Connectivity to the ASCO® 5210 Digital Power Meter via *Modbus*®

This design specification describes the *Modbus* communications protocol as supported by the *Power Meter 5210*. It includes instructions on how to pass information into and out of the device via the Modbus network. This publication should be used by individuals wishing to integrate either device into their facility by developing software to communicate with either device. Additional information can be found in Power Meter Operator's Manual 381333-368.

Modbus Protocol

Implementation Basics

The following rules define the Modbus slave implementation of the devices:

- The devices operate as slaves only (communication must be initiated by the master).
- The maximum number of bytes contained within one packet of communications is 64.
- The maximum number of registered accessed with one read is 29.

Transmission Format

Although the Modbus protocol supports both ASCII and RTU modes of transmission, only the RTU mode is implemented. Within the RTU mode, the ASCO devices support the following communication parameters:

- 8 data bits
- no parity
- 1 stop bit

Modbus RTU Packet Format

Every Modbus Packet consists of the following fields:

- Device Address Field
- Function Code Field
- Data Field
- Error Check Field

Device Address Field. This is the first byte of each Modbus RTU transmission. The device address is a number limited to the range of 0 - 247 and is associated with a single device configured with a matching address. Only the slave device whose address matches the value in this field will respond to the specified command. Device address 0 indicates a broadcast command. This means that every slave on the network will act on the command, but it will not issue any responses.

Function Code Field. This is a second byte of each transmission and represents the commanded action to the slave device (for queries from the master) or the action that was taken by the slave device (for responses from the slave). Codes between 1 and 127 are defined as Modbus RTU functions. The function codes supported by the Power Meter are detailed on pages 4-6 .

Data Field. The data field varies in length depending on whether the message is a request or a response packet. This field typically contains information required by the slave device to perform the command specified in a request packet or data being passed back by the slave device in a response packet.

Error Check Field. The error check field consists of a 16 bit (2 byte) Cyclical Redundancy Check (CRC16). It allows the receiving device to detect a packet that has been corrupted with transmission errors. Refer to *CRC-16 Algorithm* on page 2 for details.

Packet Framing and Timing

Because the Modbus RTU protocol does not define any explicit packet synchronization bytes, synchronization is accomplished implicitly with the use of silent intervals. According to the Modbus RTU standard, all messages must start with a silent interval of at least 3.5 character times. This means that every byte within a packet must precede the previous byte by fewer than 3.5 character times based on the baud rate. And every new packet of data must begin at least 3.5 character times or more after the packet that had preceded it.

In summary, the three timing intervals associated with the ASCO devices are as follows:

- Maximum time between two consecutive bytes within a packet < 3.5 character times.
- Minimum time between two consecutive packets is > 3.5 character times.
- Maximum response time from a Master request to a slave response is < 100 milliseconds.

CRC-16 Algorithm

Procedure. The algorithm essentially treats the entire data packet (less the start, stop, and, if used, parity bits) as one continuous binary number. Since we are doing a 16-bit CRC calculation, the binary number (entire packet) is multiplied by 2^{16} and then divided by the generator polynomial. In the case of the Modbus protocol, the generator polynomial is $x^{16} + x^{15} + x^2 + 1$. The 16-bit remainder of the division, which is the 16-bit CRC checksum, is then appended to the end of the packet. The resulting data packet including the 16-bit CRC checksum, when divided by the same Generator Polynomial at the receiver, will give a zero remainder if no transmission errors have occurred.

The binary value of the Generator Polynomial is **A001** hex. This is obtained by first dropping the most-significant-bit of the polynomial and then reversing the bit order. This yields 1010000000000001 or A001h.

The steps for generating the 16-bit CRC checksum are as follows:

1. Initially, load the 16-bit CRC register with the value FFFF hex.
2. Exclusive OR the 16-bit CRC register with the first data byte of the packet and store the result in the 16-bit CRC register.
3. If the Least Significant Bit (LSB) of the 16-bit CRC register is equal to one, then shift the 16-bit CRC register to the right by one bit and then Exclusive OR the result with the generator polynomial, A001 hex. Otherwise, just shift the 16-bit CRC register to the right by one bit.
4. Repeat step 3 until eight right shifts have been performed.
5. Exclusive OR the 16-bit CRC register with the next data byte of the packet.
6. Repeat steps 3-5 until all the bytes of the data packet have been used in step 5.
7. The 16-bit CRC register contains the new checksum to be appended to the end of the packet, Least Significant Byte first.

CRC-16 Pseudocode. Below is the pseudocode for generating the 16-bit CRC checksum. XOR is the Exclusive-OR function:

```
CRC16REG = FFFF hex
GENPOLY = A001 hex

FOR X = 1 to number of bytes in packet
    BEGIN
     XOR CRC16REG with the Xth data byte
     FOR Y = 1 to 8
         BEGIN
          IF [(the least-significant-bit of CRC16REG) = 1] THEN
               SHIFT CRC16REG one bit to the RIGHT
               XOR CRC16REG with GENPOLY
           OTHERWISE
                        SHIFT CRC16REG one bit to the RIGHT
         END
     NEXT Y
    END
NEXT X
```

The resulting **CRC16REG** contains the 16-bit CRC checksum

CRC-16 C Programming Language Example. **CRC16_checksum** is a C language function that calculates and returns the 16-bit CRC checksum of a string of characters. This is the brute force method as it consumes a lot of processing power performing numerous bit shifts. A table look-up method based on this function would be more suitable for embedded systems where processing power is at a premium. The following four parameters are passed as part of the function

1. pointer to string
2. length of string (in bytes)
3. initial CRC value
4. desired Generator polynomial

Included to make this CRC-16 function generic for any generator polynomial

continued on next page

The following C-language type definitions (typedef's) are assumed:

1. typedef unsigned int uint;
2. typedef unsigned char uchar;

The function is defined as follows:

```
uint CRC16_checksum(uchar *Buffer, uint Length, uint CRC, uint Genpoly) {

uint index;

    While (Length--) {           /* for each data byte in string */

       CRC = CRC ^ (uint) *Buffer++;    /* exclusive OR data byte */

       For (index = 0; index < 8; index++) {   /* for each of the 8 bits */
           If ((CRC & 0x0001) == 1) CRC = (CRC >> 1) ^ Genpoly;
           Else (CRC = CRC >> 1);

       } /* for statement */

    } /* while statement */

    return(CRC);
}
```

An ASCO Example. Let's assume the transmitting device desired to send the ASCII string "**ASCO**". Using an ASCII character look-up table, we have the following hexadecimal codes for each of the ASCO letters:

A = 0x65
S = 0x83
C = 0x67
O = 0x79

The transmitter would determine the 16-bit CRC checksum as follows (in C, both methods are equivalent):

CRC16_checksum("ASCO", 4, 0xFFFF, 0xA001) which returns CRC = 0xCD94
CRC16_checksum("\x65\x83\x67\x79", 4, 0xFFFF, 0xA001) which returns CRC = 0xCD94

Before sending the string, the transmitter would append the CRC checksum (in byte reverse order) to the string as follows:

"**ASCO\x94\xCD**" or the equivalent in hexadecimal notation **"\x65\x83\x67\x79\x94\xCD"**

If the receiving device received the string without any transmission errors, then doing the 16-bit CRC checksum on the entire received string would yield (again, both methods are equivalent):

CRC16_checksum("ASCO\x94\xCD", 4, 0xFFFF, 0xA001) which returns CRC = 0x0000
CRC16_checksum("\x65\x83\x67\x79\x94\xCD", 4, 0xFFFF, 0xA001) which returns CRC = 0x0000

Since the CRC checksum is equal to **zero**, the transmission is deemed valid.

