SERIES PM296/RPM096 POWERMETERS

COMMUNICATIONS

ASCII Communications Protocol

REFERENCE GUIDE

Every effort has been made to ensure that the material herein is complete and accurate. However, the manufacturer is not responsible for any mistakes in printing or faulty instructions contained in this book. Notification of any errors or misprints will be received with appreciation.

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

This book is copyrighted. No part of this book may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior written permission of the manufacturer.

REVISION HISTORY

Rev.A3 (F/W 2.27/2.37 or later):

Added a firmware build number (see Table 4-10).
Added setpoint status triggers SP1-SP16 (see Table 5-7).
Added Low battery alarm (F/W Versions 2.27.2/2.37.2 or later, see Table 5-22)

BG0291 Rev.A3

Table of Contents

1 GENERAL

This document specifies the ASCII serial communications protocol used to transfer data between a master computer station and the PM296/RPM096. The document provides the complete information necessary to develop a third-party communications software capable of communication with the Series PM296/RPM096 instruments.

All messages within the ASCII communications protocol are designed to consist only of printable characters.

Additional information concerning communications operation, configuring the communications parameters and communications connections is found in "Series PM296/RPM096 Powermeters Installation and Operation Manual".

IMPORTANT

1. The voltage parameters throughout the protocol can represent line-to-neutral or line-to-line voltages depending on the wiring mode selected in the instrument. When the 4LN3 or 3LN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages. In 4LN3, 4LL3, 3LN3 and 3LL3 wiring modes, harmonic voltages will represent line-to-neutral voltages. In a 3-wire direct connection, harmonic voltages will represent line-to-neutral voltages as they appear on the instrument's input transformers. In a 3-wire open delta connection, harmonic voltages will comprise L12 and L23 line-to-line voltages.
2. 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 can be used.

2 ASCII FRAMING

2.1 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	Check sum	Trailer (CRLF)
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

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

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 instruments) a decimal representation is preserved. For data formats, see Section 3.2.

Check sum

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 22h to 7Eh (hexadecimal) as follows: $[\sum(\text{each byte} - 22H)] \bmod 5CH + 22H$

Trailer

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
Char	ASCII Hex	
0	30h	Read basic data registers
1	31h	Read basic setup
2	32h	Write basic setup
3	33h	Read instrument status
4	34h	Reset/clear functions
8	38h	Reset the instrument

Message type		Description
Char	ASCII Hex	
9	39h	Read version number
?	3F	Read extended status
@	40h	Read log memory status
B	42h	Read analog output allocation
b	62h	Write analog output allocation
C	43h	Read analog expander channel allocation
c	63h	Write analog expander channel allocation
D	44h	Read digital input allocation
d	64h	Write digital input allocation
E	45h	Read timer setup
e	65h	Write timer setup
G	47h	Read pulsing setpoint
g	67h	Write pulsing setpoint
H	48h	Read phase harmonics
i	69h	Write event flag status
J	4Ah	Read pulse counter setup
j	6Ah	Write pulse counter setup
K	4Bh	Read memory partition setup
k	6Bh	Write memory partition setup
L	4Ch	Read data log setup
l	6Ch	Write data log setup
M	4Dh	Read event log
N	4Eh	Read data log
O	4Fh	Read Min/Max log
P	50h	Read TOU register allocation
p	70h	Write TOU register allocation
Q	51h	Read TOU daily profile
q	71h	Write TOU daily profile
R	52h	Read TOU calendar
r	72h	Write TOU calendar
S	53h	Read Real Time Clock
T	54h	Write Real Time Clock
U	55h	Read TOU calendar year
u	75h	Write TOU calendar year
W	57h	Read waveform

Table 2-2 Direct Read/Write ASCII Requests

Message type		Description
Char	ASCII Hex	
A	41h	Long-size direct read
a	61h	Long-size direct write
X	58h	Variable-size direct read
x	78h	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 powermeter 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 powermeter will not act on or respond to the master's request.

3 PROTOCOL IMPLEMENTATION

3.1 ASCII Specific and Direct Requests

The ASCII protocol implements two different types of messages to transfer data between a master application and the instrument: 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. Chapter 4 describes specific ASCII requests and their message body formats.

Direct read/write requests use a universal message body format, specified in Section 5.1. 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. Chapter 5 describes registers accessed via 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.

3.2 Data Formats

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

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 range, 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 0h-9h, 0ah-0fh). 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.

3.3 Configuring and Accessing Log Files

Configuring Memory for Logging

To use the onboard data logging, allocate a separate log partition for each specific data you want to be recorded in your instrument. The PM296/RPM096 provides concurrent recording data in 19 different memory partitions, one of which is intended to record event log data, two partitions for waveform log, and the others to store 16 different data logs using different sets of data parameters. Additionally, the two last data logs #15 and #16 can be configured to automatically record TOU monthly and daily profile data respectively using season TOU tariffs. Refer to Section 4.16 for information on how to allocate a memory partition for your specific data. Refer to Section 4.17 on how to configure a set of parameters to be recorded to each data log.
Each memory partition you allocated for logging is organized as a sequential file of records where all data is recorded in chronological order with a time and date stamp. When a partition is filled up,

recording can be stopped or can continue to record over the oldest records if you specified a partition with a wrap-around (circular) attribute. TOU profile log partitions are automatically configured to be of a wrap-around type.

Each record within a log file has a unique sequence number that guards against missing or duplicated records when reading the log file. This number is incremented (modulo 65536) with each log and will not be replicated within the following 65535 logs. If a record is missing because of a communication problem, the read sequence for the log can be restored from the record with the desired sequence number.

Accessing Log Files

Each log file has a separate file read pointer which always points to the current file record that will be read next, and a separate register window which gives access to the record pointed to by this pointer. Initially, the read pointer is associated with the oldest record in the file. Reading a record via the file window returns the current record data, and then the pointer automatically advances to the following record in the file. Consequent requests addressed to the file window will return a new record each time in the direction from the oldest record to the more recent records. Because the file window advances automatically after the instrument responses to the master request (disregarding of the number of registers in the window being accessed), the entire window must be read at once using a single request.

The instrument offers you two different techniques for accessing your log files, using specific or direct read requests. Specific ASCII requests provide sequential reading of a file records until the end of a file is reached. When a record is requested after the end of a file, the response message will contain a zero record with an exception code indicating the end of a log file. As opposite, direct read requests provide circular file reading, i.e., when a record is requested after the end of a file, the file read pointer is automatically shifted to the beginning of the file. Using direct read requests always allows you to read the entire log file disregarding of the current file status. You can simply poll the file window registers just as you poll ordinal data in your SCADA applications, without the need to manipulate with the file pointer. Refer to Sections 4.18, 4.19 and 4.28 for information on specific ASCII requests you can use to access your log files, and to Sections 5.14, 5.15 and 5.20 for information on direct read requests.

A log file can be read both in an arbitrary order and in sequence as explained above. To access the log records in a random order, the file read pointer can be re-written with the desired sequence number to point to the desired record. Refer to Sections 4.8, 5.12 and 5.13 for information on how to check the log file status and how to re-write the file read pointer. Writing to the memory partition command register (see Section 5.13) allows you to force the file pointer to point to the oldest record in the file or to the first new record in the file that you have not yet read. You can also use the instrument reset registers (see Sections 4.4 and 5.11) to restore the file read pointer to the oldest record in your log file if you want to re-read the file from the beginning.

IMPORTANT: Take into consideration the fact that in a wrap-around (circular) log partition, the oldest records may be overwritten by the most recent records since you have read either log status register. An attempt to point to the particular record directly by using its sequence number may fail if the addressed record has just been overwritten.

3.4 Password Protection

The PM296/RPM096 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 for communications via the front panel. 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 communications password register (see Section 5.19) before another write request will be 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.

4 SPECIFIC ASCII REQUESTS

4.1 Basic Data

Table 4-1 Read Request

Message type (ASCII)					
0					
Message body (decimal)					
Request - no body					
Response					
Field	**Offset**	**Length**	**Parameter**	**Unit** [2]	**Range** [1]
1	0	4	Voltage L1/L12 [6]	V/kV	0 to Vmax
2	4	4	Voltage L2/L21 [6]	V/kV	0 to Vmax
3	8	4	Voltage L3/L31 [6]	V/kV	0 to Vmax
4	12	5	Current L1	A	0 to Imax
5	17	5	Current L2	A	0 to Imax
6	22	5	Current L3	A	0 to Imax
7	27	6	kW L1	kW/MW	-Pmax to Pmax
8	33	6	kW L2	kW/MW	-Pmax to Pmax
9	39	6	kW L3	kW/MW	-Pmax to Pmax
10	45	4	Power factor L1		-.99 to 1.00 [4]
11	49	4	Power factor L2		-.99 to 1.00 [4]
12	53	4	Power factor L3		-.99 to 1.00 [4]
13	57	6	kW total	kW/MW	-Pmax to Pmax
14	63	4	Power factor total		-.99 to 1.00 [4]
15	67	6	kWh import	MWh [3]	0 to 99999.
16	73	5	Neutral (unbalanced) current	A	0 to Imax
17	78	4	Frequency	Hz	45.0 to 65.0
18	82	6	kvar L1	kvar/Mvar	-Pmax to Pmax
19	88	6	kvar L2	kvar/Mvar	-Pmax to Pmax
20	94	6	kvar L3	kvar/Mvar	-Pmax to Pmax
21	100	6	kVA L1	kVA/MVA	0 to Pmax
22	106	6	kVA L2	kVA/MVA	0 to Pmax
23	112	6	kVA L3	kVA/MVA	0 to Pmax
24	118	6	kvarh net	Mvarh [3]	-9999. to 99999.
25	124	6	kvar total	kvar/Mvar	-Pmax to Pmax
26	130	6	kVA total	kVA/MVA	0 to Pmax
27	136	6	Maximum sliding window kW import demand [5]	kW/MW	0 to Pmax
28	142	6	Accumulated kW import demand	kW/MW	0 to Pmax
29	148	5	Max. ampere demand L1	A	0 to Imax
30	153	5	Max. ampere demand L2	A	0 to Imax
31	158	5	Max. ampere demand L3	A	0 to Imax
32	163	2	Status inputs (hex)		See Table 4-13
33	165	6	kWh export	MWh [3]	0 to 99999.
34	171	6	Maximum sliding window kVA demand [5]	kVA/MVA	0 to Pmax
35	177	4	Voltage THD L1/L12	%	0.0 to 999.
36	181	4	Voltage THD L2/L23	%	0.0 to 999.
37	185	4	Voltage THD L3	%	0.0 to 999.
38	189	4	Current THD L1	%	0.0 to 999.
39	193	4	Current THD L2	%	0.0 to 999.
40	197	4	Current THD L3	%	0.0 to 999.
41	201	8	kVAh	MVAh [3]	0 to 99999.99
42	209	6	Present sliding window kW import demand [5]	kW/MW	0 to Pmax
43	215	6	Present sliding window kVA demand [5]	kVA/MVA	0 to Pmax
44	221	4	PF (import) at maximum KVA demand		0 to 1.00
45	225	4	Current TDD L1	%	0.0 to 99.9
46	229	4	Current TDD L2	%	0.0 to 99.9
47	233	4	Current TDD L3	%	0.0 to 99.9

Fields indicated by an N/A mark are padded with ASCII zeros.

[1] The parameter limits are as follows:

Imax (100% over-range) = 2 × CT primary current [A]
Imax aux (100% over-range) = 2 × Auxiliary CT primary current [A/mA]

Direct wiring (PT Ratio = 1):

Vmax (690 V input option) = 828.0 V
Vmax (120 V input option) = 144.0 V
Pmax = (Imax × Vmax × 3) [kW x 0.001] if wiring mode is 4LN3 or 3LN3
Pmax = (Imax × Vmax × 2) [kW x 0.001] if wiring mode is 4LL3, 3OP2, 3DIR2, 3OP3 or 3LL3

Wiring via PTs (PT Ratio > 1):

Vmax (690 V input option) = 144 × PT Ratio [V]
Vmax (120 V input option) = 144 × PT Ratio [V]
Pmax = (Imax × Vmax × 3)/1000 [MW x 0.001] if wiring mode is 4LN3 or 3LN3
Pmax = (Imax × Vmax × 2)/1000 [MW x 0.001] if wiring mode is 4LL3, 3OP2, 3DIR2, 3OP3 or 3LL3

[2] When ASCII compatibility mode is disabled (see Section 5.5), voltages, currents and powers are always transmitted with a decimal point at highest resolution available for the field. For direct wiring (PT Ratio = 1), voltages are transmitted in volts, currents in amperes, and powers in kilowatts. For wiring via PT (PT Ratio > 1), voltages are transmitted in kilovolts, currents in amperes, and powers in megawatts. When the value is greater than the field width, the right most digits of the fractional part are truncated. For the best available resolution, see Note [2] to Table 5-7.

When ASCII compatibility mode is enabled, the PM296/RPM096 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 (when the value is greater than the field width, the right most digits of the fractional part will be 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 resolution, the right-most digits are truncated. The energy roll value is user selectable (see Section 5.4).

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

[5] To get block interval demand readings, set the number of demand periods equal to 1 (see Table 4-4).

[6] When the 4LN3 or 3LN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

4.2 Basic Setup

Table 4-2 Read Request

Message type (ASCII)				
1				
Message body (decimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	3	Parameter identifier	see Table 4-4
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	3	Parameter identifier	see Table 4-4
2	3	4	Not used	permanently set to 00.0
3	7	6	Parameter value	see Table 4-4

Table 4-3 Write Request

Message type (ASCII)				
2				
Message body (decimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	3	Parameter identifier	see Table 4-4
2	3	4	Not used	set to 00.0
3	7	6	Parameter value	see Table 4-4

Table 4-4 Basic Setup Parameters

Parameter	Identifier	Range
Wiring mode [1]	W40	0 = 3OP2, 1 = 4LN3, 2 = 3DIR2, 3 = 4LL3, 4 = 3OP3, 5 = 3LN3, 6 = 3LL3
PT ratio	U14	1.0 to 6500.0
CT primary current	I17	1 to 5000 A
Auxiliary CT primary current	G19	1 to 5000 A/mA
DC voltage offset [2]	Q54	0 to 9999 (default 0)
DC voltage full scale [2]	Q55	0 to 9999 (default 20, 100 or 300)
Power demand period	D11	1,2,5,10,15,20,30,60 min 255 = external synchronization
The number of demand periods	F47	1 - 15
Volt/ampere demand period	C12	0 to 1800 sec
Averaging buffer size	S41	8, 16, 32
Reset enable/disable	R42	0 = disable, 1 = enable
Nominal frequency	Q51	50, 60
Maximum demand load current	Q52	0 to 10000 A (0 = CT primary current)
Thermal demand time constant	J48	1.0 to 3600.0 sec
The number of pre-event cycles for the waveform recorder	Q50	1 to 8
The number of cycles in a waveform series	Q56	0 to 2560 (will be rounded to a nearest bigger number multiple of 16), 0 = auto-select [3]

1 The wiring mode options are as follows:

3OP2 - 3-wire open delta using 2 CTs (2 element)
4LN3 - 4-wire WYE using 3 PTs (3 element), line to neutral voltage readings
3DIR2 - 3-wire direct connection using 2 CTs (2 element)
4LL3 - 4-wire WYE using 3 PTs (3 element), line to line voltage readings
3OP3 - 3-wire open delta using 3 CTs (2 1/2 element)
3LN3 - 4-wire WYE using 2 PTs (2 1/2 element), line to neutral voltage readings
3LL3 - 4-wire WYE using 2 PTs (2 1/2 element), line to line voltage readings

2 To get true DC voltage readings, set the offset to zero and the full scale to 20, 100 or 300 V according to your order.

3 The waveform recorder logs waveforms in series of records. A compound waveform can have as more as 2560 cycles recorded in 160 consequent records, each record comprising 16 waveform cycles. When the number of cycles is defined as zero, the instrument automatically selects the size of a waveform series. By default, a waveform series is assumed to consist of a single 16-cycle record. When a record is triggered by a voltage disturbance event and the disturbance lasts for more time than a 16-cycle record can include, the disturbance event is assumed to be a single long-duration event. In that case, the recorder will continue storing a waveform in the following adjacent records while the voltage wave shape is still non-stationary. The total number of records in a compound waveform will be limited only by the allocated memory.

4.3 Instrument Status

This is an obsolete request preserved for compatibility with older instruments which allows you to read status of only 4 from 6 relays available in your instrument. Use specific request 'D' (see Section 4.11) or a direct read request instead (see Sections 5.2 and 5.9) to get access to all relays.

Table 4-5 Read Request

Message type (ASCII)				
3				
Message body (hexadecimal)				
Request - no body				
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	8	Not used	00000000
2	8	1	Not used	0
3	9	1	Relay status	0-F (see Table 4-6)

Table 4-6 Relay Status

Bit	Description
0	Relay #4 status
1	Relay #3 status
2	Relay #2 status
3	Relay #1 status

Bit meaning: 0 = relay is energized, 1 = relay is not energized

4.4 Reset/Clear Functions

These operations can be also performed by using the direct write requests instead of the specific request '4' (see Section 5.11).

Table 4-7 Write Request

Message type (ASCII)				
4				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	1	Reset function	see Table 4-8
2	1	2	Target	see Table 4-8 (the field can be omitted if it is equal to 0)

Table 4-8 Reset/Clear Functions

Function	Description	Target
1	Clear total energy registers	0
2	Clear total maximum demand registers	0 = all maximum demands 1 = power demands 2 = volt/ampere demands
3	Clear TOU energy registers	0
4	Clear TOU demand registers	0
5	Clear pulse counters	0 = all counters 1-16 = counter #1 - #16
6	Clear Min/Max log	0
7	Clear event log	0
8	Clear data log	0-15 = data logs #1 - #16 16 = all data logs
9	Clear waveform log #1	0
A	Clear waveform log #2	0
B	Reserved	N/A
C	Restore event log read queue to the beginning	0
D	Restore data log read queue to the beginning	0-15 = data logs #1 - #16 16-31 = monthly profile logs for TOU energy registers #1 - #16 32-34 = monthly profile logs for TOU maximum demand registers #1 - #3 48-63 = daily profile logs for TOU energy registers #1 - #16 64-66 = daily profile logs for TOU maximum demand registers #1 - #3
E	Restore waveform log #1	0
F	Restore waveform log #2	0

4.5 Reset the Instrument (warm restart)

This request causes the instrument to perform full reset and restart, the same as when the instrument is turned on. No response is expected.

Table 4-9 Write Request

Message type (ASCII)
8
Message body
Request - no body
Response - no response

4.6 Firmware Version Number

Table 4-10 Read Request

Message type (ASCII)				
9				
Message body (decimal)				
Request - no body				
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	3	Firmware version number	220-299
2	3	2	Firmware build number [1]	01-99

[1] Available starting with F/W Versions 2.26.2/2.36.2 and 2.27.2/2.37.2 or later.

4.7 Extended Instrument Status

Table 4-11 Read Request

Message type (ASCII)				
?				
Message body (hexadecimal)				
Request - no body				
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	4	Relay status	see Table 4-12
2	4	4	User event flags status	see Table 4-13
3	8	4	Status inputs	see Table 4-14
4	12	4	Setpoints status	see Table 4-15
5	16	4	Log status	see Table 4-16
6	20	4	Data log status	see Table 4-17
7	24	32	Not used	0

Table 4-12 Relay Status

Bit	Description
0	Relay #1 status
1	Relay #2 status
2	Relay #3 status
3	Relay #4 status
4	Relay #5 status
5	Relay #6 status
6-15	Not used (permanently set to 0)

Bit meaning: 0 = relay is not energized, 1 = relay is energized

Table 4-13 User Event Flags

Bit	Description
0	Event flag #1
1	Event flag #2
2	Event flag #3
3	Event flag #4
4	Event flag #5
5	Event flag #6
6	Event flag #7
7	Event flag #8
8-15	Not used (permanently set to 0)

Bit meaning: 0 = OFF, 1 = ON

Table 4-14 Status Inputs

Bit	Description
0	Status input #1
1	Status input #2
2	Status input #3
3	Status input #4
4	Status input #5
5	Status input #6
6	Status input #7
7	Status input #8
8	Status input #9
9	Status input #10
10	Status input #11
11	Status input #12
12-15	Not used (permanently set to 0)

Bit meaning: 0 = contact open, 1 = contact closed

Table 4-15 Setpoints Status

Bit	Description
0	Setpoint # 1 status
1	Setpoint # 2 status
2	Setpoint # 3 status
3	Setpoint # 4 status
4	Setpoint # 5 status
5	Setpoint # 6 status
6	Setpoint # 7 status
7	Setpoint # 8 status
8	Setpoint # 9 status
9	Setpoint # 10 status
10	Setpoint # 11 status
11	Setpoint # 12 status
12	Setpoint # 13 status
13	Setpoint # 14 status
14	Setpoint # 15 status
15	Setpoint # 16 status

Bit meaning: 0 = setpoint is released, 1 = setpoint is operated

Table 4-16 Log Status

Bit	Description
0	Reserved
1	New Min/Max log
2	New event log
3	New data log (any)
4	New waveform log #1
5	New waveform log #2
6-15	Not used (permanently set to 0)

Bit meaning: 0 = no new logs, 1 = new log recorded (the new log flag is reset when the user reads the first log record after the flag has been set)

Table 4-17 Data Log Status

Bit	Description
0	New data log #1
1	New data log #2
2	New data log #3
3	New data log #4
4	New data log #5
5	New data log #6
6	New data log #7
7	New data log #8
8	New data log #9
9	New data log #10
10	New data log #11
11	New data log #12
12	New data log #13

13	New data log #14
14	New data log #15
15	New data log #16

Bit meaning: 0 = no new logs, 1 = new log recorded (the new log flag is reset when the user reads the first log record after the flag has been set)

4.8 Log Memory Status

Table 4-18 Read Request

Message type (ASCII)			
@			
Message body (hexadecimal)			
Request - no body			
Response			
Field	**Offset**	**Length**	**Parameter**
1	0	8	Total memory size, byte
2	8	8	Free memory size, byte
3	16	4	The number of logged records in event log
4	20	4	The number of logged records in data log #1
5	24	4	The number of logged records in data log #2
6	28	4	The number of logged records in data log #3
7	32	4	The number of logged records in data log #4
8	36	4	The number of logged records in data log #5
9	40	4	The number of logged records in data log #6
10	44	4	The number of logged records in data log #7
11	48	4	The number of logged records in data log #8
12	52	4	The number of logged records in data log #9
13	56	4	The number of logged records in data log #10
14	60	4	The number of logged records in data log #11
15	64	4	The number of logged records in data log #12
16	68	4	The number of logged records in data log #13
17	72	4	The number of logged records in data log #14
18	76	4	The number of logged records in data log #15
19	80	4	The number of logged records in data log #16
20	84	4	The number of logged records in waveform log #1
21	88	4	The number of logged records in waveform log #2
22	92	4	The number of new event log records
23	96	4	The number of new data log #1 records
24	100	4	The number of new data log #2 records
25	104	4	The number of new data log #3 records
26	108	4	The number of new data log #4 records
27	112	4	The number of new data log #5 records
28	116	4	The number of new data log #6 records
29	120	4	The number of new data log #7 records
30	124	4	The number of new data log #8 records
31	128	4	The number of new data log #9 records
32	132	4	The number of new data log #10 records
33	136	4	The number of new data log #11 records
34	140	4	The number of new data log #12 records
35	144	4	The number of new data log #13 records
36	148	4	The number of new data log #14 records
37	152	4	The number of new data log #15 records
38	156	4	The number of new data log #16 records
39	160	4	The number of new records in waveform log #1
40	164	4	The number of new records in waveform log #2

The number of logged records includes all records currently logged in the memory partition. The number of the new records includes the number of records that are logged after the last read request has been issued for the memory partition.

