SERIES PM172EH 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.

REVISION HISTORY

Rev.A2 (F/W Version 4.93.2 or later):

Added a firmware build number (see Table 4-10).
Added Voltage unbalance trigger (see Table 5-13).
Added Low battery alarm (see Table 5-22).

BG0362 Rev.A2

Table of Contents

1 GENERAL

This document specifies the ASCII serial communications protocol used to transfer data between a master computer station and the PM172EH. The document provides the complete information necessary to develop a third-party communications software capable of communication with the Series PM172EH 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 PM172EH Powermeters Installation and Operation Manual".

IMPORTANT

1. 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. In 4LN3, 4LL3, 3LN3 and 3LL3 wiring modes, harmonic voltages will be line-to-neutral voltages; in other modes, they will be line-to-line voltages. In a 3-wire direct connection, harmonic voltages and waveforms will represent line-to-neutral voltages as they appear on the instrument's input transformers. In 3OP2 and 3OP3 wiring modes, voltage harmonics and waveforms will be given only for phases L12 and L23.
1. Most of the advanced features are configured using multiple setup parameters that can be accessed in some contiguous registers. When writing the setup registers, it is recommended to write all the registers at once using a single request, or to clear (zero) the setup before writing into separate registers.

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: [Σ(each byte - 22H)] mod 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
4	34h	Reset/clear functions
8	38h	Reset the instrument
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

Message type		Description
Char	ASCII Hex	
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
i	68h	Set/clear event flag
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
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

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 meter is in programming mode
XM - invalid request type or illegal operation
XP - invalid data address or data value, or data is not available

NOTE

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

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 $\times$0.1, $\times$0.01 or $\times$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 PM172EH provides concurrent recording data in 11 different memory partitions, one of which is intended to record event log data, two - for waveform recording, and the others to store 8 different data logs using different sets of data parameters. Additionally, the two last data logs #7 and #8 can be configured to automatically record TOU monthly and daily profile data respectively using season TOU tariffs. Refer to Section 4.15 for information on how to allocate a memory partition for your specific data. Refer to Section 4.16 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 provides circular file reading, i.e., after the last record has been read, the file read pointer is automatically shifted to the beginning of the file. File read requests always allow 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 5.14, 5.15 and 5.16 for information on registers you can use to access your log files.

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 4.7, 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 4.3 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 PM172EH 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 5.20) 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 (×120% over-range) = 1.2 × CT primary current [A]

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 PM172EH 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
Nominal secondary voltage (L-L)	Q58	10 to 690 V
CT primary current	I17	1 to 10000 A
Power demand period	D11	1,2,5,10,15,20,30,60 min 255 = external synchronization [2]
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)
The number of pre-event cycles for the waveform log #1	Q50	1 to 8
The number of cycles in one waveform series for the waveform log #1 [3]	Q56	16 to 1280

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 Synchronization of power demand interval can be made through a digital input.

3 The waveform recorder logs waveforms in series of records. A compound waveform can have as more as 1280 cycles recorded in 80 consequent records, each record comprising 16 waveform cycles sampled at a rate of 32 samples per cycle.

4.3 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 4-6 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 1-4 = counter #1 - #4
6	Clear Min/Max log	0
7	Clear event log	0
8	Clear data log	0-7 = data logs #1 - #8 16 = all data logs
9	Clear waveform log #1	0
A	Clear waveform log #2	0
B	Reserved	0
C	Restore event log read pointer	0
D	Restore data log read pointer	0-7 = data log #1 - #8 16-23, 32-34 = monthly profile data log #7 (the same as 6) 48-55, 64-66 = daily profile data log #8 (the same as 7)
E	Restore waveform log #1 read pointer	0
F	Restore waveform log #2 log read pointer	0

4.4 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

4.5 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	400-499
2	3	2	Firmware build number [1]	01-99

[1] Available in F/W Version 4.93.2 or later.

4.6 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
2-15	Not used (permanently set to 0)

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

Table 4-13 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 = flag is cleared, 1 = flag is set

Table 4-14 Status Inputs

Bit	Description
0	Status input #1
1	Status input #2
2-15	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
4-15	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)

4.7 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	32	Not used
13	84	4	The number of logged records in waveform log #1
14	88	4	The number of logged records in waveform log #2
15	92	4	The number of new event log records
16	96	4	The number of new data log #1 records
17	100	4	The number of new data log #2 records
18	104	4	The number of new data log #3 records
19	108	4	The number of new data log #4 records
20	112	4	The number of new data log #5 records
21	116	4	The number of new data log #6 records
22	120	4	The number of new data log #7 records
23	124	4	The number of new data log #8 records
24	128	32	Not used
25	160	4	The number of new waveform log #1records
26	164	4	The number of new waveform log #2 records

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.

4.8 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 point ID	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 point ID	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.

4.9 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	0-15 = channel #1-#16
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Analog channel number	0-15 = channel #1-#16
2	2	4	Output parameter point ID	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	0-15 = channel #1-#16
2	2	4	Output parameter point ID	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				
Output disabled	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
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				
Frequency	0x1002	4	0.01Hz	0 to 10000 [3]
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

Parameter	Point ID	Length	Unit [2]	Scale range [1]
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
Average auxiliary values				
Neutral current	0x1501	8	0.01A	0 to Imax
Frequency	0x1502	4	0.01Hz	0 to 10000 [3]
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.

4.10 Digital Inputs Allocation

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
2-7	Not used

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

4.11 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	0-1 = timer #1-#2
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Timer ID	0-1 = timer #1-#2
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	0-1 = timer #1-#2
2	2	4	Timer interval, sec	1-9999, 0 = disable timer

4.12 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	0-1 (see Table 4-32)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Pulse output ID	0-1 (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	0-1 (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

Table 4-33 Pulsing Output Parameters

Pulsing parameter ID	Identifier
None	0
kWh import	1
kWh export	2
kvarh import	4
kvarh export	5
kvarh total (absolute)	6
kVAh total	7

4.13 User Event Flags Control

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

4.14 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	0-3 (see Table 4-37)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Pulse counter ID	0-3 (see Table 4-37)
2	2	2	Digital input ID	0-1 (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	0-3 (see Table 4-37)
2	2	2	Digital input ID	0-8 (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

Table 4-38 Digital Inputs

Input ID	Description
0	Not allocated
1	Digital input # 1
2	Digital input # 2

4.15 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	See Table 4-41
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Partition number	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 #7 only) 32 = TOU daily profile log (partition #8 only)

Table 4-40 Write Request

Message type (ASCII)				
k				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Partition number	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 #7 only) 32 = TOU daily profile log (partition #8 only)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Partition number	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 "@". 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 #7 and #8 can be configured as TOU monthly and daily profile log partitions respectively. Both will be set as wrap-around partitions. Before configuring 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 name
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 (can be configured as a TOU monthly profile log partition)
8	Data log #8 (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

4.16 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	0-7 = log #1-#8
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Data log number	0-7 = log #1-#8
2	2	2	The number of parameters in the 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	0-7 = log #1-#8
2	2	2	The number of parameters in the 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	0-7 = log #1-#8

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.

4.17 TOU Registers Allocation

Table 4-45 Read Request

Message type (ASCII)				
'P'				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	TOU system register ID	0-10 (see Table 4-47)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	TOU system register ID	0-10 (see Table 4-47)
2	2	2	Register input ID	see Tables 4-48, 4-49
3	4	4	For a pulse input = number of unit-hours per pulse, otherwise - permanently set to 0.	0-9999

Table 4-46 Write Request

Message type (ASCII)				
'p'				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	TOU system register ID	0-10 (see Table 4-47)
2	2	2	Register input ID	see Tables 4-48, 4-49
3	4	4	For a pulse input = number of unit-hours per pulse, otherwise - set to 0.	0-9999

Table 4-47 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

Table 4-48 TOU Energy Registers Inputs

Register input	Input ID
None	0
kWh import	1
kWh export	2
N/A [1]	3
N/A [1]	4
kvarh import	5
kvarh export	6
N/A [1]	7
N/A [1]	8
kVAh total	9
Pulse input #1	10
Pulse input #2	11

1 Specifying this input will be accepted as NONE. No error will occur.

Table 4-49 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

4.18 TOU Daily Profiles

Table 4-50 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	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

Table 4-51 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.

4.19 TOU Calendars

Table 4-52 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 4-53 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'.

4.20 TOU Calendar Years

Table 4-54 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 4-55 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.

4.21 Real Time Clock

Table 4-56 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 4-57 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.

