Chapter 6: Data Communication

This section is applicable only for EM6400 series power meters with RS 485 communication option.

RS 485 Data Port

Data Port advantages:

- Rapid, on-line, real time readings into
- Your own SCADA software or PLC.
- Schneider Electric energy management software products such as ION™ Enterprise, Vijeo Citect, PowerLogic SCADA for pinpointing energy usage and waste.
- Schneider Electric ConPAD: Power meter programming and basic data reading utility.
- Data port has built-in impedance matched design for low reflectance on long data cables at high Baud rates. Eliminates need for complicated impedance matching resistors at the ends of long data cables.
- Fast 16 ms power meter response, average time to read 10 parameters is 90 to 100 ms (9600 Baud, Even parity, One stop bit).
- Direct reading, pre-scaled Float readings. Accurate, full precision low, and high readings. No need for additional scaling factors or decimal adjustment.
- Fast, easy-to-use grouping of parameters tuned for field requirements.
- TURBO area for single point polling (upto 50 per query)
- Block area for even faster access to pre-configured data blocks

Installation

Figure 6-1: 2-wire half duplex communication connection

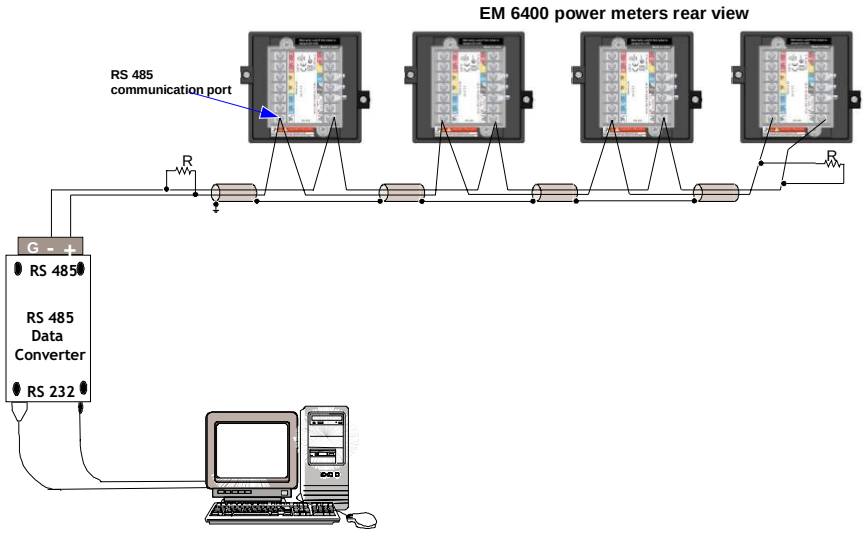
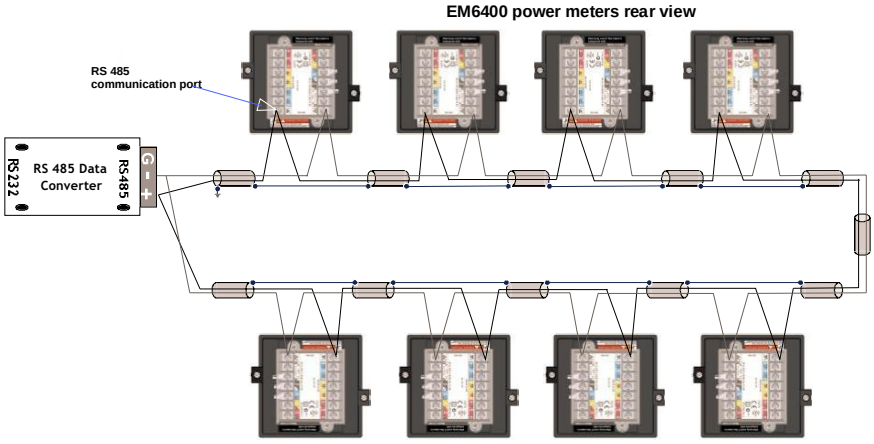


Figure 6-2: Closed loop, 2-wire half duplex.
Advantage – Reliable communications, tolerant to one break in the cable.



