SERIES PM172 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.

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1 GENERAL

This document specifies the ASCII serial communications protocol used to transfer data between a master computer station and the PM172. The document provides the complete information necessary to develop a third-party communications software capable of communication with the Series PM172 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 PM172 Powermeters Installation and Operation Manual".

IMPORTANT

1. The voltage parameters throughout the protocol can represent line-to-neutral or line-to-line voltages depending on the wiring mode selected in the instrument. When the 4LN3 or 3LN3 wiring mode is selected, the voltages will be line-to-neutral; for any other wiring mode, they will be line-to-line voltages. In 4LN3, 4LL3, 3LN3 and 3LL3 wiring modes, harmonic voltages will represent line-to-neutral voltages. In a 3-wire direct connection, harmonic voltages will represent line-to-neutral voltages as they appear on the instrument's input transformers. In a 3-wire open delta connection, harmonic voltages will comprise L12 and L23 line-to-line voltages.
2. In 3-wire connection schemes, the unbalanced current and phase readings for power factor, active power, and reactive power will be zeros, because they have no meaning. Only the total three-phase power values can be used.

2 ASCII FRAMING

2.1 ASCII Message Frame

The following specifies the ASCII message frame:

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

SYNC

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

Message length

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

Slave address

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

Message type

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

Message body

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

Check sum

Arithmetic sum, calculated in a 2-byte word over fields #2, #3, #4 and #5 to produce a one-byte check sum in the range of 22h to 7Eh (hexadecimal) as follows: $[\Sigma(\text{each byte} - 22H)] \bmod 5CH + 22H$

Trailer

Two ASCII characters CR (ASCII 13) and LF (ASCII 10).

NOTE

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

Table 2-1 Specific ASCII Requests

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

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

(E) - available in the PM172E

Table 2-2 Direct Read/Write ASCII Requests

Message type		Description
Char	ASCII Hex	
A	41h	Long-size direct read
a	61h	Long-size direct write
X	58h	Variable-size direct read
x	78h	Variable-size direct write

2.2 Exception Responses

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

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

NOTE

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

3 PROTOCOL IMPLEMENTATION

3.1 ASCII Specific and Direct Requests

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

Specific ASCII requests use different formats for accessing different data locations. The message body differs depending on the request type. Each data field has a fixed position in the ASCII string. Chapter 4 describes specific ASCII requests and their message body formats.

Direct read/write requests use a universal message body format, specified in Section 5.1. These requests allow a master application to access different data locations (registers) in the instrument by specifying a direct register index. A number of consequent registers can be read or written by a single request by specifying an arbitrary start register and the number of registers to be accessed. Chapter 5 describes registers accessed via direct read/write requests and their contents.

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

3.2 Data Formats

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

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

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

Fractional numbers are transmitted being scaled by 10 in power N, where N is the number of digits in the fractional part. For example, the frequency reading of 50.01 Hz is transmitted as 5001 being pre-multiplied by 100. Whenever a data register contains a fractional number, the register measurement unit is given with a multiplier $\times 0.1$, $\times 0.01$ 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 PM172E provides concurrent recording data in 9 different memory partitions, one of which is intended to record event log data 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 offers you two different techniques for accessing your log files, using specific or direct read requests. Specific ASCII requests provide sequential reading of a file records until the end of a file is reached. When a record is requested after the end of a file, the response message will contain a zero record with an exception code indicating the end of a log file. As opposite, direct read requests provide circular file reading, i.e., after the last record has been read, the file read pointer is automatically shifted to the beginning of the file. Using direct read requests always allows you to read the entire log file disregarding of the current file status. You can simply poll the file window registers just as you poll ordinal data in your SCADA applications, without the need to manipulate with the file pointer. Refer to Sections 4.17 and 4.18 for information on specific ASCII requests you can use to access your log files, and to Sections 5.14 and 5.15 for information on direct read requests.

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

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

3.4 Password Protection

The PM172 has a password protection option allowing you to protect your setups, cumulative registers and logs from being changed or cleared through communications. You can disable or enable password protection for communications via the front panel. For details, refer to your instrument Installation and Operation Manual. When password protection is enabled, the user password you set in your instrument should be written into the communications password register (see Section 5.19) before another write request will be issued. If the correct password is not supplied while password protection is enabled, the instrument will respond to all write requests with the exception code XM (illegal operation). It is recommended to clear the password register after you have completed your changes in order to activate password protection.

4 SPECIFIC ASCII REQUESTS

4.1 Basic Data

Table 4-1 Read Request

Message type (ASCII)					
0					
Message body (decimal)					
Request - no body					
Response					
Field	**Offset**	**Length**	**Parameter**	**Unit ②**	**Range ①**
1	0	4	Voltage L1/L12 ⑥	V/kV	0 to Vmax
2	4	4	Voltage L2/L21 ⑥	V/kV	0 to Vmax
3	8	4	Voltage L3/L31 ⑥	V/kV	0 to Vmax
4	12	5	Current L1	A	0 to Imax
5	17	5	Current L2	A	0 to Imax
6	22	5	Current L3	A	0 to Imax
7	27	6	kW L1	kW/MW	-Pmax to Pmax
8	33	6	kW L2	kW/MW	-Pmax to Pmax
9	39	6	kW L3	kW/MW	-Pmax to Pmax
10	45	4	Power factor L1		-.99 to 1.00 ④
11	49	4	Power factor L2		-.99 to 1.00 ④
12	53	4	Power factor L3		-.99 to 1.00 ④
13	57	6	kW total	kW/MW	-Pmax to Pmax
14	63	4	Power factor total		-.99 to 1.00 ④
15	67	6	kWh import (E)	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 (E)	Mvarh ③	-9999. to 99999.
25	124	6	kvar total (E)	kvar/Mvar	-Pmax to Pmax
26	130	6	kVA total (E)	kVA/MVA	0 to Pmax
27	136	6	Maximum sliding window kW import demand ⑤ (E)	kW/MW	0 to Pmax
28	142	6	Accumulated kW import demand (E)	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 (E)	MWh ③	0 to 99999.
34	171	6	Maximum sliding window kVA demand ⑤ (E)	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 (E)	MVAh ③	0 to 99999.99
42	209	6	Present sliding window kW import demand ⑤ (E)	kW/MW	0 to Pmax

Message type (ASCII)					
0					
Message body (decimal)					
Request - no body					
Response					
Field	**Offset**	**Length**	**Parameter**	**Unit ②**	**Range ①**
43	215	6	Present sliding window kVA demand ⑤ (E)	kVA/MVA	0 to Pmax
44	221	4	PF (import) at maximum KVA demand (E)		0 to 1.00
45	225	4	Current TDD L1	%	0.0 to 99.9
46	229	4	Current TDD L2	%	0.0 to 99.9
47	233	4	Current TDD L3	%	0.0 to 99.9

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

① The parameter limits are as follows:

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

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 PM172 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.

(E) available in the PM172E

4.2 Basic Setup

Table 4-2 Read Request

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

Table 4-3 Write Request

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

Table 4-4 Basic Setup Parameters

Parameter	Identifier	Range
Wiring mode ①	W40	0 = 3OP2, 1 = 4LN3, 2 = 3DIR2, 3 = 4LL3, 4 = 3OP3, 5 = 3LN3, 6 = 3LL3
PT ratio	U14	1.0 to 6500.0
CT primary current	I17	1 to 5000 A
Power demand period (E)	D11	1,2,5,10,15,20,30,60 min 255 = external synchronization
The number of demand periods (E)	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)

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

(E) available in the PM172E

4.3 Instrument Status

Table 4-5 Read Request

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

Table 4-6 Relay Status

Bit	Description
0-1	N/A (permanently set to 1)
2	Relay #2 status
3	Relay #1 status

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

4.4 Reset/Clear Functions

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

Table 4-7 Write Request

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

Table 4-8 Reset/Clear Functions

Function	Description	Target
1	Clear total energy registers (E)	0
2	Clear total maximum demand registers	0 = all maximum demands 1 = power demands (E) 2 = volt/ampere demands
3	Clear TOU energy registers (E)	0
4	Clear TOU demand registers (E)	0
5	Clear pulse counters	0 = all counters 1-4 = counter #1 - #4
6	Clear Min/Max log	0
7	Clear event log (E)	0
8	Clear data log (E)	0-7 = data logs #1 - #8 16 = all data logs
9-B	Reserved	0
C	Restore event log read queue to the beginning (E)	0

Function	Description	Target
D	Restore data log read queue to the beginning (E)	0-7 = data logs #1 - #8 16-23 = monthly profile logs for TOU energy registers #1 - #8 32-34 = monthly profile logs for TOU maximum demand registers #1 - #3 48-55 = daily profile logs for TOU energy registers #1 - #8 64-66 = daily profile logs for TOU maximum demand registers #1 - #3
E-F	Reserved	N/A

(E) available in the PM172E

4.5 Reset the Instrument (warm restart)

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

Table 4-9 Write Request

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

4.6 Firmware Version Number

Table 4-10 Read Request

Message type (ASCII)				
9				
Message body (decimal)				
Request - no body				
Response				
Field	Offset	Length	Parameter	Range
1	0	3	Firmware version	400-499

4.7 Extended Instrument Status

Table 4-11 Read Request

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

Bit	Description
0	Reserved
1	New Min/Max log
2	New event log
3	New data log (any)
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)

Table 4-16 Data Log Status

Bit	Description
0	New data log #1
1	New data log #2
2	New data log #3
3	New data log #4
4	New data log #5
5	New data log #6
6	New data log #7
7	New data log #8
8-15	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)

4.8 Log Memory Status

Table 4-17 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	40	Not used
13	92	4	The number of new event log records
14	96	4	The number of new data log #1 records
15	100	4	The number of new data log #2 records
16	104	4	The number of new data log #3 records
17	108	4	The number of new data log #4 records
18	112	4	The number of new data log #5 records
19	116	4	The number of new data log #6 records
20	120	4	The number of new data log #7 records
21	124	4	The number of new data log #8 records
22	128	40	Not used

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

4.9 Analog Output Allocation

Table 4-18 Read Request

Message type (ASCII)				
B				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Analog channel number	0-1 = channel #1-#2
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Analog channel number	0-1 = channel #1-#2
2	2	4	Output parameter index	see Table 4-22
3	6	8	Zero scale (0/4 mA)	see Table 4-22
4	14	8	Full scale (20/1 mA)	see Table 4-22

Table 4-19 Write Request

Message type (ASCII)				
b				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Analog channel number	0-1 = channel #1-#2
2	2	4	Output parameter index	see Table 4-22
3	6	8	Zero scale (0/4 mA)	see Table 4-22
4	14	8	Full scale (20/1 mA)	see Table 4-22

1. Except for the signed power factor (see Note 3 to Table 4-22), the output scale is linear within the value range. The scale range will be inverted if the full scale specified is less than the zero scale.
2. For bi-directional analog output (±1 mA), the zero scale corresponds to the center of the scale range (0 mA) and the direction of the current matches the sign of the output parameter. For signed (bi-directional) values, such as powers and signed power factor, the scale is always symmetrical with regard to 0 mA, and the full scale corresponds to +1 mA output for positive readings and to -1 mA output for negative readings. For these, the zero scale (0 mA output) is permanently set in the instrument to zero for all parameters except the signed power factor for which it is set to 1.000. In the write request, the zero scale is ignored. No error will occur when you attempt to change it. Unsigned parameters are output within the current range 0 to +1 mA and can be scaled using both zero and full scales as in the case of single-ended analog output.

