B: Modbus Map and Retrieving Logs

B.1: Introduction

The Modbus Map for the Shark® 200 meter gives details and information about the possible readings of the meter and its programming. The Shark® 200 meter can be programmed using the buttons on the face of the meter (Chapter 6), or by using software. For a programming overview, see section 5.2 of this manual. For further details see the *Communicator EXT User Manual*.

B.2: Modbus Register Map Sections

The Shark® 200 meter's Modbus Register Map includes the following sections:

Fixed Data Section, Registers 1- 47, details the Meter's Fixed Information.

Meter Data Section, Registers 1000 - 12031, details the Meter's Readings, including Primary Readings, Energy Block, Demand Block, Phase Angle Block, Status Block, THD Block, Minimum and Maximum in Regular and Time Stamp Blocks, Option Card Blocks, and Accumulators. Operating Mode readings are described in Section 6.2.6.

Commands Section, Registers 20000 - 26011, details the Meter's Resets Block, Programming Block, Other Commands Block and Encryption Block.

Programmable Settings Section, Registers 30000 - 33575, details all the setups you can program to configure your meter.

Secondary Readings Section, Registers 40001 - 40100, details the Meter's Secondary Readings.

Log Retrieval Section, Registers 49997 - 51095, details Log Retrieval. See Section B.5 for instructions on retrieving logs.

B.3: Data Formats

ASCII:	ASCII characters packed 2 per register in high, low order and without any termination characters.
SINT16/UINT16:	16-bit signed/unsigned integer.
SINT32/UINT32:	32-bit signed/unsigned integer spanning 2 registers. The lower-addressed register is the

high order half.

FLOAT: 32-bit IEEE floating point number spanning 2 registers. The lower-addressed register is the high order half (i.e., contains the exponent).

B.4: Floating Point Values

Floating Point Values are represented in the following format:

Register	0																1															
Byte	0								1								0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Meaning	s	e	e	e	e	e	e	e	e	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
	sign	exponent								mantissa																						

The formula to interpret a Floating Point Value is:

$-1^{sign} \times 2^{\,exponent-127} \times 1.mantissa = 0x0C4E11DB9$

$-1^{sign} \times 2^{\,137-127} \times 1\cdot 10000100011110110111001$

$-1 \times 2^{10} \times 1.75871956$

-1800.929

Register	0x0C4E1																0x01DB9															
Byte	0x0C4								0x0E1								0x01D								0x0B9v							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	1	1	0	0	0	1	0	0	1	1	1	0	0	0	0	1	0	0	0	1	1	1	0	1	1	0	1	1	1	0	0	1
Meaning	s	e	e	e	e	e	e	e	e	m	m	m	m	m	m	m																
	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m																
sign	exponent								mantissa																							
1	0x089 + 137								0b01100001000111011011 1001																							

Formula Explanation:

C4E11DB9 (hex) 11000100 11100001 00011101 10111001 (binary)

The sign of the mantissa (and therefore the number) is 1, which represents a negative value.

The Exponent is 10001001 (binary) or 137 decimal.

The Exponent is a value in excess 127. So, the Exponent value is 10.

The Mantissa is 11000010001110110111001 binary.

With the implied leading 1, the Mantissa is (1).611DB9 (hex).

The Floating Point Representation is therefore -1.75871956 times 2 to the 10.

Decimal equivalent: -1800.929

NOTES:

- Exponent = the whole number before the decimal point.
- Mantissa = the positive fraction after the decimal point.

B.5: Retrieving Logs Using the Shark® 200 Meter's Modbus Map

This section describes the log interface system of the Shark® 200 meter from a programming point of view. It is intended for Programmers implementing independent drivers for Log Retrieval from the meter. It describes the meaning of the meter's Modbus Registers related to Log Retrieval and Conversion, and details the procedure for retrieving a log's records.

NOTES:

- All references assume the use of Modbus function codes 0x03, 0x06, and 0x10, where each register is a 2 byte MSB (Most Significant Byte) word, except where otherwise noted.
- The carat symbol (^) notation is used to indicate mathematical "power." For example, 2^8 means 28; which is 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2, which equals 256.

B.5.1: Data Formats

Timestamp: Stores a date from 2000 to 2099. Timestamp has a Minimum resolution of 1 second.

Byte	0	1	2	3	4	5
Value	Year	Month	Day	Hour	Minute	Second
Range	0-99 (+2000)	1-12	1-31	0-23	0-59	0-59
Mask	0x7F	0x0F	0x1F	0x1F	0x3F	0x3F

The high bits of each timestamp byte are used as flags to record meter state information at the time of the timestamp. These bits should be masked out, unless needed.

B.5.2: Shark® 200 Meter Logs

The Shark® 200 meter has 6 logs: System Event, Alarm (Limits), 3 Historical, and I/O Change. Each log is described below.

1. **System Event (0)**: The System Event log is used to store events which happen in, and to, the meter. Events include Startup, Reset Commands, Log Retrievals, etc. The System Event Log Record takes 20 bytes, 14 bytes of which are available when the log is retrieved.

Byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Value	timestamp						Group	Event	Mod	Chan	Param1	Param2	Param3	Param4

NOTE: The complete Systems Events table is shown in Section B.5.5, step 1, on page B-19.

2. **Alarm Log (1):** The Alarm Log records the states of the 8 Limits programmed in the meter.

   - Whenever a limit goes out (above or below), a record is stored with the value that caused the limit to go out.
   - Whenever a limit returns within limit, a record is stored with the "most out of limit" value for that limit while it was out of limit.

The Alarm Log Record uses 16 bytes, 10 bytes of which are available when the log is retrieved.

Byte	0	1	2	3	4	5	6	7	8	9
Value	timestamp						direction	limit#	Value%	

The limit # byte is broken into a type and an ID.

Bit	0	1	2	3	4	5	6	7
Value	type	0	0	0	0	Limit ID		

3. **Historical Log 1 (2)**: The Historical Log records the values of its assigned registers at the programmed interval.

NOTE: See Section B.5.3, Number 1, for details on programming and interpreting the log.

Byte	0	1	2	3	4	5	6	-	-	N
Value	timestamp						values . . .			

4. **Historical Log 2 (3)**: Same as Historical Log 1.

5. **Historical Log 3 (4)**: Same as Historical Log 1.

6. **I/O Change Log (5)**: The I/O Change Log records changes in the input and output of Digital I/O Type Option Cards (Relay and Pulse).

I/O Change Log tables:

Table 1:

Byte	0	1	2	3	4	5	6	7	8	9
Value	Timestamp						Card 1 Changes	Card 1 States	Card 2 Changes	Card 2 States

Card Change Flags:

Bit	7	6	5	4	3	2	1	0
Value	Out 4 Change	Out 3 Change	Out 2 Change	Out 1 Change	In 4 Change	In 3 Change	In 2 Change	In 1 Change

Card Current States:

Bit	7	6	5	4	3	2	1	0
Value	Out 4 State	Out 3 State	Out 2 State	Out 1 State	In 4 State	In 3 State	In 2 State	In 1 State

B.5.3: Block Definitions

This section describes the Modbus Registers involved in retrieving and interpreting a Shark® 200 Meter Log. Other sections refer to certain 'values' contained in this section. See the corresponding value in this section for details.

NOTES:

- "Register" is the Modbus Register Address in 0-based Hexadecimal notation. To convert it to 1-based decimal notation, convert from hex16 to decimal10 and add 1. For example: 0x03E7 = 1000.
- "Size" is the number of Modbus Registers (2 byte) in a block of data.

Historical Log Programmable Settings:

The Historical Logs are programmed using a list of Modbus Registers that will be copied into the Historical Log record. In other words, Historical Log uses a direct copy of the Modbus Registers to control what is recorded at the time of record capture.

To supplement this, the programmable settings for the Historical Logs contain a list of descriptors, which group registers into items. Each item descriptor lists the data type of the item, and the number of bytes for that item. By combining these two lists, the Historical Log record can be interpreted.

For example: Registers 0x03E7 and 0x03E8 are programmed to be recorded by the historical log. The matching descriptor gives the data type as float, and the size as 4 bytes. These registers program the log to record "Primary Readings Volts A-N."

Historical Log Blocks:

Start Register: 0x7917 (Historical Log 1)

0x79D7 (Historical Log 2)

0x7A97 (Historical Log 3)

Block Size: 192 registers per log (384 bytes)

The Historical Log programmable settings are comprised of 3 blocks, one for each log. Each is identical to the others, so only Historical Log 1 is described here. All register addresses in this section are given as the Historical Log 1 address (0x7917).

Each Historical Log Block is composed of 3 sections: The header, the list of registers to log, and the list of item descriptors.

Header:

Registers: 0x7917 - 0x7918

Size: 2 registers

Byte	0	1	2	3
Value	# Registers	# Sectors		Interval

- # Registers: The number of registers to log in the record. The size of the record in memory is [12 + (# Registers x 2)]. The size during normal log retrieval is [6 + (# Registers x 2)]. If this value is 0, the log is disabled. Valid values are {0-117}.
- # Sectors: The number of Flash Sectors allocated to this log. Each sector is 64kb, minus a sector header of 20 bytes. 15 sectors are available for allocation between Historical Logs 1, 2, and 3. The sum of all Historical Logs may be less than 15. If this value is 0, the log is disabled. Valid values are {0-15}.
- Interval: The interval at which the Historical Log's Records are captured. This value is an enumeration:

0x01	1 minute
0x02	3 minute
0x04	5 minute
0x08	10 minute
0x10	15 minute
0x20	30 minute
0x40	60 minute

0x80	End of Interval (EOI) Pulse*

* Setting the interval to EOI causes a record to be logged whenever an EOI pulse event is generated. This is most commonly used in conjunction with the Digital I/O Option Cards.

NOTE: The interval between records will not be even (fixed), and thus should not be used with programs that expect a fixed interval.

Register List:

Registers:	0x7919 - 0x798D
Size:	1 register per list item, 117 list items

The Register List controls what Modbus Registers are recorded in each record of the Historical Log. Since many items, such as Voltage, Energy, etc., take up more than 1 register, multiple registers need to be listed to record those items.

For example: Registers 0x03E7 and 0x03E8 are programmed to be recorded by the historical log. These registers program the log to record "Primary Readings Volts A-N."

- Each unused register item should be set to 0x0000 or 0xFFFF to indicate that it should be ignored.
- The actual size of the record, and the number of items in the register list which are used, is determined by the # registers in the header.
- Each register item is the Modbus Address in the range of 0x0000 to 0xFFFF.

Item Descriptor List:

Registers:	0x798E - 0x79C8
Size:	1 byte per item, 117 bytes (59 registers)

While the Register List describes what to log, the Item Descriptor List describes how to interpret that information. Each descriptor describes a group of register items, and what they mean.

Each descriptor is composed of 2 parts:

- Type: The data type of this descriptor, such as signed integer, IEEE floating point, etc. This is the high nibble of the descriptor byte, with a value in the range of 0-14. If this value is 0xFF, the descriptor should be ignored.

0	ASCII: An ASCII string, or byte array
1	Bitmap: A collection of bit flags
2	Signed Integer: A 2's Complement integer
3	Float: An IEEE floating point
4	Energy: Special Signed Integer, where the value is adjusted by the energy settings in the meter's Programmable Settings.
5	Unsigned Integer
6	Signed Integer 0.1 scale: Special Signed Integer, where the value is divided by 10 to give a 0.1 scale.
7-14	Unused
15	Disabled: used as end list marker.

- Size: The size in bytes of the item described. This number is used to determine the pairing of descriptors with register items.

  For example: If the first descriptor is 4 bytes, and the second descriptor is 2 bytes, then the first 2 register items belong to the 1st descriptor, and the 3rd register item belongs to the 2nd descriptor.

  NOTE: As can be seen from the example, above, there is not a 1-to-1 relation between the register list and the descriptor list. A single descriptor may refer to multiple register items.

Register Items	**Descriptors**
0x03C7/ 0x03C8	Float, 4 byte
0x1234	Signed Int, 2 byte

NOTE: The sum of all descriptor sizes must equal the number of bytes in the data portion of the Historical Log record.

Log Status Block:

The Log Status Block describes the current status of the log in question. There is one header block for each of the logs. Each log's header has the following base address:

Log	**Base Address**
Alarms:	0xC737
System:	0xC747
Historical 1:	0xC757
Historical 2:	0xC767
Historical 3:	0xC777
I/O Change:	0xC787

Bytes	Value	Type	Range	# Bytes
0-3	Max Records	UINT32	0 to 4,294,967,294	4
4-7	Number of Records Used	UINT32	1 to 4,294,967,294	4
8-9	Record Size in Bytes	UINT16	4 to 250	2
10-11	Log Availability	UINT16		2
12-17	Timestamp, First Record	TSTAMP	1Jan2000 - 31Dec2099	6
18-23	Timestamp, Last Record	TSTAMP	1Jan2000 - 31Dec2099	6
24-31	Reserved			8

- Max Records: The maximum number of records the log can hold given the record size, and sector allocation. The data type is an unsigned integer from 0 - 2^32.
- Records Used: The number of records stored in the log. This number will equal the Max Records when the log has filled. This value will be set to 1 when the log is reset. The data type is an unsigned integer from 1 - 2^32.

NOTE: The first record in every log before it has rolled over is a "dummy" record, filled with all 0xFF's. When the log is filled and rolls over, this record is overwritten.

- Record Size: The number of bytes in this record, including the timestamp. The data type is an unsigned integer in the range of 14 - 242.
- Log Availability: A flag indicating if the log is available for retrieval, or if it is in use by another port.

0	Log Available for retrieval
1	In use by COM1 (IrDA)
2	In use by COM2 (RS485)
3	In use by COM3 (Option Card 1)
4	In use by COM4 (Option Card 2)
0xFFFF	Log Not Available - the log cannot be retrieved. This indicates that the log is disabled.

NOTE: To query the port by which you are currently connected, use the Port ID register:

Register:	0x1193
Size:	1 register

Description: A value from 1-4, which enumerates the port that the requestor is currently connected on.

NOTES:

- When Log Retrieval is engaged, the Log Availability value will be set to the port that engaged the log. The Log Availability value will stay the same until either the log has been disengaged, or 5 minutes have passed with no activity. It will then reset to 0 (available).
- Each log can only be retrieved by one port at a time.
- Only one log at a time can be retrieved.

- First Timestamp: Timestamp of the oldest record.
- Last Timestamp: Timestamp of the newest record.

Log Retrieval Block:

The Log Retrieval Block is the main interface for retrieving logs. It is comprised of 2 parts: the header and the window. The header is used to program the particular data the meter presents when a log window is requested. The window is a sliding block of data that can be used to access any record in the specified log.

Session Com Port: The Shark® 200 meter's Com Port which is currently retrieving logs. Only one Com Port can retrieve logs at any one time.

Registers:	0xC34E - 0xC34E
Size:	1 register
0	No Session Active
1	COM1 (IrDA)
2	COM2 (RS-485)
3	COM3 (Communications Capable Option Card 1)
4	COM4 (Communications Capable Option Card 2)

To get the current Com Port, see the NOTE on querying the port, on the previous page.

Log Retrieval Header:

The Log Retrieval Header is used to program the log to be retrieved, the record(s) of that log to be accessed, and other settings concerning the log retrieval.

Registers:	0xC34F - 0xC350
Size:	2 registers

Bytes	Value	Type	Format	Description	# Bytes
0-1	Log Number, Enable, Scope	UINT16	nnnnnnnn esssssss	nnnnnnnn - log to retrieve, e - retrieval session enable sssssss - retrieval mode	2
2-3	Records per Window, Number of Repeats	UINT16	wwwwwwww nnnnnnnn	wwwww-www - records per window, nnnnnnnn - repeat count	2

- Log Number: The log to be retrieved. Write this value to set which log is being retrieved.

0	System Events
1	Alarms
2	Historical Log 1
3	Historical Log 2
4	Historical Log 3
5	I/O Change Log

- Enable: This value sets if a log retrieval session is engaged (locked for retrieval) or disengaged (unlocked, read for another to engage). Write this value with 1(enable) to begin log retrieval. Write this value with 0(disable) to end log retrieval.

0	Disable
1	Enable

- Scope: Sets the amount of data to be retrieved for each record. The default should be 0 (normal).

0	Normal

1	Timestamp Only
2	Image

- Normal [0]: The default record. Contains a 6-byte timestamp at the beginning, then N data bytes for the record data.
- Timestamp [1]: The record only contains the 6-byte timestamp. This is most useful to determine a range of available data for non-interval based logs, such as Alarms and System Events.
- Image [2]: The full record, as it is stored in memory. Contains a 2-byte check-sum, 4-byte sequence number, 6-byte timestamp, and then N data bytes for the record data.

- Records Per Window: The number of records that fit evenly into a window. This value is set-able, as less than a full window may be used. This number tells the retrieving program how many records to expect to find in the window.

  (RecPerWindow x RecSize) = #bytes used in the window.

  This value should be ((123 x 2) \ recSize), rounded down.

  For example, with a record size of 30, the RecPerWindow = ((123 x 2) \ 30) = 8.2 ~= 8

- Number of Repeats: Specifies the number of repeats to use for the Modbus Function Code 0x23 (35). Since the meter must pre-build the response to each log window request, this value must be set once, and each request must use the same repeat count. Upon reading the last register in the specified window, the record index will increment by the number of repeats, if auto-increment is enabled. Section B.5.4.2 has additional information on Function Code 0x23.

0	Disables auto-increment
1	No Repeat count, each request will only get 1 window.
2-8	2-8 windows returned for each Function Code 0x23 request.

Bytes	Value	Type	Format	Description	# Bytes
0-3	Offset of First Record in Window	UINT32	ssssssss nnnnnnnn nnnnnnnn nnnnnnnn	ssssssss - window status nn…nn - 24-bit record index number.	4
4-249	Log Retrieve Window	UINT16			246

Log Retrieval Window Block:

The Log Retrieval Window block is used to program the data you want to retrieve from the log. It also provides the interface used to retrieve that data.

Registers: 0xC351 - 0xC3CD

Size: 125 registers

- Window Status: The status of the current window. Since the time to prepare a window may exceed an acceptable modbus delay (1 second), this acts as a state flag, signifying when the window is ready for retrieval. When this value indicates that the window is not ready, the data in the window should be ignored. Window Status is Read-only, any writes are ignored.

  0 Window is Ready

  0xFF Window is Not Ready

- Record Number: The record number of the first record in the data window. Setting this value controls which records will be available in the data window.

  - When the log is engaged, the first (oldest) record is "latched." This means that record number 0 will always point to the oldest record at the time of latching, until the log is disengaged (unlocked).

  - To retrieve the entire log using auto-increment, set this value to 0, and retrieve the window repeatedly, until all records have been retrieved.

NOTES:

- When auto-increment is enabled, this value will automatically increment so that the window will "page" through the records, increasing by RecordsPerWindow each time that the last register in the window is read.
- When auto-increment is not enabled, this value must be written-to manually, for each window to be retrieved.

- Log Retrieval Data Window: The actual data of the records, arranged according to the above settings.

B.5.4: Log Retrieval

Log Retrieval is accomplished in 3 basic steps:

1. Engage the log.
2. Retrieve each of the records.
3. Disengage the log.

B.5.4.1: Auto-Increment

In EIG's traditional Modbus retrieval system, you write the index of the block of data to retrieve, then read that data from a buffer (window). To improve the speed of retrieval, the index can be automatically incremented each time the buffer is read.

In the Shark® 200 meter, when the last register in the data window is read, the record index is incremented by the Records per Window.

B.5.4.2: Modbus Function Code 0x23

QUERY

Field Name	Example (Hex)
Slave Address	01
Function	23
Starting Address Hi	C3
Starting Address Lo	51

# Points Hi	00
# Points Lo	7D
Repeat Count	04

Function Code 0x23 is a user defined Modbus function code, which has a format similar to Function Code 0x03, except for the inclusion of a "repeat count." The repeat count (RC) is used to indicate that the same N registers should be read RC number of times. (See the Number of Repeats bullet on page B-14.)

NOTES:

- By itself this feature would not provide any advantage, as the same data will be returned RC times. However, when used with auto-incrementing, this function condenses up to 8 requests into 1 request, which decreases communication time, as fewer transactions are being made.
- In the Shark® 200 meter repeat counts are limited to 8 times for Modbus RTU, and 4 times for Modbus ASCII.

The response for Function Code 0x23 is the same as for Function Code 0x03, with the data blocks in sequence.

IMPORTANT! Before using function code 0x23, always check to see if the current connection supports it. Some relay devices do not support user defined function codes; if that is the case, the message will stall. Other devices don't support 8 repeat counts.

B.5.4.3: Log Retrieval Procedure

The following procedure documents how to retrieve a single log from the oldest record to the newest record, using the "normal" record type (see **Scope**). All logs are retrieved using the same method. See Section B.5.4.4 for a Log Retrieval example.

NOTES:

- This example uses auto-increment.
- In this example, Function Code 0x23 is not used.
- You will find referenced topics in Section B.5.3. Block Definitions.

- Modbus Register numbers are listed in brackets.

1. Engage the Log:

   a. Read the Log Status Block.

      i.. Read the contents of the specific logs' status block [0xC737+, 16 reg] (see Log Headers).

      ii. Store the # of Records Used, the Record Size, and the Log Availability.

      iii. If the Log Availability is not 0, stop Log Retrieval; this log is not available at this time. If Log Availability is 0, proceed to step 1b (Engage the log).

   This step is done to ensure that the log is available for retrieval, as well as retrieving information for later use.

   b. Engage the log: write log to engage to Log Number, 1 to Enable, and the desired mode to Scope (default 0 (Normal)) [0xC34F, 1 reg]. This is best done as a single-register write.

   This step will latch the first (oldest) record to index 0, and lock the log so that only this port can retrieve the log, until it is disengaged.

   c. Verify the log is engaged: read the contents of the specific logs' status block [0xC737+, 16 reg] again to see if the log is engaged for the current port (see Log Availability). If the Log is not engaged for the current port, repeat step 1b (Engage the log).

   d. Write the retrieval information.

      i. Compute the number of records per window, as follows:

      RecordsPerWindow = (246 \ RecordSize)

      - If using 0x23, set the repeat count to 2-8. Otherwise, set it to 1.

      - Since we are starting from the beginning for retrieval, the first record index is 0.

ii. Write the Records per window, the Number of repeats (1), and Record Index (0) [0xC350, 3 reg].

This step tells the Shark® 200 meter what data to return in the window.

2. Retrieve the records:

a. Read the record index and window: read the record index, and the data window [0xC351, 125 reg].

- If the meter Returns a Slave Busy Exception, repeat the request.
- If the Window Status is 0xFF, repeat the request.
- If the Window Status is 0, go to step 2b (Verify record index).

NOTES:

- We read the index and window in 1 request to minimize communication time, and to ensure that the record index matches the data in the data window returned.
- Space in the window after the last specified record (RecordSize x Record-PerWindow) is padded with 0xFF, and can be safely discarded.

b. Verify that the record index incremented by Records Per Window. The record index of the retrieved window is the index of the first record in the window. This value will increase by Records Per Window each time the window is read, so it should be 0, N, N x 2, N x 3 . . . for each window retrieved.

- If the record index matches the expected record index, go to step 2c (Compute next expected record index).
- If the record index does not match the expected record index, then go to step 1d (Write the retrieval information), where the record index will be the same as the expected record index. This will tell the Shark® 200 meter to repeat the records you were expecting.

c. Compute next Expected Record Index.

- If there are no remaining records after the current record window, go to step 3 (Disengage the log).
- Compute the next expected record index by adding Records Per Window, to the current expected record index. If this value is greater than the number of records, re-size the window so it only contains the remaining records and go to step 1d (Write the retrieval information), where the Records Per Window will be the same as the remaining records.

3. Disengage the log: write the Log Number (of log being disengaged) to the Log Index and 0 to the Enable bit [0xC34F, 1 reg].

B.5.4.4: Log Retrieval Example

The following example illustrates a log retrieval session. The example makes the following assumptions:

- Log Retrieved is Historical Log 1 (Log Index 2).
- Auto-Incrementing is used.
- Function Code 0x23 is not used (Repeat Count of 1).
- The Log contains Volts-AN, Volts-BN, Volts-CN (12 bytes).
- 100 Records are available (0-99).
- COM Port 2 (RS485) is being used (see Log Availability).
- There are no Errors.
- Retrieval is starting at Record Index 0 (oldest record).
- Protocol used is Modbus RTU. The checksum is left off for simplicity.
- The Shark® 200 meter is at device address 1.
- No new records are recorded to the log during the log retrieval process.

1. Read [0xC757, 16 reg], Historical Log 1 Header Block.

Send:	0103 C757 0010
Command:	
Register Address:	0xC757
# Registers:	16

Receive:	010320 00000100 00000064 0012 0000 060717101511 060718101511 0000000000000000
Data:	
Max Records:	0x100 = 256 records maximum.
Num Records:	0x64 = 100 records currently logged.
Record Size:	0x12 = 18 bytes per record.
Log Availability:	0x00 = 0, not in use, available for retrieval.
First Timestamp:	0x060717101511 = July 23, 2006, 16:21:17
Last Timestamp:	0x060717101511 = July 24, 2006, 16:21:17

NOTE: This indicates that Historical Log 1 is available for retrieval.

