNCTIONS (read/write setpoints)** | | | | | |
| 1160 | 52a Contact | --- | --- | F65 | Disabled |
| 1161 | 52b Contact | --- | --- | F65 | Disabled |
| 1162 | Breaker Connected | --- | --- | F65 | Disabled |
| **CONTROL FUNCTIONS (read/write setpoints)** | | | | | |
| 1170 | Local Mode | --- | --- | F65 | Disabled |
| 1171 | Remote Reset | --- | --- | F65 | Disabled |
| 1172 | Remote Open | --- | --- | F65 | Disabled |
| 1173 | Remote Close | --- | --- | F65 | Disabled |
| 1174 | Cold Load Pickup | --- | --- | F65 | Disabled |
| 1175 | Setpoint Group 2 | --- | --- | F65 | Disabled |
| 1176 | Setpoint Group 3 | --- | --- | F65 | Disabled |
| 1177 | Setpoint Group 4 | --- | --- | F65 | Disabled |
| **USER INPUT A (read/write setpoints)** | | | | | |
| 1180 | User Input A Name (9 registers) | --- | --- | F33 | User Input A |
| 1189 | User Input A Source | --- | --- | F65 | Disabled |
| 118A | User Input A Function | --- | --- | F37 | Disabled |
| 118B | User Input A Relays | --- | --- | F57 | None |
| 118C | User Input A Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT B (read/write setpoints)** | | | | | |
| 1190 | User Input B Name (9 registers) | --- | --- | F33 | User Input B |
| 1199 | User Input B Source | --- | --- | F65 | Disabled |
| 119A | User Input B Function | --- | --- | F37 | Disabled |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 17 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 119B | User Input B Relays | --- | --- | F57 | None |
| 119C | User Input B Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT C (read/write setpoints)** | | | | | |
| 11A0 | User Input C Name (9 registers) | --- | --- | F33 | User Input C |
| 11A9 | User Input C Source | --- | --- | F65 | Disabled |
| 11AA | User Input C Function | --- | --- | F37 | Disabled |
| 11AB | User Input C Relays | --- | --- | F57 | None |
| 11AC | User Input C Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT 3 (read/write setpoints)** | | | | | |
| 11B0 | User Input D Name (9 registers) | --- | --- | F33 | User Input D |
| 11B9 | User Input D Source | --- | --- | F65 | Disabled |
| 11BA | User Input D Function | --- | --- | F37 | Disabled |
| 11BB | User Input D Relays | --- | --- | F57 | None |
| 11BC | User Input D Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT E (read/write setpoints)** | | | | | |
| 11C0 | User Input E Name (9 registers) | --- | --- | F33 | User Input E |
| 11C9 | User Input E Source | --- | --- | F65 | Disabled |
| 11CA | User Input E Function | --- | --- | F37 | Disabled |
| 11CB | User Input E Relays | --- | --- | F57 | None |
| 11CC | User Input E Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT F (read/write setpoints)** | | | | | |
| 11D0 | User Input F Name (9 registers) | --- | --- | F33 | User Input F |
| 11D9 | User Input F Source | --- | --- | F65 | Disabled |
| 11DA | User Input F Function | --- | --- | F37 | Disabled |
| 11DB | User Input F Relays | --- | --- | F57 | None |
| 11DC | User Input F Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT G (read/write setpoints)** | | | | | |
| 11E0 | User Input G Name (9 registers) | --- | --- | F33 | User Input G |
| 11E9 | User Input G Source | --- | --- | F65 | Disabled |
| 11EA | User Input G Function | --- | --- | F37 | Disabled |
| 11EB | User Input G Relays | --- | --- | F57 | None |
| 11EC | User Input G Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT H (read/write setpoints)** | | | | | |
| 11F0 | User Input H Name (9 registers) | --- | --- | F33 | User Input H |
| 11F9 | User Input H Source | --- | --- | F65 | Disabled |
| 11FA | User Input H Function | --- | --- | F37 | Disabled |
| 11FB | User Input H Relays | --- | --- | F57 | None |
| 11FC | User Input H Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **BLOCKING FUNCTIONS (read/write setpoints)** | | | | | |
| 1240 | Block 1 TRIP Relay | --- | --- | F65 | Disabled |
| 1241 | Block 2 CLOSE Relay | --- | --- | F65 | Disabled |
| 1242 | Block Reset | --- | --- | F65 | Disabled |
| 1243 | Block Undervoltage 1 | --- | --- | F65 | Disabled |
| 1244 | Block Undervoltage 2 | --- | --- | F65 | Disabled |
| 1245 | Block Undervoltage 3 | --- | --- | F65 | Disabled |
| 1246 | Block Undervoltage 4 | --- | --- | F65 | Disabled |
| 1247 | Block Underfrequency 1 | --- | --- | F65 | Disabled |
| 1248 | Block Underfrequency 2 | --- | --- | F65 | Disabled |
| 1249 | Bypass Synchrocheck | --- | --- | F65 | Disabled |
| 124A[2] | Block Breaker Statistics | --- | --- | F65 | Disabled |
| 124B | Block Negative Sequence Voltage | --- | --- | F65 | Disabled |
| 124C | Block Restoration | --- | --- | F65 | Disabled |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 18 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 124D | Block Frequency Decay | --- | --- | F65 | Disabled |
| 124E[5] | Block Reverse Power (requires Mod 008) | --- | --- | F65 | Disabled |
| 124F[5] | Block Neutral Displacement | --- | --- | F65 | Disabled |
| **OVERCURRENT BLOCKING FUNCTIONS (read/write setpoints)** | | | | | |
| 1260 | Block All Overcurrent | --- | --- | F65 | Disabled |
| 1261 | Block All Phase Overcurrent | --- | --- | F65 | Disabled |
| 1262 | Block All Ground Overcurrent | --- | --- | F65 | Disabled |
| 1263 | Block All Neutral Overcurrent | --- | --- | F65 | Disabled |
| 1264[2] | Block Phase Time Overcurrent 1 | --- | --- | F65 | Disabled |
| 1265[2] | Block Phase Instantaneous Overcurrent 1 | --- | --- | F65 | Disabled |
| 1266[2] | Block Phase Instantaneous Overcurrent 2 | --- | --- | F65 | Disabled |
| 1267[2] | Block Ground Time Overcurrent | --- | --- | F65 | Disabled |
| 1268[2] | Block Ground Instantaneous Overcurrent | --- | --- | F65 | Disabled |
| 1269[2] | Block Neutral Time Overcurrent 1 | --- | --- | F65 | Disabled |
| 126A[2] | Block Neutral Time Overcurrent 2 | --- | --- | F65 | Disabled |
| 126B[2] | Block Neutral Instantaneous Overcurrent 1 | --- | --- | F65 | Disabled |
| 126C[2] | Block Neutral Instantaneous Overcurrent 2 | --- | --- | F65 | Disabled |
| 126D | Block Negative Sequence Time Overcurrent | --- | --- | F65 | Disabled |
| 126E | Block Negative Sequence Instantaneous Overcurrent | --- | --- | F65 | Disabled |
| 126F | Block Phase Time Overcurrent 2 | --- | --- | F65 | Disabled |
| 1270[3] | Block All Sensitive Ground Overcurrent | --- | --- | F65 | Disabled |
| 1271[3] | Block Sensitive Ground Instantaneous Overcurrent | --- | --- | F65 | Disabled |
| 1272[3] | Block Sensitive Ground Time Overcurrent | --- | --- | F65 | Disabled |
| **TRANSFER FUNCTIONS (read/write setpoints)** | | | | | |
| 1280 | Selected To Trip | --- | --- | F65 | Disabled |
| 1281 | Undervoltage on Other Source | --- | --- | F65 | Disabled |
| 1282 | Incomer 1 Breaker Closed | --- | --- | F65 | Disabled |
| 1283 | Incomer 2 Breaker Closed | --- | --- | F65 | Disabled |
| 1284 | Tie Breaker Connected | --- | --- | F65 | Disabled |
| 1285 | Tie Breaker Closed | --- | --- | F65 | Disabled |
| 1286 | Block Transfer | --- | --- | F65 | Disabled |
| 1287 | Transformer Lockout | --- | --- | F65 | Disabled |
| 1288 | Source Trip | --- | --- | F65 | Disabled |
| 1289 | Close From Incomer 1 | --- | --- | F65 | Disabled |
| 128A | Close From Incomer 2 | --- | --- | F65 | Disabled |
| **AUTORECLOSE FUNCTIONS (read/write setpoints, 760 ONLY)** | | | | | |
| 1290 | Initiate Reclosure | --- | --- | F65 | Disabled |
| 1291 | Cancel Reclosure | --- | --- | F65 | Disabled |
| 1292 | Block Reclosure | --- | --- | F65 | Disabled |
| **MISCELLANEOUS FUNCTIONS (read/write setpoints)** | | | | | |
| 12A0 | Trigger Trace Memory | --- | --- | F65 | Disabled |
| 12A1 | Simulate Fault | --- | --- | F65 | Disabled |
| 12A2 | Trigger Data Logger | --- | --- | F65 | Disabled |
| 12A3[8] | Start Demand Interval | --- | --- | F65 | Disabled |
| **RELAY 1 TRIP (read/write setpoints)** | | | | | |
| 1300[8] | Relay 1 TRIP Seal In Time | 0.00 to 9.99 | s | F3 | 0.04s |
| **RELAY 2 CLOSE (read/write setpoints)** | | | | | |
| 1310[8] | Relay 2 CLOSE Seal In Time | 0.00 to 9.99 | s | F3 | 0.04 s |
| **RELAY 3 AUXILIARY (read/write setpoints)** | | | | | |
| 1320 | Relay 3 AUXILIARY Name (8 words) | --- | --- | F33 | "AUXILIARY" |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 19 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 1328 | Relay 3 AUXILIARY Non-operated State | --- | --- | F34 | De-energized |
| 1329 | Relay 3 AUXILIARY Output Type | --- | --- | F35 | Self-resetting |
| 132A | Relay 3 AUXILIARY Pulse Dwell Time | 0.1 to 6000.0 | s | F2 | 0.1 s |
| **RELAY 4 AUXILIARY (read/write setpoints)** | | | | | |
| 1330 | Relay 4 AUXILIARY Name (8 words) | --- | --- | F33 | "AUXILIARY" |
| 1338 | Relay 4 AUXILIARY Non-operated State | --- | --- | F34 | De-energized |
| 1339 | Relay 4 AUXILIARY Output Type | --- | --- | F35 | Self-resetting |
| 133A | Relay 4 AUXILIARY Pulse Dwell Time | 0.1 to 6000.0 | s | F2 | 0.1 s |
| **RELAY 5 AUXILIARY (read/write setpoints)** | | | | | |
| 1340 | Relay 5 AUXILIARY Name (8 words) | --- | --- | F33 | "AUXILIARY" |
| 1348 | Relay 5 AUXILIARY Non-operated State | --- | --- | F34 | De-energized |
| 1349 | Relay 5 AUXILIARY Output Type | --- | --- | F35 | Self-resetting |
| 134A | Relay 5 AUXILIARY Pulse Dwell Time | 0.1 to 6000.0 | s | F2 | 0.1 s |
| **RELAY 6 AUXILIARY (read/write setpoints)** | | | | | |
| 1350 | Relay 6 AUXILIARY Name (8 words) | --- | --- | F33 | "AUXILIARY" |
| 1358 | Relay 6 AUXILIARY Non-operated State | --- | --- | F34 | De-energized |
| 1359 | Relay 6 AUXILIARY Output Type | --- | --- | F35 | Self-resetting |
| 135A | Relay 6 AUXILIARY Pulse Dwell Time | 0.1 to 6000.0 | s | F2 | 0.1 s |
| **RELAY 7 AUXILIARY (read/write setpoints)** | | | | | |
| 1360 | Relay 7 AUXILIARY Name (8 words) | --- | --- | F33 | "AUXILIARY" |
| 1368 | Relay 7 AUXILIARY Non-operated State | --- | --- | F34 | De-energized |
| 1369 | Relay 7 AUXILIARY Output Type | --- | --- | F35 | Self-resetting |
| 136A | Relay 7 AUXILIARY Pulse Dwell Time | 0.1 to 6000.0 | s | F2 | 0.1 s |
| **USER INPUT I (read/write setpoints)** | | | | | |
| 1370[8] | User Input I Name (9 registers) | --- | --- | F33 | User Input I |
| 1379[8] | User Input I Source | --- | --- | F65 | Disabled |
| 137A[8] | User Input I Function | --- | --- | F37 | Disabled |
| 137B[8] | User Input I Relays | --- | --- | F57 | None |
| 137C[8] | User Input I Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT J (read/write setpoints)** | | | | | |
| 1380[8] | User Input J Name (9 registers) | --- | --- | F33 | User Input J |
| 1389[8] | User Input J Source | --- | --- | F65 | Disabled |
| 138A[8] | User Input J Function | --- | --- | F37 | Disabled |
| 138B[8] | User Input J Relays | --- | --- | F57 | None |
| 138C[8] | User Input J Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT K (read/write setpoints)** | | | | | |
| 1390[8] | User Input K Name (9 registers) | --- | --- | F33 | User Input K |
| 1399[8] | User Input K Source | --- | --- | F65 | Disabled |
| 139A[8] | User Input K Function | --- | --- | F37 | Disabled |
| 139B[8] | User Input K Relays | --- | --- | F57 | None |
| 139C[8] | User Input K Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT L (read/write setpoints)** | | | | | |
| 13A0[8] | User Input L Name (9 registers) | --- | --- | F33 | User Input L |
| 13A9[8] | User Input L Source | --- | --- | F65 | Disabled |
| 13AA[8] | User Input L Function | --- | --- | F37 | Disabled |
| 13AB[8] | User Input L Relays | --- | --- | F57 | None |
| 13AC[8] | User Input L Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT M (read/write setpoints)** | | | | | |
| 13B0[8] | User Input M Name (9 registers) | --- | --- | F33 | User Input M |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 20 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 13B9[8] | User Input M Source | --- | --- | F65 | Disabled |
| 13BA[8] | User Input M Function | --- | --- | F37 | Disabled |
| 13BB[8] | User Input M Relays | --- | --- | F57 | None |
| 13BC[8] | User Input M Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT N (read/write setpoints)** | | | | | |
| 13C0[8] | User Input N Name (9 registers) | --- | --- | F33 | User Input N |
| 13C9[8] | User Input N Source | --- | --- | F65 | Disabled |
| 13CA[8] | User Input N Function | --- | --- | F37 | Disabled |
| 13CB[8] | User Input N Relays | --- | --- | F57 | None |
| 13CC[8] | User Input N Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT O (read/write setpoints)** | | | | | |
| 13D0[8] | User Input O Name (9 registers) | --- | --- | F33 | User Input O |
| 13D9[8] | User Input O Source | --- | --- | F65 | Disabled |
| 13DA[8] | User Input O Function | --- | --- | F37 | Disabled |
| 13DB[8] | User Input O Relays | --- | --- | F57 | None |
| 13DC[8] | User Input O Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT P (read/write setpoints)** | | | | | |
| 13E0[8] | User Input P Name (9 registers) | --- | --- | F33 | User Input P |
| 13E9[8] | User Input P Source | --- | --- | F65 | Disabled |
| 13EA[8] | User Input P Function | --- | --- | F37 | Disabled |
| 13EB[8] | User Input P Relays | --- | --- | F57 | None |
| 13EC[8] | User Input P Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT Q (read/write setpoints)** | | | | | |
| 13F0[8] | User Input Q Name (9 registers) | --- | --- | F33 | User Input Q |
| 13F9[8] | User Input Q Source | --- | --- | F65 | Disabled |
| 13FA[8] | User Input Q Function | --- | --- | F37 | Disabled |
| 13FB[8] | User Input Q Relays | --- | --- | F57 | None |
| 13FC[8] | User Input Q Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT R (read/write setpoints)** | | | | | |
| 1400[8] | User Input R Name (9 registers) | --- | --- | F33 | User Input R |
| 1409[8] | User Input R Source | --- | --- | F65 | Disabled |
| 140A[8] | User Input R Function | --- | --- | F37 | Disabled |
| 140B[8] | User Input R Relays | --- | --- | F57 | None |
| 140C[8] | User Input R Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT S (read/write setpoints)** | | | | | |
| 1410[8] | User Input S Name (9 registers) | --- | --- | F33 | User Input S |
| 1419[8] | User Input S Source | --- | --- | F65 | Disabled |
| 141A[8] | User Input S Function | --- | --- | F37 | Disabled |
| 141B[8] | User Input S Relays | --- | --- | F57 | None |
| 141C[8] | User Input S Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **USER INPUT T (read/write setpoints)** | | | | | |
| 1420[8] | User Input T Name (9 registers) | --- | --- | F33 | User Input T |
| 1429[8] | User Input T Source | --- | --- | F65 | Disabled |
| 142A[8] | User Input T Function | --- | --- | F37 | Disabled |
| 142B[8] | User Input T Relays | --- | --- | F57 | None |
| 142C[8] | User Input T Delay | 0.00 to 600.00 | s | F3 | 0.00 s |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 21 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| **FLEXCURVE A TRIP TIMES (read/write setpoints)** | | | | | |
| 1430 | FlexCurve A Trip Time at 1.03 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1431 | FlexCurve A Trip Time at 1.05 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1432 | FlexCurve A Trip Time at 1.10 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1433 | FlexCurve A Trip Time at 1.20 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1434 | FlexCurve A Trip Time at 1.30 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1435 | FlexCurve A Trip Time at 1.40 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1436 | FlexCurve A Trip Time at 1.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1437 | FlexCurve A Trip Time at 1.60 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1438 | FlexCurve A Trip Time at 1.70 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1439 | FlexCurve A Trip Time at 1.80 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 143A | FlexCurve A Trip Time at 1.90 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 143B | FlexCurve A Trip Time at 2.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 143C | FlexCurve A Trip Time at 2.10 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 143D | FlexCurve A Trip Time at 2.20 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 143E | FlexCurve A Trip Time at 2.30 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 143F | FlexCurve A Trip Time at 2.40 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1440 | FlexCurve A Trip Time at 2.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1441 | FlexCurve A Trip Time at 2.60 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1442 | FlexCurve A Trip Time at 2.70 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1443 | FlexCurve A Trip Time at 2.80 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1444 | FlexCurve A Trip Time at 2.90 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1445 | FlexCurve A Trip Time at 3.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1446 | FlexCurve A Trip Time at 3.10 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1447 | FlexCurve A Trip Time at 3.20 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1448 | FlexCurve A Trip Time at 3.30 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1449 | FlexCurve A Trip Time at 3.40 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 144A | FlexCurve A Trip Time at 3.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 144B | FlexCurve A Trip Time at 3.60 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 144C | FlexCurve A Trip Time at 3.70 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 144D | FlexCurve A Trip Time at 3.80 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 144E | FlexCurve A Trip Time at 3.90 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 144F | FlexCurve A Trip Time at 4.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1450 | FlexCurve A Trip Time at 4.10 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1451 | FlexCurve A Trip Time at 4.20 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1452 | FlexCurve A Trip Time at 4.30 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1453 | FlexCurve A Trip Time at 4.40 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1454 | FlexCurve A Trip Time at 4.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1455 | FlexCurve A Trip Time at 4.60 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1456 | FlexCurve A Trip Time at 4.70 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1457 | FlexCurve A Trip Time at 4.80 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1458 | FlexCurve A Trip Time at 4.90 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1459 | FlexCurve A Trip Time at 5.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 145A | FlexCurve A Trip Time at 5.10 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 145B | FlexCurve A Trip Time at 5.20 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 145C | FlexCurve A Trip Time at 5.30 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 145D | FlexCurve A Trip Time at 5.40 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 145E | FlexCurve A Trip Time at 5.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 145F | FlexCurve A Trip Time at 5.60 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1460 | FlexCurve A Trip Time at 5.70 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1461 | FlexCurve A Trip Time at 5.80 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1462 | FlexCurve A Trip Time at 5.90 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1463 | FlexCurve A Trip Time at 6.00 x PU | 0 to 65535 | ms | F1 | 0 ms |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 22 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 1464 | FlexCurve A Trip Time at 6.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1465 | FlexCurve A Trip Time at 7.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1466 | FlexCurve A Trip Time at 7.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1467 | FlexCurve A Trip Time at 8.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1468 | FlexCurve A Trip Time at 8.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1469 | FlexCurve A Trip Time at 9.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 146A | FlexCurve A Trip Time at 9.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 146B | FlexCurve A Trip Time at 10.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 146C | FlexCurve A Trip Time at 10.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 146D | FlexCurve A Trip Time at 11.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 146E | FlexCurve A Trip Time at 11.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 146F | FlexCurve A Trip Time at 12.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1470 | FlexCurve A Trip Time at 12.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1471 | FlexCurve A Trip Time at 13.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1472 | FlexCurve A Trip Time at 13.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1473 | FlexCurve A Trip Time at 14.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1474 | FlexCurve A Trip Time at 14.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1475 | FlexCurve A Trip Time at 15.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1476 | FlexCurve A Trip Time at 15.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1477 | FlexCurve A Trip Time at 16.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1478 | FlexCurve A Trip Time at 16.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1479 | FlexCurve A Trip Time at 17.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 147A | FlexCurve A Trip Time at 17.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 147B | FlexCurve A Trip Time at 18.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 147C | FlexCurve A Trip Time at 18.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 147D | FlexCurve A Trip Time at 19.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 147E | FlexCurve A Trip Time at 19.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 147F | FlexCurve A Trip Time at 20.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| **FLEXCURVE B TRIP TIMES (read/write setpoints)** | | | | | |