4.9 Analog Output Allocation

Table 4-19 Read Request

Message type (ASCII)				
B				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Analog channel number	0-1 = channel #1-#2
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Analog channel number	0-1 = channel #1-#2
2	2	4	Output parameter index	see Table 4-23
3	6	8	Zero scale (0/4 mA)	see Table 4-23
4	14	8	Full scale (20/1 mA)	see Table 4-23

Table 4-20 Write Request

Message type (ASCII)				
b				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Analog channel number	0-1 = channel #1-#2
2	2	4	Output parameter index	see Table 4-23
3	6	8	Zero scale (0/4 mA)	see Table 4-23
4	14	8	Full scale (20/1 mA)	see Table 4-23

1. Except for the signed power factor (see Note 3 to Table 4-23), the output scale is linear within the value range. The scale range will be inverted if the full scale specified is less than the zero scale.
2. For bi-directional analog output (±1 mA), the zero scale corresponds to the center of the scale range (0 mA) and the direction of the current matches the sign of the output parameter. For signed (bi-directional) 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. For these, 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. In the write request, the zero scale is ignored. No error will occur when you attempt to change it. Unsigned parameters are output within the current range 0 to +1 mA and can be scaled using both zero and full scales as in the case of single-ended analog output.

4.10 Analog Expander Channel Allocation

Table 4-21 Read Request

Message type (ASCII)				
C				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Analog channel number	0-1 = channel #1-#2
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Analog channel number	0-1 = channel #1-#2
2	2	4	Output parameter index	see Table 4-23
3	6	8	Zero scale (0/4 mA)	see Table 4-23
4	14	8	Full scale (20 mA)	see Table 4-23

Table 4-22 Write Request

Message type (ASCII)				
c				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Analog channel number	0-1 = channel #1-#2
2	2	4	Output parameter index	see Table 4-23

3	6	8	Zero scale (0/4 mA)	see Table 4-23
4	14	8	Full scale (20 mA)	see Table 4-23

NOTE

Analog expander outputs settings will not be in effect until the analog expander output is globally enabled. To activate the analog expander output, set the analog expander option to the enabled state in the user selectable options setup (see Section 5.4).

Table 4-23 Analog Output Parameters

Parameter	Point ID	Length	Unit [2]	Scale range [1]
None				
None	0x0000	4		0
Real-time values per phase				
Voltage L1/L12 [5]	0x0C00	8	0.1V/1V	0 to Vmax
Voltage L2/L23 [5]	0x0C01	8	0.1V/1V	0 to Vmax
Voltage L3/L31 [5]	0x0C02	8	0.1V/1V	0 to Vmax
Current L1	0x0C03	8	0.01A	0 to Imax
Current L2	0x0C04	8	0.01A	0 to Imax
Current L3	0x0C05	8	0.01A	0 to Imax
Voltage THD L1/L12	0x0C12	4	0.1%	0 to 9999
Voltage THD L2/L23	0x0C13	4	0.1%	0 to 9999
Voltage THD L3	0x0C14	4	0.1%	0 to 9999
Current THD L1	0x0C15	4	0.1%	0 to 9999
Current THD L2	0x0C16	4	0.1%	0 to 9999
Current THD L3	0x0C17	4	0.1%	0 to 9999
K-Factor L1	0x0C18	4	0.1	10 to 9999
K-Factor L2	0x0C19	4	0.1	10 to 9999
K-Factor L3	0x0C1A	4	0.1	10 to 9999
Current TDD L1	0x0C1B	4	0.1%	0 to 1000
Current TDD L2	0x0C1C	4	0.1%	0 to 1000
Current TDD L3	0x0C1D	4	0.1%	0 to 1000
Voltage L12	0x0C1E	8	0.1V/1V	0 to Vmax
Voltage L23	0x0C1F	8	0.1V/1V	0 to Vmax
Voltage L31	0x0C20	8	0.1V/1V	0 to Vmax
Real-time total value				
Total kW	0x0F00	8	0.001kW/1kW	-Pmax to Pmax
Total kvar	0x0F01	8	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0x0F02	8	0.001kVA/1kVA	0 to Pmax
Total PF [4]	0x0F03	4	0.001	-999 to 1000
Total PF Lag	0x0F04	4	0.001	-999 to 1000
Total PF Lead	0x0F05	4	0.001	-999 to 1000
Real-time auxiliary values				
Auxiliary current	0x1000	4	0.01A/mA	0 to Imax aux
Neutral current	0x1001	8	0.01A	0 to Imax
Frequency [3]	0x1002	4	0.01Hz	0 to 10000
DC voltage	0x1005	4	0.01V	0 to 999900
Average values per phase				
Voltage L1/L12 [5]	0x1100	8	0.1V/1V	0 to Vmax
Voltage L2/L23 [5]	0x1101	8	0.1V/1V	0 to Vmax
Voltage L3/L31 [5]	0x1102	8	0.1V/1V	0 to Vmax
Current L1	0x1103	8	0.01A	0 to Imax
Current L2	0x1104	8	0.01A	0 to Imax
Current L3	0x1105	8	0.01A	0 to Imax
Voltage L12	0x111E	8	0.1V/1V	0 to Vmax
Voltage L23	0x111F	8	0.1V/1V	0 to Vmax
Voltage L31	0x1120	8	0.1V/1V	0 to Vmax
Average total values				
Total kW	0x1400	8	0.001kW/1kW	-Pmax to Pmax
Total kvar	0x1401	8	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0x1402	8	0.001kVA/1kVA	0 to Pmax
Total PF [4]	0x1403	4	0.001	-999 to 1000
Total PF Lag	0x1404	4	0.001	-999 to 1000
Total PF Lead	0x1405	4	0.001	-999 to 1000
3-phase average voltage [5]	0x140A	8	0.1V/1V	0 to Vmax
3-phase average L-L voltage	0x140B	8	0.1V/1V	0 to Vmax
3-phase average current	0x140C	8	0.01A	0 to Imax

Parameter	Point ID	Length	Unit [2]	Scale range [1]
Average auxiliary values				
Auxiliary current	0x1500	4	0.01A/mA	0 to Imax aux
Neutral current	0x1501	8	0.01A	0 to Imax
Frequency [3]	0x1502	4	0.01Hz	0 to 10000
Present demands				
Accumulated kW import demand	0x160F	8	0.001kW/1kW	0 to Pmax
Accumulated kvar import demand	0x1610	8	0.001kvar/1kvar	0 to Pmax
Accumulated kVA demand	0x1611	8	0.001kVA/1kVA	0 to Pmax
Accumulated kW export demand	0x161A	8	0.001kW/1kW	0 to Pmax
Accumulated kvar export demand	0x161B	8	0.001kvar/1kvar	0 to Pmax

1 For parameter limits, see Note [1] to Table 4-1.

2 When using direct wiring (PT Ratio = 1), voltages are transmitted in 0.1 V units, currents in 0.01 A units, and powers in 0.001 kW/kvar/kVA units. For wiring via PTs (PT Ratio > 1), voltages are transmitted in 1V units, currents in 0.01 A units, and powers in 1 kW/kvar/kVA units.

3 The actual frequency range is 45.00 to 65.00 Hz

4 The output scale for signed (bi-directional) power factor is symmetrical with regard to ±1.000 and is linear from -0 to -1.000, and from 1.000 to +0 (note that -1.000 ≡ +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 define the entire range for power factor from -0 to +0, the scales would be specified as -0/0. Because of the fact that negative zero may not be transmitted, 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. To define the range of -0 to 0, you must send -1/1 or -1/0 (considering the modulus of ×0.001).

5 When the 4LN3 or 3LN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

4.11 Digital Inputs Allocation

These are obsolete requests that allow you to access and configure only 8 from the 12 digital inputs available in your instrument. They are preserved for compatibility with older instruments. It is recommended to use direct read/write requests instead (see Section 5.16) to get access to all digital inputs.

Table 4-24 Read Request

Message type (ASCII)				
D				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Digital input group ID	see Table 4-26
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Digital input group ID	see Table 4-26
2	2	2	Allocation mask	see Table 4-27

Table 4-25 Write Request

Message type (ASCII)				
d				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Digital input group ID	see Table 4-26
2	2	2	Allocation mask	see Table 4-27

Table 4-26 Digital Input Groups

Group ID	Description
0	Status inputs [1]
1	Pulse inputs
2	Not used (read as 0) [1]
3	External demand synchronization pulse input
4	Time synchronization pulse input

1 Writing to these locations is ignored. No error will occur.

NOTES

1. All digital inputs that were not allocated as pulse inputs will be automatically configured as status inputs.
2. A digital input allocated for the external demand synchronization pulse or time synchronization pulse will be automatically configured as a pulse input.

Table 4-27 Digital Inputs Allocation Mask

Bit number	Description
0	Digital input # 1 allocation status
1	Digital input # 2 allocation status
2	Digital input # 3 allocation status
3	Digital input # 4 allocation status
4	Digital input # 5 allocation status
5	Digital input # 6 allocation status
6	Digital input # 7 allocation status
7	Digital input # 8 allocation status

Bit meaning: 0 = input not allocated, 1 = input allocated to the group

4.12 Timer Setup

Table 4-28 Read Request

Message type (ASCII)				
E				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Timer ID	0-3 = timer #1-#4
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Timer ID	0-3 = timer #1-#4
2	2	4	Timer interval, sec	1-9999, 0 = timer disabled

Table 4-29 Write Request

Message type (ASCII)				
e				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Timer ID	0-3 = timer #1-#4
2	2	4	Timer interval, sec	1-9999, 0 = disable timer

4.13 Pulsing Setpoints

Table 4-30 Read Request

Message type (ASCII)				
G				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Pulse output ID	see Table 4-32
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Pulse output ID	see Table 4-32
2	2	2	Output parameter ID	see Table 4-33
3	4	4	For energy pulsing = number of unit-hours per pulse, otherwise - permanently set to 0	0-9999

Table 4-31 Write Request

Message type (ASCII)				
g				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Pulse output ID	see Table 4-32
2	2	2	Output parameter ID	see Table 4-33
3	4	4	For energy pulsing = number of unit-hours per pulse, otherwise - set to 0	0-9999

Table 4-32 Pulse Outputs

Pulsing output ID	Output allocation
0	Relay #1
1	Relay #2
2	Relay #3
3	Relay #4
4	Relay #5
5	Relay #6

Table 4-33 Pulsing Output Parameters

Pulsing parameter ID	Identifier
None	0
kWh import	1
kWh export	2
kWh total (absolute)	3
kvarh import	4
kvarh export	5
kvarh total (absolute)	6
kVAh total	7
Start power demand interval	8
Start tariff interval	9

4.14 Set User Event Flag

Table 4-34 Write Request

Message type (ASCII)				
i				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Event flag number	0-7 = flag #1-#8
2	2	2	Event flag preset status	0-1

4.15 Pulse Counters Setup

Table 4-35 Read Request

Message type (ASCII)				
J				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Pulse counter ID	0-15 (see Table 4-37)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Pulse counter ID	0-15 (see Table 4-37)
2	2	2	Digital input ID	0-12 (see Table 4-38)
3	4	4	Scale factor - number of units per pulse	1-9999

Table 4-36 Write Request

Message type (ASCII)				
j				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Pulse counter ID	0-15 (see Table 4-37)
2	2	2	Digital input ID	0-12 (see Table 4-38)
3	4	4	Scale factor - number of units per pulse	1-9999

Table 4-37 Pulse Counters

Counter ID	Description
0	Pulse counter # 1
1	Pulse counter # 2
2	Pulse counter # 3
3	Pulse counter # 4
4	Pulse counter # 5
5	Pulse counter # 6
6	Pulse counter # 7
7	Pulse counter # 8
8	Pulse counter # 9
9	Pulse counter # 10
10	Pulse counter # 11
11	Pulse counter # 12
12	Pulse counter # 13
13	Pulse counter # 14
14	Pulse counter # 15
15	Pulse counter # 16

Table 4-38 Digital Inputs

Input ID	Description
0	Not allocated
1	Digital input # 1
2	Digital input # 2
3	Digital input # 3
4	Digital input # 4
5	Digital input # 5
6	Digital input # 6
7	Digital input # 7
8	Digital input # 8
9	Digital input # 9
10	Digital input # 10
11	Digital input # 11
12	Digital input # 12

4.16 Log Memory Partition Setup

Table 4-39 Read Request

Message type (ASCII)				
K				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Partition number	0-18 (see Table 4-41)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Partition number	0-18 (see Table 4-41)
2	2	8	Partition size, byte	0-524288
3	10	4	The number of records in the partition	0-65535
4	14	4	Record size, byte	
5	18	2	The number of log parameters in the record (for a data log partition)	0-16

6	20	2	Partition type	0 = non-wrap 1 = wrap around 16 = TOU monthly profile log (partition #15 only) 32 = TOU daily profile log (partition #16 only)

Table 4-40 Write Request

Message type (ASCII)				
k				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Partition number	0-18 (see Table 4-41)
2	2	4	The number of records in the partition	1-65535, 0=delete partition
3	6	2	The number of log parameters in the record (for a data log partition)	0-16
4	8	2	Partition type	0 = non wrap 1 = wrap around 16 = TOU monthly profile log (partition #15 only) 32 = TOU daily profile log (partition #16 only)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Partition number	0-18 (see Table 4-41)

This request allows you to allocate a memory partition for logging and to specify the partition size and type. Before allocating a partition, it is recommended to check the available memory by issuing request "@". To help you in planning memory, Table 4-42 shows the record size for each partition. Note that an existing partition may not be resized. To change the partition properties, you should first delete the partition, and then reallocate it with the desirable properties. After reallocation of memory, the instrument performs the memory optimization and will not respond to the host requests for approximately 1 second per 128 Kbytes of memory.

Partitions #15 and #16 can be configured as TOU monthly and daily profile log partitions respectively. Both will be set as wrap-around partitions. Before you configure the partition as a profile partition, you should set up your TOU registers, daily profiles and calendars. The memory for a profile log will be allocated automatically in accordance with the number of TOU registers you defined in the TOU setup. For each TOU energy and maximum demand register, a separate log sub-partition will be allocated within a parent log partition. Each of these can be accessed and read individually (see Section 5.15). The number of log parameters in the record should specify the maximum number of active season tariffs. The file record size will be set in accordance with this number. If you specified it as less than the actual number of tariffs that may be in effect within a tariff season, then only a part of the tariff registers will be recorded to the profile.

Table 4-41 Log Memory Partitions

Partition number	Partition allocation
0	Event log
1	Data log #1
2	Data log #2
3	Data log #3
4	Data log #4
5	Data log #5
6	Data log #6
7	Data log #7
8	Data log #8
9	Data log #9
10	Data log #10
11	Data log #11
12	Data log #12
13	Data log #13
14	Data log #14
15	Data log #15 (can be configured as a TOU monthly profile log partition)
16	Data log #16 (can be configured as a TOU daily profile log partition)
17	Waveform log #1
18	Waveform log #2

Table 4-42 Partitions' Record Size

Partition	Record size, byte
Event log	14
Data log	8 + 4 * (NUMBER OF PARAMETERS)
Waveform log	6240

4.17 Data Log Setup

Table 4-43 Read Request

Message type (ASCII)				
L				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Data log number	0-15 = log #1-#16
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Data log number	0-15 = log #1-#16
2	2	2	The number of parameters in the data log record	1-16, 0=partition does not exist
3	4	4	Log parameter #1 ID	see Table 5-7
4	8	4	Log parameter #2 ID	see Table 5-7
5	12	4	Log parameter #3 ID	see Table 5-7
6	16	4	Log parameter #4 ID	see Table 5-7
7	20	4	Log parameter #5 ID	see Table 5-7
8	24	4	Log parameter #6 ID	see Table 5-7
9	28	4	Log parameter #7 ID	see Table 5-7
10	32	4	Log parameter #8 ID	see Table 5-7
11	36	4	Log parameter #9 ID	see Table 5-7
12	40	4	Log parameter #10 ID	see Table 5-7
13	44	4	Log parameter #11 ID	see Table 5-7
14	48	4	Log parameter #12 ID	see Table 5-7
15	52	4	Log parameter #13 ID	see Table 5-7
16	56	4	Log parameter #14 ID	see Table 5-7
17	60	4	Log parameter #15 ID	see Table 5-7
18	64	4	Log parameter #16 ID	see Table 5-7

Table 4-44 Write Request

Message type (ASCII)				
I				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Data log number	0-15 = log #1-#16
2	2	2	The number of parameters in the data log record	1-16
3	4	4	Log parameter #1 ID	see Table 5-7
4	8	4	Log parameter #2 ID	see Table 5-7
5	12	4	Log parameter #3 ID	see Table 5-7
6	16	4	Log parameter #4 ID	see Table 5-7
7	20	4	Log parameter #5 ID	see Table 5-7
8	24	4	Log parameter #6 ID	see Table 5-7
9	28	4	Log parameter #7 ID	see Table 5-7
10	32	4	Log parameter #8 ID	see Table 5-7
11	36	4	Log parameter #9 ID	see Table 5-7
12	40	4	Log parameter #10 ID	see Table 5-7
13	44	4	Log parameter #11 ID	see Table 5-7
14	48	4	Log parameter #12 ID	see Table 5-7
15	52	4	Log parameter #13 ID	see Table 5-7
16	56	4	Log parameter #14 ID	see Table 5-7
17	60	4	Log parameter #15 ID	see Table 5-7
18	64	4	Log parameter #16 ID	see Table 5-7
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Data log number	0-15 = log #1-#16

1. The memory partition must be allocated for the log before setting up its parameters.

2. If a partition has been allocated as a TOU profile log partition, the data log setup for the partition cannot be written. Write requests will be ignored. A read request will return identifiers of the TOU season tariff energy registers 0x7000 to 0x700F.

4.18 Event Log (Sequential Access)

This request allows you to read a packet of consequent records from the event log partition. Up to eight event log records can be read at a time. The read queue pointer is shifted forward after each request until the last logged record is read. After that, the exception code 98 is returned instead of log data. To restore the pointer to the log file origin, request '4' followed by function code 'C' or direct write to register A00Bh should be used.

Table 4-45 Read Request

Message type (ASCII)					
M					
Message body (hexadecimal)					
Request - no body					
Response					
Field	**Offset**	**Length**	**Parameter**		**Range**
1	0	2	The number of events in the packet		1-8, 98 = no more events 99 = no events logged
2	2	2	Event log #1	Second	0-59, 97 = record corrupted
3	4	2		Minute	0-59
4	6	2		Hour	0-23
5	8	2		Day	1-31
6	10	2		Month	1-12
7	12	2		Year	0-99
8	14	2		Event cause	see Table 4-46
10	18	8		Log value	see Table 4-46
11	26	4		Effect	see Table 4-46
12	30	2		Target	see Table 4-46
13	32	2	Event log #2	Second	0-59, 97 = record corrupted
14	34	2		Minute	0-59
15	36	2		Hour	0-23
16	38	2		Day	1-31
17	40	2		Month	1-12
18	42	2		Year	0-99
19	44	2		Event cause	see Table 4-46
20	46	2		Event origin	see Table 4-46
21	48	8		Log value	see Table 4-46
22	56	4		Effect	see Table 4-46
23	60	2		Target	see Table 4-46
. . .					
78	212	2	Event log #8	Second	0-59, 97 = record corrupted
79	214	2		Minute	0-59
80	216	2		Hour	0-23
81	218	2		Day	1-31
82	220	2		Month	1-12
83	222	2		Year	0-99
84	224	4		Event cause	see Table 4-46
85	228	8		Log value	see Table 4-46
86	236	4		Effect	see Table 4-46
87	240	2		Target	see Table 4-46

Table 4-46 Event Log Parameters

Event cause	Event cause code		Log value	Event effect and target	
	High byte: cause code	Low byte: event origin (location)		Effect code	Target code
Setpoint event	Trigger parameter ID high byte (see Table 5-7)	Trigger parameter ID low byte (see Table 5-7)	Trigger parameter value (see Table 5-7)	0x00E1 (225) = setpoint operated 0x00E2 (226) = setpoint released	Setpoint number = 0x00-0x0F (0-15)
Setpoint activity	0x5A (90)	Setpoint number = 0x00-0x0F (0-15)	0	Setpoint action type (see Table 5-33	See Table 5-33

Communication activity	0x5B (91)	Data location code (see Table 5-31)	0	See Table 5-33	See Table 5-33
Front panel activity	0x5C (92)	Data location code (see Table 5-31)	0	See Table 5-33	See Table 5-33
Self-check	0x5D (93)	Data location code (see Table 5-31)	0	See Table 5-33	See Table 5-33
Self-update	0x5E (94)	0x08 (8) = RTC	0	0x00F5 (245) = RTC set	0x00
Hardware failure	0x62 (98)	Diagnostic code (see Table 5-32)	0	0x0000	0x00
External event	0x63 (99)	0x00 (0) = power down 0x08 (8) = power up	0	0x0000	0x00

4.19 Data Log (Sequential Access)

This request is used to read subsequent records from the requested data log partition. All records from the partition are read in sequence until the end of the log file. After that, the error code 98 is returned in the response's first field. A specific request '4' followed by function code 'D' or direct write to register A00Ch can be used to restore the read pointer to the file origin. A direct write to the partition status/control register can be used to point to an arbitrary record in the log file (see Section 5.13).

