Series PM130 PLUS Powermeters
PM130P/PM130E/PM130EH

SATEC ASCII Communications Protocol

Reference Guide

BG0426 Rev. A4

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For further information regarding a particular installation, operation or maintenance of equipment, contact the manufacturer or your local representative or distributor.

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1 General

This document specifies the SATEC ASCII serial communications protocol used to transfer data between a master computer station and the PM130. The document provides the complete information necessary to develop third-party communications software capable of communication with the Series PM130 instruments. For additional information concerning operating the device, configuring the communication parameters, and communication connections see the PM130 PLUS Installation and Operation Manual.

The document is applicable to PM130A, PM130P, PM130E and PM130EH meters.

IMPORTANT

In 3-wire connection schemes, the unbalanced current and phase readings for power factor, active power, and reactive power will be zeros, because they have no meaning. Only the total three-phase power values are provided.

Most of the advanced features are configured using multiple setup parameters that can be accessed in a number of contiguous registers. When writing the setup registers, it is recommended to write all the registers at once using a single request, or to clear (zero) the setup before writing into separate registers.

Designations used in the guide:

E - available in the PM130E and PM130EH
EH - available in the PM130EH

2 ASCII Protocol Description

2.1 ASCII Framing

2.1.1 ASCII Message Frame

The following specifies the ASCII message frame:

Field No.	1	2	3	4	5	6	7
Contents	SYNC (!)	Message length	Slave address	Message type	Message body	Checksum	Trailer (CR LF)
Length, char	1	3	2	1	0 to 246	1	2

SYNC

Synchronization character: one character '!' (ASCII 33), used for starting synchronization.

Message length

The length of the message including only number of bytes in fields #2, #3, #4 and #5. Contains three characters between '006' and '252'.

Slave address

Contains two characters from '00' to '99'. The instrument with address '00' responds to requests with any incoming address. For RS-422/RS-485 communications (multi-drop mode), this field must NEVER be zero.

Message type

Consists of one character representing the type of a host request. A list of the message types is shown in Tables 2-1 and 2-2. Note that they are case-sensitive.

Message body

Contains the message parameters in ASCII representation. All parameter fields have a fixed format. The data fields vary in length depending on the data type. Unless otherwise indicated, the parameters should be right justified and left-padded with zeros. Most parameters are represented in ASCII hexadecimal notation, and in some cases (to provide compatibility with old devices) a decimal representation is preserved. For data formats, see Section 3.2.

Checksum

Arithmetic sum, calculated in a 2-byte word over fields #2, #3, #4 and #5 to produce a one-byte check sum in the range of 0x22 to 0x7E (hexadecimal) as follows: $[\sum(\text{each byte} - 0x22)] \bmod 0x5C + 0x22$

Trailer

The message termination consisting of two ASCII characters CR (ASCII 13) and LF (ASCII 10).

NOTE

Fields #3 and #4 of the instrument response are always the same as those in the host request.

Table 2-1 Specific ASCII Requests

Message type		Description
ASCII Char	ASCII Hex	
0	0x30	Read basic data registers
1	0x31	Read basic setup
2	0x32	Write basic setup
4	0x34	Reset/clear functions
8	0x38	Reset the instrument
9	0x39	Read version number
?	0x3F	Read extended status
B	0x42	Read analog output setup
b	0x62	Write analog output setup
J	0x4A	Read pulse counter setup
j	0x6A	Write pulse counter setup
S	0x53	Read Real Time Clock
T	0x54	Write Real Time Clock

Table 2-2 Direct Read/Write ASCII Requests

Message type		Description
ASCII Char	ASCII Hex	
A	0x41	Long-size direct read
a	0x61	Long-size direct write
X	0x58	Variable-size direct read
x	0x78	Variable-size direct write

2.2 Exception Responses

The instrument will send the following error codes in the message body in response to incorrect host requests:

XK - the meter is in programming mode

XM - invalid request type or illegal operation

XP - invalid data address or data value, or data is not available

NOTE

When a check or framing error is detected, the meter will not act on or respond to the master's request.

2.3 Protocol Implementation

2.3.1 ASCII Specific and Direct Requests

The ASCII protocol provides two different types of messages to transfer data between a master application and the meter: specific requests and direct read/write requests.

Specific ASCII requests use different formats for accessing different data locations. The message body differs depending on the request type. Each data field has a fixed position in the ASCII string. Section 3 describes specific ASCII requests and their message body formats.

Direct read/write requests use a universal message body format, described in Section 2.4. These requests allow a master application to access different data locations (registers) in the instrument by specifying a direct register index. A number of consequent registers can be read or written by a single request by specifying an arbitrary start register and the number of registers to be accessed. Section 4 gives a register map for direct read/write requests and their contents.

All measurement data in your instrument can be accessed using direct read requests, and some data can be read via specific ASCII requests. In all cases, a direct register read offers you more precise data with extended resolution. Setup data can be partially accessed using both specific and direct requests, and partially via either specific or direct requests.

2.3.2 Data Formats

Specific ASCII requests use both decimal and hexadecimal notation. Direct requests transfer ASCII data only in a hexadecimal format.

Using a decimal notation, data is transmitted in a decimal representation as is, i.e., no conversion is needed. Negative numbers are transmitted with a sign at the left. Fractional numbers are represented with a decimal point. When the value exceeds the field width, it is truncated to the right.

In a hexadecimal notation, each data byte is transferred by two hexadecimal characters in ASCII representation (i.e., ASCII printable characters 0-9, A-F are used to represent hexadecimal digits 0x00-0x09, 0x0a-0x0f). All data is transferred as 2-character (8-bit unsigned byte), 4-character (16-bit unsigned or signed integer) or 8-character (32-bit unsigned or signed long integer) whole numbers. Negative numbers are transmitted in 2-complement code. Each data byte is transmitted high order digit first. Each integer or long integer register is transmitted high order bytes first.

Fractional numbers are transmitted being scaled by 10 in power N, where N is the number of digits in the fractional part. For example, the frequency reading of 50.01 Hz is transmitted as 5001 being pre-multiplied by 100. Whenever a data register contains a fractional number, the register measurement unit is given with a multiplier ×0.1, ×0.01 or ×0.001, showing an actual register resolution (the weight of the least significant decimal digit). To get an actual fractional number with specified precision, scale the register value with the given multiplier. To write a fractional number into the register, divide the number by the given multiplier.

2.4 Direct Read/Write Request

2.4.1 General

In direct read/write requests, data registers are addressed by point ID's that are given in a 4-digit hexadecimal format.

All data is transmitted in ASCII hexadecimal notation as 2-character (UINT8, 8-bit unsigned byte), 4-character (16-bit unsigned UINT16 or signed INT16 integer) or 8-character (32-bit unsigned UINT32 or signed INT32 long integer) numbers. Negative numbers are transmitted in 2-complement code. Register type in the tables below shows an actual data size for data accessed using variable-size direct read/write requests.

When long-size direct read/write request is used, an actual data size is ignored and all registers are transmitted in an 8-character format as long signed (INT32) or unsigned (UINT32) integers.

2.4.2 Long-Size Direct Read/Write

In long-size direct read/write messages, all data items are read and written as long unsigned (UINT32) or signed (INT32) integers, which are represented in messages by 8-digit hexadecimal numbers, regardless of the actual data size. Up to 30 contiguous points can be read in one message once. A write request allows for writing only one data location at a time.

Table 2-3 Read Request

Offset	Description	Range	Type
	Message type	**'A'**	
	Request body:		
+0	Start point ID	0x0000-0xFFFF	UINT16
+4	The number of points to read	1-30 (0x01-0x1E)	UINT8
	Response body:		
+0	Number of points read	1-30 (0x01-0x1E)	UINT8
+2	Point #1 value	0x00000000-0xFFFFFFFF	INT32
+10	Point #2 value	0x00000000-0xFFFFFFFF	INT32
…	…		…

+23 4	Point #30 value	0x00000000- 0xFFFFFFFF	INT32

Table 2-4 Write Request

Offset	Description	Range	Type
	Message type	**'a'**	
	Request body:		
+0	Point ID	0x0000-0xFFFF	UINT16
+4	Point value to write	0x00000000- 0xFFFFFFFF	INT32
	Response body:		
+0	Point ID	0x0000-0xFFFF	UINT16
+4	Written value	0x00000000- 0xFFFFFFFF	INT32

2.4.3 Variable-Size Direct Read/Write

With variable-size direct read/write messages, data points are read and written as 2, 4 or 8-character hexadecimal numbers. The actual data size is indicated for each data location. When written, the data type should be exactly the same as indicated.

The number of parameters that can be read or written by a single read/write request depends on the size of each data item. The total length of all parameters should not exceed 240 characters.

Table 2-5 Read Request

Offset	Description	Range	Type
	Message type	**'X'**	
	Request body:		
+0	Start point ID	0x0000-0xFFFF	UINT16
+4	The number of points to read	1-60 (0x01-0x3C)	UINT8
	Response body:		
+0	Number of points read	1-60 (0x01-0x3C)	UINT8
+2	Point #1 value		INT8/16/32
	Point #2 value		INT8/16/32
	...		...
	Point #60 value		INT8/16/32

Table 2-6 Write Request

Offset	Description	Range	Type
	Message type	**'x'**	
	Request body:		
+0	Start point ID	0x0000-0xFFFF	UINT16
+4	The number of points to write	1-60 (0x01-0x3C)	UINT8
+6	Point #1 value		INT8/16/32
	Point #2 value		INT8/16/32
	...		...
	Point #60 value		INT8/16/32
	Response body:		
+0	Start point ID	0x0000-0xFFFF	UINT16
+4	Number of points written	1-60 (0x01-0x3C)	UINT8

2.4.4 User Assignable Registers

The PM130 contains 120 user assignable registers designated by points 0x8000 through 0x8077, any of which you can map to any point accessible in the instrument through direct read/write requests. Points that reside in different locations may be accessed by a single request by re-mapping them to adjacent points in the user assignable registers area.

The actual point ID's of the assignable registers, which are accessed via addresses 0x8000 through 0x8077, are specified in the register map through points 0x8100-0x8177, where point 0x8100 contains the actual point ID of the register accessed via point 0x8000, point 0x8101 contains the actual point ID of the register accessed via point 0x8001, and so on. The assignable registers and the map registers themselves may not be re-mapped.

To build your own register map, write to map registers (points 0x8100-0x8177) the actual point ID's of the registers you want to read from or write to via the assignable points 0x8000-0x8077. For example, if you want to read points 0x0C00 (real-time voltage of phase A) and 0x1700 (kWh import) through points 0x8000-0x8001, do the following:

- write 0x0C00 to point 0x8100
- write 0x1700 to point 0x8101

Reading from points 0x8000-0x8001 will return the voltage reading through point 0x8000, and the kWh reading through point 0x8001.

2.5 Password Protection

The PM130 has a password protection option allowing you to protect your setups, cumulative registers and logs from being changed or cleared through communications. You can disable or enable password protection through communications or via the front display. For details, refer to your instrument Installation and Operation Manual.

When password protection is enabled, the user password you set in your instrument should be written into the device authorization register (point 0xFF00) before another write request is issued. If the correct password is not supplied while password protection is enabled, the instrument will respond to all write requests with the exception code XM (illegal operation).

It is recommended to clear the password register after you have completed your changes in order to activate password protection.

2.6 Data Recording and File Transfers

2.6.1 Log File Organization

Historical files are stored to the non-volatile memory. Memory is allocated for each file statically when you set up your files and will not change unless you re-organize the files. The PM130 automatically performs de-fragmentation of the memory each time you re-organize your files. This helps keep all free memory in one continuous chunk and thus prevents possible leakage of memory caused by fragmentation.

Data records in a file are arranged in the order of their recording. Each record has a unique 16-bit sequence number that is incremented modulo 65536 with each new record. The sequence number can be used to point to a particular record in the file, or to check the sequence of records when uploading files from the device.

Each file has a write position pointer that indicates the place where the next record will be recorded, and a read position pointer that indicates the place from where the current record will be read. Both pointers show sequence numbers of the records they point to rather than record offsets in the file.

After acknowledging a record you have read, the read pointer automatically advances to the next record in the file. When the read pointer gets to the record to which the file write pointer points, the end-of-file (EOF) flag is set. It is automatically cleared when a new record is added to the file, or when you explicitly move the read pointer to any record within a file.

If a file has a wrap-around attribute (circular file), the most recent records can overwrite the oldest records. When this happens at the current read position, the read pointer automatically advances forward in order to point to the oldest record in the file.

The PM130 keeps a separate read pointer for each communication port so that access to the same file through a different port will not affect current active sessions for other ports.

Multi-section Files

Log files can have one or more (up to 8) sections for multi-channel recording. An ordinal file consists of a single section. A daily profile log file is arranged as a multi-section file.

A multi-section file is subdivided into multiple sections of the same structure, one section per recording channel. The number of sections in each file is defined at the time you set up your files and may not change unless you re-organize the file. Each section within a multi-section file can be addressed through a particular register window related to the section.

A multi-section file has a single write position pointer for all sections and stores data in all sections simultaneously. This means that records with the same sequence number in all sections are associated with the same event. A multi-section file has also a single read position pointer for all sections.

Data Log Files

Data log files can store up to 9 measured parameters per a record. Any data measured by the device can be stored in the log file. The number of parameters that each record will hold and the list of parameters you want to be recorded in the file can be selected through the Data log setup registers for a particular file.

Recording data to the data log files can be triggered through the setpoints, either on a time basis using the meter clock or periodic timers, or upon any event detected by setpoints.

Profile Data Log File

Data log file #16 can be configured for a daily profile log of the energy usage and maximum demand registers. A profile log file is organized as a multi-section file that has a separate section for each energy and maximum demand register. A file record stores the summary data (total of all tariffs) and all tariff data for each configured Summary/TOU register. See Section 4.8 for information on the file record structure.

The number of sections is taken automatically from the Summary/TOU Registers setup. Since each Summary/TOU energy register has a shadow maximum demand register, the number of sections in the file can be twice the number of the allocated Summary/TOU registers. Always configure the Summary/TOU registers before you allocate memory for your profile log file.

New records are added to the file automatically every day at midnight. You can review the list of parameters that are recorded to the file through the Data log #16 setup. It is preset automatically by the meter and shows the recorded data for the first file section, which represents the first configured energy usage register.

Real-time Waveforms

Real-time waveforms are read as a multi-section file that stores data for each recording channel in a separate section. A real-time waveform contains six AC channels - three voltage and three current waveforms, which are recorded in successive sections.

A single waveform record for a channel contains 512 points of the sampled input signal. Refer to the line frequency field in the channel header record to correctly set up the time scale for the waveforms.

2.6.2 File Transfers

File transfer protocol provides both data transfer and information services. File transfer is performed through blocks of registers separate for each file and file section. File transfer control registers allow changing the file or section position in order to point to the desired record.

