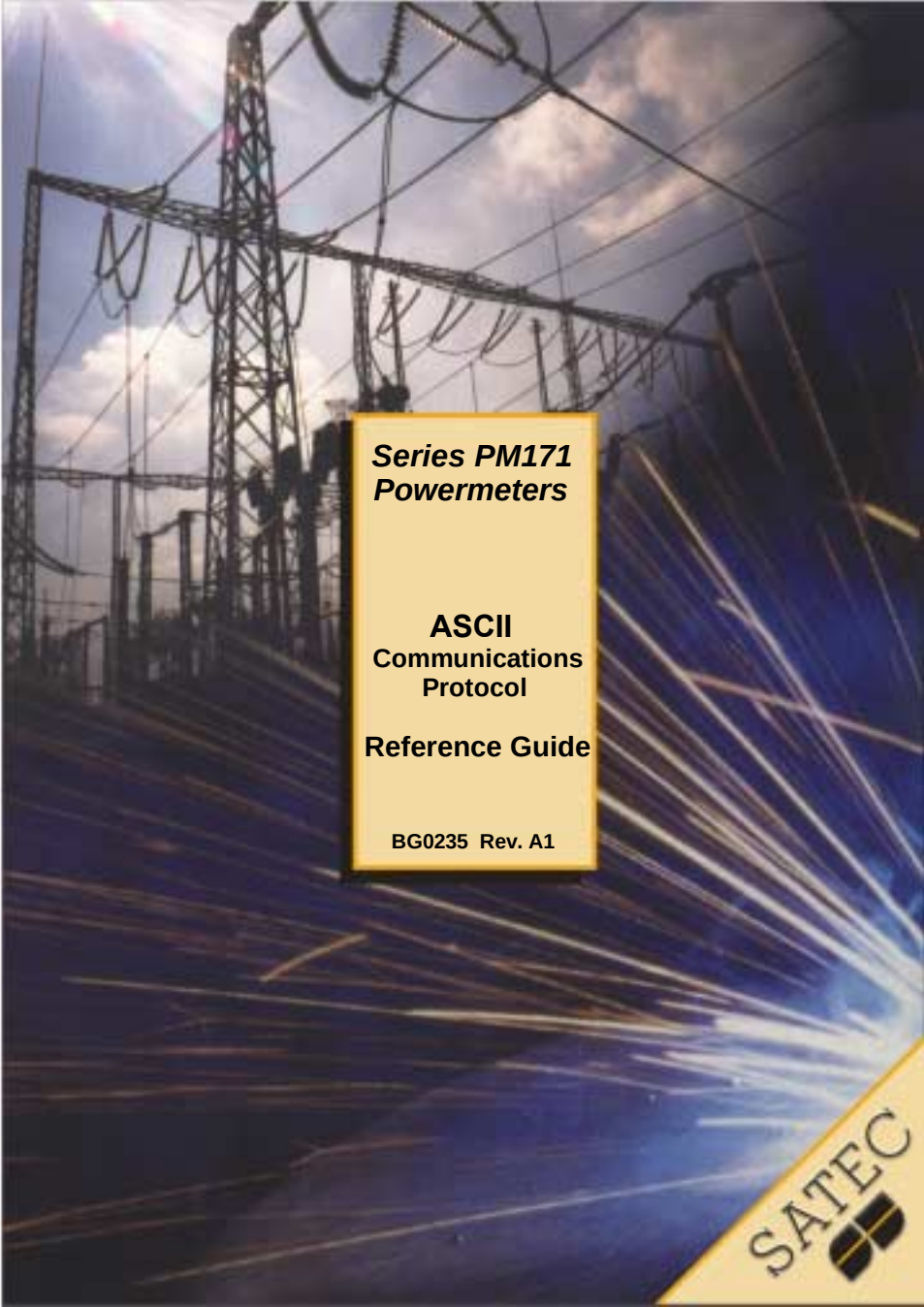

Series PM171 Powermeters

ASCII Communications Protocol

Reference Guide

BG0235 Rev. A1

SATEC

SERIES PM171 POWERMETERS

COMMUNICATIONS

ASCII Communications Protocol

REFERENCE GUIDE

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BG0235 Rev.A1

Table of Contents

1 GENERAL

This document specifies the ASCII serial communications protocol used to transfer data between a master computer station and the PM171. The document provides the complete information necessary to develop a third-party communications software capable of communication with the Series PM171 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 PM171 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

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 between '00' and '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.

In a decimal notation, the parameters are transferred in a decimal representation as is, i.e., no conversion is needed. When a value is between 0 and 1, a decimal point is placed in the data field. When the whole value exceeds the field range, it is divided by 1000 and truncated to the right. A decimal point is placed after the thousands to denote that the value has been truncated and must be multiplied by 1000 before it will be processed.

