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User's Manual

MULTIFUNCTION METER PM2160-A

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1. INTRODUCTION

Foreword

Thank you for purchasing Multifunction Meter.
PM-2160-A with Seven Segment LED display or
PM-2160-A with large multi-line backlit LCD panel

This manual describes the basic functions and operation methods. Please read through this user's manual carefully before using the product.

Purpose of manual

How to read this manual?

Installer: Read Chapters 3, 4, 5, 6, Annexure-A
System designer and new user: Read All Chapters and Annexure-A
Expert user: Read Chapters 2, 4, 5, 6, 7, Annexure-A

Regarding this user manual

- This manual should be provided to the end user. Keep an extra copy or copies of the manual in a safe place.
- Read this manual carefully to gain a thorough understanding of how to operate this product before starting operation.
- Basic Model will not have "Maximum Demand/RTC" and "Total Harmonics Distortion [THD]" features described in Edit Mode, Specifications and MODBUS Address Map.
- MODBUS Time out 4 Sec or more.

Notice

The contents of this manual are subject to change without notice as a result of continuous improvements to the instrument's performance and functions.

This manual describes the functions of this product. MASIBUS does not guarantee the application of these functions for any particular purpose.

Every effort has been made to ensure accuracy in the preparation of this manual. Should any errors or omissions come to your attention, however, please inform MASIBUS Sales office or sales representative. Under no circumstances may the contents of this manual, in part or in whole, be transcribed or copied without our permission.

Trademarks

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Checking the Contents of the Package

Unpack the box and check the contents before using the product. If the product is different from which you have ordered, if any parts or accessories are missing, or if the product appears to be damaged, contact your sales representative.

Product overview

The 2160-A MULTIFUNCTION METER is a solid state Multifunction Meter Which accurately measures all quantities of the supply including all types of energies. The 2160-A Multifunction Meter is based on Microcontroller, with a high degree of programmability.

The meter meets the Accuracy requirements of IS14697 & IEC62053-22

The Meter has been programmed to operate as an intelligent front end measuring and storing device and to communicate continuously to a Master, all the data relevant for the purpose of SCADA, through isolated RS-485 port using MODBUS-RTU protocol.

The Meter is normally supplied readily pre-programmed for operation and can be directly installed in the usual manner. The Meter can be read manually or through a Master using MODBUS-RTU Protocol.

Features

- Accuracy class 0.5s as per IS14697 & IEC 62053-22
- Accuracy class 0.2s as per IS14697 & IEC 62053-22 also available
- Accuracy class 1.0 as per IS13779 & IEC 62053-21 also available
- Field programmable CT/PT primary & secondary values
- True RMS, Microcontroller based
- Auto Scrolling feature for easy readability for all parameters
- Auto Scaling from Kilo to Mega to Giga watt
- Favorite page Store feature even after Power On-Off
- Light weight, Rugged, Reliable & Safe for User
- Aux powered & uses Switch mode power supply
- 4 lines 4 digit high-visibility LED display 0.4" [10mm] to display various parameters **OR** Optional large multi-line backlit LCD panel
- Isolated RS485 (Modbus-RTU protocol)
- ABS enclosure an insulator so safe for user
- Front panel LED output for calibration & measurement of selected type of energy
- Store energy register efficiently during power failure.
- Four Quadrant measurement for PF, Power & Energy (Active & Reactive)
- ON Hour, RUN (LOAD) HOUR & IDLE HOUR register in Non-Volatile Memory
- Power Interruption count with(Last Power OFF & Latest Power ON)Time & Date

Product Ordering Code

Ordering Code												
Model	**Accuracy**		**Communication**		**Max. Demand**		**THD**		**Output**		**Display Type**	
2160-A	X		X		X		X		X		X	
	S	Class 1.0	N	None	N	None	N	None	N	None	LED	7 seg LED [4 x 4]
	1	Class 0.5s	1	RS485 Modbus	Y	Required	Y	Required	1	Pulse Output	LCP	LCD Panel
	2	Class 0.2s	2	Ethernet*								

Note : *In case of Ethernet option Depth will be 110mm in place of 64mm

The unit has a nameplate affixed to the one side of the enclosure. Check the model and suffix codes inscribed on the nameplate to confirm that the product received is that which was ordered

List of Accessories

The product is provided with the following accessories according to the model and suffix codes (see the table below). Check that none of them are missing or damaged.

Sr. No.	Description of accessory	Quantity
1	Panel mount clamps	2

2	User manual	1

Safety Precautions

The product and the instruction manual describe important information to prevent possible harm to users and damage to the property and to use the product safely.

Understand the following description (signs and symbols), read the text and observe descriptions.