Communication Capabilities

Table 6-1: RS 485 communication distances

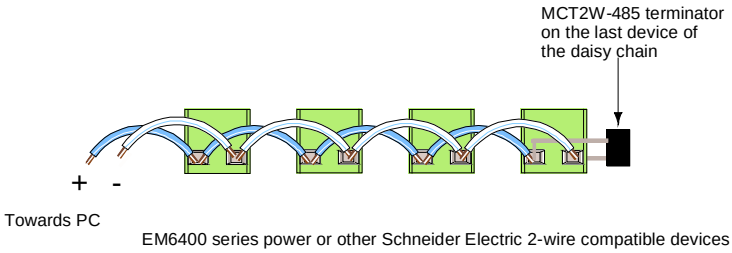
Baud Rate	Maximum communication distances 1 to 32 devices
	Meters
9600	1200
19200	900

NOTE: Distances listed should be used as guide only and cannot be guaranteed for non-Schneider Electric devices. Above distances subject to vary based on the quality of the cable.

Daisy-chaining Devices to the Power Meter

RS 485 slave port allows the power meter to be connected in a daisy chain with up to 31 2-wire devices. In this bulletin, *communications link* refers to a chain of devices that are connected by a communications cable. See Figure 6-3.

Figure 6-3: Daisy-chaining 2-wire devices



- If the power meter is the first device on the daisy chain, connect it to the host device using a RS 232 to RS 422/RS 485 converter or RS 485 to Ethernet converter.
- If the power meter is the last device on the daisy chain, terminate it with the terminator provided.

- See “Table 6-1” on page 52, for the maximum daisy-chain communications distances for 2-wire devices.
- The terminal’s voltage and current ratings are compliant with the requirements of the EIA RS 485 communications standard.

NOTE: For better performance, Schneider Electric recommend to use SWG 100 % shielded cable with low resistance (Belden or Lapp make).

Data Formats and Settings

Your SCADA software must be configured for Modbus RTU communication, before integrating the Schneider Electric EM6400 series power meter.
The mode of transmission is defined in the following which is compatible with Modbus RTU Mode:

Table 6-2: Power meter communication and protocol settings

Power meter communication settings	
Protocol	Modbus RTU
Data bits	8
Baud rate	9600 Baud, User set 1200 to 19200 Range:1200, 2400, 4800, 9600, 19200 Normal use: 9600 Baud Noisy, EMI, RFI, long data cable: 4800/2400 Baud Short cable (< 300 meters or 975 feet): 19200 Baud
Parity	Even
Device Address	1
Stop bit	1
Modbus Protocol	
Device Address	1 to 247 Upto 247 meters per COM port with repeaters
Function Code	03 (Read)
Data Address	Refer to ”Data address” on page 57 for more information
Data type	32-bit float (real) : • All parameters. • Direct reading, little end • ian float, no scaling required 32-bit unsigned integer : • INTR (number of interruptions (outages) - RMS Blocks) • RunSec (Run seconds – Integ Block)
No of Registers	2 to 50 (optional) per power meter data block of 10 x 32 bit values must be configured to suit the power meter

NOTE: The polling interval to poll the data from EM6400 power meter will depend on baud rate. We recommend polling interval of one second at 9600 Baud rate.

Parameter Settings for Different SCADA Software

The following table explains how to read the parameter VA (See "Individual parameter address" on page 57 for more information) in different Modbus master software/PLC's.