2. Write 0x0280 -> [0xC34F, 1 reg], Log Enable.

Send:	0106 C34F 0280
Command:	
Register Address:	0xC34F
# Registers:	1 (Write Single Register Command)
Data:	
Log Number:	2 (Historical Log 1)

Enable:	1 (Engage log)
Scope:	0 (Normal Mode)

Receive:	0106C34F0280 (echo)

NOTE: This engages the log for use on this COM Port, and latches the oldest record as record index 0.

3. Read [0xC757, 16 reg], Availability is 0.

Send:	0103 C757 0010
Command:	
Register Address:	0xC757
# Registers:	16

Receive:	010320 00000100 00000064 0012 0002 060717101511 060718101511 0000000000000000
Data:	
Max Records:	0x100 = 256 records maximum.
Num Records:	0x64 = 100 records currently logged.
Record Size:	0x12 = 18 bytes per record.
Log Availability:	0x02 = 2, In use by COM2, RS485 (the current port)
First Timestamp:	0x060717101511 = July 23, 2006, 16:21:17
Last Timestamp:	0x060717101511 = July 24, 2006, 16:21:17

NOTE: This indicates that the log has been engaged properly in step 2. Proceed to retrieve the log.

4. Compute #RecPerWin as (246\18)=13. Write 0x0D01 0000 0000 -> [0xC350, 3 reg] Write Retrieval Info. Set Current Index as 0.

Send:	0110 C350 0003 06 0D01 00 000000
Command:	
Register Address:	0xC350
# Registers:	3, 6 bytes
Data:	
Records per Window:	13. Since the window is 246 bytes, and the record is 18 bytes, 246\18 = 13.66, which means that 13 records evenly fit into a single window. This is 234 bytes, which means later on, we only need to read 234 bytes (117 registers) of the window to retrieve the records.
# of Repeats:	1. We are using auto-increment (so not 0), but not function code 0x23.
Window Status:	0 (ignore)
Record Index:	0, start at the first record.

Receive:	0110C3500003 (command ok)

NOTES:

- This sets up the window for retrieval; now we can start retrieving the records.
- As noted above, we compute the records per window as 246\18 = 13.66, which is rounded to 13 records per window. This allows the minimum number of requests to be made to the meter, which increases retrieval speed.

5. Read [0xC351, 125 reg], first 2 reg is status/index, last 123 reg is window data. Status OK.

Send:	0103 C351 007D
Command:	
Register Address:	0xC351
# Registers:	0x7D, 125 registers

Receive:	0103FA 00000000 060717101511FFFFFFFFFFFFFFFFFFFFFF 06071710160042FAAACF42FAAD1842FAA9A8 . . .
Data:	
Window Status:	0x00 = the window is ready.
Index:	0x00 = 0, The window starts with the 0'th record, which is the oldest record.
Record 0:	The next 18 bytes is the 0'th record (filler).
Timestamp:	0x060717101511, = July 23, 2006, 16:21:17
Data:	This record is the "filler" record. It is used by the meter so that there is never 0 records. It should be ignored. It can be identified by the data being all 0xFF. **NOTE:** Once a log has rolled over, the 0'th record will be a valid record, and the filler record will disappear.
Record 1:	The next 18 bytes is the 1'st record.
Timestamp:	0x060717101600 July 23, 2006, 16:22:00
Data:	
Volts AN:	0x42FAAACF, float = 125.33~
Volts BN:	0x42FAAD18, float = 125.33~

Volts CN: 0x42FAA9A8, float = 125.33~

. . . 13 records

NOTES:

- This retrieves the actual window. Repeat this command as many times as necessary to retrieve all of the records when auto-increment is enabled.
- Note the filler record. When a log is reset (cleared) in the meter, the meter always adds a first "filler" record, so that there is always at least 1 record in the log. This "filler" record can be identified by the data being all 0xFF, and it being index 0. If a record has all 0xFF for data, the timestamp is valid, and the index is NOT 0, then the record is legitimate.
- When the "filler" record is logged, its timestamp may not be "on the interval." The next record taken will be on the next "proper interval," adjusted to the hour. For example, if the interval is 1 minute, the first "real" record will be taken on the next minute (no seconds). If the interval is 15 minutes, the next record will be taken at :15, :30, :45, or :00 - whichever of those values is next in sequence.

6. Compare the index with Current Index.

NOTES:

- The Current Index is 0 at this point, and the record index retrieved in step 5 is 0: thus we go to step 8.
- If the Current Index and the record index do not match, go to step 7. The data that was received in the window may be invalid, and should be discarded.

7. Write the Current Index to [0xC351, 2 reg].

Send: 0110 C351 0002 04 00 00000D

Command:

Register Address: 0xC351

Registers: 2, 4 bytes

Data:

Window Status: 0 (ignore)

Record Index: 0x0D = 13, start at the 14th record.

Receive: 0110C3510002 (command ok)

NOTES:

- This step manually sets the record index, and is primarily used when an out-of-order record index is returned on a read (step 6).
- The example assumes that the second window retrieval failed somehow, and we need to recover by requesting the records starting at index 13 again.

8. For each record in the retrieved window, copy and save the data for later interpretation.

9. Increment Current Index by RecordsPerWindow.

NOTES:

- This is the step that determines how much more of the log we need to retrieve.
- On the first N passes, Records Per Window should be 13 (as computed in step 4), and the current index should be a multiple of that (0, 13, 26, . . .). Thisamount will decrease when we reach the end (see step 10).
- If the current index is greater than or equal to the number of records (in this case 100), then all records have been retrieved; go to step 12. Otherwise, go to step 10 to check if we are nearing the end of the records.

10. If number records - current index < RecordsPerWindow, decrease to match.

NOTES:

- Here we bounds-check the current index, so we don't exceed the records available.
- If the number of remaining records (#records - current index) is less than the Records per Window, then the next window is the last, and contains less than a full window of records. Make records per window equal to remaining records

(#records-current index). In this example, this occurs when current index is 91 (the 8'th window). There are now 9 records available (100-91), so make Records per Window equal 9.

11. Repeat steps 5 through 10.

NOTES:

- Go back to step 5, where a couple of values have changed.

Pass	CurIndex	FirstRecIndex	RecPerWindow
0	0	0	13
1	13	13	13
2	26	26	13
3	39	39	13
4	52	52	13
5	65	65	13
6	78	78	13
7	91	91	9
8	100	------	-------

- At pass 8, since Current Index is equal to the number of records (100), log retrieval should stop; go to step 12 (see step 9 Notes).

12. No more records available, clean up.

13. Write 0x0000 -> [0xC34F, 1 reg], disengage the log.

Send: 0106 C34F 0000

Command:

Register Address: 0xC34F

Registers: 1 (Write Single Register Command)

Data:

Log Number: 0 (ignore)

Enable: 0 (Disengage log)

Scope: 0 (ignore)

Receive: 0106C34F0000 (echo)

NOTES:

- This disengages the log, allowing it to be retrieved by other COM ports.
- The log will automatically disengage if no log retrieval action is taken for 5 minutes.

B.5.5: Log Record Interpretation

The records of each log are composed of a 6 byte timestamp, and N data. The content of the data portion depends on the log.

System Event Record:

Byte	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Value	timestamp						Group	Event	Mod	Chan	Param1	Param2	Param3	Param4

Size: 14 bytes (20 bytes image).

Data: The System Event data is 8 bytes; each byte is an enumerated value.

- Group: Group of the event.
- Event: Event within a group.
- Modifier: Additional information about the event, such as number of sectors or log number.
- Channel: The port of the Shark® 200 meter that caused the event.

0 Firmware

1 COM 1 (IrDA)

2	COM 2 (RS485)
3	COM 3 (Option Card 1)
4	COM 4 (Option Card 2)
7	User (Face Plate)

Param 1-4: These are defined for each event (see table below).

NOTE: The System Log Record is 20 bytes, consisting of the Record Header (12 bytes) and Payload (8 bytes). The Timestamp (6 bytes) is in the header. Typically, software will retrieve only the timestamp and payload, yielding a 14-byte record. The table below shows all defined payloads.

Group (Event group)	Event (Event within group)	Mod (Event modifier)	Channel (1-4 for COMs, 7 for USER, 0 for FW)	Parm1	Parm2	Parm3	Parm4	Comments
0								Startup
	0	0	0	FW version				Meter Run Firmware Startup
	1	slot#	0	class ID	card status	0xFF	0xFF	Option Card Using Default Settings
1								Log Activity
	1	log#	1-4	0xFF	0xFF	0xFF	0xFF	Reset
	2	log#	1-4	0xFF	0xFF	0xFF	0xFF	Log Retrieval Begin
	3	log#	0-4	0xFF	0xFF	0xFF	0xFF	Log Retrieval End
2								Clock Activity
	1	0	1-4	0xFF	0xFF	0xFF	0xFF	Clock Changed
	2	0	0	0xFF	0xFF	0xFF	0xFF	Daylight Time On
	3	0	0	0xFF	0xFF	0xFF	0xFF	Daylight Time Off
3								System Resets

	1	0	0-4, 7	0xFF	0xFF	0xFF	0xFF	Max & Min Reset
	2	0	0-4, 7	0xFF	0xFF	0xFF	0xFF	Energy Reset
	3	slot#	0-4	1 (inputs) or 2 (outputs)	0xFF	0xFF	0xFF	Accumulators Reset
4								Settings Activity
	1	0	1-4, 7	0xFF	0xFF	0xFF	0xFF	Password Changed
	2	0	1-4	0xFF	0xFF	0xFF	0xFF	V-switch Changed
	3	0	1-4, 7	0xFF	0xFF	0xFF	0xFF	Programma-ble Settings Changed
	4	0	1-4, 7	0xFF	0xFF	0xFF	0xFF	Measurement Stopped
5								Boot Activity
	1	0	1-4	FW version				Exit to Boot
6								Error Report-ing & Recovery
	4	log #	0	0xFF	0xFF	0xFF	0xFF	Log Babbling Detected
	5	log #	0	# records discarded		time in seconds		Babbling Log Periodic Summary
	6	log #	0	# records discarded		time in seconds		Log Babbling End Detected
	7	sector#	0	error count		stimulus	0xFF	Flash Sector Error
	8	0	0	0xFF	0xFF	0xFF	0xFF	Flash Error Counters Reset
	9	0	0	0xFF	0xFF	0xFF	0xFF	Flash Job Queue Over-flow
0x88								
	1	sector#	0	log #	0xFF	0xFF	0xFF	acquire sector
	2	sector#	0	log #	0xFF	0xFF	0xFF	release sector

	3	sector#	0	erase count				erase sector
	4	log#	0	0xFF	0xFF	0xFF	0xFF	write log start record

- log# values: 0 = system log, 1 = alarms log, 2-4 = historical logs 1-3, 5 = I/O change log
- sector# values: 0-63
- slot# values: 1-2

NOTES:

- Stimulus for a flash sector error indicates what the flash was doing when the error occurred: 1 = acquire sector, 2 = startup, 3 = empty sector, 4 = release sector, 5 = write data
- Flash error counters are reset to zero in the unlikely event that both copies in EEPROM are corrupted.
- A "babbling log" is one that is saving records faster than the meter can handle long term. Onset of babbling occurs when a log fills a flash sector in less than an hour. For as long as babbling persists, a summary of records discarded is logged every 60 minutes. Normal logging resumes when there have been no new append attempts for 30 seconds.
- Logging of diagnostic records may be suppressed via a bit in programmable settings.

Alarm Record:

Byte	0	1	2	3	4	5	6	7	8	9
Value	timestamp						direction	limit#	Value%	

Size: 10 bytes (16 bytes image)

Data: The Alarm record data is 4 bytes, and specifies which limit the event occurred on, and the direction of the event (going out of limit, or coming back into limit).

- Direction: The direction of the alarm event: whether this record indicates the limit going out, or coming back into limit.

  1 Going out of limit

  2 Coming back into limit

Bit	0	1	2	3	4	5	6	7
Value	type	0	0	0	0	Limit ID		

- Limit Type: Each limit (1-8) has both an above condition and a below condition. Limit Type indicates which of those the record represents.

  0 High Limit

  1 Low Limit

- Limit ID: The specific limit this record represents. A value in the range 0-7, Limit ID represents Limits 1-8. The specific details for this limit are stored in the programmable settings.

- Value: Depends on the Direction:

  - If the record is "Going out of limit," this is the value of the limit when the "Out" condition occurred.

  - If the record is "Coming back into limit," this is the "worst" value of the limit during the period of being "out": for High (above) limits, this is the highest value during the "out" period; for Low (below) limits, this is the lowest value during the "out" period.

Byte	0	1	2	3	4	5	6	7	8	9
Value	Identifier		Above Setpoint		Above Hyst.		Below Setpoint		Below Hyst.	

Interpretation of Alarm Data:

To interpret the data from the alarm records, you need the limit data from the Programmable Settings [0x754B, 40 registers].

There are 8 limits, each with an Above Setpoint, and a Below Setpoint. Each setpoint also has a threshold (hysteresis), which is the value at which the limit returns "into"

limit after the setpoint has been exceeded. This prevents "babbling" limits, which can be caused by the limit value fluttering over the setpoint, causing it to go in and out of limit continuously.

- Identifier: The first modbus register of the value that is being watched by this limit. While any modbus register is valid, only values that can have a Full Scale will be used by the Shark® 200 meter.
- Above Setpoint: The percent of the Full Scale above which the value for this limit will be considered "out."
  - Valid in the range of -200.0% to +200.0%
  - Stored as an integer with 0.1 resolution. (Multiply % by 10 to get the integer, divide integer by 10 to get %. For example, 105.2% = 1052.)
- Above Hysteresis: The percent of the Full Scale below which the limit will return "into" limit, if it is out. If this value is above the Above Setpoint, this Above limit will be disabled.
  - Valid in the range of -200.0% to +200.0%.
  - Stored as an integer with 0.1 resolution. (Multiply % by 10 to get the integer, divide integer by 10 to get %. For example, 104.1% = 1041.)
- Below Setpoint: The percent of the Full Scale below which the value for this limit will be considered "out."
  - Valid in the range of -200.0% to +200.0%.
  - Stored as an integer with 0.1 resolution. (Multiply % by 10 to get the integer, divide integer by 10 to get %. For example, 93.5% = 935.)
- Below Hysteresis: The percent of the Full Scale above which the limit will return "into" limit, if it is out. If this value is below the Below Setpoint, this Below limit will be disabled.
  - Valid in the range of -200.0% to +200.0%.

- Stored as an integer with 0.1 resolution. (Multiply % by 10 to get the integer, divide integer by 10 to get %. For example, 94.9% = 949.)

NOTES:

- The Full Scale is the "nominal" value for each of the different types of readings. To compute the Full Scale, use the following formulas:

Current	[CT Numerator] x [CT Multiplier]
Voltage	[PT Numerator] x [PT Multiplier]
Power 3-Phase (WYE)	[CT Numerator] x [CT Multiplier] x [PT Numerator] x [PT Multiplier] x 3
Power 3-Phase (Delta)	[CT Numerator] x [CT Multiplier] x [PT Numerator] x [PT Multiplier] x 3 x sqrt(3)
Power Single Phase (WYE)	[CT Numerator] x [CT Multiplier] x [PT Numerator] x [PT Multiplier]
Power Single Phase (Delta)	[CT Numerator] x [CT Multiplier] x [PT Numerator] x [PT Multiplier] x sqrt(3)
Frequency (Calibrated at 60 Hz)	60
Frequency (Calibrated at 50 Hz)	50
Power Factor	1.0
THD, Harmonics	100.0%
Angles	180°

- To interpret a limit alarm fully, you need both the start and end record (for duration).

- There are a few special conditions related to limits:

  - When the meter powers up, it detects limits from scratch. This means that multiple "out of limit" records can be in sequence with no "into limit" records. Cross- reference the System Events for Power Up events.
    - This also means that if a limit is "out," and it goes back in during the power off condition, no "into limit" record will be recorded.

- The "worst" value of the "into limit" record follows the above restrictions; it only represents the values since power up. Any values before the power up condition are lost.

Historical Log Record:

Byte	0	1	2	3	4	5	6	-	-	N
Value	timestamp						values . . .			

Size: 6+2 x N bytes (12+2 x N bytes), where N is the number of registers stored.

Data: The Historical Log Record data is 2 x N bytes, which contains snapshots of the values of the associated registers at the time the record was taken. Since the meter uses specific registers to log, with no knowledge of the data it contains, the Programmable Settings need to be used to interpret the data in the record. See Historical Logs Programmable Settings for details.

I/O Change Record:

I/O Change Log tables:

Byte	0	1	2	3	4	5	6	7	8	9
Value	Timestamp						Card 1 Changes	Card 1 States	Card 2 Changes	Card 2 States

Card Change Flags:

Bit	7	6	5	4	3	2	1	0
Value	Out 4 Change	Out 3 Change	Out 2 Change	Out 1 Change	In 4 Change	In 3 Change	In 2 Change	In 1 Change

Card Current States:

Bit	7	6	5	4	3	2	1	0
Value	Out 4 State	Out 3 State	Out 2 State	Out 1 State	In 4 State	In 3 State	In 2 State	In 1 State

Size: 10 bytes (16 bytes)

Data: The states of the relay and digital inputs at the time of capture for both Option cards 1 and 2. If the option card does not support I/O Change Records (no card or not a Digital Option Card), the value will be 0.

NOTES:

- An I/O Change log record will be taken for each Relay and Digital Input that has been configured in the Programmable Settings to record when its state changes.
- When any one configured Relay or Digital Input changes, the values of all Relays and Digital Inputs are recorded, even if they are not so configured.

B.5.6: Examples

Log Retrieval Section:

```
send:  01 03 75 40 00 08 - Meter designation
recv:  01 03 10 4D 65 74 72 65 44 65 73 69 6E 67 5F 20 20 20 20 00 00

send:  :01 03 C7 57 00 10 - Historical Log 1 status block
recv:  :01 03 20 00 00 05 1E 00 00 05 1E 00 2C 00 00 06 08 17 51 08
        00 06 08 18 4E 39 00 00 00 00 00 00 00 00 00 00 00

send:  :01 03 79 17 00 40 - Historical Log 1 PS settings
recv:  :01 03 80 13 01 00 01 23 75 23 76 23 77 1F 3F 1F 40 1F 41 1F
        42 1F 43 1F 44 06 0B 06 0C 06 0D 06 0E 17 75 17 76 17 77 18
        67 18 68 18 69 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
        00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
        00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
        00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
        00 00 00 00 00 00 00 00 00 00 00 00 00

send:  :01 03 79 57 00 40 - ""
recv:  :01 03 80 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
        00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
        00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
        00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
        00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
        00 00 00 00 00 00 00 00 00 00 00 00 00 62 62 62 34 34 34 44
        44 62 62 62 62 62 62 00 00 00 00 00 00

send:  :01 03 75 35 00 01 - Energy PS settings
recv:  :01 03 02 83 31 00 00

send:  :01 03 11 93 00 01 - Connected Port ID
recv:  :01 03 02 00 02 00 00

send:  :01 03 C7 57 00 10 - Historical Log 1 status block
recv:  :01 03 20 00 00 05 1E 00 00 05 1E 00 2C 00 00 06 08 17 51 08
        00 06 08 18 4E 39 00 00 00 00 00 00 00 00 00 00 00
```

send: :01 03 C3 4F 00 01 - **Log Retrieval header**
recv: :01 03 02 FF FF 00 00

send: :01 10 C3 4F 00 04 08 02 80 05 01 00 00 00 00 - **Engage the log**
recv: :01 10 C3 4F 00 04

send: :01 03 C7 57 00 10 - **Historical Log 1 status block**
recv: :01 03 20 00 00 05 1E 00 00 05 1E 00 2C 00 02 06 08 17 51 08
00 06 08 18 4E 39 00 00 00 00 00 00 00 00 00 00 00

send: :01 10 C3 51 00 02 04 00 00 00 00 - **Set the retrieval index**
recv: :01 10 C3 51 00 02

send: :01 03 C3 51 00 40 - **Read first half of window**
recv: :01 03 80 00 00 00 00 06 08 17 51 08 00 00 19 00 2F 27 0F 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 03
E8 00 01 00 05 00 00 00 00 00 00 06 08 17 51 09 00 00 19 00
2F 27 0F 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 03 E8 00 01 00 04 00 00 00 00 00 00 06 08 17 51 0A
00 00 19 00 2F 27 0F 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 03 E8 00 00 00 00

send: :01 03 C3 91 00 30 - **Read second half of window**
recv: :01 03 60 00 05 00 00 00 00 00 00 06 08 17 51 0B 00 00 19 00
2F 27 0F 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 03 E8 00 01 00 04 00 00 00 00 00 00 06 08 17 51 0C
00 00 19 00 2F 27 0F 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 03 E8 00 01 00 04 00 00 00 00 00 00 00
00

send: :01 03 C3 51 00 40 - **Read first half of last window**
recv: :01 03 80 00 00 05 19 06 08 18 4E 35 00 00 19 00 2F 27 0F 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 03
E8 00 01 00 04 00 00 00 00 00 00 06 08 18 4E 36 00 00 19 00
2F 27 0F 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 03 E8 00 01 00 04 00 00 00 00 00 00 06 08 18 4E 37
00 00 19 00 2F 27 0F 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 03 E8 00 00 00 00

send: :01 03 C3 91 00 30 - **Read second half of last window**
recv: :01 03 60 00 05 00 00 00 00 00 00 06 08 18 4E 38 00 00 19 00
2F 27 0F 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 03 E8 00 01 00 04 00 00 00 00 00 00 06 08 18 4E 39
00 00 19 00 2F 27 0F 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 03 E8 00 00 00 05 00 00 00 00 00 00 00
00

send: :01 06 C3 4F 00 00 - **Disengage the log**

recv: :01 06 C3 4F 00 00

Sample Historical Log 1 Record:

Historical Log 1 Record and Programmable Settings

```
13|01|00 01|23 75|23 76|23 77|1F 3F 1F 40|1F 41
1F 42|1F 43 1F 44|06 0B 06 0C|06 0D 06 0E|17 75|
17 76|17 77|18 67|18 68|18 69|00 00 . . . . . .
62 62 62 34 34 34 44 44 62 62 62 62 62 62 . . .
```

These are the Item Values:	These are the Type and Size:	These are the Descriptions:
13		- # registers
01		- # sectors
01		- interval
23 75	6 2	- (SINT 2 byte) Volts A THD Maximum
23 76	6 2	- (SINT 2 byte) Volts B THD Maximum
23 77	6 2	- (SINT 2 byte) Volts C THD Maximum
1F 3F 1F 40	3 4	- (Float 4 byte) Volts A Minimum
1F 41 1F 42	3 4	- (Float 4 byte) Volts B Minimum
1F 43 1F 44	3 4	- (Float 4 byte) Volts C Minimum
06 0B 06 0C	4 4	- (Energy 4 byte) VARhr Negative Phase A
06 0D 06 0E	4 4	- (Energy 4 byte) VARhr Negative Phase B
17 75	6 2	- (SINT 2 byte) Volts A 1st Harmonic Magnitude
17 76	6 2	- (SINT 2 byte) Volts A 2nd Harmonic Magnitude
17 77	6 2	- (SINT 2 byte) Volts A 3rd Harmonic Magnitude
18 67	6 2	- (SINT 2 byte) Ib 3rd Harmonic Magnitude
18 68	6 2	- (SINT 2 byte) Ib 4th Harmonic Magnitude
18 69	6 2	- (SINT 2 byte) Ib 5th Harmonic Magnitude

Sample Record

```
06 08 17 51 08 00|00 19|00 2F|27 0F|00 00 00 00|00
00 00 00|00 00 00 00|00 00 00 00|00 00 00 00|03 E8|
00 01|00 05|00 00|00 00|00 00 . . .
```

```
11 08 17 51 08 00          - August 23, 2011 17:08:00
00 19                      - 2.5%
00 2F                      - 4.7%
27 0F                      - 999.9% (indicates the value isn't valid)
00 00 00 00                - 0
```

```
00 00 00 00                - 0
00 00 00 00                - 0
00 00 00 00                - 0
00 00 00 00                - 0
03 E8                      - 100.0% (Fundamental)
00 01                      - 0.1%
00 05                      - 0.5%
00 00                      - 0.0%
00 00                      - 0.0%
00 00                      - 0.0%
```

B.6: Important Note Concerning the Shark ® 200 Meter's Modbus Map

In depicting Modbus Registers (Addresses), the Shark® 200 meter's Modbus map uses Holding Registers only.

B.6.1: Hex Representation

The representation shown in the table below is used by developers of Modbus drivers and libraries, SEL 2020/2030 programmers and Firmware Developers. The Shark ® meter's Modbus map also uses this representation.

Hex	Description
0008 - 000F	Meter Serial Number

B.6.2: Decimal Representation

The Shark ® meter's Modbus map defines Holding Registers as (4X) registers. Many popular SCADA and HMI packages and their Modbus drivers have user interfaces that require users to enter these Registers starting at 40001. So instead of entering two separate values, one for register type and one for the actual register, they have been combined into one number.