NOTE. The PM296/RPM096 offers you another mechanism to access data logs, allowing you to read records in a circular manner without needing a file pointer. In this event, the file pointer is automatically restored to the file origin after the last file record has been read (see Section 5.15).

Table 4-47 Read Request

Message type (ASCII)				
N				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Data log number	0-15 = log #1-#16
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Trigger setpoint number	1-16, 0 = profile log 97 = record corrupted 98 = no more logged records 99 = no data logged
2	2	2	Hundredths of second	0-99
3	4	2	Second	0-59
4	6	2	Minute	0-59
5	8	2	Hour	0-23
6	10	2	Day	1-31
7	12	2	Month	1-12
8	14	2	Year	0-99
9	16	2	The number of parameters in the packet	1-16
10	18	8	Parameter #1 value	see Table 5-7
11	26	8	Parameter #2 value	see Table 5-7
			...	
25	138	8	Parameter #16 value	see Table 5-7

If data log partition #15 or #16 is configured as a TOU monthly or daily profile partition, reading data from this log file will return data from the first TOU profile sub-partition allocated for TOU energy register #1, or for the following first available TOU register if this register is not configured.

4.20 Min/Max Log

Table 4-48 Read Request

Message type (ASCII)					
O					
Message body (hexadecimal)					
Request					
Field	**Offset**	**Length**	**Parameter**		**Range**
1	0	4	Start Min/Max parameter ID		see Table 5-7
2	4	2	The number of subsequent parameters to read		1-12
Response					
Field	**Offset**	**Length**	**Parameter**		**Range**
1	0	2	The number of parameters in message		1-12
2	2	2	Log parameter #1	Second	0-59
3	4	2		Minute	0-59
4	6	2		Hour	0-23
5	8	2		Day	1-31
6	10	2		Month	1-12
7	12	2		Year	0-99
8	14	8		Parameter value	see Table 5-7
9	22	2	Log parameter #2	Second	0-59
10	24	2		Minute	0-59
11	26	2		Hour	0-23
12	28	2		Day	1-31
13	30	2		Month	1-12
14	32	2		Year	0-99
15	34	8		Parameter value	see Table 5-7
. . .					
79	222	2	Log parameter #12	Second	0-59
80	224	2		Minute	0-59
81	226	2		Hour	0-23
82	228	2		Day	1-31
83	230	2		Month	1-12
84	232	2		Year	0-99
85	234	8		Parameter value	see Table 5-7

This request allows the user to obtain the Min/Max log parameters. Up to 12 parameters can be read in one packet from a single parameter group. The available Min/Max log parameters are listed in Table 5-7.

4.21 Programmable Min/Max Log Setup

Table 4-49 Read Request

Message type (ASCII)				
V				
Message body (hexadecimal)				
Request - no body				
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	4	Data ID for Min/Max log register #1	see Table 5-7
2	4	4	Data ID for Min/Max log register #2	see Table 5-7
3	8	4	Data ID for Min/Max log register #3	see Table 5-7
4	12	4	Data ID for Min/Max log register #4	see Table 5-7
5	16	4	Data ID for Min/Max log register #5	see Table 5-7
6	20	4	Data ID for Min/Max log register #6	see Table 5-7
7	24	4	Data ID for Min/Max log register #7	see Table 5-7
8	28	4	Data ID for Min/Max log register #8	see Table 5-7
9	32	4	Data ID for Min/Max log register #9	see Table 5-7
10	36	4	Data ID for Min/Max log register #10	see Table 5-7
11	40	4	Data ID for Min/Max log register #11	see Table 5-7
12	44	4	Data ID for Min/Max log register #12	see Table 5-7
13	48	4	Data ID for Min/Max log register #13	see Table 5-7
14	52	4	Data ID for Min/Max log register #14	see Table 5-7
15	56	4	Data ID for Min/Max log register #15	see Table 5-7
16	60	4	Data ID for Min/Max log register #16	see Table 5-7

Table 4-50 Write Request

Message type (ASCII)				
v				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Min/Max log register number	0-15
2	2	4	Associated parameter ID for the register	see Table 5-7
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Min/Max log register number	0-15
2	2	4	Associated parameter ID for the register	see Table 5-7

This request allows you to associate any of the 16 programmable Min/Max log registers with either harmonic parameter listed in Table 5-7.

4.22 TOU Registers Allocation

Table 4-51 Read Request

Message type (ASCII)				
P				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	TOU system register ID	0-18 (see Table 4-53)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	TOU system register ID	0-18 (see Table 4-53)
2	2	2	Register input ID	see Tables 4-54, 4-55
3	4	4	For a pulse input = number of unit-hours per pulse, otherwise - permanently set to 0.	0-9999

Table 4-52 Write Request

Message type (ASCII)				
p				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	TOU system register ID	0-18 (see Table 4-53)
2	2	2	Register input ID	see Tables 4-54, 4-55
3	4	4	For a pulse input = number of unit-hours per pulse, otherwise - set to 0.	0-9999

Table 4-53 TOU System Registers Identifiers

Register ID	Description
0	TOU energy register #1
1	TOU energy register #2
2	TOU energy register #3
3	TOU energy register #4
4	TOU energy register #5
5	TOU energy register #6
6	TOU energy register #7
7	TOU energy register #8
8	TOU maximum demand register #1
9	TOU maximum demand register #2
10	TOU maximum demand register #3
11	TOU energy register #9
12	TOU energy register #10
13	TOU energy register #11
14	TOU energy register #12
15	TOU energy register #13
16	TOU energy register #14
17	TOU energy register #15
18	TOU energy register #16

Table 4-54 TOU Energy Registers Inputs

Register input	Input ID
None	0
kWh import	1
kWh export	2
kWh net	3
kWh total	4
kvarh import	5
kvarh export	6
kvarh net	7
kvarh total	8
kVAh total	9
Pulse input #1	10
Pulse input #2	11
Pulse input #3	12
Pulse input #4	13
Pulse input #5	14
Pulse input #6	15
Pulse input #7	16
Pulse input #8	17
Pulse input #9	18
Pulse input #10	19
Pulse input #11	20
Pulse input #12	21

Table 4-55 TOU Maximum Demand Registers Inputs

Register input	Input ID
None	0
Maximum kW import sliding window demand	1
Maximum kW export sliding window demand	2
Maximum kvar import sliding window demand	3
Maximum kvar export sliding window demand	4
Maximum kVA sliding window demand	5
Maximum kW import thermal demand	6
Maximum kW export thermal demand	7
Maximum kvar import thermal demand	8
Maximum kvar export thermal demand	9
Maximum kVA thermal demand	10

4.23 TOU Daily Profiles

Table 4-56 Read Request

Message type (ASCII)					
Q					
Message body (hexadecimal)					
Request					
Field	**Offset**	**Length**	**Parameter**		**Range**
1	0	2	TOU daily profile number		0-15
Response					
Field	**Offset**	**Length**	**Parameter**		**Range**
1	0	2	TOU daily profile number		0-15
2 3 4	2 4 6	2 2 2	1st tariff change	Tariff start hour Tariff start minute Active tariff number	0 0 0-15
5 6 7	8 10 12	2 2 2	2nd tariff change	Tariff start hour Tariff start minute Active tariff number	0-23 0-45 0-15
. . .					
23 24 25	44 46 48	2 2 2	8th tariff change	Tariff start hour Tariff start minute Active tariff number	0-23 0-45 0-15

Table 4-57 Write Request

Message type (ASCII)					
q					
Message body (hexadecimal)					
Request					
Field	**Offset**	**Length**	**Parameter**		**Range**
1	0	2	TOU daily profile number		0-15
2	2	2	1st tariff change	Tariff start hour	0
3	4	2		Tariff start minute	0
4	6	2		Active tariff number	0-15
5	8	2	2nd tariff change	Tariff start hour	0-23
6	10	2		Tariff start minute	0-45
7	12	2		Active tariff number	0-15
. . .					
23	44	2	8th tariff change	Tariff start hour	0-23
24	46	2		Tariff start minute	0-45
25	48	2		Active tariff number	0-15
Response					
Field	**Offset**	**Length**	**Parameter**		**Range**
1	0	2	TOU daily profile number		0-15

The request allows you to change the daily profile for any of the 16 TOU system profiles. The daily start time for each tariff is specified with a resolution of 15 minutes. If another value is specified, it will be truncated to the lower value divisible by 15 minutes. No error will occur. The first daily tariff change time is always 00:00. It is preserved internally and cannot change.

4.24 TOU Calendars

Table 4-58 Read Request

Message type (ASCII)				
R				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Annual calendar number	0-1
2	2	2	Calendar month	1-12
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Annual calendar number	0-1
2	2	2	Calendar month	1-12
3	4	2	1st month day profile	0-15
4	6	2	2nd month day profile	0-15
5	8	2	3rd month day profile	0-15
			. . .	
33	64	2	31st month day profile	0-15

Table 4-59 Write Request

Message type (ASCII)				
r				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Annual calendar number	0-1
2	2	2	Calendar month	1-12
3	4	2	1st month day profile	0-15
4	6	2	2nd month day profile	0-15
5	8	2	3rd month day profile	0-15
			. . .	
33	64	2	31st month day profile	0-15
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Annual calendar number	0-1
2	2	2	Calendar month	1-12

These requests allow you to read/write the setup of the one-month calendar from one of the two TOU system annual calendars. The actual year should be assigned beforehand to the accessed calendar. The present calendar year can be obtained by using request U.

4.25 TOU Calendar Years

Table 4-60 Read Request

Message type (ASCII)				
U				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Annual calendar number	0-1
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Annual calendar number	0-1
2	2	2	Calendar year	0-99

Table 4-61 Write Request

Message type (ASCII)				
u				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Annual calendar number	0-1
2	2	2	Calendar year	0-99

This request allows you to associate a specific year with one of the two TOU system annual calendars.

4.26 Real Time Clock

Table 4-62 Read Request

Message type (ASCII)				
S				
Message body (decimal)				
Request - no body				
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Second	0-59
2	2	2	Minute	0-59
3	4	2	Hour	0-23
4	6	2	Day	1-31
5	8	2	Month	1-12
6	10	2	Year	0-99
7	12	2	Day of week	1-7 (1=Sunday)

Table 4-63 Write Request

Message type (ASCII)				
T				
Message body (decimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Second	0-59
2	2	2	Minute	0-59
3	4	2	Hour	0-23
4	6	2	Day	1-31
5	8	2	Month	1-12
6	10	2	Year	0-99
7	12	2	Day of week	1-7 (1=Sunday)

The day of week is not checked when written. It is set automatically when you change the date.

4.27 Phase Harmonics

Table 4-64 Read Request

Message type (ASCII)				
H				
Message body (decimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	1	Channel ID	1 - 6 (see Table 4-65)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	5	RMS value for the channel [2], V/A	0 to Vmax[1]/Imax
2	5	5	Fundamental frequency	0 to 65.50
3	10	5	%THD	0.0 to 100.0
4	15	5	Harmonic H01 (reference)	100.0
5	20	5	Harmonic H02	0.00 to 100.0
6	25	5	Harmonic H03	0.00 to 100.0
			...	
43	210	5	Harmonic H40	0.00 to 100.0

1 Phase voltage will be line-to-line voltage in 3OP2 and 3OP3 wiring modes, and line-to-neutral voltage in other configurations.

2 For RMS value representation, see Note ② to Table 4-1.

Table 4-65 Harmonic Spectrum Channels

Channel ID	Description
1	Voltage L1/L12
2	Voltage L2/L23
3	Voltage L3
4	Current L1
5	Current L2
6	Current L3

4.28 Waveform Capture/Log (Sequential Access)

Table 4-66 Read Real-time Waveform Header Record

Message type (ASCII)				
W				
Message body (decimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	1	Input channel ID	1-6 (see Table 4-70)
2	1	1	Request function	0
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Capture code	0
2	2	2	Second	0-59
3	4	2	Minute	0-59
4	6	2	Hour	0-23
5	8	2	Day	1-31
6	10	2	Month	1-12
7	12	2	Year	0-99
8	14	5	RMS value for the channel [2], V/A	0 to Vmax[1]/Imax
9	19	5	Fundamental frequency	0.00 to 65.50 Hz
10	24	5	%THD	0.0 to 100.0 %

1 Phase voltage will be line-to-line voltage in 3OP2 and 3OP3 wiring modes, and line-to-neutral voltage in other configurations.

2 For RMS value representation, see Note [2] to Table 4-1.

Table 4-67 Read Waveform Log #1 Header Record

Message type (ASCII)				
W				
Message body (decimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	1	Input channel ID	1-6 (see Table 4-70)
2	1	1	Request function	A
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Capture code: trigger setpoint number	1-16, 98 = no more logged waveforms 99 = no waveforms logged
2	2	2	Hundreds of second	0-99
3	4	2	Second	0-59
4	6	2	Minute	0-59
5	8	2	Hour	0-23
6	10	2	Day	1-31
7	12	2	Month	1-12
8	14	2	Year	0-99
9	16	5	Reserved	0
10	21	5	Sampling frequency	0.00 to 65.50 Hz
11	26	5	Reserved	0

Table 4-68 Read Waveform Log #2 Header Record

Message type (ASCII)				
W				
Message body (decimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	1	Input channel ID	1-6 (see Table 4-70)
2	1	1	Request function	9
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Capture code: trigger setpoint number	1-16, 98 = no more waveforms, 99 = no waveforms logged
2	2	2	Second	0-59
3	4	2	Minute	0-59
4	6	2	Hour	0-23
5	8	2	Day	1-31
6	10	2	Month	1-12
7	12	2	Year	0-99
8	14	5	RMS value for the channel [2], V/A	0 to Vmax[1]/Imax
9	19	5	Fundamental frequency	0.00 to 65.50 Hz
10	24	5	%THD	0.0 to 100.0 %

[1] Phase voltage will be line-to-line voltage in 3OP2 and 3OP3 wiring modes, and line-to-neutral voltage in other configurations.

[2] For RMS value representation, see Note [2] to Table 4-1.

Table 4-69 Read Waveform Samples Window

Message type (ASCII)				
W				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	1	Input channel ID	1-6 (see Table 4-70)
2	1	1	Start waveform sample point to read	N = 1-8 - read 64 waveform samples starting from the point (N-1)∗64
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	3	Waveform sample point #1	0x000-0x3FF
2	3	3	Waveform sample point #2	0x000-0x3FF
...	...	...	...	
64	189	3	Waveform sample point #64	0x000-0x3FF

Table 4-70 Waveform Input Channels

Channel ID	Description
1	Voltage L1/L12
2	Voltage L2/L23
3	Voltage L3
4	Current L1
5	Current L2
6	Current L3

These requests allow you to capture and read the real-time waveforms (4 cycles x 128 samples per cycle), and the recorded historical waveform logs – Waveform log #1 (16 cycles x 32 samples/cycle records), and Waveform log #2 (4 cycles x 128 samples/cycle records). The waveform samples are read via the samples window (Table 4-69) that can map a record for a single input channel (voltage or current waveform on either phase). By a single request it is possible to read 64 sample points. To reload this window with a sampled waveform, a corresponding waveform header should be read (Tables 4-66 - 4-68).

Each waveform sample is represented by three hexadecimal digits in ASCII format in the range of 0x000 to 0x3FF (1023 decimal). A value of 0 corresponds to the highest negative amplitude of the measured signal, and a value of 1023 corresponds to the highest positive amplitude.

Real-time Waveform Capture

The real-time waveforms can be captured simultaneously on both voltage and current channels for a single phase. To capture two waveforms on a selected phase, the voltage waveform header (channel 1, 2 or 3) for this phase should be read using function 9 (Table 4-66). Before responding to your request, the instrument reloads the waveform samples window with data corresponding to the voltage waveform. Data in this window does not change until the waveform header window is read.

To reload the waveform samples window with the current waveform data, read the current waveform header (channel 4, 5 or 6) for the same phase using function 9.

To capture and read waveform data on another phase, repeat the above steps for the phase you want to access.

Historical Waveform Log

The historical waveform log contains waveform records sampled at high (128 samples per cycle in Waveform log #2) or lower frequency (32 samples per cycle in Waveform log #1) that are captured and logged to a file on some event triggers. Each record contains six waveforms of voltage and current on three phases.

Recorded waveforms are mapped and accessed through the samples window in the same manner as the real-time waveforms (see above). On log files organization and managing, see Section 3.3, Configuring and Accessing Log Files. Before reloading waveform window registers with data for a selected channel, the required record must be obtained from the log file to the communications buffer. This is made automatically when you reload the voltage waveform on phase L1, i.e., when you read the voltage waveform header record on phase L1 (channel 1) for the corresponding log file using function 9 or A (see Tables 4-67, 4-68). Data in this buffer does not change until you read this register once again. Each time you access this register, the next record is read form the file and locked to the communications buffer. To reload waveform windows with data for the current channel or with data for another phase, read the voltage or current header window for the corresponding channel.

Waveform log files are accessed in a sequential manner. When you continue reading after the end of a file, the exception code 98 is returned in the header record's first field. It should be checked before the record will be proceeded. To restore the pointer to the log file origin, request '4' followed by function code E/F, or direct write to register 0xA00D/0xA00E should be used.

5 DIRECT READ/WRITE REQUESTS

5.1 General

This chapter describes the instrument data locations (registers) that are addressed directly using register indexes. These registers can be accessed by using universal direct read/write requests instead of specific ASCII requests, which use different formats for accessing different data locations.

Data (register) indexes are given in a 4-digit hexadecimal format. All data are transmitted in ASCII hexadecimal notation as 4-character (16-bit unsigned UINT16 or signed integer INT16) or 8-character (32-bit unsigned UINT32 or signed long integer INT32) numbers. Negative numbers are transmitted in 2-complement code. Register size in the tables below shows an actual data size in ASCII hexadecimal characters 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 8-character format as long signed INT32 or unsigned UINT32 integers.

5.1.1 Long-Size Direct Read/Write

Table 5-1 Read Request

Message type (ASCII)				
A				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	4	Start point (register) ID to read	0x0000 - 0xFFFF
2	4	2	The number of contiguous points to read	1-30 (0x01–0x1E)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Number of points in the message	1-30 (0x01-0x1E)
2	2	8	Point #1 value (INT32)	
3	10	8	Point #2 value (INT32)	
...	...	...	...	
31	234	8	Point #30 value (INT32)	

Table 5-2 Write Request

Message type (ASCII)				
a				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	4	Point (register) ID to write	0x0000 – 0xFFFF
2	4	8	Point value to write (INT32)	

In long-size direct read/write messages, all data items are read and written as long unsigned or signed integers, which are represented in messages by 8-digit INT32 hexadecimal numbers, regardless of the actual data size.

By using a long-size direct read request, up to 30 contiguous parameters can be read at once. A write request allows for writing only one data location at a time.

5.1.2 Variable-Size Direct Read/Write

Table 5-3 Read Request

Message type (ASCII)				
X				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Size**	**Parameter**	**Range**
1	0	4	Start point (register) ID to read	0x0000 – 0xFFFF
2	4	2	The number of contiguous points to read	1-61 (0x01-0x3D)
Response				
Field	**Offset**	**Size**	**Parameter**	**Range**
1	0	2	Number of points in the message	1-61 (0x01-0x3D)
2	2	4/8	Point #1 value (INT16/INT32)	
3		4/8	Point #2 value (INT16/INT32)	
...	...	...	...	
60		4/8	Point #60 value (INT16/INT32)	

Table 5-4 Write Request

Message type (ASCII)				
x				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Size**	**Parameter**	**Range**
1	0	4	Start point (register) ID to write	0x0000 – 0xFFFF
2	4	2	The number of contiguous points to write	1-61 (0x01–0x3D)
3	6	4/8	Point #1 value (INT16/INT32)	
4		4/8	Point #2 value (INT16/INT32)	
...	...	...	...	
60		4/8	Point #60 value (INT16/INT32)	
Request				
Field	**Offset**	**Size**	**Parameter**	**Range**
1	0	4	Start point (register) ID written	0x0000 – 0xFFFF
2	4	2	The number of points written	1-61 (0x01–0x3D)

With variable-size direct read/write messages, data items are read and written as 4 or 8-character hexadecimal numbers. The actual data size is indicated for each data location. When written, the data format 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.

5.1.3 User Assignable Registers

The instrument contains 120 user assignable registers in the range of indexes 0x8000 to 0x8077 (see Table 5-5). You can map any of these registers to either register index, accessible in the instrument through direct read/write requests. Registers that reside in different locations may be accessed by a single request by re-mapping them to adjacent addresses in the user assignable registers area.

The actual indexes of the user assignable registers, which are accessed via indexes 0x8000 to 0x8077h, are specified in the user assignable register map. It occupies indexes 0x8100 to 0x8177 (see Table 5-6), where the map register 0x8100 should contain the actual index of the register accessed via assignable register 0x8000h, register 0x8101 should contain the actual index of the register accessed via assignable register 0x8001h, and so on. Note that the user assignable register indexes and the user register map indexes may not be re-mapped.

Table 5-5 User Assignable Registers

Address	Register contents	Type
0x8000	Assigned register #0	INT16
0x8001	Assigned register #1	INT16
0x8002	Assigned register #2	INT16
	...	...
0x8077	Assigned register #119	INT16

Table 5-6 User Assignable Register Map

Address	Register contents	Type	R/W	Range
0x8100	Mapped address for register #0	UINT16	R/W	0x0000-0xFFFF
0x8101	Mapped address for register #1	UINT16	R/W	0x0000-0xFFFF
0x8102	Mapped address for register #2	UINT16	R/W	0x0000-0xFFFF
...	...	...	...	
0x8177	Mapped address for register #119	UINT16	R/W	0x0000-0xFFFF

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

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

Reading from registers 0x8000-0x8001 will return the voltage reading in register 8000h, and the kWh reading in register 0x8001.