Table 6-3: Parameter settings

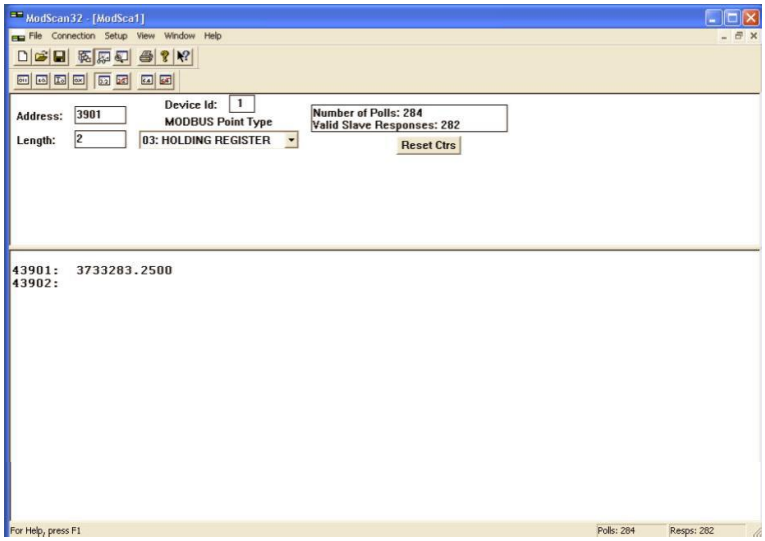
SL. No	SCADA software	Start Address	Function Code	No. of Register	Data Type	Remarks
1	ION™ Enterprise	43901	Internally configured	2	Swapped Float	Direct conversion
2	PowerLogic SCADA	43901	Internally configured	2	Real	Direct conversion
3	Vijeo Citect	43901	Internally configured	2	Real	Direct conversion
4	Intouch	43901 F	Nil	2	Float	Direct conversion
5	Modscan (Master)	3901	03 – HOLDING REGISTERS	2	Floating point	Unswapped FP mode
6	MODTEST	43901	03 – Rosemount	Points -1	Float-Rosemount	
7	CIMPLICITY	43901	Nil	100	Real	Direct conversion. The array concept can be used here to poll all the data in single scan.
8	Allenbradly – Micrologix PLC (Slave/Master)	43901	03-HOLDING REGISTERS	2	Floating point	Direct
9	GE Fanuc PLC	43901	03-HOLDING REGISTERS	2	Real	Direct
10	ABB RTU 560 (Mater)	Index-3900	03- Read HOLDING REGISTERS	Query Range - 2	MFI – Analog measured Floating value	Under sub parameters, "Sign and Exponent in First Register" should be disabled (Unchecked)
11	SEIMENS PLC (Master)	3900	03-HOLDING REGISTERS	2	Real	Direct
12	MOVICON	43901	Nil	2	Real	Direct
13	RSVIEW	43901	03-HOLDING REGISTERS	2	Real	Direct
14	ABB Microscada	3900	Format – 9	Interval – 2	Real	Direct

Communication Test

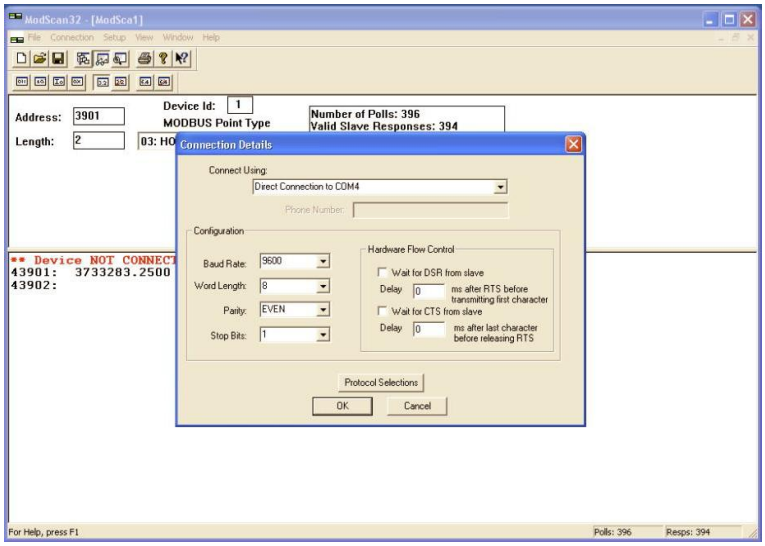
Communication test: EM6400 series power meter can be successfully used for communication using Modscan software as Modbus master in PC. Details of the settings in Modscan are given below.