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 2-character (UINT8, 8-bit unsigned byte), 4-character (16-bit unsigned UINT16 or signed INT16 integer) or 8-character (32-bit unsigned UINT32 or signed INT32 long integer) numbers. Negative numbers are transmitted in 2-complement code. Register type in the tables below shows an actual data size for data accessed using variable-size direct read/write requests. When long-size direct read/write request is used, an actual data size is ignored and all registers are transmitted in 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**	**Type**	**Parameter**	**Range**
1	0	UINT16	Start point (register) ID to read	0x0000 - 0xFFFF
2	4	UINT8	The number of contiguous data items to read	1-30 (0x01 - 0x1E)
Response				
Field	**Offset**	**Type**	**Parameter**	**Range**
1	0	UINT8	Number of data items in the message	1-30 (0x01 - 0x1E)
2	2	INT32	Data #1 value	
3	10	INT32	Data #2 value	
...	...	...	...	
31	234	INT32	Data #30 value	

Table 5-2 Write Request

Message type (ASCII)				
'a'				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Type**	**Parameter**	**Range**
1	0	UINT16	Point (register) ID to write	0x0000 - 0xFFFF
2	4	INT32	Data value to write	

In long-size direct read/write messages, all data items are read and written as long unsigned (UINT32) or signed (INT32) integers, which are represented in messages by 8-digit hexadecimal numbers, regardless of the actual data size.

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**	**Type**	**Parameter**	**Range**
1	0	UINT16	Start point (register) ID to read	0x0000 - 0xFFFF
2	4	UINT8	The number of contiguous data items to read	1-61 (0x01-0x3D)
Response				
Field	**Offset**	**Type**	**Parameter**	**Range**
1	0	UINT8	Number of data items in the message	1-61 (0x01-0x3D)
2	2	INT8/16/32	Data #1 value	
3		INT8/16/32	Data #2 value	
...	...	...	...	
60		INT8/16/32	Data #60 value	

Table 5-4 Write Request

Message type (ASCII)				
'x'				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Type**	**Parameter**	**Range**
1	0	UINT16	Start point (register) ID to write	0x0000 - 0xFFFF
2	4	UINT8	The number of contiguous data items to write	1-61 (0x01-0x3D)
3	6	INT8/16/32	Data #1 value	
4		INT8/16/32	Data #2 value	
...	...	...	...	
60		INT8/16/32	Data #60 value	
Request				
Field	**Offset**	**Type**	**Parameter**	**Range**
1	0	UINT16	Start point (register) ID written	0x0000 - 0xFFFF
2	4	UINT8	The number of data items written	1-61 (0x01-0x3D)

With variable-size direct read/write messages, data items are read and written as 2, 4 or 8-character hexadecimal numbers. The actual data size is indicated for each data location. When written, the data 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 addresses 0x8000 to 0x8077 (see Table 5-5). You can map any of these registers to either register address, 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 addresses of the user assignable registers, which are accessed via points 0x8000 to 0x8077, are specified in the user assignable register map. It occupies addresses 0x8100 to 0x8177 (see Table 5-6), where the map register 0x8100 should contain the actual address of the register accessed via assignable register 0x8000, register 0x8101 should contain the actual address of the register accessed via assignable register 0x8001, and so on. Note that the user assignable registers and the user register map addresses may not be re-mapped.

Table 5-5 User Assignable Registers

Register	Register contents	Type	R/W	Range
0x8000	Assigned register #0	[1]	[1]	[1]
0x8001	Assigned register #1	[1]	[1]	[1]
…	...	...		
0x8077	Assigned register #119	[1]	[1]	[1]

[1] depends on the mapped register

Table 5-6 User Assignable Register Map

Register	Register contents	Type	R/W	Range
0x8100	Mapped address for register 0x8000	UINT16	R/W	0x0000 - 0xFFFF
0x8101	Mapped address for register 0x8001	UINT16	R/W	0x0000 - 0xFFFF
...	...	...		
0x8177	Mapped address for register 0x8077	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 registers 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 0x8000, and the kWh reading in register 0x8001.

5.2 Extended Data Registers

Table 5-7 Extended Data Table

Parameter	Point ID	Type	R/W	Unit	Range [1]
None					
None	0x0000	UINT16	R		0
Event flags					
Event flags (bitmap)	0x0300	UINT16	R		see Table 4-13
Status inputs					
Status inputs (bitmap)	0x0600	UINT16	R		see Table 4-14
Relays					
Relay status (bitmap)	0x0800	UINT16	R		see Table 4-12
Pulse counters					
Pulse counter #1	0x0A00	UINT32	R/W		0 to 999999
Pulse counter #2	0x0A01	UINT32	R/W		0 to 999999
Pulse counter #3	0x0A02	UINT32	R/W		0 to 999999
Pulse counter #4	0x0A03	UINT32	R/W		0 to 999999
Real-time values per phase					
Voltage L1/L12 [6]	0x0C00	UINT32	R	0.1V/1V	0 to Vmax
Voltage L2/L23 [6]	0x0C01	UINT32	R	0.1V/1V	0 to Vmax
Voltage L3/L31 [6]	0x0C02	UINT32	R	0.1V/1V	0 to Vmax
Current L1	0x0C03	UINT32	R	0.01A	0 to Imax
Current L2	0x0C04	UINT32	R	0.01A	0 to Imax
Current L3	0x0C05	UINT32	R	0.01A	0 to Imax
kW L1	0x0C06	INT32	R	0.001kW/1kW	-Pmax to Pmax
kW L2	0x0C07	INT32	R	0.001kW/1kW	-Pmax to Pmax
kW L3	0x0C08	INT32	R	0.001kW/1kW	-Pmax to Pmax
kvar L1	0x0C09	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L2	0x0C0A	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L3	0x0C0B	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
kVA L1	0x0C0C	UINT32	R	0.001kVA/1kVA	0 to Pmax
kVA L2	0x0C0D	UINT32	R	0.001kVA/1kVA	0 to Pmax
kVA L3	0x0C0E	UINT32	R	0.001kVA/1kVA	0 to Pmax
Power factor L1	0x0C0F	INT16	R	0.001	-999 to 1000
Power factor L2	0x0C10	INT16	R	0.001	-999 to 1000
Power factor L3	0x0C11	INT16	R	0.001	-999 to 1000
Voltage THD L1/L12	0x0C12	UINT16	R	0.1%	0 to 9999
Voltage THD L2/L23	0x0C13	UINT16	R	0.1%	0 to 9999
Voltage THD L3	0x0C14	UINT16	R	0.1%	0 to 9999
Current THD L1	0x0C15	UINT16	R	0.1%	0 to 9999
Current THD L2	0x0C16	UINT16	R	0.1%	0 to 9999
Current THD L3	0x0C17	UINT16	R	0.1%	0 to 9999
K-Factor L1	0x0C18	UINT16	R	0.1	10 to 9999
K-Factor L2	0x0C19	UINT16	R	0.1	10 to 9999
K-Factor L3	0x0C1A	UINT16	R	0.1	10 to 9999
Current TDD L1	0x0C1B	UINT16	R	0.1%	0 to 1000
Current TDD L2	0x0C1C	UINT16	R	0.1%	0 to 1000
Current TDD L3	0x0C1D	UINT16	R	0.1%	0 to 1000
Voltage L12	0x0C1E	UINT32	R	0.1V/1V	0 to Vmax
Voltage L23	0x0C1F	UINT32	R	0.1V/1V	0 to Vmax
Voltage L31	0x0C20	UINT32	R	0.1V/1V	0 to Vmax
Real-time total values					
Total kW	0x0F00	INT32	R	0.001kW/1kW	-Pmax to Pmax
Total kvar	0x0F01	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0x0F02	UINT32	R	0.001kVA/1kVA	0 to Pmax
Total PF	0x0F03	INT16	R	0.001	-999 to 1000
Real-time auxiliary values					
Reserved	0x1000	UINT32	R		0
Neutral current	0x1001	UINT32	R	0.01A	0 to Imax
Frequency	0x1002	UINT16	R	0.01Hz	0 to 10000 [4]
Voltage unbalance	0x1003	UINT16	R	1%	0 to 300
Current unbalance	0x1004	UINT16	R	1%	0 to 300