⚠ WARNING	***This indicates a danger that may result in death or serious injury if not avoided.***
	This indicates a danger that may result in minor or moderate injury or only a physical damage if not avoided.

2. SPECIFICATIONS

System type

3Ph4W/ 3Ph3W (Site selectable)

Input

Voltage

Direct Voltage	20 to 350V (L-N) or 34V to 620V (L-L) @ 240V Nominal Voltage
PT Secondary (Nominal Voltage)	64V L-N, 110V L-N, 120V L-N or 240V L-N (Site selectable) Configurable for 3Ph3W or 3Ph4W system
Measurement Method	True RMS
Burden	<0.2VA per phase
Wire gauge	16 AWG
PT Ratio	1 to 9999.999 Programmable
Overload	1.2 x Nominal Voltage (Continuous)

Current

Secondary Current	1A or 5A (Site selectable)
Measurement Method	True RMS
Burden	<0.2VA per phase
Wire gauge	16 AWG
CT Ratio	1 to 9999.999 Programmable
Overload	For 5A CT: 8A Continuous/ 20A for 1Sec For 1A CT: 2A Continuous/ 20A for 1Sec

Starting current	0.1% of Nominal Current (class 0.5)
Frequency	45 to 65Hz

Display

LED	4 line 4 digit 0.4" [10mm] 7-segment Display [3 line 4 digit in Red & 1 line 4 digit in Green] 3mm Round LED for Parameter Indication Bar type LED for '-' indication & % Load
LCD Panel	Large multi-line backlit LCD Panel 3 lines of 7 digits – Height: 9.1 x Width: 5.15 mm last line of 9 digits – Height: 7 x Width: 3.97 mm Bar Graph for % Load for each phase

Measured Parameters

Voltage	L1-L2, L2-L3, L1-L3 and Average (3Ph3W & 3Ph4W)
	L1-N, L2-N, L3-N & average (1Ph & 3Ph4W)
Current	All phase currents & their average (mA, A, KA)
Frequency	System Frequency
Power Factor	Phase wise PF & Average PF
Power **(Phase wise & Total)**	Active Power (W, KW & MW)
	Reactive Power (VAR, KVAR & MVAR)
	Apparent Power (VA, KVA & MVA)
Energy **(Phase wise & Total)**	Active Energy for Import & Export (Separate) (WH, KWh, MWh&GWh)
	Reactive Energy for Import & Export (Separate) (VARh, KVARh, MVARh&GVARh)
	Apparent Energy (VAh, KVAh, MVAh&GVAh)
Demand	Maximum Demand on KW/KVA (Block/Sliding for 15/30 minutes window)
Power Quality	Harmonics for each Voltage and Current (3rd to 15th odd) THD for Voltage & Current (Phase wise)

Real time clock & date
ON hour ,LOAD hour (up to 65000 hours Recording)
Power Interruption count (up to 65000) with (Last Power OFF & Latest Power ON)Time & Date

Environmental

Working temperature	0 to 55º C
Storage temperature	-10 to 70ºC
Relative humidity	30-95% non-condensing
Warm up time	5 minutes

Accuracy Table

	Class 0.2 Optional	Class 0.5 Optional	Class 1.0 (Standard)
Voltage	0.25% of reading		
Current	0.1% of reading	0.2% of reading	0.5% of reading
Frequency	±0.01Hz		
Power Factor	0.2% of FS	0.25% of FS	0.5% of FS
Active Power* (≥0.02 of Ib)	0.2% of reading +/- 0.01% of FS	0.3% of reading +/- 0.01% of FS	1.0 % of reading + 0.01% of FS
Reactive Power* (≥0.02 of Ib)	0.2% of reading +/- 0.02% of FS	0.5% of reading +/- 0.02% of FS	1.0 % of reading + 0.02% of FS
Apparent Power* (≥0.02 of Ib)	0.2% of reading +/- 0.02% of FS	0.5% of reading +/- 0.02% of FS	1.0 % of reading + 0.02% of FS
Active Energy*	Class 0.2s as per IS14697/ IEC 62053-22	Class 0.5s as per IS14697/ IEC 62053-22	Class 1.0 as per IS13779/IEC 62053-21
Reactive Energy*	Class 0.2s as per IS14697	Class 0.5s as per IS14697	Class 1.0 as per IS13779
Apparent Energy*	Class 0.2s	Class 0.5s	Class 1.0

(*PF 0.5 Lag-1.0 - 0.8 Lead Applicable for Power & Energy Parameter)

Output

Communication Output

Interface	RS485
Baud rate	9600, 19200, 38400 (Selectable)
Start bit	1
Stop bit	1
Protocol	Modbus-RTU