Settings in Modscan v3.D05-00 software to establish communication with power meters:

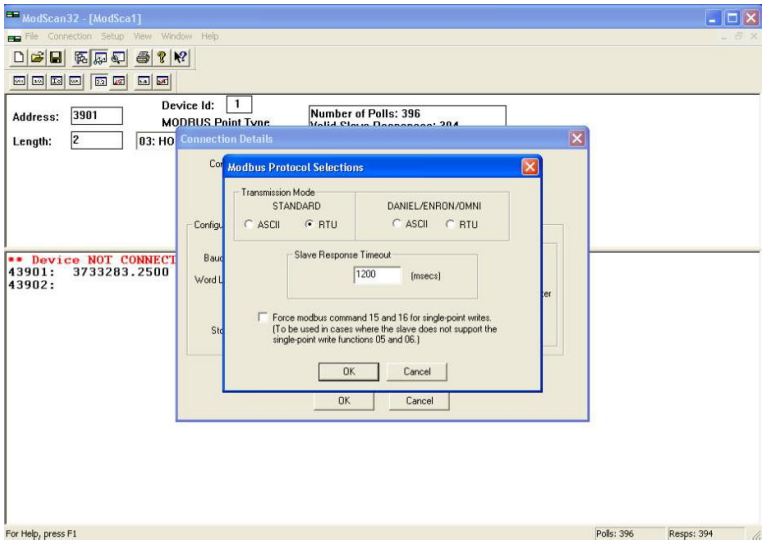
- Free download demo Modscan software from http://www.win-tech.com.
- The following explains how to read apparent power total (VA total) from register 3901.



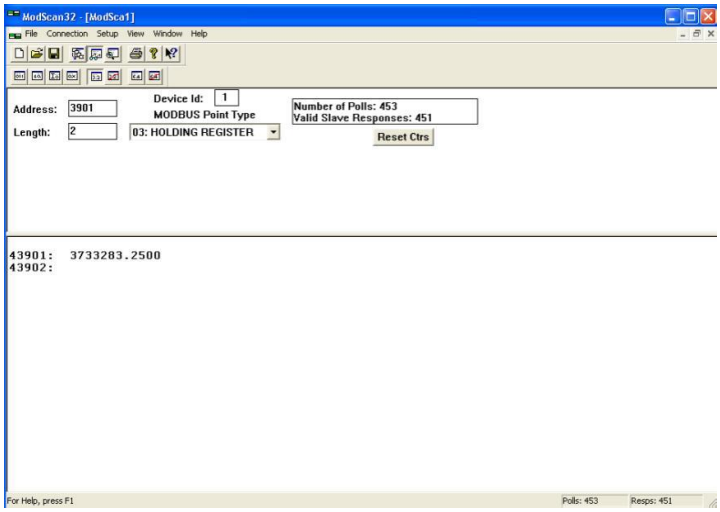
1. After starting the Modscan, to read Apparent power total (VA total), enter address as 3901 (decimal), length as 2, device ID as 1, Modbus point type as 03, and HOLDING REGISTER.
2. **Modify the connection details:** Click connection > connect, to see the **connection detail window**. Change all the settings to match the following screen. These are default settings of the power meter.



3. Set the Modbus protocol selections: On **Connection details** window (shown in previous step), click on **Protocol Selections.** Enter the protocol settings as shown below and click **OK** in all the windows.



4. The Modscan software starts polling the configured COM port for the Device ID 1.
   Modscan Demo software will stop polling after 3.5 minutes on successful communication.



This shows that the power meter is communicating with the Modbus Modscan master software successfully on the PC. The power meter is Modbus RTU compliant.

Data Address

The EM6400 power meter supports the transfer of whole block and also of individual data values (two registers are used for storing single data value).

- In the transfer of individual data values, it treats two registers as an object with the starting address (e.g., 3900) considered as the object name. This enables you to transfer required data values for energy management.
- In the transfer of the whole block, it basically treats each block as an object with the starting address (e.g.,3000) considered as the object name. This enables fast block transfers, since energy management usually requires a block of related readings for the same point of time. This method also eliminates time-skew within readings of that block.
- The device address, block start address, number of registers, must be configured to suit the power meter. You must also make the related SCADA settings for polling priority, logging, and viewing the data. Refer your SCADA software instructions to learn how to do this.