Parameter	Point ID	Type	R/W	Unit	Range [1]
Average values per phase					
Voltage L1/L12 [6]	0x1100	UINT32	R	0.1V/1V	0 to Vmax
Voltage L2/L23 [6]	0x1101	UINT32	R	0.1V/1V	0 to Vmax
Voltage L3/L31 [6]	0x1102	UINT32	R	0.1V/1V	0 to Vmax
Current L1	0x1103	UINT32	R	0.01A	0 to Imax
Current L2	0x1104	UINT32	R	0.01A	0 to Imax
Current L3	0x1105	UINT32	R	0.01A	0 to Imax
kW L1	0x1106	INT32	R	0.001kW/1kW	-Pmax to Pmax
kW L2	0x1107	INT32	R	0.001kW/1kW	-Pmax to Pmax
kW L3	0x1108	INT32	R	0.001kW/1kW	-Pmax to Pmax
kvar L1	0x1109	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L2	0x110A	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L3	0x110B	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
kVA L1	0x110C	UINT32	R	0.001kVA/1kVA	0 to Pmax
kVA L2	0x110D	UINT32	R	0.001kVA/1kVA	0 to Pmax
kVA L3	0x110E	UINT32	R	0.001kVA/1kVA	0 to Pmax
Power factor L1	0x110F	INT16	R	0.001	-999 to 1000
Power factor L2	0x1110	INT16	R	0.001	-999 to 1000
Power factor L3	0x1111	INT16	R	0.001	-999 to 1000
Voltage THD L1/L12	0x1112	UINT16	R	0.1%	0 to 9999
Voltage THD L2/L23	0x1113	UINT16	R	0.1%	0 to 9999
Voltage THD L3	0x1114	UINT16	R	0.1%	0 to 9999
Current THD L1	0x1115	UINT16	R	0.1%	0 to 9999
Current THD L2	0x1116	UINT16	R	0.1%	0 to 9999
Current THD L3	0x1117	UINT16	R	0.1%	0 to 9999
K-Factor L1	0x1118	UINT16	R	0.1	10 to 9999
K-Factor L2	0x1119	UINT16	R	0.1	10 to 9999
K-Factor L3	0x111A	UINT16	R	0.1	10 to 9999
Current TDD L1	0x111B	UINT16	R	0.1%	0 to 1000
Current TDD L2	0x111C	UINT16	R	0.1%	0 to 1000
Current TDD L3	0x111D	UINT16	R	0.1%	0 to 1000
Voltage L12	0x111E	UINT32	R	0.1V/1V	0 to Vmax
Voltage L23	0x111F	UINT32	R	0.1V/1V	0 to Vmax
Voltage L31	0x1120	UINT32	R	0.1V/1V	0 to Vmax
Average total values					
Total kW	0x1400	INT32	R	0.001kW/1kW	-Pmax to Pmax
Total kvar	0x1401	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0x1402	UINT32	R	0.001kVA/1kVA	0 to Pmax
Total PF	0x1403	INT16	R	0.001	-999 to 1000
Average auxiliary values					
Reserved	0x1500	UINT32	R		0
Neutral current	0x1501	UINT32	R	0.01A	0 to Imax
Frequency	0x1502	UINT16	R	0.01Hz	0 to 10000 [4]
Voltage unbalance	0x1503	UINT16	R	1%	0 to 300
Current unbalance	0x1504	UINT16	R	1%	0 to 300
Present demands					
Volt demand L1/L12 [6]	0x1600	UINT32	R	0.1V/1V	0 to Vmax
Volt demand L2/L23 [6]	0x1601	UINT32	R	0.1V/1V	0 to Vmax
Volt demand L3/L31 [6]	0x1602	UINT32	R	0.1V/1V	0 to Vmax
Ampere demand L1	0x1603	UINT32	R	0.01A	0 to Imax
Ampere demand L2	0x1604	UINT32	R	0.01A	0 to Imax
Ampere demand L3	0x1605	UINT32	R	0.01A	0 to Imax
Block kW import demand	0x1606	UINT32	R	0.001kW/1kW	0 to Pmax
Block kvar import demand	0x1607	UINT32	R	0.001kvar/1kvar	0 to Pmax
Block kVA demand	0x1608	UINT32	R	0.001kVA/1kVA	0 to Pmax
Sliding window kW import demand	0x1609	UINT32	R	0.001kW/1kW	0 to Pmax
Sliding window kvar import demand	0x160A	UINT32	R	0.001kvar/1kvar	0 to Pmax
Sliding window kVA demand	0x160B	UINT32	R	0.001kVA/1kVA	0 to Pmax
Reserved	0x160C	UINT32	R		0
Reserved	0x160D	UINT32	R		0
Reserved	0x160E	UINT32	R		0
Accumulated kW import demand	0x160F	UINT32	R	0.001kW/1kW	0 to Pmax
Accumulated kvar import demand	0x1610	UINT32	R	0.001kvar/1kvar	0 to Pmax

Parameter	Point ID	Type	R/W	Unit	Range [1]
Accumulated kVA demand	0x1611	UINT32	R	0.001kVA/1kVA	0 to Pmax
Predicted sliding window kW import demand	0x1612	UINT32	R	0.001kW/1kW	0 to Pmax
Predicted sliding window kvar import demand	0x1613	UINT32	R	0.001kvar/1kvar	0 to Pmax
Predicted sliding window kVA demand	0x1614	UINT32	R	0.001kVA/1kVA	0 to Pmax
PF (import) at maximum sliding window kVA demand	0x1615	UINT16	R	0.001	0 to 1000
Block kW export demand	0x1616	UINT32	R	0.001kW/1kW	0 to Pmax
Block kvar export demand	0x1617	UINT32	R	0.001kvar/1kvar	0 to Pmax
Sliding window kW export demand	0x1618	UINT32	R	0.001kW/1kW	0 to Pmax
Sliding window kvar export demand	0x1619	UINT32	R	0.001kvar/1kvar	0 to Pmax
Accumulated kW export demand	0x161A	UINT32	R	0.001kW/1kW	0 to Pmax
Accumulated kvar export demand	0x161B	UINT32	R	0.001kvar/1kvar	0 to Pmax
Predicted sliding window kW export demand	0x161C	UINT32	R	0.001kW/1kW	0 to Pmax
Predicted sliding window kvar export demand	0x161D	UINT32	R	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
Reserved	0x1702-0x1703	UINT32	R		0
kvarh import	0x1704	UINT32	R	kvarh	0 to 10^9-1
kvarh export	0x1705	UINT32	R	kvarh	0 to 10^9-1
Reserved	0x1706-0x1707	UINT32	R		0
kVAh total	0x1708	UINT32	R	kVAh	0 to 10^9-1
Reserved	0x1709-0x170C	UINT32	R		0
Harmonic kWh import	0x170D	UINT32	R	kWh	0 to 10^9-1
Harmonic kWh export	0x170E	UINT32	R	kWh	0 to 10^9-1
Reserved	0x170F-0x1710	UINT32	R		0
Harmonic kVAh	0x1711	UINT32	R	kVAh	0 to 10^9-1
Phase energies					
kWh import L1	0x1800	UINT32	R	kWh	0 to 10^9-1
kWh import L2	0x1801	UINT32	R	kWh	0 to 10^9-1
kWh import L3	0x1802	UINT32	R	kWh	0 to 10^9-1
kvarh import (inductive) L1	0x1803	UINT32	R	kvarh	0 to 10^9-1
kvarh import (inductive) L2	0x1804	UINT32	R	kvarh	0 to 10^9-1
kvarh import (inductive) L3	0x1805	UINT32	R	kvarh	0 to 10^9-1
kVAh L1	0x1806	UINT32	R	kVAh	0 to 10^9-1
kVAh L2	0x1807	UINT32	R	kVAh	0 to 10^9-1
kVAh L3	0x1808	UINT32	R	kVAh	0 to 10^9-1
L1/L12 voltage harmonics					
Harmonic H01	0x1900	UINT16	R	0.01%	0 to 10000
Harmonic H02	0x1901	UINT16	R	0.01%	0 to 10000
...	...				
Harmonic H40	0x193E	UINT16	R	0.01%	0 to 10000
L2/L23 voltage harmonics					
Harmonic H01	0x1A00	UINT16	R	0.01%	0 to 10000
Harmonic H02	0x1A01	UINT16	R	0.01%	0 to 10000
...	...				
Harmonic H40	0x1A3E	UINT16	R	0.01%	0 to 10000
L3 voltage harmonics					
Harmonic H01	0x1B00	UINT16	R	0.01%	0 to 10000
Harmonic H02	0x1B01	UINT16	R	0.01%	0 to 10000
...	...				
Harmonic H40	0x1B3E	UINT16	R	0.01%	0 to 10000