In a hexadecimal notation, all parameters are whole binary numbers of a 1-byte, 2-byte or 4-byte length. Each byte is transferred as two hexadecimal

digits in ASCII notation (i.e., ASCII printable characters 0-9, A-F are used to represent hexadecimal digits 0h-9h, 0ah-0fh). Each byte is transmitted high order digit first. Each 2-byte and 4-byte parameter is transmitted high order bytes first. Negative numbers are transmitted in 2-complement code.

To represent numbers between 0 and 1, a modulus method is used. Fractional numbers are divided by a modulus and stored in the Powermeter as whole numbers. The modulus depends on the number of decimal digits in the fractional part, i.e., on the value precision. The modulus is given in the form $\times$0.1, $\times$0.01 or $\times$0.001. For example, the frequency value of 50.01 Hz having the modulus of $\times$0.01 will be received from the instrument as the whole number of 5001. To process the value received from the instrument in this format, the value must be multiplied by the modulus. To write such a number to the instrument, the number must be divided by the modulus.

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
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

Message type		Description
Char	ASCII Hex	
D	44h	Read digital input allocation (E)
d	64h	Write digital input allocation (E)
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 (E)
j	6Ah	Write pulse counter setup (E)
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 (E)
T	54h	Write Real Time Clock (E)
U	55h	Read TOU calendar year (E)
u	75h	Write TOU calendar year (E)

(E) - available in the PM171E

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

3 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.

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**	**Range ①**
1	0	4	Voltage L1/L12	V/kV ②	0 to Vmax
2	4	4	Voltage L2/L21	V/kV ②	0 to Vmax
3	8	4	Voltage L3/L31	V/kV ②	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 ②	-Pmax to Pmax
8	33	6	kW L2	kW/MW ②	-Pmax to Pmax
9	39	6	kW L3	kW/MW ②	-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 ②	-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/Mvar②	-Pmax to Pmax
19	88	6	kvar L2	kvar/Mvar②	-Pmax to Pmax
20	94	6	kvar L3	kvar/Mvar②	-Pmax to Pmax
21	100	6	kVA L1	kVA/MVA ②	0 to Pmax
22	106	6	kVA L2	kVA/MVA ②	0 to Pmax
23	112	6	kVA L3	kVA/MVA ②	0 to Pmax
24	118	6	kvarh net (E)	Mvarh ③	-9999. to 99999.
25	124	6	kvar total (E)	kvar/Mvar ②	-Pmax to Pmax
26	130	6	kVA total (E)	kVA/MVA ②	0 to Pmax
27	136	6	Maximum sliding window kW demand ⑤ (E)	kW/MW ②	0 to Pmax
28	142	6	Accum. kW demand (E)	kW/MW ②	0 to Pmax
29	148	5	Max. ampere demand L1	A	0 to Imax

Field	Offset	Length	Parameter	Unit	Range
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 ②	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 demand ⑤ (E)	kW/MW ②	0 to Pmax
43	215	6	Present sliding window kVA demand ⑤ (E)	kVA/MVA ②	0 to Pmax
44	221	4	PF 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:

Vmax (690 V input option) = 828V @ PT Ratio = 1
Vmax (690 V input option) = 144 × PT Ratio [V] @ PT Ratio > 1
Vmax (120 V input option) =144 × PT Ratio [V]
Imax (20% over-range) = 1.2 × CT primary current [A]
Pmax = (Imax × Vmax × 3)/1000 [kW] if wiring mode is 4LN3 or 3LN3
Pmax = (Imax × Vmax × 2)/1000 [kW] if wiring mode is 4LL3, 3OP2, 3DIR2, 3OP3 or 3LL3

② When the value width is greater than the field resolution, the reading is converted to higher units and transmitted with a decimal point. The right-most digits of the reading are truncated.

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).

(E) available in the PM171E

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 50000 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	1 to 50000 A

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 PM171E

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 operated, 1 = relay released

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 (E)	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 log #1 - #8 16 = all data logs
9-B	Reserved	0
C	Restore event log queue (E)	0
D	Restore data log queue (E)	0-7 = data log #1 - #8 16 = all data logs
E-F	Reserved	N/A

(E) available in the PM171E

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	300-399

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 released, 1 = relay operated

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	0-13 = channel #1-#14
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Analog channel number	0-13 = channel #1-#14
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	0-13 = channel #1-#14
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	Scale range ①
None				
None	0000h	4		0
Real-time values per phase				
Voltage L1/L12	0C00h	8	V	0 to Vmax
Voltage L2/L23	0C01h	8	V	0 to Vmax
Voltage L3/L31	0C02h	8	V	0 to Vmax
Current L1	0C03h	8	A	0 to Imax
Current L2	0C04h	8	A	0 to Imax