The information service uses separate status/control registers for each file. The extended file information is available including current file pointers' positions, the number of records in the file, allocated file size, and more.

See Section 4.7 File Transfer Registers for information on register locations.

Common File Transfer

Log files can be read either in a sequence record-by-record, or in a random order. Each read request fills the corresponding register block with the data of the record pointed to by the file (or section) read pointer. If you want to begin reading a file from a particular record, which sequence number is known, you can change the pointer position by writing the desired sequence number into the file transfer control register. If you want to read a file from the beginning, you can simply write a corresponding command to the file command register that moves the pointer to the oldest file record. If you do not change the file position, then you will continue reading the file from the record following the one you have read the last time you accessed the file.

You need not explicitly move the file position to the following record if you want to continue reading a file in a sequence after you have uploaded the current record. Instead, continue reading the file through the file transfer block.

For the event log files, the file transfer block can contain up to 6 records that can be read at once: the file position automatically moves to the record following the last one you have just read in the file transfer block.

The file transfer is completed after you have read the last record of the file. Before storing a file record to your database, always check bit 1 in the record status word, which contains the end-of-file (EOF) flag. This bit set to 1 indicates that the file read pointer does not point to any record within the file, and you should not store any record that has this bit set. The EOF flag is set only after you have read the last record of the file, so that testing for end-of-file requires one extra read. If you wish to stop the transfer just after storing the last file record, check bit 0 in the record status word. Bit 0 is set to 1 only once when you read the last record of the file.

The following gives a summary of steps you should do to read an ordinal log file:

1. If you want to begin reading a file from a particular record or from the first record, either set the file position to the desired record sequence number, or preset the file position to point to oldest record.
2. Read the record data through the corresponding file transfer block. The file pointer will be automatically moved to the next file record.
3. Repeat steps 1-2 until all the file records are read, i.e., until either bit 0 or bit 1 is set in the record status word.

Reading a Daily Profile Log File

Reading a multi-section profile log file does not differ from reading ordinal files with the only exception that each file section is accessed through a separate transfer block.

If you want to know which registers are recorded to the file sections before reading them, check the daily profile log sections map through point 0xA0F4 (see Section 4.7, File Transfer Registers). This is a bitmap that contains one in a bit position if a designated register is recorded to the file, and contains zero if it is not.

The following gives a summary of steps for a multi-section file:

1. If you want to begin reading a file section from a particular record or from the first record, either set the file section position to the desired record sequence number, or preset the file section position to point to oldest record.
2. Read the record data through the corresponding file section transfer block. The file pointer automatically moves to the next file record.
3. Repeat steps 1-2 until all the file section records are read, i.e., until either bit 0 or bit 1 is set in the record status word.

Reading Real-time Waveforms

Each waveform record consists of six channel records that are read in sequence always starting with channel V1. Each channel's data is read in two stages. The channel header record is read first through a separate transfer block followed be reading the channel sample series. Each time you read the V1 channel header record, the meter captures new waveforms

to the buffer so that you can then read all of them through the waveform transfer blocks. The following gives a summary of steps for reading real-time waveforms:

1. Read the V1 channel header data through the corresponding real-time waveform header transfer block. The captured waveform's data is moved to the port's communication buffer.
2. Read the V1 channel sample series through the waveform series transfer block.
3. Read the next channel's header data through the corresponding waveform header transfer block.
4. Read the sample series for the selected channel through the waveform series transfer block.
5. Repeat steps 3, 4 until all channels' records are read.

3 Specific ASCII Requests

3.1 Basic Data Set

Offset	Length	Description	Range[2]	Units[2]	Type	R/W	Notes
Basic Data Set							
		Message Type	**'0'**				
		Request Body	No				
		Response Body (decimal)					
+0	4	V1/V12 Voltage	0 to Vmax	U1			1
+4	4	V2/V23 Voltage	0 to Vmax	U1			1
+8	4	V3/V31 Voltage	0 to Vmax	U1			1
+12	5	I1 Current	0 to Imax	U2			
+17	5	I2 Current	0 to Imax	U2			
+22	5	I3 Current	0 to Imax	U2			
+27	6	kW L1	-Pmax to Pmax	U3			
+33	6	kW L2	-Pmax to Pmax	U3			
+39	6	kW L3	-Pmax to Pmax	U3			
+45	4	Power factor L1	-.99 to 1.00 [4]				
+49	4	Power factor L2	-.99 to 1.00 [4]				
+53	4	Power factor L3	-.99 to 1.00 [4]				
+57	6	kW total	-Pmax to Pmax	U3			
+63	4	Power factor total	-.99 to 1.00 [4]				
+67	6	kWh import	0 to 99999.	MWh			3
+73	5	Neutral (unbalanced) current	0 to Imax	A			
+78	4	Frequency	25.0 to 400.	Hz			
+82	6	kvar L1	-Pmax to Pmax	U3			
+88	6	kvar L2	-Pmax to Pmax	U3			
+94	6	kvar L3	-Pmax to Pmax	U3			
+100	6	kVA L1	0 to Pmax	U3			
+106	6	kVA L2	0 to Pmax	U3			
+112	6	kVA L3	0 to Pmax	U3			
+118	6	kvarh net	-9999. to 99999.	Mvarh			3
+124	6	kvar total	-Pmax to Pmax	U3			
+130	6	kVA total	0 to Pmax	U3			
+136	6	Maximum sliding window kW import demand [5]	0 to Pmax	U3			
+142	6	Accumulated kW import demand	0 to Pmax	U3			
+148	5	I1 Max. ampere demand	0 to Imax	U2			
+153	5	I2 Max. ampere demand	0 to Imax	U2			
+158	5	I3 Max. ampere demand	0 to Imax	U2			

Offset	Length	Description	Range[2]	Units [2]	Type	R / W	Notes
+163	2	Status inputs (bitmap - hex)	0x00-0x03				
+165	6	kWh export	0 to 99999.	MWh			[3]
+171	6	Maximum sliding window kVA demand [5]	0 to Pmax	U3			
+177	4	V1/V12 Voltage THD	0.0 to 999.	%			[1, 5] 3-sec value
+181	4	V2/V23 Voltage THD	0.0 to 999.	%			[1, 5] 3-sec value
+185	4	V3/V31 Voltage THD	0.0 to 999.	%			[1, 5] 3-sec value
+189	4	I1 Current THD	0.0 to 999.	%			[5] 3-sec value
+193	4	I2 Current THD	0.0 to 999.	%			[5] 3-sec value
+197	4	I3 Current THD	0.0 to 999.	%			[5] 3-sec value
+201	8	kVAh total	0 to 99999.99	MVAh			[3]
+209	6	Present sliding window kW import demand [5]	0 to Pmax	U3			
+215	6	Present sliding window kVA demand [5]	0 to Pmax	U3			
+221	4	PF (import) at maximum KVA demand	0 to 1.00				
+225	4	I1 Current TDD	0.0 to 99.9	%			[5] 3-sec value
+229	4	I2 Current TDD	0.0 to 99.9	%			[5] 3-sec value
+233	4	I3 Current TDD	0.0 to 99.9	%			[5] 3-sec value

NOTES:

Energy and power demand readings are only available in PM130E and PM130EH meters. Total harmonics are only available in PM130EH meters.

1 Voltage and voltage harmonics readings: when the 4LN3, 3LN3 or 3BLN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

2 All analog registers except of harmonics are 1-second average values. For volts, amps and power scales and units, refer to Section 5 "Data Scales and Units".

When ASCII compatibility mode is disabled (see Section 5.5), voltages, currents and powers are transmitted with a decimal point in units defined in the table. When the value is greater than the field width, the right most digits of the fractional part are truncated.

When ASCII compatibility mode is enabled, the meter provides a fully downward-compatible response using a lower resolution for voltages, currents and powers - the value is transmitted as a whole number until the field is filled up, and then it is converted to higher units and transmitted with a decimal point. If the value is greater than the field width, the right most digits of the fractional part are truncated. Voltages are transmitted in volts as whole numbers or in kilovolts with a decimal point, currents in amperes as whole numbers, and powers in kilowatts as whole numbers or in megawatts with a decimal point.

3 Energy readings are transmitted in MWh, Mvarh and MVAh units with a decimal point. If the energy value exceeds the field width, the right-most digits are truncated**. If you use these request for energy readings, then, to avoid overflow, limit the energy roll value (see Device Options Setup) to 7 digits if you use kvarh net reading or to 8 digits if you do not use it.**

4 For negative power factor, the minus sign is transmitted before a decimal point as shown in the table.

5 In 2LL1 wiring mode the Harmonics calculations are not supported.

3.2 Device Control and Status

Offset	Length	Description	Range	Units	Type	R/W	Notes
Reset/Clear							
		Message Type	**'4'**				
		Request Body (hexadecimal):					
+0	1	Reset function	F30				
+1	2	Target	F30				
		Response – the same as request					
Warm Restart							
		Message Type	**'8'**				
		Request Body	No				
		Response Body	No				
Firmware Version							
		Message Type	**'9'**				
		Request Body	No				
		Response Body					
+0	4	Firmware version number	1100-1199				Two higher decimal digits = major version number, two lower decimal digits = minor version number
+4	2	Firmware build number	1-99				
Device Status							
		Message Type	**'?'**				
		Request Body	No				
		Response Body					
+0	4	Relay status (bitmap)	0x0000-0x0003				
+4	4	Not used	0x0000				
+8	4	Digital (status) inputs (bitmap)	0x0000-0x0003				
+12	4	Setpoints status (bitmap)	0x0000-0xFFFF				
+16	40	Not used	0x0000				

3.3 Device Setup

Offset	Length	Description	Range	Units	Type	R/W	Notes
Read Basic Setup							
		Message Type	**'1'**				
		Request Body (decimal):					
+0	3	Parameter ID	F31				

Offset	Length	Description	Range	Units	Type	R / W	Notes
		Response Body (decimal)					
+0	3	Parameter ID	F31				
+3	4	Not used	00.0				
+7	6	Parameter value	See "Basic Setup" in Section 4.5				
Write Basic Setup							
		Message Type	**'1'**				
		Request Body (decimal):					
+0	3	Parameter ID	F31				
+3	4	Not used	00.0				
+7	6	Parameter value	See "Basic Setup" in Section 4.5				
		Response – the same as request					
Read Analog Output Setup							
		Message Type	**'B'**				
		Request Body					
+0	2	Analog channel number	0-1=channel AO1-AO2				
		Response Body (hexadecimal)					
+0	2	Analog channel number	0-1=channel AO1-AO2				
+2	4	Output parameter point ID	F18				
+6	8	Zero scale (0/4 mA)	See Section 4.2				
+14	8	Full scale (20/1 mA)	See Section 4.2				
Write Analog Output Setup							
		Message Type	**'b'**				
		Request Body (hexadecimal)					
+0	2	Analog channel number	0-1=channel AO1-AO2				
+2	4	Output parameter point ID	F18				
+6	8	Zero scale (0/4 mA)	See Section 4.2				
+14	8	Full scale (20/1 mA)	See Section 4.2				
		Response Body – the same as request					
Read Pulse Counter Setup							
		Message Type	**'J'**				
		Request Body					
+0	2	Counter ID	0-3=counter #1-#4				
		Response Body (hexadecimal)					
+0	2	Counter ID	0-3=counter #1-#4				
+2	2	Source ID	0=not assigned, 1-4=DI1-DI4				
+4	4	Multiplier	1-9999				
Write Pulse Counter Setup							
		Message Type	**'j'**				
		Request Body (hexadecimal)					
+0	2	Counter ID	0-3=counter #1-#4				
+2	2	Source ID	0=not assigned, 1-2=DI1-DI2				

Offset	Length	Description	Range	Units	Type	R / W	Notes
+4	4	Multiplier	1-9999				
+2	4	Timer interval	1-9999, 0=timer disabled				
		Response Body – the same as request					
Read File Setup [E]							
		Message Type	**'K'**				
		Request Body (hexadecimal)					
+0	2	File ID	F8				
		Response Body (hexadecimal)					
+0	2	File ID	F8				
+2	8	Allocated file size, bytes					
+10	4	Number of records in the file	0-65535				
+14	4	File record size, bytes					
+18	2	The number of parameters per record	0-16				
+20	2	File attributes	F3				
Write File Setup [E]							
		Message Type	**'k'**				
		Request Body (hexadecimal)					
+0	2	File ID	F8				
+2	4	Number of records in the file	1-65535, 0=delete a file				
+6	2	The number of parameters per record	0-9				Write 0 for event log and waveform log
+8	2	File attributes	F3				
		Response Body (hexadecimal)					
+0	2	File ID	F8				
Read Data Log Setup [E]							
		Message Type	**'L'**				
		Request Body (hexadecimal)					
+0	2	Data log ID	0=Data log #1, 15=Data log #16				
		Response Body (hexadecimal)					
+0	2	Data log ID	0=Data log #1, 15=Data log #16				
+2	2	Number of parameters per record	1-9, 0=file does not exist				
+4	4	Data log parameter #1 point ID	See Section 4.2				
+8	4	Data log parameter #2 point ID					
+12	4	Data log parameter #3 point ID					
+16	4	Data log parameter #4 point ID					
+20	4	Data log parameter #5 point ID					
+24	4	Data log parameter #6 point ID					
+28	4	Data log parameter #7 point ID					
+32	4	Data log parameter #8 point ID					

Offset	Length	Description	Range	Units	Type	R / W	Notes
+36	4	Data log parameter #9 point ID					
Write Data Log Setup [E]							
		Message Type	**'I'**				
		Request Body (hexadecimal)					
+0	2	Data log ID	0=Data log #1, 15=Data log #16				
+2	2	Number of parameters per record	1-9				
+4	4	Data log parameter #1 point ID	See Section 4.2				
+8	4	Data log parameter #2 point ID					
+12	4	Data log parameter #3 point ID					
+16	4	Data log parameter #4 point ID					
+20	4	Data log parameter #5 point ID					
+24	4	Data log parameter #6 point ID					
+28	4	Data log parameter #7 point ID					
+32	4	Data log parameter #8 point ID					
+36	4	Data log parameter #9 point ID					
		Response Body (hexadecimal)					
+0	2	Data log ID	0=Data log #1, 15=Data log #16				
Read Clock Indication							
		Message Type	**'S'**				
		Request Body	No				
		Response Body (decimal)					
+0	2	Second	0-59				
+2	2	Minute	0-59				
+4	2	Hour	0-23				
+6	2	Day	1-31				
+8	2	Month	1-12				
+10	2	Year	0-99				
+12	2	Day of week	1-7 (1=Sunday)				
Write Clock Setup							
		Message Type	**'T'**				
		Request Body (decimal)					
+0	2	Second	0-59				
+2	2	Minute	0-59				
+4	2	Hour	0-23				
+6	2	Day	1-31				
+8	2	Month	1-12				
+10	2	Year	0-99				
+12	2	Day of week	1-7 (1=Sunday)				Ignored when written
		Response Body – the same as request					