4.10 Analog Expander Channel Allocation

Table 4-20 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 index	see Table 4-22
3	6	8	Zero scale (0/4 mA)	see Table 4-22
4	14	8	Full scale (20 mA)	see Table 4-22

Table 4-21 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 index	see Table 4-22
3	6	8	Zero scale (0/4 mA)	see Table 4-22
4	14	8	Full scale (20 mA)	see Table 4-22

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 4-22 Analog Output Parameters

Parameter	Data index	Length	Unit ②	Scale range ①
None				
None	0000h	4		0
Real-time values per phase				
Voltage L1/L12 ⑤	0C00h	8	0.1V/1V	0 to Vmax
Voltage L2/L23 ⑤	0C01h	8	0.1V/1V	0 to Vmax
Voltage L3/L31 ⑤	0C02h	8	0.1V/1V	0 to Vmax
Current L1	0C03h	8	0.01A	0 to Imax
Current L2	0C04h	8	0.01A	0 to Imax
Current L3	0C05h	8	0.01A	0 to Imax
Real-time total value				
Total kW	0F00h	8	0.001kW/1kW	-Pmax to Pmax
Total kvar	0F01h	8	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0F02h	8	0.001kVA/1kVA	0 to Pmax
Total PF ④	0F03h	4	0.001	-999 to 1000
Total PF Lag	0F04h	4	0.001	-999 to 1000
Total PF Lead	0F05h	4	0.001	-999 to 1000
Real-time auxiliary values				
Frequency ③	1002h	4	0.01Hz	0 to 10000
Average values per phase				
Voltage L1/L12 ⑤	1100h	8	0.1V/1V	0 to Vmax
Voltage L2/L23 ⑤	1101h	8	0.1V/1V	0 to Vmax
Voltage L3/L31 ⑤	1102h	8	0.1V/1V	0 to Vmax
Current L1	1103h	8	0.01A	0 to Imax
Current L2	1104h	8	0.01A	0 to Imax
Current L3	1105h	8	0.01A	0 to Imax
Average total values				
Total kW	1400h	8	0.001kW/1kW	-Pmax to Pmax
Total kvar	1401h	8	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	1402h	8	0.001kVA/1kVA	0 to Pmax
Total PF ④	1403h	4	0.001	-999 to 1000
Total PF Lag	1404h	4	0.001	-999 to 1000
Total PF Lead	1405h	4	0.001	-999 to 1000
Average auxiliary values				
Neutral current	1501h	8	0.01A	0 to Imax
Frequency ③	1502h	4	0.01Hz	0 to 10000
Present demands				
Accumulated kW import demand (E)	160Fh	8	0.001kW/1kW	0 to Pmax
Accumulated kvar import demand (E)	1610h	8	0.001kvar/1kvar	0 to Pmax
Accumulated kVA demand (E)	1611h	8	0.001kVA/1kVA	0 to Pmax
Accumulated kW export demand (E)	161Ah	8	0.001kW/1kW	0 to Pmax
Accumulated kvar export demand (E)	161Bh	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.

(E) available in the PM172E

4.11 Digital Inputs Allocation

Table 4-23 Read Request

Message type (ASCII)				
D				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Digital input group ID	see Table 4-25
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Digital input group ID	see Table 4-25
2	2	2	Allocation mask	see Table 4-26

Table 4-24 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 4-25
2	2	2	Allocation mask	see Table 4-26

Table 4-25 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 (E)
4	Time synchronization pulse input

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

(E) available in the PM172E

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 4-26 Digital Inputs Allocation Mask

Bit number	Description
0	Discrete input # 1 allocation status
1	Discrete input # 2 allocation status
2-7	Not used

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

4.12 Timer Setup

Table 4-27 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 4-28 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

4.13 Pulsing Setpoints

Table 4-29 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 4-31)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Pulse output ID	0-1 (see Table 4-31)
2	2	2	Output parameter ID	see Table 4-32
3	4	4	For energy pulsing = number of unit-hours per pulse, otherwise - permanently set to 0	0-9999

Table 4-30 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 4-31)
2	2	2	Output parameter ID	see Table 4-32
3	4	4	For energy pulsing = number of unit-hours per pulse, otherwise - set to 0	0-9999

Table 4-31 Pulse Outputs

Pulsing output ID	Output allocation
0	Relay #1
1	Relay #2

Table 4-32 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

4.14 Pulse Counters Setup

Table 4-33 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 4-35)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Pulse counter ID	0-3 (see Table 4-35)
2	2	2	Digital input ID	0-1 (see Table 4-36)
3	4	4	Scale factor - number of units per pulse	1-9999

Table 4-34 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 4-35)
2	2	2	Digital input ID	0-8 (see Table 4-36)
3	4	4	Scale factor - number of units per pulse	1-9999

Table 4-35 Pulse Counters

Counter ID	Description
0	Pulse counter # 1
1	Pulse counter # 2
2	Pulse counter # 3
3	Pulse counter # 4

Table 4-36 Digital Inputs

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

4.15 Log Memory Partition Setup

Table 4-37 Read Request

Message type (ASCII)				
K				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Partition number	0-8 (see Table 4-39)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Partition number	0-8 (see Table 4-39)
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 4-38 Write Request

Message type (ASCII)				
k				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Partition number	0-8 (see Table 4-39)
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	0-8 (see Table 4-39)

This request allows you to allocate a memory partition for logging and to specify the partition size and type. Before allocating a partition, it is recommended to check the available memory by issuing request "@". To help you in planning memory, Table 4-40 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 Kbyte 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 you configure the partition as a profile partition, you should set up your TOU registers, daily profiles and calendars. The memory for a profile log will be allocated automatically in accordance with the number of TOU registers you defined in the TOU setup. For each TOU energy and maximum demand register, a separate log sub-partition will be allocated within a parent log partition. Each of these can be accessed and read individually (see Section 5.15). The number of log parameters in the record should specify the maximum number of active season tariffs. The file record size will be set in accordance with this number. If you specified it as less than the actual number of tariffs that may be in effect within a tariff season, then only a part of the tariff registers will be recorded to the profile.

Table 4-39 Log Memory Partitions

Partition number	Partition allocation
0	Event log
1	Data log #1
2	Data log #2
3	Data log #3
4	Data log #4
5	Data log #5
6	Data log #6
7	Data log #7 (can be configured as a TOU monthly profile log partition)
8	Data log #8 (can be configured as a TOU daily profile log partition)

Table 4-40 Partitions' Record Size

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

4.16 Data Log Setup

Table 4-41 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 data log record	1-16, 0=partition does not exist
3	4	4	Log parameter #1 ID	see Table 5-7
4	8	4	Log parameter #2 ID	see Table 5-7
5	12	4	Log parameter #3 ID	see Table 5-7
6	16	4	Log parameter #4 ID	see Table 5-7
7	20	4	Log parameter #5 ID	see Table 5-7
8	24	4	Log parameter #6 ID	see Table 5-7
9	28	4	Log parameter #7 ID	see Table 5-7
10	32	4	Log parameter #8 ID	see Table 5-7
11	36	4	Log parameter #9 ID	see Table 5-7
12	40	4	Log parameter #10 ID	see Table 5-7
13	44	4	Log parameter #11 ID	see Table 5-7
14	48	4	Log parameter #12 ID	see Table 5-7
15	52	4	Log parameter #13 ID	see Table 5-7
16	56	4	Log parameter #14 ID	see Table 5-7
17	60	4	Log parameter #15 ID	see Table 5-7
18	64	4	Log parameter #16 ID	see Table 5-7

Table 4-42 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 data log record	1-16
3	4	4	Log parameter #1 ID	see Table 5-7
4	8	4	Log parameter #2 ID	see Table 5-7
5	12	4	Log parameter #3 ID	see Table 5-7
6	16	4	Log parameter #4 ID	see Table 5-7
7	20	4	Log parameter #5 ID	see Table 5-7
8	24	4	Log parameter #6 ID	see Table 5-7
9	28	4	Log parameter #7 ID	see Table 5-7
10	32	4	Log parameter #8 ID	see Table 5-7
11	36	4	Log parameter #9 ID	see Table 5-7
12	40	4	Log parameter #10 ID	see Table 5-7
13	44	4	Log parameter #11 ID	see Table 5-7
14	48	4	Log parameter #12 ID	see Table 5-7
15	52	4	Log parameter #13 ID	see Table 5-7
16	56	4	Log parameter #14 ID	see Table 5-7
17	60	4	Log parameter #15 ID	see Table 5-7
18	64	4	Log parameter #16 ID	see Table 5-7
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Data log number	0-7 = 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 7000h to 700Fh.