Parameter	Point ID	Type	R/W	Unit	Range [1]
L1 current harmonics					
Harmonic H01	0x1C00	UINT16	R	0.01%	0 to 10000
Harmonic H02	0x1C01	UINT16	R	0.01%	0 to 10000
...	...				
Harmonic H40	0x1C3E	UINT16	R	0.01%	0 to 10000
L2 current harmonics					
Harmonic H01	0x1D00	UINT16	R	0.01%	0 to 10000
Harmonic H02	0x1D01	UINT16	R	0.01%	0 to 10000
...	...				
Harmonic H40	0x1D3E	UINT16	R	0.01%	0 to 10000
L3 current harmonics					
Harmonic H01	0x1E00	UINT16	R	0.01%	0 to 10000
Harmonic H02	0x1E01	UINT16	R	0.01%	0 to 10000
...	...				
Harmonic H40	0x1E3E	UINT16	R	0.01%	0 to 10000
Fundamental's (H01) real-time values per phase					
Voltage L1/L12	0x2900	UINT32	R	0.1V/1V	0 to Vmax
Voltage L2/L23	0x2901	UINT32	R	0.1V/1V	0 to Vmax
Voltage L3/L31	0x2902	UINT32	R	0.1V/1V	0 to Vmax
Current L1	0x2903	UINT32	R	0.01A	0 to Imax
Current L2	0x2904	UINT32	R	0.01A	0 to Imax
Current L3	0x2905	UINT32	R	0.01A	0 to Imax
kW L1	0x2906	INT32	R	0.001kW/1kW	-Pmax to Pmax
kW L2	0x2907	INT32	R	0.001kW/1kW	-Pmax to Pmax
kW L3	0x2908	INT32	R	0.001kW/1kW	-Pmax to Pmax
kvar L1	0x2909	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L2	0x290A	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L3	0x290B	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
kVA L1	0x290C	UINT32	R	0.001kVA/1kVA	0 to Pmax
kVA L2	0x290D	UINT32	R	0.001kVA/1kVA	0 to Pmax
kVA L3	0x290E	UINT32	R	0.001kVA/1kVA	0 to Pmax
Power factor L1	0x290F	INT16	R	0.001	-999 to 1000
Power factor L2	0x2910	INT16	R	0.001	-999 to 1000
Power factor L3	0x2911	INT16	R	0.001	-999 to 1000
Harmonic real-time total values					
Total fundamental kW	0x2A00	INT32	R	0.001kW/1kW	-Pmax to Pmax
Total fundamental kvar	0x2A01	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
Total fundamental kVA	0x2A02	UINT32	R	0.001kVA/1kVA	0 to Pmax
Total fundamental PF	0x2A03	INT16	R	0.001	-999 to 1000
Total harmonic kW	0x2A04	INT32	R	0.001kW/1kW	-Pmax to Pmax
Reserved	0x2A05	INT32	R	0	
Total harmonic kVA	0x2A06	UINT32	R	0.001kVA/1kVA	0 to Pmax
Reserved	0x2A07	INT16	R	0	
Minimum real-time values per phase (M)					
Voltage L1/L12 [6]	0x2C00	UINT32	R	0.1V/1V	0 to Vmax
Voltage L2/L23 [6]	0x2C01	UINT32	R	0.1V/1V	0 to Vmax
Voltage L3/L31 [6]	0x2C02	UINT32	R	0.1V/1V	0 to Vmax
Current L1	0x2C03	UINT32	R	0.01A	0 to Imax
Current L2	0x2C04	UINT32	R	0.01A	0 to Imax
Current L3	0x2C05	UINT32	R	0.01A	0 to Imax
Reserved					0
Voltage THD L1/L12	0x2C12	UINT16	R	0.1%	0 to 9999
Voltage THD L2/L23	0x2C13	UINT16	R	0.1%	0 to 9999
Voltage THD L3/L31	0x2C14	UINT16	R	0.1%	0 to 9999
Current THD L1	0x2C15	UINT16	R	0.1%	0 to 9999
Current THD L2	0x2C16	UINT16	R	0.1%	0 to 9999
Current THD L3	0x2C17	UINT16	R	0.1%	0 to 9999
K-Factor L1	0x2C18	UINT16	R	0.1	10 to 9999
K-Factor L2	0x2C19	UINT16	R	0.1	10 to 9999
K-Factor L3	0x2C1A	UINT16	R	0.1	10 to 9999
Current TDD L1	0x2C1B	UINT16	R	0.1%	0 to 1000
Current TDD L2	0x2C1C	UINT16	R	0.1%	0 to 1000
Current TDD L3	0x2C1D	UINT16	R	0.1%	0 to 1000

Parameter	Point ID	Type	R/W	Unit	Range [1]
Minimum real-time total values (M)					
Total kW	0x2D00	INT32	R	0.001kW/1kW	-Pmax to Pmax
Total kvar	0x2D01	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0x2D02	UINT32	R	0.001kVA/1kVA	0 to Pmax
Total PF [3]	0x2D03	UINT16	R	0.001	0 to 1000
Minimum real-time auxiliary values (M)					
Reserved	0x2E00	UINT32	R		0
Neutral current	0x2E01	UINT32	R	0.01A	0 to Imax
Frequency	0x2E02	UINT16	R	0.01Hz	0 to 10000 [4]
Maximum real-time values per phase (M)					
Voltage L1/L12 [6]	0x3400	UINT32	R	0.1V/1V	0 to Vmax
Voltage L2/L23 [6]	0x3401	UINT32	R	0.1V/1V	0 to Vmax
Voltage L3/L31 [6]	0x3402	UINT32	R	0.1V/1V	0 to Vmax
Current L1	0x3403	UINT32	R	0.01A	0 to Imax
Current L2	0x3404	UINT32	R	0.01A	0 to Imax
Current L3	0x3405	UINT32	R	0.01A	0 to Imax
Reserved					0
Voltage THD L1/L12	0x3412	UINT16	R	0.1%	0 to 9999
Voltage THD L2/L23	0x3413	UINT16	R	0.1%	0 to 9999
Voltage THD L3/L31	0x3414	UINT16	R	0.1%	0 to 9999
Current THD L1	0x3415	UINT16	R	0.1%	0 to 9999
Current THD L2	0x3416	UINT16	R	0.1%	0 to 9999
Current THD L3	0x3417	UINT16	R	0.1%	0 to 9999
K-Factor L1	0x3418	UINT16	R	0.1	10 to 9999
K-Factor L2	0x3419	UINT16	R	0.1	10 to 9999
K-Factor L3	0x341A	UINT16	R	0.1	10 to 9999
Current TDD L1	0x341B	UINT16	R	0.1%	0 to 1000
Current TDD L2	0x341C	UINT16	R	0.1%	0 to 1000
Current TDD L3	0x341D	UINT16	R	0.1%	0 to 1000
Maximum real-time total values (M)					
Total kW	0x3500	INT32	R	0.001kW/1kW	-Pmax to Pmax
Total kvar	0x3501	INT32	R	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0x3502	UINT32	R	0.001kVA/1kVA	0 to Pmax
Total PF [3]	0x3503	UINT16	R	0.001	0 to 1000
Maximum real-time auxiliary values (M)					
Reserved	0x3600	UINT32	R		0
Neutral current	0x3601	UINT32	R	0.01A	0 to Imax
Frequency	0x3602	UINT16	R	0.01Hz	0 to 10000 [4]
Maximum demands (M)					
Max. volt demand L1/L12 [6]	0x3700	UINT32	R	0.1V/1V	0 to Vmax
Max. volt demand L2/L23 [6]	0x3701	UINT32	R	0.1V/1V	0 to Vmax
Max. volt demand L3/L31 [6]	0x3702	UINT32	R	0.1V/1V	0 to Vmax
Max. ampere demand L1	0x3703	UINT32	R	0.01A	0 to Imax
Max. ampere demand L2	0x3704	UINT32	R	0.01A	0 to Imax
Max. ampere demand L3	0x3705	UINT32	R	0.01A	0 to Imax
Reserved	0x3706- 0x3708	UINT32	R		0
Max. sliding window kW import demand	0x3709	UINT32	R	0.001kW/1kW	0 to Pmax
Max. sliding window kvar import demand	0x370A	UINT32	R	0.001kvar/1kvar	0 to Pmax
Max. sliding window kVA demand	0x370B	UINT32	R	0.001kVA/1kVA	0 to Pmax
Reserved	0x370C- 0x370E-	UINT32	R		0
Max. sliding window kW export demand	0x370F	UINT32	R	0.001kW/1kW	0 to Pmax
Max. sliding window kvar export demand	0x3710	UINT32	R	0.001kvar/1kvar	0 to Pmax
TOU system parameters					
Active tariff	0x3C00	UINT16	R		0 to 15
Active profile	0x3C01	UINT16	R		0 to 15
TOU energy register #1					
Tariff #1 register	0x3D00	UINT32	R	[5]	0 to 10^9-1
Tariff #2 register	0x3D01	UINT32	R	[5]	0 to 10^9-1
...	...				
Tariff #16 register	0x3D0F	UINT32	R	[5]	0 to 10^9-1