| 1480 | FlexCurve B Trip Time at 1.03 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1481 | FlexCurve B Trip Time at 1.05 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1482 | FlexCurve B Trip Time at 1.10 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1483 | FlexCurve B Trip Time at 1.20 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1484 | FlexCurve B Trip Time at 1.30 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1485 | FlexCurve B Trip Time at 1.40 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1486 | FlexCurve B Trip Time at 1.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1487 | FlexCurve B Trip Time at 1.60 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1488 | FlexCurve B Trip Time at 1.70 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1489 | FlexCurve B Trip Time at 1.80 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 148A | FlexCurve B Trip Time at 1.90 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 148B | FlexCurve B Trip Time at 2.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 148C | FlexCurve B Trip Time at 2.10 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 148D | FlexCurve B Trip Time at 2.20 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 148E | FlexCurve B Trip Time at 2.30 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 148F | FlexCurve B Trip Time at 2.40 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1490 | FlexCurve B Trip Time at 2.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1491 | FlexCurve B Trip Time at 2.60 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1492 | FlexCurve B Trip Time at 2.70 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1493 | FlexCurve B Trip Time at 2.80 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1494 | FlexCurve B Trip Time at 2.90 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1495 | FlexCurve B Trip Time at 3.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1496 | FlexCurve B Trip Time at 3.10 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1497 | FlexCurve B Trip Time at 3.20 x PU | 0 to 65535 | ms | F1 | 0 ms |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 23 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 1498 | FlexCurve B Trip Time at 3.30 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 1499 | FlexCurve B Trip Time at 3.40 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 149A | FlexCurve B Trip Time at 3.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 149B | FlexCurve B Trip Time at 3.60 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 149C | FlexCurve B Trip Time at 3.70 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 149D | FlexCurve B Trip Time at 3.80 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 149E | FlexCurve B Trip Time at 3.90 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 149F | FlexCurve B Trip Time at 4.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14A0 | FlexCurve B Trip Time at 4.10 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14A1 | FlexCurve B Trip Time at 4.20 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14A2 | FlexCurve B Trip Time at 4.30 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14A3 | FlexCurve B Trip Time at 4.40 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14A4 | FlexCurve B Trip Time at 4.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14A5 | FlexCurve B Trip Time at 4.60 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14A6 | FlexCurve B Trip Time at 4.70 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14A7 | FlexCurve B Trip Time at 4.80 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14A8 | FlexCurve B Trip Time at 4.90 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14A9 | FlexCurve B Trip Time at 5.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14AA | FlexCurve B Trip Time at 5.10 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14AB | FlexCurve B Trip Time at 5.20 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14AC | FlexCurve B Trip Time at 5.30 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14AD | FlexCurve B Trip Time at 5.40 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14AE | FlexCurve B Trip Time at 5.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14AF | FlexCurve B Trip Time at 5.60 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14B0 | FlexCurve B Trip Time at 5.70 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14B1 | FlexCurve B Trip Time at 5.80 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14B2 | FlexCurve B Trip Time at 5.90 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14B3 | FlexCurve B Trip Time at 6.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14B4 | FlexCurve B Trip Time at 6.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14B5 | FlexCurve B Trip Time at 7.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14B6 | FlexCurve B Trip Time at 7.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14B7 | FlexCurve B Trip Time at 8.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14B8 | FlexCurve B Trip Time at 8.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14B9 | FlexCurve B Trip Time at 9.00 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14BA | FlexCurve B Trip Time at 9.50 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14BB | FlexCurve B Trip Time at 10.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14BC | FlexCurve B Trip Time at 10.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14BD | FlexCurve B Trip Time at 11.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14BE | FlexCurve B Trip Time at 11.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14BF | FlexCurve B Trip Time at 12.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14C0 | FlexCurve B Trip Time at 12.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14C1 | FlexCurve B Trip Time at 13.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14C2 | FlexCurve B Trip Time at 13.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14C3 | FlexCurve B Trip Time at 14.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14C4 | FlexCurve B Trip Time at 14.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14C5 | FlexCurve B Trip Time at 15.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14C6 | FlexCurve B Trip Time at 15.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14C7 | FlexCurve B Trip Time at 16.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14C8 | FlexCurve B Trip Time at 16.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14C9 | FlexCurve B Trip Time at 17.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14CA | FlexCurve B Trip Time at 17.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14CB | FlexCurve B Trip Time at 18.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14CC | FlexCurve B Trip Time at 18.5 x PU | 0 to 65535 | ms | F1 | 0 ms |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 24 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 14CD | FlexCurve B Trip Time at 19.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14CE | FlexCurve B Trip Time at 19.5 x PU | 0 to 65535 | ms | F1 | 0 ms |
| 14CF | FlexCurve B Trip Time at 20.0 x PU | 0 to 65535 | ms | F1 | 0 ms |
| **PHASE TIME OVERCURRENT 1 (read/write setpoints)** | | | | | |
| 1500 | Phase Time Overcurrent 1 Function | --- | --- | F37 | Trip |
| 1501 | Phase Time Overcurrent 1 Relays | --- | --- | F57 | None |
| 1502[2] | Phase Time Overcurrent 1 Curve | --- | --- | F36 | Ext Inverse |
| 1503 | Phase Time Overcurrent 1 Voltage Restraint | --- | --- | F30 | Disabled |
| 1504[1] | Phase Time Overcurrent 1 Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1505[1] | Phase Time Overcurrent 1 Multiplier | 0.00 to 100.00 | --- | F3 | 1.00 |
| 1506[1] | Phase Time Overcurrent 1 Reset Time | --- | --- | F68 | Instantaneous |
| 1507[1] | Phase Time Overcurrent 1 Direction | --- | --- | F84 | Disabled |
| **PHASE INSTANTANEOUS OVERCURRENT 1 (read/write setpoints)** | | | | | |
| 1508[2] | Phase Instantaneous Overcurrent 1 Function | --- | --- | F37 | Disabled |
| 1509[2] | Phase Instantaneous Overcurrent 1 Relays | --- | --- | F57 | None |
| 150A[2] | Phase Instantaneous Overcurrent 1 Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 150B[2] | Phase Instantaneous Overcurrent 1 Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| 150C | Phases Required for Operation | --- | --- | F41 | Any One |
| 150D[1] | Phase Instantaneous Overcurrent 1 Direction | --- | --- | F84 | Disabled |
| **PHASE INSTANTANEOUS OVERCURRENT 2 (read/write setpoints)** | | | | | |
| 1510[2] | Phase Instantaneous Overcurrent 2 Function | --- | --- | F37 | Disabled |
| 1511[2] | Phase Instantaneous Overcurrent 2 Relays | --- | --- | F57 | None |
| 1512[2] | Phase Instantaneous Overcurrent 2 Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1513[2] | Phase Instantaneous Overcurrent 2 Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| 1514 | Phases Required for Operation | --- | --- | F41 | Any One |
| 1515[1] | Phase Instantaneous Overcurrent 2 Direction | --- | --- | F84 | Disabled |
| **PHASE DIRECTIONAL OVERCURRENT (read/write setpoints)** | | | | | |
| 1520 | Phase Directional Function | --- | --- | F38 | Disabled |
| 1521 | Phase Directional Maximum Torque Angle | 0 to 359 | ° Lead | F1 | 30° Lead |
| 1522[1] | Minimum Polarizing Voltage | 0.00 to 1.25 | x VT | F3 | 0.05 x VT |
| 1523 | Phase Directional Relays | --- | --- | F57 | None |
| 1524[4] | Block OC When Voltage Memory Expires | --- | --- | F30 | Disabled |
| **PHASE TIME OVERCURRENT 2 (read/write setpoints)** | | | | | |
| 1530[1] | Phase Time Overcurrent 2 Function | --- | --- | F37 | Disabled |
| 1531[1] | Phase Time Overcurrent 2 Relays | --- | --- | F57 | None |
| 1532[1] | Phase Time Overcurrent 2 Curve | --- | --- | F36 | Ext. Inverse |
| 1533[1] | Phase Time Overcurrent 2 Voltage Restraint | --- | --- | F30 | Disabled |
| 1534[1] | Phase Time Overcurrent 2 Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1535[1] | Phase Time Overcurrent 2 Multiplier | 0.00 to 100.00 | --- | F3 | 1.00 |
| 1536[1] | Phase Time Overcurrent 2 Reset Time | --- | --- | F68 | Instantaneous |
| 1537[1] | Phase Time Overcurrent 2 Direction | --- | --- | F84 | Disabled |
| **GROUND TIME OVERCURRENT (read/write setpoints)** | | | | | |
| 1600 | Ground Time Overcurrent Function | --- | --- | F37 | Disabled |
| 1601 | Ground Time Overcurrent Relays | --- | --- | F57 | None |
| 1602 | Ground Time Overcurrent Curve | --- | --- | F36 | Ext. Inverse |
| 1603[1] | Ground Time Overcurrent Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1604[1] | Ground Time Overcurrent Multiplier | 0.00 to 100.00 | --- | F3 | 1.00 |
| 1605[1] | Ground Time Overcurrent Reset Time | --- | --- | F68 | Instantaneous |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 25 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 1606[6] | Ground Time Overcurrent Direction | --- | --- | F84 | Disabled |
| **GROUND INSTANTANEOUS OVERCURRENT (read/write setpoints)** | | | | | |
| 1608[2] | Ground Instantaneous Overcurrent Function | --- | --- | F37 | Disabled |
| 1609[2] | Ground Instantaneous Overcurrent Relays | --- | --- | F57 | None |
| 160A[2] | Ground Instantaneous Overcurrent Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 160B[2] | Ground Instantaneous Overcurrent Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| 160C[6] | Ground Instantaneous Overcurrent Direction | --- | --- | F84 | Disabled |
| **GROUND DIRECTIONAL OVERCURRENT (read/write setpoints)** | | | | | |
| 160E[6] | Ground Directional Function | --- | --- | F38 | Disabled |
| 160F[6] | Ground Directional Maximum Torque Angle | 0 to 359 | ° Lead | F1 | 315° |
| 1610[6] | Ground Directional Minimum Polarizing Voltage | 0.00 to 1.25 | x VT | F3 | 0.05 x VT |
| 1611[6] | Ground Directional Polarizing | --- | --- | F50 | Voltage |
| 1612[6] | Ground Directional Relays | --- | --- | F57 | None |
| **NEUTRAL TIME OVERCURRENT 1 (read/write setpoints)** | | | | | |
| 1630 | Neutral Time Overcurrent 1 Function | --- | --- | F37 | Disabled |
| 1631 | Neutral Time Overcurrent 1 Relays | --- | --- | F57 | None |
| 1632 | Neutral Time Overcurrent 1 Curve | --- | --- | F36 | Ext. Inverse |
| 1633[1] | Neutral Time Overcurrent 1 Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1634[1] | Neutral Time Overcurrent 1 Multiplier | 0.00 to 100.00 | --- | F3 | 1.00 |
| 1635[1] | Neutral Time Overcurrent 1 Reset Time | --- | --- | F68 | Instantaneous |
| 1636[1] | Neutral Time Overcurrent 1 Direction | --- | --- | F84 | Disabled |
| **NEUTRAL INSTANTANEOUS OVERCURRENT 1 (read/write setpoints)** | | | | | |
| 1640[2] | Neutral Instantaneous Overcurrent 1 Function | --- | --- | F37 | Disabled |
| 1641[2] | Neutral Instantaneous Overcurrent 1 Relays | --- | --- | F57 | None |
| 1642[2] | Neutral Instantaneous Overcurrent 1 Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1643[2] | Neutral Instantaneous Overcurrent 1 Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| 1644[1] | Neutral Instantaneous Overcurrent 1 Direction | --- | --- | F84 | Disabled |
| **NEUTRAL INSTANTANEOUS OVERCURRENT 2 (read/write setpoints)** | | | | | |
| 1650[2] | Neutral Instantaneous Overcurrent 2 Function | --- | --- | F37 | Disabled |
| 1651[2] | Neutral Instantaneous Overcurrent 2 Relays | --- | --- | F57 | None |
| 1652[2] | Neutral Instantaneous Overcurrent 2 Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1653[2] | Neutral Instantaneous Overcurrent 2 Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| 1654[1] | Neutral Instantaneous Overcurrent 2 Direction | --- | --- | F84 | Disabled |
| **NEUTRAL TIME OVERCURRENT 2 (read/write setpoints)** | | | | | |
| 1660[1] | Neutral Time Overcurrent 2 Function | --- | --- | F37 | Disabled |
| 1661[1] | Neutral Time Overcurrent 2 Relays | --- | --- | F57 | None |
| 1662[1] | Neutral Time Overcurrent 2 Curve | --- | --- | F36 | Ext. Inverse |
| 1663[1] | Neutral Time Overcurrent 2 Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1664[1] | Neutral Time Overcurrent 2 Multiplier | 0.00 to 100.00 | --- | F3 | 1.00 |
| 1665[1] | Neutral Time Overcurrent 2 Reset Time | --- | --- | F68 | Instantaneous |
| 1666[1] | Neutral Time Overcurrent 2 Direction | --- | --- | F84 | Disabled |
| **NEUTRAL DIRECTIONAL OVERCURRENT (read/write setpoints)** | | | | | |
| 1670[1] | Neutral Directional Function | --- | --- | F38 | Disabled |
| 1671[1] | Neutral Directional Maximum Torque Angle | 0 to 359 | ° | F1 | 315° |
| 1672[1] | Minimum Polarizing Voltage | 0.00 to 1.25 | x VT | F3 | 0.05 x VT |
| 1674[1] | Neutral Directional Polarizing | --- | --- | F50 | Voltage |
| 1675[1] | Neutral Directional Relays | --- | --- | F57 | None |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 26 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| **NEGATIVE SEQUENCE TIME OVERCURRENT (read/write setpoints)** | | | | | |
| 1700 | Negative Sequence Time Overcurrent Function | --- | --- | F37 | Disabled |
| 1701 | Negative Sequence Time Overcurrent Relays | --- | --- | F57 | None |
| 1702[1] | Negative Sequence Time Overcurrent Curve | --- | --- | F36 | Ext. Inverse |
| 1703[1] | Negative Sequence Time Overcurrent Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1704[1] | Negative Sequence Time Overcurrent Multiplier | 0.00 to 100.00 | --- | F3 | 1.00 |
| 1705[1] | Negative Sequence Time Overcurrent Reset Time | --- | --- | F68 | Instantaneous |
| 1706[1] | Negative Sequence Time Overcurrent Direction | --- | --- | F84 | Disabled |
| **NEGATIVE SEQUENCE INSTANTANEOUS OVERCURRENT (read/write setpoints)** | | | | | |
| 1710 | Negative Sequence Inst Overcurrent Function | --- | --- | F37 | Disabled |
| 1711 | Negative Sequence Instantaneous Overcurrent Relays | --- | --- | F57 | None |
| 1712 | Negative Sequence Instantaneous Overcurrent Pickup | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1713 | Negative Sequence Instantaneous Overcurrent Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| 1714[1] | Negative Sequence Instantaneous Overcurrent Direction | --- | --- | F84 | Disabled |
| **NEGATIVE SEQUENCE VOLTAGE (read/write setpoints)** | | | | | |
| 1720 | Negative Sequence Voltage Function | --- | --- | F39 | Disabled |
| 1721 | Negative Sequence Voltage Relays | --- | --- | F57 | None |
| 1722[2] | Negative Sequence Voltage Pickup | 0.00 to 1.25 | x VT | F3 | 0.10 |
| 1723 | Negative Sequence Voltage Delay | 0.0 to 6000.0 | s | F2 | 2.0 s |
| **NEGATIVE SEQUENCE DIRECTIONAL (read/write setpoints)** | | | | | |
| 1730[1] | Negative Sequence Directional Function | --- | --- | F38 | Disabled |
| 1731[1] | Neg Seq Directional Maximum Torque Angle (MTA) | 0 to 359 | ° | F1 | 315° |
| 1732[1] | Minimum Polarizing Voltage | 0.00 to 1.25 | x VT | F3 | 0.05 x VT |
| 1733[1] | Negative Sequence Directional Relays | --- | --- | F57 | None |
| **SENSITIVE GROUND INSTANTANEOUS OVERCURRENT (read/write setpoints)** | | | | | |
| 1740[3] | Sensitive Ground Instantaneous Overcurrent Function | --- | --- | F37 | Disabled |
| 1741[3] | Sensitive Ground Instantaneous Overcurrent Relays | --- | --- | F57 | None |
| 1742[3] | Sensitive Ground Instantaneous Overcurrent Pickup | 0.005 to 1.000 | x CT | F70 | 0.100 x CT |
| 1743[3] | Sensitive Ground Instantaneous Overcurrent Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| 1744[3] | Sensitive Ground Instantaneous Overcurrent Direction | --- | --- | F84 | Disabled |
| **SENSITIVE GROUND TIME OVERCURRENT (read/write setpoints)** | | | | | |
| 1750[3] | Sensitive Ground Time Overcurrent Function | --- | --- | F37 | Disabled |
| 1751[3] | Sensitive Ground Time Overcurrent Relays | --- | --- | F57 | None |
| 1752[3] | Sensitive Ground Time Overcurrent Curve | --- | --- | F36 | Ext. Inverse |
| 1753[3] | Sensitive Ground Time Overcurrent Pickup | 0.005 to 1.000 | x CT | F70 | 0.100 x CT |
| 1754[3] | Sensitive Ground Time Overcurrent Multiplier | 0.00 to 100.00 | --- | F3 | 1.00 |
| 1755[3] | Sensitive Ground Time Overcurrent Reset Time | --- | --- | F68 | Instantaneous |
| 1756[3] | Sensitive Ground Time Overcurrent Direction | --- | --- | F84 | Disabled |
| **SENSITIVE GROUND DIRECTIONAL (read/write setpoints)** | | | | | |
| 1760[3] | Sensitive Ground Directional Function | --- | --- | F38 | Disabled |
| 1761[3] | Sensitive Ground Directional Maximum Torque Angle | 0 to 359 | ° | F1 | 315° |
| 1762[3] | Minimum Polarizing Voltage | 0.00 to 1.25 | x VT | F3 | 0.05 x VT |
| 1763[3] | Sensitive Ground Directional Polarizing | --- | --- | F50 | Voltage |
| 1764[3] | Sensitive Ground Directional Relays | --- | --- | F57 | None |
| **RESERVED FOR MOD 010 (read/write setpoints)** | | | | | |
| 1767[7] | Reserved for MOD 010 | | | | |
| 1768[7] | Reserved for MOD 010 | | | | |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 27 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 1769[7] | Reserved for MOD 010 | | | | |
| 176A[7] | Reserved for MOD 010 | | | | |
| 176B[7] | Reserved for MOD 010 | | | | |
| **RESTRICTED EARTH FAULT (read/write setpoints)** | | | | | |
| 1770[8] | Restricted Earth Fault Function | --- | --- | F39 | Disabled |
| 1771[8] | Restricted Earth Fault Relays | --- | --- | F57 | None |
| 1772[8] | Restricted Earth Fault Pickup | 0.005 to 1.000 | x CT | F70 | 0.100 x CT |
| 1773[8] | Restricted Earth Fault Delay | 0.00 to 600.00 | s | F3 | 0.00 s |
| **BUS UNDERVOLTAGE 1 (read/write setpoints)** | | | | | |
| 1780 | Bus Undervoltage 1 Function | --- | --- | F39 | Disabled |
| 1781 | Bus Undervoltage 1 Relays | --- | --- | F57 | None |
| 1782[2] | Bus Undervoltage 1 Pickup | 0.00 to 1.25 | x VT | F3 | 0.75 x VT |
| 1783 | Bus Undervoltage 1 Delay | 0.0 to 6000.0 | s | F2 | 2.0 s |
| 1784 | Bus Undervoltage 1 Phases Required for Operation | --- | --- | F41 | All Three |
| 1785[2] | Bus Undervoltage 1 Minimum Operating Voltage | 0.00 to 1.25 | x VT | F3 | 0.30 x V |
| 1786 | Bus Undervoltage 1 Curve | --- | --- | F45 | Definite Time |
| **BUS UNDERVOLTAGE 2 (read/write setpoints)** | | | | | |
| 1788 | Bus Undervoltage 2 Function | --- | --- | F39 | Disabled |
| 1789 | Bus Undervoltage 2 Relays | --- | --- | F57 | None |
| 178A[2] | Bus Undervoltage 2 Pickup | 0.00 to 1.25 | x VT | F3 | 0.75 x VT |
| 178B | Bus Undervoltage 2 Delay | 0.0 to 6000.0 | s | F2 | 2.0 s |
| 178C | Bus Undervoltage 2 Phases Required for Operation | --- | --- | F41 | All Three |
| 178D[2] | Bus Undervoltage 2 Minimum Operating Voltage | 0.00 to 1.25 | x VT | F3 | 0.30 x V |
| 178E | Bus Undervoltage 2 Curve | --- | --- | F45 | Definite Time |
| **OVERVOLTAGE 1 (read/write setpoints)** | | | | | |
| 1790 | Overvoltage 1 Function | --- | --- | F39 | Disabled |
| 1791 | Overvoltage 1 Relays | --- | --- | F57 | None |
| 1792[2] | Overvoltage 1 Pickup | 0.00 to 1.25 | x VT | F3 | 1.25 x VT |
| 1793 | Overvoltage 1 Delay | 0.0 to 6000.0 | s | F2 | 2.0 s |
| 1794 | Overvoltage 1 Phases Required for Operation | --- | --- | F41 | All Three |
| **OVERVOLTAGE 2 (read/write setpoints)** | | | | | |
| 1798 | Overvoltage 2 Function | --- | --- | F39 | Disabled |
| 1799 | Overvoltage 2 Relays | --- | --- | F57 | None |
| 179A[2] | Overvoltage 2 Pickup | 0.00 to 1.25 | x VT | F3 | 1.25 x VT |
| 179B | Overvoltage 2 Delay | 0.0 to 6000.0 | s | F2 | 2.0 s |
| 179C | Overvoltage 2 Phases Required for Operation | --- | --- | F41 | All Three |
| **UNDERFREQUENCY 1 (read/write setpoints)** | | | | | |
| 17A0 | Underfrequency 1 Function | --- | --- | F39 | Disabled |
| 17A1 | Underfrequency 1 Relays | --- | --- | F57 | None |
| 17A2 | Underfrequency 1 Pickup | 20.00 to 65.00 | Hz | F3 | 59.00 Hz |
| 17A3 | Underfrequency 1 Delay | 0.00 to 600.00 | s | F3 | 2.00 s |
| 17A4[2] | Underfrequency 1 Minimum Operating Voltage | 0.00 to 1.25 | x VT | F3 | 0.70 x VT |
| 17A5[1] | Underfrequency 1 Minimum Operating Current | 0.00 to 20.00 | x CT | F3 | 0.20 x CT |
| **UNDERFREQUENCY 2 (read/write setpoints)** | | | | | |
| 17A8 | Underfrequency 2 Function | --- | --- | F39 | Disabled |
| 17A9 | Underfrequency 2 Relays | --- | --- | F57 | None |
| 17AA | Underfrequency 2 Pickup | 20.00 to 65.00 | Hz | F3 | 58.00 Hz |
| 17AB | Underfrequency 2 Delay | 0.00 to 600.00 | s | F3 | 3.00 s |
| 17AC[2] | Underfrequency 2 Minimum Operating Voltage | 0.00 to 1.25 | x VT | F3 | 0.70 x VT |
| 17AD[1] | Underfrequency 2 Minimum Operating Current | 0.00 to 20.00 | x CT | F3 | 0.20 x CT |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 28 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| **LINE UNDERVOLTAGE 3 (read/write setpoints)** | | | | | |
| 17B0 | Line Undervoltage 3 Function | --- | --- | F39 | Disabled |
| 17B1 | Line Undervoltage 3 Relays | --- | --- | F57 | None |
| 17B2[2] | Line Undervoltage 3 Pickup | 0.00 to 1.25 | x VT | F3 | 0.75 x VT |
| 17B3 | Line Undervoltage 3 Delay | 0.0 to 6000.0 | s | F2 | 2.0 s |
| 17B4[2] | Line Undervoltage 3 Minimum Operating Voltage | 0.00 to 1.25 | x VT | F3 | 0.30 x V |
| 17B5 | Line Undervoltage 3 Curve | --- | --- | F45 | Definite Time |
| **LINE UNDERVOLTAGE 4 (read/write setpoints)** | | | | | |
| 17B8 | Line Undervoltage 4 Function | --- | --- | F39 | Disabled |
| 17B9 | Line Undervoltage 4 Relays | --- | --- | F57 | None |
| 17BA[2] | Line Undervoltage 4 Pickup | 0.00 to 1.25 | x VT | F3 | 0.75 x VT |
| 17BB | Line Undervoltage 4 Delay | 0.0 to 6000.0 | s | F2 | 2.0 s |
| 17BC[2] | Line Undervoltage 4 Minimum Operating Voltage | 0.00 to 1.25 | x VT | F3 | 0.30 x V |
| 17BD | Line Undervoltage 4 Curve | --- | --- | F45 | Definite Time |
| **FREQUENCY DECAY (read/write setpoints)** | | | | | |
| 17C0[1] | Frequency Decay Function | --- | --- | F39 | Disabled |
| 17C1[1] | Frequency Decay Relays | --- | --- | F57 | None |
| 17C2[1] | Frequency Decay Rate | 0.1 to 5.0 | Hz/s | F2 | 1.0 Hz/s |
| 17C3[1] | Frequency Decay Pickup | 20.00 to 65.00 | Hz | F3 | 59.50 Hz |
| 17C4[1] | Frequency Decay Delay | 0.00 to 600.00 | s | F3 | 2.00 s |
| 17C5[1] | Frequency Decay Minimum Operating Voltage | 0.00 to 1.25 | x VT | F3 | 0.70 x VT |
| 17C6[1] | Frequency Decay Minimum Operating Current | 0.00 to 20.00 | x CT | F3 | 0.00 x CT |
| **REVERSE POWER (read/write setpoints, requires MOD 008)** | | | | | |
| 17C8 | Reverse Power Function | --- | --- | F39 | Disabled |
| 17C9 | Reverse Power Relays | --- | --- | F57 | None |
| 17CA | Reverse Power Pickup | 0.015 to 0.600 | x RATED | F70 | 0.050 x RATED |
| 17CB | Reverse Power Delay | 0.0 to 6000.0 | s | F2 | 10.0 s |
| **NEUTRAL DISPLACEMENT (read/write setpoints)** | | | | | |
| 17CE | Neutral Displacement Function | --- | --- | F39 | Disabled |
| 17CF | Neutral Displacement Relays | --- | --- | F57 | None |
| 17D0 | Neutral Displacement Pickup | 0.00 to 1.25 | x VT | F3 | 1.00 x VT |
| 17D1 | Neutral Displacement Multiplier | 0.00 to 100.00 | --- | F3 | 1.00 |
| 17D2 | Neutral Displacement Curve | --- | --- | F36 | Ext. Inverse |
| 17D3 | Neutral Displacement Reset Time | --- | --- | F68 | Instantaneous |
| **PHASE CURRENT LEVEL (read/write setpoints)** | | | | | |
| 1800 | Phase Current Level Function | --- | --- | F38 | Disabled |
| 1801 | Phase Current Level Relays | --- | --- | F57 | None |
| 1802 | Phase Current Level Pickup | 0.05 to 20.00 | x CT | F3 | 1.10 x CT |
| 1803 | Phase Current Level Delay | 0 to 60,000 | s | F1 | 2 s |
| **NEUTRAL CURRENT LEVEL (read/write setpoints)** | | | | | |
| 1808 | Neutral Current Level Function | --- | --- | F38 | Disabled |
| 1809 | Neutral Current Level Relays | --- | --- | F57 | None |
| 180A | Neutral Current Level Pickup | 0.05 to 20.00 | x CT | F3 | 1.10 x CT |
| 180B | Neutral Current Level Delay | 0 to 60,000 | s | F1 | 2 s |
| **POWER FACTOR 1 (read/write setpoints)** | | | | | |
| 1810 | Power Factor 1 Function | --- | --- | F38 | Disabled |
| 1811 | Power Factor 1 Relays | --- | --- | F57 | None |
| 1812 | Power Factor 1 Pickup (+ Lag, - Lead) | -0.99 to +1.00 | --- | F6 | 0.80 Lag |
| 1813 | Power Factor 1 Dropout (+ Lag, - Lead) | -0.99 to +1.00 | --- | F6 | 1 |
| 1814 | Power Factor 1 Delay | 0 to 60,000 | s | F1 | 50 s |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 29 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| **POWER FACTOR 2 (read/write setpoints)** | | | | | |
| 1818 | Power Factor 2 Function | --- | --- | F38 | Disabled |
| 1819 | Power Factor 2 Relays | --- | --- | F57 | None |
| 181A | Power Factor 2 Pickup (+ Lag, - Lead) | -0.99 to +1.00 | --- | F6 | 0.80 Lag |
| 181B | Power Factor 2 Dropout (+ Lag, - Lead) | -0.99 to +1.00 | --- | F6 | 1 |
| 181C | Power Factor 2 Delay | 0 to 60,000 | s | F1 | 50 s |
| **FAULT LOCATOR (read/write setpoints)** | | | | | |
| 1830 | Length of Feeder | 0.1 to 99.9 | km, mi | F2 | 0.1 |
| 1831 | Units of Length | --- | --- | F75 | km |
| 1832 | Zpos (Resistive) of Feeder | 0.01 to 99.99 | Ω | F3 | 0.01 Ω |
| 1833 | Zpos (Inductive) of Feeder | 0.01 to 99.99 | Ω | F3 | 0.01 Ω |
| 1834 | Zzero (Resistive) of Feeder | 0.01 to 99.99 | Ω | F3 | 0.01 Ω |
| 1835 | Zzero (Inductive) of Feeder | 0.01 to 99.99 | Ω | F3 | 0.01 Ω |
| 1836[1] | Fault Type Output to Relays 4 to 7 | --- | --- | F30 | Disabled |
| 1837[9] | Fault Location After Trip | ---- | ---- | F30 | Disabled |
| **CURRENT DEMAND (read/write setpoints)** | | | | | |
| 1840 | Current Demand Function | --- | --- | F38 | Disabled |
| 1841 | Current Demand Measurement Type | --- | --- | F58 | Thermal Exp. |
| 1842 | Current Demand Thermal 90% Response | --- | --- | F16 | 15 min. |
| 1843 | Current Demand Time Interval | --- | --- | F16 | 20 min. |
| 1844 | Current Demand Relays | --- | --- | F57 | None |
| 1845 | Current Demand Pickup | 10 to 10000 | A | F1 | 1000 A |
| **REAL POWER DEMAND (read/write setpoints)** | | | | | |
| 1848 | Real Power Demand Function | --- | --- | F38 | Disabled |
| 1849 | Real Power Demand Measurement Type | --- | --- | F58 | Block Interval |
| 184A | Real Power Demand Thermal 90% Response | --- | --- | F16 | 15 min. |
| 184B | Real Power Demand Time Interval | --- | --- | F16 | 20 min. |
| 184C | Real Power Demand Relays | --- | --- | F57 | None |
| 184D[2] | Real Power Demand Pickup | 0.1 to 3000.0 | MW | F86 | 10.0 MW |
| **REACTIVE POWER DEMAND (read/write setpoints)** | | | | | |
| 1850 | Reactive Power Demand Function | --- | --- | F38 | Disabled |
| 1851 | Reactive Power Demand Measurement Type | --- | --- | F58 | Block Interval |
| 1852 | Reactive Power Demand Thermal 90% Response | --- | --- | F16 | 15 min. |
| 1853 | Reactive Power Demand Time Interval | --- | --- | F16 | 20 min. |
| 1854 | Reactive Power Demand Relays | --- | --- | F57 | None |
| 1855[2] | Reactive Power Demand Pickup | 0.1 to 3000.0 | Mvar | F86 | 10.0 Mvar |
| **APPARENT POWER DEMAND (read/write setpoints)** | | | | | |
| 1858 | Apparent Power Demand Function | --- | --- | F38 | Disabled |
| 1859 | Apparent Power Demand Measurement Type | --- | --- | F58 | Block Interval |
| 185A | App. Power Demand Thermal 90% Response | --- | --- | F16 | 15 min. |
| 185B | Apparent Power Demand Time Interval | --- | --- | F16 | 20 min. |
| 185C | Apparent Power Demand Relays | --- | --- | F57 | None |
| 185D[2] | Apparent Power Demand Pickup | 0.1 to 3000.0 | MVA | F86 | 10.0 MVA |