Pulse output

Type	WH/VARH/VAH
AC/DC Ratings	200VAC / 300VDC,100mA AC/150mA DC
Pulse rate	Programmable from 100 to 60000 pulses per KWh[I]/KWh[E]/KVARh[I] /KVARh[E] /KVAh/ MWh[I]/MWh[E]/MVARh[I] /MVARh[E] /MVAhof total.
Pulse Duration	40 mSec ± 10%
Output Type	Open collector [External Excitation Required]

Auxiliary Power Supply

Power Supply	85-265VAC, 50/60Hz or 100-300VDC
Burden	Less than 4VA **[LED]** Less than 3VA **[LCD Panel with Backlight],** Less than 2VA **[LCD Panel w/o Backlight through Configuration]**
Energy Update Rate	500 mSec

Isolation (Withstanding voltage)

- Between primary terminals* and secondary terminals**:
  At least 2000 V AC for 1 minute
- Between primary terminals*:
  At least 2000 V AC for 1 minute
- Between secondary terminals**:
  At least 2000 V AC for 1 minute

* Primary terminals indicate Aux power terminals, Voltage i/p terminals and ct terminals.
** Secondary terminals indicate pulse o/p and Communication O/P.
Insulation resistance: 20MΩ or more at 500 V DC between power terminals and grounding terminal

Physical

Mounting Type	Panel mount
Size	96 x 96 x 64 mm
Front Bezel	96 x 96 mm
Panel Cutout	92 x 92 mm
Depth behind panel	64 mm
Material	ABS
Accessory	2 Panel mount clamps
Weight	0.5 Kg
Enclosure Protection Rating	IP-51
Terminal & Cable Size	Barrier type terminal 3.3 mm^2 (12 - 22 AWG)

Resolution for Energy parameters for Seven Segment LED Display

Phase Energy Resolution		
Display Format	**Unit**	**Last Digit Resolution**
X.XXX	K	1Wh
XX.XX	K	10Wh
XXX.X	K	100Wh
X.XXX	M	1KWh
XX.XX	M	10KWh
XXX.X	M	100KWh
X.XXX	G	1MWh
XX.XX	G	10MWh
XXX.X	G	100MWh

Sys. Energy Resolution		
Display Format	**Unit**	**Last Digit Resolution**
X.XXXXX	K	0.01Wh
XX.XXXXX	K	0.01Wh
XXX.XXXXX	K	0.1Wh
X.XXXXXXX	M	1Wh
XX.XXXXXX	M	1Wh
XXX.XXXXX	M	100Wh
X.XXXXXXX	G	1KWh
XX.XXXXXX	G	10KWh
XXX.XXXXX	G	100KWh

Resolution for Voltage, Current & Power parameters on LED Display

Phase Energy Resolution			
Display Format	**Unit**	**To**	**From**
X.XXX		0.0	10.0
XX.XX		10.0	100.0
XXX.X		100.0	1000.0
X.XXX	K	1000.0	10000.0
XX.XX	K	10000.0	100000.0
XXX.X	K	100000.0	1000000.0
X.XXX	M	1000000.0	10000000.0
XX.XX	M	10000000.0	100000000.0
XXX.X	M	100000000.0	1000000000.0
XXXX	M	1000000000.0	10000000000.0

Sys. Energy Resolution			
Display Format	**Unit**	**To**	**From**
X.XXX	m	0.000	0.010
XX.XX	m	0.010	0.100
XXX.X	m	0.100	1.000
X.XXX		1.0	10.0
XX.XX		10.0	100.0
XXX.X		100.0	1000.0
X.XXX	K	1000.0	10000.0
XX.XX	K	10000.0	100000.0
XXX.X	K	100000.0	1000000.0

Resolution for Energy parameters for LCD Panel Display

Energy Resolution		
Display Format	Unit	Last Digit Resolution
X.XXXXX	K	0.01Wh
XX.XXXXX	K	0.01Wh
XXX.XXXX	K	0.1Wh
X.XXXXXX	M	1Wh
XX.XXXXX	M	10Wh
XXX.XXXX	M	100Wh
X.XXXXXX	G	1KWh
XX.XXXXX	G	10KWh
XXX.XXXX	G	100KWh

Sys. Energy Resolution		
Display Format	Unit	Last Digit Resolution
X.XXXXX	K	0.01Wh
XX.XXXXX	K	0.01Wh
XXX.XXXXX	K	0.01Wh
X.XXXXXXXX	M	0.01Wh
XX.XXXXXXX	M	0.1Wh
XXX.XXXXXX	M	1Wh
X.XXXXXXXX	G	10Wh
XX.XXXXXXX	G	100Wh
XXX.XXXXXX	G	1KWh