Parameter	Data index	Length	Unit	Scale range ①
Current L3	0C05h	8	A	0 to Imax
Real-time total value				
Total kW	0F00h	8	kW	-Pmax to Pmax
Total kvar	0F01h	8	kvar	-Pmax to Pmax
Total kVA	0F02h	8	kVA	0 to Pmax
Total PF ③	0F03h	4		-1000 to 1000 ×0.001
Total PF Lag	0F04h	4		0 to 1000 ×0.001
Total PF Lead	0F05h	4		0 to 1000 ×0.001
Real-time auxiliary values				
Frequency ②	1002h	4	Hz	0 to 10000 ×0.01
Average values per phase				
Voltage L1/L12	1100h	8	V	0 to Vmax
Voltage L2/L23	1101h	8	V	0 to Vmax
Voltage L3/L31	1102h	8	V	0 to Vmax
Current L1	1103h	8	A	0 to Imax
Current L2	1104h	8	A	0 to Imax
Current L3	1105h	8	A	0 to Imax
Average total values				
Total kW	1400h	8	kW	-Pmax to Pmax
Total kvar	1401h	8	kvar	-Pmax to Pmax
Total kVA	1402h	8	kVA	0 to Pmax
Total PF ③	1403h	4		-1000 to 1000 ×0.001
Total PF Lag	1404h	4		0 to 1000 ×0.001
Total PF Lead	1405h	4		0 to 1000 ×0.001
Average auxiliary values				
Neutral current	1501h	8	A	0 to Imax
Frequency ②	1502h	4	Hz	0 to 10000 ×0.01
Present demands				
Accumulated kW demand (import) (E)	160Fh	8	kW	0 to Pmax
Accumulated kVA demand (E)	1611h	8	kVA	0 to Pmax

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

② The actual frequency range is 45.00 to 65.00 Hz

③ 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).

(E) available in the PM171E

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	Discrete input group ID	see Table 4-25
Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	2	Discrete 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	Discrete input group ID	see Table 4-25
2	2	2	Allocation mask	see Table 4-26

Table 4-25 Discrete Input Groups

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

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

NOTES

1. All digital inputs that were not allocated as pulse inputs will be automatically configured as status inputs.
2. A digital input allocated for the external 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
2-15	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

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
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.

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
8	Data log #8

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

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

4.17 Event Log

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
9	16	2		Event origin	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
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	2		Event cause	see Table 4-44
85	226	2		Event origin	see Table 4-44
86	228	8		Log value	see Table 4-44
87	236	4		Effect	see Table 4-44
88	240	2		Target	see Table 4-44

This request allows you to read the packet of consequent records from the event log partition. Up to 8 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 queue origin, request '4' followed by function code 'C' should be issued.

Table 4-44 Event Log Parameters

Event cause	Event cause code	Event origin (location)	Log value	Event effect	Event target
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 = setpoint operated 226 = setpoint released	Setpoint number = 0-15
Comm. activity	91	Data location code (see Table 4-45)	N/A	See Table 4-46	See Table 4-46
Front panel activity	92	Data location code (see Table 4-45)	N/A	See Table 4-46	See Table 4-46
Self-check	93	Data location code (see Table 4-45)	N/A	See Table 4-46	See Table 4-46
External event	99	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
96	Clear energy registers	N/A
97	Clear demand registers	0 = all demands 1 = power demands 2 = volt/ampere demands
98	Clear TOU energy registers	N/A
99	Clear TOU demand registers	N/A
100	Clear counters	0 = all 1-4 - counter #1-#4
101	Clear Min/Max log registers	N/A
102	Clear event log	N/A
103	Clear data log	0-7 = log #1-#8 6 = all data logs

Effect code	Description	Target
225	Setpoint operated	0-15 = setpoint #1-#16
226	Setpoint released	0-15 = setpoint #1-#16
241	Setpoint disabled	0-15 = setpoint #1-#16
245	RTC set	N/A

4.18 Data Log

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	Number of the setpoint that triggered log	0-15, 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	2	Parameter #1 value	see Table 5-7
11	18	2	Parameter #2 value	see Table 5-7
12	20	2	Parameter #3 value	see Table 5-7
			...	
25	48	2	Parameter #16 value	see Table 5-7

This request allows you to read a subsequent record from the data log partition. For each data log partition, a separate queue is used to access logged records, controlled by a queue pointer. The pointer is shifted to the next record automatically after each request until the last record is read. To restore the pointer to its origin, request '4' followed by function code 'D' should be issued.

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

Table 4-50 Write Request

Message type (ASCII)				
p				
Message body (hexadecimal)				
Request/Response				
Field	**Offset**	**Length**	**Parameter**	**Range**
1 2 3	0 2 4	2 2 4	TOU system register ID Register input ID For a pulse input = number of unit-hours per pulse, otherwise - set to 0.	0-10 (see Table 4-51) see Tables 4-52, 4-53 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 kW demand register
9	N/A ①
10	TOU Maximum kVA demand register

① This register may not be allocated in the PM171. Writing to this register is ignored. No error will occur.