4 Direct Read/Write Requests

4.1 Protocol Setup Registers

Point ID	Description	Options/Range	Units	Type	R / W	Notes
Assignable Registers						
0x8000	Register 0 contents	0-65535		UINT16	R/W	
0x8001	Register 1 contents	0-65535		UINT16	R/W	
	...					
0x8077	Register 119 contents	0-65535		UINT16	R/W	
Assignable Registers Map						
0x8100	Mapped point for register 0x8000	0x0000 - 0xFFFF		UINT16	R/W	
0x8101	Mapped point for register 0x8001	0x0000 - 0xFFFF		UINT16	R/W	
	...					
0x8177	Mapped point for register 0x8077	0x0000 - 0xFFFF		UINT16	R/W	
Device Data Scales						
0x81F2	Voltage scale, secondary volts	60-828	1V	UINT16	R/W	Default 144V
0x81F3	Current scale, secondary amps	10-100	×0.1A	UINT16	R/W	Default 2×CT secondary

4.2 Analog Registers, Binary Registers and Counters

Point ID	Description	Options/Range[2]	Units[2]	Type	R / W	Notes
0x0000	**None**	0		UINT16	R	
	Special Inputs					
0x0101	Phase rotation order	0=error, 1=positive (ABC), 2=negative (CBA)		UINT16	R	
0x0600	**Digital Inputs DI1-DI4 (bitmap)**	0x0000-0x000F		UINT16	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0x0800	**Relay Outputs RO1-RO2 (bitmap)**	0x0000-0x0003		UINT16	R	
	Counters					
0x0A00	Counter #1	0-99,999		UINT32	R/W	
0x0A01	Counter #2	0-99,999		UINT32	R/W	
0x0A02	Counter #3	0-99,999		UINT32	R/W	
0x0A03	Counter #4	0-99,999		UINT32	R/W	
	1-Cycle Phase Values					
0x0C00	V1/V12 Voltage	0-Vmax	U1	UINT32	R	[1]
0x0C01	V2/V23 Voltage	0-Vmax	U1	UINT32	R	[1]
0x0C02	V3/V31 Voltage	0-Vmax	U1	UINT32	R	[1]
0x0C03	I1 Current	0-Imax	U2	UINT32	R	
0x0C04	I2 Current	0-Imax	U2	UINT32	R	
0x0C05	I3 Current	0-Imax	U2	UINT32	R	
0x0C06	kW L1	-Pmax-Pmax	U3	INT32	R	
0x0C07	kW L2	-Pmax-Pmax	U3	INT32	R	
0x0C08	kW L3	-Pmax-Pmax	U3	INT32	R	
0x0C09	kvar L1	-Pmax-Pmax	U3	INT32	R	
0x0C0A	kvar L2	-Pmax-Pmax	U3	INT32	R	
0x0C0B	kvar L3	-Pmax-Pmax	U3	INT32	R	
0x0C0C	kVA L1	0-Pmax	U3	UINT32	R	
0x0C0D	kVA L2	0-Pmax	U3	UINT32	R	
0x0C0E	kVA L3	0-Pmax	U3	UINT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0x0C0F	Power factor L1	-1000-1000	×0.001	INT16	R	
0x0C10	Power factor L2	-1000-1000	×0.001	INT16	R	
0x0C11	Power factor L3	-1000-1000	×0.001	INT16	R	
0x0C12	V1/V12 Voltage THD	0-9999	×0.1 %	UINT16	R	[1, 4] 2-cycle value
0x0C13	V2/V23 Voltage THD	0-9999	×0.1 %	UINT16	R	[1, 4] 2-cycle value
0x0C14	V3/V31 Voltage THD	0-9999	×0.1 %	UINT16	R	[1, 4] 2-cycle value
0x0C15	I1 Current THD	0-9999	×0.1 %	UINT16	R	[4] 2-cycle value
0x0C16	I2 Current THD	0-9999	×0.1 %	UINT16	R	[4] 2-cycle value
0x0C17	I3 Current THD	0-9999	×0.1 %	UINT16	R	[4] 2-cycle value
0x0C18	I1 K-Factor	10-9999	×0.1	UINT16	R	[4] 2-cycle value
0x0C19	I2 K-Factor	10-9999	×0.1	UINT16	R	[4] 2-cycle value
0x0C1A	I3 K-Factor	10-9999	×0.1	UINT16	R	[4] 2-cycle value
0x0C1B	I1 Current TDD	0-1000	×0.1 %	UINT16	R	[4] 2-cycle value
0x0C1C	I2 Current TDD	0-1000	×0.1 %	UINT16	R	[4] 2-cycle value
0x0C1D	I3 Current TDD	0-1000	×0.1 %	UINT16	R	[4] 2-cycle value
0x0C1E	V12 Voltage	0-Vmax	U1	UINT16	R	
0x0C1F	V23 Voltage	0-Vmax	U1	UINT16	R	
0x0C20	V31 Voltage	0-Vmax	U1	UINT16	R	
	1-Cycle Total Values					
0x0F00	Total kW	-Pmax-Pmax	U3	INT32	R	
0x0F01	Total kvar	-Pmax-Pmax	U3	INT32	R	
0x0F0	Total kVA	0-Pmax	U3	UINT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
2						
0x0F03	Total PF	-1000-1000	×0.001	INT16	R	
0x0F04	Total PF lag	0-1000	×0.001	UINT16	R	
0x0F05	Total PF lead	0-1000	×0.001	UINT16	R	
0x0F06	Total kW import	0-Pmax	U3	UINT32	R	
0x0F07	Total kW export	0-Pmax	U3	UINT32	R	
0x0F08	Total kvar import	0-Pmax	U3	UINT32	R	
0x0F09	Total kvar export	0-Pmax	U3	UINT32	R	
0x0F0A	3-phase average L-N/L-L voltage	0-Vmax	U1	UINT32	R	[1]
0x0F0B	3-phase average L-L voltage	0-Vmax	U1	UINT32	R	
0x0F0C	3-phase average current	0-Imax	U2	UINT32	R	
	1-Cycle Auxiliary Values					
0x1000	Not used			UINT32	R	
0x1001	In (neutral) Current	0-Imax	U2	UINT32	R	
0x1002	Frequency	0-Fmax	×0.01 Hz	UINT16	R	
0x1003	Voltage unbalance	0-3000	×0.1 %	UINT16	R	
0x1004	Current unbalance	0-3000	×0.1 %	UINT16	R	
	Phasor					
0x1080	V1/V12 Voltage magnitude	0-Vmax	U1	UINT32	R	[1]
0x1081	V2/V23 Voltage magnitude	0-Vmax	U1	UINT32	R	[1]
0x1082	V3/V31 Voltage magnitude	0-Vmax	U1	UINT32	R	[1]
0x1083	Not used			UINT32	R	
0x108	I1 Current magnitude	0-Imax	U2	UINT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
4						
0x1085	I2 Current magnitude	0-Imax	U2	UINT32	R	
0x1086	I3 Current magnitude	0-Imax	U2	UINT32	R	
0x1087	Not used			UINT32	R	
0x1088	V1/V12 Voltage angle	-1800-1800	×0.1º	INT16	R	1
0x1089	V2/V23 Voltage angle	-1800-1800	×0.1º	INT16	R	1
0x108A	V3/V31 Voltage angle	-1800-1800	×0.1º	INT16	R	1
0x108B	Not used			INT16	R	
0x108C	I1 Current angle	-1800-1800	×0.1º	INT16	R	
0x108D	I2 Current angle	-1800-1800	×0.1º	INT16	R	
0x108E	I3 Current angle	-1800-1800	×0.1º	INT16	R	
0x108F	Not used			INT16	R	
	1-Second Phase Values					
0x1100	V1/V12 Voltage	0-Vmax	U1	UINT32	R	1
0x1101	V2/V23 Voltage	0-Vmax	U1	UINT32	R	1
0x1102	V3/V31 Voltage	0-Vmax	U1	UINT32	R	1
0x1103	I1 Current	0-Imax	U2	UINT32	R	
0x1104	I2 Current	0-Imax	U2	UINT32	R	
0x1105	I3 Current	0-Imax	U2	UINT32	R	
0x1106	kW L1	-Pmax-Pmax	U3	INT32	R	
0x1107	kW L2	-Pmax-Pmax	U3	INT32	R	
0x1108	kW L3	-Pmax-Pmax	U3	INT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0x1109	kvar L1	-Pmax-Pmax	U3	INT32	R	
0x110A	kvar L2	-Pmax-Pmax	U3	INT32	R	
0x110B	kvar L3	-Pmax-Pmax	U3	INT32	R	
0x110C	kVA L1	0-Pmax	U3	UINT32	R	
0x110D	kVA L2	0-Pmax	U3	UINT32	R	
0x110E	kVA L3	0-Pmax	U3	UINT32	R	
0x110F	Power factor L1	-1000-1000	×0.001	INT16	R	
0x1110	Power factor L2	-1000-1000	×0.001	INT16	R	
0x1111	Power factor L3	-1000-1000	×0.001	INT16	R	
0x1112	V1/V12 Voltage THD	0-9999	×0.1 %	UINT16	R	[1, 4] 3-sec value
0x1113	V2/V23 Voltage THD	0-9999	×0.1 %	UINT16	R	[1, 4] 3-sec value
0x1114	V3/V31 Voltage THD	0-9999	×0.1 %	UINT16	R	[1, 4] 3-sec value
0x1115	I1 Current THD	0-9999	×0.1 %	UINT16	R	[4] 3-sec value
0x1116	I2 Current THD	0-9999	×0.1 %	UINT16	R	[4] 3-sec value
0x1117	I3 Current THD	0-9999	×0.1 %	UINT16	R	[4] 3-sec value
0x1118	I1 K-Factor	10-9999	×0.1	UINT16	R	[4] 3-sec value
0x1119	I2 K-Factor	10-9999	×0.1	UINT16	R	[4] 3-sec value
0x111A	I3 K-Factor	10-9999	×0.1	UINT16	R	[4] 3-sec value
0x111B	I1 Current TDD	0-1000	×0.1 %	UINT16	R	[4] 3-sec value
0x111C	I2 Current TDD	0-1000	×0.1 %	UINT16	R	[4] 3-sec value
0x111D	I3 Current TDD	0-1000	×0.1 %	UINT16	R	[4] 3-sec value