Individual Parameter Address

- Function Code: 03 Read
- No scaling required
- Read as block or individual parameters

Table 6-4: Individual parameter address

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
Metering								
Metering - Current								
A	Current average	3913	Float	●	●		●	●
A1	Current, phase 1	3929	Float	●	●		●	●
A2	Current, phase 2	3943	Float	●	●		●	●
A3	Current, phase 3	3957	Float	●	●		●	●
Metering – Voltage								
VLL	Line to line average voltage	3909	Float	●	●		●	
VLN	Line to neutral voltage	3911	Float	●	●		●	
V12	Voltage phase 1 to phase 2	3925	Float	●	●		●	
V23	Voltage phase 2 to phase 3	3939	Float	●	●		●	
V31	Voltage phase 3 to phase 1	3953	Float	●	●		●	
V1	Voltage phase 1 to neutral	3927	Float	●	●		●	
V2	Voltage phase 2 to neutral	3941	Float	●	●		●	
V3	Voltage phase 3 to neutral	3955	Float	●	●		●	
Metering – Power								
W	Active power, total	3903	Float	●		●	●	●
W1	Active power, phase 1	3919	Float	●		●	●	●
W2	Active power, phase 2	3933	Float	●		●	●	●
W3	Active power, phase 3	3947	Float	●		●	●	●
VAR	Reactive power, total	3905	Float	●		●		
VAR1	Reactive power, phase 1	3921	Float	●		●		
VAR2	Reactive power, phase 2	3935	Float	●		●		
VAR3	Reactive power, phase3	3949	Float	●		●		
VA	Apparent power, total	3901	Float	●		●	●	●
VA1	Apparent power, phase 1	3917	Float	●		●	●	●
VA2	Apparent power, phase 2	3931	Float	●		●	●	●
VA3	Apparent power, phase 3	3945	Float	●		●	●	●
Metering – Power Factor								
PF	Power factor average	3907	Float	●	●	●	●	
PF1	Power factor, phase 1	3923	Float	●	●	●	●	
PF2	Power factor, phase 2	3937	Float	●	●	●	●	

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
PF3	Power factor, phase 3	3951	Float	●	●	●	●	
Metering - Frequency								
F	Frequency, Hz	3915	Float	●	●		●	
Power Quality								
THD								
%V1	Voltage THD, phase 1	3861	Float	●				
%V2	Voltage THD, phase 2	3863	Float	●				
%V3	Voltage THD, phase 3	3865	Float	●				
%A1	Current THD, phase 1	3867	Float	●				
%A2	Current THD, phase 2	3869	Float	●				
%A3	Current THD, phase 3	3871	Float	●				
Energy								
FwdVAh	Forward apparent energy	3959	Float	●		●	●	●
FwdWh	Forward active energy	3961	Float	●		●	●	●
FwdVARh	Forward reactive inductive energy	3963	Float	●		●		
FwdVARh	Forward reactive capacitive energy	3965	Float	●		●		
RevVAh	Reverse apparent energy	3967	Float	●				
RevWh	Reverse active energy	3969	Float	●				
RevVARh	Reverse reactive inductive Energy	3971	Float	●				
RevVARh	Reverse reactive capacitive Energy	3973	Float	●				
On hrs	n hours	3993	Long	●	●	●	●	●
FwdRun secs	Forward run seconds	3995	Long	●		●	●	●
RevRun secs	Reverse run seconds	3997	Long					
Intr	Number of power interruptions	3999	Long	●	●	●	●	●
Demand								
Present Demand	Present demand	3975	Float	●				
Rising Demand	Rising demand	3977	Float	●				
Max MD	Maximum demand	3979	Float	●				
Max DM Occurrence Time	aximum demand occurrence time	3981	Long	●				
Percentage of Load parameters								
% Avg Load	Average load percentage	3881	Float	●				
%L1	Percentage of phase 1 load	3883	Float	●				
%L2	Percentage of phase 2 load	3885	Float	●				
%L3	Percentage of phase 3 load	3887	Float	●				
Unbalanced %Load	Unbalanced %load	3889	Float	●				
Unbalanced % voltage	Unbalanced % voltage	3891	Float	●				

NOTE: THD values are indicative only.