| **PULSE OUTPUTS (read/write setpoints)[5]** | | | | | |
| 1860 | Pulse Output Function | --- | --- | F38 | Disabled |
| 1861 | Positive Watthours Pulse Output Relays | --- | --- | F57 | None |
| 1862 | Positive Watthours Pulse Interval | 0 to 6553.5 | MWh | F86 | 100 MWh |
| 1863 | Negative Watthours Pulse Output Relays | --- | --- | F57 | None |
| 1864 | Negative Watthours Pulse Interval | 0 to 6553.5 | MWh | F86 | 100 MWh |
| 1865 | Positive Varhours Pulse Output Relays | --- | --- | F57 | None |
| 1866 | Positive Varhours Pulse Interval | 0 to 6553.5 | Mvarh | F86 | 100 Mvarh |
| 1867 | Negative Varhours Pulse Output Relays | --- | --- | F57 | None |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 30 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 1868 | Negative Varhours Pulse Interval | 0 to 6553.5 | Mvarh | F86 | 100 Mvarh |
| **ANALOG INPUT SETUP (read/write setpoints)** | | | | | |
| 1880 | Analog Input Name (10 words) | --- | --- | F33 | "ANALOG INPUT" |
| 188A | Analog Input Units (3 words) | --- | --- | F33 | "µA" |
| 188D | Analog Input Range | --- | --- | F42 | 0-20 mA |
| 188E | Analog Input Minimum Value | 0 to 65535 | Units | F1 | 0 |
| 188F | Analog Input Maximum Value | 0 to 65535 | Units | F1 | 20000 |
| **ANALOG INPUT THRESHOLD 1 (read/write setpoints)** | | | | | |
| 18A0[9] | Analog Threshold 1 Function | --- | --- | F39 | Disabled |
| 18A1 | Analog Threshold 1 Relays | --- | --- | F57 | None |
| 18A2 | Analog Threshold 1 Pickup | 0 to 65535 | Units | F1 | 100 |
| 18A3 | Analog Threshold 1 Delay | 0 to 60000 | s | F1 | 100 s |
| 18A4[1] | Analog Threshold 1 Pickup Type | --- | --- | F85 | Over |
| 18A5 | Analog Threshold 1 Dropout Ratio | 2 to 20 | % | F1 | 5% |
| **ANALOG INPUT THRESHOLD 2 (read/write setpoints)** | | | | | |
| 18A8 | Analog Threshold 2 Function | --- | --- | F39 | Disabled |
| 18A9 | Analog Threshold 2 Relays | --- | --- | F57 | None |
| 18AA | Analog Threshold 2 Pickup | 0 to 65535 | Units | F1 | 100 |
| 18AB | Analog Threshold 2 Delay | 0 to 60000 | s | F1 | 100 s |
| 18AC[1] | Analog Threshold 2 Pickup Type | --- | --- | F85 | Over |
| 18AD | Analog Threshold 2 Dropout Ratio | 2 to 20 | % | F1 | 5% |
| **ANALOG INPUT RATE 1 (read/write setpoints)** | | | | | |
| 18B0 | Analog In Rate 1 Function | --- | --- | F38 | Disabled |
| 18B1 | Analog In Rate 1 Relays | --- | --- | F57 | None |
| 18B2 | Analog In Rate 1 Pickup | –1000.0 to 1000.0 | Units / hr. | F5 | 10.0 µA/hr. |
| 18B3 | Analog In Rate 1 Delay | 0 to 60000 | s | F1 | 0 s |
| **ANALOG INPUT RATE 2 (read/write setpoints)** | | | | | |
| 18B8 | Analog In Rate 2 Function | --- | --- | F38 | Disabled |
| 18B9 | Analog In Rate 2 Relays | --- | --- | F57 | None |
| 18BA | Analog In Rate 2 Pickup | –1000.0 to 1000.0 | Units / hr. | F5 | 10.0 µA/hr. |
| 18BB | Analog In Rate 2 Delay | 0 to 60000 | s | F1 | 0 s |
| **ANALOG OUTPUT 1 (read/write setpoints)** | | | | | |
| 18C0 | Analog Output 1 Parameter | --- | --- | F77 | Disabled |
| 18C1 | Analog Output 1 Minimum | --- | --- | F78 | 0 |
| 18C2 | Analog Output 1 Maximum | --- | --- | F78 | 0 |
| **ANALOG OUTPUT 2 (read/write setpoints)** | | | | | |
| 18C4 | Analog Output 2 Parameter | --- | --- | F77 | Disabled |
| 18C5 | Analog Output 2 Minimum | --- | --- | F78 | 0 |
| 18C6 | Analog Output 2 Maximum | --- | --- | F78 | 0 |
| **ANALOG OUTPUT 3 (read/write setpoints)** | | | | | |
| 18C8 | Analog Output 3 Parameter | --- | --- | F77 | Disabled |
| 18C9 | Analog Output 3 Minimum | --- | --- | F78 | 0 |
| 18CA | Analog Output 3 Maximum | --- | --- | F78 | 0 |
| **ANALOG OUTPUT 4 (read/write setpoints)** | | | | | |
| 18CC | Analog Output 4 Parameter | --- | --- | F77 | Disabled |
| 18CD | Analog Output 4 Minimum | --- | --- | F78 | 0 |
| 18CE | Analog Output 4 Maximum | --- | --- | F78 | 0 |
| **ANALOG OUTPUT 5 (read/write setpoints)** | | | | | |
| 18D0 | Analog Output 5 Parameter | --- | --- | F77 | Disabled |
| 18D1 | Analog Output 5 Minimum | --- | --- | F78 | 0 |
| 18D2 | Analog Output 5 Maximum | --- | --- | F78 | 0 |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 31 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| **ANALOG OUTPUT 6 (read/write setpoints)** | | | | | |
| 18D4 | Analog Output 6 Parameter | --- | --- | F77 | Disabled |
| 18D5 | Analog Output 6 Minimum | --- | --- | F78 | 0 |
| 18D6 | Analog Output 6 Maximum | --- | --- | F78 | 0 |
| **ANALOG OUTPUT 7 (read/write setpoints)** | | | | | |
| 18D8 | Analog Output 7 Parameter | --- | --- | F77 | Disabled |
| 18D9 | Analog Output 7 Minimum | --- | --- | F78 | 0 |
| 18DA | Analog Output 7 Maximum | --- | --- | F78 | 0 |
| **ANALOG OUTPUT 8 (read/write setpoints)** | | | | | |
| 18DC | Analog Output 8 Parameter | --- | --- | F77 | Disabled |
| 18DD | Analog Output 8 Minimum | --- | --- | F78 | 0 |
| 18DE | Analog Output 8 Maximum | --- | --- | F78 | 0 |
| **OVERFREQUENCY (read/write setpoints)** | | | | | |
| 18E0 | Overfrequency Function | --- | --- | F38 | Disabled |
| 18E1 | Overfrequency Relays | --- | --- | F57 | None |
| 18E2 | Overfrequency Pickup | 20.00 to 65.00 | Hz | F3 | 60.50 Hz |
| 18E3 | Overfrequency Delay | 0.0 to 6000.0 | s | F2 | 5.0 s |
| **TRIP COUNTER (read/write setpoints)** | | | | | |
| 1900 | Trip Counter Function | --- | --- | F38 | Disabled |
| 1901 | Trip Counter Relays | --- | --- | F57 | None |
| 1902 | Trip Counter Limit | 1 to 10000 | --- | F1 | 10000 Trips |
| **TOTAL ARCING CURRENT (read/write setpoints)** | | | | | |
| 1908 | Total Arcing Current Function | --- | --- | F38 | Disabled |
| 1909 | Total Arcing Current Relays | --- | --- | F57 | None |
| 190A | Total Arcing Current Start Delay | 0 to 100 | ms | F1 | 32 ms |
| 190B | Total Arcing Current Limit | 1 to 50000 | $kA^2$-cyc | F1 | 1000 $kA^2$cyc |
| **VT FAILURE (read/write setpoints)** | | | | | |
| 1918 | VT Failure Function | --- | --- | F38 | Disabled |
| 1919 | VT Failure Relays | --- | --- | F57 | None |
| 191A | VT Failure Delay | 0 to 60,000 | s | F1 | 10 s |
| **SIMULATION SETUP (read/write setpoints)** | | | | | |
| 1920 | Simulation Status | --- | --- | F48 | Disabled |
| 1921 | Circuit Breaker Simulation | --- | --- | F30 | Enabled |
| 1922 | Allow Operation of Relays | --- | --- | F57 | None |
| **SIMULATION PRE-FAULT VALUES (read/write setpoints)** | | | | | |
| 1930 | Prefault Phase A/B/C Current Level | 0.00 to 20.00 | x CT | F3 | 0.50 x CT |
| 1931 | Prefault Power Factor Angle | 0 to 359 | ° Lag | F1 | 0° Lag |
| **SIMULATION FAULT VALUES (read/write setpoints)** | | | | | |
| 1940 | Fault Phase A-N Voltage Level | 0.00 to 2.00 | x VT | F3 | 1.00 x VT |
| 1941 | Fault Phase A-N Voltage Position | 0 to 359 | ° Lag | F1 | 0° Lag |
| 1942 | Fault Phase B-N Voltage Level | 0.00 to 2.00 | x T | F3 | 1.00 x VT |
| 1943 | Fault Phase B-N Voltage Position | 0 to 359 | ° Lag | F1 | 120° Lag |
| 1944 | Fault Phase C-N Voltage Level | 0.00 to 2.00 | x T | F3 | 1.00 x VT |
| 1945 | Fault Phase C-N Voltage Position | 0 to 359 | ° Lag | F1 | 240° Lag |
| 1946 | Fault Phase A Current Level | 0.00 to 20.00 | x CT | F3 | 1.00 x CT |
| 1947 | Fault Phase A Current Position | 0 to 359 | ° Lag | F1 | 60° Lag |
| 1948 | Fault Phase B Current Level | 0.00 to 20.00 | x CT | F3 | 1.00 x CT |
| 1949 | Fault Phase B Current Position | 0 to 359 | ° Lag | F1 | 180° Lag |
| 194A | Fault Phase C Current Level | 0.00 to 20.00 | x CT | F3 | 1.00 x CT |
| 194B | Fault Phase C Current Position | 0 to 359 | ° Lag | F1 | 300° Lag |
| 194C | Fault System Frequency | 20.00 to 65.00 | Hz | F3 | 60.00 Hz |
| 194D | Fault Analog Input Current | 0.00 to 20.00 | mA | F3 | 0.00 mA |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 32 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 194E[3] | Reserved for Fault Polarizing Current Level | 0.00 to 20.00 | x CT | F70 | 1.00 x CT |
| 194F[3] | Reserved for Fault Polarizing Current Position | 0 to 359 | ° Lag | F1 | 0° |
| 1950 | Fault Ground Current Level | 0.00 to 20.00 | x CT | F3 | 0.00 x CT |
| 1951 | Fault Ground Current Position | 0 to 359 | ° Lag | F1 | 0° |
| 1952[3] | Fault Sensitive Ground Current Level | 0.005 to 1.000 | x CT | F70 | 0.100 x CT |
| 1953[3] | Fault Sensitive Ground Current Position | 0 to 359 | ° Lag | F1 | 0° |
| **SIMULATION POST-FAULT VALUES (read/write setpoints)** | | | | | |
| 1960 | Postfault Bus Voltage Level | 0.00 to 2.00 | x VT | F3 | 1.00 x VT |
| 1961 | Postfault Bus Voltage Frequency | 20.00 to 65.00 | Hz | F3 | 60.00 Hz |
| 1962 | Postfault Synchronous Voltage Level | 0.00 to 2.00 | x VT | F3 | 1.00 x VT |
| 1963 | Postfault Synchronous Voltage Position | 0 to 359 | ° Lag | F1 | 0° |
| 1964 | Postfault Synchronous Voltage Frequency | 20.00 to 65.00 | Hz | F3 | 60.00 Hz |
| **S5** | **BREAKER FAILURE** | | | | **READ/WRITE** |
| 1980 | Breaker Failure Function | --- | --- | F38 | Disabled |
| 1981 | Breaker Failure Relays | --- | --- | F57 | None |
| 1982 | Breaker Failure Delay 1 | 0.03 to 1.00 | s | F3 | 0.10 s |
| 1983 | Breaker Failure Current | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1984 | Breaker Failure Delay 2 | 0.00 to 1.00 | s | F3 | 0.00 s |
| **BREAKER OPERATION (read/write setpoints)** | | | | | |
| 1988 | Breaker Operation Function | --- | --- | F38 | Disabled |
| 1989 | Breaker Operation Relays | --- | --- | F57 | None |
| 198A | Breaker Operation Delay | 0.03 to 1.00 | s | F3 | 0.10 s |
| **COIL MONITOR 1 (read/write setpoints)** | | | | | |
| 1990 | Coil Monitor 1 Function | --- | --- | F38 | Disabled |
| 1991 | Coil Monitor 1 Relays | --- | --- | F57 | None |
| 1992 | Breaker State Bypass | --- | --- | F30 | Disabled |
| 1993[8] | Coil Monitor 1 Delay | 5 to 100 | s | F1 | 5 s |
| 1994[8] | Coil Monitor 1 Type | --- | --- | F90 | Trip |
| **COIL MONITOR 2 (read/write setpoints)** | | | | | |
| 1998 | Coil Monitor 2 Function | --- | --- | F38 | Disabled |
| 1999 | Coil Monitor 2 Relays | --- | --- | F57 | None |
| 199A | Breaker State Bypass | --- | --- | F30 | Disabled |
| 199B[8] | Coil Monitor 2 Delay | 5 to 100 | s | F1 | 5 s |
| 199C[8] | Coil Monitor 2 Type | --- | --- | F90 | Close |
| **COIL MONITOR NAMES (read/write setpoints)[8]** | | | | | |
| 19A0[8] | Coil Monitor 1 Name (9 registers) | --- | --- | F33 | Trip Coil Monitor |
| 19A9[8] | Coil Monitor 2 Name (9 registers) | --- | --- | F33 | Close Coil Monitor |
| **ANALOG INPUT THRESHOLD NAMES (read/write setpoints)[8]** | | | | | |
| 19B2[8] | Analog Input Threshold 1 Name (9 registers) | --- | --- | F33 | Analog Threshld 1 |
| 19BB[8] | Analog Input Threshold 2 Name (9 registers) | --- | --- | F33 | Analog Threshld 2 |
| **FORCE OUTPUT RELAYS (read/write setpoints)** | | | | | |
| 1A00 | Force Output Relays Function | --- | --- | F30 | Disabled |
| 1A01 | Force 1 TRIP Relay | --- | --- | F34 | De-energized |
| 1A02 | Force 2 CLOSE Relay | --- | --- | F34 | De-energized |
| 1A03 | Force 3 ALARM Relay | --- | --- | F34 | De-energized |
| 1A04 | Force 4 AUXILIARY Relay | --- | --- | F34 | De-energized |
| 1A05 | Force 5 AUXILIARY Relay | --- | --- | F34 | De-energized |
| 1A06 | Force 6 AUXILIARY Relay | --- | --- | F34 | De-energized |
| 1A07 | Force 7 AUXILIARY Relay | --- | --- | F34 | De-energized |
| 1A08 | Force 8 SELF-TEST WARNING Relay | --- | --- | F34 | De-energized |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 33 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 1A09 | Force Solid State Output | --- | --- | F34 | De-energized |
| **FORCE ANALOG OUTPUTS (read/write setpoints)** | | | | | |
| 1A10 | Force Analog Outputs Function | --- | --- | F30 | Disabled |
| 1A11 | Force Analog Output 1 | 0 to 100 | % | F1 | 0% |
| 1A12 | Force Analog Output 2 | 0 to 100 | % | F1 | 0% |
| 1A13 | Force Analog Output 3 | 0 to 100 | % | F1 | 0% |
| 1A14 | Force Analog Output 4 | 0 to 100 | % | F1 | 0% |
| 1A15 | Force Analog Output 5 | 0 to 100 | % | F1 | 0% |
| 1A16 | Force Analog Output 6 | 0 to 100 | % | F1 | 0% |
| 1A17 | Force Analog Output 7 | 0 to 100 | % | F1 | 0% |
| 1A18 | Force Analog Output 8 | 0 to 100 | % | F1 | 0% |
| **PICKUP TEST (read/write setpoints)** | | | | | |
| 1A20 | Pickup Test Function | --- | --- | F30 | Disabled |
| 1A21 | Pickup Test Relays | --- | --- | F57 | None |
| **SETPOINT GROUPS (read/write setpoints)** | | | | | |
| 1B00 | Active Setpoint Group | --- | --- | F79 | Group 1 |
| 1B01 | Edit Setpoint Group | --- | --- | F80 | Active Group |
| 1B02 | Breaker Open Inhibit | --- | --- | F30 | Disabled |
| 1B03 | Overcurrent Pickup Inhibit | --- | --- | F30 | Disabled |
| 1B04 | Overvoltage Pickup Inhibit | --- | --- | F30 | Disabled |
| 1B05 | Undervoltage Pickup Inhibit | --- | --- | F30 | Disabled |
| 1B06 | Underfrequency Pickup Inhibit | --- | --- | F30 | Disabled |
| **SYNCHROCHECK (read/write setpoints)** | | | | | |
| 1B10 | Synchrocheck Function | --- | --- | F38 | Disabled |
| 1B11 | Dead Source Permissive | --- | --- | F20 | OFF |
| 1B12[2] | Dead Bus Maximum Voltage | 0.00 to 1.25 | x VT | F3 | 0.20 x VT |
| 1B13[2] | Dead Line Maximum Voltage | 0.00 to 1.25 | x VT | F3 | 0.20 x VT |
| 1B14[2] | Live Bus Minimum Voltage | 0.00 to 1.25 | x VT | F3 | 0.80 x VT |
| 1B15[2] | Live Line Minimum Voltage | 0.00 to 1.25 | x VT | F3 | 0.80 x VT |
| 1B16[2] | Maximum Voltage Difference | 0.01 to 100.00 | kV | F3 | 2.00 kV |
| 1B17 | Maximum Angle Difference | 0 to 100 | ° | F1 | 24° |
| 1B18 | Maximum Frequency Difference | 0 to 5.00 | Hz | F3 | 2.00 Hz |
| 1B19 | Synchrocheck Relays | --- | --- | F57 | None |
| **MANUAL CLOSE FEATURE BLOCKING (read/write setpoints)** | | | | | |
| 1B20 | Manual Close Feature Blocking Function | --- | --- | F38 | Disabled |
| 1B21 | Manual Close Relays | --- | --- | F57 | None |
| 1B22[2] | Manual Close Block Time | 1 to 1000 | s | F1 | 5 s |
| 1B23[1] | Select Setpoint Group | --- | --- | F80 | Active Group |
| 1B24[2] | Overcurrent Blocking Flags | --- | --- | F59 | None blocked |
| 1B25[2] | Phase Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1B26[2] | Neutral Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1B27[2] | Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1B28[2] | Negative Sequence Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1B29[3] | Sensitive Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| **COLD LOAD FEATURE BLOCKING (read/write setpoints)** | | | | | |
| 1B40 | Cold Load Pickup Feature Blocking Function | --- | --- | F38 | Disabled |
| 1B41 | Cold Load Pickup Relays | --- | --- | F57 | None |
| 1B42 | Outage Time Before Cold Load | 1 to 1000 | min. | F1 | 100 min. |
| 1B43[2] | Cold Load Pickup Block Time | 1 to 1000 | s | F1 | 5 s |
| 1B44[1] | Select Setpoint Group | --- | --- | F80 | Active Group |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 34 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 1B45[2] | Overcurrent Blocking Flags | --- | --- | F59 | None blocked |
| 1B46[2] | Phase Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1B47[2] | Neutral Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1B48[2] | Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1B49[2] | Negative Sequence Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1B4A[3] | Sensitive Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| **UNDERVOLTAGE RESTORATION (read/write setpoints)** | | | | | |
| 1B60 | Undervoltage Restoration Function | --- | --- | F38 | Disabled |
| 1B61 | Undervoltage Restoration Relays | --- | --- | F57 | None |
| 1B62 | Undervoltage Restoration Phases Required for Operation | --- | --- | F41 | All Three |
| 1B63[2] | Undervoltage Restoration Minimum Voltage | 0.00 to 1.25 | x VT | F3 | 0.90 x V |
| 1B64 | Undervoltage Restoration Delay | 0 to 10000 | s | F1 | 10 s |
| 1B65 | Undervoltage Restoration Incomplete Sequence Time | 1 to 10,000 | min. | F1 | 100 min. |
| 1B66[3] | Undervoltage Restoration Source | --- | --- | F87 | Bus |
| **UNDERFREQUENCY RESTORATION (read/write setpoints)** | | | | | |
| 1B70 | Underfrequency Restoration Function | --- | --- | F38 | Disabled |
| 1B71 | Underfrequency Restoration Relays | --- | --- | F57 | None |
| 1B72[2] | Underfrequency Restoration Minimum Voltage | 0.00 to 1.25 | x VT | F3 | 0.90 x V |
| 1B73[8] | Underfrequency Restoration Minimum Frequency | 20.00 to 65.00 | Hz | F3 | 59.90 Hz |
| 1B74 | Underfrequency Restoration Delay | 0 to 10000 | s | F1 | 10 s |
| 1B75 | Underfrequency Restoration Incomplete Sequence Time | 1 to 10,000 | min. | F1 | 100 min. |
| **TRANSFER (read/write setpoints)** | | | | | |
| 1B80 | Transfer Function | --- | --- | F56 | Disabled |
| 1B81 | Transfer Delay This Source | 0.0 to 10.0 | s | F2 | 1.0 s |
| 1B82 | Transfer Delay Other Source | 0.0 to 10.0 | s | F2 | 3.0 s |
| 1B83 | Block Trip On Double Loss | --- | --- | F30 | Disabled |
| 1B84 | Transfer Delay Select to Trip | 0.0 to 10.0 | s | F2 | 0.0 s |
| 1B85 | Transfer Ready Operate Relay 3 | --- | --- | F30 | Disabled |
| 1B86 | Bus Transfer Logic Scheme | 0 to 1 | --- | F94 | Scheme 1 |
| **AUTORECLOSE SETUP (read/write setpoints, 760 only)** | | | | | |
| 1BA0 | Autoreclose Function | --- | --- | F30 | Disabled |
| 1BA1 | Number of Reclosure Shots | 1 to 4 | 1 | F1 | 1 |
| 1BA2 | Autoreclose Reset Time | 1 to 1000 | s | F1 | 60 s |
| 1BA3 | Autoreclose Block Time Upon Manual Close | 0 to 200 | s | F1 | 10 s |
| 1BA4 | Incomplete Sequence Time | 1 to 1000 | s | F1 | 30 s |
| 1BA5 | Reclosure Enabled Relays | --- | --- | F57 | None |
| 1BA6 | Reclose In Progress Relays | --- | --- | F57 | None |
| 1BA7 | Reclosure Lockout Relays | --- | --- | F57 | None |
| 1BA8[8] | Autoreclose External Close Logic | --- | --- | F30 | Disabled |
| **AUTORECLOSE RATE SUPERVISION (read/write setpoints, 760 only)** | | | | | |
| 1BAA[8] | Rate Supervision Function | --- | --- | F38 | Disabled |
| 1BAB[8] | Max Autoreclose Rate | 1 to 50 | /hr. | F1 | 25 |
| 1BAC[8] | Rate Supervision Relays | --- | --- | F57 | None |
| **CURRENT SUPERVISION (read/write setpoints, 760 only)** | | | | | |
| 1BB0 | Current Supervision Function | --- | --- | F30 | Disabled |
| 1BB1[2] | 3 Shots For Current Above | 0.00 to 20.00 | x CT | F3 | 17.00 x CT |
| 1BB2[2] | 2 Shots For Current Above | 0.00 to 20.00 | x CT | F3 | 18.00 x CT |
| 1BB3[2] | 1 Shot For Current Above | 0.00 to 20.00 | x CT | F3 | 19.00 x CT |
| 1BB4 | Current Supervision To Lockout | --- | --- | F30 | Disabled |
| 1BB5[2] | Lockout For Current Above | 0.00 to 20.00 | x CT | F3 | 20.00 x CT |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 35 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| **ZONE COORDINATION (read/write setpoints, 760 only)** | | | | | |
| 1BB8[1] | Zone Coordination Function | --- | --- | F30 | Disabled |
| 1BB9[1] | Phase Current Increase | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1BBA[1] | Neutral Current Increase | 0.05 to 20.00 | x CT | F3 | 1.00 x CT |
| 1BBB[1] | Maximum fault Clearing Time | 1 to 1000 | s | F1 | 10 s |
| **RECLOSURE SHOT 1 (read/write setpoints, 760 only)** | | | | | |
| 1BC0[2] | Deadtime Before Reclosure 1 | 0.00 to 300.00 | s | F3 | 0.50 s |
| 1BC1[1] | Select Setpoint Group | --- | --- | F80 | Active Group |
| 1BC2[2] | Overcurrent Blocking Flags | --- | --- | F59 | None blocked |
| 1BC3[1] | Phase Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BC4[1] | Neutral Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BC5[1] | Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BC6[1] | Negative Sequence Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BC7[3] | Sensitive Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| **RECLOSURE SHOT 2 (read/write setpoints, 760 only)** | | | | | |
| 1BD0[2] | Deadtime Before Reclosure 2 | 0.00 to 300.00 | s | F3 | 3.00 s |
| 1BD1[1] | Select Setpoint Group | --- | --- | F80 | Active Group |
| 1BD2[2] | Overcurrent Blocking Flags | --- | --- | F59 | None blocked |
| 1BD3[1] | Phase Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BD4[1] | Neutral Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BD5[1] | Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BD6[1] | Negative Sequence Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BD7[3] | Sensitive Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| **RECLOSURE SHOT 3 (read/write setpoints, 760 only)** | | | | | |
| 1BE0[2] | Deadtime Before Reclosure 3 | 0.00 to 300.00 | s | F3 | 4.00 s |
| 1BE1[1] | Select Setpoint Group | --- | --- | F80 | Active Group |
| 1BE2[2] | Overcurrent Blocking Flags | --- | --- | F59 | None blocked |
| 1BE3[1] | Phase Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BE4[1] | Neutral Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BE5[1] | Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BE6[1] | Negative Sequence Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BE7[3] | Sensitive Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| **RECLOSURE SHOT 4 (read/write setpoints, 760 only)** | | | | | |
| 1BF0[2] | Deadtime Before Reclosure 4 | 0.00 to 300.00 | s | F3 | 5.00 s |
| 1BF1[1] | Select Setpoint Group | --- | --- | F80 | Active Group |
| 1BF2[2] | Overcurrent Blocking Flags | --- | --- | F59 | None blocked |
| 1BF3[1] | Phase Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BF4[1] | Neutral Time Overcurrent 1 Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BF5[1] | Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BF6[1] | Negative Sequence Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| 1BF7[3] | Sensitive Ground Time Overcurrent Raised Pickup | 0 to 100 | % | F1 | 0% |
| **LOGIC INPUT NAMES (read/write setpoints)** | | | | | |
| 1C00[1] | Logic Input 1 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 1 |
| 1C09[1] | Logic Input 2 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 2 |
| 1C12[1] | Logic Input 3 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 3 |
| 1C1B[1] | Logic Input 4 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 4 |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 36 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 1C24[1] | Logic Input 5 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 5 |
| 1C2D[1] | Logic Input 6 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 6 |
| 1C36[1] | Logic Input 7 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 7 |
| 1C3F[1] | Logic Input 8 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 8 |
| 1C48[1] | Logic Input 9 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 9 |
| 1C51[1] | Logic Input 10 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 10 |
| 1C5A[1] | Logic Input 11 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 11 |
| 1C63[1] | Logic Input 12 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 12 |
| 1C6C[1] | Logic Input 13 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 13 |
| 1C75[1] | Logic Input 14 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 14 |
| 1C7E[1] | Logic Input 15 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 15 |
| 1C87[1] | Logic Input 16 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 16 |
| 1C90[1] | Logic Input 17 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 17 |
| 1C99[1] | Logic Input 18 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 18 |
| 1CA2[1] | Logic Input 19 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 19 |
| 1CAB[1] | Logic Input 20 Name (9 words = 18 characters) | --- | --- | F33 | Logic Input 20 |
| **EVENT RECORD SELECTOR (read/write actual values)** | | | | | |
| 2000 | Event Number Selector | 0 to 65535 | --- | F1 | 0 |
| **EVENT RECORDER INFORMATION (read only actual values)** | | | | | |
| 2001 | Number of Events Since Clear | 0 to 65535 | --- | F1 | 0 |
| 2002 | Event Recorder Last Cleared (2 words) | --- | --- | F23 | --- |
| **EVENT RECORDER DATA (read only actual values)** | | | | | |
| 2010 | Record #N Date of Event (2 words) | --- | --- | F23 | --- |
| 2012 | Record #N Time of Event (2 words) | --- | --- | F22 | --- |
| 2014 | Record #N Cause of Event | --- | --- | F24 | --- |
| 2015 | Record #N Phase A Current Magnitude | 0 to 65535 | A | F1 | --- |
| 2016 | Record #N Phase B Current Magnitude | 0 to 65535 | A | F1 | --- |
| 2017 | Record #N Phase C Current Magnitude | 0 to 65535 | A | F1 | --- |
| 2018 | Record #N Ground Current Magnitude | 0 to 65535 | A | F1 | --- |
| 2019 | Record #N A-N (A-B) Voltage Magnitude | 0.00 to 600.00 | kV | F3 | --- |
| 201A | Record #N B-N (B-C) Voltage Magnitude | 0.00 to 600.00 | kV | F3 | --- |
| 201B | Record #N C-N (C-A) Voltage Magnitude | 0.00 to 600.00 | kV | F3 | --- |
| 201C | Record #N System Frequency | 0.00 to 90.00 | Hz | F3 | --- |
| 201D | Record #N Analog Input | 0 to 65535 | Units | F1 | --- |
| 201E[1] | Record #N Phase A Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 201F[1] | Record #N Phase B Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 2020[1] | Record #N Phase C Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 2021[1] | Record #N Ground Current Angle | 0 to 359 | ° Lag | F1 | --- |
| 2022[1] | Record #N A-N (A-B) Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| 2023[1] | Record #N B-N (C-B) Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| 2024[1] | Record #N C-N Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| 2025[1] | Record #N Synchronizing RMS Voltage Magnitude | 0.00 to 600.00 | kV | F3 | --- |
| 2026[1] | Record #N Synchronizing Voltage Angle | 0 to 359 | ° Lag | F1 | --- |
| 2027[1] | Record #N Synchronizing RMS Voltage Frequency | 0.00 to 90.00 | Hz | F3 | --- |
| 2028[3] | Record #N Sensitive Ground Current Magnitude | 0.00 to 655.35 | A | F3 | --- |
| 2029[3] | Record #N Sensitive Ground Current Angle | 0 to 359 | ° Lag | F1 | --- |
| **TRACE MEMORY SELECTORS (read/write)** | | | | | |
| 2100 | Trace Memory Number Selector | 0 to 65535 | --- | F1 | 0 |