Parameter	Point ID	Type	R/W	Unit	Range [1]
TOU energy register #2					
Tariff #1 register	0x3E00	UINT32	R	[5]	0 to 10^9-1
Tariff #2 register	0x3E01	UINT32	R	[5]	0 to 10^9-1
...	...				
Tariff #16 register	0x3E0F	UINT32	R	[5]	0 to 10^9-1
TOU energy register #3					
Tariff #1 register	0x3F00	UINT32	R	[5]	0 to 10^9-1
Tariff #2 register	0x3F01	UINT32	R	[5]	0 to 10^9-1
...	...				
Tariff #16 register	0x3F0F	UINT32	R	[5]	0 to 10^9-1
TOU energy register #4					
Tariff #1 register	0x4000	UINT32	R	[5]	0 to 10^9-1
Tariff #2 register	0x4001	UINT32	R	[5]	0 to 10^9-1
...	...				
Tariff #16 register	0x400F	UINT32	R	[5]	0 to 10^9-1
TOU energy register #5					
Tariff #1 register	0x4100	UINT32	R	[5]	0 to 10^9-1
Tariff #2 register	0x4101	UINT32	R	[5]	0 to 10^9-1
...	...				
Tariff #16 register	0x410F	UINT32	R	[5]	0 to 10^9-1
TOU energy register #6					
Tariff #1 register	0x4200	UINT32	R	[5]	0 to 10^9-1
Tariff #2 register	0x4201	UINT32	R	[5]	0 to 10^9-1
...	...				
Tariff #16 register	0x420F	UINT32	R	[5]	0 to 10^9-1
TOU energy register #7					
Tariff #1 register	0x4300	UINT32	R	[5]	0 to 10^9-1
Tariff #2 register	0x4301	UINT32	R	[5]	0 to 10^9-1
...	...				
Tariff #16 register	0x430F	UINT32	R	[5]	0 to 10^9-1
TOU energy register #8					
Tariff #1 register	0x4400	UINT32	R	[5]	0 to 10^9-1
Tariff #2 register	0x4401	UINT32	R	[5]	0 to 10^9-1
...	...				
Tariff #16 register	0x440F	UINT32	R	[5]	0 to 10^9-1
TOU maximum demand register #1 (M)					
Tariff #1 register	0x4800	UINT32	R	[5]	0 to Pmax
Tariff #2 register	0x4801	UINT32	R	[5]	0 to Pmax
...	...				
Tariff #16 register	0x480F	UINT32	R	[5]	0 to Pmax
TOU maximum demand register #2 (M)					
Tariff #1 register	0x4900	UINT32	R	[5]	0 to Pmax
Tariff #2 register	0x4901	UINT32	R	[5]	0 to Pmax
...	...				
Tariff #16 register	0x490F	UINT32	R	[5]	0 to Pmax
TOU maximum demand register #3 (M)					
Tariff #1 register	0x4A00	UINT32	R	[5]	0 to Pmax
Tariff #2 register	0x4A01	UINT32	R	[5]	0 to Pmax
...	...				
Tariff #16 register	0x4A0F	UINT32	R	[5]	0 to Pmax
L1/L12 voltage harmonic angles					
Harmonic H01 angle	0x6400	INT16	R	0.1 degree	-1800 to 1800
Harmonic H02 angle	0x6401	INT16	R	0.1 degree	-1800 to 1800
...	...				
Harmonic H40 angle	0x6427	INT16	R	0.1 degree	-1800 to 1800
L2/L23 voltage harmonic angles					
Harmonic H01 angle	0x6400	INT16	R	0.1 degree	-1800 to 1800
Harmonic H02 angle	0x6401	INT16	R	0.1 degree	-1800 to 1800
...	...				

Parameter	Point ID	Type	R/W	Unit	Range [1]
Harmonic H40 angle	0x6427	INT16	R	0.1 degree	-1800 to 1800
L3 voltage harmonic angles					
Harmonic H01 angle	0x6400	INT16	R	0.1 degree	-1800 to 1800
Harmonic H02 angle	0x6401	INT16	R	0.1 degree	-1800 to 1800
...	...				
Harmonic H40 angle	0x6427	INT16	R	0.1 degree	-1800 to 1800
L1 current harmonic angles					
Harmonic H01 angle	0x6400	INT16	R	0.1 degree	-1800 to 1800
Harmonic H02 angle	0x6401	INT16	R	0.1 degree	-1800 to 1800
...	...				
Harmonic H40 angle	0x6427	INT16	R	0.1 degree	-1800 to 1800
L2 current harmonic angles					
Harmonic H01 angle	0x6400	INT16	R	0.1 degree	-1800 to 1800
Harmonic H02 angle	0x6401	INT16	R	0.1 degree	-1800 to 1800
...	...				
Harmonic H40 angle	0x6427	INT16	R	0.1 degree	-1800 to 1800
L3 current harmonic angles					
Harmonic H01 angle	0x6400	INT16	R	0.1 degree	-1800 to 1800
Harmonic H02 angle	0x6401	INT16	R	0.1 degree	-1800 to 1800
...	...				
Harmonic H40 angle	0x6427	INT16	R	0.1 degree	-1800 to 1800
Generic TOU season tariff energy registers - only as a reference for TOU profile logs					
Season tariff #1 register	0x7000	UINT32		[5]	0 to 10^9-1
Season tariff #2 register	0x7001	UINT32		[5]	0 to 10^9-1
...	...				
Season tariff #16 register	0x700F	UINT32		[5]	0 to 10^9-1
Generic 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

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 TOU energy and TOU maximum demand register unit matches the measurement unit 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.

(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 [2]
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
Reserved	0x8607	UINT16	R	Read as 65535
The number of demand periods	0x8608	UINT16	R/W	1 to 15
Reserved	0x8609	UINT16	R	Read as 65535

Parameter	Register	Type	R/W	Range
The number of pre-event cycles for the waveform log #1	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	0x8609	UINT16	R	Read as 65535
The number of cycles in one waveform series for the waveform log #1 [3]	0x8610	UINT16	R	16 to 1280
Reserved	0x8611	UINT16	R	Read as 65535
Nominal secondary voltage (L-L)	0x8612	UINT16	R/W	10 to 690 V

[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
2LL1 - 2-wire line-to-line connection using 1 PT (1 element)

[2] Synchronization of power demand interval can be made through a digital input.

[3] The waveform recorder logs waveforms in series of records. A compound waveform can have as more as 1280 cycles recorded in 80 consequent records, each record comprising 16 waveform cycles sampled at a rate of 32 samples per cycle.

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
Reserved	0x8705-0x8709	UINT16	R/W	Read as 65535
Harmonic power/energy calculation mode	0x870A	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	Communication protocol	8500h	UINT16	R/W	0 = ASCII 1 = Modbus RTU 3 = DNP3.0
	Interface	8501h	UINT16	R/W	0 = RS-232 1 = RS-422 2 = RS-485
	Address	8502h	UINT16	R/W	0 to 99
	Baud rate	8503h	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	8504h	UINT16	R/W	0 = 7 bits/even parity 1 = 8 bits/no parity 2 = 8 bits/even parity
	Flow control (handshaking)	8505h	UINT16	R/W	0 = no flow control 1 = software(XON/XOFF) 2 = hardware (CTS)
	RTS control	8506h	UINT16	R/W	0 = RTS is not used 1 = RTS is permanently asserted 2 = RTS is controlled by the meter (asserted during the transmission)
	Reserved	8507h	UINT16	R	Read as 65535
	ASCII compatibility mode[1]	8508h	UINT16	R/W	0 = disabled, 1 = enabled (see Note[2] to Table 4-1)
Port #2	Communication protocol	8510h	UINT16	R/W	0 = ASCII 1 = Modbus RTU 3 = DNP3.0
	Interface	8511h	UINT16	R/W	1 = RS-422 2 = RS-485
	Address	8512h	UINT16	R/W	0 to 99
	Baud rate	8513h	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	8514h	UINT16	R/W	0 = 7 bits/even parity 1 = 8 bits/no parity 2 = 8 bits/even parity
	Reserved	8515h-8517h	UINT16	R	Read as 65535
	ASCII compatibility mode[1]	8518h	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	8A00h-8A19h
Setpoint #2	8A1Ah-8A33h
Setpoint #3	8A34h-8A4Dh
Setpoint #4	8A4Eh-8A67h
Setpoint #5	8A68h-8A81h
Setpoint #6	8A82h-8A96h
Setpoint #7	8A9Ch-8AB5h
Setpoint #8	8AB6h-8ACFh
Setpoint #9	8AD0h-8AE9h
Setpoint #10	8AEAh-8B03h
Setpoint #11	8B04h-8B1Dh
Setpoint #12	8B1Eh-8B37h
Setpoint #13	8B38h-8B51h
Setpoint #14	8B52h-8B6Bh
Setpoint #15	8B6Ch-8B85h
Setpoint #16	8B86h-8B9Fh

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 5-13
Relational operator 1	+2	UINT16	R/W	0 (N/A)
Operate limit 1	+3	INT32	R/W	see Table 5-13
Release limit 1	+4	INT32	R/W	see Table 5-13
Logical operator 2	+5	UINT16	R/W	0 = OR, 1 = AND
Trigger ID 2	+6	UINT16	R/W	see Table 5-13
Relational operator 2	+7	UINT16	R/W	0 (N/A)
Operate limit 2	+8	INT32	R/W	see Table 5-13
Release limit 2	+9	INT32	R/W	see Table 5-13
Logical operator 3	+10	UINT16	R/W	0 = OR, 1 = AND
Trigger ID 3	+11	UINT16	R/W	see Table 5-13
Relational operator 3	+12	UINT16	R/W	0 (N/A)
Operate limit 3	+13	INT32	R/W	see Table 5-13
Release limit 3	+14	INT32	R/W	see Table 5-13
Logical operator 4	+15	UINT16	R/W	0 = OR, 1 = AND
Trigger ID 4	+16	UINT16	R/W	see Table 5-13
Relational operator 4	+17	UINT16	R/W	0 (N/A)
Operate limit 4	+18	INT32	R/W	see Table 5-13
Release limit 4	+19	INT32	R/W	see Table 5-13
Action 1	+20	UINT16	R/W	see Table 5-14
Action 2	+21	UINT16	R/W	see Table 5-14
Action 3	+22	UINT16	R/W	see Table 5-14
Action 4	+23	UINT16	R/W	see Table 5-14
Operate delay	+24	UINT16	R/W	0-9999 (×0.1 sec)
Release delay	+25	UINT16	R/W	0-9999 (×0.1 sec)
Reserved	+26, 27	UINT16	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 the trigger parameters and their ranges are indicated in Table 5-13. Limits indicated as N/A are read as zeros. When writing, they can be omitted or should be written as zeros.
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 Setpoint Triggers