Block Parameter Address

Total RMS Block

- Function Code: 03H Read
- Number of registers: 20
- No scaling required
- Read as block only

Table 6-5: Total RMS block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
VA	Apparent power, total	3001	Float	●		●	●	●
W	Active power, total	3003	Float	●		●	●	●
VAR	Reactive power, total	3005	Float	●		●		
PF	Average PF	3007	Float	●	●	●	●	
VLL	Average line to line voltage	3009	Float	●	●		●	
VLN	Average line to neutral voltage	3011	Float	●	●		●	
A	Average current	3013	Float	●	●		●	●
F	Frequency, Hz	3015	Float	●	●		●	
Reserved	Reserved	3017	Long					
Intr	Number of interruption	3019	Long	●	●	●	●	●

R phase RMS Block:

- Function Code: 03H Read
- Number of registers: 20
- No scaling required
- Read as block only

Table 6-6: R phase RMS block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
VA1	Apparent power, phase1	3031	Float	●		●	●	●
W1	Active power, phase1	3033	Float	●		●	●	●
VAR1	Reactive power, phase1	3035	Float	●		●		
PF1	Power factor, phase1	3037	Float	●	●	●	●	
V12	Voltage phase1 to phase2	3039	Float	●	●		●	
V1	Voltage phase1 to neutral	3041	Float	●	●		●	
A1	Current, phase1	3043	Float	●	●		●	●
F1	Frequency, Hz	3045	Float	●	●		●	
Reserved	Reserved	3047	Long					
Intr1	Number of interruption	3049	Long	●	●	●	●	●

Y phase RMS Block:

- Function Code: 03H Read
- Number of registers: 20
- No scaling required
- Read as block only

Table 6-7: Y phase RMS block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
VA2	Apparent power, phase 2	3061	Float	●		●	●	●
W2	Active power, phase 2	3063	Float	●		●	●	●
VAR2	Reactive power, phase 2	3065	Float	●		●		
PF2	Power factor, phase 2	3067	Float	●	●	●	●	
V23	Voltage phase 2 to phase 3	3069	Float	●	●		●	
V2	Voltage phase 2 to neutral	3071	Float	●	●		●	
A2	Current, phase 2	3073	Float	●	●		●	●
F2	Frequency, Hz	3075	Float	●	●		●	
Reserved	Reserved	3077	Long					
Intr2	Number of interruption	3079	Long	●	●	●	●	●

B phase RMS Block:

- Function Code: 03H Read
- Number of registers: 20
- No scaling required
- Read as block only

Table 6-8: B phase RMS block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
VA3	Apparent power, phase 3	3091	Float	●		●	●	●
W3	Active power, phase 3	3093	Float	●		●	●	●
VAR3	Reactive power, phase 3	3095	Float	●		●		
PF3	Power factor, phase 3	3097	Float	●	●	●	●	
V31	Voltage phase 3 to phase 1	3099	Float	●	●		●	
V3	Voltage phase 3 to neutral	3101	Float	●	●		●	
A3	Current, phase 3	3103	Float	●	●		●	●
F3	Frequency, Hz	3105	Float	●	●		●	
Reserved	Reserved	3107	Long					
Intr3	Number of interruption	3109	Long	●	●	●	●	●

Forward Integrated Block

- Function Code: 03H Read
- Number of registers: 20
- No scaling required
- Read as block only

Table 6-9: Forward integrated block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
FwdVAh	Forward apparent energy	3121	Float	●		●	●	●
FwdWh	Forward active energy	3123	Float	●		●	●	●
FwdVARh	Forward reactive inductive energy	3125	Float	●		●		
Reserved	Reserved	3127	Float					
Reserved	Reserved	3129	Float					
FwdVARh	Forward reactive capacitive energy	3131	Float	●		●		
Reserved	Reserved	3133	Float					
Reserved	Reserved	3135	Float					
Reserved	Reserved	3137	Long					
FwdRunsecs	Forward run seconds	3139	Long	●		●	●	●