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10] For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 37 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 2101 | Trace Memory Channel Selector | --- | --- | F26 | $I_a$ |
| 2102 | Trace Memory Sample Selector (TMSS) | 0 to 4095 | --- | F1 | 0 |
| **TRACE MEMORY INFORMATION (read/write)** | | | | | |
| 2110 | Number of Trace Memory Triggers Since Clear | 0 to 65535 | --- | F1 | --- |
| 2111 | Number of Trace Memory Samples Stored | 0 to 4096 | --- | F1 | --- |
| 2112 | Trace Memory Start Index | 0 to 4095 | --- | F1 | --- |
| 2113 | Trace Memory Trigger Index | 0 to 4095 | --- | F1 | --- |
| 2114 | Trace Memory Trigger Cause | --- | --- | F24 | --- |
| 2115 | Trace Memory Trigger Date | --- | --- | F23 | --- |
| 2117 | Trace Memory Trigger Time | --- | --- | F22 | --- |
| 2119 | Trace Memory Sampling Frequency | 16.00 to 65.00 | Hz | F3 | --- |
| **TRACE MEMORY SAMPLES (read/write)** | | | | | |
| 2120 | Trace Memory Sample TMSS+0 | --- | --- | F25 | --- |
| 2121 | Trace Memory Sample TMSS+1 | --- | --- | F25 | --- |
| 2122 | Trace Memory Sample TMSS+2 | --- | --- | F25 | --- |
| 2123 | Trace Memory Sample TMSS+3 | --- | --- | F25 | --- |
| 2124 | Trace Memory Sample TMSS+4 | --- | --- | F25 | --- |
| 2125 | Trace Memory Sample TMSS+5 | --- | --- | F25 | --- |
| 2126 | Trace Memory Sample TMSS+6 | --- | --- | F25 | --- |
| 2127 | Trace Memory Sample TMSS+7 | --- | --- | F25 | --- |
| 2128 | Trace Memory Sample TMSS+8 | --- | --- | F25 | --- |
| 2129 | Trace Memory Sample TMSS+9 | --- | --- | F25 | --- |
| 212A | Trace Memory Sample TMSS+10 | --- | --- | F25 | --- |
| 212B | Trace Memory Sample TMSS+11 | --- | --- | F25 | --- |
| 212C | Trace Memory Sample TMSS+12 | --- | --- | F25 | --- |
| 212D | Trace Memory Sample TMSS+13 | --- | --- | F25 | --- |
| 212E | Trace Memory Sample TMSS+14 | --- | --- | F25 | --- |
| 212F | Trace Memory Sample TMSS+15 | --- | --- | F25 | --- |
| 2130 | Trace Memory Sample TMSS+16 | --- | --- | F25 | --- |
| 2131 | Trace Memory Sample TMSS+17 | --- | --- | F25 | --- |
| 2132 | Trace Memory Sample TMSS+18 | --- | --- | F25 | --- |
| 2133 | Trace Memory Sample TMSS+19 | --- | --- | F25 | --- |
| 2134 | Trace Memory Sample TMSS+20 | --- | --- | F25 | --- |
| 2135 | Trace Memory Sample TMSS+21 | --- | --- | F25 | --- |
| 2136 | Trace Memory Sample TMSS+22 | --- | --- | F25 | --- |
| 2137 | Trace Memory Sample TMSS+23 | --- | --- | F25 | --- |
| 2138 | Trace Memory Sample TMSS+24 | --- | --- | F25 | --- |
| 2139 | Trace Memory Sample TMSS+25 | --- | --- | F25 | --- |
| 213A | Trace Memory Sample TMSS+26 | --- | --- | F25 | --- |
| 213B | Trace Memory Sample TMSS+27 | --- | --- | F25 | --- |
| 213C | Trace Memory Sample TMSS+28 | --- | --- | F25 | --- |
| 213D | Trace Memory Sample TMSS+29 | --- | --- | F25 | --- |
| 213E | Trace Memory Sample TMSS+30 | --- | --- | F25 | --- |
| 213F | Trace Memory Sample TMSS+31 | --- | --- | F25 | --- |
| 2140 | Trace Memory Sample TMSS+32 | --- | --- | F25 | --- |
| 2141 | Trace Memory Sample TMSS+33 | --- | --- | F25 | --- |
| 2142 | Trace Memory Sample TMSS+34 | --- | --- | F25 | --- |
| 2143 | Trace Memory Sample TMSS+35 | --- | --- | F25 | --- |
| 2144 | Trace Memory Sample TMSS+36 | --- | --- | F25 | --- |
| 2145 | Trace Memory Sample TMSS+37 | --- | --- | F25 | --- |
| 2146 | Trace Memory Sample TMSS+38 | --- | --- | F25 | --- |
| 2147 | Trace Memory Sample TMSS+39 | --- | --- | F25 | --- |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 38 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 2148 | Trace Memory Sample TMSS+40 | --- | --- | F25 | --- |
| 2149 | Trace Memory Sample TMSS+41 | --- | --- | F25 | --- |
| 214A | Trace Memory Sample TMSS+42 | --- | --- | F25 | --- |
| 214B | Trace Memory Sample TMSS+43 | --- | --- | F25 | --- |
| 214C | Trace Memory Sample TMSS+44 | --- | --- | F25 | --- |
| 214D | Trace Memory Sample TMSS+45 | --- | --- | F25 | --- |
| 214E | Trace Memory Sample TMSS+46 | --- | --- | F25 | --- |
| 214F | Trace Memory Sample TMSS+47 | --- | --- | F25 | --- |
| 2150 | Trace Memory Sample TMSS+48 | --- | --- | F25 | --- |
| 2151 | Trace Memory Sample TMSS+49 | --- | --- | F25 | --- |
| 2152 | Trace Memory Sample TMSS+50 | --- | --- | F25 | --- |
| 2153 | Trace Memory Sample TMSS+51 | --- | --- | F25 | --- |
| 2154 | Trace Memory Sample TMSS+52 | --- | --- | F25 | --- |
| 2155 | Trace Memory Sample TMSS+53 | --- | --- | F25 | --- |
| 2156 | Trace Memory Sample TMSS+54 | --- | --- | F25 | --- |
| 2157 | Trace Memory Sample TMSS+55 | --- | --- | F25 | --- |
| 2158 | Trace Memory Sample TMSS+56 | --- | --- | F25 | --- |
| 2159 | Trace Memory Sample TMSS+57 | --- | --- | F25 | --- |
| 215A | Trace Memory Sample TMSS+58 | --- | --- | F25 | --- |
| 215B | Trace Memory Sample TMSS+59 | --- | --- | F25 | --- |
| 215C | Trace Memory Sample TMSS+60 | --- | --- | F25 | --- |
| 215D | Trace Memory Sample TMSS+61 | --- | --- | F25 | --- |
| 215E | Trace Memory Sample TMSS+62 | --- | --- | F25 | --- |
| 215F | Trace Memory Sample TMSS+63 | --- | --- | F25 | --- |
| **DATA LOGGER SELECTORS (read/write)** | | | | | |
| 2200 | Data Log Number Selector | 0 to 65535 | --- | F1 | 0 |
| 2201 | Data Log Channel Selector | 0 to 7 | --- | F1 | 0 |
| 2202 | Data Log Sample Selector (DLSS) | 0 to 4095 | --- | F1 | 0 |
| **DATA LOGGER INFORMATION (read only)** | | | | | |
| 2210 | Number of Data Log Triggers Since Clear | 0 to 65535 | --- | F1 | --- |
| 2211 | Number of Data Log Samples Stored | 0 to 4096 | --- | F1 | --- |
| 2212 | Data Log Start Index | 0 to 4095 | --- | F1 | --- |
| 2213 | Data Log Trigger Index | 0 to 4095 | --- | F1 | --- |
| 2214 | Data Log Trigger Cause | --- | --- | F24 | --- |
| 2215 | Data Log Trigger Date | --- | --- | F23 | --- |
| 2217 | Data Log Trigger Time | --- | --- | F22 | --- |
| **DATA LOGGER SAMPLES (read only)** | | | | | |
| 2220 | Data Logger Sample DLSS+0 | --- | --- | F25 | --- |
| 2222 | Data Logger Sample DLSS+1 | --- | --- | F25 | --- |
| 2222 | Data Logger Sample DLSS+2 | --- | --- | F25 | --- |
| 2223 | Data Logger Sample DLSS+3 | --- | --- | F25 | --- |
| 2224 | Data Logger Sample DLSS+4 | --- | --- | F25 | --- |
| 2225 | Data Logger Sample DLSS+5 | --- | --- | F25 | --- |
| 2226 | Data Logger Sample DLSS+6 | --- | --- | F25 | --- |
| 2227 | Data Logger Sample DLSS+7 | --- | --- | F25 | --- |
| 2228 | Data Logger Sample DLSS+8 | --- | --- | F25 | --- |
| 2229 | Data Logger Sample DLSS+9 | --- | --- | F25 | --- |
| 222A | Data Logger Sample DLSS+10 | --- | --- | F25 | --- |
| 222B | Data Logger Sample DLSS+11 | --- | --- | F25 | --- |
| 222C | Data Logger Sample DLSS+12 | --- | --- | F25 | --- |
| 222D | Data Logger Sample DLSS+13 | --- | --- | F25 | --- |
| 222E | Data Logger Sample DLSS+14 | --- | --- | F25 | --- |
| 222F | Data Logger Sample DLSS+15 | --- | --- | F25 | --- |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