The Shark ® 200 meter's Modbus map uses a shorthand version to depict the decimal fields, i.e., not all of the digits required for entry into the SCADA package UI are shown. For example:

You need to display the meter's serial number in your SCADA application. The Shark ® 200 meter's Modbus map shows the following information for meter serial number:

Decimal	Description
9 - 16	Meter Serial Number

In order to retrieve the meter's serial number, enter 40009 into the SCADA UI as the starting register, and 8 as the number of registers.

- In order to work with SCADA and Driver packages that use the 40001 to 49999 method for requesting holding registers, take 40000 and add the value of the register (Address) in the decimal column of the Modbus Map. Then enter the number (e.g., 4009) into the UI as the starting register.

- For SCADA and Driver packages that use the 400001 to 465536 method for requesting holding registers take 400000 and add the value of the register (Address) in the decimal column of the Modbus Map. Then enter the number (e.g., 400009) into the UI as the starting register. The drivers for these packages strip off the leading four and subtract 1 from the remaining value. This final value is used as the starting register or register to be included when building the actual modbus message.

B.7: Modbus Register Map (MM-1 to MM-40)

The Shark® 200 meter's Modbus Register Map begins on the following page.

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
		Fixed Data Section					
Identification Block						**read-only**	
0000 - 0007	1 - 8	Meter Name	ASCII	16 char	none		8
0008 - 000F	9 - 16	Meter Serial Number	ASCII	16 char	none		8
0010 - 0010	17 - 17	Meter Type	UINT16	bit-mapped	------st -----vvv	t = transducer model (1=yes, 0=no), s= submeter model(1=yes,0=no), vvv = V-switch: V1 = standard 200, V2 = V1 plus logging, V3 = V2 plus THD, V4 = V3 plus relays, V5 = V4 plus waveform capture up to 64 samples/cycle and 3 Meg, V6 = V4 plus waveform capture up to 512 samples/cycle and 4 Meg	1
0011 - 0012	18 - 19	Firmware Version	ASCII	4 char	none		2
0013 - 0013	20 - 20	Map Version	UINT16	0 to 65535	none		1
0014 - 0014	21 - 21	Meter Configuration	UINT16	bit-mapped	-----ccc --ffffff	ccc = CT denominator (1 or 5), ffffff = calibration frequency (50 or 60)	1
0015 - 0015	22 - 22	ASIC Version	UINT16	0-65535	none		1
0016 - 0017	23 - 24	Boot Firmware Version	ASCII	4 char	none		2
0018 - 0018	25 - 25	Option Slot 1 Usage	UINT16	bit-mapped	same as register 10000 (0x270F)		1
0019 - 0019	26 - 26	Option Slot 2 Usage	UINT16	bit-mapped	same as register 11000 (0x2AF7)		1
001A - 001D	27 - 30	Meter Type Name	ASCII	8 char	none		4
001E - 0026	31 - 39	Reserved				Reserved	9
0027 - 002E	40 - 47	Reserved				Reserved	8
002F - 0115	48 - 278	Reserved				Reserved	231
0116 - 0130	279 - 305	Integer Readings Block occupies these registers, see below					
0131 - 01F3	306 - 500	Reserved				Reserved	194
01F4 - 0203	501 - 516	Reserved				Reserved	16

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
		Meter Data Section (Note 2)					
Readings Block (Integer values)						**read-only**	
0116 - 0116	279 - 279	Volts A-N	UINT16	0 to 9999	volts		1
0117 - 0117	280 - 280	Volts B-N	UINT16	0 to 9999	volts		1
0118 - 0118	281 - 281	Volts C-N	UINT16	0 to 9999	volts		1
0119 - 0119	282 - 282	Volts A-B	UINT16	0 to 9999	volts		1
011A - 011A	283 - 283	Volts B-C	UINT16	0 to 9999	volts		1
011B - 011B	284 - 284	Volts C-A	UINT16	0 to 9999	volts		1
011C - 011C	285 - 285	Amps A	UINT16	0 to 9999	amps		1
011D - 011D	286 - 286	Amps B	UINT16	0 to 9999	amps		1
011E - 011E	287 - 287	Amps C	UINT16	0 to 9999	amps		1
011F - 011F	288 - 288	Neutral Current	UINT16	-9999 to +9999	amps	1.Use the settings from Programmable settings for scale and decimal point location. (see User Settings Flags)	1
0120 - 0120	289 - 289	Watts, 3-Ph total	SINT16	-9999 to +9999	watts		1
0121 - 0121	290 - 290	VARs, 3-Ph total	SINT16	-9999 to +9999	VARs	2. Per phase power and PF have values only for WYE hookup and will be zero for all other hookups.	1
0122 - 0122	291 - 291	VAs, 3-Ph total	UINT16	0 to +9999	VAs		1
0123 - 0123	292 - 292	Power Factor, 3-Ph total	SINT16	-1000 to +1000	none		1
0124 - 0124	293 - 293	Frequency	UINT16	0 to 9999	Hz		1
0125 - 0125	294 - 294	Watts, Phase A	SINT16	-9999 M to +9999	watts	3. If the reading is 10000 that means that the value is out of range. Please adjust the programmable settings in that case. The display will also show '----' in case of over range.	1
0126 - 0126	295 - 295	Watts, Phase B	SINT16	-9999 M to +9999	watts		1
0127 - 0127	296 - 296	Watts, Phase C	SINT16	-9999 M to +9999	watts		1
0128 - 0128	297 - 297	VARs, Phase A	SINT16	-9999 M to +9999 M	VARs		1
0129 - 0129	298 - 298	VARs, Phase B	SINT16	-9999 M to +9999 M	VARs		1
012A - 012A	299 - 299	VARs, Phase C	SINT16	-9999 M to +9999 M	VARs		1
012B - 012B	300 - 300	VAs, Phase A	UINT16	0 to +9999	VAs		1
012C - 012C	301 - 301	VAs, Phase B	UINT16	0 to +9999	VAs		1
012D - 012D	302 - 302	VAs, Phase C	UINT16	0 to +9999	VAs		1
012E - 012E	303 - 303	Power Factor, Phase A	SINT16	-1000 to +1000	none		1
012F - 012F	304 - 304	Power Factor, Phase B	SINT16	-1000 to +1000	none		1
0130 - 0130	305 - 305	Power Factor, Phase C	SINT16	-1000 to +1000	none		1
						Block Size:	27
Primary Readings Block						**read-only**	
03E7 - 03E8	1000 - 1001	Volts A-N	FLOAT	0 to 9999 M	volts		2
03E9 - 03EA	1002 - 1003	Volts B-N	FLOAT	0 to 9999 M	volts		2
03EB - 03EC	1004 - 1005	Volts C-N	FLOAT	0 to 9999 M	volts		2
03ED - 03EE	1006 - 1007	Volts A-B	FLOAT	0 to 9999 M	volts		2
03EF - 03F0	1008 - 1009	Volts B-C	FLOAT	0 to 9999 M	volts		2
03F1 - 03F2	1010 - 1011	Volts C-A	FLOAT	0 to 9999 M	volts		2
03F3 - 03F4	1012 - 1013	Amps A	FLOAT	0 to 9999 M	amps		2
03F5 - 03F6	1014 - 1015	Amps B	FLOAT	0 to 9999 M	amps		2
03F7 - 03F8	1016 - 1017	Amps C	FLOAT	0 to 9999 M	amps		2
03F9 - 03FA	1018 - 1019	Watts, 3-Ph total	FLOAT	-9999 M to +9999 M	watts		2
03FB - 03FC	1020 - 1021	VARs, 3-Ph total	FLOAT	-9999 M to +9999 M	VARs		2
03FD - 03FE	1022 - 1023	VAs, 3-Ph total	FLOAT	-9999 M to +9999 M	VAs		2
03FF - 0400	1024 - 1025	Power Factor, 3-Ph total	FLOAT	-1.00 to +1.00	none		2
0401 - 0402	1026 - 1027	Frequency	FLOAT	0 to 65.00	Hz		2
0403 - 0404	1028 - 1029	Neutral Current	FLOAT	0 to 9999 M	amps		2

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
0405 - 0406	1030 - 1031	Watts, Phase A	FLOAT	-9999 M to +9999 M	watts		2
0407 - 0408	1032 - 1033	Watts, Phase B	FLOAT	-9999 M to +9999 M	watts		2
0409 - 040A	1034 - 1035	Watts, Phase C	FLOAT	-9999 M to +9999 M	watts		2
040B - 040C	1036 - 1037	VARs, Phase A	FLOAT	-9999 M to +9999 M	VARs		2
040D - 040E	1038 - 1039	VARs, Phase B	FLOAT	-9999 M to +9999 M	VARs		2
040F - 0410	1040 - 1041	VARs, Phase C	FLOAT	-9999 M to +9999 M	VARs	Per phase power and PF have values only for WYE hookup and will be zero for all other hookups.	2
0411 - 0412	1042 - 1043	VAs, Phase A	FLOAT	-9999 M to +9999 M	VAs		2
0413 - 0414	1044 - 1045	VAs, Phase B	FLOAT	-9999 M to +9999 M	VAs		2
0415 - 0416	1046 - 1047	VAs, Phase C	FLOAT	-9999 M to +9999 M	VAs		2
0417 - 0418	1048 - 1049	Power Factor, Phase A	FLOAT	-1.00 to +1.00	none		2
0419 - 041A	1050 - 1051	Power Factor, Phase B	FLOAT	-1.00 to +1.00	none		2
041B - 041C	1052 - 1053	Power Factor, Phase C	FLOAT	-1.00 to +1.00	none		2
041D - 041E	1054 - 1055	Symmetrical Component Magnitude, 0 Seq	FLOAT	0 to 9999 M	volts		2
041F - 0420	1056 - 1057	Symmetrical Component Magnitude, + Seq	FLOAT	0 to 9999 M	volts		2
0421 - 0422	1058 - 1059	Symmetrical Component Magnitude, - Seq	FLOAT	0 to 9999 M	volts	Voltage unbalance per IEC6100-4.30	2
0423 - 0423	1060 - 1060	Symmetrical Component Phase, 0 Seq	SINT16	-1800 to +1800	0.1 degree		1
0424 - 0424	1061 - 1061	Symmetrical Component Phase, + Seq	SINT16	-1800 to +1800	0.1 degree	Values apply only to WYE hookup and will be zero for all other hookups.	1
0425 - 0425	1062 - 1062	Symmetrical Component Phase, - Seq	SINT16	-1800 to +1800	0.1 degree		1
0426 - 0426	1063 - 1063	Unbalance, 0 sequence component	UINT16	0 to 65535	0.01%		1
0427 - 0427	1064 - 1064	Unbalance, -sequence component	UINT16	0 to 65535	0.01%		1
0428 - 0428	1065 - 1065	Current Unbalance	UINT16	0 to 20000	0.01%		1
						Block Size:	66
Primary Energy Block						**read-only**	
05DB - 05DC	1500 - 1501	W-hours, Received	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format	* Wh received & delivered always have opposite signs	2
05DD - 05DE	1502 - 1503	W-hours, Delivered	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format	* Wh received is positive for "view as load", delivered is positive for "view as generator"	2
05DF - 05E0	1504 - 1505	W-hours, Net	SINT32	-99999999 to 99999999	Wh per energy format	* 5 to 8 digits	2
05E1 - 05E2	1506 - 1507	W-hours, Total	SINT32	0 to 99999999	Wh per energy format		2
05E3 - 05E4	1508 - 1509	VAR-hours, Positive	SINT32	0 to 99999999	VARh per energy format	* decimal point implied, per energy format	2
05E5 - 05E6	1510 - 1511	VAR-hours, Negative	SINT32	0 to -99999999	VARh per energy format		2
05E7 - 05E8	1512 - 1513	VAR-hours, Net	SINT32	-99999999 to 99999999	VARh per energy format	* resolution of digit before decimal point = units, kilo, or mega, per energy format	2
05E9 - 05EA	1514 - 1515	VAR-hours, Total	SINT32	0 to 99999999	VARh per energy format		2
05EB - 05EC	1516 - 1517	VA-hours, Total	SINT32	0 to 99999999	VAh per energy format	* see note 10	2
05ED - 05EE	1518 - 1519	W-hours, Received, Phase A	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
05EF - 05F0	1520 - 1521	W-hours, Received, Phase B	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
05F1 - 05F2	1522 - 1523	W-hours, Received, Phase C	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
05F3 - 05F4	1524 - 1525	W-hours, Delivered, Phase A	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
05F5 - 05F6	1526 - 1527	W-hours, Delivered, Phase B	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
05F7 - 05F8	1528 - 1529	W-hours, Delivered, Phase C	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
05F9 - 05FA	1530 - 1531	W-hours, Net, Phase A	SINT32	-99999999 to 99999999	Wh per energy format		2
05FB - 05FC	1532 - 1533	W-hours, Net, Phase B	SINT32	-99999999 to 99999999	Wh per energy format		2
05FD - 05FE	1534 - 1535	W-hours, Net, Phase C	SINT32	-99999999 to 99999999	Wh per energy format		2
05FF - 0600	1536 - 1537	W-hours, Total, Phase A	SINT32	0 to 99999999	Wh per energy format		2
0601 - 0602	1538 - 1539	W-hours, Total, Phase B	SINT32	0 to 99999999	Wh per energy format		2

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
0603 - 0604	1540 - 1541	W-hours, Total, Phase C	SINT32	0 to 99999999	Wh per energy format		2
0605 - 0606	1542 - 1543	VAR-hours, Positive, Phase A	SINT32	0 to 99999999	VARh per energy format		2
0607 - 0608	1544 - 1545	VAR-hours, Positive, Phase B	SINT32	0 to 99999999	VARh per energy format		2
0609 - 060A	1546 - 1547	VAR-hours, Positive, Phase C	SINT32	0 to 99999999	VARh per energy format		2
060B - 060C	1548 - 1549	VAR-hours, Negative, Phase A	SINT32	0 to -99999999	VARh per energy format		2
060D - 060E	1550 - 1551	VAR-hours, Negative, Phase B	SINT32	0 to -99999999	VARh per energy format		2
060F - 0610	1552 - 1553	VAR-hours, Negative, Phase C	SINT32	0 to -99999999	VARh per energy format		2
0611 - 0612	1554 - 1555	VAR-hours, Net, Phase A	SINT32	-99999999 to 99999999	VARh per energy format		2
0613 - 0614	1556 - 1557	VAR-hours, Net, Phase B	SINT32	-99999999 to 99999999	VARh per energy format		2
0615 - 0616	1558 - 1559	VAR-hours, Net, Phase C	SINT32	-99999999 to 99999999	VARh per energy format		2
0617 - 0618	1560 - 1561	VAR-hours, Total, Phase A	SINT32	0 to 99999999	VARh per energy format		2
0619 - 061A	1562 - 1563	VAR-hours, Total, Phase B	SINT32	0 to 99999999	VARh per energy format		2
061B - 061C	1564 - 1565	VAR-hours, Total, Phase C	SINT32	0 to 99999999	VARh per energy format		2
061D - 061E	1566 - 1567	VA-hours, Phase A	SINT32	0 to 99999999	VAh per energy format		2
061F - 0620	1568 - 1569	VA-hours, Phase B	SINT32	0 to 99999999	VAh per energy format		2
0621 - 0622	1570 - 1571	VA-hours, Phase C	SINT32	0 to 99999999	VAh per energy format		2
0623 - 0624	1572 - 1573	W-hours, Received, rollover count	UINT32	0 to 4,294,967,294		These registers count the number of times their corresponding energy accumulators have wrapped from ±max to 0. They are reset when energy is reset.	2
0625 - 0626	1574 - 1575	W-hours, Delivered, rollover count	UINT32	0 to 4,294,967,294			2
0627 - 0628	1576 - 1577	VAR-hours, Positive, rollover count	UINT32	0 to 4,294,967,294			2
0629 - 062A	1578 - 1579	VAR-hours, Negative, rollover count	UINT32	0 to 4,294,967,294			2
062B - 062C	1580 - 1581	VA-hours, rollover count	UINT32	0 to 4,294,967,294			2
062D - 062E	1582 - 1583	W-hours in the Interval, Received	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format	* Wh received & delivered always have opposite signs	2
062F - 0630	1584 - 1585	W-hours in the Interval, Delivered	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format	* Wh received is positive for "view as load" , delivered is positive for "view as generator"	2
0631 - 0632	1586 - 1587	VAR-hours in the Interval, Positive	SINT32	0 to 99999999	VARh per energy format		2
0633 - 0634	1588 - 1589	VAR-hours in the Interval, Negative	SINT32	0 to -99999999	VARh per energy format	* 5 to 8 digits	2
0635 - 0636	1590 - 1591	VA-hours in the Interval, Total	SINT32	0 to 99999999	VAh per energy format		2
0637 - 0638	1592 - 1593	W-hours in the Interval, Received, Phase A	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format	* decimal point implied, per energy format	2
0639 - 063A	1594 - 1595	W-hours in the Interval, Received, Phase B	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format	* resolution of digit before decimal point = units, kilo, or mega, per energy format	2
063B - 063C	1596 - 1597	W-hours in the Interval, Received, Phase C	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format	* see note 10	2
063D - 063E	1598 - 1599	W-hours in the Interval, Delivered, Phase A	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
063F - 0640	1600 - 1601	W-hours in the Interval, Delivered, Phase B	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
0641 - 0642	1602 - 1603	W-hours in the Interval, Delivered, Phase C	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
0643 - 0644	1604 - 1605	VAR-hours in the Interval, Positive, Phase A	SINT32	0 to 99999999	VARh per energy format		2
0645 - 0646	1606 - 1607	VAR-hours in the Interval, Positive, Phase B	SINT32	0 to 99999999	VARh per energy format		2
0647 - 0648	1608 - 1609	VAR-hours in the Interval, Positive, Phase C	SINT32	0 to 99999999	VARh per energy format		2
0649 - 064A	1610 - 1611	VAR-hours in the Interval, Negative, Phase A	SINT32	0 to -99999999	VARh per energy format		2
064B - 064C	1612 - 1613	VAR-hours in the Interval, Negative, Phase B	SINT32	0 to -99999999	VARh per energy format		2
063D - 064E	1614 - 1615	VAR-hours in the Interval, Negative, Phase C	SINT32	0 to -99999999	VARh per energy format		2
064F - 0650	1616 - 1617	VA-hours in the Interval, Phase A	SINT32	0 to 99999999	VAh per energy format		2
0651 - 0652	1618 - 1619	VA-hours in the Interval, Phase B	SINT32	0 to 99999999	VAh per energy format		2
0653 - 0654	1620 - 1621	VA-hours in the Interval, Phase C	SINT32	0 to 99999999	VAh per energy format		2
						Block Size:	122

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Primary Demand Block						**read-only**	
07CC - 07CE	1997 - 1999	Demand Interval End Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec	Ex. Timestamp hh:mm:ss is 03:15:00 and interval size is 15 minutes. Demand interval was 3:00:00 to 3:15:00. Note: Timestamp is zero until the end of the first interval after meter startup.	3
07CF - 07D0	2000 - 2001	Amps A, Average	FLOAT	0 to 9999 M	amps		2
07D1 - 07D2	2002 - 2003	Amps B, Average	FLOAT	0 to 9999 M	amps		2
07D3 - 07D4	2004 - 2005	Amps C, Average	FLOAT	0 to 9999 M	amps		2
07D5 - 07D6	2006 - 2007	Positive Watts, 3-Ph, Average	FLOAT	-9999 M to +9999 M	watts		2
07D7 - 07D8	2008 - 2009	Positive VARs, 3-Ph, Average	FLOAT	-9999 M to +9999 M	VARs		2
07D9 - 07DA	2010 - 2011	Negative Watts, 3-Ph, Average	FLOAT	-9999 M to +9999 M	watts		2
07DB - 07DC	2012 - 2013	Negative VARs, 3-Ph, Average	FLOAT	-9999 M to +9999 M	VARs		2
07DD - 07DE	2014 - 2015	VAs, 3-Ph, Average	FLOAT	-9999 M to +9999 M	VAs		2
07DF - 07E0	2016 - 2017	Positive PF, 3-Ph, Average	FLOAT	-1.00 to +1.00	none		2
07E1 - 07E2	2018 - 2019	Negative PF, 3-PF, Average	FLOAT	-1.00 to +1.00	none		2
07E3 - 07E4	2020 - 2021	Neutral Current, Average	FLOAT	0 to 9999 M	amps		2
07E5 - 07E6	2022 - 2023	Positive Watts, Phase A, Average	FLOAT	-9999 M to +9999 M	watts		2
07E7 - 07E8	2024 - 2025	Positive Watts, Phase B, Average	FLOAT	-9999 M to +9999 M	watts		2
07E9 - 07EA	2026 - 2027	Positive Watts, Phase C, Average	FLOAT	-9999 M to +9999 M	watts		2
07EB - 07EC	2028 - 2029	Positive VARs, Phase A, Average	FLOAT	-9999 M to +9999 M	VARs		2
07ED - 07EE	2030 - 2031	Positive VARs, Phase B, Average	FLOAT	-9999 M to +9999 M	VARs		2
07EF - 07F0	2032 - 2033	Positive VARs, Phase C, Average	FLOAT	-9999 M to +9999 M	VARs		2
07F1 - 07F2	2034 - 2035	Negative Watts, Phase A, Average	FLOAT	-9999 M to +9999 M	watts		2
07F3 - 07F4	2036 - 2037	Negative Watts, Phase B, Average	FLOAT	-9999 M to +9999 M	watts		2
07F5 - 07F6	2038 - 2039	Negative Watts, Phase C, Average	FLOAT	-9999 M to +9999 M	watts		2
07F7 - 07F8	2040 - 2041	Negative VARs, Phase A, Average	FLOAT	-9999 M to +9999 M	VARs		2
07F9 - 07FA	2042 - 2043	Negative VARs, Phase B, Average	FLOAT	-9999 M to +9999 M	VARs		2
07FB - 07FC	2044 - 2045	Negative VARs, Phase C, Average	FLOAT	-9999 M to +9999 M	VARs		2
07FD - 07FE	2046 - 2047	VAs, Phase A, Average	FLOAT	-9999 M to +9999 M	VAs		2
07FF - 0800	2048 - 2049	VAs, Phase B, Average	FLOAT	-9999 M to +9999 M	VAs		2
0801 - 0802	2050 - 2051	VAs, Phase C, Average	FLOAT	-9999 M to +9999 M	VAs		2
0803 - 0804	2052 - 2053	Positive PF, Phase A, Average	FLOAT	-1.00 to +1.00	none		2
0805 - 0806	2054 - 2055	Positive PF, Phase B, Average	FLOAT	-1.00 to +1.00	none		2
0807 - 0808	2056 - 2057	Positive PF, Phase C, Average	FLOAT	-1.00 to +1.00	none		2
0809 - 080A	2058 - 2059	Negative PF, Phase A, Average	FLOAT	-1.00 to +1.00	none		2
080B - 080C	2060 - 2061	Negative PF, Phase B, Average	FLOAT	-1.00 to +1.00	none		2
080D - 080E	2062 - 2063	Negative PF, Phase C, Average	FLOAT	-1.00 to +1.00	none		2
						Block Size:	64
Uncompensated Readings Block						**read-only**	
0BB7 - 0BB8	3000 - 3001	Watts, 3-Ph total	FLOAT	-9999 M to +9999 M	watts		2
0BB9 - 0BBA	3002 - 3003	VARs, 3-Ph total	FLOAT	-9999 M to +9999 M	VARs		2
0BBB - 0BBC	3004 - 3005	VAs, 3-Ph total	FLOAT	-9999 M to +9999 M	VAs		2
0BBD - 0BBE	3006 - 3007	Power Factor, 3-Ph total	FLOAT	-1.00 to +1.00	none		2