4.17 Event Log (Sequential Access)

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

Table 4-43 Read Request

Message type (ASCII)					
M					
Message body (hexadecimal)					
Request - no body					
Response					
Field	**Offset**	**Length**	**Parameter**		**Range**
1	0	2	The number of events in the packet		1-8, 98 = no more events 99 = no events logged
2	2	2	Event log #1	Second	0-59, 97 = record corrupted
3	4	2		Minute	0-59
4	6	2		Hour	0-23
5	8	2		Day	1-31
6	10	2		Month	1-12
7	12	2		Year	0-99
8	14	2		Event cause	see Table 4-44
10	18	8		Log value	see Table 4-44
11	26	4		Effect	see Table 4-44
12	30	2		Target	see Table 4-44

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

Table 4-44 Event Log Parameters

Event cause	Event cause code		Log value	Event effect	
	High byte: cause code	Low byte: event origin (location)		Effect code	Target code
Setpoint event	Trigger parameter ID high byte (see Table 5-12)	Trigger parameter ID low byte (see Table 5-12)	Trigger parameter value (see Table 5-12)	225 (E1h) = setpoint operated 226 (E2h) = setpoint released	Setpoint number = 0-15
Communication activity	91 (5Bh)	Data location code (see Table 4-45)	N/A	See Table 4-46	See Table 4-46
Front panel activity	92 (5Ch)	Data location code (see Table 4-45)	N/A	See Table 4-46	See Table 4-46
Self-check	93 (5Dh)	Data location code (see Table 4-45)	N/A	See Table 4-46	See Table 4-46
Self-update	94 (5Eh)	8 = RTC	N/A	245 = RTC set	N/A
External event	99 (63h)	0 = power down 8 = power up	N/A	N/A	N/A

Table 4-45 Data Location Codes

Location code	Description
3	Data keeping memory
8	Real-time clock
16	Event/alarm setpoint

Table 4-46 Event Effect Codes

Effect code		Description	Target
Dec	Hex		
96	60h	Clear energy registers	N/A
97	61h	Clear demand registers	0 = all demands 1 = power demands 2 = volt/ampere demands
98	62h	Clear TOU energy registers	N/A
99	63h	Clear TOU demand registers	N/A
100	64h	Clear counters	0 = all 1-4 = counter #1-#4
101	65h	Clear Min/Max log registers	N/A
102	66h	Clear event log	N/A
103	67h	Clear data log	0-7 = log #1-#8 16 (10h) = all data logs
225	E1h	Setpoint operated	0-15 (0Fh) = setpoint #1-#16
226	E2h	Setpoint released	0-15 (0Fh) = setpoint #1-#16
241	F1h	Setpoint disabled	0-15 (0Fh) = setpoint #1-#16
245	F5h	RTC set	N/A

4.18 Data Log (Sequential Access)

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

NOTE. The PM172 offers you another mechanism to access data logs, allowing you to read records in a circular manner without needing a file pointer. In this event, the file pointer is automatically restored to the file origin after the last file record has been read (see Section 5.15).

Table 4-47 Read Request

Message type (ASCII)				
N				
Message body (hexadecimal)				
Request				
Field	Offset	Length	Parameter	Range
1	0	2	Data log number	0-7 = log #1-#8
Response				
Field	Offset	Length	Parameter	Range
1	0	2	Trigger setpoint number	1-16, 0 = profile log 97 = record corrupted 98 = no more logged records 99 = no data logged
2	2	2	Hundredths of second	0-99
3	4	2	Second	0-59
4	6	2	Minute	0-59
5	8	2	Hour	0-23
6	10	2	Day	1-31
7	12	2	Month	1-12
8	14	2	Year	0-99
9	16	2	The number of parameters in the packet	1-16
10	18	8	Parameter #1 value	see Table 5-7
11	26	8	Parameter #2 value	see Table 5-7
12	34	8	Parameter #3 value	see Table 5-7
			...	
25	138	8	Parameter #16 value	see Table 5-7

If data log partition #7 or #8 is configured as a TOU monthly or daily profile partition, reading data from this log file will return data from the first TOU profile sub-partition allocated for TOU energy register #1, or for the following first available TOU register if this register is not configured.

4.19 Min/Max Log

Table 4-48 Read Request

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

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

4.20 TOU Registers Allocation

Table 4-49 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 4-51)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	TOU system register ID	0-10 (see Table 4-51)
2	2	2	Register input ID	see Tables 4-52, 4-53
3	4	4	For a pulse input = number of unit-hours per pulse, otherwise - permanently set to 0.	0-9999

Table 4-50 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 4-51)
2	2	2	Register input ID	see Tables 4-52, 4-53
3	4	4	For a pulse input = number of unit-hours per pulse, otherwise - set to 0.	0-9999

Table 4-51 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 4-52 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 4-53 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

4.21 TOU Daily Profiles

Table 4-54 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 4-55 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.

4.22 TOU Calendars

Table 4-56 Read Request

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

Table 4-57 Write Request

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

4.23 TOU Calendar Years

Table 4-58 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
1	2	2	Calendar year	0-99

Table 4-59 Write Request

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

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

4.24 Real Time Clock

Table 4-60 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 4-61 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 (8-bit unsigned byte), 4-character (16-bit unsigned or signed integer) or 8-character (32-bit unsigned or signed long integer) numbers. Negative numbers are transmitted in 2-complement code. Register size in the tables below shows an actual data size in ASCII hexadecimal characters for data accessed using variable-size direct read/write requests. When long-size direct read/write request is used, an actual data size is ignored and all registers are transmitted in 8-character format as long signed or unsigned integers.

5.1.1 Long-Size Direct Read/Write

Table 5-1 Read Request

Message type (ASCII)				
A				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	4	Start data (register) index to read	0000h - FFFFh
2	4	2	The number of contiguous data items to read	1-30 (01h - 1Eh)
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Number of data items in the message	1-30 (01h - 1Eh)
2	2	8	Data #1 value	
3	10	8	Data #2 value	
...	...	...	...	
31	234	8	Data #30 value	

Table 5-2 Write Request

Message type (ASCII)				
a				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	4	Data (register) index to write	0000h - FFFFh
2	4	8	Data value to write	

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

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

5.1.2 Variable-Size Direct Read/Write

Table 5-3 Read Request

Message type (ASCII)				
X				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Size**	**Parameter**	**Range**
1	0	4	Start data index (register) to read	0000h - FFFFh
2	4	2	The number of contiguous data items to read	1-61 (01h - 3Dh)
Response				
Field	**Offset**	**Size**	**Parameter**	**Range**
1	0	2	Number of data items in the message	1-61 (01h - 3Dh)
2	2	2/4/8	Data #1 value	
3		2/4/8	Data #2 value	
...	...	...	...	
60		2/4/8	Data #60 value	

Table 5-4 Write Request

Message type (ASCII)				
x				
Message body (hexadecimal)				
Request				
Field	**Offset**	**Size**	**Parameter**	**Range**
1	0	4	Start data index (register) to write	0000h - FFFFh
2	4	2	The number of contiguous data items to write	1-61 (01h - 3Dh)
3	6	2/4/8	Data #1 value	
4		2/4/8	Data #2 value	
...	...	...	...	
60		2/4/8	Data #60 value	
Request				
Field	**Offset**	**Size**	**Parameter**	**Range**
1	0	4	Start data index (register) written	0000h - FFFFh
2	4	2	The number of data items written	1-61 (01h - 3Dh)

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 indexes 8000h to 8077h (see Table 5-5). You can map any of these registers to either register index, accessible in the instrument through direct read/write requests. Registers that reside in different locations may be accessed by a single request by re-mapping them to adjacent addresses in the user assignable registers area.

The actual indexes of the user assignable registers, which are accessed via indexes 8000h to 8077h, are specified in the user assignable register map. It occupies indexes 8100h to 8177h (see Table 5-6), where the map register 8100h should contain the actual index of the register accessed via assignable register 8000h, register 8101h should contain the actual index of the register accessed via assignable register 8001h, and so on. Note that the user assignable register indexes and the user register map indexes may not be re-mapped.

Table 5-5 User Assignable Registers

Register	Register contents	Size	Direction	Range
8000h	User definable data 0	①	①	①
8001h	User definable data 1	①	①	①
8002h	User definable data 2	①	①	①
...	...	...		
8077h	User definable data 119	①	①	①

① - depends on the mapped register

Table 5-6 User Assignable Register Map

Register	Register contents	Size	Direction	Range
8100h	Data (register) index for user data 0	4	R/W	0000h-FFFFh
8101h	Data (register) index for user data 1	4	R/W	0000h-FFFFh
8102h	Data (register) index for user data 2	4	R/W	0000h-FFFFh
...	...	...		
8177h	Data (register) index for user data 119	4	R/W	0000h-FFFFh

To build your own register map, write to map registers (8100h to 8177h) the actual addresses you want to read from or write to via the assignable area (8000h to 8077h). For example, if you want to read registers 0C00h (real-time voltage of phase A) and 1700h (kWh import) via indexes 8000h-8001h, do the following:

- write 0C00h to register 8100h
- write 1700h to register 8101h

Reading from registers 8000h-8001h will return the voltage reading in register 8000h, and the kWh reading in register 8001h.

5.2 Extended Data Registers

Table 5-7 Extended Data Table

Parameter	Data ID	Length	Direction	Unit	Range ①
None					
None	0000h	4	R		0
Status inputs					
Status inputs	0600h	4	R		see Table 4-13
Relays					
Relay status	0800h	4	R		see Table 4-12
Pulse counters (E)					
Pulse counter #1	0A00h	8	R/W		0 to 999999
Pulse counter #2	0A01h	8	R/W		0 to 999999
Pulse counter #3	0A02h	8	R/W		0 to 999999
Pulse counter #4	0A03h	8	R/W		0 to 999999
Real-time values per phase					
Voltage L1/L12 ⑥	0C00h	8	R	0.1V/1V	0 to Vmax
Voltage L2/L23 ⑥	0C01h	8	R	0.1V/1V	0 to Vmax
Voltage L3/L31 ⑥	0C02h	8	R	0.1V/1V	0 to Vmax
Current L1	0C03h	8	R	0.01A	0 to Imax
Current L2	0C04h	8	R	0.01A	0 to Imax
Current L3	0C05h	8	R	0.01A	0 to Imax
kW L1	0C06h	8	R	0.001kW/1kW	-Pmax to Pmax
kW L2	0C07h	8	R	0.001kW/1kW	-Pmax to Pmax
kW L3	0C08h	8	R	0.001kW/1kW	-Pmax to Pmax
kvar L1	0C09h	8	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L2	0C0Ah	8	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L3	0C0Bh	8	R	0.001kvar/1kvar	-Pmax to Pmax
kVA L1	0C0Ch	8	R	0.001kVA/1kVA	0 to Pmax
kVA L2	0C0Dh	8	R	0.001kVA/1kVA	0 to Pmax
kVA L3	0C0Eh	8	R	0.001kVA/1kVA	0 to Pmax
Power factor L1	0C0Fh	4	R	0.001	-999 to 1000
Power factor L2	0C10h	4	R	0.001	-999 to 1000
Power factor L3	0C11h	4	R	0.001	-999 to 1000