## Table 6: Modbus Memory Map (Sheet 39 of 39)

| ADDR | DESCRIPTION | RANGE | UNITS | TYPE | DEFAULT |
|---|---|---|---|---|---|
| 2230 | Data Logger Sample DLSS+16 | --- | --- | F25 | --- |
| 2231 | Data Logger Sample DLSS+17 | --- | --- | F25 | --- |
| 2232 | Data Logger Sample DLSS+18 | --- | --- | F25 | --- |
| 2233 | Data Logger Sample DLSS+19 | --- | --- | F25 | --- |
| 2234 | Data Logger Sample DLSS+20 | --- | --- | F25 | --- |
| 2235 | Data Logger Sample DLSS+21 | --- | --- | F25 | --- |
| 2236 | Data Logger Sample DLSS+22 | --- | --- | F25 | --- |
| 2237 | Data Logger Sample DLSS+23 | --- | --- | F25 | --- |
| 2238 | Data Logger Sample DLSS+24 | --- | --- | F25 | --- |
| 2239 | Data Logger Sample DLSS+25 | --- | --- | F25 | --- |
| 223A | Data Logger Sample DLSS+26 | --- | --- | F25 | --- |
| 223B | Data Logger Sample DLSS+27 | --- | --- | F25 | --- |
| 223C | Data Logger Sample DLSS+28 | --- | --- | F25 | --- |
| 223D | Data Logger Sample DLSS+29 | --- | --- | F25 | --- |
| 223E | Data Logger Sample DLSS+30 | --- | --- | F25 | --- |
| 223F | Data Logger Sample DLSS+31 | --- | --- | F25 | --- |
| 2240 | Data Logger Sample DLSS+32 | --- | --- | F25 | --- |
| 2241 | Data Logger Sample DLSS+33 | --- | --- | F25 | --- |
| 2242 | Data Logger Sample DLSS+34 | --- | --- | F25 | --- |
| 2243 | Data Logger Sample DLSS+35 | --- | --- | F25 | --- |
| 2244 | Data Logger Sample DLSS+36 | --- | --- | F25 | --- |
| 2245 | Data Logger Sample DLSS+37 | --- | --- | F25 | --- |
| 2246 | Data Logger Sample DLSS+38 | --- | --- | F25 | --- |
| 2247 | Data Logger Sample DLSS+39 | --- | --- | F25 | --- |
| 2248 | Data Logger Sample DLSS+40 | --- | --- | F25 | --- |
| 2249 | Data Logger Sample DLSS+41 | --- | --- | F25 | --- |
| 224A | Data Logger Sample DLSS+42 | --- | --- | F25 | --- |
| 224B | Data Logger Sample DLSS+43 | --- | --- | F25 | --- |
| 224C | Data Logger Sample DLSS+44 | --- | --- | F25 | --- |
| 224D | Data Logger Sample DLSS+45 | --- | --- | F25 | --- |
| 224E | Data Logger Sample DLSS+46 | --- | --- | F25 | --- |
| 224F | Data Logger Sample DLSS+47 | --- | --- | F25 | --- |
| 2250 | Data Logger Sample DLSS+48 | --- | --- | F25 | --- |
| 2251 | Data Logger Sample DLSS+49 | --- | --- | F25 | --- |
| 2252 | Data Logger Sample DLSS+50 | --- | --- | F25 | --- |
| 2253 | Data Logger Sample DLSS+51 | --- | --- | F25 | --- |
| 2254 | Data Logger Sample DLSS+52 | --- | --- | F25 | --- |
| 2255 | Data Logger Sample DLSS+53 | --- | --- | F25 | --- |
| 2256 | Data Logger Sample DLSS+54 | --- | --- | F25 | --- |
| 2257 | Data Logger Sample DLSS+55 | --- | --- | F25 | --- |
| 2258 | Data Logger Sample DLSS+56 | --- | --- | F25 | --- |
| 2259 | Data Logger Sample DLSS+57 | --- | --- | F25 | --- |
| 225A | Data Logger Sample DLSS+58 | --- | --- | F25 | --- |
| 225B | Data Logger Sample DLSS+59 | --- | --- | F25 | --- |
| 225C | Data Logger Sample DLSS+60 | --- | --- | F25 | --- |
| 225D | Data Logger Sample DLSS+61 | --- | --- | F25 | --- |
| 225E | Data Logger Sample DLSS+62 | --- | --- | F25 | --- |
| 225F | Data Logger Sample DLSS+63 | --- | --- | F25 | --- |

1 2 3 4 5 6 7 8 9 10 For explanation of Table footnotes, see the Memory Map Notes at the end of this table.

**Memory Map Notes:**

1 These registers are new for version 2.10
2 These registers have been changed from version 2.00 to 2.10
3 These registers are new or have changed for version 3.00
4 These registers are new or have changed for version 3.10
5 These registers are new or have changed for version 3.20
6 These registers are new for version 3.30
7 These registers are new or have changed for version 3.40 MOD 010
8 These registers are new or have changed for version 3.60
9 These registers are new or have changed for version 3.70
10 These registers are new or have changed for version 7.00

## 4.7 Data Formats

**Table 7: Data Formats (Sheet 1 of 19)**

| Type | Value | Description |
|---|---|---|
| F1 | **Unsigned Value (16 bits)** | |
| | Example: 1234 stored as 1234 | |
| F2 | **Unsigned Value, 1 Decimal Place (16 bits)** | |
| | Example: 123.4 stored as 1234 | |
| F3 | **Unsigned Value, 2 Decimal Places (16 bits)** | |
| | Example: 12.34 stored as 1234 | |
| F4 | **2's Complement Signed Value (16 bits)** | |
| | Example: -1234 stored as -1234 | |
| F5 | **2's Complement Signed, 1 Decimal Place (16 bits)** | |
| | Example: -123.4 stored as -1234 | |
| F6 | **2's Complement Signed, 2 Decimal Places (16 bits)** | |
| | Example: -12.34 stored as -1234 | |
| F7 | **Unsigned Long Value (32 bits)** | |
| | High order word of long value stored in 1st 16 bits; low order word of long value stored in 2nd 16 bits<br>Example: 123456 stored as 123456 | |
| F8 | **Unsigned Long Value, 1 Decimal Place (32 bits)** | |
| | High order word of long value stored in 1st 16 bits; low order word of long value stored in 2nd 16 bits<br>Example: 12345.6 stored as 123456 | |
| F9 | **Unsigned Long Value, 2 Decimal Places (32 bits)** | |
| | High order word of long value stored in 1st 16 bits; low order word of long value stored in 2nd 16 bits<br>Example: 1234.56 stored as 123456 | |
| F10 | **2's Complement Signed Long Value (32 bits)** | |
| | High order word of long value stored in 1st 16 bits<br>Low order word of long value stored in 2nd 16 bits<br>Example: -123456 stored as -123456 | |
| F11 | **2's Complement Signed Long Value, 1 Decimal Place (32 bits)** | |
| | High order word of long value stored in 1st 16 bits<br>Low order word of long value stored in 2nd 16 bits<br>Example: -12345.6 stored as -123456 | |
| F12 | **2's Complement Signed Long Value, 2 Decimal Places (32 bits)** | |
| | High order word of long value stored in 1st 16 bits<br>Low order word of long value stored in 2nd 16 bits<br>Example: -1234.56 stored as -123456 | |
| F13 | **Hardware Revision** | |
| | 1 | A |
| | 2 | B |
| | ↓ | ↓ |
| | 26 | Z |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 2 of 19)

| Type | Value | Description |
|---|---|---|
| F14 | **Software Revision** | |
| | 0F00h | Major Revision Number (0 to 9 in steps of 1) |
| | 00F0h | Minor Revision Number (0 to 9 in steps of 1) |
| | 000Fh | Ultra Minor Revision No. (0 to 9 in steps of 1) |
| | Example: Revision 2.83 stored as 0283 hex | |
| F15 | **Installed Options** | |
| | 0001h | Phase Current (0 = 1 A, 1 = 5 A) |
| | 0002h | Ground Current (0 = 1 A, 1 = 5 A) |
| | 0004h[3] | Sensitive Ground Current (0 = 1 A, 1 = 5 A) |
| | 0020h | Power Supply (0 = LO, 1 = MID, 2 = HI) |
| | 0080h | Breaker Closed LED (0 = Red, 1 = Green) |
| | 0300h | Analog Outputs (0 = A1, 1 = A5, 2 = A20, 3 = A10) |
| | 3000h | 0 = Not applicable<br>2 = Enhanced display<br>3 = Enhanced display with Ethernet |
| | 8000h | 750/760 Product Selector (0=750, 1=760) |
| F16 | **Demand Interval/response** | |
| | 0 | 5 min. |
| | 1 | 10 min. |
| | 2 | 15 min. |
| | 3 | 20 min. |
| | 4 | 30 min. |
| | 5 | 60 min. |
| F17 | **Communication Hardware** | |
| | 0 | RS485 |
| | 1 | RS422 |
| F18 | **Line VT Connection** | |
| | 0 | $V_{an}$ |
| | 1 | $V_{bn}$ |
| | 2 | $V_{cn}$ |
| | 3 | $V_{ab}$ |
| | 4 | $V_{cb}$ |
| F19 | **Command Operation Code** | |
| | 0 | No Operation |
| | 1 | Reset |
| | 2 | Open Breaker |
| | 3 | Close Breaker |
| | 4 | Set Time |
| | 5 | Set Date |
| | 6 | Trigger Trace Memory |
| | 7 | Clear Energy Use Data |
| | 8 | Clear Max Demand Data |
| F19 ctd. | 9 | Clear Event Recorder Data |
| | 10 | Reset Trip Counter Data |
| | 11 | Reset Arcing Current Data |
| | 12 | Display Override Message |
| | 13 | Trigger Data Logger |
| | 14 | Reset Trace Memory |
| | 15 | Reset Data Logger |
| | 16[7] | Reset Ar Shot Count Data (760 Only!) |
| | 17[7] | Reset Ar Shot Rate Data (760 Only!) |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 3 of 19)

| Type | Value | Description |
|---|---|---|
| F20 | **Dead Source Permissive** | |
| | 0 | Off |
| | 1 | DB **&** DL |
| | 2 | LL **&** DB |
| | 3 | DL **&** LB |
| | 4 | DB **\|** DL |
| | 5 | DB **X** DB |
| F21 | **General Status** | |
| | 0001h | Relay In Service (0 = Not In Svc, 1 = In Svc) |
| | 0002h | Trip (0 = No Active Trips, 1 = Active Trip) |
| | 0004h | Alarm (0 = No Active Alarms, 1 = Active Alrm) |
| | 0008h | Pickup (0 = No Protection, 1 = Protection) |
| | 0010h | Setpoint Group 1 (0 = Disabled, 1 = Enabled) |
| | 0020h | Setpoint Group 2 (0 = Disabled, 1 = Enabled) |
| | 0040h | Setpoint Group 3 (0 = Disabled, 1 = Enabled) |
| | 0080h | Setpoint Group 4 (0 = Disabled, 1 = Enabled) |
| | 0100h | Breaker Open (0 = Closed, 1 = Open) |
| | 0200h | Breaker Closed (0 = Open, 1 = Closed) |
| | 0400h | Reclosure (0=Disabled, 1=Enabled), **760 only** |
| | 0800h | Reclosure (0=Enabled, 1=Disabled), **760 only** |
| | 1000h | Reclosure In Progress (0 = Not In Progress, 1 = In Progress) – **760 only!** |
| | 2000h | Reclosure Lockout (0 = Not In Lockout, 1 = In Lockout) **– 760 only!** |
| | 4000h | Local Mode (0 = Enabled, 1 = Disabled) |
| | 8000h | Message (0 = No Diagnostic Message, 1 = Diagnostic Messages) |
| F22 | **Time (32 bits)** | |
| | **Hours / Minutes (HH:MM:xx.xxx) 1st 16 bits** | |
| | FF00h | Hours (0= 12am, 1=1am,..., 23=11pm) |
| | 00FFh | Minutes (0 to 59 in steps of 1) |
| | **Seconds (xx:xx:SS.SSS) (2nd 16 bits)** | |
| | FFFFh | (0 = 00.000 s, 1=00.001 s, 59999=59.999 s) |
| | NOTE: If the time has never been set then all 32 bits will be 1. | |
| F23 | **Date (32 bits)** | |
| | **Month / Day (MM/DD/xxxx) (2nd 16 bits)** | |
| | FF00h | Month (1 = January,..., 12 = December) |
| | 00FFh | Day (1 to 31 in steps of 1) |
| | **Year (xx/xx/YYYY) (2nd 16 bits)** | |
| | FFFFh | 2000 to 2097 in steps of 1 |
| | NOTE: If the date has never been set then all 32 bits will be 1. | |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 4 of 19)

| Type | Value | Description |
|---|---|---|
| F24 | **Event Type** | |
| | **F000h** | **Event Type (first 4 bits)** |
| | 1 | General |
| | 2 | Pickup |
| | 3 | Trip |
| | 4 [8] | Alarm |
| | 5 | Control |
| | 6 | Logic Input |
| | 7 | Self-Test Warning |
| | 8 | Dropout |
| | 10 | Maintenance Alert |
| | The format for the rest of the register depends on Event Type | |
| | **General Event Type** | |
| | **00FFh** | **Event Cause (last 8 bits)** |
| | 1 | Control Power Off |
| | 2 | Control Power On |
| | 3 | Breaker Opened |
| | 4 | Breaker Closed |
| | 5 | Breaker Not Connected |
| | 6 | Reset |
| | 7 | Open Breaker |
| | 8 | Close Breaker |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 5 of 19)

| Type | Value | Description |
|---|---|---|
| F24 ctd. | 9 | Set Time |
| | 10 | Set Date |
| | 11 | Trigger Trace Memory |
| | 12 | Clear Energy Use |
| | 13 | Clear Max Demand |
| | 14 | Clear Event Recorder |
| | 15 | Reset Trip Counter |
| | 16 | Reset Arcing Current |
| | 17 | Reserved |
| | 18 | Trigger Data Logger |
| | 20 | Transfer Initiated |
| | 21 | Transfer Not Ready |
| | 22 | Close From Transfer |
| | 23 | Trip From Transfer |
| | 24 | Transfer Ready |
| | 30 | Reclosure 1 **760 only!** |
| | 31 | Reclosure 2 **760 only!** |
| | 32 | Reclosure 3 **760 only!** |
| | 33 | Reclosure 4 **760 only!** |
| | 34 | Reclosure Lockout **760 only!** |
| | 35 | Shots Reduced to 3 **760 only!** |
| | 36 | Shots Reduced to 2 **760 only!** |
| | 37 | Shots Reduced to 1 **760 only!** |
| | 38 | Shots Reduced to L/O **760 only!** |
| | 39 | Autoreclose Reset **760 only!** |
| | 40 | Setpoint Group 1 Active |
| | 41 | Setpoint Group 2 Active |
| | 42 | Setpoint Group 3 Active |
| | 43 | Setpoint Group 4 Active |
| | 44 [7] | Reset AR Count **760 only!** |
| | 45 [7] | Reset AR Shot Rate **760 only!** |
| | **Pickup / Trip / Alarm Latched Alarm / Control / Dropout Event Types** | |
| | **FF00h** | **Phases (first 8 bits)** |
| | 0100h | Phase A (0 = No Fault, 1 = Fault) |
| | 0200h | Phase B (0 = No Fault, 1 = Fault) |
| | 0400h | Phase C (0 = No Fault, 1 = Fault) |
| | **00FFh** | **CAUSE OF EVENT (last 8 bits)** |
| | 1 [2] | Phase Time Overcurrent 1 |
| | 2 [2] | Phase Instantaneous Overcurrent 1 |
| | 3 [2] | Phase Instantaneous Overcurrent 2 |
| | 4 [2] | Ground Time Overcurrent |
| | 5 [2] | Ground Instantaneous Overcurrent |
| | 6 [2] | Neutral Time OC 1 |
| | 7 [2] | Neutral Time OC 2 |
| | 8 [2] | Neutral Instantaneous Overcurrent 1 |
| | 9 [2] | Neutral Instantaneous Overcurrent 2 |
| | 10 [2] | Phase Directional is Reverse |
| | 11 [2] | Neutral Directional is Reverse |
| | 12 [2] | Manual Close Feature Blocking |
| | 13 | Cold Load Pickup Feature Blocking |
| | 14 | Bus Undervoltage 1 |
| | 15 | Bus Undervoltage 2 |

## Table 7: Data Formats (Sheet 6 of 19)

| Type | Value | Description |
|---|---|---|
| F24 ctd. | 17 | Line Undervoltage 4 |
| | 18 | Overvoltage 1 |
| | 19 | Overvoltage 2 |
| | 20 | Underfrequency 1 |
| | 21 | Underfrequency 2 |
| | 22 | Phase Current Level |
| | 23 [1] | Neutral Current Level |
| | 24 | Power Factor 1 |
| | 25 | Power Factor 2 |
| | 26 | Out Of Synchronization |
| | 27 | Current Demand |
| | 28 | Real Power Demand |
| | 29 | Reactive Power Demand |
| | 30 | Apparent Power Demand |
| | 31 | Analog Input Threshold 1 |
| | 32 | Analog Input Threshold 2 |
| | 33 | Analog Input Rate of Change 1 |
| | 34 | Analog Input Rate of Change 2 |
| | 35 | Overfrequency |
| | 36 | Trip Counter |
| | 37 | Arcing Current |
| | 38 | VT Failure |
| | 39 | Breaker Failure |
| | 40 | Breaker Operation |
| | 41 | Trip Coil Monitor |
| | 42 | Close Coil Monitor |
| | 43 | User Input A |
| | 44 | User Input B |
| | 45 | User Input C |
| | 46 | User Input D |
| | 47 | User Input E |
| | 48 | User Input F |
| | 49 | User Input G |
| | 50 | User Input H |
| | 51 | Negative Sequence Instantaneous Overcurrent |
| | 52 | Negative Sequence Time Overcurrent |
| | 53 | Negative Sequence Overvoltage |
| | 54 | Undervoltage Restoration |
| | 55 | Underfrequency Restoration |
| | 56 | Phase Time Overcurrent 2 |
| | 57 [1] | Frequency Decay |
| | 58 [1] | Negative Sequence is Reverse |
| | 59 [3] | Sensitive Ground Instantaneous OC |
| | 60 [3] | Sensitive Ground Time Overcurrent |
| | 61 [3] | Sensitive Ground Direction is Reverse |
| | 62 [4] | Reverse Power (requires Mod 008) |
| | 63 [4] | Neutral Displacement |
| | 64 [4] | Positive Watthours Pulse Output |
| | 65 [4] | Negative Watthours Pulse Output |
| | 66 [4] | Positive Varhours Pulse Output |
| | 67 [4] | Negative Varhours Pulse Output |
| | 68 [5] | Ground Directional is Reverse |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