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
0BBF - 0BC0	3008 - 3009	Watts, Phase A	FLOAT	-9999 M to +9999 M	watts	Per phase power and PF have values only for WYE hookup and will be zero for all other hookups.	2
0BC1 - 0BC2	3010 - 3011	Watts, Phase B	FLOAT	-9999 M to +9999 M	watts		2
0BC3 - 0BC4	3012 - 3013	Watts, Phase C	FLOAT	-9999 M to +9999 M	watts		2
0BC5 - 0BC6	3014 - 3015	VARs, Phase A	FLOAT	-9999 M to +9999 M	VARs		2
OBC7 - 0BC8	3016 - 3017	VARs, Phase B	FLOAT	-9999 M to +9999 M	VARs		2
0BC9 - 0BCA	3018 - 3019	VARs, Phase C	FLOAT	-9999 M to +9999 M	VARs		2
0BCB - 0BCC	3020 - 3021	VAs, Phase A	FLOAT	-9999 M to +9999 M	VAs		2
0BCD - 0BCE	3022 - 3023	VAs, Phase B	FLOAT	-9999 M to +9999 M	VAs		2
0BCF - 0BD0	3024 - 3025	VAs, Phase C	FLOAT	-9999 M to +9999 M	VAs		2
0BD1 - 0BD2	3026 - 3027	Power Factor, Phase A	FLOAT	-1.00 to +1.00	none		2
0BD3 - 0BD4	3028 - 3029	Power Factor, Phase B	FLOAT	-1.00 to +1.00	none		2
0BD5 - 0BD6	3030 - 3031	Power Factor, Phase C	FLOAT	-1.00 to +1.00	none		2
0BD7 - 0BD8	3032 - 3033	W-hours, Received	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format	* Wh received & delivered always have opposite signs	2
0BD9 - 0BDA	3034 - 3035	W-hours, Delivered	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format	* Wh received is positive for "view as load", delivered is positive for "view as generator"	2
0BDB - 0BDC	3036 - 3037	W-hours, Net	SINT32	-99999999 to 99999999	Wh per energy format	* 5 to 8 digits	2
0BDD - 0BDE	3038 - 3039	W-hours, Total	SINT32	0 to 99999999	Wh per energy format		2
0BDF - 0BE0	3040 - 3041	VAR-hours, Positive	SINT32	0 to 99999999	VARh per energy format	* decimal point implied, per energy format	2
0BE1 - 0BE2	3042 - 3043	VAR-hours, Negative	SINT32	0 to -99999999	VARh per energy format		2
0BE3 - 0BE4	3044 - 3045	VAR-hours, Net	SINT32	-99999999 to 99999999	VARh per energy format	* resolution of digit before decimal point = units, kilo, or mega, per energy format	2
0BE5 - 0BE6	3046 - 3047	VAR-hours, Total	SINT32	0 to 99999999	VARh per energy format	* see note 10	2
0BE7 - 0BE8	3048 - 3049	VA-hours, Total	SINT32	0 to 99999999	VAh per energy format		2
0BE9 - 0BEA	3050 - 3051	W-hours, Received, Phase A	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
0BEB - 0BEC	3052 - 3053	W-hours, Received, Phase B	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
0BED - 0BEE	3054 - 3055	W-hours, Received, Phase C	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
0BEF - 0BF0	3056 - 3057	W-hours, Delivered, Phase A	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
0BF1 - 0BF2	3058 - 3059	W-hours, Delivered, Phase B	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
0BF3 - 0BF4	3060 - 3061	W-hours, Delivered, Phase C	SINT32	0 to 99999999 or 0 to -99999999	Wh per energy format		2
0BF5 - 0BF6	3062 - 3063	W-hours, Net, Phase A	SINT32	-99999999 to 99999999	Wh per energy format		2
0BF7 - 0BF8	3064 - 3065	W-hours, Net, Phase B	SINT32	-99999999 to 99999999	Wh per energy format		2
0BF9 - 0BFA	3066 - 3067	W-hours, Net, Phase C	SINT32	-99999999 to 99999999	Wh per energy format		2
0BFB - 0BFC	3068 - 3069	W-hours, Total, Phase A	SINT32	0 to 99999999	Wh per energy format		2
0BFD - 0BFE	3070 - 3071	W-hours, Total, Phase B	SINT32	0 to 99999999	Wh per energy format		2
0BFF - 0C00	3072 - 3073	W-hours, Total, Phase C	SINT32	0 to 99999999	Wh per energy format		2
0C01 - 0C02	3074 - 3075	VAR-hours, Positive, Phase A	SINT32	0 to 99999999	VARh per energy format		2
0C03 - 0C04	3076 - 3077	VAR-hours, Positive, Phase B	SINT32	0 to 99999999	VARh per energy format		2
0C05 - 0C06	3078 - 3079	VAR-hours, Positive, Phase C	SINT32	0 to 99999999	VARh per energy format		2
0C07 - 0C08	3080 - 3081	VAR-hours, Negative, Phase A	SINT32	0 to -99999999	VARh per energy format		2
0C09 - 0C0A	3082 - 3083	VAR-hours, Negative, Phase B	SINT32	0 to -99999999	VARh per energy format		2
0C0B - 0C0C	3084 - 3085	VAR-hours, Negative, Phase C	SINT32	0 to -99999999	VARh per energy format		2
0C0D - 0C0E	3086 - 3087	VAR-hours, Net, Phase A	SINT32	-99999999 to 99999999	VARh per energy format		2

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
0C0F - 0C10	3088 - 3089	VAR-hours, Net, Phase B	SINT32	-99999999 to 99999999	VARh per energy format		2
0C11 - 0C12	3090 - 3091	VAR-hours, Net, Phase C	SINT32	-99999999 to 99999999	VARh per energy format		2
0C13 - 0C14	3092 - 3093	VAR-hours, Total, Phase A	SINT32	0 to 99999999	VARh per energy format		2
0C15 - 0C16	3094 - 3095	VAR-hours, Total, Phase B	SINT32	0 to 99999999	VARh per energy format		2
0C17 - 0C18	3096 - 3097	VAR-hours, Total, Phase C	SINT32	0 to 99999999	VARh per energy format		2
0C19 - 0C1A	3098 - 3099	VA-hours, Phase A	SINT32	0 to 99999999	VAh per energy format		2
0C1B - 0C1C	3100 - 3101	VA-hours, Phase B	SINT32	0 to 99999999	VAh per energy format		2
0C1D - 0C1E	3102 - 3103	VA-hours, Phase C	SINT32	0 to 99999999	VAh per energy format		2
						Block Size:	104
Phase Angle Block						**read-only**	
1003 - 1003	4100 - 4100	Phase A Current	SINT16	-1800 to +1800	0.1 degree		1
1004 - 1004	4101 - 4101	Phase B Current	SINT16	-1800 to +1800	0.1 degree		1
1005 - 1005	4102 - 4102	Phase C Current	SINT16	-1800 to +1800	0.1 degree		1
1006 - 1006	4103 - 4103	Angle, Volts A-B	SINT16	-1800 to +1800	0.1 degree		1
1007 - 1007	4104 - 4104	Angle, Volts B-C	SINT16	-1800 to +1800	0.1 degree		1
1008 - 1008	4105 - 4105	Angle, Volts C-A	SINT16	-1800 to +1800	0.1 degree		1
						Block Size:	6
Status Block						**read-only**	
1193 - 1193	4500 - 4500	Port ID	UINT16	1 to 4	none	Identifies which Shark COM port a master is connected to; 1 for COM1, 2 for COM2, etc.	1
1194 - 1194	4501 - 4501	Meter Status	UINT16	bit-mapped	mmmpch-- tffeeccc	mmm = measurement state (0=off, 1=running normally, 2=limp mode, 3=warmup, 6&7=boot, others unused) See note 16. pch = NVMEM block OK flags (p=profile, c=calibration, h=header), flag is 1 if OK t - CT PT compensation status. (0=Disabled,1=Enabled) ff = flash state (0=initializing, 1=logging disabled by Vswitch, 3=logging) ee = edit state (0=startup, 1=normal, 2=privileged command session, 3=profile update mode) ccc = port enabled for edit(0=none, 1-4=COM1-COM4, 7=front panel)	1
1195 - 1195	4502 - 4502	Limits Status	UINT16	bit-mapped	87654321 87654321	high byte is setpt 1, 0=in, 1=out low byte is setpt 2, 0=in, 1=out see notes 11, 12, 17	1

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
1196 - 1197	4503 - 4504	Time Since Reset	UINT32	0 to 4294967294	4 msec	wraps around after max count	2
1198 - 119A	4505 - 4507	Meter On Time	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
119B - 119D	4508 - 4510	Current Date and Time	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
119E - 119E	4511 - 4511	Clock Sync Status	UINT16	bit-mapped	mmmp pppe 0000 000s	mmmp pppe = configuration per programmable settings (see register 30011, 0x753A) s = status: 1=working properly, 0=not working	1
119F - 119F	4512 - 4512	Current Day of Week	UINT16	1 to 7	1 day	1=Sun, 2=Mon, etc.	1
						Block Size:	13
THD Block (Note 13)						**read-only**	
176F - 176F	6000 - 6000	Volts A-N, %THD	UINT16	0 to 10000	0.01%		1
1770 - 1770	6001 - 6001	Volts B-N, %THD	UINT16	0 to 10000	0.01%		1
1771 - 1771	6002 - 6002	Volts C-N, %THD	UINT16	0 to 10000	0.01%		1
1772 - 1772	6003 - 6003	Amps A, %THD	UINT16	0 to 10000	0.01%		1
1773 - 1773	6004 - 6004	Amps B, %THD	UINT16	0 to 10000	0.01%		1
1774 - 1774	6005 - 6005	Amps C, %THD	UINT16	0 to 10000	0.01%		1
1775 - 179C	6006 - 6045	Phase A Voltage harmonic magnitudes	UINT16	0 to 10000	0.01%	In each group of 40 registers, the first register represents the fundamental frequency or first harmonic, the second represents the second harmonic, and so on up to the 40th register which represents the 40th harmonic. Harmonic magnitudes are given as % of the fundamental magnitude. Thus the first register in each group of 40 will typically be 9999. A reading of 10000 indicates invalid.	40
179D - 17C4	6046 - 6085	Phase A Voltage harmonic phases	SINT16	-1800 to +1800	0.1 degree		40
17C5 - 17EC	6086 - 6125	Phase A Current harmonic magnitudes	UINT16	0 to 10000	0.01%		40
17ED - 1814	6126 - 6165	Phase A Current harmonic phases	SINT16	-1800 to +1800	0.1 degree		40
1815 - 183C	6166 - 6205	Phase B Voltage harmonic magnitudes	UINT16	0 to 10000	0.01%		40
183D - 1864	6206 - 6245	Phase B Voltage harmonic phases	SINT16	-1800 to +1800	0.1 degree		40
1865 - 188C	6246 - 6285	Phase B Current harmonic magnitudes	UINT16	0 to 10000	0.01%		40
188D - 18B4	6286 - 6325	Phase B Current harmonic phases	SINT16	-1800 to +1800	0.1 degree		40
18B5 - 18DC	6326 - 6365	Phase C Voltage harmonic magnitudes	UINT16	0 to 10000	0.01%		40
18DD - 1904	6366 - 6405	Phase C Voltage harmonic phases	SINT16	-1800 to +1800	0.1 degree		40
1905 - 192C	6406 - 6445	Phase C Current harmonic magnitudes	UINT16	0 to 10000	0.01%		40
192D - 1954	6446 - 6485	Phase C Current harmonic phases	SINT16	-1800 to +1800	0.1 degree		40
1955 - 1955	6486 - 6486	Wave Scope scale factor for channel Va	UINT16	0 to 32767		Convert individual samples to volts or amps: V or A = (sample * scale factor) / 1,000,000 Samples update in conjunction with THD and harmonics; samples not available (all zeroes) if THD not available.	1
1956 - 1956	6487 - 6487	Wave Scope scale factors for channel Ib	UINT16	0 to 32767			1
1957 - 1958	6488 - 6489	Wave Scope scale factors for channels Vb and Ib	UINT16	0 to 32767			2
1959 - 195A	6490 - 6491	Wave Scope scale factors for channels Vc and Ic	UINT16	0 to 32767			2
195B - 199A	6492 - 6555	Wave Scope samples for channel Va	SINT16	-32768 to +32767			64
199B - 19DA	6556 - 6619	Wave Scope samples for channel Ia	SINT16	-32768 to +32767			64
19DB - 1A1A	6620 - 6683	Wave Scope samples for channel Vb	SINT16	-32768 to +32767			64
1A1B - 1A5A	6684 - 6747	Wave Scope samples for channel Ib	SINT16	-32768 to +32767			64
1A5B - 1A9A	6748 - 6811	Wave Scope samples for channel Vc	SINT16	-32768 to +32767			64
1A9B - 1ADA	6812 - 6875	Wave Scope samples for channel Ic	SINT16	-32768 to +32767			64
						Block Size:	876

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Short term Primary Minimum Block						**read-only**	
1F27 - 1F28	7976 - 7977	Volts A-N, previous Demand interval Short Term Minimum	FLOAT	0 to 9999 M	volts		2
1F29 - 1F2A	7978 - 7979	Volts B-N, previous Demand interval Short Term Minimum	FLOAT	0 to 9999 M	volts		2
1F2B - 1F2C	7980 - 7981	Volts C-N, previous Demand interval Short Term Minimum	FLOAT	0 to 9999 M	volts		2
1F2D - 1F2E	7982 - 7983	Volts A-B, previous Demand interval Short Term Minimum	FLOAT	0 to 9999 M	volts	Minimum instantaneous value measured during the demand interval before the one most recently completed.	2
1F2F - 1F30	7984 - 7985	Volts B-C, previous Demand interval Short Term Minimum	FLOAT	0 to 9999 M	volts		2
1F31 - 1F32	7986 - 7987	Volts C-A, previous Demand interval Short Term Minimum	FLOAT	0 to 9999 M	volts		2
1F33 - 1F34	7988 - 7989	Volts A-N, Short Term Minimum	FLOAT	0 to 9999 M	volts		2
1F35 - 1F36	7990 - 7991	Volts B-N, Short Term Minimum	FLOAT	0 to 9999 M	volts		2
1F37 - 1F38	7992 - 7993	Volts C-N, Short Term Minimum	FLOAT	0 to 9999 M	volts	Minimum instantaneous value measured during the most recently completed demand interval.	2
1F39 - 1F3A	7994 - 7995	Volts A-B, Short Term Minimum	FLOAT	0 to 9999 M	volts		2
1F3B - 1F3C	7996 - 7997	Volts B-C, Short Term Minimum	FLOAT	0 to 9999 M	volts		2
1F3D - 1F3E	7998 - 7999	Volts C-A, Short Term Minimum	FLOAT	0 to 9999 M	volts		2
						Block Size:	24
Primary Minimum Block						**read-only**	
1F3F - 1F40	8000 - 8001	Volts A-N, Minimum	FLOAT	0 to 9999 M	volts		2
1F41 - 1F42	8002 - 8003	Volts B-N, Minimum	FLOAT	0 to 9999 M	volts		2
1F43 - 1F44	8004 - 8005	Volts C-N, Minimum	FLOAT	0 to 9999 M	volts		2
1F45 - 1F46	8006 - 8007	Volts A-B, Minimum	FLOAT	0 to 9999 M	volts		2
1F47 - 1F48	8008 - 8009	Volts B-C, Minimum	FLOAT	0 to 9999 M	volts		2
1F49 - 1F4A	8010 - 8011	Volts C-A, Minimum	FLOAT	0 to 9999 M	volts		2
1F4B - 1F4C	8012 - 8013	Amps A, Minimum Avg Demand	FLOAT	0 to 9999 M	amps		2
1F4D - 1F4E	8014 - 8015	Amps B, Minimum Avg Demand	FLOAT	0 to 9999 M	amps		2
1F4F - 1F50	8016 - 8017	Amps C, Minimum Avg Demand	FLOAT	0 to 9999 M	amps		2
1F51 - 1F52	8018 - 8019	Positive Watts, 3-Ph, Minimum Avg Demand	FLOAT	0 to +9999 M	watts		2
1F53 - 1F54	8020 - 8021	Positive VARs, 3-Ph, Minimum Avg Demand	FLOAT	0 to +9999 M	VARs		2
1F55 - 1F56	8022 - 8023	Negative Watts, 3-Ph, Minimum Avg Demand	FLOAT	0 to +9999 M	watts		2
1F57 - 1F58	8024 - 8025	Negative VARs, 3-Ph, Minimum Avg Demand	FLOAT	0 to +9999 M	VARs		2
1F59 - 1F5A	8026 - 8027	VAs, 3-Ph, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	VAs		2
1F5B - 1F5C	8028 - 8029	Positive Power Factor, 3-Ph, Minimum Avg Demand	FLOAT	-1.00 to +1.00	none		2
1F5D - 1F5E	8030 - 8031	Negative Power Factor, 3-Ph, Minimum Avg Demand	FLOAT	-1.00 to +1.00	none		2
1F5F - 1F60	8032 - 8033	Frequency, Minimum	FLOAT	0 to 65.00	Hz		2
1F61 - 1F62	8034 - 8035	Neutral Current, Minimum Avg Demand	FLOAT	0 to 9999 M	amps		2
1F63 - 1F64	8036 - 8037	Positive Watts, Phase A, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2
1F65 - 1F66	8038 - 8039	Positive Watts, Phase B, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
1F67 - 1F68	8040 - 8041	Positive Watts, Phase C, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2
1F69 - 1F6A	8042 - 8043	Positive VARs, Phase A, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
1F6B - 1F6C	8044 - 8045	Positive VARs, Phase B, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
1F6D - 1F6E	8046 - 8047	Positive VARs, Phase C, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
1F6F - 1F70	8048 - 8049	Negative Watts, Phase A, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2
1F71 - 1F72	8050 - 8051	Negative Watts, Phase B, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2
1F73 - 1F74	8052 - 8053	Negative Watts, Phase C, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2
1F75 - 1F76	8054 - 8055	Negative VARs, Phase A, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
1F77 - 1F78	8056 - 8057	Negative VARs, Phase B, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
1F79 - 1F7A	8058 - 8059	Negative VARs, Phase C, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
1F7B - 1F7C	8060 - 8061	VAs, Phase A, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	VAs		2
1F7D - 1F7E	8062 - 8063	VAs, Phase B, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	VAs		2
1F7F - 1F80	8064 - 8065	VAs, Phase C, Minimum Avg Demand	FLOAT	-9999 M to +9999 M	VAs		2
1F81 - 1F82	8066 - 8067	Positive PF, Phase A, Minimum Avg Demand	FLOAT	-1.00 to +1.00	none		2
1F83 - 1F84	8068 - 8069	Positive PF, Phase B, Minimum Avg Demand	FLOAT	-1.00 to +1.00	none		2
1F85 - 1F86	8070 - 8071	Positive PF, Phase C, Minimum Avg Demand	FLOAT	-1.00 to +1.00	none		2
1F87 - 1F88	8072 - 8073	Negative PF, Phase A, Minimum Avg Demand	FLOAT	-1.00 to +1.00	none		2
1F89 - 1F8A	8074 - 8075	Negative PF, Phase B, Minimum Avg Demand	FLOAT	-1.00 to +1.00	none		2
1F8B - 1F8C	8076 - 8077	Negative PF, Phase C, Minimum Avg Demand	FLOAT	-1.00 to +1.00	none		2
1F8D - 1F8D	8078 - 8078	Volts A-N, %THD, Minimum	UINT16	0 to 9999	0.01%		1
1F8E - 1F8E	8079 - 8079	Volts B-N, %THD, Minimum	UINT16	0 to 9999	0.01%		1
1F8F - 1F8F	8080 - 8080	Volts C-N, %THD, Minimum	UINT16	0 to 9999	0.01%		1
1F90 - 1F90	8081 - 8081	Amps A, %THD, Minimum	UINT16	0 to 9999	0.01%		1
1F91 - 1F91	8082 - 8082	Amps B, %THD, Minimum	UINT16	0 to 9999	0.01%		1
1F92 - 1F92	8083 - 8083	Amps C, %THD, Minimum	UINT16	0 to 9999	0.01%		1
1F93 - 1F94	8084 - 8085	Symmetrical Component Magnitude, 0 Seq, Minimum	FLOAT	0 to 9999 M	volts		2
1F95 - 1F96	8086 - 8087	Symmetrical Component Magnitude, + Seq, Minimum	FLOAT	0 to 9999 M	volts		2
1F97 - 1F98	8088 - 8089	Symmetrical Component Magnitude, - Seq, Minimum	FLOAT	0 to 9999 M	volts		2
1F99 - 1F99	8090 - 8090	Symmetrical Component Phase, 0 Seq, Minimum	SINT16	-1800 to +1800	0.1 degree		1
1F9A - 1F9A	8091 - 8091	Symmetrical Component Phase, + Seq, Minimum	SINT16	-1800 to +1800	0.1 degree		1
1F9B - 1F9B	8092 - 8092	Symmetrical Component Phase, - Seq, Minimum	SINT16	-1800 to +1800	0.1 degree		1
1F9C - 1F9C	8093 - 8093	Unbalance, 0 sequence, Minimum	UINT16	0 to 65535	0.01%		1
1F9D - 1F9D	8094 - 8094	Unbalance, -sequence, Minimum	UINT16	0 to 65535	0.01%		1
1F9E - 1F9E	8095 - 8095	Current Unbalance, Minimum	UINT16	0 to 20000	0.01%		1
						Block Size:	96

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Primary Minimum Timestamp Block						**read-only**	
20CF - 20D1	8400 - 8402	Volts A-N, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20D2 - 20D4	8403 - 8405	Volts B-N, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20D5 - 20D7	8406 - 8408	Volts C-N, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20D8 - 20DA	8409 - 8411	Volts A-B, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20DB - 20DD	8412 - 8414	Volts B-C, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20DE - 20E0	8415 - 8417	Volts C-A, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20E1 - 20E3	8418 - 8420	Amps A, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20E4 - 20E6	8421 - 8423	Amps B, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20E7 - 20E9	8424 - 8426	Amps C, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20EA - 20EC	8427 - 8429	Positive Watts, 3-Ph, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20ED - 20EF	8430 - 8432	Positive VARs, 3-Ph, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20F0 - 20F2	8433 - 8435	Negative Watts, 3-Ph, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20F3 - 20F5	8436 - 8438	Negative VARs, 3-Ph, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20F6 - 20F8	8439 - 8441	VAs, 3-Ph, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20F9 - 20FB	8442 - 8444	Positive Power Factor, 3-Ph, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20FC - 20FE	8445 - 8447	Negative Power Factor, 3-Ph, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
20FF - 2101	8448 - 8450	Frequency, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2102 - 2104	8451 - 8453	Neutral Current, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2100	1 sec		3
2105 - 2107	8454 - 8456	Positive Watts, Phase A, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2108 - 210A	8457 - 8459	Positive Watts, Phase B, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
210B - 210D	8460 - 8462	Positive Watts, Phase C, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
210E - 2110	8463 - 8465	Positive VARs, Phase A, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2111 - 2113	8466 - 8468	Positive VARs, Phase B, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2114 - 2116	8469 - 8471	Positive VARs, Phase C, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2117 - 2119	8472 - 8474	Negative Watts, Phase A, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
211A - 211C	8475 - 8477	Negative Watts, Phase B, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
211D - 211F	8478 - 8480	Negative Watts, Phase C, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2120 - 2122	8481 - 8483	Negative VARs, Phase A, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2123 - 2125	8484 - 8486	Negative VARs, Phase B, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2126 - 2128	8487 - 8489	Negative VARs, Phase C, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2129 - 212B	8490 - 8492	VAs, Phase A, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
212C - 212E	8493 - 8495	VAs, Phase B, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
212F - 2131	8496 - 8498	VAs, Phase C, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2132 - 2134	8499 - 8501	Positive PF, Phase A, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2135 - 2137	8502 - 8504	Positive PF, Phase B, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
2138 - 213A	8505 - 8507	Positive PF, Phase C, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
213B - 213D	8508 - 8510	Negative PF, Phase A, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
213E - 2140	8511 - 8513	Negative PF, Phase B, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2141 - 2143	8514 - 8516	Negative PF, Phase C, Min Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2144 - 2146	8517 - 8519	Volts A-N, %THD, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2147 - 2149	8520 - 8522	Volts B-N, %THD, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
214A - 214C	8523 - 8525	Volts C-N, %THD, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
214D - 214F	8526 - 8528	Amps A, %THD, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2150 - 2152	8529 - 8531	Amps B, %THD, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2153 - 2155	8532 - 8534	Amps C, %THD, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2156 - 2158	8535 - 8537	Symmetrical Comp Magnitude, 0 Seq, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2159 - 215B	8538 - 8540	Symmetrical Comp Magnitude, + Seq, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
215C - 215E	8541 - 8543	Symmetrical Comp Magnitude, - Seq, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
215F - 2161	8544 - 8546	Symmetrical Comp Phase, 0 Seq, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2162 - 2164	8547 - 8549	Symmetrical Comp Phase, + Seq, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2165 - 2167	8550 - 8552	Symmetrical Comp Phase, - Seq, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2168 - 2170	8553 - 8555	Unbalance, 0 Seq, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2171 - 2173	8556 - 8558	Unbalance, - Seq, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2174 - 2176	8559 - 8561	Current Unbalance, Min Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
						Block Size:	162
Short term Primary Maximum Block						**read-only**	
230F - 2310	8976 - 8977	Volts A-N, previous Demand interval Short Term Maximum	FLOAT	0 to 9999 M	volts	Maximum instantaneous value measured during the demand interval before the one most recently completed.	
2311 - 2312	8978 - 8979	Volts B-N, previous Demand interval Short Term Maximum	FLOAT	0 to 9999 M	volts		
2313 - 2314	8980 - 8981	Volts C-N, previous Demand interval Short Term Maximum	FLOAT	0 to 9999 M	volts		
2315 - 2316	8982 - 8983	Volts A-B, previous Demand interval Short Term Maximum	FLOAT	0 to 9999 M	volts		
2317 - 2318	8984 - 8985	Volts B-C, previous Demand interval Short Term Maximum	FLOAT	0 to 9999 M	volts		
2319 - 231A	8986 - 8987	Volts C-A, previous Demand interval Short Term Maximum	FLOAT	0 to 9999 M	volts		
231B - 231C	8988 - 8989	Volts A-N, Maximum	FLOAT	0 to 9999 M	volts	Maximum instantaneous value measured during the most recently completed demand interval.	2
231D - 231E	8990 - 8991	Volts B-N, Maximum	FLOAT	0 to 9999 M	volts		2
232F - 2320	8992 - 8993	Volts C-N, Maximum	FLOAT	0 to 9999 M	volts		2
2321 - 2322	8994 - 8995	Volts A-B, Maximum	FLOAT	0 to 9999 M	volts		2
2323 - 2324	8996 - 8997	Volts B-C, Maximum	FLOAT	0 to 9999 M	volts		2
2325 - 2326	8998 - 8999	Volts C-A, Maximum	FLOAT	0 to 9999 M	volts		2
						Block Size:	12