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

Table 4-53 TOU Demand Registers Inputs

Register input	Input ID
None	0
N/A ①	1
Maximum sliding window demand	2
N/A ①	3

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

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)

5 DIRECT READ/WRITE REQUESTS

5.1 General

This chapter describes the instrument data locations that are addressed directly using data location indexes. These locations can be accessed by using universal direct read/write requests instead of specific ASCII requests. A data index is a 4-digit hexadecimal number, which actually comprises a two-digit data group identifier followed by a two-digit location offset within a group. All data are transmitted in ASCII hexadecimal notation. Negative numbers are transmitted in 2-complement code.

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 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 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 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**	**Length**	**Parameter**	**Range**
1	0	4	Start data index to read	0000h - FFFFh
2	4	2	The number of contiguous data items to read	1-61 (01h - 3Dh)
Response				
Field	**Offset**	**Length**	**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**	**Length**	**Parameter**	**Range**
1	0	4	Start data index to write	0000h - FFFFh
2	4	2	The number of contiguous data items to write	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	
Request				
Field	**Offset**	**Length**	**Parameter**	**Range**
1	0	4	Start data index 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

Data index (hex)	Register contents	Length	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

Data index (hex)	Register contents	Length	Direction	Range
8100h	Data index for user data 0	4	R/W	0000h-FFFFh
8101h	Data index for user data 1	4	R/W	0000h-FFFFh
8102h	Data index for user data 2	4	R/W	0000h-FFFFh
…	…	…		
8177h	Data 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 index	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	0C00h	8	R	V	0 to Vmax
Voltage L2/L23	0C01h	8	R	V	0 to Vmax
Voltage L3/L31	0C02h	8	R	V	0 to Vmax
Current L1	0C03h	8	R	A	0 to Imax
Current L2	0C04h	8	R	A	0 to Imax
Current L3	0C05h	8	R	A	0 to Imax
kW L1	0C06h	8	R	kW	-Pmax to Pmax
kW L2	0C07h	8	R	kW	-Pmax to Pmax
kW L3	0C08h	8	R	kW	-Pmax to Pmax
kvar L1	0C09h	8	R	kvar	-Pmax to Pmax
kvar L2	0C0Ah	8	R	kvar	-Pmax to Pmax
kvar L3	0C0Bh	8	R	kvar	-Pmax to Pmax
kVA L1	0C0Ch	8	R	kVA	0 to Pmax
kVA L2	0C0Dh	8	R	kVA	0 to Pmax
kVA L3	0C0Eh	8	R	kVA	0 to Pmax
Power factor L1	0C0Fh	4	R		-999 to 1000 ×0.001
Power factor L2	0C10h	4	R		-999 to 1000 ×0.001
Power factor L3	0C11h	4	R		-999 to 1000 ×0.001
Voltage THD L1/L12	0C12h	4	R	%	0 to 9999 ×0.1
Voltage THD L2/L23	0C13h	4	R	%	0 to 9999 ×0.1
Voltage THD L3	0C14h	4	R	%	0 to 9999 ×0.1
Current THD L1	0C15h	4	R	%	0 to 9999 ×0.1
Current THD L2	0C16h	4	R	%	0 to 9999 ×0.1
Current THD L3	0C17h	4	R	%	0 to 9999 ×0.1
K-Factor L1	0C18h	4	R		10 to 9999 ×0.1
K-Factor L2	0C19h	4	R		10 to 9999 ×0.1
K-Factor L3	0C1Ah	4	R		10 to 9999 ×0.1
Current TDD L1	0C1Bh	4	R	%	0 to 1000 ×0.1