Had an error been induced during the transmission, such as the ASCII character 'A' being inadvertently changed to the character 'B' (which is hexadecimal 0x66), the receiving device would determine the new checksum as:

CRC16_checksum("BSCO\x94\xCD", 4, 0xFFFF, 0xA001) which returns CRC = 0x3300
CRC16_checksum("\x66\x83\x67\x79\x94\xCD", 4, 0xFFFF, 0xA001) which returns CRC = 0x3300

Since the CRC is **NON-ZERO (0x3300),** the receiver would assume an error had occurred and discard the packet.

Supported Function Codes for Power Meter

Function # 03 (03h) – Read Holding Registers

This function code allows the master to read one or more consecutive data registers from the Power Meter. The data registers are always 16 bit (two byte) values, transmitted high order byte first. Refer to *Register Map* on page 09 for details about the data register definitions of the Power Meter.

The following example shows the format of a transmission between a master requesting device and the responding Power Meter (slave device) at address 24. The master desires to read the four values of voltage, V_A, V_B, V_C, V_{AVE}, beginning at Holding register location 40011 (which is a "Data starting address" of 11decimal or 0A hexadecimal).

Master Transmission

Packet Format	*Example (in hex)*
Slave address	18
Function code	03
Data starting address (high byte)	00
Data starting address (low byte)	0A
Number of registers (high byte)	00
Number of registers (low byte)	04
CRC16 (low byte)	66
CRC16 (high byte)	02

Slave Response

Packet Format	*Example (in hex)*
Slave address	18
Function code	03
Byte count	08
Data word #1 (high byte)	00
Data word #1 (low byte)	E6
Data word #2 (high byte)	00
Data word #2 (low byte)	E5
Data word #3 (high byte)	00
Data word #3 (low byte)	E7
Data word #4 (high byte)	00
Data word #4 (low byte)	E6
CRC16 (low byte)	14
CRC16 (high byte)	2E

The Power Meter supports the following Read Holding Register addresses-decimal: 11-26, 31-46, 48, 51-64, 71-84, 87-93, 96-125, 127-137, 213, 435-576, 578-697,699-730. The Type of those Registers is defined as RO (Read only).

Function # 06 (06h) – Preset Single Register

This function code allows the master device to modify the contents of a single configuration register within the Power Meter. The data registers are always 16 bit (two byte) values, transmitted high order byte first. Refer to *Register Map* on page 09 for details about the about the data register definitions of the Power Meter.

The Power Meter currently supports the following Preset Single register addresses. If a Function #06 command is issued without one of these registers addresses, the Power Meter will respond with an invalid address range Exception Response (see *Exception Responses* on page 6).

Address	*Address (in hex notation)*	*Description*
40065	0040	Nominal Voltage
40066	0041	Nominal Current
40141	008C	Power Meter Hours
40142	008D	Power Meter Minutes
40143	008E	Power Meter Year
40144	008F	Power Meter Month
40145	0090	Power Meter Date
40146	0091	Power Meter Day of Week
40200	00C7	System type
40201	00C8	Source mode
40202	00C9	Potential transformer ratio (PTR)
40203	00CA	Current transformer ratio (CTR)
40204	00CB	Neutral current transformer ratio (CT4R)
40205	00CC	SCI comm. port (J5) protocol
40206	00CD	SCI comm. port (J5) baud rate
40207	00CE	SCI comm. port (J5) device address
40208	00CF	485 comm. Port (J1) protocol
40209	00D0	485 comm. Port (J1) baud rate
40210	00D1	485 comm. port (J1) device address
40211	00D2	Menu language selection
40212	00D3	Demand Integration Period
40214	00D5	Clear Demand
40215	00D6	Clear Energies
40322-40325	141-144	Power Meter Name
40422-40431	1A5-1AE	Power Meter Location
40433	01B0	Clear Min Max Parameters
40434	01B1	CT installed
40698	02B9	Date Format
40755	02F2	Clear all Demands

The following example shows the format of a transmission between a master device and the responding Power Meter (slave device) at address 24. The master desires to set the System Type (Holding register 40200) to a Single Phase – 3 Wire system (data value 02). See *System Type* on page 07 for details.

Master Transmission

Packet Format	*Example (in hex)*
Slave address	18
Function code	06
Data address (high byte)	00
Data address (low byte)	C7
Data word (high byte)	00
Data word (low byte)	02
CRC16 (low byte)	BB
CRC16 (high byte)	FF

Slave Response

Packet Format	*Example (in hex)*
Slave address	18
Function code	06
Data starting address (high byte)	00
Data starting address (low byte)	C7
Number of registers (high byte)	00
Number of registers (low byte)	02
CRC16 (low byte)	BB
CRC16 (high byte)	FF

The Power Meter supports the following Preset Single Register addresses -decimal:65-66,141-146,200-212,214-215 ,433,434,698,755.

Function # 16 (10h) – Preset Multiple Registers

This function code allows the master device to modify the contents of consecutive configuration registers within the Power Meter. The data registers are always 16 bit (two byte) values, transmitted high order byte first. Refer to *Register Map* on page 10 for details about the data register definitions of the Power Meter.

The Power Meter currently supports the following Preset Multiple register ranges. If a Function #16 command is issued without one of these corresponding register ranges, the Power Meter will respond with an invalid address range Exception Response (see *Exception Responses* on page 6).

Mutli write register e.g. 40200-212 only support entire range write and not the intermediate range such as 200-203, 205-207

The Power Meter supports the following Preset Multiple Register addresses -decimal: 200-212,141-146, 322-325, 422-431.

The following example shows the format of a transmission between a master requesting device and the responding Power Meter (slave device) at address 24. The master desires to configure Power Meter name (Holding Registers 40322 – 40425) to "ASCOMAP ".

Master Transmission

Packet Format	*Example (in hex)*
Slave address	18
Function code	10
Data starting address (high byte)	01
Data starting address (low byte)	41
Number of registers (high byte)	00
Number of registers (low byte)	04
Byte count	08
Data word #1 (high byte)	41 "A"
Data word #1 (low byte)	53 "S"
Data word #2 (high byte)	43 "C"
Data word #2 (low byte)	4F "O"
Data word #3 (high byte)	4D "M"
Data word #3 (low byte)	41 "A"
Data word #4 (high byte)	50 "P"
Data word #4 (low byte)	20 " "
CRC16 (low byte)	16
CRC16 (high byte)	69

Slave Response

Packet Format	*Example (in hex)*
Slave address	18
Function code	10
Data starting address (high byte)	01
Data starting address (low byte)	41
Number of registers (high byte)	00
Number of registers (low byte)	04
CRC16 (low byte)	92
CRC16 (high byte)	2B

Address		*Register*	*Description*	*Command String (in Hex)*
Start	*End*	*Count*		
40065	40066	2	General Settings	ADDR 10 00 C7 00 02 04 ..data.. CRC_{LO} CRC_{HI}
40200	40211	12	General Settings	ADDR 10 00 C7 00 0C 18 ..data.. CRC_{LO} CRC_{HI}
40322	40325	4	Power Meter Name	ADDR 10 00 E5 00 04 08 ..data.. CRC_{LO} CRC_{HI}
40422	40431	10	Power Meter Location	ADDR 10 01 45 00 0A 14 ..data.. CRC_{LO} CRC_{HI}

Exception Responses

If the Modbus master device sends an unsupported command, attempts to read an invalid holding register, or attempts to write invalid data, the Power Meter (Modbus slave) issues an exception response. The format for the exception response is as follows:

1. SLAVE ADDRESS
2. FUNCTION CODE*
   (With the most-significant-bit set to a 1)
3. ERROR CODE
4. CRC16 – low order byte
5. CRC16 – high order byte

* Note: The high order bit of the function code has been set to one to indicate an exception response has been generated.