Reverse Integrated Block:

- Function Code: 03H Read
- Number of registers: 20
- No scaling required
- Read as block only

Table 6-10: Reverse integrated block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
RevVAh	Reverse apparent energy	3151	Float	●				
RevWh	Reverse active energy	3153	Float	●				
RevVARh	Reverse reactive inductive energy	3155	Float	●				
Reserved	Reserved	3157	Float					
Reserved	Reserved	3159	Float					
RevVARh	Reverse reactive capacitive energy	3161	Float	●				
Reserved	Reserved	3163	Float					
Reserved	Reserved	3165	Float					
Reserved	Reserved	3167	Long					
RevRunsecs	Reverse run seconds	3169	Long	●				

Total Integrated Block:

- Function Code: 03H Read
- Number of registers: 20
- No scaling required
- Read as block only

Table 6-11: Total integrated block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
TotVAh	Total apparent energy	3181	Float	●				
TotWh	Total active energy	3183	Float	●				
TotVARh	Total reactive inductive energy	3185	Float	●				
Reserved	Reserved	3187	Float					
Reserved	Reserved	3189	Float					
TotVARh	Total reactive capacitive energy	3191	Float	●				
Reserved	Reserved	3193	Float					
Reserved	Reserved	3195	Float					
Reserved	Reserved	3197	Long					
TotRunsecs	Total run seconds	3199	Long	●				

Demand Block:

- Function Code: 03H Read
- Number of registers: 22
- No scaling required
- Read as block only

Table 6-12: Demand block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
Reserved	Reserved	3721	Long					
Reserved	Reserved	3723	Float					
Reserved	Reserved	3725	Float					
Reserved	Reserved	3727	Float					
Reserved	Reserved	3729	Float					
Reserved	Reserved	3731	Float					
Reserved	Reserved	3733	Float					
Present demand	Present demand	3735	Float	●				
Rising demand	Rising demand	3737	Float	●				
Time remaining	Time remaining	3739	Long	●				
Reserved	Reserved	3741	Float					

Note: The address 3741 is overlapped between the demand and max demand blocks.

Max Demand Block:

- Function Code: 03H Read
- Number of registers: 36
- No scaling required
- Read as block only

Table 6-13: Max demand block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
MaxDM	Maximum demand	3741	Float	•				
MaxDMTime	Maximum demand occurrence time	3743	Long	•				
Reserved	Reserved	3745	Float					
Reserved	Reserved	3747	Long					
Reserved	Reserved	3749	Float					
Reserved	Reserved	3751	Long					
Reserved	Reserved	3753	Float					
Reserved	Reserved	3755	Long					
Reserved	Reserved	3757	Float					
Reserved	Reserved	3759	Long					
Reserved	Reserved	3761	Float					
Reserved	Reserved	3763	Long					
Reserved	Reserved	3765	Float					
Reserved	Reserved	3767	Long					
Reserved	Reserved	3769	Float					
Reserved	Reserved	3771	Long					
Reserved	Reserved	3773	Float					
Reserved	Reserved	3775	Long					

Note: The address 3741 is overlapped between the Demand and Max Demand blocks

Old Forward Integrated Block

- Function Code: 03H Read
- Number of registers: 20
- No scaling required
- Read as block only

Table 6-14: Old forward integrated block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
OldFwdVAh	Old forward apparent energy	3122	Float	•		•	•	•
OldFwdWh	Old forward active energy	3124	Float	•		•	•	•
OldFwdVARh	Old forward reactive inductive energy	3126	Float	•		•		
Reserved	Reserved	3128	Float					
Reserved	Reserved	3130	Float					
OldFwdVARh	Old forward reactive capacitive energy	3132	Float	•		•		
Reserved	Reserved	3134	Float					
Reserved	Reserved	3136	Float					
Reserved	Reserved	3138	Long					
OldFwdRunsecs	Old forward run seconds	3140	Long	•		•	•	•