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0x111E	V12 Voltage	0-Vmax	U1	UINT16	R	
0x111F	V23 Voltage	0-Vmax	U1	UINT16	R	
0x1120	V31 Voltage	0-Vmax	U1	UINT16	R	
	1-Second Total Values					
0x1400	Total kW	-Pmax-Pmax	U3	INT32	R	
0x1401	Total kvar	-Pmax-Pmax	U3	INT32	R	
0x1402	Total kVA	0-Pmax	U3	UINT32	R	
0x1403	Total PF	-1000-1000	×0.001	INT16	R	
0x1404	Total PF lag	0-1000	×0.001	UINT16	R	
0x1405	Total PF lead	0-1000	×0.001	UINT16	R	
0x1406	Total kW import	0-Pmax	U3	UINT32	R	
0x1407	Total kW export	0-Pmax	U3	UINT32	R	
0x1408	Total kvar import	0-Pmax	U3	UINT32	R	
0x1409	Total kvar export	0-Pmax	U3	UINT32	R	
0x140A	3-phase average L-N/L-L voltage	0-Vmax	U1	UINT32	R	[1]
0x140B	3-phase average L-L voltage	0-Vmax	U1	UINT32	R	
0x140C	3-phase average current	0-Imax	U2	UINT32	R	
	1-Second Auxiliary Values					
0x1500	Not used			UINT32	R	
0x1501	In (neutral) Current	0-Imax	U2	UINT32	R	
0x1502	Frequency	0-Fmax	×0.01 Hz	UINT16	R	
0x1503	Voltage unbalance	0-3000	×0.1 %	UINT16	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0x1504	Current unbalance	0-3000	×0.1 %	UINT16	R	
	Present Volt, Ampere and Power Demands					
0x1600	V1/V12 Volt demand	0-Vmax	U1	UINT32	R	[1]
0x1601	V2/V23 Volt demand	0-Vmax	U1	UINT32	R	[1]
0x1602	V3/V31 Volt demand	0-Vmax	U1	UINT32	R	[1]
0x1603	I1 Ampere demand	0-Imax	U2	UINT32	R	
0x1604	I2 Ampere demand	0-Imax	U2	UINT32	R	
0x1605	I3 Ampere demand	0-Imax	U2	UINT32	R	
0x1606	kW import block demand	0-Pmax	U3	UINT32	R	
0x1607	kvar import block demand	0-Pmax	U3	UINT32	R	
0x1608	kVA block demand	0-Pmax	U3	UINT32	R	
0x1609	kW import sliding window demand	0-Pmax	U3	UINT32	R	
0x160A	kvar import sliding window demand	0-Pmax	U3	UINT32	R	
0x160B	kVA sliding window demand	0-Pmax	U3	UINT32	R	
0x160C	Not used	0		UINT32	R	
0x160D	Not used	0		UINT32	R	
0x160E	Not used	0		UINT32	R	
0x160F	kW import accumulated demand	0-Pmax	U3	UINT32	R	
0x1610	kvar import accumulated demand	0-Pmax	U3	UINT32	R	
0x1611	kVA accumulated demand	0-Pmax	U3	UINT32	R	
0x1612	kW import predicted sliding window demand	0-Pmax	U3	UINT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0x1613	kvar import predicted sliding window demand	0-Pmax	U3	UINT32	R	
0x1614	kVA predicted sliding window demand	0-Pmax	U3	UINT32	R	
0x1615	PF (import) at Max. kVA sliding window demand	0-1000	×0.001	UINT16	R	
0x1616	kW export block demand	0-Pmax	U3	UINT32	R	
0x1617	kvar export block demand	0-Pmax	U3	UINT32	R	
0x1618	kW export sliding window demand	0-Pmax	U3	UINT32	R	
0x1619	kvar export sliding window demand	0-Pmax	U3	UINT32	R	
0x161A	kW export accumulated demand	0-Pmax	U3	UINT32	R	
0x161B	kvar export accumulated demand	0-Pmax	U3	UINT32	R	
0x161C	kW export predicted sliding window demand	0-Pmax	U3	UINT32	R	
0x161D	kvar export predicted sliding window demand	0-Pmax	U3	UINT32	R	
0x161E	Not used	0		UINT32	R	
0x161F	Not used	0		UINT32	R	
0x1620	Not used	0		UINT32	R	
0x1621	Not used	0		UINT32	R	
0x1622	In Ampere demand	0-Imax	U2	UINT32	R	
	Total Energies [E]					
0x1700	kWh import	0-999,999,999	kWh	UINT32	R	
0x1701	kWh export	0-999,999,999	kWh	UINT32	R	
0x1702	Not used			INT32	R	
0x1703	Not used			UINT32	R	
0x170	kvarh import	0-999,999,999	kvarh	UINT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
4						
0x1705	kvarh export	0-999,999,999	kvarh	UINT32	R	
0x1706	Not used			INT32	R	
0x1707	Not used			UINT32	R	
0x1708	kVAh total	0-999,999,999	kVAh	UINT32	R	
0x1709	Not used			UINT32	R	
0x170A	Not used			UINT32	R	
0x170B	kVAh import	0-999,999,999	kVAh	UINT32	R	
0x170C	kVAh export	0-999,999,999	kVAh	UINT32	R	
0x170D	Not used			UINT32	R	
0x170E	Not used			UINT32	R	
0x170F	Not used			UINT32	R	
0x1710	Not used			UINT32	R	
0x1711	Not used			UINT32	R	
0x1712	kvarh Q1	0-999,999,999	kvarh	UINT32	R	
0x1713	kvarh Q2	0-999,999,999	kvarh	UINT32	R	
0x1714	kvarh Q3	0-999,999,999	kvarh	UINT32	R	
0x1715	kvarh Q4	0-999,999,999	kvarh	UINT32	R	
	Summary Energy Registers [E]					
0x1780	Summary energy register #1	0-999,999,999	kWh	UINT32	R	
0x1781	Summary energy register #2	0-999,999,999	kWh	UINT32	R	
0x1782	Summary energy register #3	0-999,999,999	kWh	UINT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0x1783	Summary energy register #4	0-999,999,999	kWh	UINT32	R	
	Phase Energies [E]					
0x1800	kWh import L1	0-999,999,999	kWh	UINT32	R	
0x1801	kWh import L2	0-999,999,999	kWh	UINT32	R	
0x1802	kWh import L3	0-999,999,999	kWh	UINT32	R	
0x1803	kvarh import L1	0-999,999,999	kvarh	UINT32	R	
0x1804	kvarh import L2	0-999,999,999	kvarh	UINT32	R	
0x1805	kvarh import L3	0-999,999,999	kvarh	UINT32	R	
0x1806	kVAh total L1	0-999,999,999	kVAh	UINT32	R	
0x1807	kVAh total L2	0-999,999,999	kVAh	UINT32	R	
0x1808	kVAh total L3	0-999,999,999	kVAh	UINT32	R	
	V1/V12 Harmonic Distortion [EH]					1, 4
0x1900	H01 Harmonic distortion	0-10000	0.01 %	UINT16	R	
0x1901	H02 Harmonic distortion	0-10000	0.01 %	UINT16	R	
	...					
0x1927	H40 Harmonic distortion	0-10000	0.01 %	UINT16	R	
	V2/V23 Harmonic Distortion [EH]					1, 4
0x1A00	H01 Harmonic distortion	0-10000	0.01 %	UINT16	R	
0x1A01	H02 Harmonic distortion	0-10000	0.01 %	UINT16	R	
	...					
0x1A27	H40 Harmonic distortion	0-10000	0.01 %	UINT16	R	
	V3/V31 Harmonic Distortion [EH]					1, 4
0x1B00	H01 Harmonic distortion	0-10000	0.01 %	UINT16	R	
0x1B01	H02 Harmonic distortion	0-10000	0.01 %	UINT16	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
	...					
0x1B27	H40 Harmonic distortion	0-10000	0.01 %	UINT16	R	
	I1 Harmonic Distortion EH					4
0x1C00	H01 Harmonic distortion	0-10000	0.01 %	UINT16	R	
0x1C01	H02 Harmonic distortion	0-10000	0.01 %	UINT16	R	
	...					
0x1C27	H40 Harmonic distortion	0-10000	0.01 %	UINT16	R	
	I2 Harmonic Distortion EH					4
0x1D00	H01 Harmonic distortion	0-10000	0.01 %	UINT16	R	
0x1D01	H02 Harmonic distortion	0-10000	0.01 %	UINT16	R	
	...					
0x1D27	H40 Harmonic distortion	0-10000	0.01 %	UINT16	R	
	I3 Harmonic Distortion EH					4
0x1E00	H01 Harmonic distortion	0-10000	0.01 %	UINT16	R	
0x1E01	H02 Harmonic distortion	0-10000	0.01 %	UINT16	R	
	...					
0x1E27	H40 Harmonic distortion	0-10000	0.01 %	UINT16	R	
	Fundamental Phase Values EH					2-cycle values
0x2900	V1/V12 Voltage	0-Vmax	U1	UINT32	R	1
0x2901	V2/V23 Voltage	0-Vmax	U1	UINT32	R	1
0x2902	V3/V31 Voltage	0-Vmax	U1	UINT32	R	1
0x2903	I1 Current	0-Imax	U2	UINT32	R	
0x2904	I2 Current	0-Imax	U2	UINT32	R	
0x2905	I3 Current	0-Imax	U2	UINT32	R	
0x2906	kW L1	-Pmax-Pmax	U3	INT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0x2907	kW L2	-Pmax-Pmax	U3	INT32	R	
0x2908	kW L3	-Pmax-Pmax	U3	INT32	R	
0x2909	kvar L1	-Pmax-Pmax	U3	INT32	R	
0x290A	kvar L2	-Pmax-Pmax	U3	INT32	R	
0x290B	kvar L3	-Pmax-Pmax	U3	INT32	R	
0x290C	kVA L1	0-Pmax	U3	UINT32	R	
0x290D	kVA L2	0-Pmax	U3	UINT32	R	
0x290E	kVA L3	0-Pmax	U3	UINT32	R	
0x290F	Power factor L1	-1000-1000	×0.001	INT16	R	
0x2910	Power factor L2	-1000-1000	×0.001	INT16	R	
0x2911	Power factor L3	-1000-1000	×0.001	INT16	R	
	Fundamental Total Values [EH]					2-cycle values
0x2A00	Total fundamental kW	-Pmax-Pmax	U3	INT32	R	
0x2A01	Total fundamental kvar	-Pmax-Pmax	U3	INT32	R	
0x2A02	Total fundamental kVA	0-Pmax	U3	UINT32	R	
0x2A03	Total fundamental PF	-1000-1000	×0.001	INT16	R	
	Minimum 1-Cycle Phase Values					
0x2C00	V1/V12 Voltage	0-Vmax	U1	UINT32	R	[1]
0x2C01	V2/V23 Voltage	0-Vmax	U1	UINT32	R	[1]
0x2C02	V3/V31 Voltage	0-Vmax	U1	UINT32	R	[1]
0x2C03	I1 Current	0-Imax	U2	UINT32	R	
0x2C04	I2 Current	0-Imax	U2	UINT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0x2C05	I3 Current	0-Imax	U2	UINT32	R	
	Minimum 1-Cycle Total Values					
0x2D00	Total kW	-Pmax-Pmax	U3	INT32	R	
0x2D01	Total kvar	-Pmax-Pmax	U3	INT32	R	
0x2D02	Total kVA	0-Pmax	U3	UINT32	R	
0x2D03	Total PF	0-1000	×0.001	UINT32	R	Absolute value
	Minimum 1-Cycle Auxiliary Values					
0x2E00	Not used			UINT32	R	
0x2E01	In Current	0-Imax	U2	UINT32	R	
0x2E02	Frequency	0-Fmax	×0.01 Hz	UINT32	R	
	Maximum 1-Cycle Phase Values					
0x3400	V1/V12 Voltage	0-Vmax	U1	UINT32	R	[1]
0x3401	V2/V23 Voltage	0-Vmax	U1	UINT32	R	[1]
0x3402	V3/V31 Voltage	0-Vmax	U1	UINT32	R	[1]
0x3403	I1 Current	0-Imax	U2	UINT32	R	
0x3404	I2 Current	0-Imax	U2	UINT32	R	
0x3405	I3 Current	0-Imax	U2	UINT32	R	
	Maximum 1-Cycle Total Values					
0x3500	Total kW	-Pmax-Pmax	U3	INT32	R	
0x3501	Total kvar	-Pmax-Pmax	U3	INT32	R	
0x3502	Total kVA	0-Pmax	U3	UINT32	R	
0x3503	Total PF	0-1000	×0.001	UINT32	R	Absolute value
	Maximum 1-Cycle Auxiliary Values					
0x360	Not used			UINT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0						
0x3601	In Current	0-Imax	U2	UINT32	R	
0x3602	Frequency	0-Fmax	×0.01 Hz	UINT32	R	
	Maximum Demands					
0x3700	V1/V12 Maximum volt demand	0-Vmax	U1	UINT32	R	1
0x3701	V2/V23 Maximum volt demand	0-Vmax	U1	UINT32	R	1
0x3702	V3/V31 Maximum volt demand	0-Vmax	U1	UINT32	R	1
0x3703	I1 Maximum ampere demand	0-Imax	U2	UINT32	R	
0x3704	I2 Maximum ampere demand	0-Imax	U2	UINT32	R	
0x3705	I3 Maximum ampere demand	0-Imax	U2	UINT32	R	
0x3706	Not used			UINT32	R	
0x3707	Not used			UINT32	R	
0x3708	Not used			UINT32	R	
0x3709	Maximum kW import sliding window demand	0-Pmax	U3	UINT32	R	
0x370A	Maximum kvar import sliding window demand	0-Pmax	U3	UINT32	R	
0x370B	Maximum kVA sliding window demand	0-Pmax	U3	UINT32	R	
0x3737	Not used			UINT32	R	
0x370D	Not used			UINT32	R	
0x370E	Not used			UINT32	R	
0x370F	Maximum kW export sliding window demand	0-Pmax	U3	UINT32	R	
0x3710	Maximum kvar export sliding window demand	0-Pmax	U3	UINT32	R	
0x3711	Not used			UINT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0x3712	Not used			UINT32	R	
0x3713	Not used			UINT32	R	
0x3714	Not used			UINT32	R	
0x3715	In Maximum ampere demand	0-Imax	U2	UINT32	R	
	TOU Parameters [E]					
0x3C00	Active tariff	0-7		UINT32	R	
0x3C01	Active profile	0-15: 0-3 = Season 1 Profile #1-4, 4-7 = Season 2 Profile #1-4, 8-11 = Season 3 Profile #1-4, 12-15 = Season 4 Profile #1-4		UINT32	R	
	Scaled Analog Outputs					
0x3C80	Analog output AO1	0-4095		UINT32	R/W	
0x3C81	Analog output AO2	0-4095		UINT32	R/W	
	TOU Energy Register #1 [E]					
0x3D00	Tariff #1 register	0-999,999,999	kWh	UINT32	R	
0x3D01	Tariff #2 register	0-999,999,999	kWh	UINT32	R	
	…				R	
0x3D07	Tariff #8 register	0-999,999,999	kWh	UINT32	R	
	TOU Energy Register #2 [E]					
0x3E00	Tariff #1 register	0-999,999,999	kWh	UINT32	R	
0x3E01	Tariff #2 register	0-999,999,999	kWh	UINT32	R	
	…				R	
0x3E07	Tariff #8 register	0-999,999,999	kWh	UINT32	R	
	TOU Energy Register #3 [E]					
0x3F00	Tariff #1 register	0-999,999,999	kWh	UINT32	R	
0x3F01	Tariff #2 register	0-999,999,999	kWh	UINT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
	…				R	
0x3F07	Tariff #8 register	0-999,999,999	kWh	UINT32	R	
	TOU Energy Register #4 E					
0x4000	Tariff #1 register	0-999,999,999	kWh	UINT32	R	
0x4001	Tariff #2 register	0-999,999,999	kWh	UINT32	R	
	…				R	
0x4007	Tariff #8 register	0-999,999,999	kWh	UINT32	R	
	Summary Energy Accumulated Demands E					
0x4500	Summary register #1 demand	0-Pmax	U3	UINT32	R	
0x4501	Summary register #2 demand	0-Pmax	U3	UINT32	R	
0x4502	Summary register #3 demand	0-Pmax	U3	UINT32	R	
0x4503	Summary register #4 demand	0-Pmax	U3	UINT32	R	
	Summary Energy Block Demands E					
0x4580	Summary register #1 demand	0-Pmax	U3	UINT32	R	
0x4581	Summary register #2 demand	0-Pmax	U3	UINT32	R	
0x4582	Summary register #3 demand	0-Pmax	U3	UINT32	R	
0x4583	Summary register #4 demand	0-Pmax	U3	UINT32	R	
	Summary Energy Sliding Window Demands E					
0x4600	Summary register #1 demand	0-Pmax	U3	UINT32	R	
0x4601	Summary register #2 demand	0-Pmax	U3	UINT32	R	
0x4602	Summary register #3 demand	0-Pmax	U3	UINT32	R	
0x4603	Summary register #4 demand	0-Pmax	U3	UINT32	R	
	Summary Energy Maximum Demands E					
0x478	Summary register #1 maximum demand	0-Pmax	U3	UINT32	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0						
0x4781	Summary register #2 maximum demand	0-Pmax	U3	UINT32	R	
0x4782	Summary register #3 maximum demand	0-Pmax	U3	UINT32	R	
0x4783	Summary register #4 maximum demand	0-Pmax	U3	UINT32	R	
	TOU Maximum Demand Register #1 E					
0x4800	Tariff #1 maximum demand	0-Pmax	U3	UINT32	R	
0x4801	Tariff #2 maximum demand	0-Pmax	U3	UINT32	R	
	…				R	
0x4807	Tariff #8 maximum demand	0-Pmax	U3	UINT32	R	
	TOU Maximum Demand Register #2 E					
0x4900	Tariff #1 maximum demand	0-Pmax	U3	UINT32	R	
0x4901	Tariff #2 maximum demand	0-Pmax	U3	UINT32	R	
	…				R	
0x4907	Tariff #8 maximum demand	0-Pmax	U3	UINT32	R	
	TOU Maximum Demand Register #3 E					
0x4A00	Tariff #1 maximum demand	0-Pmax	U3	UINT32	R	
0x4A01	Tariff #2 maximum demand	0-Pmax	U3	UINT32	R	
	…				R	
0x4A07	Tariff #8 maximum demand	0-Pmax	U3	UINT32	R	
	TOU Maximum Demand Register #4 E					
0x4880	Tariff #1 maximum demand	0-Pmax	U3	UINT32	R	
0x4881	Tariff #2 maximum demand	0-Pmax	U3	UINT32	R	
	…				R	
0x4887	Tariff #8 maximum demand	0-Pmax	U3	UINT32	R	
	V1/V12 Harmonic Angles EH					1, 3, 4
0x6400	H01 Harmonic angle	-1800-1800	$\times 0.1^{o}$	INT16	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
0x6400	H02 Harmonic angle	-1800-1800	×0.1º	INT16	R	
	…					
0x6427	H40 Harmonic angle	-1800-1800	×0.1º	INT16	R	
	V2/V23 Harmonic Angles EH					1, 3, 4
0x6500	H01 Harmonic angle	-1800-1800	×0.1º	INT16	R	
0x6500	H02 Harmonic angle	-1800-1800	×0.1º	INT16	R	
	…					
0x6527	H40 Harmonic angle	-1800-1800	×0.1º	INT16	R	
	V1/V31 Harmonic Angles EH					1, 3, 4
0x6600	H01 Harmonic angle	-1800-1800	×0.1º	INT16	R	
0x6600	H02 Harmonic angle	-1800-1800	×0.1º	INT16	R	
	…					
0x6627	H40 Harmonic angle	-1800-1800	×0.1º	INT16	R	
	I1 Harmonic Angles EH					3, 4
0x6700	H01 Harmonic angle	-1800-1800	×0.1º	INT16	R	
0x6700	H02 Harmonic angle	-1800-1800	×0.1º	INT16	R	
	…					
0x6727	H40 Harmonic angle	-1800-1800	×0.1º	INT16	R	
	I2 Harmonic Angles EH					3, 4
0x6800	H01 Harmonic angle	-1800-1800	×0.1º	INT16	R	
0x6800	H02 Harmonic angle	-1800-1800	×0.1º	INT16	R	
	…					
0x6827	H40 Harmonic angle	-1800-1800	×0.1º	INT16	R	
	I3 Harmonic Angles EH					3, 4
0x6900	H01 Harmonic angle	-1800-1800	×0.1º	INT16	R	
0x6900	H02 Harmonic angle	-1800-1800	×0.1º	INT16	R	

Point ID	Description	Options/Range[2]	Units [2]	Type	R / W	Notes
	…					
0x6927	H40 Harmonic angle	-1800-1800	×0.1º	INT16	R	
0x7C00	**Setpoint Status SP1-SP16 (bitmap)**	0x00000000-0x0000FFFF		UINT32	R	

NOTES:

Energy and power demand readings are only available in PM130E and PM130EH meters. Harmonics are only available in PM130EH meters.