The following table is a list of the exception codes supported by the Power Meter.

Exception Response Error Codes

Error code	*Error name*	*Power Meter implementation*
01	Illegal function	The slave does not support the function code contained in the master query packet.
02	Illegal data address	The slave does not support the Holding Register address referenced in the data field of the master query packet.
03	Illegal data value	The slave does not support the data referenced in the data field of the master query packet.

The following example shows the format of a transmission between a master device and the responding Power Meter (slave device) at address 24. The master device attempts to write an invalid data value (04) to the System Type holding register 40200. The Power Meter slave device responds with Error code 03.

Master Transmission

Packet Format	*Example (in hex)*
Slave address	18
Function code	06
Data starting address (high byte)	00
Data starting address (low byte)	C7
Data (high byte)	00
Data (low byte)	04
CRC16 (low byte)	3B
CRC16 (high byte)	FD

Slave Response

Packet Format	*Example (in hex)*
Slave address	18
Function code	86
Error code	03
CRC16 (low byte)	D3
CRC16 (high byte)	A6

The following example shows the format of a transmission between a master device and the responding Power Meter (slave device) at address 24. The master device attempts to write to an invalid address, 40216 (0x00D7). The Power Meter slave device responds with Error code 02.

Master Transmission

Packet Format	*Example (in hex)*
Slave address	18
Function code	06
Data starting address (high byte)	00
Data starting address (low byte)	D7
Data (high byte)	00
Data (low byte)	03
CRC16 (low byte)	7B
CRC16 (high byte)	FA

Slave Response

Packet Format	*Example (in hex)*
Slave address	18
Function code	86
Error code	02
CRC16 (low byte)	12
CRC16 (high byte)	66

Configuration Register Details for Power Meter

Register Map for Power Meter

The following table describes the mapping of the registers within the Power Meter to Holding Registers defined in the Modbus protocol.

Note:
The addresses in the format of 4xxxx follow the MODICON MODBUS protocol for point addressing.
The actual address sent is the Register Address shown in the map minus the value **40001**.

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
40001-40010			Undefined			
40011	RO	V_{AN}	Phase A line to neutral voltage	0 – 59,999	Volt	843086-004
40012	RO	V_{BN}	Phase B line to neutral voltage	0 – 59,999	Volt	843086-004
40013	RO	V_{CN}	Phase C line to neutral voltage	0 – 59,999	Volt	843086-004
40014	RO	V_{AVE}	Line to neutral average voltage	0 – 59,999	Volt	843086-004
40015	RO	V_{AB}	A-B line to line voltage	0 – 59,000	Volt	843086-004
40016	RO	V_{BC}	B-C line to line voltage	0 – 59,000	Volt	843086-004
40017	RO	V_{CA}	C-A line to line voltage	0 – 59,000	Volt	843086-004
40018	RO	VL_{AVE}	Line to line average voltage	0 – 59,000	Volt	843086-004
40019	RO	VL_{UNBAL}	Line to line voltage unbalance	0 – 100%		843086-004
40020	RO	V_{UNBAL}	Line to neutral voltage unbalance	0 – 100%		843086-004
40021	RO	I_A	Phase A current	0 – 29,999 (55000)	Amp.	843086-004
40022	RO	I_B	Phase B current	0 – 29,999 (55000)	Amp.	843086-004
40023	RO	I_C	Phase C current	0 – 29,999 (55000)	Amp.	843086-004
40024	RO	I_{AVE}	Average current	0 – 29,999 (55000)	Amp.	843086-004
40025	RO	I_{UNBAL}	Current unbalance	0 – 100%		843086-004
40026	RO	I_N	CT4 or neutral current	0 – 29,999 (55000)	Amp.	843086-004
40027-40030			Undefined			
40031	RO	kW_A	Active Power phase A	-29,999 to +29,999	kW	843086-004
40032	RO	kW_B	Active Power phase B	-29,999 to +29,999	kW	843086-004
40033	RO	kW_C	Active Power phase C	-29,999 to +29,999	kW	843086-004
40034	RO	kW_T	Active Power total	-29,999 to +29,999	kW	843086-004
40035	RO	$kVAR_A$	Reactive Power phase A	-29,999 to +29,999	kVAR	843086-004
40036	RO	$kVAR_B$	Reactive Power phase B	-29,999 to +29,999	kVAR	843086-004
40037	RO	$kVAR_C$	Reactive Power phase C	-29,999 to +29,999	kVAR	843086-004
40038	RO	$kVAR_T$	Reactive Power total	-29,999 to +29,999	kVAR	843086-004
40039	RO	Pf_A	Power Factor phase A	(-.99 to +1.00) * 100	Pf	843086-004
40040	RO	Pf_B	Power Factor phase B	(-.99 to +1.00) * 100	Pf	843086-004
40041	RO	Pf_C	Power Factor phase C	(-.99 to +1.00) * 100	Pf	843086-004
40042	RO	Pf_T	Power Factor total	(-.99 to +1.00) * 100	Pf	843086-004
40043	RO	kVA_A	volt-ampere Power phase A	0 – 29,999	kVA	843086-004
40044	RO	kVA_B	volt-ampere Power phase B	0 – 29,999	kVA	843086-004
40045	RO	kVA_C	volt-ampere Power phase C	0 – 29,999	kVA	843086-004
40046	RO	kVA_T	volt-ampere Power total	0 – 29,999	kVA	843086-004
40047			Undefined			
40048	RO	Freq.	Frequency on phase V_A	(40.00 to 80.00) * 100	Hz x 100	843086-004
40049-40050			Undefined			
40051	RO	$NormkWH_{IMP}$	Normal kWH Import (LO word)	-1,999,999,999 to + 1,999,999,999	kWH	843086-004
40052	RO	$NormkWH_{IMP}$	Normal kWH Import (HO word)		kWH	843086-004
40054	RO	$NormkWH_{EXP}$	Normal kWH Export (HO word)		kWH	843086-004
40055	RO	$NormkWH_{NET}$	Normal kWH Net (LO word)	-1,999,999,999 to + 1,999,999,999	kWH	843086-004
40056	RO	$NormkWH_{NET}$	Normal kWH Net (HO word)		kWH	843086-004
40058	RO	$NormkVarH_{IMP}$	Normal kVarH Import (HO word)		kVARH	843086-004
40059	RO	$NormkVarH_{EXP}$	Normal kVarH Export (LO word)	-1,999,999,999 to + 1,999,999,999	kVARH	843086-004
40060	RO	$NormkVarH_{EXP}$	Normal kVarH Export (HO word)		kVARH	843086-004