Parameter	Data ID	Length	Direction	Unit	Range ①
Voltage THD L1/L12	0C12h	4	R	0.1%	0 to 9999
Voltage THD L2/L23	0C13h	4	R	0.1%	0 to 9999
Voltage THD L3	0C14h	4	R	0.1%	0 to 9999
Current THD L1	0C15h	4	R	0.1%	0 to 9999
Current THD L2	0C16h	4	R	0.1%	0 to 9999
Current THD L3	0C17h	4	R	0.1%	0 to 9999
K-Factor L1	0C18h	4	R	0.1	10 to 9999
K-Factor L2	0C19h	4	R	0.1	10 to 9999
K-Factor L3	0C1Ah	4	R	0.1	10 to 9999
Current TDD L1	0C1Bh	4	R	0.1%	0 to 1000
Current TDD L2	0C1Ch	4	R	0.1%	0 to 1000
Current TDD L3	0C1Dh	4	R	0.1%	0 to 1000
Voltage L12	0C1Eh	8	R	0.1V/1V	0 to Vmax
Voltage L23	0C1Fh	8	R	0.1V/1V	0 to Vmax
Voltage L31	0C20h	8	R	0.1V/1V	0 to Vmax
Real-time total values					
Total kW	0F00h	8	R	0.001kW/1kW	-Pmax to Pmax
Total kvar	0F01h	8	R	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	0F02h	8	R	0.001kVA/1kVA	0 to Pmax
Total PF	0F03h	4	R	0.001	-999 to 1000
Reserved	0F04h	4	R		0
Reserved	0F05h	4	R		0
Real-time auxiliary values					
Reserved	1000h	8	R		0
Neutral current	1001h	8	R	0.01A	0 to Imax
Frequency ④	1002h	4	R	0.01Hz	0 to 10000
Voltage unbalance	1003h	4	R	1%	0 to 300
Current unbalance	1004h	4	R	1%	0 to 300
Average values per phase					
Voltage L1/L12 ⑥	1100h	8	R	0.1V/1V	0 to Vmax
Voltage L2/L23 ⑥	1101h	8	R	0.1V/1V	0 to Vmax
Voltage L3/L31 ⑥	1102h	8	R	0.1V/1V	0 to Vmax
Current L1	1103h	8	R	0.01A	0 to Imax
Current L2	1104h	8	R	0.01A	0 to Imax
Current L3	1105h	8	R	0.01A	0 to Imax
kW L1	1106h	8	R	0.001kW/1kW	-Pmax to Pmax
kW L2	1107h	8	R	0.001kW/1kW	-Pmax to Pmax
kW L3	1108h	8	R	0.001kW/1kW	-Pmax to Pmax
kvar L1	1109h	8	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L2	110Ah	8	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L3	110Bh	8	R	0.001kvar/1kvar	-Pmax to Pmax
kVA L1	110Ch	8	R	0.001kVA/1kVA	0 to Pmax
kVA L2	110Dh	8	R	0.001kVA/1kVA	0 to Pmax
kVA L3	110Eh	8	R	0.001kVA/1kVA	0 to Pmax
Power factor L1	110Fh	4	R	0.001	-999 to 1000
Power factor L2	1110h	4	R	0.001	-999 to 1000
Power factor L3	1111h	4	R	0.001	-999 to 1000
Voltage THD L1/L12	1112h	4	R	0.1%	0 to 9999
Voltage THD L2/L23	1113h	4	R	0.1%	0 to 9999
Voltage THD L3	1114h	4	R	0.1%	0 to 9999
Current THD L1	1115h	4	R	0.1%	0 to 9999
Current THD L2	1116h	4	R	0.1%	0 to 9999
Current THD L3	1117h	4	R	0.1%	0 to 9999
K-Factor L1	1118h	4	R	0.1	10 to 9999
K-Factor L2	1119h	4	R	0.1	10 to 9999
K-Factor L3	111Ah	4	R	0.1	10 to 9999
Current TDD L1	111Bh	4	R	0.1%	0 to 1000
Current TDD L2	111Ch	4	R	0.1%	0 to 1000
Current TDD L3	111Dh	4	R	0.1%	0 to 1000
Voltage L12	110Eh	8	R	0.1V/1V	0 to Vmax
Voltage L23	110Fh	8	R	0.1V/1V	0 to Vmax
Voltage L31	1120h	8	R	0.1V/1V	0 to Vmax

Parameter	Data ID	Length	Direction	Unit	Range ①
Average total values					
Total kW	1400h	8	R	0.001kW/1kW	-Pmax to Pmax
Total kvar	1401h	8	R	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	1402h	8	R	0.001kVA/1kVA	0 to Pmax
Total PF	1403h	4	R	0.001	-999 to 1000
Reserved	1404h	4	R		0
Reserved	1405h	4	R		0
Average auxiliary values					
Reserved	1500h	8	R		0
Neutral current	1501h	8	R	0.01A	0 to Imax
Frequency ④	1502h	4	R	0.01Hz	0 to 10000
Voltage unbalance	1503h	4	R	1%	0 to 300
Current unbalance	1504h	4	R	1%	0 to 300
Present demands					
Volt demand L1/L12 ⑥	1600h	8	R	0.1V/1V	0 to Vmax
Volt demand L2/L23 ⑥	1601h	8	R	0.1V/1V	0 to Vmax
Volt demand L3/L31 ⑥	1602h	8	R	0.1V/1V	0 to Vmax
Ampere demand L1	1603h	8	R	0.01A	0 to Imax
Ampere demand L2	1604h	8	R	0.01A	0 to Imax
Ampere demand L3	1605h	8	R	0.01A	0 to Imax
Block kW import demand (E)	1606h	8	R	0.001kW/1kW	0 to Pmax
Block kvar import demand (E)	1607h	8	R	0.001kvar/1kvar	0 to Pmax
Block kVA demand (E)	1608h	8	R	0.001kVA/1kVA	0 to Pmax
Sliding window kW import demand (E)	1609h	8	R	0.001kW/1kW	0 to Pmax
Sliding window kvar import demand (E)	160Ah	8	R	0.001kvar/1kvar	0 to Pmax
Sliding window kVA demand (E)	160Bh	8	R	0.001kVA/1kVA	0 to Pmax
Reserved	160Ch	8	R		0
Reserved	160Dh	8	R		0
Reserved	160Eh	8	R		0
Accumulated kW import demand (E)	160Fh	8	R	0.001kW/1kW	0 to Pmax
Accumulated kvar import demand (E)	1610h	8	R	0.001kvar/1kvar	0 to Pmax
Accumulated kVA demand (E)	1611h	8	R	0.001kVA/1kVA	0 to Pmax
Predicted sliding window kW import demand (E)	1612h	8	R	0.001kW/1kW	0 to Pmax
Predicted sliding window kvar import demand (E)	1613h	8	R	0.001kvar/1kvar	0 to Pmax
Predicted sliding window kVA demand (E)	1614h	8	R	0.001kVA/1kVA	0 to Pmax
PF (import) at maximum sliding window kVA demand (E)	1615h	4	R	0.001	0 to 1000
Block kW export demand (E)	1616h	8	R	0.001kW/1kW	0 to Pmax
Block kvar export demand (E)	1617h	8	R	0.001kvar/1kvar	0 to Pmax
Sliding window kW export demand (E)	1618h	8	R	0.001kW/1kW	0 to Pmax
Sliding window kvar export demand (E)	1619h	8	R	0.001kvar/1kvar	0 to Pmax
Accumulated kW export demand (E)	161Ah	8	R	0.001kW/1kW	0 to Pmax
Accumulated kvar export demand (E)	161Bh	8	R	0.001kvar/1kvar	0 to Pmax
Predicted sliding window kW export demand (E)	161Ch	8	R	0.001kW/1kW	0 to Pmax
Predicted sliding window kvar export demand (E)	161Dh	8	R	0.001kvar/1kvar	0 to Pmax
Total energies (E)					
kWh import	1700h	8	R	kWh	0 to 10^9-1
kWh export	1701h	8	R	kWh	0 to 10^9-1
Reserved	1702h	8	R		0
Reserved	1703h	8	R		0

Parameter	Data ID	Length	Direction	Unit	Range ①
kvarh import	1704h	8	R	kvarh	0 to 10^9-1
kvarh export	1705h	8	R	kvarh	0 to 10^9-1
Reserved	1706h	8	R		0
Reserved	1707h	8	R		0
kVAh total	1708h	8	R	kVAh	0 to 10^9-1
Phase energies (E)					
kWh import L1	1800h	8	R	kWh	0 to 10^9-1
kWh import L2	1801h	8	R	kWh	0 to 10^9-1
kWh import L3	1802h	8	R	kWh	0 to 10^9-1
kvarh import (inductive) L1	1803h	8	R	kvarh	0 to 10^9-1
kvarh import (inductive) L2	1804h	8	R	kvarh	0 to 10^9-1
kvarh import (inductive) L3	1805h	8	R	kvarh	0 to 10^9-1
kVAh L1	1806h	8	R	kVAh	0 to 10^9-1
kVAh L2	1807h	8	R	kVAh	0 to 10^9-1
kVAh L3	1808h	8	R	kVAh	0 to 10^9-1
Fundamental's (H01) real-time values per phase					
Voltage L1/L12	2900h	8	R	0.1V/1V	0 to Vmax
Voltage L2/L23	2901h	8	R	0.1V/1V	0 to Vmax
Voltage L3/L31	2902h	8	R	0.1V/1V	0 to Vmax
Current L1	2903h	8	R	0.01A	0 to Imax
Current L2	2904h	8	R	0.01A	0 to Imax
Current L3	2905h	8	R	0.01A	0 to Imax
kW L1	2906h	8	R	0.001kW/1kW	-Pmax to Pmax
kW L2	2907h	8	R	0.001kW/1kW	-Pmax to Pmax
kW L3	2908h	8	R	0.001kW/1kW	-Pmax to Pmax
kvar L1	2909h	8	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L2	290Ah	8	R	0.001kvar/1kvar	-Pmax to Pmax
kvar L3	290Bh	8	R	0.001kvar/1kvar	-Pmax to Pmax
kVA L1	290Ch	8	R	0.001kVA/1kVA	0 to Pmax
kVA L2	290Dh	8	R	0.001kVA/1kVA	0 to Pmax
kVA L3	290Eh	8	R	0.001kVA/1kVA	0 to Pmax
Power factor L1	290Fh	4	R	0.001	-999 to 1000
Power factor L2	2910h	4	R	0.001	-999 to 1000
Power factor L3	2911h	4	R	0.001	-999 to 1000
Fundamental's (H01) real-time total values					
Total kW	2a00h	8	R	0.001kW/1kW	-Pmax to Pmax
Total kvar	2a01h	8	R	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	2a02h	8	R	0.001kVA/1kVA	0 to Pmax
Total PF	2a03h	4	R	0.001	-999 to 1000
Minimum real-time values per phase (M)					
Voltage L1/L12 ⑥	2C00h	8	R	0.1V/1V	0 to Vmax
Voltage L2/L23 ⑥	2C01h	8	R	0.1V/1V	0 to Vmax
Voltage L3/L31 ⑥	2C02h	8	R	0.1V/1V	0 to Vmax
Current L1	2C03h	8	R	0.01A	0 to Imax
Current L2	2C04h	8	R	0.01A	0 to Imax
Current L3	2C05h	8	R	0.01A	0 to Imax
Minimum real-time total values (M)					
Total kW	2D00h	8	R	0.001kW/1kW	-Pmax to Pmax
Total kvar	2D01h	8	R	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	2D02h	8	R	0.001kVA/1kVA	0 to Pmax
Total PF ③	2D03h	4	R	0.001	0 to 1000
Minimum real-time auxiliary values (M)					
Reserved	2E00h	8	R		0
Neutral current	2E01h	8	R	0.01A	0 to Imax
Frequency ④	2E02h	4	R	0.01Hz	0 to 10000
Minimum demands (M) - Reserved					
Reserved	2F00h-2F10h	8	R		0
Maximum real-time values per phase (M)					
Voltage L1/L12 ⑥	3400h	8	R	0.1V/1V	0 to Vmax