5.2 Extended Data Registers

The following Table 5-7 lists all registers containing the data measured by the instrument. Notice that these registers are arranged into groups which are not located at adjacent addresses. You can re-map these registers into adjacent addresses to access multiple data from different data groups by using a single request. Refer to Section 5.1.3 for information on the user assignable registers.

Extended data can be read, written or/and used as event triggers for event/alarm setpoints. A direction attribute shows allowable usage of the registers as follows: R = read, W = write, ATRG = analog (numeric) trigger, BTRG = binary (digital) trigger, NTRG = new value trigger. On using data for triggering events, see Section 5.6.

Table 5-7 Extended Data Table

Parameter	Point ID	Type	R/W	Unit	Range [1]
None					
None	0x0000	UINT16	R		0
Special inputs					
Voltage disturbance [7]	0x0100	UINT16	ATRG	%	0 to 100
Phase rotation	0x0101	UINT16	ATRG		0 = ERR, 1= POS, 2 = NEG
User event flags					
Event flags	0x0300	UINT16	R		see Table 4-13
Event flag #1	0x0300		BTRG		N/A
Event flag #2	0x0301		BTRG		N/A
Event flag #3	0x0302		BTRG		N/A
Event flag #4	0x0303		BTRG		N/A
Event flag #5	0x0304		BTRG		N/A
Event flag #6	0x0305		BTRG		N/A
Event flag #7	0x0306		BTRG		N/A
Event flag #8	0x0307		BTRG		N/A
Internal events					
kWh import pulse	0x0400		BTRG		N/A
kWh export pulse	0x0401		BTRG		N/A
kvarh import pulse	0x0403		BTRG		N/A
kvarh export pulse	0x0404		BTRG		N/A
kvarh total pulse	0x0405		BTRG		N/A
kVAh total pulse	0x0406		BTRG		N/A
Start new power demand interval	0x0407		BTRG		N/A
Start new tariff interval	0x0408		BTRG		N/A
Start new volt/ampere demand interval	0x0409		BTRG		N/A
Start new sliding window demand interval	0x040A		BTRG		N/A
New month	0x040B		BTRG		N/A
Timers					
Timer #1	0x0500		BTRG		N/A
Timer #2	0x0501		BTRG		N/A

Parameter	Point ID	Type	R/W	Unit	Range [1]
Timer #3	0x0502		BTRG		N/A
Timer #4	0x0503		BTRG		N/A
Status inputs					
Status inputs	0x0600	UINT16	R		see Table 4-14
Status input #1	0x0600		BTRG		N/A
Status input #2	0x0601		BTRG		N/A
Status input #3	0x0602		BTRG		N/A
Status input #4	0x0603		BTRG		N/A
Status input #5	0x0604		BTRG		N/A
Status input #6	0x0605		BTRG		N/A
Status input #7	0x0606		BTRG		N/A
Status input #8	0x0607		BTRG		N/A
Status input #9	0x0608		BTRG		N/A
Status input #10	0x0609		BTRG		N/A
Status input #11	0x060A		BTRG		N/A
Status input #12	0x060B		BTRG		N/A
Pulse inputs					
Pulse input #1	0x0700		BTRG		N/A
Pulse input #2	0x0701		BTRG		N/A
Pulse input #3	0x0702		BTRG		N/A
Pulse input #4	0x0703		BTRG		N/A
Pulse input #5	0x0704		BTRG		N/A
Pulse input #6	0x0705		BTRG		N/A
Pulse input #7	0x0706		BTRG		N/A
Pulse input #8	0x0707		BTRG		N/A
Pulse input #9	0x0708		BTRG		N/A
Pulse input #10	0x0709		BTRG		N/A
Pulse input #11	0x070A		BTRG		N/A
Pulse input #12	0x070B		BTRG		N/A
Relays					
Relay status	0x0800	UINT16	R		see Table 4-12
Relay #1 status	0x0800		BTRG		N/A
Relay #2 status	0x0801		BTRG		N/A
Relay #3 status	0x0802		BTRG		N/A
Relay #4 status	0x0803		BTRG		N/A
Relay #5 status	0x0804		BTRG		N/A
Relay #6 status	0x0805		BTRG		N/A
Pulse counters					
Pulse counter #1	0x0A00	UINT32	R/W/ATRG		10^9-1
Pulse counter #2	0x0A01	UINT32	R/W/ATRG		10^9-1
Pulse counter #3	0x0A02	UINT32	R/W/ATRG		10^9-1
Pulse counter #4	0x0A03	UINT32	R/W/ATRG		10^9-1
Pulse counter #5	0x0A04	UINT32	R/W/ATRG		10^9-1
Pulse counter #6	0x0A05	UINT32	R/W/ATRG		10^9-1
Pulse counter #7	0x0A06	UINT32	R/W/ATRG		10^9-1
Pulse counter #8	0x0A07	UINT32	R/W/ATRG		10^9-1
Pulse counter #9	0x0A08	UINT32	R/W/ATRG		10^9-1
Pulse counter #10	0x0A09	UINT32	R/W/ATRG		10^9-1
Pulse counter #11	0x0A0A	UINT32	R/W/ATRG		10^9-1
Pulse counter #12	0x0A0B	UINT32	R/W/ATRG		10^9-1
Pulse counter #13	0x0A0C	UINT32	R/W/ATRG		10^9-1
Pulse counter #14	0x0A0D	UINT32	R/W/ATRG		10^9-1
Pulse counter #15	0x0A0E	UINT32	R/W/ATRG		10^9-1
Pulse counter #16	0x0A0F	UINT32	R/W/ATRG		10^9-1
Time/Date parameters					
Packed date [8]	0x0B00	UINT32	ATRG		000101 to 991231
Packed time [9]	0x0B01	UINT32	ATRG		000000 to 235959
Day of week	0x0B02	UINT16	ATRG		1= Sun, 7=Sat
Year	0x0B03	UINT16	ATRG		0 to 99
Month	0x0B04	UINT16	ATRG		1 to 12
Day of month	0x0B05	UINT16	ATRG		1 to 31
Hour	0x0B06	UINT16	ATRG		0 to 23
Minute	0x0B07	UINT16	ATRG		0 to 59
Second	0x0B08	UINT16	ATRG		0 to 59
Real-time values per phase					
Voltage L1/L12 [6]	0x0C00	UINT32	R/ATRG	0.1V/1V	0 to Vmax

Parameter	Point ID	Type	R/W	Unit	Range [1]
Voltage L2/L23 [6]	0x0C01	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Voltage L3/L31 [6]	0x0C02	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Current L1	0x0C03	UINT32	R/ATRG	0.01A	0 to Imax
Current L2	0x0C04	UINT32	R/ATRG	0.01A	0 to Imax
Current L3	0x0C05	UINT32	R/ATRG	0.01A	0 to Imax
kW L1	0x0C06	INT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
kW L2	0x0C07	INT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
kW L3	0x0C08	INT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
kvar L1	0x0C09	INT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
kvar L2	0x0C0A	INT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
kvar L3	0x0C0B	INT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
kVA L1	0x0C0C	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
kVA L2	0x0C0D	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
kVA L3	0x0C0E	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
Power factor L1	0x0C0F	INT16	R/ATRG	0.001	-999 to 1000
Power factor L2	0x0C10	INT16	R/ATRG	0.001	-999 to 1000
Power factor L3	0x0C11	INT16	R/ATRG	0.001	-999 to 1000
Voltage THD L1/L12	0x0C12	UINT16	R/ATRG	0.1%	0 to 9999
Voltage THD L2/L23	0x0C13	UINT16	R/ATRG	0.1%	0 to 9999
Voltage THD L3	0x0C14	UINT16	R/ATRG	0.1%	0 to 9999
Current THD L1	0x0C15	UINT16	R/ATRG	0.1%	0 to 9999
Current THD L2	0x0C16	UINT16	R/ATRG	0.1%	0 to 9999
Current THD L3	0x0C17	UINT16	R/ATRG	0.1%	0 to 9999
K-Factor L1	0x0C18	UINT16	R/ATRG	0.1	10 to 9999
K-Factor L2	0x0C19	UINT16	R/ATRG	0.1	10 to 9999
K-Factor L3	0x0C1A	UINT16	R/ATRG	0.1	10 to 9999
Current TDD L1	0x0C1B	UINT16	R/ATRG	0.1%	0 to 1000
Current TDD L2	0x0C1C	UINT16	R/ATRG	0.1%	0 to 1000
Current TDD L3	0x0C1D	UINT16	R/ATRG	0.1%	0 to 1000
Voltage L12	0x0C1E	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Voltage L23	0x0C1F	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Voltage L31	0x0C20	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Real-time low values on any phase					
Low voltage [6]	0x0D00	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Low current	0x0D01	UINT32	R/ATRG	0.01A	0 to Imax
Low kW	0x0D02	INT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
Low kvar	0x0D03	INT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
Low kVA	0x0D04	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
Low PF Lag	0x0D05	UINT16	R/ATRG	0.001	0 to 1000
Low PF Lead	0x0D06	UINT16	R/ATRG	0.001	0 to 1000
Low voltage THD	0x0D07	UINT16	R/ATRG	0.1%	0 to 9999
Low current THD	0x0D08	UINT16	R/ATRG	0.1%	0 to 9999
Low K-Factor	0x0D09	UINT16	R/ATRG	0.1	10 to 9999
Low current TDD	0x0D0A	UINT16	R/ATRG	0.1%	0 to 1000
Low L-L voltage	0x0D0B	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Real-time high values on any phase					
High voltage [6]	0x0E00	UINT32	R/ATRG	0.1V/1V	0 to Vmax
High current	0x0E01	UINT32	R/ATRG	0.01A	0 to Imax
High kW	0x0E02	UINT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
High kvar	0x0E03	UINT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
High kVA	0x0E04	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
High PF Lag	0x0E05	UINT16	R/ATRG	0.001	0 to 1000
High PF Lead	0x0E06	UINT16	R/ATRG	0.001	0 to 1000
High voltage THD	0x0E07	UINT16	R/ATRG	0.1%	0 to 9999
High current THD	0x0E08	UINT16	R/ATRG	0.1%	0 to 9999
High K-Factor	0x0E09	UINT16	R/ATRG	0.1	10 to 9999
High current TDD	0x0E0A	UINT16	R/ATRG	0.1%	0 to 1000
High L-L voltage	0x0E0B	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Real-time total values					
Total kW	0x0F00	INT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
Total kvar	0x0F01	INT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0x0F02	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
Total PF	0x0F03	INT16	R/ATRG	0.001	-999 to 1000
Total PF lag	0x0F04	UINT16	R/ATRG	0.001	0 to 1000
Total PF lead	0x0F05	UINT16	R/ATRG	0.001	0 to 1000
Total kW import	0x0F06	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
Total kW export	0x0F07	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
Total kvar import	0x0F08	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax

Parameter	Point ID	Type	R/W	Unit	Range [1]
Total kvar export	0x0F09	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
3-phase average voltage [6]	0x0F0A	UINT32	R/ATRG	0.1V/1V	0 to Vmax
3-phase average L-L voltage	0x0F0B	UINT32	R/ATRG	0.1V/1V	0 to Vmax
3-phase average current	0x0F0C	UINT32	R/ATRG	0.01A	0 to Imax
Real-time auxiliary values					
Auxiliary current	0x1000	UINT32	R/ATRG	0.01A/mA	0 to Imax aux
Neutral current	0x1001	UINT32	R/ATRG	0.01A	0 to Imax
Frequency [4]	0x1002	UINT16	R/ATRG	0.01Hz	0 to 10000
Voltage unbalance	0x1003	UINT16	R/ATRG	1%	0 to 300
Current unbalance	0x1004	UINT16	R/ATRG	1%	0 to 300
DC voltage	0x1005	UINT32	R/ATRG	0.01V	0 to 999900
Average values per phase					
Voltage L1/L12 [6]	0x1100	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Voltage L2/L23 [6]	0x1101	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Voltage L3/L31 [6]	0x1102	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Current L1	0x1103	UINT32	R/ATRG	0.01A	0 to Imax
Current L2	0x1104	UINT32	R/ATRG	0.01A	0 to Imax
Current L3	0x1105	UINT32	R/ATRG	0.01A	0 to Imax
kW L1	0x1106	INT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
kW L2	0x1107	INT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
kW L3	0x1108	INT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
kvar L1	0x1109	INT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
kvar L2	0x110A	INT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
kvar L3	0x110B	INT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
kVA L1	0x110C	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
kVA L2	0x110D	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
kVA L3	0x110E	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
Power factor L1	0x110F	INT16	R/ATRG	0.001	-999 to 1000
Power factor L2	0x1110	INT16	R/ATRG	0.001	-999 to 1000
Power factor L3	0x1111	INT16	R/ATRG	0.001	-999 to 1000
Voltage THD L1/L12	0x1112	UINT16	R/ATRG	0.1%	0 to 9999
Voltage THD L2/L23	0x1113	UINT16	R/ATRG	0.1%	0 to 9999
Voltage THD L3	0x1114	UINT16	R/ATRG	0.1%	0 to 9999
Current THD L1	0x1115	UINT16	R/ATRG	0.1%	0 to 9999
Current THD L2	0x1116	UINT16	R/ATRG	0.1%	0 to 9999
Current THD L3	0x1117	UINT16	R/ATRG	0.1%	0 to 9999
K-Factor L1	0x1118	UINT16	R/ATRG	0.1	10 to 9999
K-Factor L2	0x1119	UINT16	R/ATRG	0.1	10 to 9999
K-Factor L3	0x111A	UINT16	R/ATRG	0.1	10 to 9999
Current TDD L1	0x111B	UINT16	R/ATRG	0.1%	0 to 1000
Current TDD L2	0x111C	UINT16	R/ATRG	0.1%	0 to 1000
Current TDD L3	0x111D	UINT16	R/ATRG	0.1%	0 to 1000
Voltage L12	0x111E	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Voltage L23	0x111F	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Voltage L31	0x1120	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Average low values on any phase					
Low voltage [6]	0x1200	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Low current	0x1201	UINT32	R/ATRG	0.01A	0 to Imax
Low kW	0x1202	INT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
Low kvar	0x1203	INT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
Low kVA	0x1204	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
Low PF Lag	0x1205	UINT16	R/ATRG	0.001	0 to 1000
Low PF Lead	0x1206	UINT16	R/ATRG	0.001	0 to 1000
Low voltage THD	0x1207	UINT16	R/ATRG	0.1%	0 to 9999
Low current THD	0x1208	UINT16	R/ATRG	0.1%	0 to 9999
Low K-Factor	0x1209	UINT16	R/ATRG	0.1	10 to 9999
Low current TDD	0x120A	UINT16	R/ATRG	0.1%	0 to 1000
Low L-L voltage	0x120B	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Average high values on any phase					
High voltage [6]	0x1300	UINT32	R/ATRG	0.1V/1V	0 to Vmax
High current	0x1301	UINT32	R/ATRG	0.01A	0 to Imax
High kW	0x1302	INT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
High kvar	0x1303	INT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
High kVA	0x1304	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
High PF Lag	0x1305	UINT16	R/ATRG	0.001	0 to 1000
High PF Lead	0x1306	UINT16	R/ATRG	0.001	0 to 1000
High voltage THD	0x1307	UINT16	R/ATRG	0.1%	0 to 9999
High current THD	0x1308	UINT16	R/ATRG	0.1%	0 to 9999

Parameter	Point ID	Type	R/W	Unit	Range [1]
High K-Factor	0x1309	UINT16	R/ATRG	0.1	10 to 9999
High current TDD	0x130A	UINT16	R/ATRG	0.1%	0 to 1000
High L-L voltage	0x130B	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Average total values					
Total kW	0x1400	INT32	R/ATRG	0.001kW/1kW	-Pmax to Pmax
Total kvar	0x1401	INT32	R/ATRG	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0x1402	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
Total PF	0x1403	INT16	R/ATRG	0.001	-999 to 1000
Total PF lag	0x1404	UINT16	R/ATRG	0.001	0 to 1000
Total PF lead	0x1405	UINT16	R/ATRG	0.001	0 to 1000
Total kW import	0x1406	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
Total kW export	0x1407	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
Total kvar import	0x1408	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
Total kvar export	0x1409	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
3-phase average voltage [6]	0x140A	UINT32	R/ATRG	0.1V/1V	0 to Vmax
3-phase average L-L voltage	0x140B	UINT32	R/ATRG	0.1V/1V	0 to Vmax
3-phase average current	0x140C	UINT32	R/ATRG	0.01A	0 to Imax
Average auxiliary values					
Auxiliary current	0x1500	UINT32	R/ATRG	0.01A/mA	0 to Imax aux
Neutral current	0x1501	UINT32	R/ATRG	0.01A	0 to Imax
Frequency [4]	0x1502	UINT16	R/ATRG	0.01Hz	0 to 10000
Voltage unbalance	0x1503	UINT16	R/ATRG	1%	0 to 300
Current unbalance	0x1504	UINT16	R/ATRG	1%	0 to 300
DC voltage	0x1505	UINT32	R/ATRG	0.01V	0 to 999900
Present demands					
Volt demand L1/L12 [6]	0x1600	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Volt demand L2/L23 [6]	0x1601	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Volt demand L3/L31 [6]	0x1602	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Ampere demand L1	0x1603	UINT32	R/ATRG	0.01A	0 to Imax
Ampere demand L2	0x1604	UINT32	R/ATRG	0.01A	0 to Imax
Ampere demand L3	0x1605	UINT32	R/ATRG	0.01A	0 to Imax
kW import block demand	0x1606	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
kvar import block demand	0x1607	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
kVA block demand	0x1608	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
kW import sliding window demand	0x1609	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
kvar import sliding window demand	0x160A	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
kVA sliding window demand	0x160B	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
kW import thermal demand	0x160C	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
kvar import thermal demand	0x160D	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
kVA thermal demand	0x160E	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
kW import accumulated demand	0x160F	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
kvar import accumulated demand	0x1610	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
kVA accumulated demand	0x1611	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
kW import predicted sliding window demand	0x1612	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
kvar import predicted sliding window demand	0x1613	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
kVA predicted sliding window demand	0x1614	UINT32	R/ATRG	0.001kVA/1kVA	0 to Pmax
PF (import) at maximum kVA sliding window demand	0x1615	UINT16	R/ATRG	0.001	0 to 1000
kW export block demand	0x1616	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
kvar export block demand	0x1617	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
kW export sliding window demand	0x1618	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
kvar export sliding window demand	0x1619	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
kW export accumulated demand	0x161A	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
kvar export accumulated demand	0x161B	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
kW export predicted sliding window demand	0x161C	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
kvar export predicted sliding window demand	0x161D	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
kW export thermal demand	0x161E	UINT32	R/ATRG	0.001kW/1kW	0 to Pmax
kvar export thermal demand	0x161F	UINT32	R/ATRG	0.001kvar/1kvar	0 to Pmax
Total energies					
kWh import	0x1700	UINT32	R	kWh	0 to 10^9-1
kWh export	0x1701	UINT32	R	kWh	0 to 10^9-1
kWh net	0x1702	INT32	R	kWh	-10^9+1 to 10^9-1
kWh total	0x1703	UINT32	R	kWh	0 to 10^9-1

Parameter	Point ID	Type	R/W	Unit	Range [1]
kvarh import	0x1704	UINT32	R	kvarh	0 to 10^9-1
kvarh export	0x1705	UINT32	R	kvarh	0 to 10^9-1
kvarh net	0x1704	INT32	R	kvarh	-10^9+1 to 10^9-1
kvarh total	0x1705	UINT32	R	kvarh	0 to 10^9-1
kVAh total	0x1708	UINT32	R	kVAh	0 to 10^9-1
L1/L12 phase voltage harmonics					
Harmonic H01	0x1900	UINT16	R/ATRG	0.01%	0 to 10000
Harmonic H02	0x1901	UINT16	R/ATRG	0.01%	0 to 10000
. . .	. . .				
Harmonic H40	0x1927	UINT16	R/ATRG	0.01%	0 to 10000
L2/L23 phase voltage harmonics					
Harmonic H01	0x1A00	UINT16	R/ATRG	0.01%	0 to 10000
Harmonic H02	0x1A01	UINT16	R/ATRG	0.01%	0 to 10000
. . .	. . .				
Harmonic H40	0x1A27	UINT16	R/ATRG	0.01%	0 to 10000
L3 phase voltage harmonics					
Harmonic H01	0x1B00	UINT16	R/ATRG	0.01%	0 to 10000
Harmonic H02	0x1B01	UINT16	R/ATRG	0.01%	0 to 10000
. . .	. . .				
Harmonic H40	0x1B27	UINT16	R/ATRG	0.01%	0 to 10000
L1 phase current harmonics					
Harmonic H01	0x1C00	UINT16	R/ATRG	0.01%	0 to 10000
Harmonic H02	0x1C01	UINT16	R/ATRG	0.01%	0 to 10000
. . .	. . .				
Harmonic H40	0x1C27	UINT16	R/ATRG	0.01%	0 to 10000
L2 phase current harmonics					
Harmonic H01	0x1D00	UINT16	R/ATRG	0.01%	0 to 10000
Harmonic H02	0x1D01	UINT16	R/ATRG	0.01%	0 to 10000
. . .	. . .				
Harmonic H40	0x1D27	UINT16	R/ATRG	0.01%	0 to 10000
L3 phase current harmonics					
Harmonic H01	0x1E00	4	R/ATRG	0.01%	0 to 10000
Harmonic H02	0x1E01	4	R/ATRG	0.01%	0 to 10000
. . .	. . .				
Harmonic H40	0x1E27	4	R/ATRG	0.01%	0 to 10000
L1/L12 phase harmonic voltages (odd harmonics)					
Harmonic H01	0x1F00	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Harmonic H03	0x1F01	UINT32	R/ATRG	0.1V/1V	0 to Vmax
. . .	. . .				
Harmonic H39	0x1F13	UINT32	R/ATRG	0.1V/1V	0 to Vmax
L2/L23 phase harmonic voltages (odd harmonics)					
Harmonic H01	0x2000	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Harmonic H03	0x2001	UINT32	R/ATRG	0.1V/1V	0 to Vmax
. . .	. . .				
Harmonic H39	0x2013	UINT32	R/ATRG	0.1V/1V	0 to Vmax
L3 phase harmonic voltages (odd harmonics)					
Harmonic H01	0x2100	UINT32	R/ATRG	0.1V/1V	0 to Vmax
Harmonic H03	0x2101	UINT32	R/ATRG	0.1V/1V	0 to Vmax
. . .	. . .				
Harmonic H39	0x2113	UINT32	R/ATRG	0.1V/1V	0 to Vmax
L1 phase harmonic current (odd harmonics)					
Harmonic H01	0x2200	UINT32	R/ATRG	0.01A	0 to Imax
Harmonic H03	0x2201	UINT32	R/ATRG	0.01A	0 to Imax
. . .	. . .				
Harmonic H39	0x2213	UINT32	R/ATRG	0.01A	0 to Imax
L2 phase harmonic current (odd harmonics)					
Harmonic H01	0x2300	UINT32	R/ATRG	0.01A	0 to Imax
Harmonic H03	0x2301	UINT32	R/ATRG	0.01A	0 to Imax
. . .	. . .				
Harmonic H39	0x2313	UINT32	R/ATRG	0.01A	0 to Imax
L3 phase harmonic current (odd harmonics)					
Harmonic H01	0x2400	UINT32	R/ATRG	0.01A	0 to Imax
Harmonic H03	0x2401	UINT32	R/ATRG	0.01A	0 to Imax
. . .	. . .				
Harmonic H39	0x2413	UINT32	R/ATRG	0.01A	0 to Imax