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
40061	RO	NormkVarH$_{NET}$	Normal kVarH Net (LO word)	-1,999,999,999 to + 1,999,999,999	kVARH	843086-004
40062	RO	NormkVarH$_{NET}$	Normal kVarH Net (HO word)		kVARH	843086-004
40063	RO	NormkVAH$_{NET}$	Normal kVAH Net (LO word)	-1,999,999,999 to + 1,999,999,999	kVAH	843086-004
40064	RO	NormkVAH$_{NET}$	Normal kVAH Net (HO word)		kVAH	843086-004
40065	RW	Nom_Volt	Nominal Voltage	70-59999	Volt	843086-004
40066	RW	Nom_Amps	Nominal Current	1-55000	Amp.	843086-004
40067-40070			Undefined			
40071	RO	EmerkWH$_{IMP}$	Emerg kWH Import (LO word)	-1,999,999,999 to + 1,999,999,999	kWH	843086-004
40072	RO	EmerkWH$_{IMP}$	Emerg kWH Import (HO word)		kWH	843086-004
40073	RO	EmerkWH$_{EXP}$	Emerg kWH Export (LO word)	-1,999,999,999 to + 1,999,999,999	kWH	843086-004
40074	RO	EmerkWH$_{EXP}$	Emerg kWH Export (HO word)		kWH	843086-004
40075	RO	EmerkWH$_{NET}$	Emerg kWH Net (LO word)	-1,999,999,999 to + 1,999,999,999	kWH	843086-004
40076	RO	EmerkWH$_{NET}$	Emerg kWH Net (HO word)		kWH	843086-004
40077	RO	EmerkVarH$_{IMP}$	Emerg kVarH Import (LO word)	-1,999,999,999 to + 1,999,999,999	kVARH	843086-004
40078	RO	EmerkVarH$_{IMP}$	Emerg kVarH Import (HO word)		kVARH	843086-004
40079	RO	EmerkVarH$_{EXP}$	Emerg kVarH Export (LO word)	-1,999,999,999 to + 1,999,999,999	kVARH	843086-004
40080	RO	EmerkVarH$_{EXP}$	Emerg kVarH Export (HO word)		kVARH	843086-004
40081	RO	EmerkVarH$_{NET}$	Emerg kVarH Net (LO word)	-1,999,999,999 to + 1,999,999,999	kVARH	843086-004
40082	RO	EmerkVarH$_{NET}$	Emerg kVarH Net (HO word)		kVARH	843086-004
40083	RO	EmerkVAH$_{NET}$	Emerg kVAH Net (LO word)	-1,999,999,999 to + 1,999,999,999	kVAH	843086-004
40084	RO	EmerkVAH$_{NET}$	Emerg kVAH Net (HO word)		kVAH	843086-004
40085-40086			Undefined			
40087	RO	kW$_T$	Active Power (Watts) total	-29,999 to +29,999	kW	843086-004
40088	RO	kW$_T$	Instantaneous Watt Demand	-29,999 to +29,999	kW	843086-011
40089	RO	kW$_T$	Current Month Maximum Demand	-29,999 to +29,999	kW	843086-011
40090	RO	kW$_T$	Active Power (watts) Total	-29,999 to +29,999		
40091	RO	I$_{AVE}$	Average current	0 – 29,999(55,000)	Amp.	843086-004
40092	RO	VL$_{AVE}$	Line to line average voltage	0 – 59,999	Volt	843086-004
40093	RO	Freq.	Frequency on phase V$_A$	(40.00 to 80.00) * 100	Hz x 100	843086-004
40094-40095			Undefined			
40096	RO	SwitchPosition	Main & auxiliary Switch positions	0:normal 1:emergency		843086-004
40097	RO	kW$_T$	Active Power total	-29,999 to +29,999	kW	843086-004
40098	RO	kVAR$_T$	Reactive Power total	-29,999 to +29,999	kVAR	843086-004
40099	RO	kVA$_T$	volt-ampere Power total	0 – 29,999	kVA	843086-004
40100	RO	Pf$_T$	Power Factor total	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40101	RO	Freq.	Frequency on phase V$_A$	(40.00 to 80.00) * 100	Hz x 100	843086-004
40102-40107	RO	V_String	Software Version string	12 ASCII characters		843086-004
40108-40113	RO	SW_Date	Software build date string	12 ASCII characters		843086-004
40114-40119	RO	SerialNumber	Device serial number	12 ASCII characters		843086-004
40120-40125	RO	ModelNumber	Device model number	12 ASCII characters		843086-004
40126			Undefined			
40127	RO	H_STATUS	Health status word	0:Normal 1:Error		843086-004
40128-40129			Undefined			
40130	RO	kW$_T$	Active Power (Watts) total	-29,999 to +29,999	kW	843086-004
40131	RO	kW$_T$	Instantaneous Watt demand	-29,999 to +29,999	kW	843086-011
40132	RO	kW$_T$	Current Month Maximum Demand	-29,999 to +29,999	kW	843086-011
40133	RO		Current Month Maximum Watt Demand Date	1-31	Date	843086-011
40134	RO		Current Month Maximum Watt Demand Month	1-12	Month	843086-011
40135	RO		Current Month Maximum Watt Demand Year	00-99	Year	843086-011
40136	RO		Current Month Maximum Watt Demand Hour	00-23	Hour	843086-011

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
40137	RO		Current Month Maximum Watt Demand Minute	00-59	Minute	843086-011
40138-40140			Undefined			
40141	RW		Power Meter Hours	0-23	Hours	843086-011
40142	RW		Power Meter Minutes	0-59	Minutes	843086-011
40143	RW		Power Meter Year	0-99	Year	843086-011
40144	RW		Power Meter Month	1-12	Month	843086-011
40145	RW		Power Meter Date	1-31	Date	843086-011
40146	RW		Power Meter Day of week	0-6	Day	843086-011
40147-40199			Undefined			
40200	RW	$TYPE_{SYSTEM}$	System Type	0:3Ø-4 w wye 1:3Ø-3 w delta 2:1Ø-3 w 3:1Ø-2 w		843086-004
40201	RW	$MODE_{SOURCE}$	Source Mode	0: normal 1: emergency 2: load 3: other (note 4)		843086-004
40202	RW	PTR	Potential Transformer Ratio	120 to 28200 (note 5)		843086-004
40203	RW	CTR	Current Transformer Ratio	5 to 55000		843086-004
40204	RW	CT4R	4th Current Input Transformer Ratio	OFF to 55000		843086-004
40205	RW	$PROTOCOL_{SCI}$	SCI comm. port (J5) protocol	1:ASCOBUS II 2:Modbus RTU		843086-004
40206	RW	$BAUD_{SCI}$	SCI comm. port (J5) baud rate	1:9600 2:19.2k		843086-004
40207	RW	$ADDR_{SCI}$	SCI comm. port (J5) device address	1 to 239		843086-004
40208	RW	$PROTOCOL_{485}$	485 comm. port (J1) protocol	1:ASCOBUS II 2:Modbus RTU		843086-004
40209	RW	$BAUD_{485}$	485 comm. port (J1) baud rate	1:9600 2:19.2k 3:38.4k 4:57.6k		843086-004
40210	RW	$ADDR_{485}$	485 comm. port (J1) device address	1 to 239		843086-004
40211	RW	$TYPE_{LANG}$	Language selection	0 to 8 (Note 1)		843086-004
40212	RW	MIN	Demand Integration period	1 to 15	Minutes	843086-011
40213	RO	Subintl_Size	Demand Subinterval Size(Fixed at 1 minute)			
40214	WO	Clear_Demand	Reset Instantaneous and Current Month maximum Demand registers to 0	(Write value 0x0000)		843086-011
40215	WO	Clear_Energy	Clears Energy registers to 0	(Write value 0xFFFF)		843086-004
40216-40321			Undefined			
40322-40325	RW	PM-Name	Power Meter Name	8 ASCII chars		843086-004
40326-40421			Undefined			
40422-40431	RW	PM-Location	Power Meter Location	20 ASCII chars		843086-004
40432			Undefined			
40433	RW		Clear Min max parameters	(Write value 0xFFFF)		843086-004
40434	RW		CT installed	0:A-B-C 1:A 2:B 3:C		843086-004
40435	RO		OTHER kWH Import (LO word)	0 to + 1,999,999,999	kWH	843086-004
40436	RO		OTHER kWH Import (HO word)		kWH	843086-004
40437	RO		OTHER kWH Export (LO word)	0 to + 1,999,999,999	kWH	843086-004
40438	RO		OTHER kWH Export (HO word)		kWH	843086-004
40439	RO		OTHER kWH Net (LO word)	0 to + 1,999,999,999	kWH	843086-004
40440	RO		OTHER kWH Net (HO word)		kWH	843086-004
40441	RO		OTHER kVarH Import (LO word)	0 to + 1,999,999,999	kVARH	843086-004
40442	RO		OTHER kVarH Import (HO word)		kVARH	843086-004
40443	RO		OTHER kVarH Export (LO word)	0 to + 1,999,999,999	kVARH	843086-004
40444	RO		OTHER kVarH Export (HO word)		kVARH	843086-004
40445	RO		OTHER kVarH Net (LO word)	0 to + 1,999,999,999	kVARH	843086-004
40446	RO		OTHER kVarH Net (HO word)		kVARH	843086-004