Parameter	Data ID	Length	Direction	Unit	Range ①
Voltage L2/L23 ⑥	3401h	8	R	0.1V/1V	0 to Vmax
Voltage L3/L31 ⑥	3402h	8	R	0.1V/1V	0 to Vmax
Current L1	3403h	8	R	0.01A	0 to Imax
Current L2	3404h	8	R	0.01A	0 to Imax
Current L3	3405h	8	R	0.01A	0 to Imax
Maximum real-time total values (M)					
Total kW	3500h	8	R	0.001kW/1kW	-Pmax to Pmax
Total kvar	3501h	8	R	0.001kvar/1kvar	-Pmax to Pmax
Total kVA	3502h	8	R	0.001kVA/1kVA	0 to Pmax
Total PF ③	3503h	4	R	0.001	0 to 1000
Maximum real-time auxiliary values (M)					
Reserved	3600h	8	R		0
Neutral current	3601h	8	R	0.01A	0 to Imax
Frequency ④	3602h	4	R	0.01Hz	0 to 10000
Maximum demands (M)					
Max. volt demand L1/L12 ⑥	3700h	8	R	0.1V/1V	0 to Vmax
Max. volt demand L2/L23 ⑥	3701h	8	R	0.1V/1V	0 to Vmax
Max. volt demand L3/L31 ⑥	3702h	8	R	0.1V/1V	0 to Vmax
Max. ampere demand L1	3703h	8	R	0.01A	0 to Imax
Max. ampere demand L2	3704h	8	R	0.01A	0 to Imax
Max. ampere demand L3	3705h	8	R	0.01A	0 to Imax
Reserved	3706h	8	R		0
Reserved	3707h	8	R		0
Reserved	3708h	8	R		0
Max. sliding window kW import demand (E)	3709h	8	R	0.001kW/1kW	0 to Pmax
Max. sliding window kvar import demand (E)	370Ah	8	R	0.001kvar/1kvar	0 to Pmax
Max. sliding window kVA demand (E)	370Bh	8	R	0.001kVA/1kVA	0 to Pmax
Reserved	370Ch	8	R		0
Reserved	370Dh	8	R		0
Reserved	370Eh	8	R		0
Max. sliding window kW export demand (E)	370Fh	8	R	0.001kW/1kW	0 to Pmax
Max. sliding window kvar export demand (E)	3710h	8	R	0.001kvar/1kvar	0 to Pmax
TOU system parameters (E)					
Active tariff	3C00h	2	R		0 to 15
Active profile	3C01h	2	R		0 to 15
TOU energy register #1 (E)					
Tariff #1 register	3D00h	8	R	⑤	0 to 10^9-1
Tariff #2 register	3D01h	8	R	⑤	0 to 10^9-1
...	...				
Tariff #16 register	3D0Fh	8	R	⑤	0 to 10^9-1
TOU energy register #2 (E)					
Tariff #1 register	3E00h	8	R	⑤	0 to 10^9-1
Tariff #2 register	3E01h	8	R	⑤	0 to 10^9-1
...	...				
Tariff #16 register	3E0Fh	8	R	⑤	0 to 10^9-1
TOU energy register #3 (E)					
Tariff #1 register	3F00h	8	R	⑤	0 to 10^9-1
Tariff #2 register	3F01h	8	R	⑤	0 to 10^9-1
...	...				
Tariff #16 register	3F0Fh	8	R	⑤	0 to 10^9-1
TOU energy register #4 (E)					
Tariff #1 register	4000h	8	R	⑤	0 to 10^9-1
Tariff #2 register	4001h	8	R	⑤	0 to 10^9-1
...	...				
Tariff #16 register	400Fh	8	R	⑤	0 to 10^9-1

Parameter	Data ID	Length	Direction	Unit	Range ①
TOU energy register #5 (E)					
Tariff #1 register	4100h	8	R	⑤	0 to 10^9-1
Tariff #2 register	4101h	8	R	⑤	0 to 10^9-1
...	...				
Tariff #16 register	410Fh	8	R	⑤	0 to 10^9-1
TOU energy register #6 (E)					
Tariff #1 register	4200h	8	R	⑤	0 to 10^9-1
Tariff #2 register	4201h	8	R	⑤	0 to 10^9-1
...	...				
Tariff #16 register	420Fh	8	R	⑤	0 to 10^9-1
TOU energy register #7 (E)					
Tariff #1 register	4300h	8	R	⑤	0 to 10^9-1
Tariff #2 register	4301h	8	R	⑤	0 to 10^9-1
...	...				
Tariff #16 register	430Fh	8	R	⑤	0 to 10^9-1
TOU energy register #8 (E)					
Tariff #1 register	4400h	8	R	⑤	0 to 10^9-1
Tariff #2 register	4401h	8	R	⑤	0 to 10^9-1
...	...				
Tariff #16 register	440Fh	8	R	⑤	0 to 10^9-1
TOU minimum demand register #1 (M) - Reserved					
Reserved	4500h-450Fh	8	R		0
TOU minimum demand register #2 (M) - Reserved					
Reserved	4600h-460Fh	8	R		0
TOU minimum demand register #3 (M) - Reserved					
Reserved	4700h-470Fh	8	R		0
TOU maximum demand register #1 (M) (E)					
Tariff #1 register	4800h	8	R	⑤	0 to Pmax
Tariff #2 register	4801h	8	R	⑤	0 to Pmax
...	...				
Tariff #16 register	480Fh	8	R	⑤	0 to Pmax
TOU maximum demand register #2 (M) (E)					
Tariff #1 register	4900h	8	R	⑤	0 to Pmax
Tariff #2 register	4901h	8	R	⑤	0 to Pmax
...	...				
Tariff #16 register	490Fh	8	R	⑤	0 to Pmax
TOU maximum demand register #3 (M) (E)					
Tariff #1 register	4A00h	8	R	⑤	0 to Pmax
Tariff #2 register	4A01h	8	R	⑤	0 to Pmax
...	...				
Tariff #16 register	4A0Fh	8	R	⑤	0 to Pmax
TOU season tariff energy registers (E) - only as a reference for TOU profile logs					
Season tariff #1 register	7000h	8		⑤	0 to 10^9-1
Season tariff #2 register	7001h	8		⑤	0 to 10^9-1
...	...				
Season tariff #16 register	700Fh	8		⑤	0 to 10^9-1
TOU season tariff maximum demand registers (E) - only as a reference for TOU profile logs					
Season tariff #1 register	7100h	8		⑤	0 to Pmax
Season tariff #2 register	7101h	8		⑤	0 to Pmax
...	...				
Season tariff #16 register	710Fh	8		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.

(E) available in the PM172E.

5.3 Basic Setup Registers

Table 5-8 Basic Setup Registers

Parameter	Register	Size	Direction	Range
Wiring mode ①	8600h	4	R/W	0 = 3OP2, 1 = 4LN3, 2 = 3DIR2, 3 = 4LL3, 4 = 3OP3, 5 = 3LN3, 6 = 3LL3
PT ratio	8601h	4	R/W	10 to 65000 × 0.1
CT primary current	8602h	4	R/W	1 to 5000 A
Power demand period (E)	8603h	4	R/W	1,2,5,10,15,20,30,60 min, 255 = external synchronization
Volt/ampere demand period	8604h	4	R/W	1 to 1800 sec
Averaging buffer size	8605h	4	R/W	8, 16, 32
Reset enable/disable	8606h	4	R/W	0 = disable, 1 = enable
Reserved	8607h	4	R	Read as 65535
The number of demand periods (E)	8608h	4	R/W	1 to 15
Reserved	8609h	4	R	Read as 65535
Reserved	860Ah	4	R	Read as 65535
Nominal frequency	860Bh	4	R/W	50, 60 Hz
Maximum demand load current	860Ch	4	R/W	0 to 10000 A (0 = CT primary current)

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

(E) available in the PM172E

5.4 User Selectable Options Setup

Table 5-9 User Selectable Options Registers

Parameter	Register	Size	Direction	Range
Power calculation mode	8700h	4	R/W	0 = using reactive power 1 = using non-active power
Energy roll value (E) ①	8701h	4	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 (E)	8702h	4	R/W	0 = disable, 1 = enable
Analog output option	8703h	4	R/W	0 = none 1 = 0-20 mA 2 = 4-20 mA 3 = 0-1 mA 4 = ±1 mA
Analog expander output ②	8704h	4	R/W	0 = none 1 = 0-20 mA 2 = 4-20 mA 3 = 0-1 mA 4 = ±1 mA

(E) available in the PM172E (read as 65535 in the PM172P)