Parameter	Point ID	Type	R/W	Unit	Range [1]
Harmonic total kW (odd harmonics)					
Harmonic H01	0x2500	UINT32	R/TRG	0.001kW/1kW	-Pmax to Pmax
Harmonic H03	0x2501	UINT32	R/TRG	0.001kW/1kW	-Pmax to Pmax
. . .	. . .				
Harmonic H39	0x2513	UINT32	R/TRG	0.001kW/1kW	-Pmax to Pmax
Harmonic total kvar (odd harmonics)					
Harmonic H01	0x2600	UINT32	R/TRG	0.001kvar/1kvar	-Pmax to Pmax
Harmonic H03	0x2601	UINT32	R/TRG	0.001kvar/1kvar	-Pmax to Pmax
. . .	. . .				
Harmonic H39	0x2613	UINT32	R/TRG	0.001kvar/1kvar	-Pmax to Pmax
Harmonic total PF (odd harmonics)					
Harmonic H01	0x2700	UINT32	R/TRG	0.001	-999 to 1000
Harmonic H03	0x2701	UINT32	R/TRG	0.001	-999 to 1000
. . .	. . .				
Harmonic H39	0x2713	UINT32	R/TRG	0.001	-999 to 1000
Minimum real-time values per phase (M)					
Voltage L1/L12 [6]	0x2C00	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Voltage L2/L23 [6]	0x2C01	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Voltage L3/L31 [6]	0x2C02	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Current L1	0x2C03	UINT32	R/NTRG	0.01A	0 to Imax
Current L2	0x2C04	UINT32	R/NTRG	0.01A	0 to Imax
Current L3	0x2C05	UINT32	R/NTRG	0.01A	0 to Imax
kW L1	0x2C06	INT32	R/NTRG	0.001kW/1kW	-Pmax to Pmax
kW L2	0x2C07	INT32	R/NTRG	0.001kW/1kW	-Pmax to Pmax
kW L3	0x2C08	INT32	R/NTRG	0.001kW/1kW	-Pmax to Pmax
kvar L1	0x2C09	INT32	R/NTRG	0.001kvar/1kvar	-Pmax to Pmax
kvar L2	0x2C0A	INT32	R/NTRG	0.001kvar/1kvar	-Pmax to Pmax
kvar L3	0x2C0B	INT32	R/NTRG	0.001kvar/1kvar	-Pmax to Pmax
kVA L1	0x2C0C	UINT32	R/NTRG	0.001kVA/1kVA	0 to Pmax
kVA L2	0x2C0D	UINT32	R/NTRG	0.001kVA/1kVA	0 to Pmax
kVA L3	0x2C0E	UINT32	R/NTRG	0.001kVA/1kVA	0 to Pmax
Power factor L1 [3]	0x2C0F	INT16	R/NTRG	0.001	-999 to 1000
Power factor L2 [3]	0x2C10	INT16	R/NTRG	0.001	-999 to 1000
Power factor L3 [3]	0x2C11	INT16	R/NTRG	0.001	-999 to 1000
Voltage THD L1/L12	0x2C12	UINT16	R/NTRG	0.1%	0 to 9999
Voltage THD L2/L23	0x2C13	UINT16	R/NTRG	0.1%	0 to 9999
Voltage THD L3	0x2C14	UINT16	R/NTRG	0.1%	0 to 9999
Current THD L1	0x2C15	UINT16	R/NTRG	0.1%	0 to 9999
Current THD L2	0x2C16	UINT16	R/NTRG	0.1%	0 to 9999
Current THD L3	0x2C17	UINT16	R/NTRG	0.1%	0 to 9999
K-Factor L1	0x2C18	UINT16	R/NTRG	0.1	10 to 9999
K-Factor L2	0x2C19	UINT16	R/NTRG	0.1	10 to 9999
K-Factor L3	0x2C1A	UINT16	R/NTRG	0.1	10 to 9999
Current TDD L1	0x2C1B	UINT16	R/NTRG	0.1%	0 to 1000
Current TDD L2	0x2C1C	UINT16	R/NTRG	0.1%	0 to 1000
Current TDD L3	0x2C1D	UINT16	R/NTRG	0.1%	0 to 1000
Voltage L12	0x2C1E	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Voltage L23	0x2C1F	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Voltage L31	0x2C20	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Minimum real-time total values (M)					
Total kW	0x2D00	INT32	R/NTRG	0.001kW/1kW	-Pmax to Pmax
Total kvar	0x2D01	INT32	R/NTRG	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0x2D02	UINT32	R/NTRG	0.001kVA/1kVA	0 to Pmax
Total PF [3]	0x2D03	UINT16	R/NTRG	0.001	0 to 1000
Total PF lag	0x2D04	UINT16	R/NTRG	0.001	0 to 1000
Total PF lead	0x2D05	UINT16	R/NTRG	0.001	0 to 1000
Minimum real-time auxiliary values (M)					
Auxiliary current	0x2E00	UINT32	R/NTRG	0.01A/mA	0 to Imax aux
Neutral current	0x2E01	UINT32	R/NTRG	0.01A	0 to Imax
Frequency [4]	0x2E02	UINT16	R/NTRG	0.01Hz	0 to 10000
Voltage unbalance	0x2E03	UINT16	R/NTRG	1%	0 to 300
Current unbalance	0x2E04	UINT16	R/NTRG	1%	0 to 300
DC voltage	0x2E05	UINT32	R/NTRG	0.01V	0 to 999900
Minimum demands (M) – Reserved					
Reserved	0x2F00-0x2F12	INT32	R		0

Parameter	Point ID	Type	R/W	Unit	Range [1]
Programmable Min/Max minimum registers (M)					
Register #1	0x3000	INT32	R	[5]	[5]
Register #2	0x3001	INT32	R	[5]	[5]
. . .	. . .				
Register #16	0x300F	INT32	R	[5]	[5]
Maximum real-time values per phase (M)					
Voltage L1/L12 [6]	0x3400	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Voltage L2/L23 [6]	0x3401	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Voltage L3/L31 [6]	0x3402	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Current L1	0x3403	UINT32	R/NTRG	0.01A	0 to Imax
Current L2	0x3404	UINT32	R/NTRG	0.01A	0 to Imax
Current L3	0x3405	UINT32	R/NTRG	0.01A	0 to Imax
kW L1	0x3406	INT32	R/NTRG	0.001kW/1kW	-Pmax to Pmax
kW L2	0x3407	INT32	R/NTRG	0.001kW/1kW	-Pmax to Pmax
kW L3	0x3408	INT32	R/NTRG	0.001kW/1kW	-Pmax to Pmax
kvar L1	0x3409	INT32	R/NTRG	0.001kvar/1kvar	-Pmax to Pmax
kvar L2	0x340A	INT32	R/NTRG	0.001kvar/1kvar	-Pmax to Pmax
kvar L3	0x340B	INT32	R/NTRG	0.001kvar/1kvar	-Pmax to Pmax
kVA L1	0x340C	UINT32	R/NTRG	0.001kVA/1kVA	0 to Pmax
kVA L2	0x340D	UINT32	R/NTRG	0.001kVA/1kVA	0 to Pmax
kVA L3	0x340E	UINT32	R/NTRG	0.001kVA/1kVA	0 to Pmax
Power factor L1 [3]	0x340F	INT16	R/NTRG	0.001	-999 to 1000
Power factor L2 [3]	0x3410	INT16	R/NTRG	0.001	-999 to 1000
Power factor L3 [3]	0x3411	INT16	R/NTRG	0.001	-999 to 1000
Voltage THD L1/L12	0x3412	UINT16	R/NTRG	0.1%	0 to 9999
Voltage THD L2/L23	0x3413	UINT16	R/NTRG	0.1%	0 to 9999
Voltage THD L3	0x3414	UINT16	R/NTRG	0.1%	0 to 9999
Current THD L1	0x3415	UINT16	R/NTRG	0.1%	0 to 9999
Current THD L2	0x3416	UINT16	R/NTRG	0.1%	0 to 9999
Current THD L3	0x3417	UINT16	R/NTRG	0.1%	0 to 9999
K-Factor L1	0x3418	UINT16	R/NTRG	0.1	10 to 9999
K-Factor L2	0x3419	UINT16	R/NTRG	0.1	10 to 9999
K-Factor L3	0x341A	UINT16	R/NTRG	0.1	10 to 9999
Current TDD L1	0x341B	UINT16	R/NTRG	0.1%	0 to 1000
Current TDD L2	0x341C	UINT16	R/NTRG	0.1%	0 to 1000
Current TDD L3	0x341D	UINT16	R/NTRG	0.1%	0 to 1000
Voltage L12	0x341E	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Voltage L23	0x341F	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Voltage L31	0x3420	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Maximum real-time total values (M)					
Total kW	0x3500	INT32	R/NTRG	0.001kW/1kW	-Pmax to Pmax
Total kvar	0x3501	INT32	R/NTRG	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0x3502	UINT32	R/NTRG	0.001kVA/1kVA	0 to Pmax
Total PF [3]	0x3503	UINT16	R/NTRG	0.001	0 to 1000
Total PF lag	0x3504	UINT16	R/NTRG	0.001	0 to 1000
Total PF lead	0x3505	UINT16	R/NTRG	0.001	0 to 1000
Maximum real-time auxiliary values (M)					
Auxiliary current	0x3600	UINT32	R/NTRG	0.01A/mA	0 to Imax aux
Neutral current	0x3601	UINT32	R/NTRG	0.01A	0 to Imax
Frequency [4]	0x3602	UINT16	R/NTRG	0.01Hz	0 to 10000
Voltage unbalance	0x3603	UINT16	R/NTRG	1%	0 to 300
Current unbalance	0x3604	UINT16	R/NTRG	1%	0 to 300
DC voltage	0x3605	UINT32	R/NTRG	0.01V	0 to 999900
Maximum demands (M)					
Max. volt demand L1/L12 [6]	0x3700	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Max. volt demand L2/L23 [6]	0x3701	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Max. volt demand L3/L31 [6]	0x3702	UINT32	R/NTRG	0.1V/1V	0 to Vmax
Max. ampere demand L1	0x3703	UINT32	R/NTRG	0.01A	0 to Imax
Max. ampere demand L2	0x3704	UINT32	R/NTRG	0.01A	0 to Imax
Max. ampere demand L3	0x3705	UINT32	R/NTRG	0.01A	0 to Imax
Reserved	0x3706	UINT32	R/NTRG		0
Reserved	0x3707	UINT32	R/NTRG		0
Reserved	0x3708	UINT32	R/NTRG		0
Max. kW import sliding window demand	0x3709	UINT32	R/NTRG	0.001kW/1kW	0 to Pmax
Max. kvar import sliding window demand	0x370A	UINT32	R/NTRG	0.001kvar/1kvar	0 to Pmax
Max. kVA sliding window demand	0x370B	UINT32	R/NTRG	0.001kVA/1kVA	0 to Pmax

Parameter	Point ID	Type	R/W	Unit	Range [1]
Max. kW import thermal demand	0x370C	UINT32	R/NTRG	0.001kW/1kW	0 to Pmax
Max. kvar import thermal demand	0x370D	UINT32	R/NTRG	0.001kvar/1kvar	0 to Pmax
Max. kVA thermal demand	0x370E	UINT32	R/NTRG	0.001kVA/1kVA	0 to Pmax
Max. kW export sliding window demand	0x370F	UINT32	R/NTRG	0.001kW/1kW	0 to Pmax
Max. kvar export sliding window demand	0x3710	UINT32	R/NTRG	0.001kvar/1kvar	0 to Pmax
Max. kW export thermal demand	0x3711	UINT32	R/NTRG	0.001kW/1kW	0 to Pmax
Max. kvar export thermal demand	0x3712	UINT32	R/NTRG	0.001kvar/1kvar	0 to Pmax
Programmable Min/Max maximum registers (M)					
Register #1	0x3800	INT32	R/NTRG	[5]	[5]
Register #2	0x3801	INT32	R/NTRG	[5]	[5]
. . .	. . .				
Register #16	0x380F	INT32	R/NTRG	[5]	[5]
TOU system parameters					
Active tariff	0x3C00	UINT16	R/ATRG		0 to 15
Active profile	0x3C01	UINT16	R/ATRG		0 to 15
TOU energy register #1					
Tariff #1 register	0x3D00	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x3D01	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x3D0F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #2					
Tariff #1 register	0x3E00	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x3E01	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x3E0F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #3					
Tariff #1 register	0x3F00	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x3F01	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x3F0F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #4					
Tariff #1 register	0x4000	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x4001	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x400F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #5					
Tariff #1 register	0x4100	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x4101	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x410F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #6					
Tariff #1 register	0x4200	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x4201	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x420F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #7					
Tariff #1 register	0x4300	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x4301	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x430F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #8					
Tariff #1 register	0x4400	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x4401	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x440F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #9					
Tariff #1 register	0x4B00	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x4B01	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x4B0F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #10					
Tariff #1 register	0x4C00	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x4C01	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				

Parameter	Point ID	Type	R/W	Unit	Range [1]
Tariff #16 register	0x4C0F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #11					
Tariff #1 register	0x4D00	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x4D01	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x4D0F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #12					
Tariff #1 register	0x4E00	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x4E01	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x4E0F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #13					
Tariff #1 register	0x4F00	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x4F01	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x4F0F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #14					
Tariff #1 register	0x5000	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x5001	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x500F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #15					
Tariff #1 register	0x5100	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x5101	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x510F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU energy register #16					
Tariff #1 register	0x5200	INT32	R	[5]	-10^9+1 to 10^9-1
Tariff #2 register	0x5201	INT32	R	[5]	-10^9+1 to 10^9-1
...	...				
Tariff #16 register	0x520F	INT32	R	[5]	-10^9+1 to 10^9-1
TOU maximum demand register #1 (M)					
Tariff #1 register	0x4800	UINT32	R/NTRG	[5]	0 to Pmax
Tariff #2 register	0x4801	UINT32	R/NTRG	[5]	0 to Pmax
...	...				
Tariff #16 register	0x480F	UINT32	R/NTRG	[5]	0 to Pmax
TOU maximum demand register #2 (M)					
Tariff #1 register	0x4900	UINT32	R/NTRG	[5]	0 to Pmax
Tariff #2 register	0x4901	UINT32	R/NTRG	[5]	0 to Pmax
...	...				
Tariff #16 register	0x490F	UINT32	R/NTRG	[5]	0 to Pmax
TOU maximum demand register #3 (M)					
Tariff #1 register	0x4A00	UINT32	R/NTRG	[5]	0 to Pmax
Tariff #2 register	0x4A01	UINT32	R/NTRG	[5]	0 to Pmax
...	...				
Tariff #16 register	0x4A0F	UINT32	R/NTRG	[5]	0 to Pmax
TOU season tariff energy registers - only as a reference for TOU profile logs					
Season tariff #1 register	0x7000	INT32		[5]	-10^9+1 to 10^9-1
Season tariff #2 register	0x7001	INT32		[5]	-10^9+1 to 10^9-1
...	...				
Season tariff #16 register	0x700F	INT32		[5]	-10^9+1 to 10^9-1
TOU season tariff maximum demand registers - only as a reference for TOU profile logs					
Season tariff #1 register	0x7100	UINT32		[5]	0 to Pmax
Season tariff #2 register	0x7101	UINT32		[5]	0 to Pmax
...	...				
Season tariff #16 register	0x710F	UINT32		[5]	0 to Pmax
Setpoint status [10]					
Setpoints status	0x7C00	UINT16	R		
Setpoint #1 status	0x7C00		BTRG		N/A
Setpoint #2 status	0x7C01		BTRG		N/A
Setpoint #3 status	0x7C02		BTRG		N/A
Setpoint #4 status	0x7C03		BTRG		N/A
Setpoint #5 status	0x7C04		BTRG		N/A
Setpoint #6 status	0x7C05		BTRG		N/A
Setpoint #7 status	0x7C06		BTRG		N/A
Setpoint #8 status	0x7C07		BTRG		N/A
Setpoint #9 status	0x7C08		BTRG		N/A

Parameter	Point ID	Type	R/W	Unit	Range [1]
Setpoint #10 status	0x7C09		BTRG		N/A
Setpoint #11 status	0x7C0A		BTRG		N/A
Setpoint #12 status	0x7C0B		BTRG		N/A
Setpoint #13 status	0x7C0C		BTRG		N/A
Setpoint #14 status	0x7C0D		BTRG		N/A
Setpoint #15 status	0x7C0E		BTRG		N/A
Setpoint #16 status	0x7C0F		BTRG		N/A

1 For parameter limits, see Note 1 to Table 4-1

2 When using direct wiring (PT Ratio = 1), voltages are transmitted in 0.1 V units, currents in 0.01 A units, and powers in 0.001 kW/kvar/kVA units. For wiring via PTs (PT Ratio > 1), voltages are transmitted in 1V units, currents in 0.01 A units, and powers in 1 kW/kvar/kVA units.

3 New absolute min/max value (lag or lead).

4 The actual frequency range is 45.00 - 65.00 Hz.

5 The Programmable Min/Max register, TOU energy and TOU maximum demand register unit and range match those of the input parameter for which the register is allocated.

6 When the 4LN3 or 3LN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

7 Operate limit for the voltage disturbance trigger specifies the voltage deviation allowed in percentage of nominal (full scale) voltage, which refers to line-to-line voltage in 3OP2 and 3OP3 wiring modes, and to line-to-neutral voltage in other modes. The nominal voltage is 120 × PT Ratio VRMS for instruments with the 120V input option, and 380 × PT Ratio VRMS for instruments with the 690V input option.

8 Packed date format: year × 10000 + month × 100 + day of month.

9 Packed time format: hour × 10000 + minute × 100 + second.

10 Available starting with F/W Versions 2.26.2/2.36.2 and 2.27.2/2.37.2 or later.

(M) These parameters are logged to the Min/Max log.

5.3 Basic Setup Registers

Table 5-8 Basic Setup Registers

Parameter	Register	Type	R/W	Range
Wiring mode [1]	0x8600	UINT16	R/W	0 = 3OP2, 1 = 4LN3, 2 = 3DIR2, 3 = 4LL3, 4 = 3OP3, 5 = 3LN3, 6 = 3LL3
PT ratio	0x8601	UINT16	R/W	10 to 65000 × 0.1
CT primary current	0x8602	UINT16	R/W	1 to 5000 A
Power demand period	0x8603	UINT16	R/W	1,2,5,10,15,20,30,60 min, 255 = external synchronization
Volt/ampere demand period	0x8604	UINT16	R/W	1 to 1800 sec
Averaging buffer size	0x8605	UINT16	R/W	8, 16, 32
Reset enable/disable	0x8606	UINT16	R/W	0 = disable, 1 = enable
Auxiliary CT primary current	0x8607	UINT16	R/W	1 to 5000 A/mA
The number of demand periods	0x8608	UINT16	R/W	1 to 15
Thermal demand time constant	0x8609	UINT16	R/W	10 to 36000 x 0.1sec
The number of pre-event cycles for the waveform recorder	0x860A	UINT16	R/W	1 to 8
Nominal frequency	0x860B	UINT16	R/W	50, 60 Hz
Maximum demand load current	0x860C	UINT16	R/W	0 to 10000 A (0 = CT primary current)
Reserved	0x860D	UINT16	R	Read as 65535
DC voltage offset [2]	0x860E	UINT16	R/W	0 to 9999 (default 0)
DC voltage full scale [2]	0x860F	UINT16	R/W	0 to 9999 (default 20, 100 or 300)
The number of cycles in a waveform series	0x8610	UINT16	R/W	0 to 2560 (will be rounded to a nearest bigger number multiple of 16), 0 = auto-select (see Note 3 to Table 4-4.

1 For the wiring mode options, see Note 1 to Table 4-4

2 To get true DC voltage readings, set the offset to zero and the full scale to 20, 100 or 300 V according to your order.

5.4 User Selectable Options Setup

Table 5-9 User Selectable Options Registers

Parameter	Register	Type	R/W	Range
Power calculation mode	0x8700	UINT16	R/W	0 = using reactive power 1 = using non-active power
Energy roll value [1]	0x8701	UINT16	R/W	0 = 1×10^4 kWh 1 = 1×10^5 kWh 2 = 1×10^6 kWh 3 = 1×10^7 kWh 4 = 1×10^8 kWh 5 = 1×10^9 kWh
Phase energy calculation mode	0x8702	UINT16	R/W	0 = disable, 1 = enable
Analog output option	0x8703	UINT16	R/W	0 = none 1 = 0-20 mA 2 = 4-20 mA 3 = 0-1 mA 4 = ±1 mA
Analog expander output [2]	0x8704	UINT16	R/W	0 = none 1 = 0-20 mA 2 = 4-20 mA 3 = 0-1 mA 4 = ±1 mA
Battery option	0x8705	UINT16	R/W	0 = battery OFF, 1 = battery ON
Reserved	0x8706	UINT16	R	Read as 65535
Thermal demand option	0x8707	UINT16	R/W	0 = disable, 1 = enable

1 For short energy readings (see Table 4-1), the maximum roll value will be 1×10^8 for positive readings and 1×10^7 for negative readings.