1 Voltage and voltage harmonics readings: when the 4LN3, 3LN3 or 3BLN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

2 For volts, amps, power and frequency scales and units, refer to Section 5 ”Data Scales and Units”.

3 Harmonic angles are referenced to the fundamental voltage harmonic H01 on phase L1.

4 In 2LL1 wiring mode the Harmonics calculations are not supported.

4.3 Minimum/Maximum Log Registers

Point ID	Description	Options/Range/Format[2]	Units [2]	Type	R / W	Notes
	Minimum Phase Values					
0xB000 0xB001	Min. V1/V12 Voltage Timestamp	0-Vmax F1	U1 sec	UINT32 UINT32	R R	[1]
0xB002 0xB003	Min. V2/V23 Voltage Timestamp	0-Vmax F1	U1 sec	UINT32 UINT32	R R	[1]
0xB004 0xB005	Min. V3/V31 Voltage Timestamp	0-Vmax F1	U1 sec	UINT32 UINT32	R R	[1]
0xB006 0xB007	Min. I1 Current Timestamp	0-Imax F1	U2 sec	UINT32 UINT32	R R	
0xB008 0xB009	Min. I2 Current Timestamp	0-Imax	U2 sec	UINT32 UINT32	R R	
0xB00A 0xB00B	Min. I3 Current Timestamp	0-Imax	U2 sec	UINT32 UINT32	R R	
	Minimum Total Values					
0xB080 0xB081	Min. Total kW Timestamp	-Pmax-Pmax	U3 sec	INT32 UINT32	R R	
0xB082 0xB083	Min. Total kvar Timestamp	-Pmax-Pmax	U3 sec	INT32 UINT32	R R	
0xB084 0xB085	Min. Total kVA Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
0xB086	Min. Total PF Timestamp	-1000-1000	×0.001	INT32 UINT32	R R	

Point ID	Description	Options/Range/Format[2]	Units [2]	Type	R / W	Notes
0xB087			sec			
	Minimum Auxiliary Values					
0xB100 0xB101	Not used	0		UINT32 UINT32	R R	
0xB102 0xB103	Min. In Current Timestamp	0-Imax	U2 sec	UINT32 UINT32	R R	
0xB104 0xB105	Min. Frequency Timestamp	0-Fmax	×0.01 Hz sec	UINT32 UINT32	R R	
	Maximum Phase Values					
0xB200 0xB201	Max. V1/V12 Voltage Timestamp	0-Vmax	U1 sec	UINT32 UINT32	R R	1
0xB202 0xB203	Max. V2/V23 Voltage Timestamp	0-Vmax	U1 sec	UINT32 UINT32	R R	1
0xB204 0xB205	Max. V3/V31 Voltage Timestamp	0-Vmax	U1 sec	UINT32 UINT32	R R	1
0xB206 0xB207	Max. I1 Current Timestamp	0-Imax	U2 sec	UINT32 UINT32	R R	
0xB208 0xB209	Max. I2 Current Timestamp	0-Imax	U2 sec	UINT32 UINT32	R R	
0xB20A 0xB20B	Max. I3 Current Timestamp	0-Imax	U2 sec	UINT32 UINT32	R R	
	Maximum Auxiliary Values					
0xB300	Not used	0		UINT32 UINT32	R R	

Point ID	Description	Options/Range/Format[2]	Units [2]	Type	R / W	Notes
0xB301						
0xB302 0xB303	Max. In Current Timestamp	0-Imax	U2 sec	UINT32 UINT32	R R	
0xB304 0xB305	Max. Frequency Timestamp	0-Fmax	×0.01 Hz sec	UINT32 UINT32	R R	
	Summary Energy Maximum Demands [E]					
0xB340 0xB341	Summary register #1 Maximum Demand Timestamp	0-Pmax	U3	UINT32	R	
0xB342 0xB343	Summary register #2 Maximum Demand Timestamp	0-Pmax	U3	UINT32	R	
0xB344 0xB345	Summary register #3 Maximum Demand Timestamp	0-Pmax	U3	UINT32	R	
0xB346 0xB347	Summary register #4 Maximum Demand Timestamp	0-Pmax	U3	UINT32	R	
	Maximum Demands					
0xB380 0xB381	V1/V12 Maximum volt demand Timestamp	0-Vmax	U1 sec	UINT32 UINT32	R R	[1]
0xB382 0xB383	V2/V23 Maximum volt demand Timestamp	0-Vmax	U1 sec	UINT32 UINT32	R R	[1]
0xB384 0xB385	V3/V31 Maximum volt demand Timestamp	0-Vmax	U1 sec	UINT32 UINT32	R R	[1]
0xB386 0xB38	I1 Maximum ampere demand Timestamp	0-Imax	U2 sec	UINT32 UINT32	R R	

Point ID	Description	Options/Range/Format[2]	Units [2]	Type	R / W	Notes
7						
0xB388 0xB389	I2 Maximum ampere demand Timestamp	0-Imax	U2 sec	UINT32 UINT32	R R	
0xB38A 0xB38B	I3 Maximum ampere demand Timestamp	0-Imax	U2 sec	UINT32 UINT32	R R	
0xB38C 0xB38D	Not used	0		UINT32 UINT32	R R	
0xB38E 0xB38F	Not used	0		UINT32 UINT32	R R	
0xB390 0xB391	Not used	0		UINT32 UINT32	R R	
0xB392 0xB393	Maximum kW import sliding window demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
0xB394 0xB395	Maximum kvar import sliding window demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
0xB396 0xB397	Maximum kVA sliding window demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
0xB398 0xB399	Not used	0		UINT32 UINT32	R R	
0xB39A 0xB39B	Not used	0		UINT32 UINT32	R R	
0xB39C	Not used	0		UINT32 UINT32	R R	

Point ID	Description	Options/Range/Format[2]	Units [2]	Type	R / W	Notes
0xB39D						
0xB39E 0xB39F	Maximum kW export sliding window demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
0xB3A0 0xB3A1	Maximum kvar export sliding window demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
0xB3A2 0xB3A3	Not used	0		UINT32 UINT32	R R	
0xB3A4 0xB3A5	Not used	0		UINT32 UINT32	R R	
0xB3A6 0xB3A7	Not used	0		UINT32 UINT32	R R	
0xB3A8 0xB3A9	Not used	0		UINT32 UINT32	R R	
0xB3AA 0xB3AB	In Maximum ampere demand Timestamp	0-Imax	U2 sec	UINT32 UINT32	R R	
	TOU Maximum Demand Register #1 [E]					
0xB480 0xB481	Tariff #1 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
0xB482 0xB483	Tariff #2 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
	…				R	
0xB48E 0xB48	Tariff #8 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	

Point ID	Description	Options/Range/Format[2]	Units [2]	Type	R / W	Notes
F						
	TOU Maximum Demand Register #2 [E]					
0xB500 0xB501	Tariff #1 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
0xB502 0xB503	Tariff #2 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
	…				R	
0xB50E 0xB50F	Tariff #8 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
	TOU Maximum Demand Register #3 [E]					
0xB580 0xB581	Tariff #1 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
0xB582 0xB583	Tariff #2 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
	…				R	
0xB58E 0xB58F	Tariff #8 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
	TOU Maximum Demand Register #4 [E]					
0xB4C0 0xB4C1	Tariff #1 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
0xB4C2 0xB4C3	Tariff #2 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	
	…				R	
0xB4CE 0xB4CF	Tariff #8 maximum demand Timestamp	0-Pmax	U3 sec	UINT32 UINT32	R R	

NOTES:

Power demand readings are only available in the PM130E and PM130EH meters.

1 Voltage readings: when the 4LN3, 3LN3 or 3BLN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

2 For volts, amps, power and frequency scales and units, refer to Section 5 ”Data Scales and Units”.

4.4 Device Control and Status Registers

Point ID	Description	Options/Range	Units	Type	R/W	Notes
Device Authorization Register						
0xFF00	When write: 4-digit password. When read: 0 = access permitted, -1 = authorization required.	0-9999 (write) 0/-1 (read)		INT16	R/W	
Remote Relay Control						
0x8400- 0x8401						
	Remote relay command	0 = remove a remote command 1 = operate relay 2 = remove a remote command and release a locally latched relay		UINT 16	W	
+0	**RO1 Control**					
+1	**RO2 Control**					
Device Reset/Clear Registers						
0xA000	Clear total energy registers	0		UINT 16	W	
0xA001	Clear total maximum demand registers	0 = Clear all maximum demands 1 = Clear power demands [E] 2 = Clear volt, ampere and harmonic demands		UINT 16	W	
0xA002	Clear TOU energy registers [E]	0		UINT 16	W	
0xA003	Clear TOU maximum demand registers [E]	0		UINT 16	W	
0xA004	Clear pulse counters	0 = Clear all counters 1-4 = Clear counter #1-#4		UINT 16	W	
0xA005	Clear Min/Max log	0		UINT 16	W	
0xA006	Clear event log [E]	0		UINT 16	W	
0xA007	Clear data log [E]	0 = Clear Data log #1, 15 = Clear Data log #15, 16 = Clear all data logs		UINT 16	W	
0xA00A	Clear operation/event counters	6=clear communication counters		UINT 16	W	

Point ID	Description	Options/Range	Units	Type	R/ W	Notes
Device Status Registers						
0x7D00	Relay status RO1-RO2 (bitmap)	0x0000-0x0003		UINT16	R	Bits set to 1 indicate closed relay contacts.
0x7D01	Event flags (bitmap) [E]	0x0000-0x00FF		UINT16	R	
0x7D02	Digital (status) inputs DI1-DI2	0x0000-0x0003		UINT16	R	Bits set to 1 indicate closed input contacts.
0x7D03	Present setpoint status SP1-SP16 (bitmap)	0x0000-0xFFFF		UINT16	R	Bits set to 1 indicate operated (activated) setpoints.
0x7D06	Current serial port number	0=COM1, 1=COM2		UINT16	R	
Alarm Notification Registers						
0x7E00	Setpoint alarm status SP1-SP16 (bitmap). Nonvolatile register that keeps the status of the operated setpoints.	0x0000-0xFFFF		UINT16	R/ W	When read: Bits set to 1 indicate that the designated setpoint have been operated at least once since the alarm bits were reset. When written: Bits preset to 0 clear corresponding alarms, Bits set to 1 have no effect.
0x7E01	Self-check alarm status (device diagnostics). Nonvolatile register that keeps the status of the internal device diagnostics.	F23		UINT16	R/ W	When read: Bits set to 1 indicate that the designated diagnostics failed at least once since the alarm bits were reset. When written: Bits preset to 0 clear corresponding alarms; bits set to 1 have no effect.

4.5 Device Setup Registers

Address	Description	Options/Range	Units	Type	R / W	Notes
Device Identification						
0x7F00- 0x7F01	Instrument options	F28		UINT16	R	
0xFF43	Device model ID	13010=PM130P, 13011=PM130A, 13020=PM130E, 13030-13032=PM130EH		UINT16	R	
Factory Device Settings						
0xFF40- 0xFF42						
+0	I1-I3 input overload	200	%	UINT16	R	
+1	I1-I3 input range	1, 5	A	UINT16	R	
+2	V1-V3 input range	690, 120 (option U)	V	UINT16	R	Does not limit the 690V input range
Communication Ports Setup						
0x8500- 0x851F						
+0	Communication protocol	COM1: 0=SATEC ASCII, 1=Modbus RTU, 2=DNP3.0, 4=DTE, COM2: 0=SATEC ASCII, 1=Modbus RTU, 2=DNP3.0, 5=Profibus DP		UINT16	R/ W	
+1	Interface	COM1: 2=RS-485, COM2: 0=RS-232, 1=RS-422, 2=RS-485, 6=Ethernet, 7=Profibus, 8=GSM/GPRS		UINT16	R/ W	
+2	Device address	SATEC ASCII: 0-99 Modbus RTU: 1-247 DNP3.0: 0–65532 Profibus DP: 0-126		UINT16	R/ W	
+3	Baud rate	1=300 bps, 2=600 bps, 3=1200 bps, 4=2400 bps, 5=4800 bps, 6=9600 bps, 7=19200 bps, 8=38400 bps, 9=57600 bps, 10=115200 bps		UINT16	R/ W	
+4	Data format	0=7 bits/even parity, 1=8 bits/no parity, 2=8 bits/even parity		UINT16	R/ W	
+5	Flow control	0=no flow control		UINT16	R/	N/A for COM1 (read as 65535)