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Primary Maximum Block						**read-only**	
2327 - 2328	9000 - 9001	Volts A-N, Maximum	FLOAT	0 to 9999 M	volts		2
2329 - 232A	9002 - 9003	Volts B-N, Maximum	FLOAT	0 to 9999 M	volts		2
232B - 232C	9004 - 9005	Volts C-N, Maximum	FLOAT	0 to 9999 M	volts		2
232D - 232E	9006 - 9007	Volts A-B, Maximum	FLOAT	0 to 9999 M	volts		2
232F - 2330	9008 - 9009	Volts B-C, Maximum	FLOAT	0 to 9999 M	volts		2
2331 - 2332	9010 - 9011	Volts C-A, Maximum	FLOAT	0 to 9999 M	volts		2
2333 - 2334	9012 - 9013	Amps A, Maximum Avg Demand	FLOAT	0 to 9999 M	amps		2
2335 - 2336	9014 - 9015	Amps B, Maximum Avg Demand	FLOAT	0 to 9999 M	amps		2
2337 - 2338	9016 - 9017	Amps C, Maximum Avg Demand	FLOAT	0 to 9999 M	amps		2
2339 - 233A	9018 - 9019	Positive Watts, 3-Ph, Maximum Avg Demand	FLOAT	0 to +9999 M	watts		2
233B - 233C	9020 - 9021	Positive VARs, 3-Ph, Maximum Avg Demand	FLOAT	0 to +9999 M	VARs		2
233D - 233E	9022 - 9023	Negative Watts, 3-Ph, Maximum Avg Demand	FLOAT	0 to +9999 M	watts		2
233F - 2340	9024 - 9025	Negative VARs, 3-Ph, Maximum Avg Demand	FLOAT	0 to +9999 M	VARs		2
2341 - 2342	9026 - 9027	VAs, 3-Ph, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	VAs		2
2343 - 2344	9028 - 9029	Positive Power Factor, 3-Ph, Maximum Avg Demand	FLOAT	-1.00 to +1.00	none		2
2345 - 2346	9030 - 9031	Negative Power Factor, 3-Ph, Maximum Avg Demand	FLOAT	-1.00 to +1.00	none		2
2347 - 2348	9032 - 9033	Frequency, Maximum	FLOAT	0 to 65.00	Hz		2
2349 - 234A	9034 - 9035	Neutral Current, Maximum Avg Demand	FLOAT	0 to 9999 M	amps		2
234B - 234C	9036 - 9037	Positive Watts, Phase A, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2
234D - 234E	9038 - 9039	Positive Watts, Phase B, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2
234F - 2350	9040 - 9041	Positive Watts, Phase C, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2
2351 - 2352	9042 - 9043	Positive VARs, Phase A, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
2353 - 2354	9044 - 9045	Positive VARs, Phase B, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
2355 - 2356	9046 - 9047	Positive VARs, Phase C, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
2357 - 2358	9048 - 9049	Negative Watts, Phase A, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2
2359 - 235A	9050 - 9051	Negative Watts, Phase B, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2
235B - 235C	9052 - 9053	Negative Watts, Phase C, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	watts		2
235D - 235E	9054 - 9055	Negative VARs, Phase A, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
235F - 2360	9056 - 9057	Negative VARs, Phase B, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
2361 - 2362	9058 - 9059	Negative VARs, Phase C, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	VARs		2
2363 - 2364	9060 - 9061	VAs, Phase A, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	VAs		2
2365 - 2366	9062 - 9063	VAs, Phase B, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	VAs		2
2367 - 2368	9064 - 9065	VAs, Phase C, Maximum Avg Demand	FLOAT	-9999 M to +9999 M	VAs		2
2369 - 236A	9066 - 9067	Positive PF, Phase A, Maximum Avg Demand	FLOAT	-1.00 to +1.00	none		2

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
236B - 236C	9068 - 9069	Positive PF, Phase B, Maximum Avg Demand	FLOAT	-1.00 to +1.00	none		2
236D - 236E	9070 - 9071	Positive PF, Phase C, Maximum Avg Demand	FLOAT	-1.00 to +1.00	none		2
236F - 2370	9072 - 9073	Negative PF, Phase A, Maximum Avg Demand	FLOAT	-1.00 to +1.00	none		2
2371 - 2372	9074 - 9075	Negative PF, Phase B, Maximum Avg Demand	FLOAT	-1.00 to +1.00	none		2
2373 - 2374	9076 - 9077	Negative PF, Phase C, Maximum Avg Demand	FLOAT	-1.00 to +1.00	none		2
2375 - 2375	9078 - 9078	Volts A-N, %THD, Maximum	UINT16	0 to 9999	0.01%		1
2376 - 2376	9079 - 9079	Volts B-N, %THD, Maximum	UINT16	0 to 9999	0.01%		1
2377 - 2377	9080 - 9080	Volts C-N, %THD, Maximum	UINT16	0 to 9999	0.01%		1
2378 - 2378	9081 - 9081	Amps A, %THD, Maximum	UINT16	0 to 9999	0.01%		1
2379 - 2379	9082 - 9082	Amps B, %THD, Maximum	UINT16	0 to 9999	0.01%		1
237A - 237A	9083 - 9083	Amps C, %THD, Maximum	UINT16	0 to 9999	0.01%		1
237B - 237C	9084 - 9085	Symmetrical Component Magnitude, 0 Seq, Maximum	FLOAT	0 to 9999 M	volts		2
237D - 237E	9086 - 9087	Symmetrical Component Magnitude, + Seq, Maximum	FLOAT	0 to 9999 M	volts		2
237F - 2380	9088 - 9089	Symmetrical Component Magnitude, - Seq, Maximum	FLOAT	0 to 9999 M	volts		2
2381 - 2381	9090 - 9090	Symmetrical Component Phase, 0 Seq, Maximum	SINT16	-1800 to +1800	0.1 degree		1
2382 - 2382	9091 - 9091	Symmetrical Component Phase, + Seq, Maximum	SINT16	-1800 to +1800	0.1 degree		1
2383 - 2383	9092 - 9092	Symmetrical Component Phase, - Seq, Maximum	SINT16	-1800 to +1800	0.1 degree		1
2384 - 2384	9093 - 9093	Unbalance, 0 Seq, Maximum	UINT16	0 to 65535	0.01%		1
2385 - 2385	9094 - 9094	Unbalance, - Seq, Maximum	UINT16	0 to 65535	0.01%		1
2386 - 2386	9095 - 9095	Current Unbalance, Maximum	UINT16	0 to 20000	0.01%		1
						Block Size:	96
Primary Maximum Timestamp Block						**read-only**	
24B7 - 24B9	9400 - 9402	Volts A-N, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24BA - 24BC	9403 - 9405	Volts B-N, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24BD - 24BF	9406 - 9408	Volts C-N, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24C0 - 24C2	9409 - 9411	Volts A-B, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24C3 - 24C5	9412 - 9414	Volts B-C, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24C6 - 24C8	9415 - 9417	Volts C-A, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24C9 - 24CB	9418 - 9420	Amps A, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24CC - 24CE	9421 - 9423	Amps B, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24CF - 24D1	9424 - 9426	Amps C, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24D2 - 24D4	9427 - 9429	Positive Watts, 3-Ph, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24D5 - 24D7	9430 - 9432	Positive VARs, 3-Ph, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24D8 - 24DA	9433 - 9435	Negative Watts, 3-Ph, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24DB - 24DD	9436 - 9438	Negative VARs, 3-Ph, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24DE - 24E0	9439 - 9441	VAs, 3-Ph, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24E1 - 24E3	9442 - 9444	Positive Power Factor, 3-Ph, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24E4 - 24E6	9445 - 9447	Negative Power Factor, 3-Ph, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24E7 - 24E9	9448 - 9450	Frequency, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
24EA - 24EC	9451 - 9453	Neutral Current, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2100	1 sec		3
24ED - 24EF	9454 - 9456	Positive Watts, Phase A, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24F0 - 24F2	9457 - 9459	Positive Watts, Phase B, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24F3 - 24F5	9460 - 9462	Positive Watts, Phase C, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24F6 - 24F8	9463 - 9465	Positive VARs, Phase A, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24F9 - 24FB	9466 - 9468	Positive VARs, Phase B, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24FC - 24FE	9469 - 9471	Positive VARs, Phase C, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
24FF - 2501	9472 - 9474	Negative Watts, Phase A, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2502 - 2504	9475 - 9477	Negative Watts, Phase B, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2505 - 2507	9478 - 9480	Negative Watts, Phase C, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2508 - 250A	9481 - 9483	Negative VARs, Phase A, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
250B - 250D	9484 - 9486	Negative VARs, Phase B, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
250E - 2510	9487 - 9489	Negative VARs, Phase C, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2511 - 2513	9490 - 9492	VAs, Phase A, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2514 - 2516	9493 - 9495	VAs, Phase B, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2517 - 2519	9496 - 9498	VAs, Phase C, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
251A - 251C	9499 - 9501	Positive PF, Phase A, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
251D - 251F	9502 - 9504	Positive PF, Phase B, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2520 - 2522	9505 - 9507	Positive PF, Phase C, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2523 - 2525	9508 - 9510	Negative PF, Phase A, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2526 - 2528	9511 - 9513	Negative PF, Phase B, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2529 - 252B	9514 - 9516	Negative PF, Phase C, Max Avg Dmd Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
252C - 252E	9517 - 9519	Volts A-N, %THD, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
252F - 2531	9520 - 9522	Volts B-N, %THD, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2532 - 2534	9523 - 9525	Volts C-N, %THD, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2535 - 2537	9526 - 9528	Amps A, %THD, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2538 - 253A	9529 - 9531	Amps B, %THD, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
253B - 253D	9532 - 9534	Amps C, %THD, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
253E - 2540	9535 - 9537	Symmetrical Comp Magnitude, 0 Seq, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2541 - 2543	9538 - 9540	Symmetrical Comp Magnitude, + Seq, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2544 - 2546	9541 - 9543	Symmetrical Comp Magnitude, - Seq, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2547 - 2549	9544 - 9546	Symmetrical Comp Phase, 0 Seq, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
254A - 254C	9547 - 9549	Symmetrical Comp Phase, + Seq, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
254D - 254F	9550 - 9552	Symmetrical Comp Phase, - Seq, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2550 - 2552	9553 - 9555	Unbalance, 0 Seq, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2553 - 2555	9556 - 9558	Unbalance, - Seq, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
2556 - 2558	9559 - 9561	Current Unbalance, Max Timestamp	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
						Block Size:	159
		Option Card 1 Section					
Card Identification and Configuration Block (Note 14)						**read-only**	
270F - 270F	10000 - 10000	Class ID and card status	UINT16	bit-mapped	undv-----cccctttt	Flags active if bit is set: u=unsupported card; n=card need configuration; d=card is using default configuration; v=communication with card is ok Field: cccc=class of installed card. Field tttt=type of card. See note 22	1
2710 - 2710	10001 - 10001	Reserved				Reserved	1
2711 - 2718	10002 - 10009	Card name	ASCII	16 char	none	ASCII name of the installed card	8
2719 - 2720	10010 - 10017	Serial number	ASCII	16 char	none	Serial Number in ASCII of the installed card	8
2721 - 2722	10018 - 10019	Version	ASCII	4 char	none	Version in ASCII of the hardware of the installed card.	2
2723 - 2746	10020 - 10055	Reserved				Reserved	36
2747 - 2748	10056 - 10057	Firmware Version	ASCII	4 char	none	Version of the BOOT firmware of the card, left justified and padded with spaces. Blank for boards without embedded firmware.	2
2749 - 274A	10058 - 10059	Firmware Version	ASCII	4 char	none	Version of the RUN firmware of the card, left justified and padded with spaces. Blank for boards without embedded firmware.	2
274B - 274E	10060 - 10063	Reserved				Reserved	4
						Block Size:	64
Current Communication Settings for Option Card 1						**Read-only**	
274F - 274F	10064 - 10064	Current speed and format	UINT16	bit-mapped	-abcde-- fghijklm	Bps: a=57600; b=38400; c=19200; d=14400; e=9600 Stop bits 'f': cleared 1 stop bit, set 2 stop bits Parity: g=even; h=odd; i=none Data bits: j=8; k=7; l=6; m=5	1
2750 - 2750	10065 - 10065	Reserved	UINT16	bit-mapped		Reserved	1
2751 - 2751	10066 - 10066	Current protocol	UINT16	bit-mapped	-------- -----ppp-	ppp=protocol 100=DNP3; 010=Ascii Modbus; 001=Rtu Modbus	1
2752 - 2752	10067 - 10067	Current reply delay	UINT16	0 to 65535	milliseconds	Delay to reply to a Modbus transaction after receiving it.	1
2753 - 2756	10068 - 10071	Reserved				Reserved	4
						Block Size:	8
Data and Control Blocks for Option Card 1						**read-only**	
2757 - 2790	10072 - 10129	Data and Control Block for Option Card 1. Meaning of registers depends on installed card. -- see below				Register assignments depend on which type of card is in the slot. See overlays below.	58
						Block Size:	66

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Expansions for Data and Control Block for Option Card 1							
Data and Control Block -- Digital I/O Relay Card Overlay (Note 15)						**read-only except as indicated**	
2757 - 2757	10072 - 10072	Digital Input States	UINT16	bit-mapped	-------- 22221111	Two nibble fields: (2222) for input#2 and (1111) for input #1. Lsb in each nibble is the current state of the input. Msb in each nibble is the oldest registered state.	1
2758 - 2758	10073 - 10073	Digital Relay States	UINT16	bit-mapped	-------- --ab--cd	If "a" is 1 then state of Relay#2 is unknown, otherwise state of Relay#2 is in "c": (1=tripped, 0=released). If "b" is 1 then state of Relay#1 is unknown, otherwise state of Relay#1 is in "d": (1=tripped, 0=released).	1
2759 - 2759	10074 - 10074	Turn relay on	UINT16	bit-mapped	-------- ------21	Writing a 1 in bit N turns relay N+1 ON (this register is writeable only in privileged session)	1
275A - 275A	10075 - 10075	Turn relay off	UINT16	bit-mapped	-------- ------21	Writing a 1 in bit N turns relay N+1 OFF (this register is writeable only in privileged session)	1
275B - 275B	10076 - 10076	Trip/Release delay timer for Relay 1	UINT16	0 to 9999	0.1 sec	time to trip or release	1
275C - 275C	10077 - 10077	Trip/Release delay timer for Relay 2	UINT16	0 to 9999	0.1 sec	time to trip or release	1
275D - 275E	10078 - 10079	Reserved				Reserved	2
275F - 275F	10080 - 10080	Input 1 Accumulator, Scaled	UINT16	0 to 9999	resolution is 1, 10, 100, 1000, 10000, or 100000 counts	Disabled accumulators always read 0.	1
2760 - 2760	10081 - 10081	Input 2 Accumulator, Scaled	UINT16	0 to 9999			1
2761 - 2762	10082 - 10083	Reserved				Reserved	2
2763 - 2763	10084 - 10084	Relay 1 Accumulator, Scaled	UINT16	0 to 9999	resolution is 1, 10, 100, 1000, 10000, or 100000 counts	Disabled accumulators always read 0.	1
2764 - 2764	10085 - 10085	Relay 2 Accumulator, Scaled	UINT16	0 to 9999			1
2765 - 2790	10086 - 10129	Reserved				Reserved	44
						Block Size:	58
Data and Control Block -- Digital I/O Pulse Output Card Overlay (Note 15)						**read-only except as indicated**	
2757 - 2757	10072 - 10072	Digital Input States	UINT16	bit-mapped	dddd cccc bbbb aaaa	Nibble "dddd" for input#4, "cccc" for input#3, "bbbb" for input#2 and "aaaa" for input#1. Within each field, rightmost bit is the current state (1=closed, 0=open), and bits at left are the older states 100ms apart. (historical states) Example: xxxx xxxx xxxx 0011 Current state of input#1 is closed, before that it was closed too, before that it was open and the oldest state known is open.	1
2758 - 2758	10073 - 10073	Digital Output States	UINT16	bit-mapped	-------- ----4321	One bit for each output. Bit 4 is for output #4, and bit 1 is for output #1. If a bit is set the output is closed, otherwise it is opened.	1
2759 - 2759	10074 - 10074	Pulse Output Test Select	UINT16	bit-mapped	-------- ----4321	Write 1 to a bit to set its corresponding Pulse Output into test mode. Write 0 to restore it to normal operation. A privileged session is required to write the bits. Reading this register reports the mode for each output (1=under test, 0=normal).	1
275A - 275A	10075 - 10075	Pulse Output Test Power	UINT16	bit-mapped	ddvvvvvv vvvvvvvv	This register is Writeable in privileged session only. Simulates constant Power for the Pulse Output under test. Format is same as Kt settings for Pulse Output. "V" is raw value in Wh/pulse from 0 to 9999. "dd"=decimal point position: 00=0.XXXX, 01=X.XXX, 10=XX.XX, 11= XXX.X	1
275B - 275E	10076 - 10079	Reserved				Reserved	4

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
275F - 275F	10080 - 10080	Input 1 Accumulator, Scaled	UINT16	0 to 9999	resolution is 1, 10, 100, 1000, 10000, or 100000 counts	Disabled accumulators always read 0.	1
2760 - 2760	10081 - 10081	Input 2 Accumulator, Scaled	UINT16	0 to 9999			1
2761 - 2761	10082 - 10082	Input 3 Accumulator, Scaled	UINT16	0 to 9999			1
2762 - 2762	10083 - 10083	Input 4 Accumulator, Scaled	UINT16	0 to 9999			1
2763 - 2763	10084 - 10084	Output 1 Accumulator, Scaled	UINT16	0 to 9999			1
2764 - 2764	10085 - 10085	Output 2 Accumulator, Scaled	UINT16	0 to 9999			1
2765 - 2765	10086 - 10086	Output 3 Accumulator, Scaled	UINT16	0 to 9999			1
2766 - 2766	10087 - 10087	Output 4 Accumulator, Scaled	UINT16	0 to 9999			1
2767 - 2790	10088 - 10129	Reserved				Reserved	42
						Block Size:	58
Data and Control Block--Analog Out 0-1mA / Analog Out 4-20mA (Note 15)						**read-only**	
2757 - 2757	10072 - 10072	Status of card	UINT16	bit-mapped	----cf-- --------	Flag fields: c=calibration not good; f=configuration error	1
2758 - 2790	10073 - 10129	Reserved				Reserved	57
						Block Size:	58
Data and Control Block -- Network Card Overlay (Note 15)						**read-only**	
2757 - 2757	10072 - 10072	Card and Network Status	UINT16	bit-mapped	rhp----- sfw-m-ii	Flags: r=run mode; h=card is healthy; p=using last good known programmable settings Server flags: s=smtp ok; f=ftp ok; w=web server ok; m=modbus tcp/ip ok. IP Status ii: 00=IP not valid yet, 01=IP from p.settings; 10=IP from DHCP;11=using last good known IP.	1
2758 - 2758	10073 - 10073	Reserved				Reserved	1
2759 - 275B	10074 - 10076	MAC address in use by the network card	UINT16	bit-mapped	6 bytes	These 3 registers hold the 6 bytes of the card's ethernet MAC address	3
275C - 275F	10077 - 10080	Current IP Address	UINT16			These 4 registers hold the 4 numbers (1 number each register) that make the IP address used by the card.	4
2760 - 2760	10081 - 10081	Current IP Mask Length	UINT16	0 to 32		Number of bits that are set in the IP address mask, starting from the Msb of the 32 bit word. Example 24 = 255.255.255.0; a value of 2 would mean 192.0.0.0	1
2761 - 2762	10082 - 10083	Firmware Version	ASCII	4 char	none	Version of the BOOT firmware of the card, left justified and padded with spaces. Blank for boards without embedded firmware.	2
2763 - 2764	10084 - 10085	Firmware Version	ASCII	4 char	none	Version of the RUN firmware of the card, left justified and padded with spaces. Blank for boards without embedded firmware.	2
2765 - 2790	10086 - 10129	Reserved				Reserved for Extended Nw Status	44
						Block Size:	58

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Option Card 2 Section							
Card Identification and Configuration Block (Note 14)						**read-only**	
2AF7 - 2AF7	11000 - 11000	Class ID and card status	UINT16	bit-mapped	undv-----ccccttttt	Flags active if bit is set: u=unsupported card; n=card need configuration; d=card is using default configuration; v=communication with card is ok Field: cccc=class of installed card. Field tttt=type of card. See note 22	1
2AF8 - 2AF8	11001 - 11001	Reserved				Read only	1
2AF9 - 2B00	11002 - 11009	Card name	ASCII	16 char	none	ASCII name of the installed card	8
2B01 - 2B08	11010 - 11017	Serial number	ASCII	16 char	none	Serial Number in ASCII of the installed card	8
2B09 - 2B0A	11018 - 11019	Version	ASCII	4 char	none	Version in ASCII of the hardware of the installed card.	2
2B0B - 2B28	11020 - 11055	Reserved				Reserved	36
2B2F - 2B30	11056 - 11057	Firmware Version	ASCII	4 char	none	Version of the BOOT firmware of the card, left justified and padded with spaces. Blank for boards without embedded firmware.	2
2B31 - 2B32	11058 - 11059	Firmware Version	ASCII	4 char	none	Version of the RUN firmware of the card, left justified and padded with spaces. Blank for boards without embedded firmware.	2
2B33 - 2B36	11060 - 11063	Reserved				Reserved	4
						Block Size:	64
Current Communication Settings for Option Card 2						**Read-only**	
2B37 - 2B37	11064 - 11064	Current speed and format	UINT16	bit-mapped	-abcde-- fghijklm	Bps: a=57600; b=38400; c=19200; d=14400; e=9600 Stop bits 'f': cleared 1 stop bit, set 2 stop bits Parity: g=even; h=odd; i=none Data bits: j=8; k=7; l=6; m=5	1
2B38 - 2B38	11065 - 11065	Reserved	UINT16	bit-mapped		Reserved	1
2B39 - 2B39	11066 - 11066	Current protocol	UINT16	bit-mapped	-------- -----ppp-	ppp=protocol 100=DNP3; 010=Ascii Modbus; 001=Rtu Modbus	1
2B3A - 2B3A	11067 - 11067	Current reply delay	UINT16	0 to 65535	milliseconds	Delay to reply a Modbus transaction after receiving it.	1
2B3B - 2B3E	11068 - 11071	Reserved				Reserved	4
						Block Size:	8
Data and Control Blocks for Option Card 2						**read-only**	
2B3F - 2B78	11072 - 11129	Data and Control Block for Option Card 2 Meaning of registers depend on installed card. -- see below				Register assignments depend on which type of card is in the slot. See overlays below.	58
						Block Size:	66
Expansions for Data and Control Block for Option Card 2							
Data and Control Block -- Digital I/O Relay Card Overlay (Note 15)						**read-only except as indicated**	
2B3F - 2B3F	11072 - 11072	Digital Input States	UINT16	bit-mapped	-------- 22221111	Two nibble fields: (2222) for input#2 and (1111) for input #1. Lsb in each nibble is the current state of the input. Msb in each nibble is the oldest registered state.	1
2B40 - 2B40	11073 - 11073	Digital Relay States	UINT16	bit-mapped	-------- --ab--cd	If "a" is 1 then state of Relay#2 is unknown, otherwise state of Relay#2 is in "c": (1=tripped, 0=released). If "b" is 1 then state of Relay#1 is unknown, otherwise state of Relay#1 is in "d": (1=tripped, 0=released).	1
2B41 - 2B41	11074 - 11074	Turn relay on	UINT16	bit-mapped	-------- ------21	Writing a 1 in bit N turns relay N+1 ON (this register is writeable only in privileged session)	1