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	Size	Direction	Range
Port #1	Reserved	8500h	4	R	Read as 65535
	Interface	8501h	4	R/W	0 = RS-232 1 = RS-422 2 = RS-485
	Address	8502h	4	R/W	0 to 99
	Baud rate	8503h	4	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	4	R/W	0 = 7 bits/even parity 1 = 8 bits/no parity 2 = 8 bits/even parity
	Incoming flow control (handshaking)	8505h	4	R/W	0 = no handshaking 1 = software handshaking (XON/XOFF protocol) 2 = hardware handshaking (CTS protocol)
	Outgoing flow control (RTS/DTR)	8506h	4	R/W	0 = RTS signal not used 1 = RTS permanently asserted (DTR mode) 2 = RTS asserted during the transmission
	Reserved	8507h	4	R	Read as 65535
	ASCII compatibility mode ①	8508h	4	R/W	0 = disabled, 1 = enabled (see Note ② to Table 4-1)
Port #2	Reserved	8510h	4	R	Read as 65535
	Interface	8511h	4	R/W	1 = RS-422 2 = RS-485
	Address	8512h	4	R/W	0 to 99
	Baud rate	8513h	4	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	4	R/W	0 = 7 bits/even parity 1 = 8 bits/no parity 2 = 8 bits/even parity
	Reserved	8515h-8517h	4	R	Read as 65535
	ASCII compatibility mode ①	8518h	4	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	Size	Direction	Range
Logical operator 1	+0	4	R/W	0 = OR
Trigger ID 1	+1	4	R/W	see Table 5-13
Relational operator 1	+2	4	R/W	0 (N/A)
Operate limit 1	+3	8	R/W	see Table 5-13
Release limit 1	+4	8	R/W	see Table 5-13
Logical operator 2	+5	4	R/W	0 = OR, 1 = AND
Trigger ID 2	+6	4	R/W	see Table 5-13
Relational operator 2	+7	4	R/W	0 (N/A)
Operate limit 2	+8	8	R/W	see Table 5-13
Release limit 2	+9	8	R/W	see Table 5-13
Logical operator 3	+10	4	R/W	0 = OR, 1 = AND
Trigger ID 3	+11	4	R/W	see Table 5-13
Relational operator 3	+12	4	R/W	0 (N/A)
Operate limit 3	+13	8	R/W	see Table 5-13
Release limit 3	+14	8	R/W	see Table 5-13
Logical operator 4	+15	4	R/W	0 = OR, 1 = AND
Trigger ID 4	+16	4	R/W	see Table 5-13
Relational operator 4	+17	4	R/W	0 (N/A)
Operate limit 4	+18	8	R/W	see Table 5-13
Release limit 4	+19	8	R/W	see Table 5-13
Action 1	+20	4	R/W	see Table 5-14
Action 2	+21	4	R/W	see Table 5-14
Action 3	+22	4	R/W	see Table 5-14
Action 4	+23	4	R/W	see Table 5-14
Operate delay	+24	4	R/W	0-9999 (×0.1 sec)
Release delay	+25	4	R/W	0-9999 (×0.1 sec)
Reserved	+26	4	R	0
Reserved	+27	4	R	0

NOTES

1. The setpoint is disabled when the first trigger parameter ID is set to NONE. To disable the setpoint, write zero into this register.

2. When writing the setpoint registers (except the event when the setpoint is to be disabled), it is recommended to write all the setpoint registers using a single request, or to disable the setpoint before writing into separate registers. Each written value is checked for compatibility with the other setpoint parameters; if the new value does not conform to these, the request will be rejected.
3. Operate and release limits for 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 (E)			
kWh import pulse	0400h		N/A
kWh export pulse	0401h		N/A
kvarh import pulse	0403h		N/A
kvarh export pulse	0404h		N/A
kvarh total pulse	0405h		N/A
kVAh total pulse	0406h		N/A
Start new demand interval	0407h		N/A
Start new tariff interval	0408h		N/A
Start new volt/ampere demand interval	0409h		N/A
Start new sliding window demand interval	040Ah		N/A
Timers (E)			
Timer #1	0500h		N/A
Timer #2	0501h		N/A
Status inputs			
Status input #1 ON	0600h		N/A
Status input #2 ON	0601h		N/A
Status input #1 OFF	8600h		N/A
Status input #2 OFF	8601h		N/A
Pulse inputs			
Pulse input #1	0700h		N/A
Pulse input #2	0701h		N/A
Phase reversal			
Positive phase rotation reversal ③	8901h		N/A
Negative phase rotation reversal ③	8902h		N/A
Pulse counters			
High pulse counter #1	0A00h		0 to 999999
High pulse counter #2	0A01h		0 to 999999
High pulse counter #3	0A02h		0 to 999999
High pulse counter #4	0A03h		0 to 999999
Time/Date parameters (E)			
Day of week	0B02h		1-7 (1= Sun, 7=Sat)
Year	0B03h		0 to 99
Month	0B04h		1 to 12
Day of month	0B05h		1 to 31
Hour	0B06h		0 to 23
Minutes	0B07h		0 to 59
Seconds	0B08h		0 to 59
High/low real-time values per phase			
High current L1	0C03h	0.01A	0 to Imax
High current L2	0C04h	0.01A	0 to Imax
High current L3	0C05h	0.01A	0 to Imax
Low current L1	8C03h	0.01A	0 to Imax
Low current L2	8C04h	0.01A	0 to Imax
Low current L3	8C05h	0.01A	0 to Imax

Trigger parameter	Trigger ID	Unit ②	Range ①
High/low real-time values on any phase			
High voltage ⑤	0E00h	0.1V/1V	0 to Vmax
Low voltage ⑤	8D00h	0.1V/1V	0 to Vmax
High current	0E01h	0.01A	0 to Imax
Low current	8D01h	0.01A	0 to Imax
High voltage THD	0E07h	0.1%	0 to 9999
High current THD	0E08h	0.1%	0 to 9999
High K-Factor	0E09h	0.1	10 to 9999
High current TDD	0E0Ah	0.1%	0 to 1000
High/low real-time auxiliary values			
High frequency ④	1002h	0.01Hz	0 to 10000
Low frequency ④	9002h	0.01Hz	0 to 10000
High/low average values per phase			
High current L1	1103h	0.01A	0 to Imax
High current L2	1104h	0.01A	0 to Imax
High current L3	1105h	0.01A	0 to Imax
Low current L1	9103h	0.01A	0 to Imax
Low current L2	9104h	0.01A	0 to Imax
Low current L3	9105h	0.01A	0 to Imax
High/low average values on any phase			
High voltage ⑤	1300h	0.1V/1V	0 to Vmax
Low voltage ⑤	9200h	0.1V/1V	0 to Vmax
High current	0301h	0.01A	0 to Imax
Low current	8201h	0.01A	0 to Imax
High/low average total values			
High total kW import	1406h	0.001kW/1kW	0 to Pmax
High total kW export	1407h	0.001kW/1kW	0 to Pmax
High total kvar import	1408h	0.001kvar/1kvar	0 to Pmax
High total kvar export	1409h	0.001kvar/1kvar	0 to Pmax
High total kVA	1402h	0.001kVA/1kVA	0 to Pmax
Low total PF lag	9404h	0.001	0 to 1000
Low total PF lead	9405h	0.001	0 to 1000
High/low average auxiliary values			
High neutral current	1501h	0.01A	0 to Imax
High frequency ④	1502h	0.01Hz	0 to 10000
Low frequency ④	9502h	0.01Hz	0 to 10000
High present demands			
High volt demand L1/L12 ⑤	1600h	0.1V/1V	0 to Vmax
High volt demand L2/L23 ⑤	1601h	0.1V/1V	0 to Vmax
High volt demand L3/L31 ⑤	1602h	0.1V/1V	0 to Vmax
High ampere demand L1	1603h	0.01A	0 to Imax
High ampere demand L2	1604h	0.01A	0 to Imax
High ampere demand L3	1605h	0.01A	0 to Imax
High block kW import demand (E)	1606h	0.001kW/1kW	0 to Pmax
High block kvar import demand (E)	1607h	0.001kvar/1kvar	0 to Pmax
High block kVA demand (E)	1608h	0.001kVA/1kVA	0 to Pmax
High sliding window kW import demand (E)	1609h	0.001kW/1kW	0 to Pmax
High sliding window kvar import demand (E)	160Ah	0.001kvar/1kvar	0 to Pmax
High sliding window kVA demand (E)	160Bh	0.001kVA/1kVA	0 to Pmax
High accumulated kW import demand (E)	160Fh	0.001kW/1kW	0 to Pmax
High accumulated kvar import demand (E)	1610h	0.001kvar/1kvar	0 to Pmax
High accumulated kVA demand (E)	1611h	0.001kVA/1kVA	0 to Pmax
High predicted kW import demand (E)	1612h	0.001kW/1kW	0 to Pmax
High predicted kvar import demand (E)	1613h	0.001kvar/1kvar	0 to Pmax
High predicted kVA demand (E)	1614h	0.001kVA/1kVA	0 to Pmax
High block kW export demand (E)	1616h	0.001kW/1kW	0 to Pmax
High block kvar export demand (E)	1617h	0.001kvar/1kvar	0 to Pmax
High sliding window kW export demand (E)	1618h	0.001kW/1kW	0 to Pmax
High sliding window kvar export demand (E)	1619h	0.001kvar/1kvar	0 to Pmax

Trigger parameter	Trigger ID	Unit ②	Range ①
High accumulated kW export demand (E)	161Ah	0.001kW/1kW	0 to Pmax
High accumulated kvar export demand (E)	161Bh	0.001kvar/1kvar	0 to Pmax
High predicted kW export demand (E)	161Ch	0.001kW/1kW	0 to Pmax
High predicted kvar export demand (E)	161Dh	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 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.