Address	Description	Options/Range	Units	Type	R / W	Notes
		1=software (XON/XOFF) 2=hardware (CTS)			W	
+6	RTS mode	0=not used, 1=RTS is permanently asserted 2=RTS is asserted during the transmission		UINT16	R/ W	N/A for COM1 (read as 65535)
+7	ASCII compatibility mode	0=disabled, 1=enabled		UINT16	R/ W	
+8-15	Reserved			UINT16	R	
0x8500- 0x850F	**COM1 Setup**					
0x8510- 0x851F	**COM2 Setup**					
Basic Setup						
0x8600- 0x8614						
+0	Wiring mode	F2		UINT16	R/ W	
+1	PT ratio	10 to 65000	×0.1	UINT16	R/ W	
+2	CT primary current	1 to 50,000	A	UINT16	R/ W	
+3	Power block demand period [E]	1,2,3,5,10,15,20,30,60 min, 255 = external synchronization	min	UINT16	R/ W	If the external synchronization is selected, the DI1 input is considered a pulse or KYZ input. The pulse edge restarts the power demand block accumulation interval. [E]
+4	Volt/ampere demand period	0 to 1800	sec	UINT16	R/ W	
+5-7	Reserved			UINT16	R/ W	Read as 65535
+8	Number of blocks in a sliding window [E]	1 to 15		UINT16	R/ W	[E]
+9-10	Reserved			UINT16	R/ W	Read as 65535
+11	Nominal line frequency	25, 50, 60, 400	Hz	UINT16	R/ W	
+12	Maximum demand load current	0 to 50,000 (0 = CT primary current)	A	UINT16	R/ W	
+13-19	Reserved			UINT16	R/ W	Read as 65535
+20	PT ratio multiplication factor	×1, ×10		UINT16	R/ W	

Address	Description	Options/Range	Units	Type	R / W	Notes
Device Options Setup						
0x8700-0x870A						
+0	Power calculation mode	0=using reactive power: S=f(P,Q), 1=using non-active power: Q=f(S,P)		UINT16	R/W	
+1	Energy roll value [E]	0=1×10^4, 1=1×10^5, 2=1×10^6, 3=1×10^7, 4=1×10^8, 5=1x10^9		UINT16	R/W	[E]
+2	Phase energy calculation mode [E]	0=disabled, 1=enabled		UINT16	R/W	[E]
+3-9	Reserved			UINT16	R/W	Read as 65535
+10	Energy LED test mode [E]	0=disabled, 1=Wh test, 2=varh test		UINT16	R/W	LED pulse rate is 10,000 pulses/kWh
+11	Starting voltage, percent of FS voltage	15-50	×0.1 %	UINT16	R/W	Default 1.5%
+12-13	Reserved			UINT16	R/W	Read as 65535
+14	Device resolution (see Section 5 for details)	0 = Low resolution, 1 = High resolution		UINT16	R/W	Default 0
Digital Inputs Setup						
0x8900-0x8904						Obsolete registers. Refer to Digital Inputs setup registers 0X9600-0X9607
+0	Status inputs (bitmap)	0x0003		UINT16	R/W	Ignored when written
+1	Pulse inputs (bitmap)	0x0003		UINT16	R/W	Ignored when written
+2	Not used	0		UINT16	R/W	
+3	External demand synchronization input (bitmap)	0x0001=DI1		UINT16	R/W	Ignored when written
+4	Time synchronization input (bitmap)	0x0001=DI1, 0x0002=DI2, 0x0004=DI3, 0x0008=DI4		UINT16	R/W	
Alarm/Event Setpoints Setup						
0x8200-0x825F						
+0	Trigger parameter ID	F12		UINT16	R/W	
+1	Action ID	F14		UINT16	R/W	
+2	Operate delay	0-9999	×0.1	UINT16	R/	

Address	Description	Options/Range	Units	Type	R / W	Notes
			sec		W	
+3	Release delay	0-9999	×0.1 sec	UINT16	R/ W	
+4,5	Operate limit	See Section 4.2		UINT32	R/ W	Scaled value
+6,7	Release limit	See Section 4.2		UINT32	R/ W	Scaled value
0x8200-0x8205	**Setpoint #1**					
0x8206-0x820B	**Setpoint #2**					
0x820C-0x8211	**Setpoint #3**					
0x8212-0x8217	**Setpoint #4**					
0x8218-0x821D	**Setpoint #5**					
0x821E-0x8223	**Setpoint #6**					
0x8224-0x8229	**Setpoint #7**					
0x822A-0x822F	**Setpoint #8**					
0x8230-0x8235	**Setpoint #9**					
0x8236-0x820B	**Setpoint #10**					
0x823C-0x8241	**Setpoint #11**					
0x8242-0x8247	**Setpoint #12**					
0x8248-0x824D	**Setpoint #13**					
0x824E-0x8253	**Setpoint #14**					
0x8254-0x8259	**Setpoint #15**					
0x825A-0x825F	**Setpoint #16**					

Address	Description	Options/Range	Units	Type	R / W	Notes
Local Settings						
0x8C00-0x8C0A						
+0	Daylight savings time (DST) option	0 = DST disabled (standard time only), 1 = DST enabled		UINT16	R/W	
+1	DST start month	1-12		UINT16	R/W	
+2	DST start week of the month	1-4 = 1st, 2nd, 3rd and 4th week, 5=the last week of the month		UINT16	R/W	
+3	DST start weekday	1-7 (1=Sun, 7=Sat)		UINT16	R/W	
+4	DST end month	1-12		UINT16	R/W	
+5	DST end week of the month	1-4=1st, 2nd, 3rd and 4th week, 5=the last week of the month		UINT16	R/W	
+6	DST end weekday	1-7 (1=Sun, 7=Sat)		UINT16	R/W	
+7	Clock synchronization source	1-4 = DI1-DI4, 32767 = meter clock		UINT16	R/W	A DI input is considered a pulse or KYZ input. The pulse edge adjusts the clock at the nearest whole minute.
+8	Country code	ITU calling number		UINT16	R/W	
+9	DST start hour	1-6		UINT16	R/W	
+10	DST end hour	1-6		UINT16	R/W	
TOU Daily Profile Setup [E]						
0x9000-0x907F						
+0	1st tariff change	F10		UINT16	R/W	
+1	2nd tariff change	F10		UINT16	R/W	
+2	3rd tariff change	F10		UINT16	R/W	
+3	4th tariff change	F10		UINT16	R/W	
+4	5th tariff change	F10		UINT16	R/W	
+5	6th tariff change	F10		UINT16	R/W	

Address	Description	Options/Range	Units	Type	R / W	Notes
+6	7th tariff change	F10		UINT16	R/ W	
+7	8th tariff change	F10		UINT16	R/ W	
0x9000- 0x9007	**Daily profile #1: Season 1, Day type 1**					
0x9008- 0x900F	**Daily profile #2: Season 1, Day type 2**					
0x9010- 0x9017	**Daily profile #3: Season 1, Day type 3**					
0x9018- 0x901F	**Daily profile #4: Season 1, Day type 4**					
0x9020- 0x9027	**Daily profile #5: Season 2, Day type 1**					
0x9028- 0x902F	**Daily profile #6: Season 2, Day type 2**					
0x9030- 0x9037	**Daily profile #7: Season 2, Day type 3**					
0x9038- 0x903F	**Daily profile #8: Season 2, Day type 4**					
0x9040- 0x9047	**Daily profile #9: Season 3, Day type 1**					
0x9048- 0x904F	**Daily profile #10: Season 3, Day type 2**					
0x9050- 0x9057	**Daily profile #11: Season 3, Day type 3**					
0x9058- 0x905F	**Daily profile #12: Season 3, Day type 4**					
0x9060- 0x9067	**Daily profile #13: Season 4, Day type 1**					
0x9068- 0x906F	**Daily profile #14: Season 4, Day type 2**					
0x9070- 0x9077	**Daily profile #15: Season 4, Day type 3**					
0x9078- 0x907F	**Daily profile #16: Season 4, Day type 4**					
TOU Calendar Setup [E]						
0x9100- 0x923F						
+0-9	**Calendar entry record**				R/ W	
+0	Daily profile	0-3 = Season 1, Day types 0-3		UINT16	R/	

Address	Description	Options/Range	Units	Type	R / W	Notes
		4-7 = Season 2, Day types 0-3 8-11 = Season 3, Day types 0-3 12-15 = Season 4, Day types 0-3			W	
+1	Week of month	0=all, 1=1st, 2=2nd, 3=3rd, 4=4th, 5=last week of the month		UINT16	R/ W	
+2	Weekday	0=all, 1-7 (Sun=1, Sat=7)		UINT16	R/ W	
+3	Till Weekday	0=all, 1-7 (Sun=1, Sat=7)		UINT16	R/ W	
+4	Month	0=all, 1-12=January - December		UINT16	R/ W	
+5	Day of month	0=all, 1-31=day 1-31		UINT16	R/ W	
+6	Till Month	0=all, 1-12=January - December		UINT16	R/ W	
+7	Till Day of month	0=all, 1-31=day 1-31		UINT16	R/ W	
+8-9	Reserved			UINT16	R/ W	
0x9100-0x9109	**Calendar entry #1**					
0x910A-0x9113	**Calendar entry #2**					
0x9114-0x911D	**Calendar entry #3**					
…						
0x9236-0X923F	**Calendar entry #32**					
Summary Energy/TOU Registers Setup [E]						
0X9400-0X941F						
+0	Not used			UINT16	R/ W	
+1	Units of measurement	0=none, 1=kWh, 2=kvarh, 3=kVAh, 4=m^3, 5=CF (cubic feet), 6=CCF (hundred cubic feet)		UINT16	R/ W	
+2	Flags (bitmap)	Bit 0=1 - TOU enabled Bit 1=1 - Use profile enabled Bit 2=1 - Max. Demand profile		UINT16	R/ W	

Address	Description	Options/Range	Units	Type	R / W	Notes
		enabled Bit 3=1 - Summary (total) profile enabled				
+3	Not used	0		UINT16	R/ W	
0X9400- 0X9403	**Register #1 Setup**					
0X9404- 0X9407	**Register #2 Setup**					
0X9408- 0X940B	**Register #3 Setup**					
0X940C- 0X940F	**Register #4 Setup**					
Summary Energy/TOU Registers Source Setup [E]						
0X9500- 0X9517						
+0	Energy source ID	F11		UINT16	R/ W	
+1	Target summary register number	0-3 = register #1-#4		UINT16	R/ W	
+2	Multiplier	0-1000000	×0.00 1	INT32	R/ W	
0X9500- 0X9502	**Energy Source #1**					
0X9503- 0X9505	**Energy Source #2**					
0X9506- 0X9508	**Energy Source #3**					
0X9509- 0X950B	**Energy Source #4**					
Digital Inputs Setup						
0X9600- 0X960F						
+0	Pulse mode	0 = pulse, 1 = KYZ		UINT16	R/ W	
+1	Polarity	0 = normal, 1 = inverting		UINT16	R/ W	
+2	De-bounce time, ms	1-100		UINT16	R/ W	Debounce time will be the same for both inputs
+3	Reserved			UINT16	R/ W	

Address	Description	Options/Range	Units	Type	R / W	Notes
0X9600-0X9603	**DI1 Setup**					
0X9604-0X9607	**DI2 Setup**					
0X9608-0X960B	**DI3 Setup**					
0X960C-0X960F	**DI4 Setup**					
Relay Outputs Setup						
0X9700-0X970B						
+0	Operation Mode	0=latched, 1=unlatched, 2=pulse, 3=KYZ		UINT16	R/W	
+1	Polarity	Bit 0 – Polarity: 0=normal, 1=inverting, Bit 1 - Retentive mode: 0=disabled, 1=enabled		UINT16	R/W	
+2	Pulse width, ms	1-1000		UINT16	R/W	
+3	Pulse source ID [E]	F17		UINT16	R/W	
+4	Units per pulse	1-10000	x0.1	UINT16	R/W	
+5	Reserved			UINT16	R/W	
0X9700-0X9705	**RO1 Setup**					
0X9706-0X970B	**RO2 Setup**					

4.6 Analog and Digital I/O Configuration

Address	Description	Options/Range	Units	Type	R / W	Notes
I/O Slots Configuration Info						
0xF100-0xF12F						
+0	I/O type	F29		UINT16	R	
+1	Number of I/Os on the slot	0-2		UINT16	R	
+2	First I/O number on the slot	0		UINT16	R	
+3	Last I/O number on the slot	0-1		UINT16	R	
0xF100-0xF103	**DI Slot Configuration**					
0xF104-0xF107	**RO Slot Configuration**					
0xF108-0xF10B	**AI/AO Slot Configuration**					
0xF10C-0xF12F	Reserved					
I/O Type Info						
0xF200-0xF23F						
+0	Number of I/O slots of this type	0-1		UINT16	R	
+1	Total number of I/O's of this type	0-4		UINT16	R	
+2	Number of I/O's in the slot	0-4		UINT16	R	
+3	Not used	0		UINT16	R	
0xF200-0xF203	**DI Type Info**					
0xF204-0xF207	**RO Type Info**					
0xF208-0xF20B	**AI Type Info**					
0xF20C-0xF20F	**AO Type Info**					
0xF210-0xF23F	Reserved					

4.7 File Transfer Registers [E]

Address	Description	Options/Range	Units	Type	R / W	Notes
File Allocation Status Registers						
0xA0F0	File memory size, Bytes	59520		UINT32	R	
0xA0F1	Free file memory size, Bytes			UINT32	R	
0xA0F2	File allocation map (bitmap)	F6		UINT32	R	Bits set to 1 indicate that the memory is allocated to the designated files
0xA0F3	Reserved	0		UINT32	R	
0xA0F4	Daily profile log sections map (bitmap)	F7		UINT32	R	Bits set to 1 indicate that the corresponding sections are allocated in the Data log #8 file to the designated energy/maximum demand registers
File Transfer Control/Status Registers						
0xA100- 0xA3FF						
+0	File status (bitmap)	F4		UINT16	R	
+1	Number of records logged in the file	0 to 65535		UINT16	R	
+2	Number of the new records never read before	0 to 65535		UINT16	R	
+3	Sequence number of the last record in a file + 1 (modulo 65536)	0 to 65535 (increments modulo 65536 with each new record)		UINT16	R	Will return zero if the file is empty
+4	Sequence number of the first (oldest) record in a file	0 to 65535		UINT16	R	
+5	Sequence number of the first new record in a file never read before	0 to 65535		UINT16	R	
+6	Sequence number of the current record to be read through the file read window. Can be overwritten to point to the desired record in a file	0 to 65535		UINT16	R/ W	If there is no a record in the file that matches the written sequence, the device will respond with the exception code 03 (invalid data)
+7	Command register (write-only)	Write value: 0 = point to the first (oldest) record in a file 1 = point to the first new record never read before. If there are no new records, the file pointer will be set to the oldest record in a file		UINT16	R/ W	Read as 0
0xA100- 0xA107	Event log file control			UINT16	R	
0xA108- 0xA10F	Data log #1 file control			UINT16	R	
0xA180-	Data log #16 file control			UINT16	R	