### Table 7: Data Formats (Sheet 7 of 19)

| Type | Value | Description |
|---|---|---|
| F24 ctd. | 69 [6] | Reserved for Mod 010 |
| | 70 [7] | User Input I |
| | 71 [7] | User Input J |
| | 72 [7] | User Input K |
| | 73 [7] | User Input L |
| | 74 [7] | User Input M |
| | 75 [7] | User Input N |
| | 76 [7] | User Input O |
| | 77 [7] | User Input P |
| | 78 [7] | User Input Q |
| | 79 [7] | User Input R |
| | 80 [7] | User Input S |
| | 81 [7] | User Input T |
| | 82 [7] | Autoreclose Rate **760 ONLY!** |
| | 83 [7] | Restricted Earth Fault |
| | **Logic Input Event Type** | |
| | **FF00h** | **States (first 8 bits)** |
| | 0100h | Contact State (0 = Open, 1 = Closed) |
| | 0200h | Virtual State (0 = Off, 1 = On) |
| | 0400h | Logic Input (0 = Not Asserted, 1 = Asserted) |
| | **00FFh** | **Input Function (last 8 bits)** |
| | 1 | 52a Contact |
| | 2 | 52b Contact |
| | 3 | Breaker Connected |
| | 10 | Local Mode |
| | 11 | Remote Reset |
| | 12 | Remote Open |
| | 13 | Remote Close |
| | 14 | Cold Load Pickup |
| | 15 | Setpoint Group 2 |
| | 16 | Setpoint Group 3 |
| | 17 | Setpoint Group 4 |
| | 20 | User Input A |
| | 21 | User Input B |
| | 22 | User Input C |
| | 23 | User Input D |
| | 24 | User Input E |
| | 25 | User Input F |
| | 26 | User Input G |
| | 27 | User Input H |
| | 30 | Block 1 TRIP |
| | 31 | Block 2 CLOSE |
| | 32 | Block Reset |
| | 33 | Block Undervolt 1 |
| | 34 | Block Undervolt 2 |
| | 35 | Block Undervolt 3 |
| | 36 | Block Undervolt 4 |
| | 37 | Block Underfreq 1 |
| | 38 | Block Underfreq 2 |
| | 39 | Bypass Synchrocheck |
| | 40 | Block Trip Count |
| | 41 | Block Negative Sequence Overvoltage |

## Table 7: Data Formats (Sheet 8 of 19)

| Type | Value | Description |
|---|---|---|
| F24 ctd. | 42 | Block Restoration |
| | 43 [1] | Block Freq Decay |
| | 50 | Block All Overcurrent |
| | 51 | Block Phase Overcurrent |
| | 52 | Block Ground Overcurrent |
| | 53 | Block Neutral Overcurrent |
| | 54 [2] | Block Phase Time Overcurrent 1 |
| | 55 [2] | Block Phase Instantaneous Overcurrent 1 |
| | 56 [2] | Block Phase Instantaneous Overcurrent 2 |
| | 57 [2] | Block Ground Time Overcurrent |
| | 58 [2] | Block Ground Instantaneous Overcurrent |
| | 59 [2] | Block Neutral Time Overcurrent 2 |
| | 60 [2] | Block Neutral Time Overcurrent 1 |
| | 61 [2] | Block Neutral Instantaneous Overcurrent 1 |
| | 62 [2] | Block Neutral Instantaneous Overcurrent 2 |
| | 63 | Block Negative Sequence Instantaneous Overcurrent |
| | 64 | Block Negative Sequence Time Overcurrent |
| | 65 [1] | Block Phase Time Overcurrent 2 |
| | 70 | Selected To Trip |
| | 71 | Undervoltage On Other Source |
| | 72 | Incomer 1 Closed |
| | 73 | Incomer 2 Closed |
| | 74 | BusTie Connected |
| | 75 | Bus Tie Closed |
| | 76 | Block Transfer |
| | 77 | Transformer Lockout |
| | 78 | Source Trip |
| | 79 | Close From Incomer 1 |
| | 80 | Close From Incomer 2 |
| | 90 | Initiate Reclosure |
| | 91 | Cancel Reclosure |
| | 92 | Block Reclosure |
| | 100 | Trigger Trace Memory |
| | 101 | Simulate Fault |
| | 102 | Trigger Data Log |
| | 103 [3] | Block All Sensitive Ground Overcurrent |
| | 104 [3] | Block Sensitive Ground Instantaneous OC |
| | 105 [3] | Block Sensitive Ground Time Overcurrent |
| | 106 [4] | Block Reverse Power (requires Mod 008) |
| | 107 [4] | Block Neutral Displacement |
| | 108 [7] | User Input I |
| | 109 [7] | User Input J |
| | 110 [7] | User Input K |
| | 111 [7] | User Input L |
| | 112 [7] | User Input M |
| | 113 [7] | User Input N |
| | 114 [7] | User Input O |
| | 115 [7] | User Input P |
| | 116 [7] | User Input Q |
| | 117 [7] | User Input R |

## Table 7: Data Formats (Sheet 9 of 19)

| Type | Value | Description |
|---|---|---|
| F24 ctd. | 120 [7] | Start Demand Interval |
| | **Self-Test Warning Event Type** | |
| | **00FFh** | **Event Cause (last 8 bits)** |
| | 1 | Relay Not Ready |
| | 2 | Analog Output +32V |
| | 3 | FLASH Corrupt |
| | 4 | EEPROM Corrupt |
| | 5 | Dry Contact +32V |
| | 6 | A/D Virtual Ground |
| | 7 | Internal RS485 |
| | 8 | Internal Temperature |
| | 9 | Clock Not Set |
| | 10 | Prototype Software |
| | 11 | Not Calibrated |
| | 12 | Force Relays |
| | 13 | Force Analog Out |
| | 14 | Simulation Mode |
| | 15 | Pickup Test |
| | 16 | Factory Service Mode |
| | 17 | IRIG-B Failure |
| | 18 [7] | Not Used |
| | 19 [7] | Not Used |
| | 20 [7] | RTC Crystal |
| | **Maintenance Alert Event Type** | |
| | **00FFh** | **Event Cause (last 8 bits)** |
| | 1 | Event Rate High |
| | 2 | EEPROM Usage High |
| F25 | **2's Complement Signed Value** | |
| | To convert phase currents to Amps, multiply by 'Phase CT Primary' and divide by 1000. To convert ground current to Amps, multiply by 'Ground CT Primary' and divide by 1000. To convert sensitive ground current to Amps, multiply by 'Sensitive Ground CT Primary' and divide by 10000. To convert to voltages to Volts, multiply by 'VT Ratio', multiply by 'VT Secondary Voltage' and divide by 1000. | |
| F26 | **Trace Memory Channel Selector** | |
| | The contents of the Trace Memory Samples depends on the value contained in the Trace Memory Channel Selector as follows: | |
| | 0 | Phase A Current (Format F25) |
| | 1 | Phase B Current (Format F25) |
| | 2 | Phase C Current (Format F25) |
| | 3 | Ground Current (Format F25) |
| | 4 | A-N (A-B) Voltage (Format F25) |
| | 5 | B-N Voltage (Format F25) |
| | 6 | C-N (C-B) Voltage (Format F25) |
| | 7 | Line Voltage (Format F25) |
| | 8 | Output Relay States (Format F40) |
| | 9 | Logic Input States (Format F46) |
| | 10 [3] | Sensitive Ground Current (Format F25) |
| F27 | **Communications Parity** | |
| | 0 | None |
| | 1 | Odd |
| | 2 | Even |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 10 of 19)

| Type | Value | Description |
|---|---|---|
| F28 | **VT Connection Type** | |
| | 0 | None |
| | 1 | Wye |
| | 2 | Delta |
| F29 | **760 Operation** | |
| | 0 | Not Ready |
| | 1 | Ready |
| F30 | **Enabled/Disabled** | |
| | 0 | 0 = Disabled |
| | 1 | 1 = Enabled |
| F31 | **Baud Rate** | |
| | 0 | 300 Baud |
| | 1 | 1200 Baud |
| | 2 | 2400 Baud |
| | 3 | 4800 Baud |
| | 4 | 9600 Baud |
| | 5 | 19200 Baud |
| F32 | **Default Message** | |
| | | Internally Defined |
| F33 | **ASCII Text Characters** | |
| | 00FFh | Second ASCII Character |
| | FF00h | First ASCII Character |
| F34 | **Relay Non-operated State** | |
| | 0 | De-energized |
| | 1 | Energized |
| F35 | **Relay Output Type** | |
| | 0 | Self-Resetting |
| | 1 | Latched |
| | 2 | Pulsed |
| F36 | **Overcurrent Curve Shape** | |
| | 0 | Extremely Inverse |
| | 1 | Very Inverse |
| | 2 | Normally Inverse |
| | 3 | Moderately Inverse |
| | 4 | Definite Time |
| | 5 | IEC Curve A |
| | 6 | IEC Curve B |
| | 7 | IEC Curve C |
| | 8 | FlexCurve A |
| | 9 | FlexCurve B |
| | 10 | IAC Extreme Inverse |
| | 11 | IAC Very Inverse |
| | 12 | IAC Inverse |
| | 13 | IAC Short Inverse |
| | 14 | IEC Short Inverse |
| F37 | **Trip/Alarm/Control Function** | |
| | 0 | Disabled |
| | 1 | Trip |
| | 2 | Trip & Autoreclose **760 only!** |
| | 3 | Alarm |
| | 4 | Control |
| | 5 [8] | Latched Alarm |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 11 of 19)

| Type | Value | Description |
|---|---|---|
| F38 | **Alarm/Control Function** | |
| | 0 | Disabled |
| | 3 | Alarm |
| | 4 | Control |
| | 5 [8] | Latched Alarm |
| F39 | **Trip/Alarm/Control Function** | |
| | 0 | Disabled |
| | 1 | Trip |
| | 3 | Alarm |
| | 4 | Control |
| | 5 [8] | Latched Alarm |
| | 6 [9] | Blk Thrsh 1 (Analog Input Threshold 2 only) |
| F40 | **Output Relay Status** | |
| | 0001h | Relay 1 Trip (0 = not operated, 1 = operated) |
| | 0002h | Relay 2 Close (0 = not operated, 1 = operated) |
| | 0004h | Relay 3 Alarm (0 = not operated, 1 = operated) |
| | 0008h | Relay 4 Aux (0 = not operated, 1 = operated) |
| | 0010h | Relay 5 Aux (0 = not operated, 1 = operated) |
| | 0020h | Relay 6 Aux (0 = not operated, 1 = operated) |
| | 0040h | Relay 7 Aux (0 = not operated, 1 = operated) |
| | 0080h | Relay 8 Self-test (0 = not operated, 1 = operated) |
| F41 | **Current/Voltage Phases** | |
| | 1 | Any One |
| | 2 | Any Two |
| | 3 | All Three |
| F42 [2] | **Analog Input Range** | |
| | 0 | 0-1 mA |
| | 1 | 0-5 mA |
| | 2 | 4-20 mA |
| | 3 | 0-20 mA |
| | 4 [1] | 0-10 mA |
| F43 [2] | **IRIG-B Signal Type** | |
| | 0 | None |
| | 1 | DC Shift |
| | 2 | Amplitude Modulated |
| F44 | **Out Of Service States** | |
| | 0001h | Major Internal Failure (0=disabled, 1=enabled) |
| | 0002h | Minor Internal Failure (0=disabled, 1=enabled) |
| | 0004h | Testing Mode (0=Disabled, 1=Enabled) |
| | 0020h | Code Programming Mode (0=Disabled, 1=Enabled) |
| F45 | **Undervoltage Curve Type** | |
| | 0 | Definite Time |
| | 1 | Inverse Time |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 12 of 19)

| Type | Value | Description |
|---|---|---|
| F46 | **Contact Input Status** | |
| | 0001h | Contact Input 1 State (0=Open, 1=Closed) |
| | 0002h | Contact Input 2 State (0=Open, 1=Closed) |
| | 0004h | Contact Input 3 State (0=Open, 1=Closed) |
| | 0008h | Contact Input 4 State (0=Open, 1=Closed) |
| | 0010h | Contact Input 5 State (0=Open, 1=Closed) |
| | 0020h | Contact Input 6 State (0=Open, 1=Closed) |
| | 0040h | Contact Input 7 State (0=Open, 1=Closed) |
| | 0080h | Contact Input 8 State (0=Open, 1=Closed) |
| | 0100h | Contact Input 9 State (0=Open, 1=Closed) |
| | 0200h | Contact Input 10 State (0=Open, 1=Closed) |
| | 0400h | Contact Input 11 State (0=Open, 1=Closed) |
| | 0800h | Contact Input 12 State (0=Open, 1=Closed) |
| | 1000h | Contact Input 13 State (0=Open, 1=Closed) |
| | 2000h | Contact Input 14 State (0=Open, 1=Closed) |
| | 4000h | Setpoint Access (0=Restricted, 1=Allowed) |
| F47 | **Trip/Close Coil Status** | |
| | 0001h | Coil Monitor 1 Circuit (0=Open, 1=Closed) |
| | 0002h | Coil Monitor 2 Circuit (0=Open, 1=Closed) |
| F48 | **Simulation Status** | |
| | 0 | Disabled |
| | 1 | Prefault State |
| | 2 | Fault State |
| | 3 | Postfault State |
| F49 | **Protection Function State** | |
| | 1000h | Pickup (0=Not picked up, 1=Picked up) |
| | 2000h | Operate (0=Not operating, 1=Operating) |
| | 4000h | Latched (0=Not latched, 1=Latched) |
| | 8000h | Latched Alarm (0=Not latched, 1=Latched) |
| | 0100h | Phase A (0=Phase A is not picked up/operating, 1= Phase A is picked up/operating) |
| | 0200h | Phase B (0=Phase B is not picked up/operating, 1= Phase B is picked up/operating) |
| | 0400h | Phase C (0=Phase C is not picked up/operating, 1= Phase C is picked up/operating) |
| F50 | **Polarization** | |
| | 0 | Voltage |
| | 1 | Current |
| | 2 | Dual |
| F51 | **A100 Self-Test Errors** | |
| | 0001h | +32V Analog Out Volt Monitor (0 = OK, 1 = Fail) |
| | 0002h | +32V Switch In Volt Monitor (0 = OK, 1 = Failed) |
| | 0004h | Real Time Clock (0 = OK, 1 = Unable to Start) |
| | 0008h | Not Used |
| | 0010h | EEPROM Failure (0 = OK, 1 = Failed) |
| | 0020h | Internal Temperature (-40 to 70 °C) (0 = OK, 1= Out of Range) |
| | 0040h | A/D Virtual Ground (0 = OK, 1 = Out of Spec) |
| | 0080h | Not Calibrated (0 = OK, 1 = Not Calibrated) |
| | 0100h [7] | Not Used |
| | 8000h | Prototype Unit (0 = OK, 1 = Installed) |
| F52 | **2's Complement Signed Value,<br>2 Decimal Places<br>Distance to Fault** | |
| | Example: -12.34 stored as -1234. Note: a value of 327.67 indicates that the distance could not be calculated. | |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 13 of 19)

| Type | Value | Description |
|---|---|---|
| F53 | **Unsigned Value, 2 Decimal Places - Line Z1 to Fault** | |
| | Example: 12.34 stored as 1234. Note: a value of 655.35 indicates that the impedance could not be calculated | |
| F54 | **Force LED State** | |
| | 0001h | LED #1 (Top) (0 = Off, 1 = On) |
| | 0002h | LED #2 (0 = Off, 1 = On) |
| | 0004h | LED #3 (0 = Off, 1 = On) |
| | 0008h | LED #4 (0 = Off, 1 = On) |
| | 0010h | LED #5 (0 = Off, 1 = On) |
| | 0020h | LED #6 (0 = Off, 1 = On) |
| | 0040h | LED #7 (0 = Off, 1 = On) |
| | 0080h | LED #8 (Bottom) (0 = Off, 1 = On) |
| F55 | **Front Panel Key** | |
| | 0 | '0' |
| | 1 | '1' |
| | 2 | '2' |
| | 3 | '3' |
| | 4 | '4' |
| | 5 | '5' |
| | 6 | '6' |
| | 7 | '7' |
| | 8 | '8' |
| | 9 | '9' |
| | 10 | '.' |
| | 13 | 'Value Up' |
| | 14 | 'Value Down' |
| | 15 | 'Message Up' |
| | 16 | 'Message Down' |
| | 17 | 'Message Right' |
| | 18 | 'Enter' |
| | 19 | 'Escape' |
| | 20 | 'Menu' |
| | 21 | 'Message Left' |
| | 22 | 'Reset' |
| | 23 | 'Open' |
| | 24 | 'Close' |
| | 25 | 'Help' |
| | 31 | No Key |
| F56 | **Transfer Function** | |
| | 0 | Disabled |
| | 1 | Incomer 1 |
| | 2 | Incomer 2 |
| | 3 | Bus Tie |
| F57 | **Output Relays (3-7)** | |
| | 0004h | 3 Alarm (0 = Do Not Operate, 1 = Operate) |
| | 0008h | 4 Auxiliary (0 = Do Not Operate, 1 = Operate) |
| | 0010h | 5 Auxiliary (0 = Do Not Operate, 1 = Operate) |
| | 0020h | 6 Auxiliary (0 = Do Not Operate, 1 = Operate) |
| | 0040h | 7 Auxiliary (0 = Do Not Operate, 1 = Operate) |
| F58 | **Demand Measurement Type** | |
| | 0 | Thermal Exponential |
| | 1 | Block Interval |
| | 2 | Rolling Demand |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 14 of 19)

| Type | Value | Description |
|---|---|---|
| F59 [2] | **Overcurrent Blocking Flags** | |
| | 0001h [2] | Phase Inst OC 1 (0 = Do Not Block, 1= Block) |
| | 0002h [2] | Neutral Inst OC 1 (0 = Do Not Block, 1= Block) |
| | 0004h [2] | Ground Inst OC (0 = Do Not Block, 1= Block) |
| | 0008h [2] | Neg Seq Inst OC (0 = Do Not Block, 1= Block) |
| | 0010h [3] | Sens Gnd Inst OC (0 = Do Not Block, 1= Block) |
| F61 | **C400 Self Test Errors** | |
| | 0001h | A100 Communications (0 = OK, 1 = Failing) |
| | 8000h | Prototype Unit (0 = OK, 1 = Installed) |
| F62 | **Port Used For DNP** | |
| | 0 | None |
| | 1 | COM1 |
| | 2 | COM2 |
| | 3 | Front |
| F63 [2] | **Inputs 1-14 Asserted Logic** | |
| | 0 [1] | Disabled |
| | 1 [1] | Contact Close |
| | 2 [1] | Contact Open |
| | 3 [1] | Virtual On |
| | 4 [1] | Virtual Off |
| | 5 [1] | Closed **&** $V_{on}$ |
| | 6 [1] | Closed **&** $V_{off}$ |
| | 7 [1] | Open **&** $V_{on}$ |
| | 8 [1] | Open **&** $V_{off}$ |
| | 9 [1] | Closed **\|** $V_{on}$ |
| | 10 [1] | Closed **\|** $V_{off}$ |
| | 11 [1] | Open **\|** $V_{on}$ |
| | 12 [1] | Open **\|** $V_{off}$ |
| | 13 [1] | Closed **X** $V_{on}$ |
| | 14 [1] | Closed **X** $V_{off}$ |
| | 15 [1] | Open **X** $V_{on}$ |
| | 16 [1] | Open **X** $V_{off}$ |
| F64 [2] | **Inputs 15-20 Asserted Logic** | |
| | 0 [1] | Disabled |
| | 1 [1] | Virtual On |
| | 2 [1] | Virtual Off |
| F65 | **Logic Input Function** | |
| | 0 | Disabled |
| | 1 | Input 1 |
| | 2 | Input 2 |
| | 3 | Input 3 |
| | ↓ | ↓ |
| | 20 | Input 20 |
| F66 | **Logic Input State** | |
| | 0 | Off |
| | 1 | On |
| F68 | **Reset Time Model** | |
| | 0 | Instantaneous |
| | 1 | Linear |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 15 of 19)

| Type | Value | Description |
|---|---|---|
| F69 | **Logic Input State** | |
| | 0100h | Contact State (0 = Open, 1 = Closed) |
| | 0200h | Virtual State (0 = Off, 1 = On) |
| | 0400h | Logic Input (0 = Not Asserted, 1 = Asserted) |
| F70 | **Unsigned Value, 3 Decimal Places** | |
| | Example: 1.234 stored as 1234 | |
| F71 | **Factory Service Commands** | |
| | 0 | Clear Any Pending Commands |
| | 1 | Load Factory Default Setpoints |
| | 2 | Load Factory Default Calibration Data |
| | 3 | Clear Diagnostic Data |
| F72 | **Force Hardware** | |
| | 0001h | LED's (0=Normal, 1=Use LED force codes) |
| | 0002h [8] | Reserved |
| | 0004h | A100 Output Relay Watchdog (0=Normal, 1=Stop Updating) |
| | 0008h | C400 Watchdog (0=Normal, 1=Stop Updating) |
| | 0010h | 485 Communication Port (0=Normal, 1=Echo) |
| | 0020h | E485 Comm Port (0=Normal, 1=Echo) |
| | 0040h | A100 Watchdog (0=Normal, 1=Stop Updating) |
| F73 | **Dynamic Overcurrent Priority** | |
| | 0 | No Priority Adjustment |
| | 1 | Voltage Restraint |
| | 2 | Manual Close |
| | 3 | Cold Load |
| | 4 | Autoreclose |
| F74 | **Data Logger Sample Rate** | |
| | 0 | 1 cycle |
| | 1 | 1 second |
| | 2 | 1 minute |
| | 3 | 5 minutes |
| | 4 | 10 minutes |
| | 5 | 15 minutes |
| | 6 | 20 minutes |
| | 7 | 30 minutes |
| | 8 | 60 minutes |
| F75 | **Units of Length** | |
| | 0 | km |
| | 1 | Miles |
| F76 | **Type of Fault** | |
| | 0001h | øA (0=Not involved, 1= Involved) |
| | 0002h | øB (0=Not involved, 1= Involved) |
| | 0004h | øC (0=Not involved, 1= Involved) |
| | 0008h | Ground (0=Not involved, 1= Involved) |
| | Example: øB to øC to Ground = 000Eh | |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