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
2B42 - 2B42	11075 - 11075	Turn relay off	UINT16	bit-mapped	-------- ------21	Writing a 1 in bit N turns relay N+1 OFF (this register is writeable only in privileged session)	1
2B43 - 2B43	11076 - 11076	Trip/Release delay timer for Relay 1	UINT16	0 to 9999	0.1 sec	time to trip or release	1
2B44 - 2B44	11077 - 11077	Trip/Release delay timer for Relay 2	UINT16	0 to 9999	0.1 sec	time to trip or release	1
2B45 - 2B46	11078 - 11079	Reserved				Reserved	2
2B47 - 2B47	11080 - 11080	Input 1 Accumulator, Scaled	UINT16	0 to 9999	resolution is 1, 10, 100, 1000, 10000, or 100000 counts	Disabled accumulators always read 0.	1
2B48 - 2B48	11081 - 11081	Input 2 Accumulator, Scaled	UINT16	0 to 9999			1
2B49 - 2B4A	11082 - 11083	Reserved				Reserved	2
2B4B - 2B4B	11084 - 11084	Relay 1 Accumulator, Scaled	UINT16	0 to 9999	resolution is 1, 10, 100, 1000, 10000, or 100000 counts	Disabled accumulators always read 0.	1
2B4C - 2B4C	11085 - 11085	Relay 2 Accumulator, Scaled	UINT16	0 to 9999			1
2B4D - 2B78	11086 - 11129	Reserved				Reserved	44
						Block Size:	58
Data and Control Block -- Digital I/O Pulse Output Card Overlay (Note 15)						**read-only except as indicated**	
2B3F - 2B3F	11072 - 11072	Digital Input States	UINT16	bit-mapped	dddd cccc bbbb aaaa	Nibble "dddd" for input#4, "cccc" for input#3, "bbbb" for input#2 and "aaaa" for input#1. Within each field, right most bit is the current state (1=closed, 0=open), and bits at left are the older states 100ms apart. (historical states) Example: xxxx xxxx xxxx 0011 Current state of input#1 is closed, before that it was closed too, before that it was open and the oldest state known is open.	1
2B40 - 2B40	11073 - 11073	Digital Output States	UINT16	bit-mapped	-------- ----4321	One bit for each output. Bit 4 is for output #4, and bit 1 is for output #1. If a bit is set the output is closed, otherwise it is opened.	1
2B41 - 2B41	11074 - 11074	Pulse Output Test Select	UINT16	bit-mapped	-------- ----4321	Write 1 to a bit to set its corresponding Pulse Output into test mode. Write 0 to restore it to normal operation. A privileged session is required to write the bits. Reading this register reports the mode for each output (1=under test, 0=normal).	1
2B42 - 2B42	11075 - 11075	Pulse Output Test Power	UINT16	bit-mapped	ddvvvvvv vvvvvvvv	This register is Writeable in privileged session only. Simulates constant Power for the Pulse Output under test. Format is same as Kt settings for Pulse Output. "V" is raw value in Wh/pulse from 0 to 9999. "dd"=decimal point position: 00=0.XXXX, 01=X.XXX, 10=XX.XX, 11= XXX.X	1
2B43 - 2B46	11076 - 11079	Reserved				Reserved	4
2B47 - 2B47	11080 - 11080	Input 1 Accumulator, Scaled	UINT16	0 to 9999	resolution is 1, 10, 100, 1000, 10000, or 100000 counts	Disabled accumulators always read 0.	1
2B48 - 2B48	11081 - 11081	Input 2 Accumulator, Scaled	UINT16	0 to 9999			1
2B49 - 2B49	11082 - 11082	Input 3 Accumulator, Scaled	UINT16	0 to 9999			1
2B4A - 2B4A	11083 - 11083	Input 4 Accumulator, Scaled	UINT16	0 to 9999			1
2B4B - 2B4B	11084 - 11084	Output 1 Accumulator, Scaled	UINT16	0 to 9999			1
2B4C - 2B4C	11085 - 11085	Output 2 Accumulator, Scaled	UINT16	0 to 9999			1
2B4D - 2B4D	11086 - 11086	Output 3 Accumulator, Scaled	UINT16	0 to 9999			1
2B4E - 2B4E	11087 - 11087	Output 4 Accumulator, Scaled	UINT16	0 to 9999			1
2B4F - 2B78	11088 - 11129	Reserved				Reserved	42
						Block Size:	58

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Data and Control Block--Analog Out 0-1mA / Analog Out 4-20mA (Note 15)						**read-only**	
2B3F - 2B3F	11072 - 11072	Status of card	UINT16	bit-mapped	----cf-- --------	Flag fields: c=calibration not good; f=configuration error	1
2B40 - 2B78	11073 - 11129	Reserved	UINT16			Reserved	57
						Block Size:	58
Data and Control Block -- Network Card Overlay (Note 15)						**read-only**	
2B3F - 2B3F	11072 - 11072	Card and Network Status	UINT16	bit-mapped	rhp----- sfw-m-ii	Flags: r=run mode; h=card is healthy; p=using last good known programmable settings Server flags: s=smtp ok; f=ftp ok; w=web server ok; m=modbus tcp/ip ok. IP Status ii: 00=IP not valid yet, 01=IP from p.settings; 10=IP from DHCP;11=using last good known IP.	1
2B40 - 2B40	11073 - 11073	Reserved				Reserved	1
2B41 - 2B43	11074 - 11076	MAC address in use by the network card	UINT16	bit-mapped	6 bytes	These 3 registers hold the 6 bytes of the card's Ethernet MAC address.	3
2B44 - 2B47	11077 - 11080	Current IP Address	UINT16			These 4 registers hold the 4 numbers (1 number each register) that make the IP address used by the card.	4
2B48 - 2B48	11081 - 11081	Current IP Mask Length	UINT16	0 to 32		Number of bits that are set in the IP address mask, starting from the Msb of the 32 bit word. Example 24 = 255.255.255.0; a value of 2 would mean 192.0.0.0	1
2B49 - 2B4A	11082 - 11083	Firmware Version	ASCII	4 char	none	Version of the BOOT firmware of the card, left justified and padded with spaces. Blank for boards without embedded firmware.	2
2B4B - 2B4C	11084 - 11085	Firmware Version	ASCII	4 char	none	Version of the RUN firmware of the card, left justified and padded with spaces. Blank for boards without embedded firmware.	2
2B4D - 2B78	11086 - 11129	Reserved				Reserved for Extended Nw Status	44
						Block Size:	58
Accumulators Block						**read-only**	
2EDF - 2EE0	12000 - 12001	Option Card 1, Input 1 Accumulator	UINT32	0 to 999999999	number of transitions	These are unscaled counts. See option card section for scaled versions. Input accumulators count either or both transitions; output accumulators count both transitions. Unused accumulators always read 0.	2
2EE1 - 2EE6	12002 - 12007	Option Card 1, Inputs 2-4 Accumulators	UINT32	0 to 999999999	number of transitions		6
2EE7 - 2EE8	12008 - 12009	Option Card 1, Output or Relay 1 Accumulator	UINT32	0 to 999999999	number of transitions		2
2EE9 - 2EEE	12010 - 12015	Option Card 1, Output or Relays 2-4	UINT32	0 to 999999999	number of transitions		6
2EEF - 2EF6	12016 - 12023	Option Card 2 Inputs Accumulators	UINT32	0 to 999999999	number of transitions		8
2EF7 - 2EFE	12024 - 12031	Option Card 2 Outputs Accumulators	UINT32	0 to 999999999	number of transitions		8
						Block Size:	32
Commands Section (Note 4)							
Resets Block (Note 9)						**write-only**	
4E1F - 4E1F	20000 - 20000	Reset Max/Min Blocks	UINT16	password (Note 5)			1
4E20 - 4E20	20001 - 20001	Reset Energy Accumulators	UINT16	password (Note 5)			1
4E21 - 4E21	20002 - 20002	Reset Alarm Log (Note 21)	UINT16	password (Note 5)		Reply to a reset log command indicates that the command was accepted but not necessarily that the reset is finished. Poll log status block to determine this.	1
4E22 - 4E22	20003 - 20003	Reset System Log (Note 21)	UINT16	password (Note 5)			1
4E23 - 4E23	20004 - 20004	Reset Historical Log 1 (Note 21)	UINT16	password (Note 5)			1
4E24 - 4E24	20005 - 20005	Reset Historical Log 2 (Note 21)	UINT16	password (Note 5)			1
4E25 - 4E25	20006 - 20006	Reset Historical Log 3 (Note 21)	UINT16	password (Note 5)			1
4E26 - 4E26	20007 - 20007	Reset I/O Change Log (Note 21)	UINT16	password (Note 5)			1

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
4E27 - 4E27	20008 - 20008	Reset Power Quality Log	UINT16	password (Note 5)			1
4E28 - 4E28	20009 - 20009	Reset Waveform Capture Log	UINT16	password (Note 5)			1
4E29 - 4E2A	20010 - 20011	Reserved				Reserved	2
4E2B - 4E2B	20012 - 20012	Reset Option Card 1 Input Accumulators	UINT16	password (Note 5)			1
4E2C - 4E2C	20013 - 20013	Reset Option Card 1 Output Accumulators	UINT16	password (Note 5)			1
4E2D - 4E2D	20014 - 20014	Reset Option Card 2 Input Accumulators	UINT16	password (Note 5)			1
4E2E - 4E2E	20015 - 20015	Reset Option Card 2 Output Accumulators	UINT16	password (Note 5)			1
						Block Size:	16
Privileged Commands Block						**conditional write**	
5207 - 5207	21000 - 21000	Initiate Meter Firmware Reprogramming	UINT16	password (Note 5)			1
5208 - 5208	21001 - 21001	Force Meter Restart	UINT16	password (Note 5)		causes a watchdog reset, always reads 0	1
5209 - 5209	21002 - 21002	Open Privileged Command Session	UINT16	password (Note 5)		meter will process command registers (this register through 'Close Privileged Command Session' register below) for 5 minutes or until the session is closed, whichever comes first.	1
520A - 520A	21003 - 21003	Initiate Programmable Settings Update	UINT16	password (Note 5)		meter enters PS update mode	1
520B - 520B	21004 - 21004	Calculate Programmable Settings Checksum (Note 3)	UINT16	0000 to 9999		meter calculates checksum on RAM copy of PS block	1
520C - 520C	21005 - 21005	Programmable Settings Checksum (Note 3)	UINT16	0000 to 9999		read/write checksum register; PS block saved in nonvolatile memory on write (Note 8)	1
520D - 520D	21006 - 21006	Write New Password (Note 3)	UINT16	0000 to 9999		write-only register; always reads zero	1
520E - 520E	21007 - 21007	Terminate Programmable Settings Update (Note 3)	UINT16	any value		meter leaves PS update mode via reset	1
520F - 5211	21008 - 21010	Set Meter Clock	TSTAMP	1Jan2000 - 31Dec2099	1 sec	saved only when 3rd register is written	3
5212 - 5212	21011 - 21011	Manually Trigger Waveform Capture	UINT16	any value		applies to Shark 300 only; returns busy exception if blocked by another capture in progress	1
5213 - 5219	21012 - 21018	Reserved				Reserved	7
521A - 521A	21019 - 21019	Close Privileged Command Session	UINT16	any value		ends an open command session	1
						Block Size:	20
Encryption Block						**read/write**	
658F - 659A	26000 - 26011	Perform a Secure Operation	UINT16			encrypted command to read password or change meter type	12
						Block Size:	12
Programmable Settings Section							
Basic Setups Block						**write only in PS update mode**	
752F - 752F	30000 - 30000	CT multiplier & denominator	UINT16	bit-mapped	dddddddd mmmmmmmm	high byte is denominator (1 or 5, read-only), low byte is multiplier (1, 10, or 100)	1
7530 - 7530	30001 - 30001	CT numerator	UINT16	1 to 9999	none		1
7531 - 7531	30002 - 30002	PT numerator	UINT16	1 to 9999	none		1
7532 - 7532	30003 - 30003	PT denominator	UINT16	1 to 9999	none		1
7533 - 7533	30004 - 30004	PT multiplier & hookup	UINT16	bit-mapped	mmmmmmmm mmmmhhhh	mm…mm = PT multiplier (1, 10, 100, or 1000) hhhh = hookup enumeration (0 = 3 element wye[9S], 1 = delta 2 CTs[5S], 3 = 2.5 element wye[6S])	1
7534 - 7534	30005 - 30005	Averaging Method	UINT16	bit-mapped	--iiiiii b---sss	iiiiii = interval (5,15,30,60) b = 0-block or 1-rolling sss = # subintervals (1,2,3,4)	1

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
7535 - 7535	30006 - 30006	Power & Energy Format	UINT16	bit-mapped	ppppiinn feee-ddd	pppp = power scale (0-unit, 3-kilo, 6-mega, 8-auto) ii = power digits after decimal point (0-3), applies only if f=1 and pppp is not auto nn = number of energy digits (5-8 --> 0-3) eee = energy scale (0-unit, 3-kilo, 6-mega) f = decimal point for power (0=data-dependant placement, 1=fixed placement per ii value) ddd = energy digits after decimal point (0-6) See note 10.	1
7536 - 7536	30007 - 30007	Operating Mode Screen Enables	UINT16	bit-mapped	-------x eeeeeeee	eeeeeeee = op mode screen rows on/off, rows top to bottom are bits low order to high order x = set to suppress PF on W/VAR/PF screens	1
7537 - 7537	30008 - 30008	Daylight Saving On Rule	UINT16	bit-mapped	hhhhhwww -dddmmmm	applies only if daylight savings in User Settings Flags =	1
7538 - 7538	30009 - 30009	Daylight Saving Off Rule	UINT16	bit-mapped	hhhhhwww -dddmmmm	on; specifies when to make changeover hhhhh = hour, 0-23 www = week, 1-4 for 1st - 4th, 5 for last ddd = day of week, 1-7 for Sun - Sat mmmm = month, 1-12 Example: 2AM on the 4th Sunday of March hhhhh=2, www=4, ddd=1, mmmm=3	1
7539 - 7539	30010 - 30010	Time Zone UTC offset	UINT16	bit-mapped	z000 0000 hhhh hhmm	mm = minutes/15; 00=00, 01=15, 10=30, 11=45 hhhhhh = hours; -23 to +23 z = Time Zone valid (0=no, 1=yes) i.e. register=0 indicates that time zone is not set while register=0x8000 indicates UTC offset = 0	1
753A - 753A	30011 - 30011	Clock Sync Configuration	UINT16	bit-mapped	0000 0000 mmmp pppe	e = enable automatic clock sync (0=no, 1=yes) mmm = sync method (1=NTP, 4=Line, all other values=no sync) pppp = method-dependent paramter. NTP pppp=port performing synchronization (2-3 = COM3-COM4). Line pppp=expected frequency (0=60 Hz, 1=50 Hz)	1
753B - 753B	30012 - 30012	Reserved				Reserved	1
753C - 753C	30013 - 30013	User Settings 2	UINT16	bit-mapped	-------- cccccccs	ccccccc = under range voltage cutoff, 0 to 12.7 % full scale in .1% steps. Vrms below this value is reported as 0. See note 12 for full scale information. s = display secondary volts (1=yes, 0=no)	1
753D - 753D	30014 - 30014	DNP Options	UINT16	bit-mapped	-------- ww-i-vvp	p selects primary or secondary values for DNP voltage, current and power registers (0=secondary, 1=primary) vv sets divisor for voltage scaling (0=1, 1=10, 2=100) i sets divisor for current scaling (0=1, 1=10) ww sets divisor for power scaling in addition to scaling for Kilo (0=1, 1=10, 2=100, 3=1000) Example: 120KV, 500A, 180MW p=1, vv=2, i=0, and ww=3 voltage reads 1200, current reads 500, watts reads 180	1

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
753E - 753E	30015 - 30015	User Settings Flags	UINT16	bit-mapped	vvkgeinn srpdywfa	vv = number of digits after decimal point for voltage display. 0 - For voltage range (0 - 9999V) 1 - For voltage range (100.0kV - 999.9 kV) 2 - For voltage range (10.00kV - 99.99 kV) 3 - For voltage range (0kV - 9.999 kV) This setting is used only when k=1. k = enable fixed scale for voltage display. (0=autoscale, 1=unit if vv=0 and kV if vv=1,2,3) g = enable alternate full scale bar graph current (1=on, 0=off) e = enable ct pt compensation (0=Disabled, 1=Enabled). i = fixed scale and format current display 0=normal autoscaled current display 1=always show amps with no decimal places nn = number of phases for voltage & current screen (3=ABC, 2=AB, 1=A, 0=ABC) s = scroll (1=on, 0=off) r = password for reset in use (1=on, 0=off) p = password for configuration in use (1=on, 0=off) d = daylight saving time changes (0=off, 1=on) y = diagnostic events in system log (1=yes, 0=no) w = power direction (0=view as load, 1=view as generator) f = flip power factor sign (1=yes, 0=no) a = apparent power computation method	1
753F - 753F	30016 - 30016	Full Scale Current (for load % bar graph)	UINT16	0 to 9999	none	If non-zero and user settings bit g is set, this value replaces CT numerator in the full scale current calculation. (See Note 12)	1
7540 - 7547	30017 - 30024	Meter Designation	ASCII	16 char	none		8
7548 - 7548	30025 - 30025	COM1 setup	UINT16	bit-mapped	----dddd -0100110	yy = parity (0-none, 1-odd, 2-even) dddd = reply delay (* 50 msec) ppp = protocol (1-Modbus RTU, 2-Modbus ASCII, 3-DNP) bbbb = baud rate (1-9600, 2-19200, 4-38400, 6-57600, 13=1200, 14=2400, 15=4800)	1
7549 - 7549	30026 - 30026	COM2 setup	UINT16	bit-mapped	yy--dddd -pppbbbb		1
754A - 754A	30027 - 30027	COM2 address	UINT16	1 to 247	none		1
754B - 754B	30028 - 30028	Limit #1 Identifier	UINT16	0 to 65535		use Modbus address as the identifier (see notes 7, 11, 12)	1
754C - 754C	30029 - 30029	Limit #1 Out High Setpoint	SINT16	-200.0 to +200.0	0.1% of full scale	Setpoint for the "above" limit (LM1), see notes 11-12.	1
754D - 754D	30030 - 30030	Limit #1 In High Threshold	SINT16	-200.0 to +200.0	0.1% of full scale	Threshold at which "above" limit clears; normally less than or equal to the "above" setpoint; see notes 11-12.	1
754E - 754E	30031 - 30031	Limit #1 Out Low Setpoint	SINT16	-200.0 to +200.0	0.1% of full scale	Setpoint for the "below" limit (LM2), see notes 11-12.	1
754F - 754F	30032 - 30032	Limit #1 In Low Threshold	SINT16	-200.0 to +200.0	0.1% of full scale	Threshold at which "below" limit clears; normally greater than or equal to the "below" setpoint; see notes 11-12.	1
7550 - 7554	30033 - 30037	Limit #2	SINT16	same as Limit #1	same as Limit #1	same as Limit #1	5
7555 - 7559	30038 - 30042	Limit #3	SINT16				5
755A - 755E	30043 - 30047	Limit #4	SINT16				5
755F - 7563	30048 - 30052	Limit #5	SINT16				5
7564 - 7568	30053 - 30057	Limit #6	SINT16				5
7569 - 756D	30058 - 30062	Limit #7	SINT16				5
756E - 7572	30063 - 30067	Limit #8	SINT16				5
7573 - 7582	30068 - 30083	Reserved				Reserved	16
7583 - 75C2	30084 - 30147	Reserved				Reserved	64

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
75C3 - 75C3	30148 - 30148	watts loss due to iron when watts positive	UINT16	0 to 99.99	0.01%		1
75C4 - 75C4	30149 - 30149	watts loss due to copper when watts positive	UINT16	0 to 99.99	0.01%		1
75C5 - 75C5	30150 - 30150	var loss due to iron when watts positive	UINT16	0 to 99.99	0.01%		1
75C6 - 75C6	30151 - 30151	var loss due to copper when watts positive	UINT16	0 to 99.99	0.01%		1
75C7 - 75C3	30152 - 30152	watts loss due to iron when watts negative	UINT16	0 to 99.99	0.01%		1
75C8 - 75C48	30153 - 30153	watts loss due to copper when watts negative	UINT16	0 to 99.99	0.01%		1
75C9 - 75C9	30154 - 30154	var loss due to iron when watts negative	UINT16	0 to 99.99	0.01%		1
75CA - 75CA	30155 - 30155	var loss due to copper when watts negative	UINT16	0 to 99.99	0.01%		1
75CB - 75CB	30156 - 30156	transformer loss compensation user settings flag	UINT16	bit-mapped	-------- ----cfwv	c - 0 disable compensation for losses due to copper, 1 enable compensaion for losses due to copper f - 0 disable compensation for losses due to iron, 1 enable compensaion for losses due to iron w - 0 add watt compensation, 1 subtract watt compensation v - 0 add var compensation, 1 subtract var compensation	1
75CC - 75E5	30157 - 30182	Reserved				Reserved	26
75E6 - 75E6	30183 - 30183	Programmable Settings Update Counter	UINT16	0-65535		Increments each time programmable settings are changed; occurs when new checksum is calculated.	1
75E7 - 7626	30184 - 30247	Reserved for Software Use				Reserved	64
7627 - 7627	30248 - 30248	A phase PT compensation @ 69V (% error)	SINT16	-15 to 15	0.01%		1
7628 - 7628	30249 - 30249	A phase PT compensation @ 120V (% error)	SINT16	-15 to 15	0.01%		1
7629 - 7629	30250 - 30250	A phase PT compensation @ 230V (% error)	SINT16	-15 to 15	0.01%		1
762A - 762A	30251 - 30251	A phase PT compensation @ 480V (% error)	SINT16	-15 to 15	0.01%		1
762B - 762B	30252 - 30255	B phase PT compensation @ 69V, 120V, 230V, 480V (% error)	SINT16	-15 to 15	0.01%		4
762F - 762F	30256 - 30259	C phase PT compensation @ 69V, 120V, 230V, 480V (% error)	SINT16	-15 to 15	0.01%		4
7633 - 7633	30260 - 30260	A phase CT compensation @ c1 (% error)	SINT16	-15 to 15	0.01%	For Class 10 unit c1=0.25A c2=0.5A c3=1A c4=5A For Class 2 unit c1=0.05A c2=0.1A c3=0.2A c4=1A	1
7634 - 7634	30261 - 30261	A phase CT compensation @ c2 (% error)	SINT16	-15 to 15	0.01%		1
7635 - 7635	30262 - 30262	A phase CT compensation @ c3 (% error)	SINT16	-15 to 15	0.01%		1
7636 - 7636	30263 - 30263	A phase CT compensation @ c4 (% error)	SINT16	-15 to 15	0.01%		1
7637 - 7637	30264 - 30267	B phase CT compensation @ c1, c2, c3, c4 (% error)	SINT16	-15 to 15	0.01%		4
763B - 763E	30268 - 30271	C phase CT compensation @ c1, c2, c3, c4 (% error)	SINT16	-15 to 15	0.01%		4
763F - 7642	30272 - 30275	A phase PF compensation @ c1, c2, c3, c4	SINT16	-50 to 50			4
7643 - 7646	30276 - 30279	B phase PF compensation @ c1, c2, c3, c4	SINT16	-50 to 50			4
7647 - 764A	30280 - 30283	C phase PF compensation @ c1, c2, c3, c4	SINT16	-50 to 50			4
						Block Size:	284

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Log Setups Block						**write only in PS update mode**	
7917 - 7917	31000 - 31000	Historical Log #1 Sizes	UINT16	bit-mapped	eeeeeeee ssssssss	high byte is number of registers to log in each record (0-117), low byte is number of flash sectors for the log (see note 19) 0 in either byte disables the log	1
7918 - 7918	31001 - 31001	Historical Log #1 Interval	UINT16	bit-mapped	00000000 hgfedcba	only 1 bit set: a=1 min, b=3 min, c=5 min, d=10 min, e=15 min, f=30 min, g=60 min, h=EOI pulse	1
7919 - 7919	31002 - 31002	Historical Log #1, Register #1 Identifier	UINT16	0 to 65535		use Modbus address as the identifier (see note 7)	1
791A - 798D	31003 - 31118	Historical Log #1, Register #2 - #117 Identifiers	UINT16	0 to 65535		same as Register #1 Identifier	116
798E - 79D6	31119 - 31191	Historical Log #1 Software Buffer				Reserved for software use.	73
79D7 - 7A96	31192 - 31383	Historical Log #2 Sizes, Interval, Registers & Software Buffer	same as Historical Log #1				192
7A97 - 7B56	31384 - 31575	Historical Log #3 Sizes, Interval, Registers & Software Buffer	same as Historical Log #1				192
7B57 - 7B57	31576 - 31607	Waveform Log Sample Rate & Pretrigger	UINT16	bit-mapped	ssssssss pppppppp	High byte is samples/60Hz cycle = 5(32), 6(64), 7(128), 8(256), or 9(512) Low byte is number of pretrigger cycles.	1
7B58 - 7B58	31577 - 31577	Power Quality Log Triggers	UINT16	bit-mapped	-------8 76543210	Set bits to enable PQ events/waveform captures. 2,1,0 = Voltage Surge, channel C,B,A	1
7B59 - 7B59	31578 - 31578	Waveform Log Triggers	UINT16	bit-mapped	-------8 76543210	5,4,3 = Current Surge, channel C, B, A 8,7,6 = Voltage Sag, channel C, B, A	1
7B5A - 7B5A	31579 - 31579	Waveform & PQ Log Sizes	UINT16	bit-mapped	pppppppp wwwwwwww	High byte is number of flash sectors for PQ log, Low byte is number of flash sectors for waveform log	1
7B5B - 7B5B	31580 - 31580	Reserved				Reserved	1
7B5C - 7B5C	31581 - 31581	Channel A Voltage Surge Threshold	UINT16	0 to 3276.7	0.1% of full scale	Thresholds are % of full scale, see note 12	1
7B5D - 7B5D	31582 - 31582	Channel A Current Surge Threshold	UINT16	0 to 3276.7	0.1% of full scale		1
7B5E - 7B5E	31583 - 31583	Channel A Voltage Sag Threshold	UINT16	0 to 3276.7	0.1% of full scale		1
7B5F - 7B61	31584 - 31586	Reserved				Reserved	3
7B62 - 7B67	31587 - 31592	Channel B Surge & Sag Thresholds	same as Channel A				6
7B68 - 7B6D	31593 - 31598	Channel C Surge & Sag Thresholds	same as Channel A				6
7B6E - 7B76	31599 - 31607	Reserved				Reserved	9
						Block Size:	608
Programmable Settings for Option Card 1							
Option Card 1 Setups Block						**write only in PS update mode**	
7CFF - 7CFF	32000 - 32000	Class ID of the Option Card 1 Settings	UINT16	bit-mapped	-------- cccctttt	Which class (cccc) and type(tttt) of card the Option Settings for Card 1 apply to. See note 22.	1
7D00 - 7D3E	32001 - 32063	Settings for Option Card 1, First Overlay -- see below	Register assignments depend on which type of card is in the slot. See overlays below.				63
7D3F - 7F3E	32064 - 32575	Settings for Option Card 1, Second Overlay -- see below	Register assignments depend on which type of card is in the slot. See overlays below.				512
						Block Size:	576