2 Do not enable the analog expander output if the analog expander is not connected to the instrument, otherwise the computer communications will become garbled.

5.5 Communications Setup

Table 5-10 Communications Setup Registers

Comm. Port	Parameter	Register	Type	R/W	Range
Port #1	Protocol	0x8500	UINT16	R/W	0 = ASCII 1 = Modbus RTU 3 = DNP3.0
	Interface	0x8501	UINT16	R/W	0 = RS-232 2 = RS-485
	Address	0x8502	UINT16	R/W	0 to 99
	Baud rate	0x8503	UINT16	R/W	0 = 110 bps 1 = 300 bps 2 = 600 bps 3 = 1200 bps 4 = 2400 bps 5 = 4800 bps 6 = 9600 bps 7 = 19200 bps
	Data format	0x8504	UINT16	R/W	0 = 7 bits/even parity 1 = 8 bits/no parity 2 = 8 bits/even parity
	Incoming flow control (handshaking)	0x8505	UINT16	R/W	0 = no handshaking 1 = software handshaking (XON/XOFF protocol) 2 = hardware handshaking (CTS protocol)
	Outgoing flow control (RTS/DTR)	0x8506	UINT16	R/W	0 = RTS signal not used 1 = RTS permanently asserted (DTR mode) 2 = RTS asserted during the transmission
	Reserved	0x8507	UINT16	R	Read as 65535

Comm. Port	Parameter	Register	Type	R/W	Range
	ASCII compatibility mode [1]	0x8508	UINT16	R/W	0 = disabled, 1 = enabled (see Note [2] to Table 4-1)
Port #2	Protocol	0x8510	UINT16	R/W	0 = ASCII 1 = Modbus RTU 3 = DNP3.0
	Interface	0x8511	UINT16	R/W	1 = RS-422 2 = RS-485
	Address	0x8512	UINT16	R/W	0 to 99
	Baud rate	0x8513	UINT16	R/W	0 = 110 bps 1 = 300 bps 2 = 600 bps 3 = 1200 bps 4 = 2400 bps 5 = 4800 bps 6 = 9600 bps 7 = 19200 bps
	Data format	0x8514	UINT16	R/W	0 = 7 bits/even parity 1 = 8 bits/no parity 2 = 8 bits/even parity
	Reserved	0x8515-0x8517	UINT16	R	Read as 65535
	ASCII compatibility mode [1]	0x8518	UINT16	R/W	0 = disabled, 1 = enabled (see Note [2] to Table 4-1)

[1] Changing ASCII compatibility mode for either port will cause the same setting to be applied for both ports.

When changing the instrument address, baud rate or data format, the new communications parameters will take effect 100 ms after the instrument responds to the master's request.

5.6 Alarm/Event Setpoints

Table 5-11 Setpoint Setup Locations

Setpoint number	Registers
Setpoint #1	0x8A00-0x8A1B
Setpoint #2	0x8A1C-0x8A37
Setpoint #3	0x8A38-0x8A53
Setpoint #4	0x8A54-0x8A6F
Setpoint #5	0x8A70-0x8A8B
Setpoint #6	0x8A8C-0x8AA7
Setpoint #7	0x8AA8-0x8AC3
Setpoint #8	0x8AC4-0x8ADF
Setpoint #9	0x8AE0-0x8AFB
Setpoint #10	0x8AFC-0x8B17
Setpoint #11	0x8B18-0x8B33
Setpoint #12	0x8B34-0x8B4F
Setpoint #13	0x8B50-0x8B6B
Setpoint #14	0x8B6C-0x8B87
Setpoint #15	0x8B88-0x8BA3
Setpoint #16	0x8BA4-0x8BBF

Table 5-12 Setpoint Setup Registers

Parameter	Offset	Type	R/W	Range
Logical operator 1	+0	UINT16	R/W	0 = OR
Trigger ID 1	+1	UINT16	R/W	see Table 5-7
Relational operator 1	+2	UINT16	R/W	see Table 5-13
Operate limit 1	+3	INT32	R/W	see Table 5-7
Release limit 1	+4	INT32	R/W	see Table 5-7
Logical operator 2	+5	UINT16	R/W	0 = OR, 1 = AND
Trigger ID 2	+6	UINT16	R/W	see Table 5-7
Relational operator 2	+7	UINT16	R/W	see Table 5-13
Operate limit 2	+8	INT32	R/W	see Table 5-7
Release limit 2	+9	INT32	R/W	see Table 5-7
Logical operator 3	+10	UINT16	R/W	0 = OR, 1 = AND
Trigger ID 3	+11	UINT16	R/W	see Table 5-7

Parameter	Offset	Type	R/W	Range
Relational operator 3	+12	UINT16	R/W	see Table 5-13
Operate limit 3	+13	INT32	R/W	see Table 5-7
Release limit 3	+14	INT32	R/W	see Table 5-7
Logical operator 4	+15	UINT16	R/W	0 = OR, 1 = AND
Trigger ID 4	+16	UINT16	R/W	see Table 5-7
Relational operator 4	+17	UINT16	R/W	see Table 5-13
Operate limit 4	+18	INT32	R/W	see Table 5-7
Release limit 4	+19	INT32	R/W	see Table 5-7
Action 1	+20	4	R/W	see Table 5-14
Action 2	+21	4	R/W	see Table 5-14
Action 3	+22	4	R/W	see Table 5-14
Action 4	+23	4	R/W	see Table 5-14
Operate delay	+24	4	R/W	0-9999 (×0.1 sec)
Release delay	+25	4	R/W	0-9999 (×0.1 sec)
Reserved	+26	4	R	0
Reserved	+27	4	R	0

NOTES

1. The setpoint is disabled when the first trigger parameter ID is set to NONE. To disable the setpoint, write zero into this register.
2. When writing the setpoint registers (except the event when the setpoint is to be disabled), it is recommended to write all the setpoint registers using a single request, or to disable the setpoint before writing into separate registers. Each written value is checked for compatibility with the other setpoint parameters; if the new value does not conform to these, the request will be rejected.
3. Operate and release limits for trigger parameters, their ranges and measurement units are indicated in Table 5-7. Limits for binary triggers (BTRG) and new value triggers (NTRG) are read as zeros. When writing, they can be omitted or should be written as zeros. Release limits for special inputs (voltage disturbance and phase rotation) and for date/time parameters are not used. Write them as zeros. All trigger limits are read/written as long (8-character) unsigned integer numbers.
4. When a setpoint action is directed to a relay allocated to output energy pulses, an attempt to re-allocate it for a setpoint will result in a negative response.

Table 5-13 Relational Operators

Relational operator	Operate condition	Release condition	Setpoint limits	Used with triggers of type
0 = NONE	N/A	N/A	Not used	ATRG, BTRG, NTRG
1 = GREATER OR EQUAL	Over operate limit	Under release limit	Both limits active	ATRG
2 = LESS OR EQUAL	Under operate limit	Over release limit	Both limits active	ATRG
3 = EQUAL	Equal	Not equal	Release limit not used	ATRG
4 = NOT EQUAL	Not equal	Equal	Release limit not used	ATRG
5 = ON	Binary status ON	Binary status OFF	Not used	BTRG
6 = OFF	Binary status OFF	Binary status ON	Not used	BTRG
7 = NEW	New Min/Max value	N/A	Not used	NTRG

ATRG = analog (numeric) trigger, BTRG = binary (digital) trigger, NTRG = new value trigger.

Table 5-14 Setpoint Actions

Action type (high byte)		Action target (low byte)	
Description	ID	Description	ID
No action	0x00	N/A	0x00
Set user event flag	0x20	Flag number	0x00-0x07 = flags #1-#8
Reset user event flag	0x21	Flag number	0x00-0x07 = flags #1-#8
Operate relay	0x30	Relay number	0x00-0x05 = relays #1-#6
Increment counter	0x40	Counter number	0x00-0x0F = counter #1-#16
Decrement counter	0x41	Counter number	0x00-0x0F = counter #1-#16
Clear counter	0x42	Counter number	0x00-0x0F = counter #1-#16
Reset total energy registers	0x60	N/A	0x00
Reset total maximum demand registers	0x61	N/A	0x00 = reset all maximum demands 0x01 = reset power maximum demands 0x02 = reset volt/ampere maximum demands

Action type (high byte)		Action target (low byte)	
Description	**ID**	**Description**	**ID**
Reset TOU energy	0x62	N/A	0x00
Reset TOU demands	0x63	N/A	0x00
Clear all counters	0x64	N/A	0x00
Clear Min/Max registers	0x65	N/A	0x00
Event logging	0x70	Setpoint transition mode	0x00 = log on operate setpoint 0x01 = log on release setpoint 0x02 = log on either transition (both operate and release)
Data logging	0x71	Log number	0x00-0x0F = data log #1-#16
Waveform log #1	0x72	N/A	0x00
Waveform log #2	0x73	N/A	0x00

5.7 Relay Operation Control Registers

These registers allow you to manually override setpoint relay operations. Either relay may be manually forced operated or released using commands sent via communications.

NOTES

1. A relay allocated as a pulsing relay may not be manually operated or released. When a relay is allocated for pulsing, it automatically reverts to normal operation.
2. A relay is energized when forced operated, and is de-energized when forced released.

Table 5-15 Relay Operation Control Registers

Parameter	Register	Type	R/W	Range
Relay #1 control status	0x8400	UINT16	R/W	see Table 5-16
Relay #2 control status	0x8401	UINT16	R/W	see Table 5-16
Relay #3 control status	0x8402	UINT16	R/W	see Table 5-16
Relay #4 control status	0x8403	UINT16	R/W	see Table 5-16
Relay #5 control status	0x8404	UINT16	R/W	see Table 5-16
Relay #6 control status	0x8405	UINT16	R/W	see Table 5-16

Table 5-16 Relay Operation Status

Operation status	ID
Normal operation	0
Force operate	1
Force release	2

5.8 Instrument Options Registers

Table 5-17 Instrument Options Registers

Parameter	Register	Type	R/W	Range
Options 1 register	0x7F00	UINT16	R	see Table 5-18
Options 2 register	0x7F01	UINT16	R	see Table 5-18

Table 5-18 Instrument Options

Options register	Bit	Description
Options1	0	120V option
	1	690V option
	2-3	N/A
	4	100% current over-range
	5	N/A
	6	Analog output 0/4-20 mA
	7	Analog output 0-1 mA
	8	Analog output ±1 mA
	9	Relays option
	10	Digital inputs option
	11	Auxiliary current option

	12	Setup is secured by a password (see Section 3.4)
	13	ASCII compatibility mode enabled (see Table 5-10)
	14	Analog expander output ±1 mA
	15	N/A
Options 2	0-2	Number of relays - 1
	3-6	Number of digital inputs - 1
	7-8	Number of analog outputs - 1
	9-10	N/A
	11-12	DC voltage input option: 01 = 20V, 10=100V, 11 = 300V
	13	N/A
	14-15	Memory module size: 11 = 1024 Kbytes

5.9 Extended Status Registers

Table 5-19 Extended Status Registers

Parameter	Register	Type	R/W	Range
Relay status	0x7D00	UINT16	R	see Table 4-12
User event flags	0x7D01	UINT16	R	see Table 4-13
Status inputs	0x7D02	UINT16	R	see Table 4-14
Setpoint status	0x7D03	UINT16	R	see Table 4-15
Log status	0x7D04	UINT16	R	see Table 4-16
Data log status	0x7D05	UINT16	R	see Table 4-17
Active serial port number	0x7D06	UINT16	R	0 = Port 1, 1 = Port 2
Battery status	0x7D07	UINT16	R	0 = low, 1 = normal

5.10 Alarm Status Registers

Table 5-20 Alarm Status Registers

Parameter	Register	Type	R/W	Range
Setpoint alarm status	0x7E00h	UINT16	R/W	see Table 5-21
Self-check alarm status	0x7E01h	UINT16	R/W	see Table 5-22

The setpoint alarm register stores the status of the operated setpoints by setting the appropriate bits to 1. The alarm status bits can be reset all together by writing zero to the setpoint alarm register. It is possible to reset each alarm status bit separately by writing back the contents of the alarm register with a corresponding alarm bit set to 0.

The self-check alarm register indicates possible problems with the instrument hardware or setup configuration. The hardware problems are indicated by the appropriate bits which are set whenever the instrument fails self-test diagnostics or in the event of loss of power. The setup configuration problems are indicated by the dedicated bit which is set when either configuration register is corrupted. In this event, the instrument will use the default configuration. The configuration corrupt bit may also be set as a result of the legal changes in the setup configuration since the instrument might implicitly change or clear other setups if they are affected by the changes made.

Hardware fault bits can be reset by writing zero to the self-check alarm register. The configuration corrupt status bit and RTC synchronization bit are also reset automatically when you change setup or update RTC either via the front panel or through communications.

Table 5-21 Setpoint Alarm Status

Bit	Description
0	Alarm #1
1	Alarm #2
2	Alarm #3
3	Alarm #4
4	Alarm #5
5	Alarm #6
6	Alarm #7
7	Alarm #8
8	Alarm #9
9	Alarm #10
10	Alarm #11

11	Alarm #12
12	Alarm #13
13	Alarm #14
14	Alarm #15
15	Alarm #16

Bit meaning: 1 = setpoint has been operated

Table 5-22 Self-check Alarm Status

Bit	Description
0	Reserved
1	ROM error
2	RAM error
3	Watchdog timer reset
4	Sampling failure
5	Out of control trap
6	Reserved
7	Timing failure
8	Loss of power (power up)
9	External reset (warm restart)
10	Configuration corrupted
11	RTC time-synchronization required
12	Low battery [1]
13-15	Reserved

[1] Available starting with F/W Version 2.27.2/2.37.2 or later.

5.11 Reset/Clear Registers

Table 5-23 Reset/Clear Registers

Action	Register	Type	R/W	Range
Clear total energy registers	0xA000	UINT16	W	0
Clear total maximum demand registers	0xA001	UINT16	W	0 = all maximum demands 1 = power demands 2 = volt/ampere demands
Clear TOU energy registers	0xA002	UINT16	W	0
Clear TOU demand registers	0xA003	UINT16	W	0
Clear pulse counters	0xA004	UINT16	W	0 = all counters 1-16 = counter #1 - #16
Clear Min/Max log	0xA005	UINT16	W	0
Clear event log	0xA006	UINT16	W	0
Clear data log	0xA007	UINT16	W	0-15 = data log #1 - #16 16 = all data logs
Clear waveform log #1	0xA008	UINT16	W	0
Clear waveform log #2	0xA009	UINT16	W	0
Reserved	0xA00A	UINT16		
Restore event log read queue to the beginning	0xA00B	UINT16	W	0
Restore data log read queue to the beginning	0xA00C	UINT16	W	0-15 = data logs #1 - #16 16-31 = monthly profile logs for TOU energy registers #1 - #16 32-34 = monthly profile logs for TOU maximum demand registers #1 - #3 48-63 = daily profile logs for TOU energy registers #1 - #16 64-66 = daily profile logs for TOU maximum demand registers #1 - #3
Restore waveform log #1	0xA00D	UINT16	W	0
Restore waveform log #2	0xA00E	UINT16	W	0

5.12 Memory Allocation Status Registers

Table 5-24 Log Memory Status Registers

Parameter	Register	Type	R/W	Range
Total memory size, Bytes	0xA0F0	UINT32	R	0 to 1048576
Free memory size, Bytes	0xA0F1	UINT32	R	0 to 1048576
Memory partitions map	0xA0F2	UINT32	R	See Table 5-25
Monthly profile log partition map	0xA0F3	UINT32	R	See Table 5-25
Daily profile log partition map	0xA0F4	UINT32	R	See Table 5-25

Table 5-25 Log Partitions Allocation Map

Memory Partition/Sub-partition	Bit
Event log	0
Data log #1	1
Data log #2	2
Data log #3	3
Data log #4	4
Data log #5	5
Data log #6	6
Data log #7	7
Data log #8	8
Data log #9	9
Data log #10	10
Data log #11	11
Data log #12	12
Data log #13	13
Data log #14	14
Data log #15	15
Data log #16	16
Waveform log #1	17
Waveform log #2	18
Reserved	19-31
TOU Monthly Profile Log. Energy Reg. #1	0
TOU Monthly Profile Log. Energy Reg. #2	1
TOU Monthly Profile Log. Energy Reg. #3	2
TOU Monthly Profile Log. Energy Reg. #4	3
TOU Monthly Profile Log. Energy Reg. #5	4
TOU Monthly Profile Log. Energy Reg. #6	5
TOU Monthly Profile Log. Energy Reg. #7	6
TOU Monthly Profile Log. Energy Reg. #8	7
TOU Monthly Profile Log. Energy Reg. #9	8
TOU Monthly Profile Log. Energy Reg. #10	9
TOU Monthly Profile Log. Energy Reg. #11	10
TOU Monthly Profile Log. Energy Reg. #12	11
TOU Monthly Profile Log. Energy Reg. #13	12
TOU Monthly Profile Log. Energy Reg. #14	13
TOU Monthly Profile Log. Energy Reg. #15	14
TOU Monthly Profile Log. Energy Reg. #16	15
TOU Monthly Profile Log. Max. Demand Reg. #1	16
TOU Monthly Profile Log. Max. Demand Reg. #2	17
TOU Monthly Profile Log. Max. Demand Reg. #3	18
Reserved	19-31
TOU Daily Profile Log. Energy Reg. #1	0
TOU Daily Profile Log. Energy Reg. #2	1
TOU Daily Profile Log. Energy Reg. #3	2
TOU Daily Profile Log. Energy Reg. #4	3
TOU Daily Profile Log. Energy Reg. #5	4
TOU Daily Profile Log. Energy Reg. #6	5
TOU Daily Profile Log. Energy Reg. #7	6
TOU Daily Profile Log. Energy Reg. #8	7
TOU Daily Profile Log. Energy Reg. #9	8
TOU Daily Profile Log. Energy Reg. #10	9
TOU Daily Profile Log. Energy Reg. #11	10
TOU Daily Profile Log. Energy Reg. #12	11
TOU Daily Profile Log. Energy Reg. #13	12
TOU Daily Profile Log. Energy Reg. #14	13
TOU Daily Profile Log. Energy Reg. #15	14

Memory Partition/Sub-partition	Bit
TOU Daily Profile Log. Energy Reg. #16	15
TOU Daily Profile Log. Max. Demand Reg. #1	16
TOU Daily Profile Log. Max. Demand Reg. #2	17
TOU Daily Profile Log. Max. Demand Reg. #3	18
Reserved	19-31

Bit meaning: 0 = a partition is not allocated; 1 = a partition is allocated

5.13 Memory Partition Status/Control Registers

Table 5-26 Memory Partition Status/Control Register Locations

Memory Partition	Registers
Event log	0xA100-0xA107
Data log #1	0xA108-0xA10F
Data log #2	0xA110-0xA117
Data log #3	0xA118-0xA11F
Data log #4	0xA120-0xA127
Data log #5	0xA128-0xA12F
Data log #6	0xA130-0xA137
Data log #7	0xA138-0xA13F
Data log #8	0xA140-0xA147
Data log #9	0xA148-0xA14F
Data log #10	0xA150-0xA157
Data log #11	0xA158-0xA15F
Data log #12	0xA160-0xA167
Data log #13	0xA168-0xA16F
Data log #14	0xA170-0xA177
Data log #15	0xA178-0xA17F
Data log #16	0xA180-0xA187
Waveform log 32/16	0xA188-0xA18F
Waveform log 128/4	0xA190-0xA197
Reserved	0xA198-0xA1FF
TOU Monthly Profile Log. Energy Reg. #1	0xA200-0xA207
TOU Monthly Profile Log. Energy Reg. #2	0xA208-0xA20F
TOU Monthly Profile Log. Energy Reg. #3	0xA210-0xA217
TOU Monthly Profile Log. Energy Reg. #4	0xA218-0xA21F
TOU Monthly Profile Log. Energy Reg. #5	0xA220-0xA227
TOU Monthly Profile Log. Energy Reg. #6	0xA228-0xA22F
TOU Monthly Profile Log. Energy Reg. #7	0xA230-0xA237
TOU Monthly Profile Log. Energy Reg. #8	0xA238-0xA23F
TOU Monthly Profile Log. Energy Reg. #9	0xA240-0xA247
TOU Monthly Profile Log. Energy Reg. #10	0xA248-0xA24F
TOU Monthly Profile Log. Energy Reg. #11	0xA250-0xA257
TOU Monthly Profile Log. Energy Reg. #12	0xA258-0xA25F
TOU Monthly Profile Log. Energy Reg. #13	0xA260-0xA267
TOU Monthly Profile Log. Energy Reg. #14	0xA268-0xA26F
TOU Monthly Profile Log. Energy Reg. #15	0xA270-0xA277
TOU Monthly Profile Log. Energy Reg. #16	0xA278-0xA27F
TOU Monthly Profile Log. Max. Demand Reg. #1	0xA280-0xA287
TOU Monthly Profile Log. Max. Demand Reg. #2	0xA288-0xA28F
TOU Monthly Profile Log. Max. Demand Reg. #3	0xA290-0xA297
Reserved	0xA298-0xA2FF
TOU Daily Profile Log. Energy Reg. #1	0xA300-0xA307
TOU Daily Profile Log. Energy Reg. #2	0xA308-0xA30F
TOU Daily Profile Log. Energy Reg. #3	0xA310-0xA317
TOU Daily Profile Log. Energy Reg. #4	0xA318-0xA31F
TOU Daily Profile Log. Energy Reg. #5	0xA320-0xA327
TOU Daily Profile Log. Energy Reg. #6	0xA328-0xA32F
TOU Daily Profile Log. Energy Reg. #7	0xA330-0xA337
TOU Daily Profile Log. Energy Reg. #8	0xA338-0xA33F
TOU Daily Profile Log. Energy Reg. #9	0xA340-0xA347
TOU Daily Profile Log. Energy Reg. #10	0xA348-0xA34F
TOU Daily Profile Log. Energy Reg. #11	0xA350-0xA357
TOU Daily Profile Log. Energy Reg. #12	0xA358-0xA35F
TOU Daily Profile Log. Energy Reg. #13	0xA360-0xA367
TOU Daily Profile Log. Energy Reg. #14	0xA368-0xA36F
TOU Daily Profile Log. Energy Reg. #15	0xA370-0xA377

Memory Partition	Registers
TOU Daily Profile Log. Energy Reg. #16	0xA378-0xA37F
TOU Daily Profile Log. Max. Demand Reg. #1	0xA380-0xA387
TOU Daily Profile Log. Max. Demand Reg. #2	0xA388-0xA38F
TOU Daily Profile Log. Max. Demand Reg. #3	0xA390-0xA397
Reserved	0xA398-0xA3FF

If data log partition #15 is configured as a TOU monthly profile partition, registers 0xA178-0xA17F are mapped to registers 0xA200-0xA207 for the first TOU monthly profile sub-partition allocated for TOU energy register #1, or if this register is not configured, for the following first available TOU register.