(E) available in the PM172E

Table 5-14 Setpoint Actions

Action	ID
No action	0000h
Operate relay #1 ①	3000h
Operate relay #2 ①	3001h
Increment counter #1	4000h
Increment counter #2	4001h
Increment counter #3	4002h
Increment counter #4	4003h
Clear counter #1	4200h
Clear counter #2	4201h
Clear counter #3	4202h
Clear counter #4	4203h
Clear all counters	6400h
Reset total energy (E)	6000h
Reset all total maximum demands (E)	6100h
Reset power maximum demands (E)	6101h
Reset volt/ampere maximum demands (E)	6102h
Reset TOU energy (E)	6200h
Reset TOU maximum demands (E)	6300h
Clear Min/Max registers (E)	6500h
Event log (E) ②	7002h
Data log #1 (E)	7100h
Data log #2 (E)	7101h
Data log #3 (E)	7102h
Data log #4 (E)	7103h
Data log #5 (E)	7104h
Data log #6 (E)	7105h
Data log #7 (E)	7106h
Data log #8 (E)	7107h

(E) available in the PM172E

① In the PM172E, 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	Size	Direction	Range
Relay #1 control status	8400h	4	R/W	see Table 5-16
Relay #2 control status	8401h	4	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	Size	Direction	Range
Options 1 register	7F00h	4	R	see Table 5-18
Options 2 register	7F01h	4	R	see Table 5-18

Table 5-18 Instrument Options

Options register	Bit	Description
Options1	0	120V option
	1	690V option
	2-3	N/A
	4	100% current over-range
	5	N/A
	6	Analog output 0/4-20 mA
	7	Analog output 0-1 mA
	8	Analog output ±1 mA
	9	Relays option
	10	Digital inputs option
	11	N/A
	12	Setup is secured by a password (see Section 3.4)
	13	ASCII compatibility mode enabled (see Table 5-10)
	14	Analog expander output ±1 mA
	15	N/A
Options 2	0-2	Number of relays - 1
	3-6	Number of digital inputs - 1
	7-8	Number of analog outputs - 1
	9-13	N/A
	14-15	Memory module size (PM172E) 10 = 512 Kbyte

5.9 Extended Status Registers

Table 5-19 Extended Status Registers

Parameter	Register	Size	Direction	Range
Relay status	7D00h	4	R	see Table 4-12
Reserved	7D01h	4	R	read as 0000
Status inputs	7D02h	4	R	see Table 4-13
Setpoint status	7D03h	4	R	see Table 4-14
Log status	7D04h	4	R	see Table 4-15
Active serial port number	7D05h	4	R	0 = Port 1, 1 = Port 2
Battery status	7D06h	4	R	0 = low, 1 = normal

5.10 Alarm Status Registers

Table 5-20 Alarm Status Registers

Parameter	Register	Size	Direction	Range
Setpoint alarm status	7E00h	4	R/W	see Table 5-21
Self-check alarm status	7E01h	4	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
12-15	Reserved

5.11 Reset/Clear Registers

Table 5-23 Reset/Clear Registers

Action	Register	Size	Direction	Range
Clear total energy registers (E)	A000h	4	W	0
Clear total maximum demand registers	A001h	4	W	0 = all maximum demands 1 = power demands (E) 2 = volt/ampere demands
Clear TOU energy registers (E)	A002h	4	W	0
Clear TOU demand registers (E)	A003h	4	W	0
Clear pulse counters (E)	A004h	4	W	0 = all counters 1-4 = counter #1 - #4
Clear Min/Max log	A005h	4	W	0
Clear event log (E)	A006h	4	W	0
Clear data log (E)	A007h	4	W	0-7 = data log #1 - #8 16 = all data logs
Reserved	A008h	4		
Reserved	A009h	4		
Reserved	A00Ah	4		
Restore event log read queue to the beginning (E)	A00Bh	4	W	0
Restore data log read queue to the beginning (E)	A00Ch	4	W	0-7 = data logs #1 - #8 16-23 = monthly profile logs for TOU energy registers #1 - #8 32-34 = monthly profile logs for TOU maximum demand registers #1 - #3 48-55 = daily profile logs for TOU energy registers #1 - #8 64-66 = daily profile logs for TOU maximum demand registers #1 - #3
Reserved	A00Dh	4		
Reserved	A00Eh	4		

(E) available in the PM172E

5.12 Memory Allocation Status Registers

Table 5-24 Log Memory Status Registers

Parameter	Register	Size	Direction	Range
Total memory size, Bytes	A0F0h	8	R	0 to 524288
Free memory size, Bytes	A0F1h	8	R	0 to 524288
Memory partitions map	A0F2h	8	R	See Table 5.25
Monthly profile log partition map	A0F3h	8	R	See Table 5.25
Daily profile log partition map	A0F4h	8	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	9-31
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	A100h-A107h
Data log #1	A108h-A10Fh
Data log #2	A110h-A117h
Data log #3	A118h-A11Fh
Data log #4	A120h-A127h
Data log #5	A128h-A12Fh
Data log #6	A130h-A137h
Data log #7	A138h-A13Fh
Data log #8	A140h-A147h
Reserved	A148h-A1FFh
TOU Monthly Profile Log. Energy Reg. #1	A200h-A207h
TOU Monthly Profile Log. Energy Reg. #2	A208h-A20Fh
TOU Monthly Profile Log. Energy Reg. #3	A210h-A217h
TOU Monthly Profile Log. Energy Reg. #4	A218h-A21Fh
TOU Monthly Profile Log. Energy Reg. #5	A220h-A227h
TOU Monthly Profile Log. Energy Reg. #6	A228h-A22Fh
TOU Monthly Profile Log. Energy Reg. #7	A230h-A237h
TOU Monthly Profile Log. Energy Reg. #8	A238h-A23Fh

Memory Partition	Registers
Reserved	A240h-A27Fh
TOU Monthly Profile Log. Max. Demand Reg. #1	A280h-A287h
TOU Monthly Profile Log. Max. Demand Reg. #2	A288h-A28Fh
TOU Monthly Profile Log. Max. Demand Reg. #3	A290h-A297h
Reserved	A298h-A2FFh
TOU Daily Profile Log. Energy Reg. #1	A300h-A307h
TOU Daily Profile Log. Energy Reg. #2	A308h-A30Fh
TOU Daily Profile Log. Energy Reg. #3	A310h-A317h
TOU Daily Profile Log. Energy Reg. #4	A318h-A31Fh
TOU Daily Profile Log. Energy Reg. #5	A320h-A327h
TOU Daily Profile Log. Energy Reg. #6	A328h-A32Fh
TOU Daily Profile Log. Energy Reg. #7	A330h-A337h
TOU Daily Profile Log. Energy Reg. #8	A338h-A33Fh
Reserved	A340h-A37Fh
TOU Daily Profile Log. Max. Demand Reg. #1	A380h-A387h
TOU Daily Profile Log. Max. Demand Reg. #2	A388h-A38Fh
TOU Daily Profile Log. Max. Demand Reg. #3	A390h-A397h
Reserved	A398h-A3FFh

If data log partition #7 is configured as a TOU monthly profile partition, registers A138h-A13Fh are mapped to registers A200h-A207h 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 A140h-A147h are mapped to registers A300h-A307h 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	Size	Direction	Range
Log partition status	+0	4	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	4	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	4	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	4	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	4	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	4	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.

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

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

5.14 Event Log Registers (Circular Access)

These registers allow you to circularly read a packet of consequent records from the event log file. From 1 to 6 event log records can be read at a time via the event log windows, which comprise registers 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	CD80h-CD87h
Event log window #2	CD88h-CD8Fh
Event log window #3	CD90h-CD97h
Event log window #4	CD98h-CD9Fh
Event log window #5	CDA0h-CDA7h
Event log window #6	CDA8h-CDAFh

Table 5-29 Event Log Window Registers

Parameter	Offset	Size	Direction	Range
Status indication	+0	4	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)

Parameter	Offset	Size	Direction	Range
The record sequence number	+1	4	R	0 to 65535 (increments modulo 65536 with each log)
Timestamp ①	+2	8	R	Local time (UNIX-style)
Fractional seconds portion of timestamp (milliseconds)	+3	4	R	0-990 (at 10 ms resolution)
Event cause	+4	4	R	see Table 5-46
Log value ②	+5	8	R	see Table 5-46
Event effect	+6	4	R	see Table 5-46
Reserved	+7	4	R	0

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

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

NOTES:

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

Table 5-30 Event Log Parameters

Event cause	Event cause code		Log value	Event effect	
	High byte: cause code	Low byte: event origin (location)		High byte: effect code	Low byte: target code
Setpoint event	Trigger parameter ID high byte (see Table 5-13)	Trigger parameter ID low byte (see Table 5-13)	Trigger parameter value (see Table 5-7)	225 (E1h) = setpoint operated 226 (E2h) = setpoint released	Setpoint number = 0-15 (00h - 0Fh)
Communication activity	91 (5Bh)	Data location code (see Table 5-31)	N/A	See Table 5-32	See Table 5-32
Front panel activity	92 (5Ch)	Data location code (see Table 5-31)	N/A	See Table 5-32	See Table 5-32
Self-check	93 (5Dh)	Data location code (see Table 5-31)	N/A	See Table 5-32	See Table 5-32
Self-update (daylight savings time)	94 (5Eh)	8 = RTC	N/A	245 (F5h) = RTC set	N/A
External event	99 (63h)	0 = power down 8 = power up	N/A	N/A	N/A

Table 5-31 Data Location Codes

Location code	Description
3	Data keeping memory
8	Real-time clock
16	Event/alarm setpoint

Table 5-32 Event Effect Codes

Effect code		Description	Target
Dec	Hex		
96	60h	Clear energy registers	N/A
97	61h	Clear demand registers	0 = all demands 1 = power demands 2 = volt/ampere demands
98	62h	Clear TOU energy registers	N/A
99	63h	Clear TOU demand registers	N/A
100	64h	Clear counters	0 = all counters, 1-4 = counter #1-#4
101	65h	Clear Min/Max log registers	N/A
102	66h	Clear event log	N/A
103	67h	Clear data log	0-7 = log #1-#8, 16 (10h) = all data logs
225	E1h	Setpoint operated	0-15 (00h-0Fh) = setpoint #1-#16
226	E2h	Setpoint released	0-15 (00h-0Fh) = setpoint #1-#16
241	F1h	Setpoint disabled	0-15 (00h-0Fh) = setpoint #1-#16
245	F5h	RTC set	N/A