**Table 7: Data Formats (Sheet 16 of 19)**

| Type | Value | Description |
|---|---|---|
| F77 [2] | **Analog Output Parameter Type** | |
| | 0 | Disabled |
| | 1 | Phase A Current |
| | 2 | Phase B Current |
| | 3 | Phase C Current |
| | 4 | Average Phase Current |
| | 5 | % of Load to Trip |
| | 6 | Neutral Current |
| | 7 | Phase A-N Voltage |
| | 8 | Phase B-N Voltage |
| | 9 | Phase C-N Voltage |
| | 10 | Average Phase Voltage |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 17 of 19)

| Type | Value | Description |
|---|---|---|
| F77 [2] ctd. | 11 | Line A-B Voltage |
| | 12 | Line B-C Voltage |
| | 13 | Line C-A Voltage |
| | 14 | Average Line Voltage |
| | 15 | Frequency |
| | 16 | 3ϕ Real Power (MW) |
| | 17 | 3ϕ Reactive Power (Mvar) |
| | 18 | 3ϕ Apparent Power (MVA) |
| | 19 | 3ϕ Power Factor |
| | 20 | Last Phase A Current Demand |
| | 21 | Last Phase B Current Demand |
| | 22 | Last Phase C Current Demand |
| | 23 | Last Real Power Demand |
| | 24 | Last Reactive Power Demand |
| | 25 | Last Apparent Power Demand |
| | 26 | Analog Input |
| | 27 | Last Fault Location |
| | 28 | Positive Watthours |
| | 29 | Negative Watthours |
| | 30 | Positive Varhours |
| | 31 | Negative Varhours |
| | 32 | Ground Current |
| | 33 [1] | ϕA Real Power (MW) |
| | 34 [1] | ϕA Reactive Power (Mvar) |
| | 35 [1] | ϕA Apparent Power (MVA) |
| | 36 [1] | ϕA Power Factor |
| | 37 [1] | ϕB Real Power (MW) |
| | 38 [1] | ϕB Reactive Power (Mvar) |
| | 39 [1] | ϕB Apparent Power (MVA) |
| | 40 [1] | ϕB Power Factor |
| | 41 [1] | ϕC Real Power (MW) |
| | 42 [1] | ϕC Reactive Power (Mvar) |
| | 43 [1] | ϕC Apparent Power (MVA) |
| | 44 [1] | ϕC Power Factor |
| | 45 [1] | Synchro Voltage |
| | 46 [1] | Synchro Frequency |
| | 47 [1] | Synchro Voltage Angle |
| | 48 [1] | Sychro Voltage Difference |
| | 49 [1] | Sychro Angle Difference |
| | 50 [1] | Sychro Frequency Difference |
| | 51 [1] | Frequency Decay Rate |
| | 52 [3] | Polarizing Current |
| | 53 [1] | Phase A Current Angle |
| | 54 [1] | Phase B Current Angle |
| | 55 [1] | Phase C Current Angle |
| | 56 [1] | Neutral Current Angle |
| | 57 [1] | Ground Current Angle |
| | 58 [3] | Polarizing Current Angle |
| | 59 [1] | A-N Voltage Angle |
| | 60 [1] | B-N Voltage Angle |

## Table 7: Data Formats (Sheet 18 of 19)

<table>
<tr><th>Type</th><th>Value</th><th>Description</th></tr>
<tr><td rowspan="17">F77 [2] ctd.</td><td>64 [1]</td><td>C-A Voltage Angle</td></tr>
<tr><td>65 [1]</td><td>Positive Sequence Current Magnitude</td></tr>
<tr><td>66 [1]</td><td>Positive Sequence Current Angle</td></tr>
<tr><td>67 [1]</td><td>Negative Sequence Current Magnitude</td></tr>
<tr><td>68 [1]</td><td>Negative Sequence Current Angle</td></tr>
<tr><td>69 [1]</td><td>Zero Sequence Current Magnitude</td></tr>
<tr><td>70 [1]</td><td>Zero Sequence Current Angle</td></tr>
<tr><td>71 [1]</td><td>Positive Sequence Voltage Magnitude</td></tr>
<tr><td>72 [1]</td><td>Positive Sequence Voltage Angle</td></tr>
<tr><td>73 [1]</td><td>Negative Sequence Voltage Magnitude</td></tr>
<tr><td>74 [1]</td><td>Negative Sequence Voltage Angle</td></tr>
<tr><td>75 [1]</td><td>Zero Sequence Voltage Magnitude</td></tr>
<tr><td>76 [1]</td><td>Zero Sequence Voltage Angle</td></tr>
<tr><td>77 [3]</td><td>Sensitive Ground Current</td></tr>
<tr><td>78 [3]</td><td>Sensitive Ground Current Angle</td></tr>
<tr><td>79 [4]</td><td>Neutral Voltage</td></tr>
<tr><td>80 [4]</td><td>Neutral Voltage Angle</td></tr>
<tr><td rowspan="2">F78 [2]</td><td colspan="2">Analog Output Minimum / Maximum</td></tr>
<tr><td colspan="2">The Range, Step Value, and Units for the Analog Output Minimum and Maximum depends upon the parameter type programmed for the output. The following table shows the format for a given parameter type:
<table>
<tr><th>PARAMETER</th><th>RANGE</th><th>STEP</th><th>UNITS</th></tr>
<tr><td>All currents</td><td>0 to 65535</td><td>1</td><td>Amps</td></tr>
<tr><td>All voltages</td><td>0.00 to 655.35</td><td>0.01</td><td>kV</td></tr>
<tr><td>% Load to Trip</td><td>0 to 2000</td><td>1</td><td>%</td></tr>
<tr><td>Frequency</td><td>20.00 to 65.00</td><td>0.01</td><td>Hz</td></tr>
<tr><td>all pwr / energy</td><td colspan="3">see F86</td></tr>
<tr><td>Power Factor</td><td>-0.99 to +1.00</td><td>0.01</td><td>---</td></tr>
<tr><td>Analog Input</td><td>0 to 65535</td><td>1</td><td>units</td></tr>
<tr><td>Fault Location</td><td>-1000.0 to +1000.0</td><td>0.1</td><td>km / mi</td></tr>
<tr><td>Frequency Decay</td><td>-10.00 to +10.00</td><td>0.01</td><td>Hz/s</td></tr>
<tr><td>All Angles</td><td>0 to 359</td><td>1</td><td>° Lag</td></tr>
</table></td></tr>
<tr><td rowspan="5">F79</td><td colspan="2">Setpoint Group</td></tr>
<tr><td>0</td><td>Group 1</td></tr>
<tr><td>1</td><td>Group 2</td></tr>
<tr><td>2</td><td>Group 3</td></tr>
<tr><td>3</td><td>Group 4</td></tr>
<tr><td rowspan="6">F80</td><td colspan="2">Edit Setpoint Group</td></tr>
<tr><td>0</td><td>Group 1</td></tr>
<tr><td>1</td><td>Group 2</td></tr>
<tr><td>2</td><td>Group 3</td></tr>
<tr><td>3</td><td>Group 4</td></tr>
<tr><td>4</td><td>Active Group</td></tr>
<tr><td rowspan="5">F81</td><td colspan="2">Trace Memory / Data Logger Buffer</td></tr>
<tr><td>0</td><td>2 x 2048</td></tr>
<tr><td>1</td><td>4 x 1024</td></tr>
<tr><td>2</td><td>8 x 512</td></tr>
<tr><td>3</td><td>16 x 256</td></tr>
</table>

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## Table 7: Data Formats (Sheet 19 of 19)

| Type | Value | Description |
|---|---|---|
| F82 | **Trace Memory / Data Logger Trigger** | |
| | 0x0001 | Trigger on pickup |
| | 0x0002 | Trigger on dropout |
| | 0x0004 | Trigger on trip |
| | 0x0008 | Trigger on alarm |
| | 0x0010 | Trigger on control |
| F83 [1] | **Phase Sequence** | |
| | 0 | ABC |
| | 1 | ACB |
| F84 [1] | **Overcurrent Direction** | |
| | 0 | Disabled |
| | 1 | Forward |
| | 2 | Reverse |
| F85 [1] | **Pickup Type** | |
| | 0 | Over |
| | 1 | Under |
| F86 [1] | **Auto-Ranging Power / Energy** | |
| | All power quantities auto-range to display units relative to the nominal power of the system as defined below. Multiply the power quantity in question by the multiplier in register 0316h to yield the correct reading. The SI prefix for all power and energy quantities before scaling by the multiplier is 'k'. All power quantities are signed, single word registers (F4).<br>All energy quantities are unsigned, double word registers (F7).<br>The multiplier is determined from the nominal power which is defined as the product of three setpoints:<br>$P_N$ = Phase CT Primary x Bus VT Secondary Voltage x Bus VT Ratio<br><br>**NOMINAL POWER $P_N$** / **MULTIPLIER**<br>$P_N < 1$ MVA / 1<br>1 MVA $\le P_N <$ 10 MVA / 10<br>10 MVA $\le P_N$ / 100<br><br>Example: If the 3ϕ Real Power register (0310) has a value of '123' and the Multiplier register (0316) has a value of '10' then the value to display is 1230 kW. | |
| F87 [3] | **Undervoltage Restoration Source** | |
| | 0 | Bus |
| | 1 | Line |
| F88 [6] | **Reserved for Mod 010** | |
| | 0 | |
| | 1 | |
| F89 [7] | **DNP Data Link Confirmation Mode** | |
| | 0 | Never |
| | 1 | Sometimes |
| | 2 | Always |
| F90 [7] | **Coil Monitor Type** | |
| | 0 | Trip |
| | 1 | Close |
| F91 [10] | **Ethernet Options** | |
| | This code represents the IP address, IP subnet mask, and IP default gateway of the relay. It is a string containing up to 15 ASCII characters terminated by a NULL or blank space. The string must be formatted as a correct IP address or subnet mask (for example, 3.94.247.21 or 255.255.255.0). | |
| F92 [10] | **Trace Memory Buffer** | |
| | 0 | 0 x 4096 |
| | 1 | 4 x 2048 |
| | 2 | 8 x 1024 |
| | 3 | 16 x 512 |
| F94 | **Bus Transfer Logic Schemes** | |
| | 0 | Scheme 1 |
| | 1 | Scheme 2 |

1 2 3 4 5 6 7 8 9 10 For explanation of footnotes, see notes of end of Table.

## 4.8 Data Formats Notes

1. New for version 2.10
2. Changed from version 2.00 to 2.10
3. New or changed for version 3.00
4. New or changed for version 3.20
5. New for version 3.30
6. New for version 3.31 MOD 010
7. New or changed for version 3.60
8. New or changed for version 3.70
9. New or changed for version 4.00
10. New for version 7.00

# 5 DNP Communications

## 5.1 DNP 3.0 Device Profile Document

The communications port configured as a DNP slave port must support the full set of features listed in the Level 2 DNP V3.00 Implementation (DNP-L2) described in Chapter 2 of the subset definitions. See the DNP protocol website at http://www.dnp.org for details

| DNP 3.0: DEVICE PROFILE DOCUMENT | |
|---|---|
| Vendor Name: General Electric Multilin Inc. | |
| Device Name: 750/760 Feeder Management Relay | |
| Highest DNP Level Supported:<br>For Requests: Level 2<br>For Responses: Level 2 | Device Function:<br>❒ Master ☒ Slave |
| Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table):<br>Binary Input (Object 1, variations 1 and 2)<br>Binary Output (Object 10, variation 2)<br>Analog Input (Object 30, variations 1, 2, 3, and 4)<br>Analog Input Change (Object 32, variations 1, 2, 3, and 4)<br>Warm Restart (Function Code 14) | |
| Maximum Data Link Frame Size (octets):<br>Transmitted: 292<br>Received: 292 | Maximum Application Fragment Size (octets):<br>Transmitted: 2048<br>Received: 2048 |
| Maximum Data Link Re-tries:<br>❒ None<br>❒ Fixed<br>☒ Configurable (note 1) | Maximum Application Layer Re-tries:<br>☒ None<br>❒ Configurable |
| Requires Data Link Layer Confirmation:<br>❒ Never<br>❒ Always<br>❒ Sometimes<br>☒ Configurable (note 1) | |
| Requires Application Layer Confirmation:<br>❒ Never<br>❒ Always<br>☒ When reporting Event Data<br>❒ When sending multi-fragment responses<br>❒ Sometimes<br>❒ Configurable | |
| Timeouts while waiting for:<br>Data Link Confirm ❒ None ❒ Fixed ❒ Variable ☒ Configurable<br>Complete Appl. Fragment ☒ None ❒ Fixed ❒ Variable ❒ Configurable<br>Application Confirm ☒ None ❒ Fixed ❒ Variable ❒ Configurable (fixed value is 5000 milliseconds)<br>Complete Appl. Response ☒ None ❒ Fixed ❒ Variable ❒ Configurable<br>Others: (None) | |

| DNP 3.0: DEVICE PROFILE DOCUMENT (Continued) | | | | |
|---|---|---|---|---|
| Executes Control Operations: | | | | |
| Write Binary Outputs | ☒ Never | ☐ Always | ☐ Sometimes | ☐ Configurable |
| Select/Operate | ☐ Never | ☒ Always | ☐ Sometimes | ☐ Configurable |
| Direct Operate | ☐ Never | ☒ Always | ☐ Sometimes | ☐ Configurable |
| Direct Operate: No Ack | ☐ Never | ☒ Always | ☐ Sometimes | ☐ Configurable |
| Count > 1 | ☒ Never | ☐ Always | ☐ Sometimes | ☐ Configurable |
| Pulse On | ☐ Never | ☐ Always | ☒ Sometimes | ☐ Configurable |
| Pulse Off | ☒ Never | ☐ Always | ☐ Sometimes | ☐ Configurable |
| Latch On | ☐ Never | ☐ Always | ☒ Sometimes | ☐ Configurable |
| Latch Off | ☐ Never | ☐ Always | ☒ Sometimes | ☐ Configurable |
| Trip/Close | ☐ Never | ☐ Always | ☒ Sometimes | ☐ Configurable |
| See *Binary / Control Relay Output* on page 2–82 for explanation of the above. | | | | |
| Queue | ☒ Never | ☐ Always | ☐ Sometimes | ☐ Configurable |
| Clear Queue | ☒ Never | ☐ Always | ☐ Sometimes | ☐ Configurable |

| | |
|---|---|
| Reports Binary Input Change Events when no specific variations requested:<br>☐ Never<br>☒ Only time-tagged<br>☐ Only non-time-tagged<br>☐ Configurable to send both, one or the other | Reports time-tagged Binary Input Change Events when no specific variation requested:<br>☐ Never<br>☒ Binary Input Change With Time<br>☐ Binary Input Change With Relative Time<br>☐ Configurable |
| Sends Unsolicited Responses:<br>☒ Never<br>☐ Configurable<br>☐ Only certain objects<br>☐ Sometimes<br>☐ ENABLE/DISABLE UNSOLICITED Function codes supported | Sends Static Data in Unsolicited Responses:<br>☒ Never<br>☐ When Device Restarts<br>☐ When Status Flags Change |
| Default Counter Object/Variation:<br>☒ No Counters Reported<br>☐ Configurable<br>☐ Default Object / Default Variation<br>☐ Point-by-point list attached | Counters Roll Over at:<br>☒ No Counters Reported<br>☐ Configurable<br>☐ 16 Bits<br>☐ 32 Bits<br>☐ Other Value<br>☐ Point-by-point list attached |
| Sends Multi-Fragment Responses: ☐ Yes ☒ No | |

Note 1: The data link layer confirmation mode, confirmation time-out, and number of retries are all configurable. Refer to the *DNP Configuration* section in Chapter 5 of the instruction manual for more details.

## 5.2 DNP Implementation

The table below gives a list of all objects recognized and returned by the relay. Additional information is provided on the following pages including a list of the default variations returned for each object and lists of defined point numbers for each object.

**Implementation Table Notes:**

1. For this object, the quantity specified in the request must be exactly 1 as there is only one instance of this object defined in the relay.

2. All static input data known to the relay is returned in response to a request for Class 0. This includes all objects of type 1 (Binary Input), type 10 (Binary Output) and type 30 (Analog Input).
3. The point tables for Binary Input and Analog Input objects contain a field which defines to which event class the corresponding static data has been assigned.
4. For this object, the qualifier code must specify an index of 7 only.

### Table 8: DNP Implementation Table

| Object | | | Request | | Response | |
|---|---|---|---|---|---|---|
| Obj | Var | Description | Func Codes | Qual Codes (Hex) | Func Codes | Qual Codes (Hex) |
| 1 | 0 | Binary Input - All Variations | 1 | 06 | | |
| 1 | 1 | Binary Input | 1 | 00, 01, 06 | 129 | 00, 01 |
| 1 | 2 | Binary Input With Status (Note 6) | 1 | 00, 01, 06 | 129 | 00, 01 |
| 2 | 0 | Binary Input Change - All Variations | 1 | 06, 07, 08 | | |
| 2 | 1 | Binary Input Change Without Time | 1 | 06, 07, 08 | 129 | 17, 28 |
| 2 | 2 | Binary Input Change With Time | 1 | 06, 07, 08 | 129 | 17, 28 |
| 10 | 0 | Binary Output - All Variations | 1 | 06 | | |
| 10 | 2 | Binary Output Status | 1 | 00, 01, 06 | 129 | 00, 01 |
| 12 | 1 | Control Relay Output Block | 3, 4, 5, 6 | 17, 28 | 129 | 17, 28 |
| 30 | 0 | Analog Input - All Variations | 1 | 06 | | |
| 30 | 1 | 32-Bit Analog Input With Flag | 1 | 00, 01, 06 | 129 | 00, 01 |
| 30 | 2 | 16-Bit Analog Input With Flag | 1 | 00, 01, 06 | 129 | 00, 01 |
| 30 | 3 | 32-Bit Analog Input Without Flag | 1 | 00, 01, 06 | 129 | 00, 01 |
| 30 | 4 | 16-Bit Analog Input Without Flag | 1 | 00, 01, 06 | 129 | 00, 01 |
| 32 | 0 | Analog Input Change - All Variations | 1 | 06, 07, 08 | | |
| 32 | 1 | 32-Bit Analog Input Change without Time | 1 | 06, 07, 08 | 129 | 17, 28 |
| 32 | 2 | 16-Bit Analog Input Change without Time | 1 | 06, 07, 08 | 129 | 17, 28 |
| 32 | 3 | 32-Bit Analog Input Change with Time | 1 | 06, 07, 08 | 129 | 17, 28 |
| 32 | 4 | 16-Bit Analog Input Change with Time | 1 | 06, 07, 08 | 129 | 17, 28 |
| 50 | 1 | Time and Date | 1, 2 | 07 (Note 1) | 129 | 07 |
| 60 | 1 | Class 0 Data (Note 2) | 1 | 06 | 129 | |
| 60 | 2 | Class 1 Data (Note 3) | 1 | 06, 07, 08 | 129 | |
| 60 | 3 | Class 2 Data (Note 3) | 1 | 06, 07, 08 | 129 | |
| 60 | 4 | Class 3 Data (Note 3) | 1 | 06, 07, 08 | 129 | |
| 80 | 1 | Internal Indications | 2 | 00 (Note 4) | 129 | |
| | | No object - Cold Start | 13 | | | |
| | | No object - Warm Start (Note 5) | 14 | | | |
| | | No object - Delay Measurement | 23 | | | |

1, 2, 3, 4, 5, 6: see the IMPLEMENATION TABLE NOTES above.

The following table specifies the default variation for all objects returned by the relay. These are the variations that will be returned for the object in a response when no specific variation is specified in a request.

| Object | Description | Default Variation |
|---|---|---|
| 1 | Binary Input - Single Bit | 1 |
| 2 | Binary Input Change With Time | 2 |
| 10 | Binary Output Status | 2 |
| 30 | 16-Bit Analog Input Without Flag | 4 |

| Object | Description | Default Variation |
|---|---|---|
| 32 | 16-Bit Analog Input Change Without Time | 2 |

# 6 DNP Point Lists

## 6.1 Binary Input / Binary Input Change

**The point list for Binary Input (Object 01) and Binary Input Change (Object 02) is shown below.**

**Table 9: Binary Inputs DNP Points**

| Index | Description | Event Class |
|---|---|---|
| 0 | Relay In Service | Class 1 |
| 1 | Trip Condition(s) Active | Class 1 |
| 2 | Alarm Condition(s) Active | Class 1 |
| 3 | Protection Picked Up | Class 1 |
| 4 | Setpoint Group 1 Active | Class 1 |
| 5 | Setpoint Group 2 Active | Class 1 |
| 6 | Setpoint Group 3 Active | Class 1 |
| 7 | Setpoint Group 4 Active | Class 1 |
| 8 | Breaker Is Open | Class 1 |
| 9 | Breaker Is Closed | Class 1 |
| 10 | Reclosure Enabled [1] | Class 1 |
| 11 | Reclosure Disabled [1] | Class 1 |
| 12 | Reclosure In Progress [1] | Class 1 |
| 13 | Reclosure Locked Out [1] | Class 1 |
| 14 | Local Mode Active | Class 1 |
| 15 | Diagnostic Message(s) Active | Class 1 |
| 16 | Major Internal Failure | Class 1 |
| 17 | Minor Internal Failure | Class 1 |
| 18 | Testing Mode Active | Class 1 |
| 19 | Contact Input 1 Closed | Class 1 |
| 20 | Contact Input 2 Closed | Class 1 |
| 21 | Contact Input 3 Closed | Class 1 |
| 22 | Contact Input 4 Closed | Class 1 |
| 23 | Contact Input 5 Closed | Class 1 |
| 24 | Contact Input 6 Closed | Class 1 |
| 25 | Contact Input 7 Closed | Class 1 |
| 26 | Contact Input 8 Closed | Class 1 |

**Table 9: Binary Inputs DNP Points**

| Index | Description | Event Class |
|---|---|---|
| 27 | Contact Input 9 Closed | Class 1 |
| 28 | Contact Input 10 Closed | Class 1 |
| 29 | Contact Input 11 Closed | Class 1 |
| 30 | Contact Input 12 Closed | Class 1 |
| 31 | Contact Input 13 Closed | Class 1 |
| 32 | Contact Input 14 Closed | Class 1 |
| 33 | Setpoint Access Jumper Present | Class 1 |
| 34 | Coil Monitor 1 Circuit Closed | Class 1 |
| 35 | Coil Monitor 2 Circuit Closed | Class 1 |
| 36 | Relay 1 Trip Operated | Class 1 |
| 37 | Relay 2 Close Operated | Class 1 |
| 38 | Relay 3 Auxiliary Operated | Class 1 |
| 39 | Relay 4 Auxiliary Operated | Class 1 |
| 40 | Relay 5 Auxiliary Operated | Class 1 |
| 41 | Relay 6 Auxiliary Operated | Class 1 |
| 42 | Relay 7 Auxiliary Operated | Class 1 |
| 43 | Relay 8 Service Operated | Class 1 |


1. Any detected change in the state of any point will cause the generation of an event object.
2. An event object will be generated as a result of any change in any point.

## 6.2 Binary / Control Relay Output

**The point list for Binary Output (Object 10) and Control Relay Output (Object 12) is shown below.**

**Table 10: Binary Outputs DNP Points**

| Index | Description |
|---|---|
| 0 | Reset |
| 1 | Open Breaker |
| 2 | Close Breaker |
| 3 | Virtual Input 1 |
| 4 | Virtual Input 2 |
| 5 | Virtual Input 3 |
| 6 | Virtual Input 4 |
| 7 | Virtual Input 5 |
| 8 | Virtual Input 6 |
| 9 | Virtual Input 7 |
| 10 | Virtual Input 8 |
| 11 | Virtual Input 9 |
| 12 | Virtual Input 10 |
| 13 | Virtual Input 11 |
| 14 | Virtual Input 12 |
| 15 | Virtual Input 13 |
| 16 | Virtual Input 14 |
| 17 | Virtual Input 15 |
| 18 | Virtual Input 16 |
| 19 | Virtual Input 17 |
| 20 | Virtual Input 18 |
| 21 | Virtual Input 19 |
| 22 | Virtual Input 20 |
| 23 | Breaker Control |

The following restrictions should be observed when using object 12 to control the points listed in the above table.