Address	Description	Options/Range	Units	Type	R / W	Notes
0xA187						
0xA300-0xA307	Daily Profile Log, Energy/Usage Reg.#1 control			UINT16	R	
0xA308-0xA30F	Daily Profile Log, Energy/Usage Reg.#2 control			UINT16	R	
0xA310-0xA317	Daily Profile Log, Energy/Usage Reg.#3 control			UINT16	R	
0xA318-0xA31F	Daily Profile Log, Energy/Usage Reg.#4 control			UINT16	R	
0xA380-0xA387	Daily Profile Log, Max. Demand Reg.#1 control			UINT16	R	
0xA388-0xA38F	Daily Profile Log, Max. Demand Reg.#2 control			UINT16	R	
0xA390-0xA397	Daily Profile Log, Max. Demand Reg.#3 control			UINT16	R	
0xA398-0xA39F	Daily Profile Log, Max. Demand Reg.#4 control			UINT16	R	
Data Log File Transfer Registers						
0xC000-0xC77F						
	Data Log Record Structure					
+0	Record status (bitmap)	F5		UINT16	R	
+1	Record sequence number	0 to 65535 (increments modulo 65536)		UINT16	R	
+2	Record time, sec	F1	sec	UINT32	R	
+3	Record time, fractional seconds, ms	0-999	ms	UINT16	R	
+4	Trigger event ID	0=Profile log file, 1-16=SP1-SP16		UINT16	R	
+5	Parameter #1 value			INT32	R	
+6	Parameter #2 value			INT32	R	
+7	Parameter #3 value			INT32	R	
+8	Parameter #4 value			INT32	R	
+9	Parameter #5 value			INT32	R	
+10	Parameter #6 value			INT32	R	
+11	Parameter #7 value			INT32	R	
+12	Parameter #8 value			INT32	R	
+13	Parameter #9 value			INT32	R	
	Data Log Transfer Blocks					
0xC000-0xC017	Data log #1				R	
0xC468-0xC47F	Data log #16				R	

Address	Description	Options/Range	Units	Type	R / W	Notes
0xC480-0xC497	Daily Profile Log, Energy/Usage Reg.#1 section				R	
0xC498-0xC4AF	Daily Profile Log, Energy/Usage Reg.#2 section				R	
0xC4B0-0xC4C7	Daily Profile Log, Energy/Usage Reg.#3 section				R	
0xC4C8-0xC4DF	Daily Profile Log, Energy/Usage Reg.#4 section				R	
0xC600-0xC617	Daily Profile Log, Max. Demand Reg.#1 section				R	
0xC618-0xC62F	Daily Profile Log, Max. Demand Reg.#2 section				R	
0xC630-0xC647	Daily Profile Log, Max. Demand Reg.#3 section				R	
0xC648-0xC65F	Daily Profile Log, Max. Demand Reg.#4 section				R	
Event Log File Transfer Registers						
0xCD80-0xCDAF						
	Event Record Structure					
+0	Record status (bitmap)	F5		UINT16	R	
+1	Record sequence number	0 to 65535 (increments modulo 65536)		UINT16	R	
+2	Record time, sec	F1	s	UINT32	R	
+3	Record time, fractional seconds, ms	0-999	ms	UINT16	R	
+4	Event point/cause ID	F19		UINT16	R	
+5	Log value			UINT32	R	32-bit non-scaled register
+6	Event effect	F20		UINT16	R	
+7	Reserved	0		UINT16	R	
	Event Log Transfer Blocks					
0xCD80-0xCD87	Event log record #1				R	
0xCD88-0xCD8F	Event log record #2				R	
0xCD90-0xCD97	Event log record #3				R	
0xCD98-0xCD9F	Event log record #4				R	
0xCDA0-0xCDA7	Event log record #5				R	
0xCDA8-0xCDAF	Event log record #6				R	

Address	Description	Options/Range	Units	Type	R / W	Notes
Waveform Header Transfer Registers						
0xCE00-0xCEFB						
	Waveform Header Structure					
+0	Record status (bitmap)	F5		UINT16	R	
+1	Record sequence number in a file	0 to 65535 (increments modulo 65536)		UINT16	R	
+2	Record time, sec	F1	sec	UINT32	R	Indicates the time for the last sample point in the record
+3	Record time, fractional seconds, ms	0-999	ms	UINT16	R	
+4	Trigger event ID	0=real-time waveform		UINT16	R	
+5	Waveform series (compound waveform) number	1		UINT16	R	
+6	Record sequence number in a waveform series	0		UINT16	R	
+7	Analog input full scale, engineering units (volts/amperes) (ANALOG_SCALE)	Vmax, Imax		UINT32	R	
+8	Digital full scale for the channel, sample code (DIGITAL_SCALE)	-4096 to 4095		INT16	R	Corresponds to twice the analog input full-scale range.
+9	Zero offset, sample code (ZERO_OFFSET)	0		INT16	R	Corresponds to the center of the digital scale range
+10	Line frequency	0 to 6500	x 0.01Hz	UINT16	R	The sampling frequency is equal to the line frequency multiplied by the sampling rate in samples per cycle
+11	Trigger sample point offset in the waveform series	0-511		UINT16	R	Corresponds to the first record in the series
+12,13	Reserved	0		UINT16	R	
	Waveform Header Transfer Blocks					
0xCE00-0xCE0D	Real-time waveform, channel V1/V12				R	1, 3
0xCE0E-0xCE1B	Real-time waveform, channel V2/V23				R	1, 3
0xCE1C-0xCE29	Real-time waveform, channel V3/V31				R	1, 3
0xCE2A-0xCE37	Real-time waveform, channel I1				R	3
0xCE38-0xCE45	Real-time waveform, channel I2				R	3
0xCE46-0xCE53	Real-time waveform, channel I3				R	3
Waveform Series Transfer Block						
0xD000-0xD1FF	**Waveform Sample Series**					2
+0	Sample point 1	-4096 to 4095		INT16	R	

Address	Description	Options/Range	Units	Type	R / W	Notes
+1	Sample point 2	-4096 to 4095		INT16	R	
+2	Sample point 2	-4096 to 4095		INT16	R	
+511	Sample point 512	-4096 to 4095		INT16	R	

NOTE

1 When the 3OP2 or 3OP3 wiring mode is selected, the voltages will be line-to-line; for any other wiring mode, they will be line-to-neutral.

2 To convert digital samples to their analog equivalents in input measurement units (volts, amps), the following scaling should be applied:

$$ANALOG\_SAMPLE\ [Volts/Amps] = \frac{(DIGITAL\_SAMPLE - ZERO\_OFFSET) \times ANALOG\_SCALE \times 2}{DIGITAL\_SCALE}$$

3 In 2LL1 wiring mode the Real-Time Waveform data represents Line-to-Natural data and not Line-to-Line data.

4.8 Billing/TOU Daily Profile Data Log [E]

File Channel/Section [1]	Record Field No. [2]	Point Label	Point ID	Description	Range	Units [3]	Type	Notes
0/0				**Energy Register #1**				
	1	REG1	0x1780	Summary (total) energy reading	0-999,999,999	kWh	UINT32	
	2	TRF1	0x7000	Tariff #1 energy reading	0-999,999,999	kWh	UINT32	
	3	TRF2	0x7001	Tariff #2 energy reading	0-999,999,999	kWh	UINT32	
	4	TRF3	0x7002	Tariff #3 energy reading	0-999,999,999	kWh	UINT32	
	5	TRF4	0x7003	Tariff #4 energy reading	0-999,999,999	kWh	UINT32	
	6	TRF5	0x7004	Tariff #5 energy reading	0-999,999,999	kWh	UINT32	
	7	TRF6	0x7005	Tariff #6 energy reading	0-999,999,999	kWh	UINT32	
	8	TRF7	0x7006	Tariff #7 energy reading	0-999,999,999	kWh	UINT32	
	9	TRF8	0x7007	Tariff #8 energy reading	0-999,999,999	kWh	UINT32	
…				…				
3/3				**Energy Register #4**				
	1	REG4	0x1783	Summary (total) energy reading	0-999,999,999	kWh	UINT32	
	2	TRF1	0x7000	Tariff #1 energy reading	0-999,999,999	kWh	UINT32	
	3	TRF2	0x7	Tariff #2 energy reading	0-	kWh	UINT	

File Channel/Section [1]	Record Field No. [2]	Point Label	Point ID	Description	Range	Units [3]	Type	Notes
			001		999,999,999		32	
	4	TRF3	0x7002	Tariff #3 energy reading	0-999,999,999	kWh	UINT32	
	5	TRF4	0x7003	Tariff #4 energy reading	0-999,999,999	kWh	UINT32	
	6	TRF5	0x7004	Tariff #5 energy reading	0-999,999,999	kWh	UINT32	
	7	TRF6	0x7005	Tariff #6 energy reading	0-999,999,999	kWh	UINT32	
	8	TRF7	0x7006	Tariff #7 energy reading	0-999,999,999	kWh	UINT32	
	9	TRF8	0x7007	Tariff #8 energy reading	0-999,999,999	kWh	UINT32	
16/4				**Daily Maximum Demand Register #1**				
	1	REG1 MD	0x4780	Summary (total) max. demand reading	0-Pmax	U3	UINT32	
	2	TRF1 MD	0x7100	Tariff #1 max. demand reading	0-Pmax	U3	UINT32	
	3	TRF2 MD	0x7101	Tariff #2 max. demand reading	0-Pmax	U3	UINT32	
	4	TRF3 MD	0x7102	Tariff #3 max. demand reading	0-Pmax	U3	UINT32	
	5	TRF4 MD	0x7103	Tariff #4 max. demand reading	0-Pmax	U3	UINT32	
	6	TRF5 MD	0x7104	Tariff #5 max. demand reading	0-Pmax	U3	UINT32	
	7	TRF6 MD	0x7105	Tariff #6 max. demand reading	0-Pmax	U3	UINT32	
	8	TRF7 MD	0x7106	Tariff #7 max. demand reading	0-Pmax	U3	UINT32	
	9	TRF8 MD	0x7107	Tariff #8 max. demand reading	0-Pmax	U3	UINT32	
…				…				

File Channel/Section [1]	Record Field No. [2]	Point Label	Point ID	Description	Range	Units [3]	Type	Notes
19/7				**Daily Maximum Demand Register #4**				
	1	REG4 MD	0x4783	Summary (total) max. demand reading	0-Pmax	U3	UINT32	
	2	TRF1 MD	0x7100	Tariff #1 max. demand reading	0-Pmax	U3	UINT32	
	3	TRF2 MD	0x7101	Tariff #2 max. demand reading	0-Pmax	U3	UINT32	
	4	TRF3 MD	0x7102	Tariff #3 max. demand reading	0-Pmax	U3	UINT32	
	5	TRF4 MD	0x7103	Tariff #4 max. demand reading	0-Pmax	U3	UINT32	
	6	TRF5 MD	0x7104	Tariff #5 max. demand reading	0-Pmax	U3	UINT32	
	7	TRF6 MD	0x7105	Tariff #6 max. demand reading	0-Pmax	U3	UINT32	
	8	TRF7 MD	0x7106	Tariff #7 max. demand reading	0-Pmax	U3	UINT32	
	9	TRF8 MD	0x7107	Tariff #8 max. demand reading	0-Pmax	U3	UINT32	

[1] An energy use profile section is allocated for registers for which a source input is selected in the Summary/TOU Register setup and for which energy use profile is enabled. A maximum demand profile section is allocated for registers for which maximum demand profile is enabled in the Summary/TOU Register setup. Not configured sections/channels are not available for download. Refer to the file channel mask in the file info for configured channels.

[2] The number of parameters in a section is automatically configured depending on the number of actually used tariffs selected in the TOU Daily Profiles.

[3] For power scale and units, refer to Section 5 ”Data Scales and Units”.

5 Data Scales and Units

Code	Condition	Value/Range	Notes
Data Scales			
Vmax		Voltage scale × PT Ratio, V	2
Imax		Current scale × CT Ratio, A	1, 3
Pmax	Wiring 4LN3, 3LN3, 3BLN3	Vmax × Imax × 3, W	4
	Wiring 4LL3, 3LL3, 3BLL3, 3OP2, 3OP3, 3DIR2, 2LL1	Vmax × Imax × 2, W	
Fmax	Nominal frequency 25, 50 or 60 Hz	100 Hz	
	Nominal frequency 400Hz	500 Hz	
Data Units – Low Resolution Option			
U1		1V	
U2		1A	
U3		1kW/kvar/kVA	
Data Units – High Resolution Option			
U1	PT Ratio = 1	0.1V	
	PT Ratio > 1	1V	
U2		0.01A	
U3	PT Ratio = 1	1W/Var/VA	
	PT Ratio > 1	1kW/kvar/kVA	

See Device Options Setup for information on selecting the device resolution option.

1 CT Ratio = CT primary current/CT secondary current

2 The default Voltage scale is 144V (120V + 20%). You can change it via the Device Data Scale setup (see Section 4.1) or via the Device Options setup in PAS.

3 The default Current scale is 2 × CT secondary current (2.0A with 1A secondaries, 10.A with 5A secondaries). You can change it via the Device Data Scale setup (see Section 4.1) or via the Device Options setup in PAS.