Resolution for Voltage, Current & Power parameters on LCD Panel display

Voltage/ POWER			
Display Format	Unit	To	From
X.XXXX		0.0	10.0
XX.XXX		10.0	100.0
XXX.XX		100.0	1000.0
X.XXXX	K	1000.0	10000.0
XX.XXX	K	10000.0	100000.0
XXX.XX	K	100000.0	1000000.0
X.XXXX	M	1000000.0	10000000.0
XX.XXX	M	10000000.0	100000000.0
XXX.XX	M	100000000.0	1000000000.0
XXXXX	M	1000000000.0	10000000000.0

Current			
Display Format	Unit	To	From
X.XXXX		0.0	10.0
XX.XXX		10.0	100.0
XXX.XX		100.0	1000.0
X.XXXX	K	1000.0	10000.0
XX.XXX	K	10000.0	100000.0
XXX.XX	K	100000.0	1000000.0

2.1 List of available Features

Parameters	Features	2160A-LED	2160A-LCD Panel
BASIC	Vrms(L-N)	✓	
	Vrms(L-L)	✓	
	Irms	✓	
	Frequency	✓	
	%Load	✓	
	%V Unbalance	✓	
	%A Unbalance	✓	
Power	Active Power	✓	
	Reactive Power	✓	
	Apparent Power	✓	
	Power Factor	✓	
	Phase Angle	✓	
Import Energy	Active Energy Import	✓	
	Reactive Energy Import	✓	
	Apparent Energy Import	✓	
	Overflow Energy Count For System Energy	✓	

Export Energy	Active Energy Export	✓
	Reactive Energy Export	✓
	Apparent Energy Export	✓
	Overflow Energy Count For System Energy	✓
RTC	Real Time	✓
	Real Date	✓
Demand	Maximum Demand with Date & Time	✓
	Rising Demand	✓
Harmonics	% THD	✓
	% Harmonics [Up to 15th Odd]	C
Hour	ON Hour	✓
	Load Hour / RUN Hour (Total)	✓
	Idle Hour	C
	Load Hour / RUN Hour (Import)	✓
	Load Hour / RUN Hour (Export)	✓
Power Interruption	Power Interruption Count	✓
	Power Interruption Time stamp	C
Communication	Modbus on RS485	O
	Modnet on RJ45 (MODBUS TCP/IP)	O
O/P	Pulse Output for Energy	O

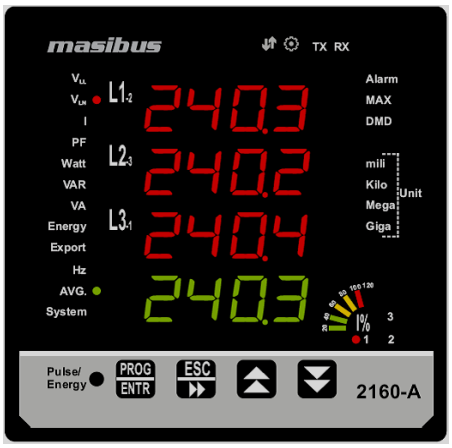
NOTE:
In above table:

- '**C**' means available only on **communication**
- '**O**' means based on **Ordering Code**

3. FRONT & REAR PANEL PICTURE

3.1 Front Panel Picture

For Seven Segment LED Display



For LCD Panel Display

Fig-3.1 Detail of front panel

PGM/ENT key

RUN mode:

- Key press is used to enter into PGM mode(view mode)

PGM mode:

On key press

- If in view mode goes into edit mode.
- If in edit mode goes into view mode.


SHIFT/ESC key

RUN mode:

- Key press is used to move from one frame to the other Horizontally

- **Continuously 4 Second key press is used to move in First page (Vrms) from any page in page matrix**

PGM mode:

On key press

- When in view mode this key press is used to exit from PGM mode to RUN mode.
- If in edit mode used to shift to the next digit.

UP/INCREMENT key

RUN mode:

- Key press is used to move from one frame to the other vertically up.

PGM mode:

- Increment value in edit mode.
- Move UP to next configuration parameter in view mode.

DOWN/DECREMENT key

RUN mode:

- Key press is used to move from one frame to the other Vertically Down.

PGM mode:

- Decrement value in edit mode.
- Move Down to next configuration parameter in view mode.