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
40447	RO		OTHER kVAH Net (LO word)	0 to + 1,999,999,999	kVAH	843086-004
40448	RO		OTHER kVAH Net (HO word)		kVAH	843086-004
40449	RO		% of Full scale Rated current in A Phase	0 to 200		843086-004
40450	RO		% of Full scale Rated current in B Phase	0 to 200		843086-004
40451	RO		% of Full scale Rated current in C Phase	0 to 200		843086-004
40452	RO		% of Full scale Rated Active Power in A Phase	0 to 200		843086-004
40453	RO		% of Full scale Rated Active Power in B Phase	0 to 200		843086-004
40454	RO		% of Full scale Active Power current in C Phase	0 to 200		843086-004
40455	RO		NORMAL Minimum Voltage on A Phase	0 to 59999	Volt	843086-004
40456	RO		NORMAL Maximum Voltage on A Phase	0 to 59999	Volt	843086-004
40457	RO		NORMAL Minimum Voltage on B Phase	0 to 59999	Volt	843086-004
40458	RO		NORMAL Maximum Voltage on B Phase	0 to 59999	Volt	843086-004
40459	RO		NORMAL Minimum Voltage on C Phase	0 to 59999	Volt	843086-004
40460	RO		NORMAL Maximum Voltage on C Phase	0 to 59999	Volt	843086-004
40461	RO		NORMAL Minimum L-N Average Voltage	0 to 59999	Volt	843086-004
40462	RO		NORMAL Maximum L-N Average Voltage	0 to 59999	Volt	843086-004
40463	RO		NORMAL Minimum Voltage on AB Phase	0 to 59999	Volt	843086-004
40464	RO		NORMAL Maximum Voltage on AB Phase	0 to 59999	Volt	843086-004
40465	RO		NORMAL Minimum Voltage on BC Phase	0 to 59999	Volt	843086-004
40466	RO		NORMAL Maximum Voltage on BC Phase	0 to 59999	Volt	843086-004
40467	RO		NORMAL Minimum Voltage on CA Phase	0 to 59999	Volt	843086-004
40468	RO		NORMAL Maximum Voltage on CA Phase	0 to 59999	Volt	843086-004
40469	RO		NORMAL Minimum L-L Average Voltage	0 to 59999	Volt	843086-004
40470	RO		NORMAL Maximum L-L Average Voltage	0 to 59999	Volt	843086-004
40471	RO		NORMAL Minimum Current in A Phase	0 – 55,000	Amp.	843086-004
40472	RO		NORMAL Maximum Current in A Phase	0 – 55,000	Amp.	843086-004
40473	RO		NORMAL Minimum Current in B Phase	0 – 55,000	Amp.	843086-004
40474	RO		NORMAL Maximum Current in B Phase	0 – 55,000	Amp.	843086-004
40475	RO		NORMAL Minimum Current in C Phase	0 – 55,000	Amp.	843086-004
40476	RO		NORMAL Maximum Current in C Phase	0 – 55,000	Amp.	843086-004
40477	RO		NORMAL Minimum Average Current	0 – 55,000	Amp.	843086-004
40478	RO		NORMAL Maximum Average Current	0 – 55,000	Amp.	843086-004
40479	RO		NORMAL Minimum Current in	0 – 55,000	Amp.	843086-004