Old Reverse Integrated Block:

- Function Code: 03H Read
- Number of registers: 20
- No scaling required
- Read as block only

Table 6-15: Old reverse integrated block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
OldRevVAh	Old reverse apparent energy	3152	Float	•				
OldRevWh	Old reverse active energy	3154	Float	•				
OldRevVARh	Old reverse reactive inductive energy	3156	Float	•				
Reserved	Reserved	3158	Float					
Reserved	Reserved	3160	Float					
OldRevVARh	Old reverse reactive capacitive energy	3162	Float	•				
Reserved	Reserved	3164	Float					
Reserved	Reserved	3166	Float					
Reserved	Reserved	3168	Long					
OldRevRunsecs	Old reverse run seconds	3170	Long	•				

Old Total Integrated Block:

- Function Code: 03H Read
- Number of registers: 20
- No scaling required
- Read as block only

Table 6-16: Old total integrated block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
OldTotVAh	Old total apparent energy	3182	Float	•				
OldTotWh	Old total active energy	3184	Float	•				
OldTotVARh	Old total reactive inductive energy	3186	Float	•				
Reserved	Reserved	3188	Float					
Reserved	Reserved	3190	Float					
OldTotVARh	Old total reactive capacitive energy	3192	Float	•				
Reserved	Reserved	3194	Float					
Reserved	Reserved	3196	Float					
Reserved	Reserved	3198	Long					
OldTotRunsecs	Old total run seconds	3200	Long	•				

Phase Angle Block:

- Function Code: 03H Read
- Number of registers: 18
- No scaling required
- Read as block only

Table 6-17: Phase angle block

Parameter	Description	Address	Type	EM 6400	EM 6459	EM 6434	EM 6436	EM 6433
Neutral voltage	Neutral voltage	3701	Float	●	●			
An	Neutral current	3703	Float	●	●			
V1	Voltage phase angle, phase 1	3705	Float	●	●			
V2	Voltage phase angle, phase 2	3707	Float	●	●			
V3	Voltage phase angle, phase 3	3709	Float	●	●			
A1	Current phase angle, phase 1	3711	Float	●	●			
A2	Current phase angle, phase 2	3713	Float	●	●			
A3	Current phase angle, phase 3	3715	Float	●	●			
RPM	Rotations per minute	3717	Float	●	●			

Note: The parameters V1, V2, V3 (voltage phase angles), neutral voltage, and neutral current are available only through communication.

NOTE:

- *Most of the reserved and unavailable parameters return zero value.*
- *The SCADA software must support register blocks consisting of different data types (integers and floats) to transfer of whole block.*
- *Each Modbus register size is 16 bits. All the power meter readings are 32 bits. Therefore, each power meter reading occupies two consecutive Modbus registers. For example, VA parameter absolute address is 3901. It occupies both 3901 and 3902 Modbus registers.*
- *Address configuration: All addresses are in decimal. Some SCADA software supports Modbus register address instead of absolute register address. In this case add 40000 to the above address and use it. For example, VA parameter absolute address is 3901. Modbus address can be 43901 (40000+3901).*
- *Phase Angle Block: Voltage phase angles (0,120,240) are hard coded (not measured). Hence, these values are also available in communication in the absence of input signals; however, these voltage phase angles are not available in the power meter display.*
- *TURBO, and Percentage of Load Blocks: These parameters can be read individually or as a block*
- *TURBO block: 50 parameters maximum*
- *Percentage of Load block: 5 parameters maximum*
- *All power meters addresses should be set between 1 and 247.*
- *All power meters should have uniform communication settings like Baud rate, parity and stop bit.*
- *Use Diagnostic mode display in the power meter to analyze the problem in communication.*
- *Error: u – Invalid unit ID*
  A – Invalid Address
  c – CRC error (cyclic redundancy checking)
  t – Transmitting
  r – Receiving
  F – Invalid function code
  o – Parity, framing or overrun error
  O- Buffer overflow