3.2 Rear Panel Picture

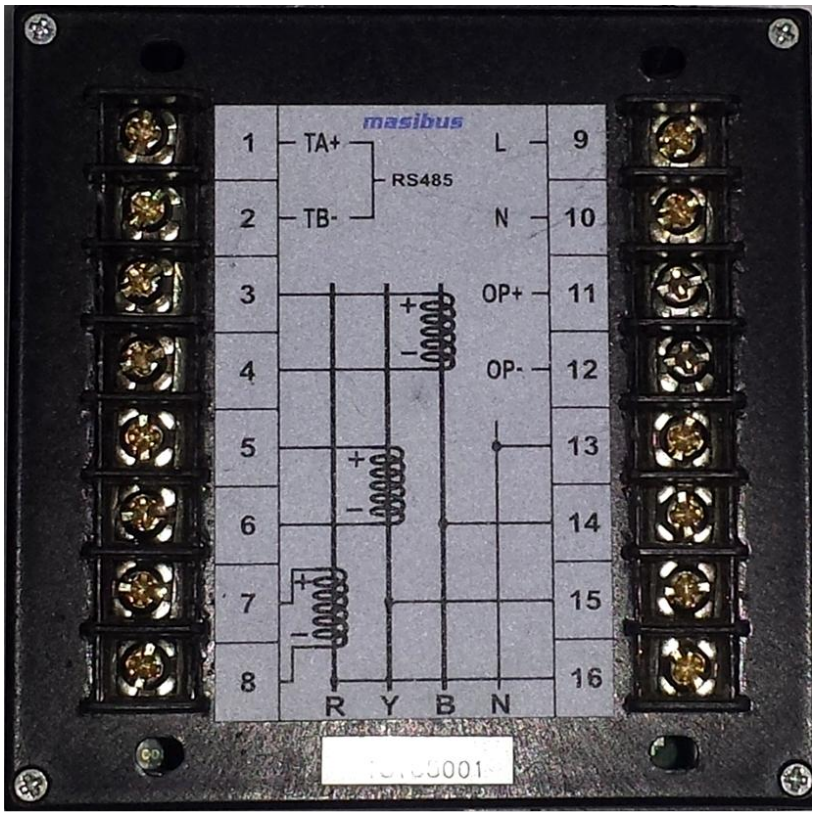
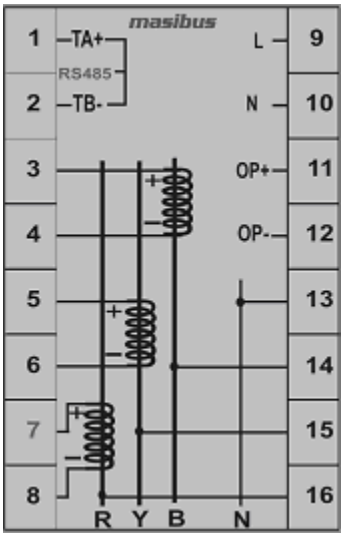