Parameter	Data index	Length	Direction	Unit	Range ①
Current TDD L2	0C1Ch	4	R	%	0 to 1000 ×0.1
Current TDD L3	0C1Dh	4	R	%	0 to 1000 ×0.1
Real-time total values					
Total kW	0F00h	8	R	kW	-Pmax to Pmax
Total kvar	0F01h	8	R	kvar	-Pmax to Pmax
Total kVA	0F02h	8	R	kVA	0 to Pmax
Total PF	0F03h	4	R		-999 to 1000 ×0.001
Reserved	0F04h	4	R		0
Reserved	0F05h	4	R		0
Real-time auxiliary values					
Reserved	1000h	8	R		0
Neutral current	1001h	8	R	A	0 to Imax
Frequency ③	1002h	4	R	Hz	0 to 1000 ×0.1
Voltage unbalance	1003h	4	R	%	0 to 300
Current unbalance	1004h	4	R	%	0 to 300
Average values per phase					
Voltage L1/L12	1100h	8	R	V	0 to Vmax
Voltage L2/L23	1101h	8	R	V	0 to Vmax
Voltage L3/L31	1102h	8	R	V	0 to Vmax
Current L1	1103h	8	R	A	0 to Imax
Current L2	1104h	8	R	A	0 to Imax
Current L3	1105h	8	R	A	0 to Imax
kW L1	1106h	8	R	kW	-Pmax to Pmax
kW L2	1107h	8	R	kW	-Pmax to Pmax
kW L3	1108h	8	R	kW	-Pmax to Pmax
kvar L1	1109h	8	R	kvar	-Pmax to Pmax
kvar L2	110Ah	8	R	kvar	-Pmax to Pmax
kvar L3	110Bh	8	R	kvar	-Pmax to Pmax
kVA L1	110Ch	8	R	kVA	0 to Pmax
kVA L2	110Dh	8	R	kVA	0 to Pmax
kVA L3	110Eh	8	R	kVA	0 to Pmax
Power factor L1	110Fh	4	R		-999 to 1000 ×0.001
Power factor L2	1110h	4	R		-999 to 1000 ×0.001
Power factor L3	1111h	4	R		-999 to 1000 ×0.001
Voltage THD L1/L12	1112h	4	R	%	0 to 9999 ×0.1
Voltage THD L2/L23	1113h	4	R	%	0 to 9999 ×0.1
Voltage THD L3	1114h	4	R	%	0 to 9999 ×0.1
Current THD L1	1115h	4	R	%	0 to 9999 ×0.1
Current THD L2	1116h	4	R	%	0 to 9999 ×0.1
Current THD L3	1117h	4	R	%	0 to 9999 ×0.1
K-Factor L1	1118h	4	R		10 to 9999 ×0.1
K-Factor L2	1119h	4	R		10 to 9999 ×0.1
K-Factor L3	111Ah	4	R		10 to 9999 ×0.1
Current TDD L1	111Bh	4	R	%	0 to 1000 ×0.1
Current TDD L2	111Ch	4	R	%	0 to 1000 ×0.1

Parameter	Data index	Length	Direction	Unit	Range ①
Current TDD L3	111Dh	4	R	%	0 to 1000 ×0.1
Average total values					
Total kW	1400h	8	R	kW	-Pmax to Pmax
Total kvar	1401h	8	R	kvar	-Pmax to Pmax
Total kVA	1402h	8	R	kVA	0 to Pmax
Total PF	1403h	4	R		-999 to 1000 ×0.001
Reserved	1404h	4	R		0
Reserved	1405h	4	R		0
Average auxiliary values					
Reserved	1500h	8	R		0
Neutral current	1501h	8	R	A	0 to Imax
Frequency ③	1502h	4	R	Hz	0 to 1000 ×0.1
Voltage unbalance	1503h	4	R	%	0 to 300
Current unbalance	1504h	4	R	%	0 to 300
Present demands					
Volt demand L1	1600h	8	R	V	0 to Vmax
Volt demand L2	1601h	8	R	V	0 to Vmax
Volt demand L3	1602h	8	R	V	0 to Vmax
Ampere demand L1	1603h	8	R	A	0 to Imax
Ampere demand L2	1604h	8	R	A	0 to Imax
Ampere demand L3	1605h	8	R	A	0 to Imax
Block kW demand (E)	1606h	8	R	kW	0 to Pmax
Reserved	1607h	8	R		0
Block kVA demand (E)	1608h	8	R	kVA	0 to Pmax
Sliding window kW demand (E)	1609h	8	R	kW	0 to Pmax
Reserved	160Ah	8	R		0
Sliding window kVA demand (E)	160Bh	8	R	kVA	0 to Pmax
Reserved	160Ch	8	R		0
Reserved	160Dh	8	R		0
Reserved	160Eh	8	R		0
Accumulated kW demand (E)	160Fh	8	R	kW	0 to Pmax
Reserved	1610h	8	R		0
Accumulated kVA demand (E)	1611h	8	R	kVA	0 to Pmax
Predicted sliding window kW demand (E)	1612h	8	R	kW	0 to Pmax
Reserved	1613h	8	R		0
Predicted sliding window kVA demand (E)	1614h	8	R	kVA	0 to Pmax
PF at maximum sliding window kVA demand (E)	1615h	4	R		0 to 1000 ×0.001
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