Trigger parameter	Trigger ID	Unit [2]	Range [1]
None	0000h		N/A
Internal events			
Voltage disturbance [6]	0x0100	%	1 to 100
Event flags			
Event flag #1 ON	0x0300		N/A
Event flag #2 ON	0x0301		N/A
Event flag #3 ON	0x0302		N/A
Event flag #4 ON	0x0303		N/A
Event flag #5 ON	0x0304		N/A
Event flag #6 ON	0x0305		N/A
Event flag #7 ON	0x0306		N/A
Event flag #8 ON	0x0307		N/A
Event flag #1 OFF	0x8300		N/A
Event flag #2 OFF	0x8301		N/A
Event flag #3 OFF	0x8302		N/A
Event flag #4 OFF	0x8303		N/A
Event flag #5 OFF	0x8304		N/A
Event flag #6 OFF	0x8305		N/A
Event flag #7 OFF	0x8306		N/A
Event flag #8 OFF	0x8307		N/A
Internal events			
kWh import pulse	0x0400		N/A
kWh export pulse	0x0401		N/A
kvarh import pulse	0x0403		N/A
kvarh export pulse	0x0404		N/A
kvarh total pulse	0x0405		N/A
kVAh total pulse	0x0406		N/A
Start new demand interval	0x0407		N/A
Start new tariff interval	0x0408		N/A
Start new volt/ampere demand interval	0x0409		N/A
Start new sliding window demand interval	0x040A		N/A
Timers			
Timer #1	0x0500		N/A
Timer #2	0x0501		N/A
Status inputs			
Status input #1 ON	0x0600		N/A
Status input #2 ON	0x0601		N/A
Status input #1 OFF	0x8600		N/A
Status input #2 OFF	0x8601		N/A
Pulse inputs			
Pulse input #1	0x0700		N/A
Pulse input #2	0x0701		N/A
Relay status			
Relay #1 ON	0x0800		0 to 999999
Relay #2 ON	0x0801		0 to 999999
Relay #1 OFF	0x8800		0 to 999999
Relay #2 OFF	0x8801		0 to 999999
Phase reversal			
Positive phase rotation reversal ③	0x8901		N/A
Negative phase rotation reversal ③	0x8902		N/A
Pulse counters			
High pulse counter #1	0x0A00		0 to 999999
High pulse counter #2	0x0A01		0 to 999999
High pulse counter #3	0x0A02		0 to 999999
High pulse counter #4	0x0A03		0 to 999999

Trigger parameter	Trigger ID	Unit [2]	Range [1]
Time/Date parameters			
Day of week	0x0B02		1-7 (1= Sun, 7=Sat)
Year	0x0B03		0 to 99
Month	0x0B04		1 to 12
Day of month	0x0B05		1 to 31
Hour	0x0B06		0 to 23
Minutes	0x0B07		0 to 59
Seconds	0x0B08		0 to 59
High/low real-time values per phase			
High current L1	0x0C03	0.01A	0 to Imax
High current L2	0x0C04	0.01A	0 to Imax
High current L3	0x0C05	0.01A	0 to Imax
Low current L1	0x8C03	0.01A	0 to Imax
Low current L2	0x8C04	0.01A	0 to Imax
Low current L3	0x8C05	0.01A	0 to Imax
High/low real-time values on any phase			
High voltage [5]	0x0E00	0.1V/1V	0 to Vmax
Low voltage [5]	0x8D00	0.1V/1V	0 to Vmax
High current	0x0E01	0.01A	0 to Imax
Low current	0x8D01	0.01A	0 to Imax
High voltage THD	0x0E07	0.1%	0 to 9999
High current THD	0x0E08	0.1%	0 to 9999
High K-Factor	0x0E09	0.1	10 to 9999
High current TDD	0x0E0A	0.1%	0 to 1000
High/low real-time auxiliary values			
High frequency	0x1002	0.01Hz	0 to 10000 [4]
Low frequency	0x9002	0.01Hz	0 to 10000 [4]
High voltage unbalance [7]	0x1003	1%	0 to 300
High/low average values per phase			
High current L1	0x1103	0.01A	0 to Imax
High current L2	0x1104	0.01A	0 to Imax
High current L3	0x1105	0.01A	0 to Imax
Low current L1	0x9103	0.01A	0 to Imax
Low current L2	0x9104	0.01A	0 to Imax
Low current L3	0x9105	0.01A	0 to Imax
High/low average values on any phase			
High voltage [5]	0x1300	0.1V/1V	0 to Vmax
Low voltage [5]	0x9200	0.1V/1V	0 to Vmax
High current	0x1301	0.01A	0 to Imax
Low current	0x9201	0.01A	0 to Imax
High/low average total values			
High total kW import	0x1406	0.001kW/1kW	0 to Pmax
High total kW export	0x1407	0.001kW/1kW	0 to Pmax
High total kvar import	0x1408	0.001kvar/1kvar	0 to Pmax
High total kvar export	0x1409	0.001kvar/1kvar	0 to Pmax
High total kVA	0x1402	0.001kVA/1kVA	0 to Pmax
Low total PF lag	0x9404	0.001	0 to 1000
Low total PF lead	0x9405	0.001	0 to 1000
High/low average auxiliary values			
High neutral current	0x1501	0.01A	0 to Imax
High frequency	0x1502	0.01Hz	0 to 10000 [4]
Low frequency	0x9502	0.01Hz	0 to 10000 [4]
High voltage unbalance [7]	0x1503	1%	0 to 300
High present demands			
High volt demand L1/L12 [5]	0x1600	0.1V/1V	0 to Vmax
High volt demand L2/L23 [5]	0x1601	0.1V/1V	0 to Vmax
High volt demand L3/L31 [5]	0x1602	0.1V/1V	0 to Vmax
High ampere demand L1	0x1603	0.01A	0 to Imax
High ampere demand L2	0x1604	0.01A	0 to Imax
High ampere demand L3	0x1605	0.01A	0 to Imax
High block kW import demand	0x1606	0.001kW/1kW	0 to Pmax
High block kvar import demand	0x1607	0.001kvar/1kvar	0 to Pmax
High block kVA demand	0x1608	0.001kVA/1kVA	0 to Pmax
High sliding window kW import demand	0x1609	0.001kW/1kW	0 to Pmax

Trigger parameter	Trigger ID	Unit [2]	Range [1]
High sliding window kvar import demand	0x160A	0.001kvar/1kvar	0 to Pmax
High sliding window kVA demand	0x160B	0.001kVA/1kVA	0 to Pmax
High accumulated kW import demand	0x160F	0.001kW/1kW	0 to Pmax
High accumulated kvar import demand	0x1610	0.001kvar/1kvar	0 to Pmax
High accumulated kVA demand	0x1611	0.001kVA/1kVA	0 to Pmax
High predicted kW import demand	0x1612	0.001kW/1kW	0 to Pmax
High predicted kvar import demand	0x1613	0.001kvar/1kvar	0 to Pmax
High predicted kVA demand	0x1614	0.001kVA/1kVA	0 to Pmax
High block kW export demand	0x1616	0.001kW/1kW	0 to Pmax
High block kvar export demand	0x1617	0.001kvar/1kvar	0 to Pmax
High sliding window kW export demand	0x1618	0.001kW/1kW	0 to Pmax
High sliding window kvar export demand	0x1619	0.001kvar/1kvar	0 to Pmax
High accumulated kW export demand	0x161A	0.001kW/1kW	0 to Pmax
High accumulated kvar export demand	0x161B	0.001kvar/1kvar	0 to Pmax
High predicted kW export demand	0x161C	0.001kW/1kW	0 to Pmax
High predicted kvar export demand	0x161D	0.001kvar/1kvar	0 to Pmax
Setpoint status			
Setpoint #1 ON	0x7C00		N/A
Setpoint #2 ON	0x7C01		N/A
Setpoint #3 ON	0x7C02		N/A
Setpoint #4 ON	0x7C03		N/A
Setpoint #5 ON	0x7C04		N/A
Setpoint #6 ON	0x7C05		N/A
Setpoint #7 ON	0x7C06		N/A
Setpoint #8 ON	0x7C07		N/A
Setpoint #9 ON	0x7C08		N/A
Setpoint #10 ON	0x7C09		N/A
Setpoint #11 ON	0x7C0A		N/A
Setpoint #12 ON	0x7C0B		N/A
Setpoint #13 ON	0x7C0C		N/A
Setpoint #14 ON	0x7C0D		N/A
Setpoint #15 ON	0x7C0E		N/A
Setpoint #16 ON	0x7C0F		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 The setpoint is operated when the actual phase sequence does not match the indicated phase rotation

4 The actual frequency range is 45.00 - 65.00 Hz

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.