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Overlays for Option Card 1 Programmable Settings							
Settings Registers for any communication capable card, including network and analog cards					**First Overlay**	**write only in PS update mode**	
7D00 - 7D00	32001 - 32001	Slave address	UINT16	1~247 (for Modbus) 1~65534 (for DNP)	none	Slave address of the unit. The communication capable card is always a master. Set to 0 when an analog board is installed.	1
7D01 - 7D01	32002 - 32002	Speed and format	UINT16	bit-mapped	-abcde-- fghijklm	Bps: a=57600; b=38400; c=19200; d=14400; e=9600 Stop bits 'f': cleared 1 stop bit, set 2 stop bits Parity: g=even; h=odd; i=none Data bits: j=8; k=7; l=6; m=5 Set to 0 when an analog board is installed.	1
7D02 - 7D02	32003 - 32003	Reserved				Reserved	1
7D03 - 7D03	32004 - 32004	Protocol	UINT16	bit-mapped	-------- -----ppp-	ppp= 100 =DNP3; 010=Ascii Modbus; 001=Rtu Modbus Set to 0 when an analog board is installed.	1
7D04 - 7D04	32005 - 32005	Reply delay	UINT16	0 to 65535	milliseconds	Delay to reply to a Modbus transaction after receiving it. Set to 0 when an analog board is installed	1
7D05 - 7D3E	32006 - 32063	Reserved				Reserved	58
						Block Size:	63
Settings Registers for Digital I/O Relay Card					**First Overlay**	**write only in PS update mode**	
7D00 - 7D00	32001 - 32001	Input#1 - 2 bindings & logging enables	UINT16	bit-mapped	-------- 2222 1111	One nibble for each input. Assuming "abcc" as the bits in each nibble: "a": select this input for EOI (End Of Interval)pulse sensing. "b": log this input when pulse is detected "cc": Input event trigger mode - Contact sensing method; 00 = none; 01 = open to close; 10 = close to open; 11 = any change. Every input has an associated internal accumulator (See input Accumulator Scaling), which is incremented every time the input changes according with the trigger mode crieteria "cc"	1
7D01 - 7D01	32002 - 32002	Relay #1 Delay to Operate	UINT16	0.1 second units		Delay to operate the relay since request.	1
7D02 - 7D02	32003 - 32003	Relay #1 Delay to Release	UINT16	0.1 second units		Delay to release the relay since request.	1
7D03 - 7D08	32004 - 32009	Reserved	UINT16			Set to 0.	6
7D09 - 7D09	32010 - 32010	Relay #2 Delay to Operate	UINT16	0.1 second units		Delay to operate the relay since request.	1
7D0A - 7D0A	32011 - 32011	Relay #2 Delay to Release	UINT16	0.1 second units		Delay to release the relay since request.	1
7D0B - 7D20	32012 - 32033	Reserved	UINT16			Set to 0.	22
7D21 - 7D21	32034 - 32034	Input Accumulators Scaling	UINT16	bit-mapped	-------- 22221111	4 bits per input or output accumulator	1
7D22 - 7D22	32035 - 32035	Relay Accumulators Scaling	UINT16	bit-mapped	-------- 22221111	The nibble informs what should be the scaling of the accumulator 0=no-scaling, 1=0.1, 2=0.01, 3= 1m, 4=0.1m, 5=0.01m, 6=1u, 7=0.1u; the value 15 disable the accumulator. Example: suppose that the internal input accumulator #1 is 12345, and its corresponding scaling setting is "0011" (3 decimal). Then, the accumulator will be read as: Scaling 3, means 1m or 0.001. Scaled accumulator = 12345 * 0.001 = 12 (Twelve).	1

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
7D23 - 7D23	33036 - 33036	Fast pulse input selector	UINT16	bit-mapped	p------- -----nnn	When value 'nnn' is non-zero, it determines which of the card inputs will be a fast pulse detection input. The polarity bit 'P' tells the event to be detected: 1=open-to-close; 0=close-to-open. There is no "any-change" detection mode.	1
7D24 - 7D3E	32037 - 32063	Reserved				Set to 0.	27
						Block Size:	63
Settings Registers for Digital I/O Pulse Output Card					**First Overlay**	**write only in PS update mode**	
7D00 - 7D00	32001 - 32001	Input#1 - 4 bindings & logging enables	UINT16	bit-mapped	44443333 22221111	One nibble for each input. Assuming "abcc" as the bits in each nibble: "a": select this input for EOI (End Of Interval)pulse sensing. "b": log this input when pulse is detected "cc": Input event trigger mode - Contact sensing method; 00 = none; 01 = open to close; 10 = close to open; 11 = any change. Every input has an associated internal accumulator (See input Accumulator Scaling), which is incremented every time the input changes according with the trigger mode crieteria "cc"	1
7D01 - 7D01	32002 - 32002	Source for Pulse Ouput#1	UINT16	enumeration	-----ppp ----vvvv	"ppp" (Phase) : 000 = none, 001 = Phase A, 010 = Phase B, 011 = Phase C, 100 = All Phases, 101 = Pulse from EOI(End Of Interval). "vvvv"(Value) : 0000= none, 0001 = Wh, 0010 = +Wh, 0011 = -Wh, 0100= Varh, 0101 = +Varh, 0110 = -Varh, 0111 = VAh, 1000= Received Wh, 1001= Delivered Wh, 1010= Inductive Varh, 1011 = Capacitive Varh	1
7D02 - 7D02	32003 - 32003	Kt [Wh/pulse] factor for Pulse Output#1	UINT16	bit-mapped	ddVVVVVV VVVVVVVV	"V…V" = not scaled energy value per pulse, from 0 to 9999. "dd"= decimal point position: 00=0.XXXX, 01=X.XXX, 10=XX.XX, 11= X.XXX.	1
7D03 - 7D04	32004 - 32005	Output#2 Assignment and Kt	UINT16	same as Output #1			2
7D05 - 7D06	32006 - 32007	Output#3 Assignment and Kt	UINT16	same as Output #1			2
7D07 - 7D08	32008 - 32009	Output#4 Assignment and Kt	UINT16	same as Output #1			2

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
7D09 - 7D09	32010 - 32010	Input Accumulators Scaling	UINT16	bit-mapped	44443333 22221111	see Relay Card above	1
7D0A - 7D0A	32011 - 32011	Output Accumulators Scaling	UINT16	bit-mapped	44443333 22221111		1
7D0B - 7D0B	32012 - 32012	Fast pulse input selector	UINT16	bit-mapped	p------- -----nnn	When value 'nnn' is non-zero, it determines which of the card inputs will be a fast pulse detection input. The polarity bit 'P' tells the event to be detected: 1=open-to-close; 0=close-to-open. There is no "any-change" detection mode.	1
7D0C - 7D3E	32013 - 32063	Reserved				Reserved	51
						Block Size:	63
Settings Registers for Digital I/O Relay Card					**Second Overlay**	**write only in PS update mode**	
7D3F - 7D46	32064 - 32071	Input#1 Label	ASCII	16 char			8
7D47 - 7D4E	32072 - 32079	Input#1 Low State Name	ASCII	16 char			8
7D4F - 7D56	32080 - 32087	Input#1 High State Name	ASCII	16 char			8
7D57 - 7D6E	32088 - 32111	Input#2 Label and State Names	same as Input#1				24
7D6F - 7D9E	32112 - 32159	Reserved				Reserved	48
7D9F - 7DA6	32160 - 32167	Relay#1 Label	ASCII	16 char			8
7DA7 - 7DAE	32168 - 32175	Relay#1 Open State Name	ASCII	16 char			8
7DAF - 7DB6	32176 - 32183	Relay#1 Closed State Name	ASCII	16 char			8
7DB7 - 7DCE	32184 - 32207	Relay#2 Label and State Names	same as Relay#1				24
7DCF - 7DFE	32208 - 32255	Reserved				Reserved	48
7DFF - 7E06	32256 - 32263	Input#1 Accumulator Label	ASCII	16 char			8
7E07 - 7E0E	32264 - 32271	Input#2 Accumulator Label	ASCII	16 char			8
7E0F - 7E1E	32272 - 32287	Reserved				Reserved	16
7E1F - 7E1F	32288 - 32288	Input#1 Accumulator Kt	UINT16	bit-mapped	ddVVVVVV VVVVVVVV	KT power factor for the Pulse Output	1
7E20 - 7E20	32289 - 32289	Input#2 Accumulator Kt	UINT16	bit-mapped	ddVVVVVV VVVVVVVV	"V" is raw power value in Wh/pulse from 0 to 9999. "dd"=decimal point position: 00=0.XXXX, 01=X.XXX, 10=XX.XX, 11= X.XXX.	1
7E21 - 7F3E	32290 - 32575	Reserved				Reserved	286
						Block Size:	512
Settings Registers for Digital I/O Pulse Output Card					**Second Overlay**	**write only in PS update mode**	
7D3F - 7D46	32064 - 32071	Input#1 Label	ASCII	16 char			8
7D47 - 7D4E	32072 - 32079	Input#1 Low State Name	ASCII	16 char			8
7D4F - 7D56	32080 - 32087	Input#1 High State Name	ASCII	16 char			8
7D57 - 7D6E	32088 - 32111	Input#2 Label and State Names	same as Input#1				24
7D6F - 7D86	32112 - 32135	Input#3 Label and State Names	same as Input#1				24
7D87 - 7D9E	32136 - 32159	Input#4 Label and State Names	same as Input#1				24
7D9F - 7DA6	32160 - 32167	Output#1 Label	ASCII	16 char			8
7DA7 - 7DAE	32168 - 32175	Output#1 Open State Name	ASCII	16 char			8
7DAF - 7DB6	32176 - 32183	Output#1 Closed State Name	ASCII	16 char			8
7DB7 - 7DCE	32184 - 32207	Output#2 Label and State Names	same as Output#1				24
7DCF - 7DE6	32208 - 32231	Output#3 Label and State Names	same as Output#1				24
7DE7 - 7DFE	32232 - 32255	Output#4 Label and State Names	same as Output#1				24
7DFF - 7E06	32256 - 32263	Input#1 Accumulator Label	ASCII	16 char			8
7E07 - 7E0E	32264 - 32271	Input#2 Accumulator Label	ASCII	16 char			8
7E0F - 7E16	32272 - 32279	Input#3 Accumulator Label	ASCII	16 char			8
7E17 - 7E1E	32280 - 32287	Input#4 Accumulator Label	ASCII	16 char			8

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
7E1F - 7E1F	32288 - 32288	Input#1 Accumulator Kt	UINT16	bit-mapped	ddVVVVVV VVVVVVVV	KT power factor for the accumulator input "V" is raw power value in Wh/pulse from 0 to 9999. "dd"=decimal point position: 00=0.XXXX, 01=X.XXX, 10=XX.XX, 11= X.XXX.	1
7E20 - 7E20	32289 - 32289	Input#2 Accumulator Kt	UINT16	bit-mapped	ddVVVVVV VVVVVVVV		1
7E21 - 7E21	32290 - 32290	Input#3 Accumulator Kt	UINT16	bit-mapped	ddVVVVVV VVVVVVVV		1
7E22 - 7E22	32291 - 32291	Input#4 Accumulator Kt	UINT16	bit-mapped	ddVVVVVV VVVVVVVV		1
7E23 - 7F3E	32292 - 32575	Reserved				Reserved	284
						Block Size:	512
Settings Registers for Analog Out 0-1mA / Analog Out 4-20mA Cards					**Second Overlay**	**write only in PS update mode**	
7D3F - 7D3F	32064 - 32064	Update rate	UINT16	0 to 65535	milliseconds	Fixed -- see specifications.	1
7D40 - 7D40	32065 - 32065	Channel direction - 1mA Card only!	UINT16	bit-mapped	-------- ----4321	Full range output for 0-1mA card only: A bit set(1) means full range (-1mA to +1mA); a bit cleared(0) means source only (0mA to +1mA).	1
7D41 - 7D41	32066 - 32066	Format parameter for output #1	UINT16	bit-mapped	-------- ---f suwb	Format of the polled register:f=float 32; s=signed 32 bit int; u=unsigned 32 bit int; w=signed 16 bit int; b=unsigned 16 bit int.	1
7D42 - 7D42	32067 - 32067	Source register for Output#1	UINT16	0 to 65535		This register should be programmed with the address of the register whose value is to be used for current output. In different words, the current level output of analog board will follow the value of the register addressed here.	1
7D43 - 7D44	32068 - 32069	High value of source register for output#1	Depends on the format parameter			Value read from the source register at which High nominal current will be output. Example: for the 4-20mA card, if this register is programmed with 750, then the current output will be 20mA when the value read from the source register is 750.	2
7D45 - 7D46	32070 - 32071	Low value of source register for output#1	Depends on the format parameter			Value read from the source register at which Low nominal current will be output. Example: for the 4-20mA card, if this register is programmed with 0, then the current output will be 4mA when the value read from the source register is 0.	2
7D47 - 7D4C	32072 - 32077	Analog output#2 format, register, max & min	Same as analog output#1				6
7D4D - 7D52	32078 - 32083	Analog output#3 format, register, max & min	Same as analog output#1				6
7D53 - 7D58	32084 - 32089	Analog output#4 format, register, max & min	Same as analog output#1				6
7D59 - 7F3E	32090 - 32575	Reserved				Reserved	486
						Block Size:	512

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Settings Registers for Network Cards					**Second Overlay**	**write only in PS update mode**	
7D3F - 7D3F	32064 - 32064	General Options		bit-mapped	-----DGT ---- -W--	W=Web server:0=Enabled, 1=Disabled T=Silentmode:0=Disabled, 1=Enabled (When enabled TCP/Reset is not sent when Connection is attempted to an unbound port) G=Modbus Tcp/Ip Gateway:0=Enabled,1=Disabled D=DNP-Tcp/Ip-Wrapper: 0=Disabled, 1=Enabled.	1
7D40 - 7D40	32065 - 32065	DHCP enable		bit-mapped	-------- -------d	DHCP: d=1 enabled, d=0 disabled (user must provide IP configuration).	1
7D41 - 7D48	32066 - 32073	Host name label	ASCII			16 bytes (8 registers)	8
7D49 - 7D4C	32074 - 32077	IP card network address	UINT16	0 to 255 (IPv4)		These 4 registers hold the 4 numbers (1 number each register) that make the IP address used by the card.	4
7D4D - 7D4D	32078 - 32078	IP network address mask length	UINT16	0 to 32		Number of bits that are set in the IP address mask, starting from the Msb of the 32 bit word. Example 24 = 255.255.255.0; a value of 2 would mean 192.0.0.0	1
7D4E - 7D51	32079 - 32082	IP card network gateway address	UINT16	0 to 255 (IPv4)		These 4 registers hold the 4 numbers that make the IP gateway address on network.	4
7D52 - 7D55	32083 - 32086	DNS #1, IP address	UINT16	0 to 255 (IPv4)		IP address of the DNS#1 on the network.	4
7D56 - 7D59	32087 - 32090	DNS #2, IP address	UINT16	0 to 255 (IPv4)		IP address of the DNS#2 on the network.	4
7D5A - 7D5A	32091 - 32091	TCP/IP Port – Modbus Gateway Service	UINT16	32-65534		Port for the Gateway service (modbus tcp/ip) when enabled	1
7D5B - 7D5B	32092 - 32092	TCP/IP Port – WebService	UINT16	32-65534		Port for the Web service (html viewer) when enabled	1
7D5C - 7D5C	32093 - 32093	Reserved – must be set to 0				Reserved. Set these regs to zero.	1
7D5D - 7D5D	32094 - 32094	Reserved – must be set to 0				Reserved. Set these regs to zero.	1
7D5E - 7D61	32095 - 32098	Reserved – must be set to 0				Reserved. Set these regs to zero.	4
7D62 - 7D65	32099 - 32102	Reserved – must be set to 0				Reserved. Set these regs to zero.	4
7D66 - 7D66	32103 - 32103	Reserved – must be set to 0				Reserved. Set these regs to zero.	1
7D67 - 7D67	32104 - 32104	Reserved – must be set to 0				Reserved. Set these regs to zero.	1
7D68 - 7D6C	32105 - 32109	Reserved – must be set to 0				Reserved. Set these regs to zero.	5
7D6D - 7D8C	32110 - 32141	NTP1 URL or IP(string)				IP address of the NTP server the Shark will contact.	32
7D8D - 7DAC	32142 - 32173	Reserved – must be set to 0				Set these to regs to zero. Shark uses only 1 NTP	32
7DAD - 7F3E	32174 - 32575	Reserved – must be set to 0				Reserved. Set these regs to zero.	402
						Block Size:	512
Programmable Settings for Option Card 2							
Option Card 2 Setups Block						**write only in PS update mode**	
80E7 - 80E7	33000 - 33000	Class ID of the Option Card 2 Settings	UINT16	bit-mapped	-------- cccctttt	Which class (cccc) and type(tttt) of card the Option Settings for Card 2 apply to. See note 22	1
80E8 - 8126	33001 - 33063	Settings for Option Card 2, First Overlay -- see below	Register assignments depend on which type of card is in the slot. See overlays below.				63
8127 - 8326	33064 - 33575	Settings for Option Card 2, Second Overlay -- see below	Register assignments depend on which type of card is in the slot. See overlays below.				512
						Block Size:	576

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Overlays for Option Card 2 Programmable Settings							
Settings Registers for any communication capable card, including network and analog cards					**First Overlay**	**write only in PS update mode**	
80E8 - 80E8	33001 - 33001	Slave address	UINT16	1~247 (for Modbus) 1~65534 (for DNP)	none	Slave address of the unit. The communication capable card is always a master. Set to 0 when an analog board is installed.	1
80E9 - 80E9	33002 - 33002	Speed and format	UINT16	bit-mapped	-abcde-- fghijklm	Bps: a=57600; b=38400; c=19200; d=14400; e=9600 Stop bits 'f': cleared 1 stop bit, set 2 stop bits Parity: g=even; h=odd; i=none Data bits: j=8; k=7; l=6; m=5 Set to 0 when an analog board is installed.	1
80EA - 80EA	33003 - 33003	Reserved	UINT16	bit-mapped		Reserved	1
80EB - 80EB	33004 - 33004	Protocol	UINT16	bit-mapped	-------- -----ppp-	ppp= 100 =DNP3; 010=Ascii Modbus; 001=Rtu Modbus Set to 0 when an analog board is installed.	1
80EC - 80EC	33005 - 33005	Reply delay	UINT16	0 to 65535	milliseconds	Delay to reply to a Modbus transaction after receiving it. Set to 0 when an analog board is installed	1
80ED - 8126	33006 - 33063	Reserved				Reserved	58
						Block Size:	63
Settings Registers for Digital I/O Relay Card					**First Overlay**	**write only in PS update mode**	
80E8 - 80E8	33001 - 33001	Input#1 - 2 bindings & logging enables	UINT16	bit-mapped	-------- 2222 1111	One nibble for each input. Assuming "abcc" as the bits in each nibble: "a": select this input for EOI (End Of Interval)pulse sensing. "b": log this input when pulse is detected "cc": Input event trigger mode - Contact sensing method; 00 = none; 01 = open to close; 10 = close to open; 11 = any change. Every input has an associated internal accumulator (See input Accumulator Scaling), which is incremented every time the input changes according with the trigger mode crieteria "cc"	1
80E9 - 80E9	33002 - 33002	Relay #1 Delay to Operate	UINT16	0.1 second units		Delay to operate the relay since request.	1
80EA - 80EA	33003 - 33003	Relay #1 Delay to Release	UINT16	0.1 second units		Delay to release the relay since request.	1
80EB - 80F0	33004 - 33009	Reserved	UINT16			Set to 0.	6
80F1 - 80F1	33010 - 33010	Relay #2 Delay to Operate	UINT16	0.1 second units		Delay to operate the relay since request.	1
80F2 - 80F2	33011 - 33011	Relay #2 Delay to Release	UINT16	0.1 second units		Delay to release the relay since request.	1
80F3 - 8108	33012 - 33033	Reserved	UINT16			Set to 0.	22
8109 - 8109	33034 - 33034	Input Accumulators Scaling	UINT16	bit-mapped	-------- 22221111	4 bits per input or output accumulator	1
810A - 810A	33035 - 33035	Relay Accumulators Scaling	UINT16	bit-mapped	-------- 22221111	The nibble informs what should be the scaling of the accumulator 0=no-scaling, 1=0.1, 2=0.01, 3= 1m, 4=0.1m, 5=0.01m, 6=1u, 7=0.1u; the value 15 disable the accumulator. Example: suppose that the internal input accumulator #1 is 12345, and its corresponding scaling setting is "0011" (3 decimal). Then, the accumulator will be read as: Scaling 3, means 1m or 0.001. Scaled accumulator = 12345 * 0.001 = 12 (Twelve).	1

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
810B - 810B	33036 - 33036	Fast pulse input selector	UINT16	bit-mapped	p------- -----nnn	When value 'nnn' is non-zero, it determines which of the card inputs will be a fast pulse detection input. The polarity bit 'P' tells the event to be detected: 1=open-to-close; 0=close-to-open. There is no "any-change" detection mode.	1
810C - 8126	33037 - 33063	Reserved				Reserved	27
						Block Size:	63
Settings Registers for Digital I/O Pulse Output Card					**First Overlay**	**write only in PS update mode**	
80E8 - 80E8	33001 - 33001	Input#1 - 4 bindings & logging enables	UINT16	bit-mapped	44443333 22221111	One nibble for each input. Assuming "abcc" as the bits in each nibble: "a": select this input for EOI (End Of Interval)pulse sensing. "b": log this input when pulse is detected "cc": Input event trigger mode - Contact sensing method; 00 = none; 01 = open to close; 10 = close to open; 11 = any change. Every input has an associated internal accumulator (See input Accumulator Scaling), which is incremented every time the input changes according with the trigger mode crieteria "cc"	1
80E9 - 80E9	33002 - 33002	Source for Pulse Ouput#1	UINT16	enumeration	-----ppp ----vvvv	"ppp" (Phase) : 000 = none, 001 = Phase A, 010 = Phase B, 011 = Phase C, 100 = All Phases, 101 = Pulse from EOI(End Of Interval). "vvvv"(Value) : 0000= none, 0001 = Wh, 0010 = +Wh, 0011 = -Wh, 0100= Varh, 0101 = +Varh, 0110 = -Varh, 0111 = VAh, 1000= Received Wh, 1001= Delivered Wh, 1010= Inductive Varh, 1011 = Capacitive Varh	1
80EA - 80EA	33003 - 33003	Kt [Wh/pulse] factor for Pulse Output#1	UINT16	bit-mapped	ddVVVVVV VVVVVVVV	"V...V" = not scaled energy value per pulse, from 0 to 9999. "dd"= decimal point position: 00=0.XXXX, 01=X.XXX, 10=XX.XX, 11= X.XXX.	1
80EB - 80EC	33004 - 33005	Output#2 Assignment and Kt	UINT16	same as Output #1			2
80ED - 80EE	33006 - 33007	Output#3 Assignment and Kt	UINT16	same as Output #1			2
80EF - 80F0	33008 - 33009	Output#4 Assignment and Kt	UINT16	same as Output #1			2
80F1 - 80F1	33010 - 33010	Input Accumulators Scaling	UINT16	bit-mapped	44443333 22221111	see Relay Card above	1
80F2 - 80F2	33011 - 33011	Output Accumulators Scaling	UINT16	bit-mapped	44443333 22221111		1