1. The *Count* field is checked first. If it is zero, the command will be accepted but no action will be taken. If this field is non-zero, the command will be executed exactly once regardless of its value.
2. The *Control Code* field of object 12 is then inspected:
   - The Queue, and Clear sub-fields are ignored.

- If the Code sub-field is NUL, then the command will be accepted without any action being taken.
- A Code sub-field of "Pulse On" (1) is valid only for points 0 through 2. This is used to activate the function (e.g., Reset) associated with the point.
- A Code sub-field of "Pulse On" (1) in combination with a value in the Trip/Close sub-field form a "Trip" or "Close" value. A "Trip" value consists of a "Pulse On" (1) in the Code sub-field and a 2 in the Trip/Close sub-field. This results in a value of 81 (hex) in the Control Code field. A "Close" value consists of a "Pulse On" (1) in the Code sub-field and a 1 in the Trip/Close sub-field. This results in a value of 41 (hex) in the Control Code field.
- A Code sub-field of "Latch On" (3) or "Latch Off" (4) is valid for all virtual input points (i.e., points 3 through 22). This is used to set the associated Virtual Input on ("Latch On") or off ("Latch Off"). As well, a "Close" value in the Control Code field will cause the virtual input to be turned on while a "Trip" value in this field will cause the virtual input to be turned off.
- The "Breaker Control" point (23) will only accept a "Trip" or "Close" value. A value of "Trip" will activate the "Breaker Open" function. Similarly, a value of "Close" will activate the "Breaker Close" function.
- All operations not defined above are invalid and will be rejected.

3. The *On Time* and *Off Time* fields are ignored. A "Pulse On" Code takes effect immediately when received, therefore timing is irrelevant.
4. The *Status* field in the response will reflect the success or failure of the control attempt thus:
   - A Status of "Request Accepted" (0) will be returned if the command was accepted.
   - A Status of "Request not Accepted due to Formatting Errors" (3) will be returned if the Control Code field was incorrectly formatted or an invalid Code was present in the command.
   - A Status of "Control Operation not Supported for this Point" (4) will be returned if an attempt was made to operate the "Open Breaker" (1), "Close Breaker" (2) or "Breaker Control" (23) points and the relay is in local mode (this status is indicated by Object 1, Point 14).

Setting or clearing a Virtual Input will always succeed, however an operate of the Reset, Open Breaker, Close Breaker or Breaker Control points may fail (even if the command is accepted) due to other inputs or conditions (e.g., blocks) existing at the time. To verify the success or failure of an operate of these points it is necessary that the associated Binary Input(s) be examined after the control attempt is performed.

When using object 10 to read the status of a Binary Output, a read of points 0 through 2 and 23 will always return zero. For other points, the current state of the corresponding Virtual Input will be returned.

## 6.3 Analog Input / Analog Input Change

In the following table, the entry in the "Format" column indicates that the format of the associated data point can be determined by looking up the entry in the Memory Map Data Formats table. For example, an "F1" format is described in that table as a (16-bit) unsigned value without any decimal places. Therefore, the value read should be interpreted in this manner.

**The point list for Analog Input (Object 30) and Analog Input Change (Object 32) is shown below. Refer to the notes following the table for additional details.**

Table 11: Analog Inputs DNP Points (Sheet 1 of 7)

| Index when Point Mapping is: | | Format | Description | Event Class Assigned |
|---|---|---|---|---|
| Disabled | Enabled | | | |
| n/a | 0 | - | User Map Value 1 | |
| n/a | 1 | - | User Map Value 2 | |
| ↓ | ↓ | ↓ | ↓ | |
| n/a | 118 | - | User Map Value 119 | |
| n/a | 119 | - | User Map Value 120 | |
| 0 | 120 | F49 | Phase Time Overcurrent 1 | Class 1 |
| 1 | 121 | F49 | Phase Instantaneous Overcurrent 1 | Class 1 |
| 2 | 122 | F49 | Phase Instantaneous Overcurrent 2 | Class 1 |
| 3 | 123 | F49 | Ground Time Overcurrent | Class 1 |
| 4 | 124 | F49 | Ground Instantaneous Overcurrent | Class 1 |
| 5 | 125 | F49 | Neutral Time Overcurrent 1 | Class 1 |
| 6 | 126 | F49 | Neutral Time Overcurrent 2 | Class 1 |
| 7 | 127 | F49 | Neutral Instantaneous Overcurrent 1 | Class 1 |
| 8 | 128 | F49 | Neutral Instantaneous Overcurrent 2 | Class 1 |
| 9 | 129 | F49 | Phase Directional Is Reverse | Class 1 |
| 10 | 130 | F49 | Neutral Directional Is Reverse | Class 1 |
| 11 | 131 | F49 | Manual Close Blocking | Class 1 |
| 12 | 132 | F49 | Cold Load Pickup Blocking | Class 1 |
| 13 | 133 | F49 | Bus Undervoltage 1 | Class 1 |
| 14 | 134 | F49 | Bus Undervoltage 2 | Class 1 |
| 15 | 135 | F49 | Line Undervoltage 3 | Class 1 |
| 16 | 136 | F49 | Line Undervoltage 4 | Class 1 |
| 17 | 137 | F49 | Overvoltage 1 | Class 1 |
| 18 | 138 | F49 | Overvoltage 2 | Class 1 |
| 19 | 139 | F49 | Underfrequency 1 | Class 1 |
| 20 | 140 | F49 | Underfrequency 2 | Class 1 |
| 21 | 141 | F49 | Phase Current Level | Class 1 |
| 22 | 142 | F49 | Neutral Current Level | Class 1 |

Table 11: Analog Inputs DNP Points (Sheet 2 of 7)

| Index when Point Mapping is: | | Format | Description | Event Class Assigned |
|---|---|---|---|---|
| Disabled | Enabled | | | |
| 23 | 143 | F49 | Power Factor 1 | Class 1 |
| 24 | 144 | F49 | Power Factor 2 | Class 1 |
| 25 | 145 | F49 | Synchrocheck Block (Not In Sync) | Class 1 |
| 26 | 146 | F49 | Current Demand | Class 1 |
| 27 | 147 | F49 | Real Power Demand | Class 1 |
| 28 | 148 | F49 | Reactive Power Demand | Class 1 |
| 29 | 149 | F49 | Apparent Power Demand | Class 1 |
| 30 | 150 | F49 | Analog Input Threshold 1 | Class 1 |
| 31 | 151 | F49 | Analog Input Threshold 2 | Class 1 |
| 32 | 152 | F49 | Analog Input Rate of Change 1 | Class 1 |
| 33 | 153 | F49 | Analog Input Rate of Change 2 | Class 1 |
| 34 | 154 | F49 | Overfrequency | Class 1 |
| 35 | 155 | F49 | Trip Counter | Class 1 |
| 36 | 156 | F49 | Arcing Current | Class 1 |
| 37 | 157 | F49 | VT Failure | Class 1 |
| 38 | 158 | F49 | Breaker Failure | Class 1 |
| 39 | 159 | F49 | Breaker Operation Failure | Class 1 |
| 40 | 160 | F49 | Trip Coil Monitor | Class 1 |
| 41 | 161 | F49 | Close Coil Monitor | Class 1 |
| 42 | 162 | F49 | User Input A | Class 1 |
| 43 | 163 | F49 | User Input B | Class 1 |
| 44 | 164 | F49 | User Input C | Class 1 |
| 45 | 165 | F49 | User Input D | Class 1 |
| 46 | 166 | F49 | User Input E | Class 1 |
| 47 | 167 | F49 | User Input F | Class 1 |
| 48 | 168 | F49 | User Input G | Class 1 |
| 49 | 169 | F49 | User Input H | Class 1 |
| 50 | 170 | F49 | Negative Sequence Instantaneous Overcurrent | Class 1 |
| 51 | 171 | F49 | Negative Sequence Time Overcurrent | Class 1 |

Table 11: Analog Inputs DNP Points (Sheet 3 of 7)

| Index when Point Mapping is: | | Format | Description | Event Class Assigned |
|---|---|---|---|---|
| Disabled | Enabled | | | |
| 52 | 172 | F49 | Negative Sequence Overvoltage | Class 1 |
| 53 | 173 | F49 | Undervoltage Restoration | Class 1 |
| 54 | 174 | F49 | Underfrequency Restoration | Class 1 |
| 55 | 175 | F49 | Phase Time Overcurrent 2 | Class 1 |
| 56 | 176 | F49 | Frequency Decay | Class 1 |
| 57 | 177 | F49 | Negative Sequence Directional Is Reverse | Class 1 |
| 58 | 178 | F49 | Sensitive Ground Instantaneous Overcurrent | Class 1 |
| 59 | 179 | F49 | Sensitive Ground Time Overcurrent | Class 1 |
| 60 | 180 | F49 | Sensitive Ground Directional Is Reverse | Class 1 |
| 61 | 181 | F1 | Phase A RMS Current (see Note 3) | Class 2 |
| 62 | 182 | F1 | Phase B RMS Current (see Note 3) | Class 2 |
| 63 | 183 | F1 | Phase C RMS Current (see Note 3) | Class 2 |
| 64 | 184 | F1 | Percent Of Load-To-Trip (see Note 3) | Class 2 |
| 65 | 185 | F1 | Ground Current (see Note 3) | Class 2 |
| 66 | 186 | F3 | Phase A-Neutral RMS Voltage (see Note 3) | Class 2 |
| 67 | 187 | F3 | Phase B-Neutral RMS Voltage (see Note 3) | Class 2 |
| 68 | 188 | F3 | Phase C-Neutral RMS Voltage (see Note 3) | Class 2 |
| 69 | 189 | F3 | Phase A-Phase B RMS Voltage (see Note 3) | Class 2 |
| 70 | 190 | F3 | Phase B-Phase C RMS Voltage (see Note 3) | Class 2 |
| 71 | 191 | F3 | Phase C-Phase A RMS Voltage (see Note 3) | Class 2 |
| 72 | 192 | F3 | Sensitive Ground Current (see Note 3) | Class 2 |
| 73 | 193 | F1 | Average Current (see Note 3) | Class 2 |
| 74 | 194 | F3 | Average Line Voltage (see Note 3) | Class 2 |
| 75 | 195 | F3 | Average Phase Voltage (see Note 3) | Class 2 |
| 76 | 196 | F1 | Neutral Current (see Note 3) | Class 2 |
| 77 | 197 | F86 | 3ϕ Real Power (see Note 3) | Class 2 |
| 78 | 198 | F86 | 3ϕ Reactive Power (see Note 3) | Class 2 |
| 79 | 199 | F86 | 3ϕ Apparent Power (see Note 3) | Class 2 |
| 80 | 200 | F6 | 3ϕ Power Factor (see Note 3) | Class 2 |
| 81 | 201 | F3 | System Frequency (see Note 4) | Class 2 |

Table 11: Analog Inputs DNP Points (Sheet 4 of 7)

| Index when Point Mapping is: | | Format | Description | Event Class Assigned |
|---|---|---|---|---|
| Disabled | Enabled | | | |
| 82 | 202 | F1 | Analog Input (see Note 3) | Class 2 |
| 83 | 203 | F23 | Date Of Last Trip (upper 16 Bits, see Note 1) | Class 1 |
| 84 | 204 | F23 | Date Of Last Trip (lower 16 Bits, see Note 1) | Class 1 |
| 85 | 205 | F22 | Time Of Last Trip (upper 16 Bits, see Note 1) | Class 1 |
| 86 | 206 | F22 | Time Of Last Trip (lower 16 Bits, see Note 1) | Class 1 |
| 87 | 207 | F24 | Cause Of Last Trip | Class 1 |
| 88 | 208 | F1 | Last Trip Phase A RMS Current | Class 1 |
| 89 | 209 | F1 | Last Trip Phase B RMS Current | Class 1 |
| 90 | 210 | F1 | Last Trip Phase C RMS Current | Class 1 |
| 91 | 211 | F1 | Last Trip Ground Current | Class 1 |
| 92 | 212 | F3 | Last Trip Sensitive Ground Current | Class 1 |
| 93 | 213 | F3 | Last Trip A-N (A-B) RMS Voltage | Class 1 |
| 94 | 214 | F3 | Last Trip B-N (B-C) RMS Voltage | Class 1 |
| 95 | 215 | F3 | Last Trip C-N (C-A) RMS Voltage | Class 1 |
| 96 | 216 | F3 | Last Trip System Frequency | Class 1 |
| 97 | 217 | F1 | Last Trip Analog Input | Class 1 |
| 98 | 218 | F1 | Last Trip Neutral Current | Class 1 |
| 99 | 219 | F23 | Date Of Fault 1 (Upper 16 Bits - See Note 1) | Class 3 |
| 100 | 220 | F23 | Date Of Fault 1 (Lower 16 Bits - See Note 1) | Class 3 |
| 101 | 221 | F22 | Time Of Fault 1 (Upper 16 Bits - See Note 1) | Class 3 |
| 102 | 222 | F22 | Time Of Fault 1 (Lower 16 Bits - See Note 1) | Class 3 |
| 103 | 223 | F76 | Type Of Fault 1 | Class 3 |
| 104 | 224 | F52 | Distance To Fault 1 | Class 3 |
| 105 | 225 | F53 | Line Z1 To Fault 1 (Magnitude) | Class 3 |
| 106 | 226 | F23 | Date Of Fault 2 (Upper 16 Bits - See Note 1) | |
| 107 | 227 | F23 | Date Of Fault 2 (Lower 16 Bits - See Note 1) | |
| 108 | 228 | F22 | Time Of Fault 2 (Upper 16 Bits - See Note 1) | |
| 109 | 229 | F22 | Time Of Fault 2 (Lower 16 Bits - See Note 1) | |
| 110 | 230 | F76 | Type Of Fault 2 | |
| 111 | 231 | F52 | Distance To Fault 2 | |

Table 11: Analog Inputs DNP Points (Sheet 5 of 7)

| Index when Point Mapping is: | | Format | Description | Event Class Assigned |
|---|---|---|---|---|
| Disabled | Enabled | | | |
| 112 | 232 | F53 | Line Z1 To Fault 2 (Magnitude) | |
| 113 | 233 | F23 | Date Of Fault 3 (Upper 16 Bits - See Note 1) | |
| 114 | 234 | F23 | Date Of Fault 3 (Lower 16 Bits - See Note 1) | |
| 115 | 235 | F22 | Time Of Fault 3 (Upper 16 Bits - See Note 1) | |
| 116 | 236 | F22 | Time Of Fault 3 (Lower 16 Bits - See Note 1) | |
| 117 | 237 | F76 | Type Of Fault 3 | |
| 118 | 238 | F52 | Distance To Fault 3 | |
| 119 | 239 | F53 | Line Z1 To Fault 3 (Magnitude) | |
| 120 | 240 | F23 | Date Of Fault 4 (Upper 16 Bits - See Note 1) | |
| 121 | 241 | F23 | Date Of Fault 4 (Lower 16 Bits - See Note 1) | |
| 122 | 242 | F22 | Time Of Fault 4 (Upper 16 Bits - See Note 1) | |
| 123 | 243 | F22 | Time Of Fault 4 (Lower 16 Bits - See Note 1) | |
| 124 | 244 | F76 | Type Of Fault 4 | |
| 125 | 245 | F52 | Distance To Fault 4 | |
| 126 | 246 | F53 | Line Z1 To Fault 4 (Magnitude) | |
| 127 | 247 | F23 | Date Of Fault 5 (Upper 16 Bits - See Note 1) | |
| 128 | 248 | F23 | Date Of Fault 5 (Lower 16 Bits - See Note 1) | |
| 129 | 249 | F22 | Time Of Fault 5 (Upper 16 Bits - See Note 1) | |
| 130 | 250 | F22 | Time Of Fault 5 (Lower 16 Bits - See Note 1) | |
| 131 | 251 | F76 | Type Of Fault 5 | |
| 132 | 252 | F52 | Distance To Fault 5 | |
| 133 | 253 | F53 | Line Z1 To Fault 5 (Magnitude) | |
| 134 | 254 | F23 | Date Of Fault 6 (Upper 16 Bits - See Note 1) | |
| 135 | 255 | F23 | Date Of Fault 6 (Lower 16 Bits - See Note 1) | |
| 136 | 256 | F22 | Time Of Fault 6 (Upper 16 Bits - See Note 1) | |
| 137 | 257 | F22 | Time Of Fault 6 (Lower 16 Bits - See Note 1) | |
| 138 | 258 | F76 | Type Of Fault 6 | |
| 139 | 259 | F52 | Distance To Fault 6 | |
| 140 | 260 | F53 | Line Z1 To Fault 6 (Magnitude) | |
| 141 | 261 | F23 | Date Of Fault 7 (Upper 16 Bits - See Note 1) | |

Table 11: Analog Inputs DNP Points (Sheet 6 of 7)

| Index when Point Mapping is: | | Format | Description | Event Class Assigned |
|---|---|---|---|---|
| Disabled | Enabled | | | |
| 142 | 262 | F23 | Date Of Fault 7 (Lower 16 Bits - See Note 1) | |
| 143 | 263 | F22 | Time Of Fault 7 (Upper 16 Bits - See Note 1) | |
| 144 | 264 | F22 | Time Of Fault 7 (Lower 16 Bits - See Note 1) | |
| 145 | 265 | F76 | Type Of Fault 7 | |
| 146 | 266 | F52 | Distance To Fault 7 | |
| 147 | 267 | F53 | Line Z1 To Fault 7 (Magnitude) | |
| 148 | 268 | F23 | Date Of Fault 8 (Upper 16 Bits - See Note 1) | |
| 149 | 269 | F23 | Date Of Fault 8 (Lower 16 Bits - See Note 1) | |
| 150 | 270 | F22 | Time Of Fault 8 (Upper 16 Bits - See Note 1) | |
| 151 | 271 | F22 | Time Of Fault 8 (Lower 16 Bits - See Note 1) | |
| 152 | 272 | F76 | Type Of Fault 8 | |
| 153 | 273 | F52 | Distance To Fault 8 | |
| 154 | 274 | F53 | Line Z1 To Fault 8 (Magnitude) | |
| 155 | 275 | F23 | Date Of Fault 9 (Upper 16 Bits - See Note 1) | |
| 156 | 276 | F23 | Date Of Fault 9 (Lower 16 Bits - See Note 1) | |
| 157 | 277 | F22 | Time Of Fault 9 (Upper 16 Bits - See Note 1) | |
| 158 | 278 | F22 | Time Of Fault 9 (Lower 16 Bits - See Note 1) | |
| 159 | 279 | F76 | Type Of Fault 9 | |
| 160 | 280 | F52 | Distance To Fault 9 | |
| 161 | 281 | F53 | Line Z1 To Fault 9 (Magnitude) | |
| 162 | 282 | F23 | Date Of Fault 10 (Upper 16 Bits - See Note 1) | |
| 163 | 283 | F23 | Date Of Fault 10 (Lower 16 Bits - See Note 1) | |
| 164 | 284 | F22 | Time Of Fault 10 (Upper 16 Bits - See Note 1) | |
| 165 | 285 | F22 | Time Of Fault 10 (Lower 16 Bits - See Note 1) | |
| 166 | 286 | F76 | Type Of Fault 10 | |
| 167 | 287 | F52 | Distance To Fault 10 | |
| 168 | 288 | F53 | Line Z1 To Fault 10 (Magnitude) | |
| 169 | 289 | F49 | Reserved for MOD 008 | Class 1 |
| 170 | 290 | F49 | Neutral Displacement | Class 1 |
| 171 | 291 | F49 | Ground Directional is Reverse | Class 1 |

**Table 11: Analog Inputs DNP Points (Sheet 7 of 7)**

| Index when Point Mapping is: | | Format | Description | Event Class Assigned |
|---|---|---|---|---|
| Disabled | Enabled | | | |
| 172 | 292 | F49 | Reserved For MOD 010 | Class 1 |
| 173 | 293 | F49 | User Input I | Class 1 |
| 174 | 294 | F49 | User Input J | Class 1 |
| 175 | 295 | F49 | User Input K | Class 1 |
| 176 | 296 | F49 | User Input L | Class 1 |
| 177 | 297 | F49 | User Input M | Class 1 |
| 178 | 298 | F49 | User Input N | Class 1 |
| 179 | 299 | F49 | User Input O | Class 1 |
| 180 | 300 | F49 | User Input P | Class 1 |
| 181 | 301 | F49 | User Input Q | Class 1 |
| 182 | 302 | F49 | User Input R | Class 1 |
| 183 | 303 | F49 | User Input S | Class 1 |
| 184 | 304 | F49 | User Input T | Class 1 |
| 185 | 305 | F49 | Autoreclose Rate Supervision | Class 1 |
| 186 | 306 | F49 | Restricted Earth Fault | Class 1 |
| 187 | 307 | F1 | Auto Ranging Power / Energy Multiplier | Class 2 |
| 188 | 308 | F3 | Neutral Voltage (see Note 3) | Class 2 |
| 189 | 309 | F3 | Last Trip Neutral Voltage | Class 1 |


1. To support existing SCADA hardware that is not capable of 32-bit data reads, the upper and lower 16-bit portions of all time and date values have been assigned to separate points. To read a date or time, it is necessary to read both the upper and lower 16-bit portions, concatenate these two values to form a 32-bit value and interpret the result in the format associated with the point (i.e., F22 for time, F23 for date).
2. Points which have an assigned event class will generate an event object as a result of any change in the point's value unless otherwise noted.
3. An event object will be generated if the point's value changes by a minimum of 2% of its previous value.
4. An event object will be generated if the system frequency changes by 0.04 Hz or more.
5. There are two defined maps for Analog Output points. The map that is used is specified by the setting of the "DNP Point Mapping" setpoint at Modbus address 10DBh. This setpoint may be set to a value of "Disabled" or "Enabled". When "Disabled", only the preassigned Analog Output points are available beginning at point index 0.

When “Enabled”, the User Map Values are assigned to points 0 through 119 with the preassigned Analog Outputs following beginning with Point Index 120. The value read from points 0 through 119 will depend upon the value programmed into the corresponding User Map Address setpoint (note that programming of these setpoints can only be accomplished via Modbus). Refer to *Accessing Data via the User Map* on page 2–16 for more information.

Please note that changes in User Map Values never generate event objects.