If data log partition #16 is configured as a TOU daily profile partition, registers 0xA180-0xA187 are mapped to registers 0xA300-0xA307 for the first TOU daily profile sub-partition allocated for TOU energy register #1, or if this register is not configured, for the following first available TOU register.

Table 5-27 Memory Partition Status/Control Window Registers

Parameter	Offset	Type	R/W	Range
Log partition status	+0	UINT16	R	Bit-mapped register: bit 0 = 0 - non-wrap partition = 1 - wrap-around partition bit 4 = 1 - TOU monthly profile partition bit 5 = 1 - TOU daily profile partition bit 9 = 1 - reading after the end of file: the read pointer has rolled over the end of a log file, that is the file is being re-read from the beginning. This bit is cleared when the read pointer [+6] points to a new record, or either command register [+6] or [+7] is written.
The total number of records logged in the partition/sub-partition	+1	UINT16	R	0 to 65535. Returns the total number of logged records available in the partition.
The number of the new records never read before	+2	UINT16	R	0 to 65535. Returns the number of records from the first new one never read before and until the end of the log file.
The next sequence number to be used when the next log event will take place	+3	UINT16	R	0 to 65535 (increments modulo 65536 with each log). Returns the sequence number that will be applied to the next record being logged.
The sequence number of the first (oldest) record in the log file	+4	UINT16	R	0 to 65535. Returns the sequence number of the oldest record in the log file.
The sequence number of the first new record never read before	+5	UINT16	R	0 to 65535. Returns the sequence number of the first new (most recent) record that has never been read. If this number is equal to the contents of register [+3], there are no newest records never read before.
The sequence number of the current record to be read	+6	UINT16	R/W [1]	0 to 65535. Points to the record that will be read via the partition read window. Can be overwritten to point to the desired record.

Parameter	Offset	Type	R/W	Range
Command register	+7	UINT16	R/W	This is a write-only register. Write value: 0 = automatically restores the read sequence to the beginning of the log file, that is puts the read pointer to the first (oldest) record in the log file (actually, safely copies the contents of the register [+4] to the register [+6]). 1 = automatically sets the read sequence to the first new record never read before, that is puts the read pointer to the record following the last one whenever read. If there are new records in the partition, this actually copies the contents of the register [+5] to the register [+6]. If there are no new records, the register [+5] will point to the first (oldest) record in the log file as if the command register was written with zero. Read as 0.

[1] If there is no record in the log file that matches the written sequence number, the instrument will respond with the exception code XP (invalid data).

5.14 Event Log Registers (Circular Access)

These registers allow you to circularly read a packet of consequent records from the event log file. From 1 to 6 event log records can be read at a time via the event log windows, which comprise registers 0xCD80 through 0xCDAF. Reading from either register window always returns the next logged event record. All registers within one window must be read at once using a single request. After reading an event log window, the partition queue pointer is shifted forward until the end of the log file. After the last record has been read, the file pointer is automatically restored to the beginning of the log file so that the next read request will return the first (oldest) event. To point to an arbitrary record, use the log partition status/control registers A100h-A107h (see Section 5.13).

Table 5-28 Event Log Windows Locations

Event log window	Registers (see Table 5-29)
Event log window #1	0xCD80-0xCD87
Event log window #2	0xCD88-0xCD8F
Event log window #3	0xCD90-0xCD97
Event log window #4	0xCD98-0xCD9F
Event log window #5	0xCDA0-0xCDA7
Event log window #6	0xCDA8-0xCDAF

Table 5-29 Event Log Window Registers

Parameter	Offset	Size	R/W	Range
Status indication	+0	UINT16	R	Bit-mapped register: bit 0 = 1 - the end record is being read (the end of a log file reached) bit 1 = 1 - reading after the end of file: the read pointer has rolled over the end of a log file, i.e., the file is being re-read from the beginning. This bit is cleared when a new record is being read, or the read sequence has changed by overwriting the partition pointer. bit 8 = 1 - no records logged in the partition bit 9 = 1 - the record is corrupted bit 15 = 1 - read error (detailed by bits 8-9)
The record sequence number	+1	UINT16	R	0 to 65535 (increments modulo 65536 with each log)
Timestamp [1]	+2	UINT32	R	Local time (UNIX-style)
Fractional seconds portion of timestamp (milliseconds)	+3	UINT16	R	0-990 (at 10 ms resolution)
Event cause	+4	UINT16	R	see Table 5-30
Log value [2]	+5	INT32	R	see Table 5-30
Event effect	+6	UINT16	R	see Table 5-30
Reserved	+7	UINT16	R	0

[1] Timestamp is given in local time in a UNIX-style time format: it represents the number of seconds since midnight (00:00:00), January 1, 1970. The time is valid after January 1, 2000.

[2] For the log value size and range, refer to Table 5-7.

NOTES:

1. If a requested record is corrupted (the redundant check fails), the record is reported with all zeros (except the sequence number) and the bits 9 and 15 in the status indication word being set to 1.
2. If a record is requested when the log file is empty, the record is reported with all zeros and bits 8 and 15 in the status indication word being set to 1.

Table 5-30 Event Log Parameters

Event cause	Event cause code		Log value	Event effect	
	High byte: cause code	Low byte: event origin (location)		High byte: effect code	Low byte: target code
Setpoint event	Trigger parameter ID high byte (see Table 5-7)	Trigger parameter ID low byte (see Table 5-7)	Trigger parameter value (see Table 5-7)	0xE1 (225) = setpoint operated 0xE2 (226) = setpoint released	Setpoint number = 0x00-0x0F (0-15)
Setpoint activity	0x5A (90)	Setpoint number = 0x00-0x0F (0-15)	0	Setpoint action type (see Table 5-33	See Table 5-33
Communication activity	0x5B (91)	Data location code (see Table 5-31)	0	See Table 5-33	See Table 5-33
Front panel activity	0x5C (92)	Data location code (see Table 5-31)	0	See Table 5-33	See Table 5-33
Self-check	0x5D (93)	Data location code (see Table 5-31)	0	See Table 5-33	See Table 5-33
Self-update (daylight savings time)	0x5E (94)	0x08 (8) = RTC	0	0xF5 (245) = RTC set	00
Hardware failure	0x62 (98)	Diagnostic code (see Table 5-32)	0	0x0000	00
External event	0x63 (99)	0x00 (0) = power down 0x08 (8) = power up	0	0x00	00

Table 5-31 Data Location Codes

Location code		Description
Dec	Hex	
0-2	0x00-0x02	Reserved
3	0x03	Data keeping memory
4	0x04	Factory setup
5	0x05	Access setup
6	0x06	Basic setup
7	0x07	Communications setup
8	0x08	Real-time clock
9	0x09	Discrete inputs allocation
10	0x0A	Pulse counters allocation
11	0x0B	Multiplexed analog outputs setup
12	0x0C	External analog outputs setup
13	0x0D	Reserved
14	0x0E	Timers setup
15	0x0F	Display options
16	0x10	Event/alarm setpoints
17	0x11	Pulsing setpoints
18	0x12	User assignable register map
19	0x13	Programmable Min/Max log setup
20	0x14	Data log setup
21	0x15	Memory partitions setup
22	0x16	TOU energy registers setup
23	0x17	TOU demand registers setup
24	0x18	TOU daily profiles
25	0x19	TOU calendar
26	0x1A	TOU calendar years
27	0x1B	Relay control registers
28	0x1C	User selectable options
29	0x1D	Reserved
30	0x1E	Reserved

Location code		Description
Dec	Hex	
31	0x1F	DNP 3.0 class 0 map
32	0x10	DNP 3.0 options setup
33	0x11	DNP 3.0 events setup
34	0x12	DNP 3.0 event setpoints
35	0x13	Calibration registers
36	0x14	Time zone information

Table 5-32 Diagnostic Codes

Diagnostic code		Description
Dec	Hex	
0	0x00	Power down
1	0x01	ROM error
2	0x02	RAM error
3	0x03	Watch dog timer reset
4	0x04	Sampling failure
5	0x05	Out of control trap
6	0x06	Reserved
7	0x07	Timing failure
8	0x08	Power up

Table 5-33 Event Effect Codes

Effect code		Description	Target
Dec	Hex		
96	0x60	Clear energy registers	0x00 (0)
97	0x61	Clear demand registers	0x00 (0)= all demands 0x01 (1) = power demands 0x02 (2) = volt/ampere demands
98	0x62	Clear TOU energy registers	0x00 (0)
99	0x63	Clear TOU demand registers	0x00 (0)
100	0x64	Clear counters	0x00 (0) = clear all counters 0x01-10 (1-16) = counter #1-#16
101	0x65	Clear Min/Max log registers	0x00 (0)
102	0x66	Clear event log	0x00 (0)
103	0x67	Clear data log	0x00-0x0F (0-15) = log #1-#16 0x10 (16) = clear all data logs
104	0x68	Clear 32/16 waveform log	0x00 (0)
105	0x69	Clear 128/4 waveform log	0x00 (0)
225	0xE1	Setpoint operated	0x00-0x0F (0-15)= setpoint #1-#16
226	0xE2	Setpoint released	0x00-0x0F (0-15) = setpoint #1-#16
241	0xF1	Setpoint disabled	0x00-0x0F (0-15) = setpoint #1-#16
242	0xF2	Setup cleared	0x00 (0)
243	0xF3	Setup set by default	0x00 (0)
244	0xF4	Setup changed	0x00 (0)
245	0xF5	RTC set	0x00 (0)

5.15 Data Log Registers (Circular Access)

These registers allow you to circularly read consequent records from the event log file. Each data log file is accessed via a separate register window. Reading from either register window always returns the next logged record from the corresponding data log. All registers within one window must be read at once using a single request. After reading a log window, the partition queue pointer is shifted forward until the end of the log file. After the last record has been read, the file pointer is automatically restored to the beginning of the log file so that the next read request will return the first (oldest) record. To point to an arbitrary record, use the data log partition status/control registers (see Section 5.13).

Table 5-34 Data Log Window Locations

Data log	Window registers
Data log #1	0xC000-0xC017
Data log #2	0xC018-0xC02F
Data log #3	0xC030-0xC047
Data log #4	0xC048-0xC05F
Data log #5	0xC060-0xC077
Data log #6	0xC078-0xC08F
Data log #7	0xC090-0xC0A7

Data log	Window registers
Data log #8	0xC0A8-0xC0BF
Data log #9	0xC0C0-0xC0D7
Data log #10	0xC0D8-0xC0EF
Data log #11	0xC0F0-0xC107
Data log #12	0xC108-0xC11F
Data log #13	0xC120-0xC137
Data log #14	0xC138-0xC14F
Data log #15	0xC150-0xC167
Data log #16	0xC168-0xC17F
TOU Monthly Profile Log. Energy Reg. #1	0xC180-0xC197
TOU Monthly Profile Log. Energy Reg. #2	0xC198-0xC1Af
TOU Monthly Profile Log. Energy Reg. #3	0xC1B0-0xC1C7
TOU Monthly Profile Log. Energy Reg. #4	0xC1C8-0xC1DF
TOU Monthly Profile Log. Energy Reg. #5	0xC1E0-0xC1F7
TOU Monthly Profile Log. Energy Reg. #6	0xC1F8-0xC20F
TOU Monthly Profile Log. Energy Reg. #7	0xC210-0xC227
TOU Monthly Profile Log. Energy Reg. #8	0xC228-0xC23F
TOU Monthly Profile Log. Energy Reg. #9	0xC240-0xC257
TOU Monthly Profile Log. Energy Reg. #10	0xC258-0xC26F
TOU Monthly Profile Log. Energy Reg. #11	0xC270-0xC287
TOU Monthly Profile Log. Energy Reg. #12	0xC288-0xC29F
TOU Monthly Profile Log. Energy Reg. #13	0xC2A0-0xC267
TOU Monthly Profile Log. Energy Reg. #14	0xC2B8-0xC2CF
TOU Monthly Profile Log. Energy Reg. #15	0xC2D0-0xC2E7
TOU Monthly Profile Log. Energy Reg. #16	0xC2E8-0xC2FF
TOU Monthly Profile Log. Max. Demand Reg. #1	0xC300-0xC317
TOU Monthly Profile Log. Max. Demand Reg. #2	0xC318-0xC32F
TOU Monthly Profile Log. Max. Demand Reg. #3	0xC330-0xC347
Reserved	0xC348-0xC47F
TOU Daily Profile Log. Energy Reg. #1	0xC480-0xC497
TOU Daily Profile Log. Energy Reg. #2	0xC498-0xC4AF
TOU Daily Profile Log. Energy Reg. #3	0xC4B0-0xC4C7
TOU Daily Profile Log. Energy Reg. #4	0xC4C8-0xC4DF
TOU Daily Profile Log. Energy Reg. #5	0xC4E0-0xC4F7
TOU Daily Profile Log. Energy Reg. #6	0xC4F8-0xC50F
TOU Daily Profile Log. Energy Reg. #7	0xC510-0xC527
TOU Daily Profile Log. Energy Reg. #8	0xC528-0xC53F
TOU Daily Profile Log. Energy Reg. #9	0xC540-0xC557
TOU Daily Profile Log. Energy Reg. #10	0xC558-0xC56F
TOU Daily Profile Log. Energy Reg. #11	0xC570-0xC587
TOU Daily Profile Log. Energy Reg. #12	0xC588-0xC59F
TOU Daily Profile Log. Energy Reg. #13	0xC5A0-0xC5B7
TOU Daily Profile Log. Energy Reg. #14	0xC5B8-0xC5CF
TOU Daily Profile Log. Energy Reg. #15	0xC5D0-0xC5E7
TOU Daily Profile Log. Energy Reg. #16	0xC5E8-0xC5FF
TOU Daily Profile Log. Max. Demand Reg. #1	0xC600-0xC617
TOU Daily Profile Log. Max. Demand Reg. #2	0xC618-0xC62F
TOU Daily Profile Log. Max. Demand Reg. #3	0xC630-0xC647
Reserved	0xC648-0xC77F

If data log partition #15 is configured as a TOU monthly profile partition, registers 0xC150-0xC167 are mapped to registers 0xC180-0xC197 for the first TOU monthly profile sub-partition allocated for TOU energy register #1, or if this register is not configured, for the following first available TOU register.

If data log partition #16 is configured as a TOU daily profile partition, registers 0xC168-0xC17F are mapped to registers 0xC480-0xC497 for the first TOU daily profile sub-partition allocated for TOU energy register #1, or if this register is not configured, for the following first available TOU register.

Table 5-35 Data Log Read Window Registers

Parameter	Offset	Type	R/W	Range
Status indication	+0	UINT16	R	Bit-mapped register: bit 0 = 1 - the end record is being read (the end of a log file reached) bit 1 = 1 - reading after the end of file: the read pointer has rolled over the end of a log file, i.e., the file is being re-read from the beginning. This bit is cleared when a new record is being read, or the read sequence has changed by overwriting the partition pointer. bit 8 = 1 - no records logged in the partition bit 9 = 1 - the record is corrupted bit 15 = 1 - read error (detailed by bits 8-9)
The record sequence number	+1	UINT16	R	0 to 65535 (increments modulo 65536 with each log)
Timestamp [1]	+2	UINT32	R	Local time (UNIX-style)
Fractional seconds portion of timestamp (milliseconds)	+3	UINT16	R	0-990 (at 10 ms resolution)
Event setpoint ID	+4	UINT16	R	0 (TOU profile log), 1 to 16
Parameter #1 value	+5	INT32	R	see Table 5-7
Parameter #2 value	+6	INT32	R	see Table 5-7
Parameter #3 value	+7	INT32	R	see Table 5-7
Parameter #4 value	+8	INT32	R	see Table 5-7
Parameter #5 value	+9	INT32	R	see Table 5-7
Parameter #6 value	+10	INT32	R	see Table 5-7
Parameter #7 value	+11	INT32	R	see Table 5-7
Parameter #8 value	+12	INT32	R	see Table 5-7
Parameter #9 value	+13	INT32	R	see Table 5-7
Parameter #10 value	+14	INT32	R	see Table 5-7
Parameter #12 value	+15	INT32	R	see Table 5-7
Parameter #13 value	+16	INT32	R	see Table 5-7
Parameter #13 value	+17	INT32	R	see Table 5-7
Parameter #14 value	+18	INT32	R	see Table 5-7
Parameter #15 value	+19	INT32	R	see Table 5-7
Parameter #16 value	+20	INT32	R	see Table 5-7
Reserved	+21 to +23	INT32	R	0

[1] Timestamp is given in local time in a UNIX-style time format: it represents the number of seconds since midnight (00:00:00), January 1, 1970. The time is valid after January 1, 2000.

NOTES:

1. If a requested record is corrupted (the redundant check fails), the record is reported with all zeros (except the sequence number) and bits 9 and 15 in the status indication word being set to 1.
2. If a record is requested when the log file is empty, the record is reported with all zeros and bits 8 and 15 in the status indication word being set to 1.
3. The parameters that reside outside of the specified partition record size will be read as zeros.

5.16 Min/Max Log Registers

These registers allow you to read time-stamped Min/Max log records using direct read requests.

Table 5-36 Min/Max Log Registers

Parameter	Register	Type	Unit	Range
Minimum real-time values per phase				
Min. Voltage L1/L12 [6] Timestamp	0xB000 0xB001	INT32 UINT32	0.1V/1V	0 to Vmax
Min. Voltage L2/L23 [6] Timestamp	0xB002 0xB003	INT32 UINT32	0.1V/1V	0 to Vmax
Min. Voltage L3/L31 [6] Timestamp	0xB004 0xB005	INT32 UINT32	0.1V/1V	0 to Vmax
Min. Current L1 Timestamp	0xB006 0xB007	INT32 UINT32	0.01A	0 to Imax
Min. Current L2 Timestamp	0xB008 0xB009	INT32 UINT32	0.01A	0 to Imax
Min. Current L3 Timestamp	0xB00A 0xB00B	INT32 UINT32	0.01A	0 to Imax
Min. kW L1 Timestamp	0xB00C 0xB00D	INT32 UINT32	0.001kW/1kW	-Pmax to Pmax
Min. kW L2 Timestamp	0xB00E 0xB00F	INT32 UINT32	0.001kW/1kW	-Pmax to Pmax
Min. kW L3 Timestamp	0xB010 0xB011	INT32 UINT32	0.001kW/1kW	-Pmax to Pmax
Min. kvar L1 Timestamp	0xB012 0xB013	INT32 UINT32	0.001kvar/1kvar	-Pmax to Pmax
Min. kvar L2 Timestamp	0xB014 0xB015	INT32 UINT32	0.001kvar/1kvar	-Pmax to Pmax
Min. kvar L3 Timestamp	0xB016 0xB017	INT32 UINT32	0.001kvar/1kvar	-Pmax to Pmax
Min. kVA L1 Timestamp	0xB018 0xB019	INT32 UINT32	0.001kVA/1kVA	0 to Pmax
Min. kVA L2 Timestamp	0xB01A 0xB01B	INT32 UINT32	0.001kVA/1kVA	0 to Pmax
Min. kVA L3 Timestamp	0xB01C 0xB01D	INT32 UINT32	0.001kVA/1kVA	0 to Pmax
Min. Power factor L1 [3] Timestamp	0xB01E 0xB01F	INT32 UINT32	0.001	0 to 1000
Min. Power factor L2 [3] Timestamp	0xB020 0xB021	INT32 UINT32	0.001	0 to 1000
Min. Power factor L3 [3] Timestamp	0xB022 0xB023	INT32 UINT32	0.001	0 to 1000
Min. Voltage THD L1/L12 Timestamp	0xB024 0xB025	INT32 UINT32	0.1%	0 to 9999
Min. Voltage THD L2/L23 Timestamp	0xB026 0xB027	INT32 UINT32	0.1%	0 to 9999
Min. Voltage THD L3 Timestamp	0xB028 0xB029	INT32 UINT32	0.1%	0 to 9999
Min. Current THD L1 Timestamp	0xB02A 0xB02B	INT32 UINT32	0.1%	0 to 9999
Min. Current THD L2 Timestamp	0xB02C 0xB02D	INT32 UINT32	0.1%	0 to 9999
Min. Current THD L3 Timestamp	0xB02E 0xB02F	INT32 UINT32	0.1%	0 to 9999
Min. K-Factor L1 Timestamp	0xB030 0xB031	INT32 UINT32	0.1	10 to 9999
Min. K-Factor L2 Timestamp	0xB032 0xB033	INT32 UINT32	0.1	10 to 9999