Fig-3.2 Detail of Rear panel

4. TERMINAL CONNECTIONS

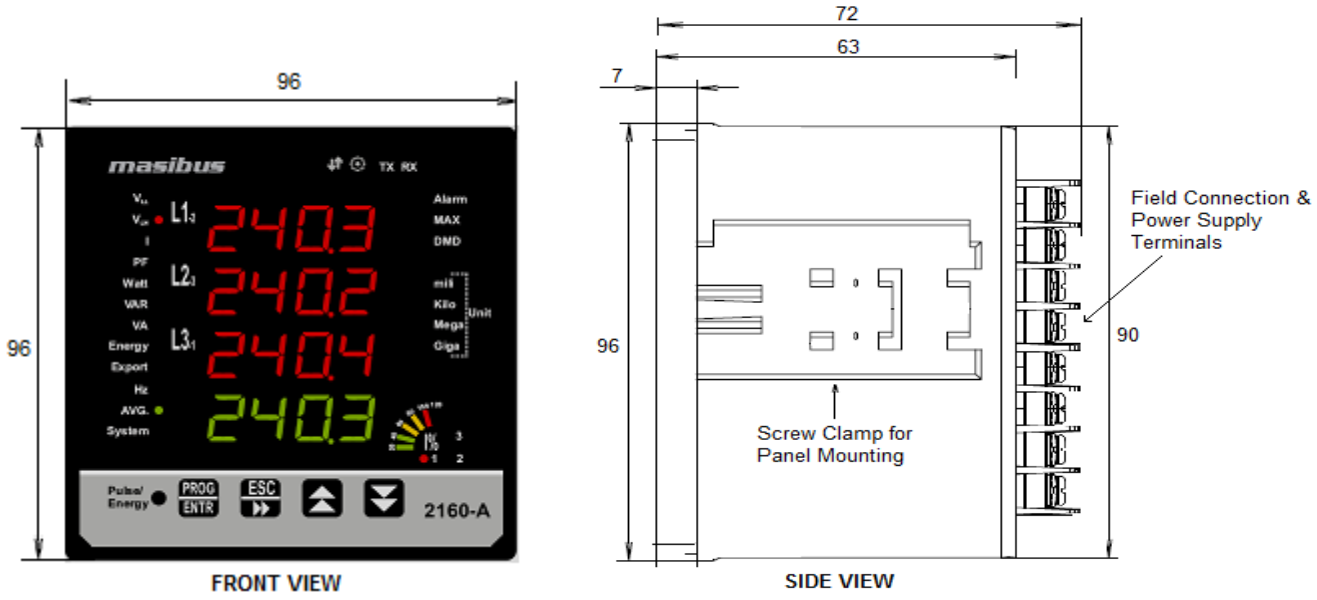
4.1 Rear Panel Terminal Connections



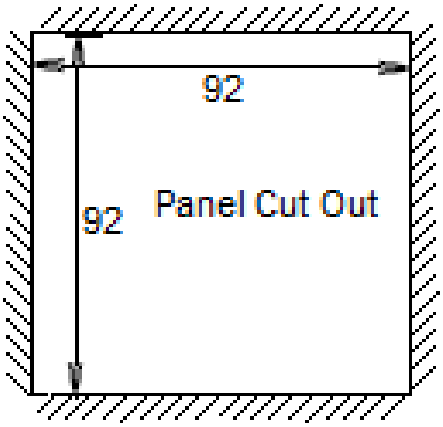
Terminal No.	Description	
1	RS-485 [A+]	RS-485 Connection
2	RS-485 [B-]	
3	IB+ [Current In B-Phase]	Three Phase Current Inputs
4	IB- [Current Out B-Phase]	
5	IY+ [Current In Y-Phase]	
6	IY- [Current Out Y-Phase]	
7	IR+ [Current In R-Phase]	
8	IR- [Current Out R-Phase]	
9	L(Line)	Aux. Power Supply Input
10	N(Neutral)	
11	OP+	Pulse Output Connection
12	OP-	
13	N [Neutral for Voltage input]	Three Phase Voltage Inputs
14	Vb[Voltage B-Phase]	
15	Vy [Voltage Y-Phase]	
16	Vr [Voltage R-Phase]	

5. MECHANICAL GUIDELINE

5.1 Front Bezel Diagram



5.2 Panel Cutout Diagram



(All Dimensions are in mm)

6. INSTALLATION GUIDELINE

6.1 Safety/Warning Precautions

Safety Precautions

Dangerous voltages capable of causing death are sometimes present in this instrument. Before installation or beginning of any troubleshooting procedures the power to all equipment must be switched off and isolated. Units suspected of being faulty must be disconnected and removed first and brought to a properly equipped workshop for testing and repair. Component replacement and interval adjustments must be made by a company person only.

Warning Precautions

Read the instructions in this manual before performing installation and take note of the following precautions:

- *All wiring must confirm to appropriate standards of good practice and local codes and regulations. Wiring must be suitable for voltage, current, and temperature rating of the system.*
- *Ensure that all incoming AC power and other power sources are turned OFF before performing any work on the instrument. Protect the measurement AC Inputs voltage (V1, V2, V3) with 2A external over current protection device and the power supply source inputs with 5A external over current protection device, located close to the equipment.*
- *Before connecting the instrument to the power source, check the labels on the instrument to ensure that your instrument is equipped with the appropriate power supply voltage, input voltages and currents. Failure to do so may result in serious or even fatal injury and/or equipment damage.*
- *Under no circumstances don't connect instrument a power source if it is damaged.*
- *To prevent potential fire or shock hazard, do not expose the instrument to rain or moisture.*
- *The secondary of an external current transformer must never be allowed to be open circuit when the primary is energized. An open circuit can cause high voltages, possibly resulting in equipment damage, fire and even serious or fatal injury. Ensure that the current transformer wiring is secured using an external strain relief to reduce mechanical strain on the screw terminals, if necessary.*
- *Only qualified personnel familiar with the instrument and its associated electrical equipment must perform setup procedures.*
- *Beware not to over-tighten the terminal screws.*
- *Read this manual thoroughly before connecting the device to the current carrying circuits. During operation of the device, hazardous voltages are present on input terminals. Failure to observe precautions can result in serious or even fatal injury or damage to equipment.*
- *Upon receipt of the shipment remove the unit from the carton and inspect the unit for shipping damage. If any damage due to transit, report and claim with the carrier. Write down the model*