6 Operate limit for the voltage disturbance trigger specifies the voltage deviation allowed in percentage of the nominal secondary line-to-line voltage. The tested voltage refers to line-to-line voltage in 3OP2 and 3OP3 wiring modes, and to line-to-neutral voltage in other modes. See Section 5.3, Basic Setup, for information on setting the nominal voltage in your meter.

7 Available in Version 4.93.2 or later.

Table 5-14 Setpoint Actions

Action	ID
No action	0x0000
Set event flag #1	0x2000
Set event flag #2	0x2001
Set event flag #3	0x2002
Set event flag #4	0x2003
Clear event flag #1	0x2100
Clear event flag #2	0x2101
Clear event flag #3	0x2102
Clear event flag #4	0x2103
Operate relay #1 [1]	0x3000
Operate relay #2 [1]	0x3001
Increment counter #1	0x4000
Increment counter #2	0x4001

Action	ID
Increment counter #3	0x4002
Increment counter #4	0x4003
Clear counter #1	0x4200
Clear counter #2	0x4201
Clear counter #3	0x4202
Clear counter #4	0x4203
Clear all counters	0x6400
Reset total energy	0x6000
Reset all total maximum demands	0x6100
Reset power maximum demands	0x6101
Reset volt/ampere maximum demands	0x6102
Reset TOU energy	0x6200
Reset TOU maximum demands	0x6300
Clear Min/Max registers	0x6500
Event log [2]	0x7002
Data log #1	0x7100
Data log #2	0x7101
Data log #3	0x7102
Data log #4	0x7103
Data log #5	0x7104
Data log #6	0x7105
Data log #7	0x7106
Data log #8	0x7107
Waveform log #1	0x7200
Waveform log #2	0x7300

1 Operate/release actions via relays are automatically recorded to the event log whenever an electrical quantity, status input, or phase reversal trigger is used.

2 Either setpoint transition (both operate and release) is recorded to the event log.

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

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	Direction	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
	2-5	Zeros
	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	N/A
	12	Setup is secured by a password (see Section 3.4)
	13	ASCII compatibility mode is 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
	9-13	N/A
	14-15	Memory module: 10 = 512 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
Active serial port number	0x7D05	UINT16	R	0 = Port 1, 1 = Port 2
Battery status	0x7D06	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	0x7E00	UINT16	R/W	see Table 5-21
Self-check alarm status	0x7E01	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 in Version 4.93.2 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, 1-4 = counter #1 - #4
Clear Min/Max log	0xA005	UINT16	W	0
Clear event log	0xA006	UINT16	W	0
Clear data log	0xA007	UINT16	W	0-7 = data log #1 - #8, 16 = all data logs
Clear waveform log #1	0xA008	UINT16		0
Clear waveform log #2	0xA009	UINT16		0
Reserved	0xA00A	UINT16		
Restore event log read pointer	0xA00B	UINT16	W	0
Restore data log read pointer	0xA00C	UINT16	W	0-7 = data log #1 - #8 16-23, 32-34 = monthly profile data log #7 (the same as 6) 48-55, 64-66 = daily profile data log #8 (the same as 7)
Restore waveform log #1 read pointer	0xA00D	UINT16	W	0

Action	Register	Type	R/W	Range
Restore waveform log #2 read pointer	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 524288
Free memory size, Bytes	0xA0F1	UINT32	R	0 to 524288
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
Reserved	9-16
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
Reserved	8 - 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 - 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
Reserved	0xA148-0xA1FF
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
Reserved	0xA240-0xA187
Waveform log #1	0xA188-0xA18F
Waveform log #2	0xA190-0xA197
Reserved	0xA198-0xA27F
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
Reserved	0xA340-0xA37F
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 #7 is configured as a TOU monthly profile partition, registers 0xA138-0xA13F 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 #8 is configured as a TOU daily profile partition, registers 0xA140-0xA147 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.
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

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 CD80h through CDAFh. 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	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 cause	+4	UINT16	R	see Table 5-46
Log value [2]	+5	INT32	R	see Table 5-46
Event effect	+6	UINT16	R	see Table 5-46
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)		
Setpoint event	Trigger parameter ID high byte (see Table 5-13)	Trigger parameter ID low byte (see Table 5-13)	Trigger parameter value (see Table 5-13)	0xE100-0xE10F, 0xE200-0xE20F (see Table 5-32)
Communications	0x5B	Data location code (see Table 5-31)	N/A	See Table 5-32
Front panel	0x5C	Data location code (see Table 5-31)	N/A	See Table 5-32
Self-check	0x5D	Data location code (see Table 5-31)	N/A	See Table 5-32
Self-update	0x5E	8 = RTC	N/A	0xF500 = RTC set
External event	0x63	0 = power down, 8 = power up	N/A	N/A

Table 5-31 Data Location Codes

Location code	Description
3	Data keeping memory
4	Factory setup
5	Access setup
6	Basic setup
7	Communications setup
8	Real-time clock
9	Digital inputs allocation
10	Pulse counters allocation
11	Analog output setup
12	Analog expander setup
14	Timers setup
15	Display options
16	Event/alarm setpoints
17	Pulsing setpoints
18	User assignable register map
20	Data log setup
21	Memory partitions setup
22	TOU energy registers setup
23	TOU demand registers setup
24	TOU daily profiles
25	TOU calendar
26	TOU calendar years
27	Relay control registers
28	User selectable options
31	DNP 3.0 class 0 map
32	DNP 3.0 options setup
33	DNP 3.0 events setup
34	DNP 3.0 event setpoints
35	Calibration registers
36	Time zone information

Table 5-32 Event Effect Codes

Effect code	Description
0x6000	Clear energy registers
0x6100	Clear all demand registers
0x6101	Clear power demand registers
0x6100	Clear volt/ampere demand registers
0x6200	Clear TOU energy registers
0x6300	Clear TOU demand registers
0x6400	Clear all counters
0x6401-0x6404	Clear counters #1-#4
0x6500	Clear Min/Max log registers
0x6600	Clear Event log
0x6700-0x6707	Clear Data log #1-#8
0x6700	Clear all data logs
0x6800	Clear Waveform log #1
0x6900	Clear Waveform log #2
0xE100-0xE10F	Setpoint #1-#16 operated
0xE200-0xE20F	Setpoint #1-#16 released
0xF100-0xF10F	Setpoint #1-#16 cleared
0xF500	RTC set

5.15 Data Log Registers

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 5-33 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 #8	0xC0A8-0xC0BF
Reserved	0xC0C0-0xC17F
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
Reserved	0xC240-0xC2FF
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
Reserved	0xC540-0xC5FF
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 #7 is configured as a TOU monthly profile partition, registers 0xC090-0xC0A7 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 #8 is configured as a TOU daily profile partition, registers 0xC0A8-0xC0BF 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 5-34 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	+21-23	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 Waveform Capture/Log Registers

Table 5-35 Waveform Header Windows

Waveform header window	Registers (see Tables 5-36 - 5-37)
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 5-36 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 80 contiguous records of a compound waveform
The record sequence number in the waveform series	+6	UINT16	R	0 to 79
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	UINT16	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, 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:

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

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 5-37 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 - the Waveform log #1 (16 cycles x 32 samples per cycle records), and the Waveform log #2 (4 cycles x 128 samples per cycle records). The waveform samples are read via the register window 0xD000-0xD1FF (see Table 5-37) 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 5-35).

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 logs contain waveform records sampled at high (128 samples per cycle in Waveform log #2) or lower sampling 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.