Parameter	Data index	Length	Direction	Unit	Range ①
Reserved	1703h	8	R		0
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	V	0 to Vmax
Voltage L2/L23	2901h	8	R	V	0 to Vmax
Voltage L3/L31	2902h	8	R	V	0 to Vmax
Current L1	2903h	8	R	A	0 to Imax
Current L2	2904h	8	R	A	0 to Imax
Current L3	2905h	8	R	A	0 to Imax
kW L1	2906h	8	R	kW	-Pmax to Pmax
kW L2	2907h	8	R	kW	-Pmax to Pmax
kW L3	2908h	8	R	kW	-Pmax to Pmax
kvar L1	2909h	8	R	kvar	-Pmax to Pmax
kvar L2	290Ah	8	R	kvar	-Pmax to Pmax
kvar L3	290Bh	8	R	kvar	-Pmax to Pmax
kVA L1	290Ch	8	R	kVA	0 to Pmax
kVA L2	290Dh	8	R	kVA	0 to Pmax
kVA L3	290Eh	8	R	kVA	0 to Pmax
Power factor L1	290Fh	4	R		-999 to 1000 ×0.001
Power factor L2	2910h	4	R		-999 to 1000 ×0.001
Power factor L3	2911h	4	R		-999 to 1000 ×0.001
Fundamental's (H01) real-time total values					
Total kW	2a00h	8	R	kW	-Pmax to Pmax
Total kvar	2a01h	8	R	kvar	-Pmax to Pmax
Total kVA	2a02h	8	R	kVA	0 to Pmax
Total PF	2a03h	4	R		-999 to 1000 ×0.001
Minimum real-time values per phase (M)					
Voltage L1/L12	2C00h	8	R	V	0 to Vmax
Voltage L2/L23	2C01h	8	R	V	0 to Vmax
Voltage L3/L31	2C02h	8	R	V	0 to Vmax
Current L1	2C03h	8	R	A	0 to Imax
Current L2	2C04h	8	R	A	0 to Imax

Parameter	Data index	Length	Direction	Unit	Range ①
Current L3	2C05h	8	R	A	0 to Imax
Minimum real-time total values (M)					
Total kW	2D00h	8	R	kW	-Pmax to Pmax
Total kvar	2D01h	8	R	kvar	-Pmax to Pmax
Total kVA	2D02h	8	R	kVA	0 to Pmax
Total PF ②	2D03h	4	R		0 to 1000 ×0.001
Minimum real-time auxiliary values (M)					
Reserved	2E00h	8	R		0
Neutral current	2E01h	8	R	A	0 to Imax
Frequency ③	2E02h	4	R	Hz	0 to 1000 ×0.1
Minimum demands (M) - Reserved					
Reserved	2F00h	8	R		0
Reserved	2F01h	8	R		0
Reserved	2F02h	8	R		0
Reserved	2F03h	8	R		0
Reserved	2F04h	8	R		0
Reserved	2F05h	8	R		0
Reserved	2F06h	8	R		0
Reserved	2F07h	8	R		0
Reserved	2F08h	8	R		0
Reserved	2F09h	8	R		0
Reserved	2F0Ah	8	R		0
Reserved	2F0Bh	8	R		0
Maximum real-time values per phase (M)					
Voltage L1/L12	3400h	8	R	V	0 to Vmax
Voltage L2/L23	3401h	8	R	V	0 to Vmax
Voltage L3/L31	3402h	8	R	V	0 to Vmax
Current L1	3403h	8	R	A	0 to Imax
Current L2	3404h	8	R	A	0 to Imax
Current L3	3405h	8	R	A	0 to Imax
Maximum real-time total values (M)					
Total kW	3500h	8	R	kW	-Pmax to Pmax
Total kvar	3501h	8	R	kvar	-Pmax to Pmax
Total kVA	3502h	8	R	kVA	0 to Pmax
Total PF ②	3503h	4	R		0 to 1000 ×0.001
Maximum real-time auxiliary values (M)					
Reserved	3600h	8	R		0
Neutral current	3601h	8	R	A	0 to Imax
Frequency ③	3602h	4	R	Hz	0 to 1000 ×0.1
Maximum demands (M)					
Max. volt demand L1	3700h	8	R		0 to Vmax
Max. volt demand L2	3701h	8	R		0 to Vmax
Max. volt demand L3	3702h	8	R		0 to Vmax
Max. ampere demand L1	3703h	8	R	A	0 to Imax
Max. ampere demand L2	3704h	8	R	A	0 to Imax
Max. ampere demand L3	3705h	8	R	A	0 to Imax
Reserved	3706h	8	R		0