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
			Neutral			
40480	RO		NORMAL Maximum Current in Neutral	0 – 55,000	Amp.	843086-004
40481	RO		NORMAL Minimum Active Power on A Phase	-32768 to +32768	kW	843086-004
40482	RO		NORMAL Maximum Active Power on A Phase	-32768 to +32768	kW	843086-004
40483	RO		NORMAL Minimum Active Power on B Phase	-32768 to +32768	kW	843086-004
40484	RO		NORMAL Maximum Active Power on B Phase	-32768 to +32768	kW	843086-004
40485	RO		NORMAL Minimum Active Power on C Phase	-32768 to +32768	kW	843086-004
40486	RO		NORMAL Maximum Active Power on C Phase	-32768 to +32768	kW	843086-004
40487	RO		NORMAL Minimum Total Active Power	0 to 55000	kW	843086-004
40488	RO		NORMAL Maximum Total Active Power	0 to 55000	kW	843086-004
40489	RO		NORMAL Minimum Reactive Power on A Phase	-32768 to +32768	kVAR	843086-004
40490	RO		NORMAL Maximum Reactive Power on A Phase	-32768 to +32768	kVAR	843086-004
40491	RO		NORMAL Minimum Reactive Power on B Phase	-32768 to +32768	kVAR	843086-004
40492	RO		NORMAL Maximum Reactive Power on B Phase	-32768 to +32768	kVAR	843086-004
40493	RO		NORMAL Minimum Reactive Power on C Phase	-32768 to +32768	kVAR	843086-004
40494	RO		NORMAL Maximum Reactive Power on C Phase	-32768 to +32768	kVAR	843086-004
40495	RO		NORMAL Minimum Total Reactive Power	0 to 55000	kVAR	843086-004
40496	RO		NORMAL Maximum Total Reactive Power	0 to 55000	kVAR	843086-004
40497	RO		NORMAL Minimum Apparent Power on A Phase	-32768 to +32768	kVA	843086-004
40498	RO		NORMAL Maximum Apparent Power on A Phase	-32768 to +32768	kVA	843086-004
40499	RO		NORMAL Minimum Apparent Power on B Phase	-32768 to +32768	kVA	843086-004
40500	RO		NORMAL Maximum Apparent Power on B Phase	-32768 to +32768	kVA	843086-004
40501	RO		NORMAL Minimum Apparent Power on C Phase	-32768 to +32768	kVA	843086-004
40502	RO		NORMAL Maximum Apparent Power on C Phase	-32768 to +32768	kVA	843086-004
40503	RO		NORMAL Minimum Total Apparent Power	0 to 55000	kVA	843086-004
40504	RO		NORMAL Maximum Total Apparent Power	0 to 55000	kVA	843086-004
40505	RO		NORMAL Minimum Power Factor A Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40506	RO		NORMAL Maximum Power Factor A Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40507	RO		NORMAL Minimum Power Factor B Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40508	RO		NORMAL Maximum Power Factor B Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40509	RO		NORMAL Minimum Power Factor C Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40510	RO		NORMAL Maximum Power Factor C Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
40511	RO		NORMAL Minimum Total Power Factor	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40512	RO		NORMAL Maximum Total Power Factor	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40513	RO		NORMAL Minimum System Frequency	(40 to 100) * 100	Hz x 100	843086-004
40514	RO		NORMAL Maximum System Frequency	(40 to 100) * 100	Hz x 100	843086-004
40515	RO		EMERG Minimum Voltage on A Phase	0 to 59999	Volt	843086-004
40516	RO		EMERG Maximum Voltage on A Phase	0 to 59999	Volt	843086-004
40517	RO		EMERG Minimum Voltage on B Phase	0 to 59999	Volt	843086-004
40518	RO		EMERG Maximum Voltage on B Phase	0 to 59999	Volt	843086-004
40519	RO		EMERG Minimum Voltage on C Phase	0 to 59999	Volt	843086-004
40520	RO		EMERG Maximum Voltage on C Phase	0 to 59999	Volt	843086-004
40521	RO		EMERG Minimum L-N Average Voltage	0 to 59999	Volt	843086-004
40522	RO		EMERG Maximum L-N Average Voltage	0 to 59999	Volt	843086-004
40523	RO		EMERG Minimum Voltage on AB Phase	0 to 59999	Volt	843086-004
40524	RO		EMERG Maximum Voltage on AB Phase	0 to 59999	Volt	843086-004
40525	RO		EMERG Minimum Voltage on BC Phase	0 to 59999	Volt	843086-004
40526	RO		EMERG Maximum Voltage on BC Phase	0 to 59999	Volt	843086-004
40527	RO		EMERG Minimum Voltage on CA Phase	0 to 59999	Volt	843086-004
40528	RO		EMERG Maximum Voltage on CA Phase	0 to 59999	Volt	843086-004
40529	RO		EMERG Minimum L-L Average Voltage	0 to 59999	Volt	843086-004
40530	RO		EMERG Maximum L-L Average Voltage	0 to 59999	Volt	843086-004
40531	RO		EMERG Minimum Current in A Phase	0 – 55,000	Amp.	843086-004
40532	RO		EMERG Maximum Current in A Phase	0 – 55,000	Amp.	843086-004
40533	RO		EMERG Minimum Current in B Phase	0 – 55,000	Amp.	843086-004
40534	RO		EMERG Maximum Current in B Phase	0 – 55,000	Amp.	843086-004
40535	RO		EMERG Minimum Current in C Phase	0 – 55,000	Amp.	843086-004
40536	RO		EMERG Maximum Current in C Phase	0 – 55,000	Amp.	843086-004
40537	RO		EMERG Minimum Average Current	0 – 55,000	Amp.	843086-004
40538	RO		EMERG Maximum Average Current	0 – 55,000	Amp.	843086-004
40539	RO		EMERG Minimum Current in Neutral	0 – 55,000	Amp.	843086-004
40540	RO		EMERG Maximum Current in Neutral	0 – 55,000	Amp.	843086-004
40541	RO		EMERG Minimum Active Power on A Phase	-32768 to +32768	kW	843086-004
40542	RO		EMERG Maximum Active Power	-32768 to +32768	kW	843086-004

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
			on A Phase			
40543	RO		EMERG Minimum Active Power on B Phase	-32768 to +32768	kW	843086-004
40544	RO		EMERG Maximum Active Power on B Phase	-32768 to +32768	kW	843086-004
40545	RO		EMERG Minimum Active Power on C Phase	-32768 to +32768	kW	843086-004
40546	RO		EMERG Maximum Active Power on C Phase	-32768 to +32768	kW	843086-004
40547	RO		EMERG Minimum Total Active Power	0 to 55000	kW	843086-004
40548	RO		EMERG Maximum Total Active Power	0 to 55000	kW	843086-004
40549	RO		EMERG Minimum Reactive Power on A Phase	-32768 to +32768	kVAR	843086-004
40550	RO		EMERG Maximum Reactive Power on A Phase	-32768 to +32768	kVAR	843086-004
40551	RO		EMERG Minimum Reactive Power on B Phase	-32768 to +32768	kVAR	843086-004
40552	RO		EMERG Maximum Reactive Power on B Phase	-32768 to +32768	kVAR	843086-004
40553	RO		EMERG Minimum Reactive Power on C Phase	-32768 to +32768	kVAR	843086-004
40554	RO		EMERG Maximum Reactive Power on C Phase	-32768 to +32768	kVAR	843086-004
40555	RO		EMERG Minimum Total Reactive Power	0 to 55000	kVAR	843086-004
40556	RO		EMERG Maximum Total Reactive Power	0 to 55000	kVAR	843086-004
40557	RO		EMERG Minimum Apparent Power on A Phase	-32768 to +32768	kVA	843086-004
40558	RO		EMERG Maximum Apparent Power on A Phase	-32768 to +32768	kVA	843086-004
40559	RO		EMERG Minimum Apparent Power on B Phase	-32768 to +32768	kVA	843086-004
40560	RO		EMERG Maximum Apparent Power on B Phase	-32768 to +32768	kVA	843086-004
40561	RO		EMERG Minimum Apparent Power on C Phase	-32768 to +32768	kVA	843086-004
40562	RO		EMERG Maximum Apparent Power on C Phase	-32768 to +32768	kVA	843086-004
40563	RO		EMERG Minimum Total Apparent Power	0 to 55000	kVA	843086-004
40564	RO		EMERG Maximum Total Apparent Power	0 to 55000	kVA	843086-004
40565	RO		EMERG Minimum Power Factor A Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40566	RO		EMERG Maximum Power Factor A Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40567	RO		EMERG Minimum Power Factor B Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40568	RO		EMERG Maximum Power Factor B Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40569	RO		EMERG Minimum Power Factor C Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40570	RO		EMERG Maximum Power Factor C Phase	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40571	RO		EMERG Minimum Total Power Factor	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40572	RO		EMERG Maximum Total Power Factor	(-0.99 to +1.00) * 100	Pf x 100	843086-004
40573	RO		EMERG Minimum System Frequency	(40 to 100) * 100	Hz x 100	843086-004