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
80F3 - 80F3	33012 - 33012	Fast pulse input selector	UINT16	bit-mapped	p------- -----nnn	When value 'nnn' is non-zero, it determines which of the card inputs will be a fast pulse detection input. The polarity bit 'P' tells the event to be detected: 1=open-to-close; 0=close-to-open. There is no "any-change" detection mode.	1
80F4 - 8126	33013 - 33063	Reserved				Reserved	51
						Block Size:	63
Settings Registers for Digital I/O Relay Card					**Second Overlay**	**write only in PS update mode**	
8127 - 812E	33064 - 33071	Input#1 Label	ASCII	16 char			8
812F - 8136	33072 - 33079	Input#1 Low State Name	ASCII	16 char			8
8137 - 813E	33080 - 33087	Input#1 High State Name	ASCII	16 char			8
813F - 8156	33088 - 33111	Input#2 Label and State Names	same as Input#1				24
8157 - 8186	33112 - 33159	Reserved					48
8187 - 818E	33160 - 33167	Relay#1 Label	ASCII	16 char			8
818F - 8196	33168 - 33175	Relay#1 Open State Name	ASCII	16 char			8
8197 - 819E	33176 - 33183	Relay#1 Closed State Name	ASCII	16 char			8
819F - 81B6	33184 - 33207	Relay#2 Label and State Names	same as Relay#1				24
81B7 - 81E6	33208 - 33255	Reserved					48
81E7 - 81EE	33256 - 33263	Input#1 Accumulator Label	ASCII	16 char			8
81EF - 81F6	33264 - 33271	Input#2 Accumulator Label	ASCII	16 char			8
8208 - 8208	33289 - 33289	Input#2 Accumulator Kt	UINT16	bit-mapped	ddVVVVVV VVVVVVVV	KT power factor for the Pulse Output "V" is raw power value in Wh/pulse from 0 to 9999. "dd"=decimal point position: 00=0.XXXX, 01=X.XXX, 10=XX.XX, 11= X.XXX.	1
8209 - 8326	33290 - 33575	Reserved					286
						Block Size:	512
Settings Registers for Digital I/O Pulse Output Card					**Second Overlay**	**write only in PS update mode**	
8127 - 812E	33064 - 33071	Input#1 Label	ASCII	16 char			8
812F - 8136	33072 - 33079	Input#1 Low State Name	ASCII	16 char			8
8137 - 813E	33080 - 33087	Input#1 High State Name	ASCII	16 char			8
813F - 8156	33088 - 33111	Input#2 Label and State Names	same as Input#1				24
8157 - 816E	33112 - 33135	Input#3 Label and State Names	same as Input#1				24
816F - 8186	33136 - 33159	Input#4 Label and State Names	same as Input#1				24
8187 - 818E	33160 - 33167	Output#1 Label	ASCII	16 char			8
818F - 8196	33168 - 33175	Output#1 Open State Name	ASCII	16 char			8
8197 - 819E	33176 - 33183	Output#1 Closed State Name	ASCII	16 char			8
819F - 81B6	33184 - 33207	Output#2 Label and State Names	same as Output#1				24
81B7 - 81CE	33208 - 33231	Output#3 Label and State Names	same as Output#1				24
81CF - 81E6	33232 - 33255	Output#4 Label and State Names	same as Output#1				24
81E7 - 81EE	33256 - 33263	Input#1 Accumulator Label	ASCII	16 char			8
81EF - 81F6	33264 - 33271	Input#2 Accumulator Label	ASCII	16 char			8
81F7 - 81FE	33272 - 33279	Input#3 Accumulator Label	ASCII	16 char			8

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
81FF - 8206	33280 - 33287	Input#4 Accumulator Label	ASCII	16 char			8
8207 - 8207	33288 - 33288	Input#1 Accumulator Kt	UINT16	bit-mapped	ddVVVVVV VVVVVVVV	KT power factor for the accumulator input "V" is raw power value in Wh/pulse from 0 to 9999. "dd"=decimal point position: 00=0.XXXX, 01=X.XXX, 10=XX.XX, 11= X.XXX.	1
8208 - 8208	33289 - 33289	Input#2 Accumulator Kt	UINT16	bit-mapped	ddVVVVVV VVVVVVVV		1
8209 - 8209	33290 - 33290	Input#3 Accumulator Kt	UINT16	bit-mapped	ddVVVVVV VVVVVVVV		1
820A - 820A	33291 - 33291	Input#4 Accumulator Kt	UINT16	bit-mapped	ddVVVVVV VVVVVVVV		1
820B - 8326	33292 - 33575	Reserved				Reserved	284
						Block Size:	512
Settings Registers for Analog Out 0-1mA / Analog Out 4-20mA Cards					**Second Overlay**	**write only in PS update mode**	
8127 - 8127	33064 - 33064	Update rate	UINT16	0 to 65535	milliseconds	Fixed -- see specifications.	1
8128 - 8128	33065 - 33065	Channel direction - 1mA Card only!	UINT16	bit-mapped	-------- ----4321	Full range output for 0-1mA card only: A bit set(1) means full range (-1mA to +1mA); a bit cleared(0) means source only (0mA to +1mA).	1
8129 - 8129	33066 - 33066	Format parameter for output #1	UINT16	bit-mapped	-------- ---f suwb	Format of the polled register:f=float 32; s=signed 32 bit int; u=unsigned 32 bit int; w=signed 16 bit int; b=unsigned 16 bit int.	1
812A - 812A	33067 - 33067	Source register for Output#1	UINT16	0 to 65535		This register should be programmed with the address of the register whose value is to be used for current output. In different words, the current level output of analog board will follow the value of the register addressed here.	1
812B - 812C	33068 - 33069	High value of source register for output#1	Depends on the format parameter			Value read from the source register at which High nominal current will be output. Example: for the 4-20mA card, if this register is programmed with 750, then the current output will be 20mA when the value read from the source register is 750.	2
812D - 812E	33070 - 33071	Low value of source register for output#1	Depends on the format parameter			Value read from the source register at which Low nominal current will be output. Example: for the 4-20mA card, if this register is programmed with 0, then the current output will be 4mA when the value read from the source register is 0.	2
812F - 8134	33072 - 33077	Analog output#2 format, register, max & min	Same as analog output#1				6
8135 - 813A	33078 - 33083	Analog output#3 format, register, max & min	Same as analog output#1				6
813B - 8140	33084 - 33089	Analog output#4 format, register, max & min	Same as analog output#1				6
8141 - 8326	33090 - 33575	Reserved				Reserved	486
						Block Size:	512

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Settings Registers for Network Cards					**Second Overlay**	**write only in PS update mode**	
8127 - 8127	33064 - 33064	General Options		bit-mapped	-----DGT ---- -W--	W=Web server:0=Enabled, 1=Disabled T=Silentmode:0=Disabled, 1=Enabled (When enabled TCP/Reset is not sent when Connection is attempted to an unbound port) G=Modbus Tcp/Ip Gateway:0=Enabled,1=Disabled D=DNP-Tcp/Ip-Wrapper: 0=Disabled, 1=Enabled.	1
8128 - 8128	33065 - 33065	DHCP enable		bit-mapped	-------- -------d	DHCP: d=1 enabled, d=0 disabled (user must provide IP configuration).	1
8129 - 8130	33066 - 33073	Host name label	ASCII			16 bytes (8 registers)	8
8131 - 8134	33074 - 33077	IP card network address	UINT16	0 to 255 (IPv4)		These 4 registers hold the 4 numbers (1 number each register) that make the IP address used by the card.	4
8135 - 8135	33078 - 33078	IP network address mask length	UINT16	0 to 32		Number of bits that are set in the IP address mask, starting from the Msb of the 32 bit word. Example 24 = 255.255.255.0; a value of 2 would mean 192.0.0.0	1
8136 - 8139	33079 - 33082	IP card network gateway address	UINT16	0 to 255 (IPv4)		These 4 registers hold the 4 numbers that make the IP gateway address on network.	4
813A - 813D	33083 - 33086	DNS #1, IP address	UINT16	0 to 255 (IPv4)		IP address of the DNS#1 on the network.	4
813E - 8141	33087 - 33090	DNS #2, IP address	UINT16	0 to 255 (IPv4)		IP address of the DNS#2 on the network.	4
8142 - 8142	33091 - 33091	TCP/IP Port – Modbus Gateway Service	UINT16	32-65534		Port for the Gateway service (modbus tcp/ip) when enabled	1
8143 - 8143	33092 - 33092	TCP/IP Port – WebService	UINT16	32-65534		Port for the Web service (html viewer) when enabled	1
8144 - 8144	33093 - 33093	Reserved – must be set to 0				Reserved. Set these regs to zero.	1
8145 - 8145	33094 - 33094	Reserved – must be set to 0				Reserved. Set these regs to zero.	1
8146 - 8149	33095 - 33098	Reserved – must be set to 0				Reserved. Set these regs to zero.	4
814A - 814D	33099 - 33102	Reserved – must be set to 0				Reserved. Set these regs to zero.	4
814E - 814E	33103 - 33103	Reserved – must be set to 0				Reserved. Set these regs to zero.	1
814F - 814F	33104 - 33104	Reserved – must be set to 0				Reserved. Set these regs to zero.	1
8150 - 8154	33105 - 33109	Reserved – must be set to 0				Reserved. Set these regs to zero.	5
8155 - 8174	33110 - 33141	NTP1 URL or IP(string)				IP address of the NTP server the Shark will contact.	32
8175 - 8194	33142 - 33173	Reserved – must be set to 0				Set these to regs to zero. Shark uses only 1 NTP	32
8195 - 8326	33174 - 33575	Reserved – must be set to 0				Reserved. Set these regs to zero.	402
						Block Size:	512
Secondary Readings Sectior							
Secondary Block						**read-only except as noted**	
9C40 - 9C40	40001 - 40001	System Sanity Indicator	UINT16	0 or 1	none	0 indicates proper meter operation	1
9C41 - 9C41	40002 - 40002	Volts A-N	UINT16	2047 to 4095	volts	2047= 0, 4095= +150	1
9C42 - 9C42	40003 - 40003	Volts B-N	UINT16	2047 to 4095	volts	volts = 150 * (register - 2047) / 2047	1
9C43 - 9C43	40004 - 40004	Volts C-N	UINT16	2047 to 4095	volts		1
9C44 - 9C44	40005 - 40005	Amps A	UINT16	0 to 4095	amps	0= -10, 2047= 0, 4095= +10	1
9C45 - 9C45	40006 - 40006	Amps B	UINT16	0 to 4095	amps	amps = 10 * (register - 2047) / 2047	1
9C46 - 9C46	40007 - 40007	Amps C	UINT16	0 to 4095	amps		1
9C47 - 9C47	40008 - 40008	Watts, 3-Ph total	UINT16	0 to 4095	watts	0= -3000, 2047= 0, 4095= +3000	1
9C48 - 9C48	40009 - 40009	VARs, 3-Ph total	UINT16	0 to 4095	VARs	watts, VARs, VAs =	1
9C49 - 9C49	40010 - 40010	VAs, 3-Ph total	UINT16	2047 to 4095	VAs	3000 * (register - 2047) / 2047	1

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
9C4A - 9C4A	40011 - 40011	Power Factor, 3-Ph total	UINT16	1047 to 3047	none	1047= -1, 2047= 0, 3047= +1 pf = (register - 2047) / 1000	1
9C4B - 9C4B	40012 - 40012	Frequency	UINT16	0 to 2730	Hz	0= 45 or less, 2047= 60, 2730= 65 or more freq = 45 + ((register / 4095) * 30)	1
9C4C - 9C4C	40013 - 40013	Volts A-B	UINT16	2047 to 4095	volts	2047= 0, 4095= +300	1
9C4D - 9C4D	40014 - 40014	Volts B-C	UINT16	2047 to 4095	volts	volts = 300 * (register - 2047) / 2047	1
9C4E - 9C4E	40015 - 40015	Volts C-A	UINT16	2047 to 4095	volts		1
9C4F - 9C4F	40016 - 40016	CT numerator	UINT16	1 to 9999	none	CT = numerator * multiplier / denominator	1
9C50 - 9C50	40017 - 40017	CT multiplier	UINT16	1, 10, 100	none		1
9C51 - 9C51	40018 - 40018	CT denominator	UINT16	1 or 5	none		1
9C52 - 9C52	40019 - 40019	PT numerator	UINT16	1 to 9999	none	PT = numerator * multiplier / denominator	1
9C53 - 9C53	40020 - 40020	PT multiplier	UINT16	1, 10, 100, 1000	none		1
9C54 - 9C54	40021 - 40021	PT denominator	UINT16	1 to 9999	none		1
9C55 - 9C56	40022 - 40023	W-hours, Positive	UINT32	0 to 99999999	Wh per energy format	* 5 to 8 digits	2
9C57 - 9C58	40024 - 40025	W-hours, Negative	UINT32	0 to 99999999	Wh per energy format	* decimal point implied, per energy format	2
9C59 - 9C5A	40026 - 40027	VAR-hours, Positive	UINT32	0 to 99999999	VARh per energy format	* resolution of digit before decimal point = units, kilo, or	2
9C5B - 9C5C	40028 - 40029	VAR-hours, Negative	UINT32	0 to 99999999	VARh per energy format	mega, per energy format	2
9C5D - 9C5E	40030 - 40031	VA-hours	UINT32	0 to 99999999	VAh per energy format	* see note 10	2
9C5F - 9C60	40032 - 40033	W-hours, Positive, Phase A	UINT32	0 to 99999999	Wh per energy format		2
9C61 - 9C62	40034 - 40035	W-hours, Positive, Phase B	UINT32	0 to 99999999	Wh per energy format		2
9C63 - 9C64	40036 - 40037	W-hours, Positive, Phase C	UINT32	0 to 99999999	Wh per energy format		2
9C65 - 9C66	40038 - 40039	W-hours, Negative, Phase A	UINT32	0 to 99999999	Wh per energy format		2
9C67 - 9C68	40040 - 40041	W-hours, Negative, Phase B	UINT32	0 to 99999999	Wh per energy format		2
9C69 - 9C6A	40042 - 40043	W-hours, Negative, Phase C	UINT32	0 to 99999999	Wh per energy format		2
9C6B - 9C6C	40044 - 40045	VAR-hours, Positive, Phase A	UINT32	0 to 99999999	VARh per energy format		2
9C6D - 9C6E	40046 - 40047	VAR-hours, Positive, Phase B	UINT32	0 to 99999999	VARh per energy format		2
9C6F - 9C70	40048 - 40049	VAR-hours, Positive, Phase C	UINT32	0 to 99999999	VARh per energy format		2
9C71 - 9C72	40050 - 40051	VAR-hours, Negative, Phase A	UINT32	0 to 99999999	VARh per energy format		2
9C73 - 9C74	40052 - 40053	VAR-hours, Negative, Phase B	UINT32	0 to 99999999	VARh per energy format		2
9C75 - 9C76	40054 - 40055	VAR-hours, Negative, Phase C	UINT32	0 to 99999999	VARh per energy format		2
9C77 - 9C78	40056 - 40057	VA-hours, Phase A	UINT32	0 to 99999999	VAh per energy format		2
9C79 - 9C7A	40058 - 40059	VA-hours, Phase B	UINT32	0 to 99999999	VAh per energy format		2
9C7B - 9C7C	40060 - 40061	VA-hours, Phase C	UINT32	0 to 99999999	VAh per energy format		2
9C7D - 9C7D	40062 - 40062	Watts, Phase A	UINT16	0 to 4095	watts		1
9C7E - 9C7E	40063 - 40063	Watts, Phase B	UINT16	0 to 4095	watts		1

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
9C7F - 9C7F	40064 - 40064	Watts, Phase C	UINT16	0 to 4095	watts		1
9C80 - 9C80	40065 - 40065	VARs, Phase A	UINT16	0 to 4095	VARs	0= -3000, 2047= 0, 4095= +3000	1
9C81 - 9C81	40066 - 40066	VARs, Phase B	UINT16	0 to 4095	VARs	watts, VARs, VAs =	1
9C82 - 9C82	40067 - 40067	VARs, Phase C	UINT16	0 to 4095	VARs	3000 * (register - 2047) / 2047	1
9C83 - 9C83	40068 - 40068	VAs, Phase A	UINT16	2047 to 4095	VAs		1
9C84 - 9C84	40069 - 40069	VAs, Phase B	UINT16	2047 to 4095	VAs		1
9C85 - 9C85	40070 - 40070	VAs, Phase C	UINT16	2047 to 4095	VAs		1
9C86 - 9C86	40071 - 40071	Power Factor, Phase A	UINT16	1047 to 3047	none	1047= -1, 2047= 0, 3047= +1	1
9C87 - 9C87	40072 - 40072	Power Factor, Phase B	UINT16	1047 to 3047	none	pf = (register - 2047) / 1000	1
9C88 - 9C88	40073 - 40073	Power Factor, Phase C	UINT16	1047 to 3047	none		1
9C89 - 9CA2	40074 - 40099	Reserved	N/A	N/A	none	Reserved	26
9CA3 - 9CA3	40100 - 40100	Reset Energy Accumulators	UINT16	password (Note 5)		write-only register; always reads as 0	1
						Block Size:	100
		Log Retrieval Section					
Log Retrieval Block						**read/write except as noted**	
C34C - C34D	49997 - 49998	Log Retrieval Session Duration	UINT32	0 to 4294967294	4 msec	0 if no session active; wraps around after max count	2
C34E - C34E	49999 - 49999	Log Retrieval Session Com Port	UINT16	0 to 4		0 if no session active, 1-4 for session active on COM1 - COM4	1
C34F - C34F	50000 - 50000	Log Number, Enable, Scope	UINT16	bit-mapped	nnnnnnnn essssss	high byte is the log number (0-system, 1-alarm, 2-history1, 3-history2, 4-history3, 5-I/O changes, 10-PQ, 11-waveform e is retrieval session enable(1) or disable(0) ssssss is what to retrieve (0-normal record, 1-timestamps only, 2-complete memory image (no data validation if image)	1
C350 - C350	50001 - 50001	Records per Window or Batch, Record Scope Selector, Number of Repeats	UINT16	bit-mapped	wwwwwwww snnnnnnn	high byte is records per window if s=0 or records per batch if s=1, low byte is number of repeats for function 35 or 0 to suppress auto-incrementing; max number of repeats is 8 (RTU) or 4 (ASCII) total windows, a batch is all the windows	1
C351 - C352	50002 - 50003	Offset of First Record in Window	UINT32	bit-mapped	ssssssss nnnnnnnn nnnnnnnn nnnnnnnn	ssssssss is window status (0 to 7-window number, 0xFF-not ready); this byte is read-only. nn…nn is a 24-bit record number. The log's first record is latched as a reference point when the session is enabled. This offset is a record index relative to that point. Value provided is the relative index of the whole or partial record that begins the window.	2
C353 - C3CD	50004 - 50126	Log Retrieve Window	UINT16	see comments	none	mapped per record layout and retrieval scope, read-only	123
						Block Size:	130

Modbus Address Hex	Modbus Address Decimal	Description (Note 1)	Format	Range (Note 6)	Units or Resolution	Comments	# Reg
Log Status Block						**read only**	
		Alarm Log Status Block					
C737 - C738	51000 - 51001	Log Size in Records	UINT32	0 to 4,294,967,294	record		2
C739 - C73A	51002 - 51003	Number of Records Used	UINT32	1 to 4,294,967,294	record		2
C73B - C73B	51004 - 51004	Record Size in Bytes	UINT16	14 to 242	byte		1
C73C - C73C	51005 - 51005	Log Availability	UINT16		none	0=available, 1-4=in use by COM1-4, 0xFFFF=not available (log size=0)	1
C73D - C73F	51006 - 51008	Timestamp, First Record	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
C740 - C742	51009 - 51011	Timestamp, Last Record	TSTAMP	1Jan2000 - 31Dec2099	1 sec		3
C743 - C746	51012 - 51015	Reserved				Reserved	4
						Individual Log Status Block Size:	16
C747 - C756	51016 - 51031	**System Log Status Block**		same as alarm log status block			16
C757 - C766	51032 - 51047	**Historical Log 1 Status Block**		same as alarm log status block			16
C767 - C776	51048 - 51063	**Historical Log 2 Status Block**		same as alarm log status block			16
C777 - C786	51064 - 51079	**Historical Log 3 Status Block**		same as alarm log status block			16
C787 - C796	51080 - 51095	**I/O Change Log Status Block**		same as alarm log status block			16
C797 - C7A6	51096 - 51111	**Power Quality Log Status Block**		same as alarm log status block			16
C7A7 - C7B6	51112 - 51127	**Waveform Capture Log Status Block**		same as alarm log status block			16
						Block Size:	128
		End of Map					

Data Formats	
ASCII	ASCII characters packed 2 per register in high, low order and without any termination characters. For example, "Shark200" would be 4 registers containing 0x5378, 0x6172, 0x6B32, 0x3030.
SINT16 / UINT16	16-bit signed / unsigned integer.
SINT32 / UINT32	32-bit signed / unsigned integer spanning 2 registers. The lower-addressed register is the high order half.
FLOAT	32-bit IEEE floating point number spanning 2 registers. The lower-addressed register is the high order half (i.e., contains the exponent).
TSTAMP	3 adjacent registers, 2 bytes each. First (lowest-addressed) register high byte is year (0-99), low byte is month (1-12). Middle register high byte is day(1-31), low byte is hour (0-23 plus DST bit). DST (daylight saving time) bit is bit 6 (0x40). Third register high byte is minutes (0-59), low byte is seconds (0-59). For example, 9:35:07AM on October 12, 2049 would be 0x310A, 0x0C49, 0x2307, assuming DST is in effect.

Notes	
1	All registers not explicitly listed in the table read as 0. Writes to these registers will be accepted but won't actually change the register (since it doesn't exist).
2	Meter Data Section items read as 0 until first readings are available or if the meter is not in operating mode. Writes to these registers will be accepted but won't actually change the register.
3	Register valid only in programmable settings update mode. In other modes these registers read as 0 and return an illegal data address exception if a write is attempted.
4	Meter command registers always read as 0. They may be written only when the meter is in a suitable mode. The registers return an illegal data address exception if a write is attempted in an incorrect mode.
5	If the password is incorrect, a valid response is returned but the command is not executed. Use 5555 for the password if passwords are disabled in the programmable settings.
6	M denotes a 1,000,000 multiplier.
7	Each identifier is a Modbus register. For entities that occupy multiple registers (FLOAT, SINT32, etc.) all registers making up the entity must be listed, in ascending order. For example, to log phase A volts, VAs, voltage THD, and VA hours, the register list would be 0x3E7, 0x3E8, 0x411, 0x412, 0x176F, 0x61D, 0x61E and the number of registers (0x7917 high byte) would be 7.
8	Writing this register causes data to be saved permanently in nonvolatile memory. Reply to the command indicates that it was accepted but not whether or not the save was successful. This can only be determined after the meter has restarted.
9	Reset commands make no sense if the meter state is LIMP. An illegal function exception will be returned.
10	Energy registers should be reset after a format change.
11	Entities to be monitored against limits are identified by Modbus address. Entities occupying multiple Modbus registers, such as floating point values, are identified by the lower register address. If any of the 8 limits is unused, set its identifier to zero. If the indicated Modbus register is not used or is a nonsensical entity for limits, it will behave as an unused limit.
12	There are 2 setpoints per limit, one above and one below the expected range of values. LM1 is the "too high" limit, LM2 is "too low". The entity goes "out of limit" on LM1 when its value is greater than the setpoint. It remains "out of limit" until the value drops below the in threshold. LM2 works similarly, in the opposite direction. If limits in only one direction are of interest, set the in threshold on the "wrong" side of the setpoint. Limits are specified as % of full scale, where full scale is automatically set appropriately for the entity being monitored:

current	FS = CT numerator * CT multiplier
voltage	FS = PT numerator * PT multiplier
3 phase power	FS = CT numerator * CT multiplier * PT numerator * PT multiplier * 3 [* SQRT(3) for delta hookup]
single phase power	FS = CT numerator * CT multiplier * PT numerator * PT multiplier [* SQRT(3) for delta hookup]
frequency	FS = 60 (or 50)
power factor	FS = 1.0
percentage	FS = 100.0
angle	FS = 180.0

13	THD not available shows 10000 in all THD and harmonic magnitude and phase registers for the channel. THD may be unavailable due to low V or I amplitude, delta hookup (V only), or V-switch setting.
14	Option Card Identification and Configuration Block is an image of the EEPROM on the card
15	A block of data and control registers is allocated for each option slot. Interpretation of the register data depends on what card is in the slot.
16	Measurement states: Off occurs during programmable settings updates; Run is the normal measuring state; Limp indicates that an essentail non-volatile memory block is corrupted; and Warmup occurs briefly (approximately 4 seconds) at startup while the readings stabilize. Run state is required for measurement, historical logging, demand interval processing, limit alarm evaluation, min/max comparisons, and THD calculations. Resetting min/max or energy is allowed only in run and off states; warmup will return a busy exception. In limp state, the meter reboots at 5 minute intervals in an effort to clear the problem.
17	Limits evaluation for all entites except demand averages commences immediately after the warmup period. Evaluation for demand averages, maximum demands, and minimum demands commences at the end of the first demand interval after startup.
18	Autoincrementing and function 35 must be used when retrieving waveform logs.
19	Depending on the V-switch setting, there are 15, 29, or 45 flash sectors available in a common pool for distribution among the 3 historical and waveform logs. The pool size, number of sectors for each log, and the number of registers per record together determine the maximum number of records a log can hold. S = number of sectors assigned to the log, H = number of Modbus registers to be monitored in each historical record (up to 117), R = number of bytes per record = (12 + 2H) for historical logs N = number of records per sector = 65516 / R, rounded down to an integer value (no partial records in a sector) T = total number of records the log can hold = S * N T = S * 2 for the waveform log.

20	Only 1 input on all digital input cards may be specified as the end-of-interval pulse.
21	Logs cannot be reset during log retrieval. Waveform log cannot be reset while storing a capture. Busy exception will be returned.
22	Combination of class and type currently defined are: 0x23 = Fiber cards 0x24 = Network card 0x41 = Relay card 0x42 = Pulse card 0x81 = 0-1mA analog output card 0x82 = 4-20mA analog output card.