Parameter	Data index	Length	Direction	Unit	Range ①
Reserved	3707h	8	R		0
Reserved	3708h	8	R		0
Max. sliding window kW demand (E)	3709h	8	R	kW	0 to Pmax
Reserved	370Ah	8	R		0
Max. sliding window kVA demand (E)	370Bh	8	R	kVA	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	④	0 to 10^9-1
Tariff #2 register	3D01h	8	R	④	0 to 10^9-1
…	…				
Tariff #16 register	3D0Fh	8	R	④	0 to 10^9-1
TOU energy register #2 (E)					
Tariff #1 register	3E00h	8	R	④	0 to 10^9-1
Tariff #2 register	3E01h	8	R	④	0 to 10^9-1
…	…				
Tariff #16 register	3E0Fh	8	R	④	0 to 10^9-1
TOU energy register #3 (E)					
Tariff #1 register	3F00h	8	R	④	0 to 10^9-1
Tariff #2 register	3F01h	8	R	④	0 to 10^9-1
…	…				
Tariff #16 register	3F0Fh	8	R	④	0 to 10^9-1
TOU energy register #4 (E)					
Tariff #1 register	4000h	8	R	④	0 to 10^9-1
Tariff #2 register	4001h	8	R	④	0 to 10^9-1
…	…				
Tariff #16 register	400Fh	8	R	④	0 to 10^9-1
TOU energy register #5 (E)					
Tariff #1 register	4100h	8	R	④	0 to 10^9-1
Tariff #2 register	4101h	8	R	④	0 to 10^9-1
…	…				
Tariff #16 register	410Fh	8	R	④	0 to 10^9-1
TOU energy register #6 (E)					
Tariff #1 register	4200h	8	R	④	0 to 10^9-1
Tariff #2 register	4201h	8	R	④	0 to 10^9-1
…	…				
Tariff #16 register	420Fh	8	R	④	0 to 10^9-1
TOU energy register #7 (E)					
Tariff #1 register	4300h	8	R	④	0 to 10^9-1
Tariff #2 register	4301h	8	R	④	0 to 10^9-1
…	…				
Tariff #16 register	430Fh	8	R	④	0 to 10^9-1

Parameter	Data index	Length	Direction	Unit	Range ①
TOU energy register #8 (E)					
Tariff #1 register	4400h	8	R	④	0 to 10^9-1
Tariff #2 register	4401h	8	R	④	0 to 10^9-1
…	…				
Tariff #16 register	440Fh	8	R	④	0 to 10^9-1
TOU minimum kW demands (M) - Reserved					
Reserved	4500h	8	R		0
Reserved	4501h	8	R		0
…	…				
Reserved	450Fh	8	R		0
TOU minimum kVA demands (M) - Reserved					
Reserved	4700h	8	R		0
Reserved	4701h	8	R		0
…	…				
Reserved	470Fh	8	R		0
TOU maximum kW demands (M) (E)					
Tariff #1 register	4800h	8	R	kW	0 to Pmax
Tariff #2 register	4801h	8	R	kW	0 to Pmax
…	…				
Tariff #16 register	480Fh	8	R	kW	0 to Pmax
TOU maximum kVA demands (M) (E)					
Tariff #1 register	4A00h	8	R	kVA	0 to Pmax
Tariff #2 register	4A01h	8	R	kVA	0 to Pmax
…	…				
Tariff #16 register	4A0Fh	8	R	kVA	0 to Pmax

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

② New absolute min/max value (lag or lead)

③ The actual frequency range is 45.00 - 65.00 Hz

④ The TOU energy register unit will depend on the input parameter for which the register is allocated

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

(E) available in the PM171E

5.3 Basic Setup Registers

Table 5-8 Basic Setup Registers

Parameter	Data index	Length	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 50000 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	1 to 50000 A

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

(E) available in the PM171E

5.4 User Selectable Options Setup

Table 5-9 User Selectable Options Registers

Parameter	Data index	Length	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 1 = 1×10^5 2 = 1×10^6 3 = 1×10^7 4 = 1×10^8 5 = 1×10^9
Phase energy calculation mode (E)	8702h	4	R/W	0 = disable, 1 = enable

Parameter	Data index	Length	Direction	Range
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 = disable, 1 = enable

(E) available in the PM171E (read as 65535 in the PM171P)

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

Parameter	Data index	Length	Direction	Range
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

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	Setup indexes (hex)
Setpoint #1	8200h-8205h
Setpoint #2	8206h-820Bh
Setpoint #3	820Ch-8211h
Setpoint #4	8212h-8217h
Setpoint #5	8218h-821Dh
Setpoint #6	821Eh-8223h
Setpoint #7	8224h-8229h
Setpoint #8	822Ah-822Fh
Setpoint #9	8230h-8235h
Setpoint #10	8236h-820Bh
Setpoint #11	823Ch-8241h
Setpoint #12	8242h-8247h
Setpoint #13	8248h-824Dh
Setpoint #14	824Eh-8253h
Setpoint #15	8254h-8259h
Setpoint #16	825Ah-825Fh

Table 5-12 Setpoint Setup Registers

Parameter	Offset	Length	Direction	Range
Trigger ID	+0	4	R/W	see Table 5-13
Action	+1	4	R/W	see Table 5-14
Operate delay	+2	4	R/W	0-9999 (×0.1 sec)
Release delay	+3	4	R/W	0-9999 (×0.1 sec)
Operate limit	+4	8	R/W	see Table 5-13
Release limit	+5	8	R/W	see Table 5-13

1. The setpoint is disabled when its trigger parameter 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 index (hex)	Unit	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 (E)			
Pulse input #1	0700h		N/A
Pulse input #2	0701h		N/A
Phase reversal			
Positive phase rotation reversal ②	8901h		N/A
Negative phase rotation reversal ②	8902h		N/A
Pulse counters (E)			
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