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
40574	RO		EMERG Maximum System Frequency	(40 to 100) * 100	Hz x 100	843086-004
40575	RO		Resettable Engine Runtime counter in Hours	0 to 65535	Hour	843086-004
40576	RO		Cumulative Engine Runtime counter in Hours	0 to 65535	Hour	843086-004
40577	WO		Clear Resettable Engine Run time counter	(Write value 0xFFFF)		843086-004
40578	RO		Expanded Health Status Register (LO Word)	0 to 31 (Note 2)		843086-004
40579	RO		Expanded Health Status Register (HO Word)			843086-004
40580	RO		Phase A Voltage THD	0 to 100%		843086-007
40581	RO		Phase B Voltage THD	0 to 100%		843086-007
40582	RO		Phase C Voltage THD	0 to 100%		843086-007
40583	RO		Phase A Current THD	0 to 100%		843086-007
40584	RO		Phase B Current THD	0 to 100%		843086-007
40585	RO		Phase C Current THD	0 to 100%		843086-007
40586	RO		APAC Port Enable	1 – Enable; 2 – Disable		843086-011
40587	RO		APAC Address	1 to 127		843086-011
40588	RO		APAC Baud rate	0 – 100Kbps; 1 – 250Kbps; 2 – 500Kbps; 3 – 1000Kbps;		843086-011
40589	RO		Heart Beat time	0 to 60000	msec	843086-011
40590	RO		Transmit PDO1 Transmission Type	0 to 255 0 – OFF; 254 – Timed based on Event Time & Inhibit Timer 255 – Timed based on Event Time, Inhibit Timer & on change of the mapped parameters		843086-011
40591	RO		Transmit PDO1 Inhibit Time	0 to 60000	msec	843086-011
40592	RO		Transmit PDO1 Event Time	0 to 60000	msec	843086-011
40593	RO		Transmit PDO2 Transmission Type	0 to 255 0 – OFF; 254 – Timed based on Event Time & Inhibit Timer; 255 – Timed based on Event Time, Inhibit Timer & on change of the mapped parameters		843086-011
40594	RO		Transmit PDO2 Inhibit Time	0 to 60000	msec	843086-011
40595	RO		Transmit PDO2 Event Time	0 to 60000	msec	843086-011
40596	RO		Transmit PDO3 Transmission Type	0 to 255 0 – OFF; 254 – Timed based on Event Time & Inhibit Timer; 255 – Timed based on Event Time, Inhibit Timer & on change of the mapped parameters		843086-011
40597	RO		Transmit PDO3 Inhibit Time	0 to 60000	msec	843086-011
40598	RO		Transmit PDO3 Event Time	0 to 60000	msec	843086-011
40599	RO		Transmit PDO4 Transmission Type	0 to 255 0 – OFF; 254 – Timed based on Event Time & Inhibit Timer; 255 – Timed based on Event Time, Inhibit Timer & on change of the mapped parameters		843086-011

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
40600	RO		Transmit PDO4 Inhibit Time	0 to 60000	msec	843086-011
40601	RO		Transmit PDO4 Event Time	0 to 60000	msec	843086-011
40602	RO	KW	First Month Max Demand	-29,999 to +29,999	kW	843086-011
40603	RO		First Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40604	RO		First Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40605	RO		First Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40606	RO	KW	Second Month Max Demand	-29,999 to +29,999	kW	843086-011
40607	RO		Second Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40608	RO		Second Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40609	RO		Second Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40610	RO	KW	Third Month Max Demand	-29,999 to +29,999	kW	843086-011
40611	RO		Third Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40612	RO		Third Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40613	RO		Third Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40614	RO	KW	Fourth Month Max Demand	-29,999 to +29,999	kW	843086-011
40615	RO		Fourth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40616	RO		Fourth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40617	RO		Fourth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40618	RO	KW	Fifth Month Max Demand	-29,999 to +29,999	kW	843086-011
40619	RO		Fifth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40620	RO		Fifth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40621	RO		Fifth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40622	RO	KW	Sixth Month Max Demand	-29,999 to +29,999	kW	843086-011
40623	RO		Sixth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40624	RO		Sixth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40625	RO		Sixth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40626	RO	KW	Seventh Month Max Demand	-29,999 to +29,999	kW	843086-011
40627	RO		Seventh Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40628	RO		Seventh Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40629	RO		Seventh Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40630	RO	KW	Eighth Month Max Demand	-29,999 to +29,999	kW	843086-011
40631	RO		Eighth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40632	RO		Eighth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40633	RO		Eighth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40634	RO	KW	Ninth Month Max Demand	-29,999 to +29,999	kW	843086-011
40635	RO		Ninth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40636	RO		Ninth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
40637	RO		Ninth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40638	RO	KW	Tenth Month Max Demand	-29,999 to +29,999	kW	843086-011
40639	RO		Tenth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40640	RO		Tenth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40641	RO		Tenth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40642	RO	KW	Eleventh Month Max Demand	-29,999 to +29,999	kW	843086-011
40643	RO		Eleventh Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40644	RO		Eleventh Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40645	RO		Eleventh Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40646	RO	KW	Twelveth Month Max Demand	-29,999 to +29,999	kW	843086-011
40647	RO		Twelveth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40648	RO		Twelveth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40649	RO		Twelveth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40650	RO	KW	Thirteenth Month Max Demand	-29,999 to +29,999	kW	843086-011
40651	RO		Thirteenth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-011
40652	RO		Thirteenth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-011
40653	RO		Thirteenth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-011
40654	RO	KW	Fourteenth Month Max Demand	-29,999 to +29,999	kW	843086-013
40655	RO		Fourteenth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-013
40656	RO		Fourteenth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-013
40657	RO		Fourteenth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-013
40658	RO	KW	Fifteenth Month Max Demand	-29,999 to +29,999	kW	843086-013
40659	RO		Fifteenth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-013
40660	RO		Fifteenth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-013
40661	RO		Fifteenth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-013
40662	RO	KW	Sixteenth Month Max Demand	-29,999 to +29,999	kW	843086-013
40663	RO		Sixteenth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-013
40664	RO		Sixteenth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-013
40665	RO		Sixteenth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-013
40666	RO	KW	Seventeenth Month Max Demand	-29,999 to +29,999	kW	843086-013
40667	RO		Seventeenth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-013
40668	RO		Seventeenth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-013
40669	RO		Seventeenth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-013

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
40670	RO	KW	Eighteenth Month Max Demand	-29,999 to +29,999	kW	843086-013
40671	RO		Eighteenth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-013
40672	RO		Eighteenth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-013
40673	RO		Eighteenth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-013
40674	RO	KW	Nineteenth Month Max Demand	-29,999 to +29,999	kW	843086-013
40675	RO		Nineteenth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-013
40676	RO		Nineteenth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-013
40677	RO		Nineteenth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-013
40678	RO	KW	Twentieth Month Max Demand	-29,999 to +29,999	kW	843086-013
40679	RO		Twentieth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-013
40680	RO		Twentieth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-013
40681	RO		Twentieth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-013
40682	RO	KW	Twenty First Month Max Demand	-29,999 to +29,999	kW	843086-013
40683	RO		Twenty First Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-013
40684	RO		Twenty First Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-013
40685	RO		Twenty First Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-013
40686	RO	KW	Twenty Second Month Max Demand	-29,999 to +29,999	kW	843086-013
40687	RO		Twenty Second Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-013
40688	RO		Twenty Second Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-013
40689	RO		Twenty Second Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-013
40690	RO	KW	Twenty Third Month Max Demand	-29,999 to +29,999	kW	843086-013
40691	RO		Twenty Third Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-013
40692	RO		Twenty Third Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-013
40693	RO		Twenty Third Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-013
40694	RO	KW	Twenty Fourth Month Max Demand	-29,999 to +29,999	kW	843086-013
40695	RO		Twenty Fourth Month Date (Date, Month)	Date (1-31),Month (1-12)	Date, Month	843086-013
40696	RO		Twenty Fourth Month Year (Year, Hours)	Year (0-99), Hours (0-23)	Year, Hours	843086-013
40697	RO		Twenty Fourth Month Minutes (Minutes, Seconds)	0-59	Minutes, Seconds	843086-013
40698	RW		Date Format	0 to 2	0 – US Format 1 – EU Format 2 – ISO Format	843086--013