4 Pmax is rounded to whole kilowatts. With PT=1.0, if Pmax is greater than 9,999,000 W, it is truncated to 9,999,000 W.

6 Data Formats

Format Code	Value	Description	Notes
Timestamp			
F1		Local time in a UNIX-style format. Represents the number of seconds since midnight (00:00:00), January 1, 1970. The time is valid after January 1, 2000.	
Wiring Mode			
F2	0	3OP2 - 3-wire open delta using 2 CTs (2 element)	
	1	4LN3 - 4-wire WYE using 3 PTs (3 element), line-to-neutral voltage readings	
	2	3DIR2 - 3-wire direct connection using 2 CTs (2 element)	
	3	4LL3 - 4-wire WYE using 3 PTs (3 element), line-to-line voltage readings	
	4	3OP3 - 3-wire open delta using 3 CTs (2 1/2 element)	
	5	3LN3 - 4-wire WYE using 2 PTs (2 1/2 element), line-to-neutral voltage readings	
	6	3LL3 - 4-wire WYE using 2 PTs (2 1/2 element), line-to-line voltage readings	
	7	2LL1 - 2-wire line-to-line connection using 1 PT (1 element)	
	8	3BLN3 - 3-wire broken delta using 2 PTs (2 1/2 element), line-to-neutral voltage readings	
	9	3BLL3 - 3-wire broken delta using 2 PTs (2 1/2 element), line-to-line voltage readings	
File Attributes			
F3	Bit 0 = 0 Bit 0 = 1	Non-wrap (stop when filled) Wrap-around (circular file)	
	Bit 5 = 1	TOU daily profile log	
File Status Word			
F4	Bit 0 = 0 Bit 0 = 1	Non-wrap (stop when filled) Wrap-around (circular file)	
	Bit 5 = 1	Daily profile log file	
	Bit 9 = 1	Reading after EOF	
File Record Status Word			
F5	Bit 0 = 1	The last record of the file is being read	
	Bit 1 = 1	Reading after EOF	
	Bit 8 = 1	File is empty	
	Bit 9 = 1	Corrupted record (CRC error)	
	Bit 15 = 1	Generic read error (with one of the bits 8-9)	
File Allocation Map			
F6	Bit 0	Event log file	
	Bit 1	Data log #1 file	
	Bit 2-15	Reserved	
	Bit 16	Data log #16 file	
	Bits 17-31	Reserved	
Profile Log Sections Map			
F7	Bit 0:3 = 1	Summary/TOU energy/usage registers #1-#4	
	Bit 16:19 = 1	Summary/TOU maximum demand registers #1-#4	
File ID			
F8	0	Event log file	
	1	Data log #1 file	
	16	Data log #16 file	
Waveform Log Channel Mask			
F9	Bit 0 = 1	Channel V1/V12	3
	Bit 1 = 1	Channel V2/V23	3
	Bit 2 = 1	Channel V3/V31	3
	Bit 3 = 1	N/A	
	Bit 4 = 1	Channel I1	3
	Bit 5 = 1	Channel I2	3
	Bit 6 = 1	Channel I3	3
TOU Tariff Change Time			
F10	Bits 8:15 = 0-7	Tariff number #1-#8	

Format Code	Value	Description	Notes
	Bits 2:7 = 0-23	Tariff start hour	
	Bits 0:1 = 0-3	Tariff start quarter of an hour	
Summary/TOU Energy Register Source ID			
F11	0x0000	None	
	0x0700-0x0703	Pulse input DI1-DI4	
	0x1700	kWh import	
	0x1701	kWh export	
	0x1704	kvarh import	
	0x1705	kvarh export	
	0x1708	kVAh total	
	0x1709	kVAh import	
	0x170A	kVAh export	
	0x170B	kvarh Q1	
	0x170C	kvarh Q2	
	0x170D	kvarh Q3	
	0x170E	kvarh Q4	
Setpoint Trigger Parameters ID			
F12	0x0000	None (condition is not active)	
		Status Inputs	
	0x0600	Status input #1 ON	
	0x0601	Status input #2 ON	
	0x0602	Status input #3 ON	
	0x0603	Status input #4 ON	
	0x8600	Status input #1 OFF	
	0x8601	Status input #2 OFF	
	0x8602	Status input #3 OFF	
	0x8603	Status input #4 OFF	
	0x0701	Pulse input #2	
		Relays	
	0x0800	Relay #1 ON	
	0x0801	Relay #2 ON	
	0x8800	Relay #1 OFF	
	0x8801	Relay #2 OFF	
		Phase Reversal	2
	0x8901	Positive phase rotation reversal	
	0x8902	Negative phase rotation reversal	
		Pulse Counters	
	0x0A00	High pulse counter #1	
	0x0A01	High pulse counter #2	
	0x0A02	High pulse counter #3	
	0x0A03	High pulse counter #4	
		1-Cycle Values on any Phase	
	0x0E00	High voltage	
	0x8D00	Low voltage	
	0x0E01	High current	
	0x8D01	Low current	
	0x0E07	High voltage THD EH	4
	0x0E08	High current THD EH	4
	0x0E09	High K-Factor EH	4
	0x0E0A	High current TDD EH	4
		1-Cycle Auxiliary Values	
	0x1002	High frequency	
	0x9002	Low frequency	
	0x1003	High voltage unbalance	
	0x1004	High current unbalance	
		1-Sec Phase Values	
	0x1103	High I1 current	
	0x1104	High I2 current	
	0x1105	High I3 current	
	0x9103	Low I1 current	
	0x9104	Low I2 current	
	0x9105	Low I3 current	
		1-Sec Values on any Phase	
	0x1300	High voltage	
	0x9200	Low voltage	
	0x1301	High current	

Format Code	Value	Description	Notes
	0x9201	Low current	
		1-Sec Total Values	
	0x1406	High total kW import	
	0x1407	High total kW export	
	0x1408	High total kvar import	
	0x1409	High total kvar export	
	0x1402	High total kVA	
	0x9404	Low total PF Lag	
	0x9405	Low total PF Lead	
		1-Sec Auxiliary Values	
	0x1501	High neutral current	
	0x1502	High frequency	
	0x9502	Low frequency	
		Present Demands	
	0x1600	High V1/V12 Volt demand	
	0x1601	High V2/V23 Volt demand	
	0x1602	High V3/V31 Volt demand	
	0x1603	High I1 Ampere demand	
	0x1604	High I2 Ampere demand	
	0x1605	High I3 Ampere demand	
	0x1606	High block kW import demand [E]	
	0x1608	High block kVA demand [E]	
	0x1609	High sliding window kW import demand [E]	
	0x160B	High sliding window kVA demand [E]	
	0x160F	High accumulated kW import demand [E]	
	0x1611	High accumulated kVA demand [E]	
	0x1612	High predicted kW import demand [E]	
	0x1614	High predicted kVA demand [E]	
		Time and Date Parameters	
	0x0B02	Day of week	
	0x0B03	Year	
	0x0B04	Month	
	0x0B05	Day of month	
	0x0B06	Hour	
	0x0B07	Minutes	
	0x0B08	Seconds	
	0x0B09	Minute interval	
Setpoint Action ID			
F14	0x0000	No action	
	0x3000	Operate Relay #1	
	0x3001	Operate Relay #2	
	0x3100	Release latched Relay #1	
	0x3101	Release latched Relay #2	
	0x4000	Increment counter #1	
	0x4001	Increment counter #2	
	0x4002	Increment counter #3	
	0x4003	Increment counter #4	
	0x4400	Count operating time using counter #1	
	0x4401	Count operating time using counter #2	
	0x4402	Count operating time using counter #3	
	0x4403	Count operating time using counter #4	
	0x5100	Send event notification	
	0x7100	Data log #1	
Counter Source ID			
F16	0x0000	None	
	0x0001-0x0002	Pulse input DI1-DI2	
Relay Output Pulse Source ID			
F17	0x0000	None	
	0x0400	kWh import pulse [E]	
	0x0401	kWh export pulse [E]	
	0x0403	kvarh import pulse [E]	
	0x0404	kvarh export pulse [E]	
	0x0405	kvarh total pulse [E]	
	0x0406	kVAh pulse [E]	
AO Output Parameters ID			
F18	0x0000	None (output disabled)	1

Format Code	Value	Description	Notes
		1-Cycle Phase Values	
	0x0C00	V1/V12 Voltage	
	0x0C01	V2/V23 Voltage	
	0x0C02	V3/V31 Voltage	
	0x0C03	I1 Current	
	0x0C04	I2 Current	
	0x0C05	I3 Current	
	0x0C1E	V12 Voltage	
	0x0C1F	V23 Voltage	
	0x0C20	V31 Voltage	
		1-Cycle Total Values	
	0x0F00	Total kW	
	0x0F01	Total kvar	
	0x0F02	Total kVA	
	0x0F03	Total PF	
	0x0F04	Total PF Lag	
	0x0F05	Total PF Lead	
		1-Cycle Auxiliary Values	
	0x1001	In Current	
	0x1002	Frequency	
		1-Sec Phase Values	
	0x1100	V1/V12 Voltage	
	0x1101	V2/V23 Voltage	
	0x1102	V3/V31 Voltage	
	0x1103	I1 Current	
	0x1104	I2 Current	
	0x1105	I3 Current	
	0x111E	V12 Voltage	
	0x111F	V23 Voltage	
	0x1120	V31 Voltage	
		1-Sec Total Values	
	0x1400	Total kW	
	0x1401	Total kvar	
	0x1402	Total kVA	
	0x1403	Total PF	
	0x1404	Total PF Lag	
	0x1405	Total PF Lead	
		1-Sec Auxiliary Values	
	0x1501	In Current	
	0x1502	Frequency	
		Present Demands [E]	
	0x160F	Accumulated kW import demand	
	0x1610	Accumulated kvar import demand	
	0x1611	Accumulated kVA demand	
	0x161A	Accumulated kW export demand	
	0x161B	Accumulated kvar export demand	
Event Cause/Point ID			
		Communications Events	
	0x5B00-0x5BFF	Data point ID (low byte, see F21)	
		Front Panel Operations	
	0x5C00-0x5CFF	Data point ID (low byte, see F21)	
		Self-Check Diagnostics Events	
	0x5D00-0x5DFF	Data point ID (low byte, see F21)	
		Hardware Diagnostics Events	
	0x6202	RAM/Data error	
	0x6203	Hardware watchdog reset	
	0x6204	DSP/Sampling fault	
	0x6205	CPU exception	
	0x6206	Reserved	
	0x6207	Software watchdog reset	
	0x620D	Low battery	
	0x620F	EEPROM fault	
		External Events	
	0x6300	Power down	
	0x6308	Power up	
	0x6309	External reset	

Format Code	Value	Description	Notes
Event Effect ID			
F20		**Communications/Self-check/Front Panel Events**	
	0x0000	None	
	0x6000	Total energy registers cleared	
	0x6100	All total maximum demands cleared	
	0x6101	Power maximum demands cleared	
	0x6102	Volt/Ampere/Harmonic maximum demands cleared	
	0x6200	Summary/TOU energy registers cleared	
	0x6300	Summary/TOU maximum demand registers cleared	
	0x6400	All counters cleared	
	0x6401-0x6403	Counter cleared (low byte = counter ID)	
	0x6500	Min/Max log cleared	
	0x6600	Event log file cleared (low byte = File ID)	
	0x6700, 0x670F	Data log file cleared (low byte = File ID)	
	0x6710	All data logs cleared	
	0x6B06	Communication counters cleared	
	0xF100-0xF10F	Setpoint cleared (low byte = setpoint ID)	
	0xF200	Setup/Data cleared	
	0xF300	Setup reset (set by default)	
	0xF400	Setup changed	
	0xF500	RTC set	
Data Point ID			
F21		**Data Locations**	
	0x03	Data memory	
	0x04	Factory setup	
	0x05	Access/Password setup	
	0x06	Basic setup	
	0x07	Communications setup	
	0x08	Real-time clock	
	0x09	Digital inputs setup	
	0x0A	Pulse counters setup	
	0x0B	AO setup	
	0x0E	Timers setup	
	0x10	Event/alarm setpoints	
	0x11	Pulsing setup	
	0x12	User assignable register map	
	0x14	Data log setup	
	0x15	File/Memory setup	
	0x16	TOU energy registers setup	
	0x18	TOU daily profiles	
	0x19	TOU calendar	
	0x1B	RO Setup	
	0x1C	User selectable options	
	0x1F	DNP 3.0 class 0 map	
	0x20	DNP 3.0 options setup	
	0x21	DNP 3.0 events setup	
	0x22	DNP 3.0 event setpoints	
	0x23	Calibration registers	
	0x24	Date/Time Setup	
	0x25	Net setup	
	0x2B-0x3F	Reserved	
Device Diagnostics			
F23	Bit 0	Reserved	
	Bit 1	Reserved	
	Bit 2 = 1	RAM/Data error	
	Bit 3 = 1	CPU watchdog reset	
	Bit 4 = 1	Sampling fault	
	Bit 5 = 1	CPU exception	
	Bit 6	Reserved	
	Bit 7 = 1	Software watchdog reset	
	Bit 8 = 1	Power down	
	Bit 9 = 1	Device reset	
	Bit 10 = 1	Configuration reset	
	Bit 11 = 1	RTC fault	
	Bit 12	Reserved	

Format Code	Value		Description	Notes
	Bit 13		Reserved	
	Bit 14		Reserved	
	Bit 15 = 1		EEPROM fault	
Instrument Options				
F28	Bit 0=1		120V Option	
	Bit 1=1		690V Option	
	Bits 2-5		Reserved	
	Bit 6=1		Analog output 0/4 or 4/20mA	
	Bit 7=1		Analog output 0-1mA	
	Bit 8=1		Analog output ±1mA	
	Bit 9=1		RO option	
	Bit 10=1		DI option	
	Bit 11=1		Reserved	
	Bit 12=1		Setup is secured by a password (authorization required)	
	Bit 13=1		Reserved	
	Bit 14=1		Reserved	
	Bit 15		Reserved	
	Bits 16-18		Number of RO - 1	
	Bits 19-22		Number of DI – 1	
	Bits 23-24		Number of AO - 1	
	Bits 25-29		Reserved	
	Bits 30-31		Reserved	
I/O Slot Types				
F29	DI	DRY	00000000B	
	RO		00100000B	
	AI	±1 mA	01010000B	
	AI	0-20 mA	01010001B	
	AI	4-20 mA	01010010B	
	AI	0-1 mA	01010011B	
	AO	±1 mA	01100000B	
	AO	0-20 mA	01100001B	
	AO	4-20 mA	01100010B	
	AO	0-1 mA	01100011B	
	Empty slot		11111111B	
Reset/Clear Function				
F30	Function	Target		
	1	0	Clear total energy registers [E]	
	2	0=all maximum demands 1=power demands [E] 2=volt, ampere demands	Clear total maximum demand registers	
	3	0	Clear TOU energy registers [E]	
	4	0	Clear TOU demand registers [E]	
	5	0=all counters 1-4=counter #1-#4	Clear pulse counters	
	6	0	Clear Min/Max log	
Basic Setup Parameters ID				
F31	W40		Wiring mode	
	U14		PT ratio	
	I17		CT primary current	
	D11		Power block demand period [E]	
	F47		The number of blocks in a sliding window [E]	
	C12		Volt/ampere demand period	
	Q51		Nominal frequency	
	Q52		Maximum demand load current	
	Q60		PT ratio multiplication factor	

NOTES:

[1] **Analog Outputs**

1) For bi-directional analog output (±1 mA), the zero scale setup corresponds to the center (0 mA) of the scale range, and the direction of the current matches the sign of the output parameter. Unsigned parameters are output within the current range 0 to +1 mA and can be scaled as in the case of single-ended analog output (0-1 mA).

For signed values, such as powers and signed power factor, the scale is always symmetrical with regard to 0 mA, and the full scale corresponds to +1 mA output for positive readings and to -1 mA output for negative readings. The zero scale (0 mA output) is permanently set in the instrument to zero for all parameters except the signed power factor for which it is set to 1.000 (see Note 2). In write requests, the zero scale is ignored.

2) Except for the signed power factor, the setup scale is continuous within the entire value range. For signed power factor, the setup scale is broken at +1.000 in order to provide continuous output current when the power factor changes close to ±1.000. The setup scale is symmetrical in the range of -0 to +0 with a center at 1.000 (-1.000 is assumed to be equal to +1.000). Negative power factor is output as -1.000 minus measured value, and non-negative power factor is output as +1.000 minus measured value. To set the entire range for power factor from-0 to +0, the scales would be specified as -0 to 0. Because of the fact that negative zero may not be transmitted through communications, the value of -0.001 is used to specify the scale of -0, and both +0.001 and 0.000 are used to specify the scale of +0.

[2] **Phase Reversal Trigger**

The setpoint is operated when the actual phase sequence does not match the designated phase rotation order.

[3] In 2LL1 wiring mode the Real-Time Waveform data represents Line-to-Natural data and not line-to-Line data.

[4] In 2LL1 wiring mode the Harmonics calculations are not supported.