Trigger parameter	Trigger index (hex)	Unit	Range ①
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	A	0 to Imax
High current L2	0C04h	A	0 to Imax
High current L3	0C05h	A	0 to Imax
Low current L1	8C03h	A	0 to Imax
Low current L2	8C04h	A	0 to Imax
Low current L3	8C05h	A	0 to Imax
High/low real-time values on any phase			
High voltage	0E00h	V	0 to Vmax
Low voltage	8D00h	V	0 to Vmax
High current	0E01h	A	0 to Imax
Low current	8D01h	A	0 to Imax
High voltage THD	0E07h	%	0 to 9999 ×0.1
High current THD	0E08h	%	0 to 9999 ×0.1
High K-Factor	0E09h	%	10 to 9999 ×0.1
High current TDD	0E0Ah	%	0 to 1000 ×0.1
High/low real-time auxiliary values			
High frequency ③	1002h	Hz	0 to 10000 ×0.01
Low frequency ③	9002h	Hz	0 to 10000 ×0.01
High/low average values per phase			
High current L1	1103h	A	0 to Imax
High current L2	1104h	A	0 to Imax
High current L3	1105h	A	0 to Imax
Low current L1	9103h	A	0 to Imax
Low current L2	9104h	A	0 to Imax
Low current L3	9105h	A	0 to Imax
High/low average values on any phase			
High voltage	1300h	V	0 to Vmax
Low voltage	9200h	V	0 to Vmax
High current	0301h	A	0 to Imax
Low current	8201h	A	0 to Imax
High/low average total values			
High total kW import	1406h	kW	0 to Pmax
High total kW export	1407h	kW	0 to Pmax
High total kvar import	1408h	kvar	0 to Pmax
High total kvar export	1409h	kvar	0 to Pmax
High total kVA	1402h	kVA	0 to Pmax

Trigger parameter	Trigger index (hex)	Unit	Range ①
Low total PF lag	9404h		0 to 1000 ×0.001
Low total PF lead	9405h		0 to 1000 ×0.001
High/low average auxiliary values			
High neutral current	1501h	A	0 to Imax
High frequency ③	1502h	Hz	0 to 10000 ×0.01
Low frequency ③	9502h	Hz	0 to 10000 ×0.01
High present demands			
High volt demand L1	1600h	V	0 to Vmax
High volt demand L2	1601h	V	0 to Vmax
High volt demand L3	1602h	V	0 to Vmax
High ampere demand L1	1603h	A	0 to Imax
High ampere demand L2	1604h	A	0 to Imax
High ampere demand L3	1605h	A	0 to Imax
High block kW demand (E)	1606h	kW	0 to Pmax
High block kVA demand (E)	1608h	kVA	0 to Pmax
High sliding window kW demand (E)	1609h	kW	0 to Pmax
High sliding window kVA demand (E)	160Bh	kVA	0 to Pmax
High accumulated kW demand (E)	160Fh	kW	0 to Pmax
High accumulated kVA demand (E)	1611h	kVA	0 to Pmax
Predicted kW demand (import) (E)	1612h	kW	0 to Pmax
Predicted kVA demand (E)	1614h	kVA	0 to Pmax

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

② The setpoint is operated when the actual phase sequence does not match the indicated phase rotation

③ The actual frequency range is 45.00 - 65.00 Hz

(E) available in the PM171E

Table 5-14 Setpoint Actions

Action	ID (hex)
No action	0000h
Operate relay #1 ①	3000h
Operate relay #2 ①	3001h
Increment counter #1 (E)	4000h
Increment counter #2 (E)	4001h
Increment counter #3 (E)	4002h
Increment counter #4 (E)	4003h
Clear counter #1 (E)	4200h
Clear counter #2 (E)	4201h
Clear counter #3 (E)	4202h
Clear counter #4 (E)	4203h
Clear all counters (E)	6400h
Reset total energy (E)	6000h
Reset all total maximum demands (E)	6100h

Action	ID (hex)
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 PM171E

① In the PM171E, 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 the user to manually override relay operation that is normally operated via alarm setpoints.

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.

Table 5-15 Relay Operation Control Registers

Parameter	Data index	Length	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	Data index	Length	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
	2-5	Reserved
	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
	11-15	Reserved
Options 2	0-2	Number of relays - 1
	3-6	Number of digital inputs - 1
	7-8	Number of analog outputs - 1
	9-13	Reserved
	14-15	Memory module size (PM171E) 10 = 512 Kbyte

5.9 Extended Status Registers

Table 5-19 Extended Status Registers

Parameter	Data index	Length	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

5.10 Alarm Status Registers

Table 5-20 Alarm Status Registers

Parameter	Data index	Length	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	Data index	Length	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 queue (E)	A00Bh	4	W	0
Restore data log queue (E)	A00Ch	4	W	0-7 = data log #1 - #8 16 = all data logs

(E) available in the PM171E

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