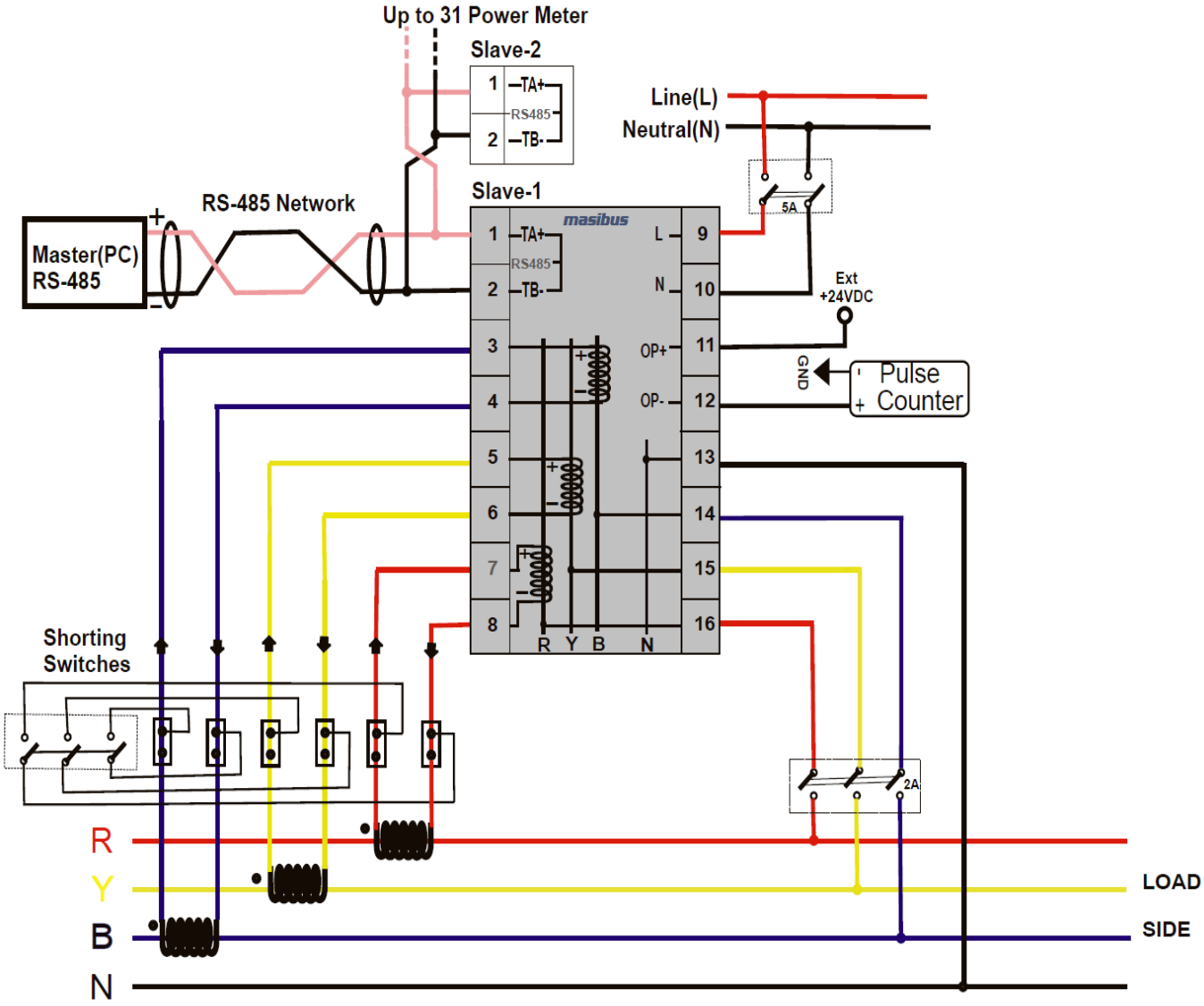
number and serial number for future reference when corresponding with our Customer Support Division.

- *Do not use this instrument in areas such as excessive shock, vibration, dirt, moisture, corrosive gases or rain. The ambient temperature of the areas should not exceed the maximum rating specified.*