Parameter	Register	Type	Unit	Range
Min. K-Factor L3 Timestamp	0xB034 0xB035	INT32 UINT32	0.1	10 to 9999
Min. Current TDD L1 Timestamp	0xB036 0xB037	INT32 UINT32	0.1%	0 to 1000
Min. Current TDD L2 Timestamp	0xB038 0xB039	INT32 UINT32	0.1%	0 to 1000
Min. Current TDD L3 Timestamp	0xB03A 0xB03B	INT32 UINT32	0.1%	0 to 1000
Min. Voltage L12 Timestamp	0xB03C 0xB03D	INT32 UINT32	0.1V/1V	0 to Vmax
Min. Voltage L23 Timestamp	0xB03E 0xB03F	INT32 UINT32	0.1V/1V	0 to Vmax
Min. Voltage L31 Timestamp	0xB040 0xB041	INT32 UINT32	0.1V/1V	0 to Vmax
Minimum real-time total values				
Min. Total kW Timestamp	0xB080 0xB081	INT32 UINT32	0.001kW/1kW	-Pmax to Pmax
Min. Total kvar Timestamp	0xB082 0xB083	INT32 UINT32	0.001kvar/1kvar	-Pmax to Pmax
Min. Total kVA Timestamp	0xB084 0xB085	INT32 UINT32	0.001kVA/1kVA	0 to Pmax
Min. Total PF [3] Timestamp	0xB086 0xB087	INT32 UINT32	0.001	0 to 1000
Min. Total PF Lag Timestamp	0xB088 0xB089	INT32 UINT32	0.001	0 to 1000
Min. Total PF Lead Timestamp	0xB08A 0xB08B	INT32 UINT32	0.001	0 to 1000
Minimum real-time auxiliary values				
Min. Auxiliary current Timestamp	0xB100 0xB101	INT32 UINT32	0.01A/mA	0 to Imax aux
Min. Neutral current Timestamp	0xB102 0xB103	INT32 UINT32	0.01A	0 to Imax
Min. Frequency [4] Timestamp	0xB104 0xB105	INT32 UINT32	0.01Hz	0 to 10000
Min. Voltage unbalance Timestamp	0xB106 0xB107	INT32 UINT32	1%	0 to 300
Min. Current unbalance Timestamp	0xB108 0xB109	INT32 UINT32	1%	0 to 300
Min. DC voltage Timestamp	0xB10A 0xB10B	INT32 UINT32	0.01V	0 to 999900
Programmable Min/Max minimum registers				
Min. Register #1 Timestamp	0xB180 0xB181	INT32 UINT32	⑤	
Min. Register #2 Timestamp	0xB182 0xB183	INT32 UINT32	⑤	
...	...			
Min. Register #16 Timestamp	0xB19E 0xB19F	INT32 UINT32	⑤	
Maximum real-time values per phase				
Max. Voltage L1/L12 [6] Timestamp	0xB200 0xB201	INT32 UINT32	0.1V/1V	0 to Vmax
Max. Voltage L2/L23 [6] Timestamp	0xB202 0xB203	INT32 UINT32	0.1V/1V	0 to Vmax
Max. Voltage L3/L31 [6] Timestamp	0xB204 0xB205	INT32 UINT32	0.1V/1V	0 to Vmax
Max. Current L1 Timestamp	0xB206 0xB207	INT32 UINT32	0.01A	0 to Imax
Max. Current L2 Timestamp	0xB208 0xB209	INT32 UINT32	0.01A	0 to Imax
Max. Current L3 Timestamp	0xB20A 0xB20B	INT32 UINT32	0.01A	0 to Imax

Parameter	Register	Type	Unit	Range
Max. kW L1 Timestamp	0xB20C 0xB20D	INT32 UINT32	0.001kW/1kW	-Pmax to Pmax
Max. kW L2	0xB20E	INT32	0.001kW/1kW	-Pmax to Pmax
Timestamp	0xB20F	UINT32		
Max. kW L3 Timestamp	0xB210 0xB211	INT32 UINT32	0.001kW/1kW	-Pmax to Pmax
Max. kvar L1 Timestamp	0xB212 0xB213	INT32 UINT32	0.001kvar/1kvar	-Pmax to Pmax
Max. kvar L2 Timestamp	0xB214 0xB215	INT32 UINT32	0.001kvar/1kvar	-Pmax to Pmax
Max. kvar L3 Timestamp	0xB216 0xB217	INT32 UINT32	0.001kvar/1kvar	-Pmax to Pmax
Max. kVA L1 Timestamp	0xB218 0xB219	INT32 UINT32	0.001kVA/1kVA	0 to Pmax
Max. kVA L2 Timestamp	0xB21A 0xB21B	INT32 UINT32	0.001kVA/1kVA	0 to Pmax
Max. kVA L3 Timestamp	0xB21C 0xB21D	INT32 UINT32	0.001kVA/1kVA	0 to Pmax
Max. Power factor L1 [3] Timestamp	0xB21E 0xB21F	INT32 UINT32	0.001	0 to 1000
Max. Power factor L2 [3] Timestamp	0xB220 0xB221	INT32 UINT32	0.001	0 to 1000
Max. Power factor L3 [3] Timestamp	0xB222 0xB223	INT32 UINT32	0.001	0 to 1000
Max. Voltage THD L1/L12 Timestamp	0xB224 0xB225	INT32 UINT32	0.1%	0 to 9999
Max. Voltage THD L2/L23 Timestamp	0xB226 0xB227	INT32 UINT32	0.1%	0 to 9999
Max. Voltage THD L3 Timestamp	0xB228 0xB229	INT32 UINT32	0.1%	0 to 9999
Max. Current THD L1 Timestamp	0xB22A 0xB22B	INT32 UINT32	0.1%	0 to 9999
Max. Current THD L2 Timestamp	0xB22C 0xB22D	INT32 UINT32	0.1%	0 to 9999
Max. Current THD L3 Timestamp	0xB22E 0xB22F	INT32 UINT32	0.1%	0 to 9999
Max. K-Factor L1 Timestamp	0xB230 0xB231	INT32 UINT32	0.1	10 to 9999
Max. K-Factor L2 Timestamp	0xB232 0xB233	INT32 UINT32	0.1	10 to 9999
Max. K-Factor L3 Timestamp	0xB234 0xB235	INT32 UINT32	0.1	10 to 9999
Max. Current TDD L1 Timestamp	0xB236 0xB237	INT32 UINT32	0.1%	0 to 1000
Max. Current TDD L2 Timestamp	0xB238 0xB239	INT32 UINT32	0.1%	0 to 1000
Max. Current TDD L3 Timestamp	0xB23A 0xB23B	INT32 UINT32	0.1%	0 to 1000
Max. Voltage L12 Timestamp	0xB23C 0xB23D	INT32 UINT32	0.1V/1V	0 to Vmax
Max. Voltage L23 Timestamp	0xB23E 0xB23F	INT32 UINT32	0.1V/1V	0 to Vmax
Max. Voltage L31 Timestamp	0xB240 0xB241	INT32 UINT32	0.1V/1V	0 to Vmax
Maximum real-time total values				
Max. Total kW Timestamp	0xB280 0xB281	INT32 UINT32	0.001kW/1kW	-Pmax to Pmax
Max. Total kvar Timestamp	0xB282 0xB283	INT32 UINT32	0.001kvar/1kvar	-Pmax to Pmax
Max. Total kVA Timestamp	0xB284 0xB285	INT32 UINT32	0.001kVA/1kVA	0 to Pmax

Parameter	Register	Type	Unit	Range
Max. Total PF ③ Timestamp	0xB286 0xB287	INT32 UINT32	0.001	0 to 1000
Max. Total PF Lag Timestamp	0xB288 0xB289	INT32 UINT32	0.001	0 to 1000
Max. Total PF Lead Timestamp	0xB28A 0xB28B	INT32 UINT32	0.001	0 to 1000
Maximum real-time auxiliary values				
Max. Auxiliary current Timestamp	0xB300 0xB301	INT32 UINT32	0.01A/mA	0 to Imax aux
Max. Neutral current Timestamp	0xB302 0xB303	INT32 UINT32	0.01A	0 to Imax
Max. Frequency ④ Timestamp	0xB304 0xB305	INT32 UINT32	0.01Hz	0 to 10000
Max. Voltage unbalance Timestamp	0xB306 0xB307	INT32 UINT32	1%	0 to 300
Max. Current unbalance Timestamp	0xB308 0xB309	INT32 UINT32	1%	0 to 300
Max. DC voltage Timestamp	0xB30A 0xB30B	INT32 UINT32	0.01V	0 to 999900
Maximum demands (M)				
Max. volt demand L1/L12 [6] Timestamp	0xB380 0xB381	INT32 UINT32	0.1V/1V	0 to Vmax
Max. volt demand L2/L23 [6] Timestamp	0xB382 0xB383	INT32 UINT32	0.1V/1V	0 to Vmax
Max. volt demand L3/L31 [6] Timestamp	0xB384 0xB385	INT32 UINT32	0.1V/1V	0 to Vmax
Max. ampere demand L1 Timestamp	0xB386 0xB387	INT32 UINT32	0.01A	0 to Imax
Max. ampere demand L2 Timestamp	0xB388 0xB389	INT32 UINT32	0.01A	0 to Imax
Max. ampere demand L3 Timestamp	0xB38A 0xB38B	INT32 UINT32	0.01A	0 to Imax
Reserved	0xB38C - 0xB38D	INT32 UINT32		0
Reserved	0xB38E - 0xB38F	INT32 UINT32		0
Reserved	0xB390 - 0xB391	INT32 UINT32		0
Max. kW import sliding window demand Timestamp	0xB392 0xB393	INT32 UINT32	0.001kW/1kW	0 to Pmax
Max. kvar import sliding window demand Timestamp	0xB394 0xB395	INT32 UINT32	0.001kvar/1kvar	0 to Pmax
Max. kVA sliding window demand Timestamp	0xB396 0xB397	INT32 UINT32	0.001kVA/1kVA	0 to Pmax
Max. kW import thermal demand Timestamp	0xB398 0xB399	INT32 UINT32	0.001kW/1kW	0 to Pmax
Max. kvar import thermal demand Timestamp	0xB39A 0xB39B	INT32 UINT32	0.001kvar/1kvar	0 to Pmax
Max. kVA thermal demand Timestamp	0xB39C 0xB39D	INT32 UINT32	0.001kVA/1kVA	0 to Pmax
Max. kW export sliding window demand Timestamp	0xB39E 0xB39F	INT32 UINT32	0.001kW/1kW	0 to Pmax
Max. kvar export sliding window demand Timestamp	0xB3A0 0xB3A1	INT32 UINT32	0.001kvar/1kvar	0 to Pmax
Max. kW export thermal demand Timestamp	0xB3A2 0xB3A3	INT32 UINT32	0.001kW/1kW	0 to Pmax
Max. kvar export thermal demand Timestamp	0xB3A4 0xB3A5	INT32 UINT32	0.001kvar/1kvar	0 to Pmax
Programmable Min/Max maximum registers				
Max. Register #1 Timestamp	0xB400 0xB401	INT32 UINT32	[5]	

Parameter	Register	Type	Unit	Range
Max. Register #2 Timestamp	0xB402 0xB403	INT32 UINT32	[5]	
...	...			
Max. Register #16 Timestamp	0xB40E 0xB40F	INT32 UINT32	[5]	
TOU maximum demand register #1				
Max. Demand Tariff #1 register Timestamp	0xB480 0xB481	INT32 UINT32	[5]	0 to Pmax
Max. Demand Tariff #2 register Timestamp	0xB482 0xB483	INT32 UINT32	[5]	0 to Pmax
...				
Max. Demand Tariff #16 register Timestamp	0xB49E 0xB49F	INT32 UINT32	[5]	0 to Pmax
TOU maximum demand register #2				
Max. Demand Tariff #1 register Timestamp	0xB500 0xB501	INT32 UINT32	[5]	0 to Pmax
Max. Demand Tariff #2 register Timestamp	0xB502 0xB503	INT32 UINT32	[5]	0 to Pmax
...				
Max. Demand Tariff #16 register Timestamp	0xB51E 0xB51F	INT32 UINT32	[5]	0 to Pmax
TOU maximum demand register #3				
Max. Demand Tariff #1 register Timestamp	0xB580 0xB581	INT32 UINT32	[5]	0 to Pmax
Max. Demand Tariff #2 register Timestamp	0xB582 0xB583	INT32 UINT32	[5]	0 to Pmax
...				
Max. Demand Tariff #16 register Timestamp	0xB59E 0xB59F	INT32 UINT32	[5]	0 to Pmax

Timestamp is given in local time in a UNIX-style time format: it represents the number of seconds since midnight (00:00:00), January 1, 1970. The time is valid after January 1, 2000.

[1] For parameter limits, see Note [1] to Table 4-1

[2] When using direct wiring (PT Ratio = 1), voltages are transmitted in 0.1 V units, currents in 0.01 A units, and powers in 0.001 kW/kvar/kVA units. For wiring via PTs (PT Ratio > 1), voltages are transmitted in 1V units, currents in 0.01 A units, and powers in 1 kW/kvar/kVA units.

[3] New absolute min/max value (lag or lead).

[4] The actual frequency range is 45.00 - 65.00 Hz.

[5] The Programmable Min/Max register and TOU maximum demand register unit and range match those of the input parameter for which the register is allocated.

[6] When the 4LN3 or 3LN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages.

5.17 Digital Inputs Allocation Registers

Table 5-37 Digital Inputs Allocation Registers

Parameter	Register	Type	R/W	Range
Status inputs allocation mask	0x8900	UINT16	R [1]	See Table 5-38
Pulse inputs allocation mask	0x8901	UINT16	R/W	See Table 5-38
Not used	0x8902	UINT16	R [1]	Read as 0
External demand synchronization input mask	0x8903	UINT16	R/W	See Table 5-38
Time synchronization input mask	0x8904	UINT16	R/W	See Table 5-38

[1] Writing to these locations is ignored. No error will occur.

NOTES

1. All digital inputs that were not allocated as pulse inputs will be automatically configured as status inputs.
2. A digital input allocated for the external demand synchronization pulse or time synchronization pulse will be automatically configured as a pulse input.

Table 5-38 Digital Inputs Allocation Mask

Bit number	Description
0	Digital input # 1 allocation status
1	Digital input # 2 allocation status
2	Digital input # 3 allocation status
3	Digital input # 4 allocation status
4	Digital input # 5 allocation status
5	Digital input # 6 allocation status
6	Digital input # 7 allocation status
7	Digital input # 8 allocation status
8	Digital input # 9 allocation status
9	Digital input # 10 allocation status
10	Digital input # 11 allocation status
11	Digital input # 12 allocation status
12-15	Not used

Bit meaning: 0 = input not allocated, 1 = input allocated to the group

5.18 Time Zone Information Registers

Table 5-39 Time Zone Registers

Parameter	Register	Type	R/W	Range
Daylight savings time (DST) option	0x8C00	UINT16	R/W	0 = disable DST (use standard time only), 1 = enable DST
DST start month	0x8C01	UINT16	R/W	1 - 12
DST start week of the month	0x8C02	UINT16	R/W	1 - 4 = 1st, 2nd, 3rd and 4th week, 5 = the last weekday in the month
DST start weekday	0x8C03	UINT16	R/W	1-7 (1= Sun, 7 = Sat)
DST end month	0x8C04	UINT16	R/W	1 - 12
DST end week of the month	0x8C05	UINT16	R/W	1 - 4 = 1st, 2nd, 3rd and 4th week, 5 = the last weekday in the month
DST end weekday	0x8C06	UINT16	R/W	1-7 (1= Sun, 7 = Sat)

5.19 Communications Password Register

Table 5-40 Password Register

Parameter	Register	Type	R/W	Range
Communications password	0xFF00	UINT16	R/W	Write: 0 to 65535 Read: 0 = access permitted, 65535 = authorization required

5.20 Waveform Capture/Log Registers (Circular Access)

Table 5-41 Waveform Header Windows

Waveform header window	Registers
Real-time waveform capture, channel V L1/L12	0xCE00-0xCE0D
Real-time waveform capture, channel V L2/L23	0xCE0E-0xCE1B
Real-time waveform capture, channel V L3	0xCE1C-0xCE29
Real-time waveform capture, channel I L1	0xCE2A-0xCE37
Real-time waveform capture, channel I L2	0xCE38-0xCE45
Real-time waveform capture, channel I L3	0xCE46-0xCE53
Waveform log #1, channel V L1/L12	0xCE54-0xCE61
Waveform log #1, channel V L2/L23	0xCE62-0xCE6F
Waveform log #1, channel V L3	0xCE70-0xCE7D
Waveform log #1, channel I L1	0xCE7E-0xCE8B
Waveform log #1, channel I L2	0xCE8C-0xCE99
Waveform log #1, channel I L3	0xCE9A-0xCEA7
Waveform log #2, channel V L1/L12	0xCEA8-0xCEB5
Waveform log #2, channel V L2/L23	0xCEB6-0xCEC3
Waveform log #2, channel V L3	0xCEC4-0xCED1
Waveform log #2, channel I L1	0xCED2-0xCEDF
Waveform log #2, channel I L2	0xCEE0-0xCEED
Waveform log #2, channel I L3	0xCEEE-0xCEFB

Table 5-42 Waveform Header Window Registers

Parameter	Offset	Type	R/W	Range
Command/Status indication	+0	UINT16	R	Bit-mapped register: bit 0 = 1 - the end record is being read (the end of a log file reached) bit 1 = 1 - reading after the end of file: the read pointer has rolled over the end of a log file, i.e., the file is being re-read from the beginning. This bit is cleared when a new record is being read, or the read sequence has changed by overwriting the partition pointer. bit 8 = 1 - no records logged in the partition bit 9 = 1 - the record is corrupted bit 15 = 1 - read error (detailed by bits 8-9)
The record sequence number in the log file	+1	UINT16	R	0 to 65535 (increments modulo 65536 with each log record)
The record timestamp [1]	+2	UINT32	R	Local time (UNIX-style)
Fractional seconds portion of timestamp (milliseconds)	+3	UINT16	R	0-990 (at 10 ms resolution)
Trigger event setpoint ID	+4	UINT16	R	1 to 16 = setpoint #1-#16, 0 = real-time waveform
The waveform series (compound waveform) number	+5	UINT16	R	1 to 65535 (rolls over to 1 after 65535). Each series can comprise up to 160 contiguous records of a compound waveform
The record sequence number in the waveform series	+6	UINT16	R	0 to 159
Analog input full scale, engineering units (volts/amperes) (ANALOG_SCALE)	+7	UINT32	R	For the analog input scale units and range, refer to those of voltage and current in Table 5-7
Digital full scale for the channel, sample code (DIGITAL_SCALE)	+8	UINT16	R	1023 (10 bit A/D), 4095 (12 bit A/D), 8191 (13 bit A/D). Corresponds to twice the analog input full scale range.
Zero offset, code (ZERO_OFFSET)	+9	INT16	R	Corresponds to the center of the digital sample's full scale range
Sampling frequency	+10	UINT16	R	0 to 6500 x 0.01Hz
Trigger sample point offset in the waveform series	+11	UINT16	R	0-511 (corresponds to the first record in the series)
Reserved	+12 to +13	UINT16	R	0

Registers at offsets +0,+1, +4 to +6, and +11 are applicable only for waveform log records. For real-time waveforms these are read as zeros.

[1] Timestamp is given in local time in a UNIX-style time format: it represents the number of seconds since midnight (00:00:00), January 1, 1970. The time is valid after January 1, 2000. Record timestamp shows the time for the last sample point in the waveform record.

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

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

NOTES

1. If a record is requested when the log file is empty, the record is reported with all zeros and bits 8 and 15 in the status indication word being set to 1.
2. Phase voltage will be line-to-line voltage in 3OP2 and 3OP3 wiring modes, and line-to-neutral voltage in other configurations.

Table 5-43 Waveform Samples Registers

Parameter	Register	Type	R/W	Range
Waveform sample point #1	0xD000	INT16	R	0 to 1023/8191
Waveform sample point #2	0xD001	INT16	R	0 to 1023/8191
Waveform sample point #3	0xD002	INT16	R	0 to 1023/8191
...	...			
Waveform sample point #512	0xD1FF	INT16	R	0 to 1023/8191

Through these registers you can capture and read the real-time waveforms (4 cycles x 128 samples per cycle), and the recorded historical waveform logs – Waveform log #1 (16 cycles x 32 samples per cycle) and Waveform log #2 (4 cycles x 128 samples per cycle). The waveform samples are read via the register window 0xD000-0xD1FF (see Table 5-43) that can map a record for a single input channel (voltage or current waveform on either phase). To reload this window with a sampled waveform, a corresponding waveform header window should be accessed (see Table 5-42).

Real-time Waveform Capture

The real-time waveforms can be captured simultaneously on both voltage and current channels for a single phase. To capture two waveforms on a selected phase, the first register (at offset +0) in the voltage waveform header window for this phase should be accessed by reading this register or by reading the entire header window. Before responding to your request, the instrument reloads both the waveform header and waveform samples window with data corresponding to the voltage waveform. Data in these windows does not change until the first (command/status indication) register in either of the waveform header windows is read.

To reload the waveform header and samples windows with the current waveform data, read the first register in the current waveform header window for the same phase.

To capture and read waveform data on another phase, repeat the above steps for the phase you want to access.

Historical Waveform Log

The historical waveform log contains waveform records sampled at a high (128 samples per cycle in Waveform log #2) or a lower rate (32 samples per cycle in Waveform log #1) that are captured and logged to a file on some event triggers. Each record contains six waveforms of voltage and current on three phases.

Recorded waveforms are mapped and accessed through register windows in the same manner as the real-time waveforms (see above). On log files organization and managing, see Section 3.3, Configuring and Accessing Log Files. Before reloading waveform window registers with data for a selected channel, the required record must be obtained from the log file to the communications buffer. This is made automatically when you reload the voltage waveform on phase L1, i.e., when you read the register at offset +0 in the voltage waveform header on phase L1 for the corresponding log file. Data in this buffer does not change until you read this register once again. Each time you access this register, the next record is read form the file and locked to the communications buffer. To reload waveform windows with data for the current channel or with data for another phase, read the command/status indication register in the voltage or current header window for the corresponding channel.

Waveform log files are accessed in a circular manner. When the last record in the file is being read, bit 0 in the status indication register in the waveform header windows is set to 1. If you continue reading after the end of a file, the file pointer rolls over to the beginning of the file and the first (oldest) record is returned with bit 1 in the status indication register being set to 1.

NOTES