5.17 Min/Max Log Registers

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

Table 5-38 Min/Max Log Registers

Parameter	Register	Type	Unit[2]	Range[1]
Minimum real-time values per phase				
Min. Voltage L1/L12 [6]	0xB000	UINT32	0.1V/1V	0 to Vmax
Timestamp	0xB001	UINT32		
Min. Voltage L2/L23 [6]	0xB002	UINT32	0.1V/1V	0 to Vmax
Timestamp	0xB003	UINT32		
Min. Voltage L3/L31 [6]	0xB004	UINT32	0.1V/1V	0 to Vmax
Timestamp	0xB005	UINT32		
Min. Current L1	0xB006	UINT32	0.01A	0 to Imax
Timestamp	0xB007	UINT32		
Min. Current L2	0xB008	UINT32	0.01A	0 to Imax
Timestamp	0xB009	UINT32		
Min. Current L3	0xB00A	UINT32	0.01A	0 to Imax
Timestamp	0xB00B	UINT32		
Reserved				
Min. Voltage THD L1/L12	0xB024	UINT32	0.1%	0 to 9999
Timestamp	0xB025	UINT32		
Min. Voltage THD L2/L23	0xB026	UINT32	0.1%	0 to 9999
Timestamp	0xB027	UINT32		
Min. Voltage THD L3/L31	0xB028	UINT32	0.1%	0 to 9999
Timestamp	0xB029	UINT32		
Min. Current THD L1	0xB02A	UINT32	0.1%	0 to 9999
Timestamp	0xB02B	UINT32		
Min. Current THD L2	0xB02C	UINT32	0.1%	0 to 9999
Timestamp	0xB02D	UINT32		
Min. Current THD L3	0xB02E	UINT32	0.1%	0 to 9999
Timestamp	0xB02F	UINT32		
Min. Current K-Factor L1	0xB030	UINT32	0.1	10 to 9999
Timestamp	0xB031	UINT32		
Min. Current K-Factor L2	0xB032	UINT32	0.1	10 to 9999
Timestamp	0xB033	UINT32		
Min. Current K-Factor L3	0xB034	UINT32	0.1	10 to 9999
Timestamp	0xB035	UINT32		
Min. Current TDD L1	0xB036	UINT32	0.1%	0 to 1000
Timestamp	0xB037	UINT32		
Min. Current TDD L2	0xB038	UINT32	0.1%	0 to 1000
Timestamp	0xB039	UINT32		
Min. Current TDD L3	0xB03A	UINT32	0.1%	0 to 1000
Timestamp	0xB03B	UINT32		
Minimum real-time total values				
Min. Total kW	0xB080	INT32	0.001kW/1kW	-Pmax to Pmax
Timestamp	0xB081	UINT32		
Min. Total kvar	0xB082	INT32	0.001kvar/1kvar	-Pmax to Pmax
Timestamp	0xB083	UINT32		
Min. Total kVA	0xB084	UINT32	0.001kVA/1kVA	0 to Pmax
Timestamp	0xB085	UINT32		
Total PF [3]	0xB086	UINT32	0.001	0 to 1000
Timestamp	0xB087	UINT32		
Minimum real-time auxiliary values				
Reserved	0xB100-0xB101			0
Min. Neutral current	0xB102	UINT32	0.01A	0 to Imax
Timestamp	0xB103	UINT32		
Min. Frequency	0xB104	UINT32	0.01Hz	0 to 10000 [4]
Timestamp	0xB105	UINT32		

Parameter	Register	Type	Unit[2]	Range[1]
Maximum real-time values per phase				
Max. Voltage L1/L12 [6]	0xB200	UINT32	0.1V/1V	0 to Vmax
Timestamp	0xB201	UINT32		
Max. Voltage L2/L23 [6]	0xB202	UINT32	0.1V/1V	0 to Vmax
Timestamp	0xB203	UINT32		
Max. Voltage L3/L31 [6]	0xB204	UINT32	0.1V/1V	0 to Vmax
Timestamp	0xB205	UINT32		
Max. Current L1	0xB206	UINT32	0.01A	0 to Imax
Timestamp	0xB207	UINT32		
Max. Current L2	0xB208	UINT32	0.01A	0 to Imax
Timestamp	0xB209	UINT32		
Max. Current L3	0xB20A	UINT32	0.01A	0 to Imax
Timestamp	0xB20B	UINT32		
Reserved				
Max. Voltage THD L1/L12	0xB224	UINT32	0.1%	0 to 9999
Timestamp	0xB225	UINT32		
Max. Voltage THD L2/L23	0xB226	UINT32	0.1%	0 to 9999
Timestamp	0xB227	UINT32		
Max. Voltage THD L3/L31	0xB228	UINT32	0.1%	0 to 9999
Timestamp	0xB229	UINT32		
Max. Current THD L1	0xB22A	UINT32	0.1%	0 to 9999
Timestamp	0xB22B	UINT32		
Max. Current THD L2	0xB22C	UINT32	0.1%	0 to 9999
Timestamp	0xB22D	UINT32		
Max. Current THD L3	0xB22E	UINT32	0.1%	0 to 9999
Timestamp	0xB22F	UINT32		
Max. Current K-Factor L1	0xB230	UINT32	0.1	10 to 9999
Timestamp	0xB231	UINT32		
Max. Current K-Factor L2	0xB232	UINT32	0.1	10 to 9999
Timestamp	0xB233	UINT32		
Max. Current K-Factor L3	0xB234	UINT32	0.1	10 to 9999
Timestamp	0xB235	UINT32		
Max. Current TDD L1	0xB236	UINT32	0.1%	0 to 1000
Timestamp	0xB237	UINT32		
Max. Current TDD L2	0xB238	UINT32	0.1%	0 to 1000
Timestamp	0xB239	UINT32		
Max. Current TDD L3	0xB23A	UINT32	0.1%	0 to 1000
Timestamp	0xB23B	UINT32		
Maximum real-time total values				
Max. Total kW	0xB280	INT32	0.001kW/1kW	-Pmax to Pmax
Timestamp	0xB281	UINT32		
Max. Total kvar	0xB282	INT32	0.001kvar/1kvar	-Pmax to Pmax
Timestamp	0xB283	UINT32		
Total kVA	0xB284	UINT32	0.001kVA/1kVA	0 to Pmax
Timestamp	0xB285	UINT32		
Max. Total PF [3]	0xB286	UINT32	0.001	0 to 1000
Timestamp	0xB287	UINT32		
Maximum real-time auxiliary values				
Reserved	0xB300-0xB301			0
Max. Neutral current	0xB302	UINT32	0.01A	0 to Imax
Timestamp	0xB303	UINT32		
Max. Frequency	0xB304	UINT32	0.01Hz	0 to 10000 [4]
Timestamp	0xB305	UINT32		
Maximum demands (M)				
Max. volt demand L1/L12 [6]	0xB380	UINT32	0.1V/1V	0 to Vmax
Timestamp	0xB381	UINT32		
Max. volt demand L2/L23 [6]	0xB382	UINT32	0.1V/1V	0 to Vmax
Timestamp	0xB383	UINT32		
Max. volt demand L3/L31 [6]	0xB384	UINT32	0.1V/1V	0 to Vmax
Timestamp	0xB385	UINT32		
Max. ampere demand L1	0xB386	UINT32	0.01A	0 to Imax
Timestamp	0xB387	UINT32		
Max. ampere demand L2	0xB388	UINT32	0.01A	0 to Imax

Parameter	Register	Type	Unit[2]	Range[1]
Timestamp	0xB389	UINT32		
Max. ampere demand L3	0xB38A	UINT32	0.01A	0 to Imax
Timestamp	0xB38B	UINT32		
Reserved	0xB38C-0xB391			0
Max. sliding window kW import demand	0xB392	UINT32	0.001kW/1kW	0 to Pmax
Timestamp	0xB393	UINT32		
Reserved	0xB394-0xB395	UINT32		
Max. sliding window kVA demand	0xB396	UINT32	0.001kVA/1kVA	0 to Pmax
Timestamp	0xB397	UINT32		
Reserved	0xB398-0xB39D			0
Max. sliding window kW export demand	0xB39E	UINT32	0.001kW/1kW	0 to Pmax
Timestamp	0xB39F	UINT32		
TOU maximum demand register #1				
Max. Demand Tariff #1 register	0xB480	UINT32	5	0 to Pmax
Timestamp	0xB481	UINT32		
Max. Demand Tariff #2 register	0xB482	UINT32	5	0 to Pmax
Timestamp	0xB483	UINT32		
...				
Max. Demand Tariff #16 register	0xB49E	UINT32	5	0 to Pmax
Timestamp	0xB49F	UINT32		
TOU maximum demand register #2				
Max. Demand Tariff #1 register	0xB500	UINT32	5	0 to Pmax
Timestamp	0xB501	UINT32		
Max. Demand Tariff #2 register	0xB502	UINT32	5	0 to Pmax
Timestamp	0xB503	UINT32		
...				
Max. Demand Tariff #16 register	0xB51E	UINT32	5	0 to Pmax
Timestamp	0xB51F	UINT32		
TOU maximum demand register #3				
Max. Demand Tariff #1 register	0xB580	UINT32	5	0 to Pmax
Timestamp	0xB581	UINT32		
Max. Demand Tariff #2 register	0xB582	UINT32	5	0 to Pmax
Timestamp	0xB583	UINT32		
...				
Max. Demand Tariff #16 register	0xB59E	UINT32	5	0 to Pmax
Timestamp	0xB59F	UINT32		

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 TOU maximum demand register unit matches the measurement unit 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.

5.18 Digital Inputs Allocation Registers

Table 5-39 Digital Inputs Allocation Registers

Parameter	Register	Type	R/W	Range
Status inputs allocation mask	0x8900	UINT16	R [1]	See Table 5-37
Pulse inputs allocation mask	0x8901	UINT16	R/W	See Table 5-37
Not used	0x8902	UINT16	R [1]	Read as 0
External demand synchronization input mask	0x8903	UINT16	R/W	See Table 5-37
Time synchronization input mask	0x8904	UINT16	R/W	See Table 5-37

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 5-40 Digital Inputs Allocation Mask

Bit number	Description
0	Digital input # 1 allocation status
1	Digital input # 2 allocation status
2-15	Not used

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

5.19 Time Zone Information Registers

Table 5-41 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)

5.20 Communications Password Register

Table 5-42 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

NOTES