5.15 Data Log Registers (Circular Access)

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

Table 5-33 Data Log Window Locations

Data log	Window registers
Data log #1	C000h-C017h
Data log #2	C018h-C02Fh
Data log #3	C030h-C047h
Data log #4	C048h-C05Fh
Data log #5	C060h-C077h
Data log #6	C078h-C08Fh
Data log #7	C090h-C0A7h
Data log #8	C0A8h-C0BFh
Reserved	C0C0h-C17Fh
TOU Monthly Profile Log. Energy Reg. #1	C180h-C197h
TOU Monthly Profile Log. Energy Reg. #2	C198h-C1AFh
TOU Monthly Profile Log. Energy Reg. #3	C1B0h-C1C7h
TOU Monthly Profile Log. Energy Reg. #4	C1C8h-C1DFh
TOU Monthly Profile Log. Energy Reg. #5	C1E0h-C1F7h
TOU Monthly Profile Log. Energy Reg. #6	C1F8h-C20Fh
TOU Monthly Profile Log. Energy Reg. #7	C210h-C227h
TOU Monthly Profile Log. Energy Reg. #8	C228h-C23Fh
Reserved	C240h-C2FFh
TOU Monthly Profile Log. Max. Demand Reg. #1	C300h-C317h
TOU Monthly Profile Log. Max. Demand Reg. #2	C318h-C32Fh
TOU Monthly Profile Log. Max. Demand Reg. #3	C330h-C347h
Reserved	C348h-C47Fh
TOU Daily Profile Log. Energy Reg. #1	C480h-C497h
TOU Daily Profile Log. Energy Reg. #2	C498h-C4AFh
TOU Daily Profile Log. Energy Reg. #3	C4B0h-C4C7h
TOU Daily Profile Log. Energy Reg. #4	C4C8h-C4DFh
TOU Daily Profile Log. Energy Reg. #5	C4E0h-C4F7h
TOU Daily Profile Log. Energy Reg. #6	C4F8h-C50Fh
TOU Daily Profile Log. Energy Reg. #7	C510h-C527h
TOU Daily Profile Log. Energy Reg. #8	C528h-C53Fh
Reserved	C540h-C5FFh
TOU Daily Profile Log. Max. Demand Reg. #1	C600h-C617h
TOU Daily Profile Log. Max. Demand Reg. #2	C618h-C62Fh
TOU Daily Profile Log. Max. Demand Reg. #3	C630h-C647h
Reserved	C648h-C77Fh

If data log partition #7 is configured as a TOU monthly profile partition, registers C090h-C0A7h are mapped to registers C180h-C197h 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 C0A8h-C0BFh are mapped to registers C480h-C497h 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	Size	Direction	Range
Status indication	+0	4	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	4	R	0 to 65535 (increments modulo 65536 with each log)
Timestamp ①	+2	8	R	Local time (UNIX-style)
Fractional seconds portion of timestamp (milliseconds)	+3	4	R	0-990 (at 10 ms resolution)
Event setpoint ID	+4	4	R	0 (TOU profile log), 1 to 16
Parameter #1 value	+5	8	R	see Table 5-7
Parameter #2 value	+6	8	R	see Table 5-7
Parameter #3 value	+7	8	R	see Table 5-7
Parameter #4 value	+8	8	R	see Table 5-7
Parameter #5 value	+9	8	R	see Table 5-7
Parameter #6 value	+10	8	R	see Table 5-7
Parameter #7 value	+11	8	R	see Table 5-7
Parameter #8 value	+12	8	R	see Table 5-7
Parameter #9 value	+13	8	R	see Table 5-7
Parameter #10 value	+14	8	R	see Table 5-7
Parameter #12 value	+15	8	R	see Table 5-7
Parameter #13 value	+16	8	R	see Table 5-7
Parameter #13 value	+17	8	R	see Table 5-7
Parameter #14 value	+18	8	R	see Table 5-7
Parameter #15 value	+19	8	R	see Table 5-7
Parameter #16 value	+20	8	R	see Table 5-7
Reserved	+21 to +23		R	0

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

NOTES:

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

5.16 Min/Max Log Registers

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

Table 5-35 Min/Max Log Registers

Parameter	Register	Size	Unit	Range
Minimum real-time values per phase				
Min. Voltage L1/L12 ⑥ Timestamp	B000h B001h	8 8	0.1V/1V	0 to Vmax
Min. Voltage L2/L23 ⑥ Timestamp	B002h B003h	8 8	0.1V/1V	0 to Vmax
Min. Voltage L3/L31 ⑥ Timestamp	B004h B005h	8 8	0.1V/1V	0 to Vmax
Min. Current L1 Timestamp	B006h B007h	8 8	0.01A	0 to Imax
Min. Current L2 Timestamp	B008h B009h	8 8	0.01A	0 to Imax
Min. Current L3 Timestamp	B00Ah B00Bh	8 8	0.01A	0 to Imax
Minimum real-time total values				
Min. Total kW Timestamp	B080h B081h	8 8	0.001kW/1kW	-Pmax to Pmax
Min. Total kvar Timestamp	B082h B083h	8 8	0.001kvar/1kvar	-Pmax to Pmax
Min. Total kVA Timestamp	B084h B085h	8 8	0.001kVA/1kVA	0 to Pmax
Total PF ③ Timestamp	B086h B087h	4 8	0.001	0 to 1000
Minimum real-time auxiliary values				
Reserved Timestamp	B100h B101h	8 8		0
Min. Neutral current Timestamp	B102h B103h	8 8	0.01A	0 to Imax
Min. Frequency ④ Timestamp	B104h B105h	4 8	0.01Hz	0 to 10000
Maximum real-time values per phase				
Max. Voltage L1/L12 ⑥ Timestamp	B200h B201h	8 8	0.1V/1V	0 to Vmax
Max. Voltage L2/L23 ⑥ Timestamp	B202h B203h	8 8	0.1V/1V	0 to Vmax
Max. Voltage L3/L31 ⑥ Timestamp	B204h B205h	8 8	0.1V/1V	0 to Vmax
Max. Current L1 Timestamp	B206h B207h	8 8	0.01A	0 to Imax
Max. Current L2 Timestamp	B208h B209h	8 8	0.01A	0 to Imax
Max. Current L3 Timestamp	B20Ah B20Bh	8 8	0.01A	0 to Imax
Maximum real-time total values				
Max. Total kW Timestamp	B280h B281h	8 8	0.001kW/1kW	-Pmax to Pmax
Max. Total kvar Timestamp	B282h B283h	8 8	0.001kvar/1kvar	-Pmax to Pmax
Total kVA Timestamp	B284h B285h	8 8	0.001kVA/1kVA	0 to Pmax
Max. Total PF ③ Timestamp	B286h B287h	4 8	0.001	0 to 1000
Maximum real-time auxiliary values				
Reserved	B300h - B301h	8 8		0
Max. Neutral current	B302h	8	0.01A	0 to Imax

Parameter	Register	Size	Unit	Range
Timestamp	B303h	8		
Max. Frequency ④ Timestamp	B304h B305h	4 8	0.01Hz	0 to 10000
Maximum demands (M)				
Max. volt demand L1/L12 ⑥	B380h	8	0.1V/1V	0 to Vmax
Timestamp	B381h	8		
Max. volt demand L2/L23 ⑥ Timestamp	B382h B383h	8 8	0.1V/1V	0 to Vmax
Max. volt demand L3/L31 ⑥ Timestamp	B384h B385h	8 8	0.1V/1V	0 to Vmax
Max. ampere demand L1 Timestamp	B386h B387h	8 8	0.01A	0 to Imax
Max. ampere demand L2 Timestamp	B388h B389h	8 8	0.01A	0 to Imax
Max. ampere demand L3 Timestamp	B38Ah B38Bh	8 8	0.01A	0 to Imax
Reserved	B38Ch - B38Dh	8 8		0
Reserved	B38Eh - B38Fh	8 8		0
Reserved	B390h - B391h	8 8		0
Max. sliding window kW import demand (E) Timestamp	B392h B393h	8 8	0.001kW/1kW	0 to Pmax
Reserved	B394h - B395h	8 8		
Max. sliding window kVA demand (E) Timestamp	B396h B397h	8 8	0.001kVA/1kVA	0 to Pmax
Reserved	B398h - B399h	8 8		0
Reserved	B39Ah - B39Bh	8 8		0
Reserved	B39Ch - B39Dh	8 8		0
Max. sliding window kW export demand (E) Timestamp	B39Eh B39Fh	8 8	0.001kW/1kW	0 to Pmax
TOU maximum demand register #1 (E)				
Max. Demand Tariff #1 register Timestamp	B480h B481h	8 8	⑤	0 to Pmax
Max. Demand Tariff #2 register Timestamp	B482h B483h	8 8	⑤	0 to Pmax
...				
Max. Demand Tariff #16 register Timestamp	B49Eh B49Fh	8 8	⑤	0 to Pmax
TOU maximum demand register #2 (E)				
Max. Demand Tariff #1 register Timestamp	B500h B501h	8 8	⑤	0 to Pmax
Max. Demand Tariff #2 register Timestamp	B502h B503h	8 8	⑤	0 to Pmax
...				
Max. Demand Tariff #16 register Timestamp	B51Eh B51Fh	8 8	⑤	0 to Pmax
TOU maximum demand register #3 (E)				
Max. Demand Tariff #1 register Timestamp	B580h B581h	8 8	⑤	0 to Pmax
Max. Demand Tariff #2 register Timestamp	B582h B583h	8 8	⑤	0 to Pmax
...				
Max. Demand Tariff #16 register Timestamp	B59Eh B59Fh	8 8	⑤	0 to Pmax

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

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

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

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

④ The actual frequency range is 45.00 - 65.00 Hz.

⑤ The 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.

5.17 Digital Inputs Allocation Registers

Table 5-36 Digital Inputs Allocation Registers

Parameter	Register	Size	Direction	Range
Status inputs allocation mask	8900h	4	R ①	See Table 5-37
Pulse inputs allocation mask	8901h	4	R/W	See Table 5-37
Not used	8902h	4	R ①	Read as 0
External demand synchronization input mask (E)	8903h	4	R/W	See Table 5-37
Time synchronization input mask	8904h	4	R/W	See Table 5-37

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

(E) available in the PM172E

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 5-37 Digital Inputs Allocation Mask

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

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

5.18 Time Zone Information Registers

Table 5-38 Time Zone Registers

Parameter	Register	Size	Direction	Range
Daylight savings time (DST) option	8C00h	4	R/W	0 = disable DST (use standard time only), 1 = enable DST
DST start month	8C01h	4	R/W	1 - 12
DST start week of the month	8C02h	4	R/W	1 - 4 = 1st, 2nd, 3rd and 4th week, 5 = the last weekday in the month
DST start weekday	8C03h	4	R/W	1-7 (1= Sun, 7 = Sat)
DST end month	8C04h	4	R/W	1 - 12
DST end week of the month	8C05h	4	R/W	1 - 4 = 1st, 2nd, 3rd and 4th week, 5 = the last weekday in the month
DST end weekday	8C06h	4	R/W	1-7 (1= Sun, 7 = Sat)

5.19 Communications Password Register

Table 5-39 Password Register

Parameter	Register	Size	Direction	Range
Communications password	FF00h	4	R/W	Write: 0 to 65535 Read: 0 = access permitted 65535 = authorization required

NOTES