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
40699	RO	KW	Last 60 Mins Max Demand	-29,999 to +29,999	kW	843086-013
40700	RO		Last 60 Mins Max Demand Date	Date (1-31)	Date	843086-013
40701	RO		Last 60 Mins Max Demand Month	Month (1-12)	Month	843086-013
40702	RO		Last 60 Mins Max Demand Year	Year (0-99)	Year	
40703	RO		Last 60 Mins Max Demand Hours	Hours (0-23)	Hours	843086-013
40704	RO		Last 60 Mins Max Demand Minutes	0-59	Minutes	843086-013
40705	RO		Last 60 Mins Max Demand Seconds	0-59	Seconds	843086-013
40706	RO		Last 60 Mins Max Demand Day	0 – 6 0 – Sunday; 1 – Monday; 2 – Tuesday; 3 – Wednesday; 4 – Thursday; 5 – Friday; 6 – Saturday		843086-013
40707	RO	KW	Last 24 Hours Max Demand	-29,999 to +29,999	kW	843086-013
40708	RO		Last 24 Hours Max Demand Date	Date (1-31)	Date	843086-013
40709	RO		Last 24 Hours Max Demand Month	Month (1-12)	Month	843086-0132
40710	RO		Last 24 Hours Max Demand Year	Year (0-99)	Year	843086-013
40711	RO		Last 24 Hours Max Demand Hours	Hours (0-23)	Hours	843086-013
40712	RO		Last 24 Hours Max Demand Minutes	0-59	Minutes	843086-013
40713	RO		Last 24 Hours Max Demand Seconds	0-59	Seconds	843086-013
40714	RO		Last 24 Hours Max Demand Day	0 – 6 0 – Sunday; 1 – Monday; 2 – Tuesday; 3 – Wednesday; 4 – Thursday; 5 – Friday; 6 – Saturday		843086-013
40715	RO	KW	Last 30 Days Max Demand	-29,999 to +29,999	kW	843086-013
40716	RO		Last 30 Days Max Demand Date	Date (1-31)	Date	843086-013
40717	RO		Last 30 Days Max Demand Month	Month (1-12)	Month	843086-013
40718	RO		Last 30 Days Max Demand Year	Year (0-99),	Year	843086-013
40719	RO		Last 30 Days Max Demand Hours	Hours (0-23)	Hours	843086-013
40720	RO		Last 30 Days Max Demand Minutes	0-59	Minutes	843086-013
40721	RO		Last 30 Days Max Demand Seconds	0-59	Seconds	843086-013
40722	RO		Last 30 Days Max Demand Day	0 – 6 0 – Sunday; 1 – Monday; 2 – Tuesday; 3 – Wednesday; 4 – Thursday; 5 – Friday; 6 – Saturday		843086-013
40723	RO	KW	Last 12 Months Max Demand	-29,999 to +29,999	kW	843086-013
40724	RO		Last 12 Months Max Demand Date	Date (1-31)	Date	843086-013
40725	RO		Last 12 Months Max Demand Month	Month (1-12)	Month	843086-013
40726	RO		Last 12 Months Max Demand Year	Year (0-99),	Year	843086-013
40727	RO		Last 12 Months Max Demand Hours	Hours (0-23)	Hours	843086-013
40728	RO		Last 12 Months Max Demand Minutes	0-59	Minutes	843086-013
40729	RO		Last 12 Months Max Demand Seconds.	0-59	Seconds	843086-013

Reg Number	*Register Type*	Parameter Name	Parameter Description	Data Range	Units	Implemented in Firmware Version
40730	RO		Last 12 Months Max Demand Day	0 – 6 0 – Sunday; 1 – Monday; 2 – Tuesday; 3 – Wednesday; 4 – Thursday; 5 – Friday; 6 – Saturday		843086-013
40731-40754			Undefined			
40755	WO		Clear all Demands	(Write value 0x0000)	Clear Demand	843086-013

Note 1 - Languages

Data	*Language*
0	English
1	Spanish
2	Italian
3	French
4	German
5	Portuguese
6	Russian
7	Korean
8	Chinese

Note 2- Bit Position in Health Register

Value	*Functionality*	*Description*
0	EEPROM	0 - Normal 1 - Failed
1	DC Test	
2	AC Test	
3	RTC Test	
4	LCD Test	
5	Left Key Status	
6	Right Key Status	
7	Up Key Status	
8	Down Key Status	
9	ESC Key Status	
10	Enter Key Status	
11	Phase A ADC	
12	Phase B ADC	
13	Phase C ADC	
14	Phase N ADC	
15	RS485 Test	
16	APAC1 Test	
17	APAC2 Test	
18	Digital Inputs Test	
19	PLL Test	
20	AC Good Test	
21	LED Test	
22	Calibration Status	
23	Defaults loaded to all structures in database	
24	Defaults loaded to Config structure in database	
25	Runtime ADC error	
26	Unexpected Interrupt value(note 10)	0-Normal 1 to 15-Failed
27		
28		
29		
30	Not Used	
31	Not Used	

Note 3- Unexpected Interrupt Details:

Value	*Description*
1	SPI2 end-transfer/overrun
2	SCI1 or SCI2 error interrupt
3	SCC interrupt A
4	MibADC end event conversion
5	SW interrupt(SSI)
6	HET interrupt 2
6	HECC1 interrupt B
8	SCC interrupt B
9	MibADC end groupt 1 conversion
10	DMA interrupt 1
11	GIO interrupt B
12	MibADC end group 2 conversion
13	SCI3 error interrupt
14	HECC2 interrupt A
15	HECC2 interrupt B

Note 4- Source Mode – Holding Register no. 40201

The source mode register defines the source bus to which the Power Meter is connected. The Energy register display window changes according to the bus defined. The user can specify a normal bus connection, an emergency bus connection, a connection to the load side of the bus or no specific designation.

Binary value	*Label*	*Description*
0 (00h)	*NORMAL*	*Normal power bus*
1 (01h)	*EMERGENCY*	*Emergency power bus*
2 (02h)	*LOAD*	*Load power bus*
3 (03h)	*OTHER*	*Any power bus with no designation on the Energy registers*

When the LOAD selection is chosen, the Power Meter uses the N/E INPUT status input to determine ATS switch position. Two sets of Energy registers are used; Normal energy registers & Emergency energy registers.

Note 5- Potential Transformer Ratio – Register no. 40202

This register defines the full-scale voltage input value for the three phases of voltage. This is based on the ratio of the external voltage transformers (PTs) connected between the Power Meter and the power bus.

Range
120 to 28,200

The value of 28,200 is the ratio 235:1 (120 * 235 = 28,200). Note that if external voltage transformers are not required and subsequently not used, the ratio should be set to 120, which is 1:1.