6.2 Common Wiring with RS-485 Connections

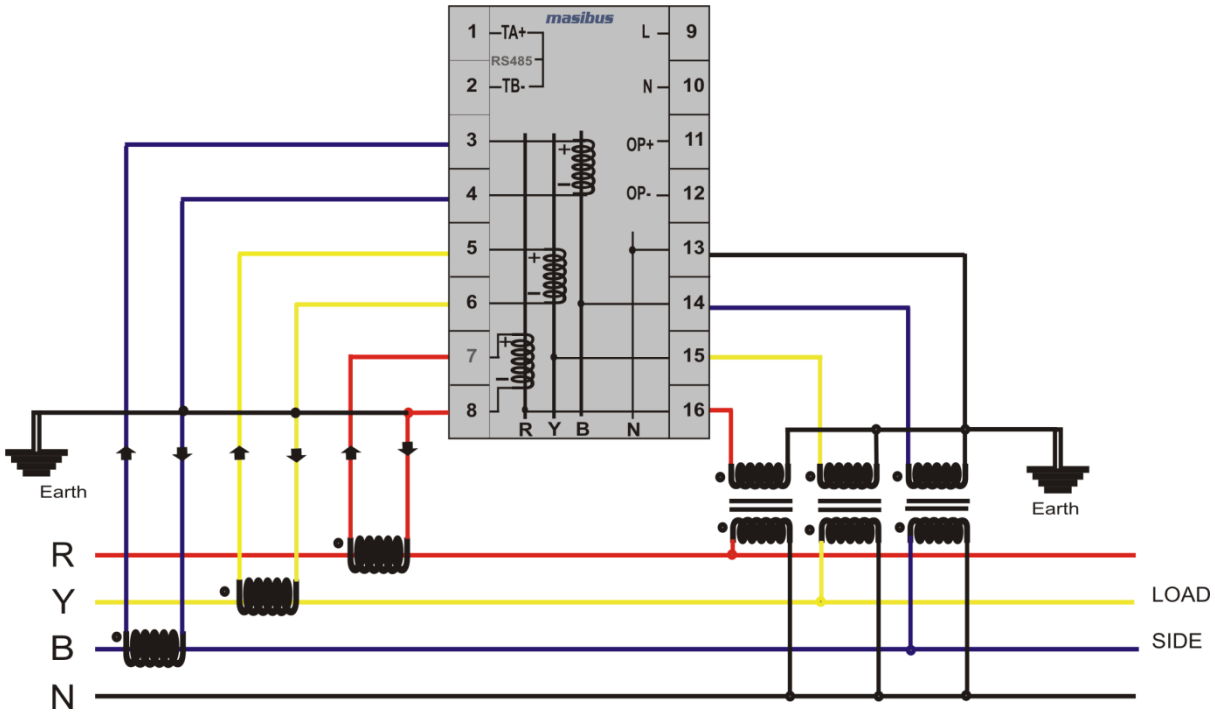
Recommended wiring for Aux Supply, Voltage input & Current Input along with RS-485 Connections

Also note correct polarity for Current Input & Phase wise Voltage & Current Input combination is essential

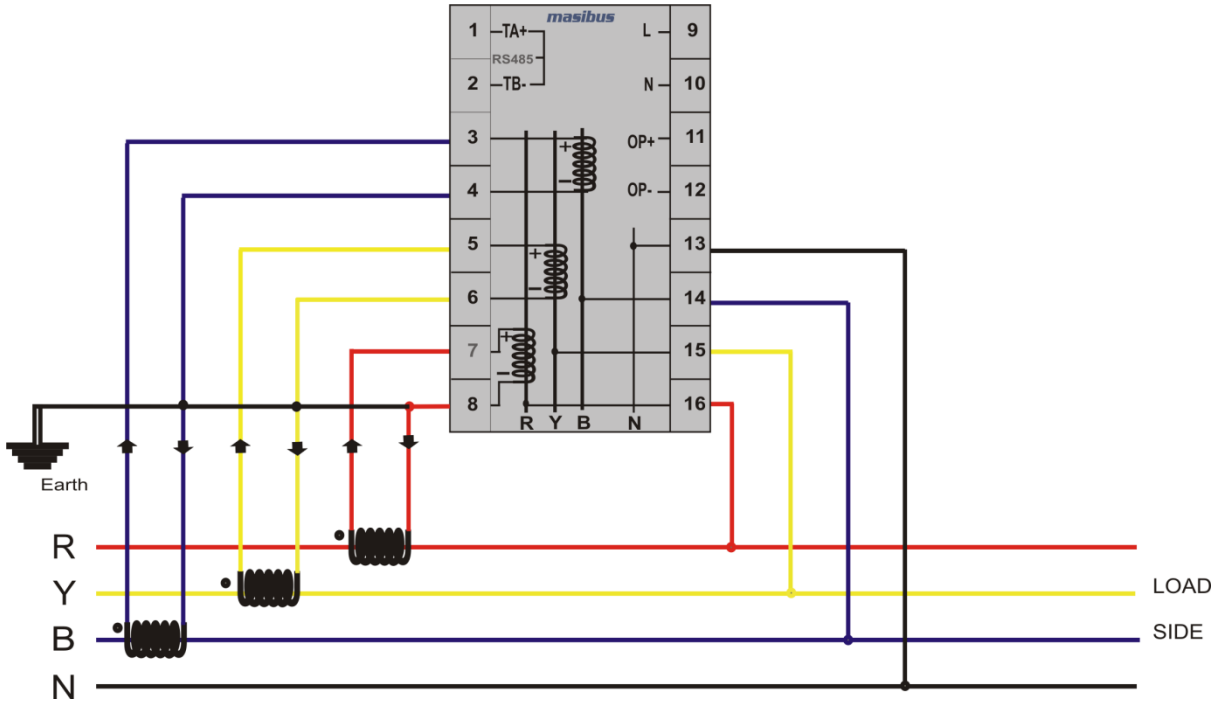


6.3.1 Three Phase Four Wire System

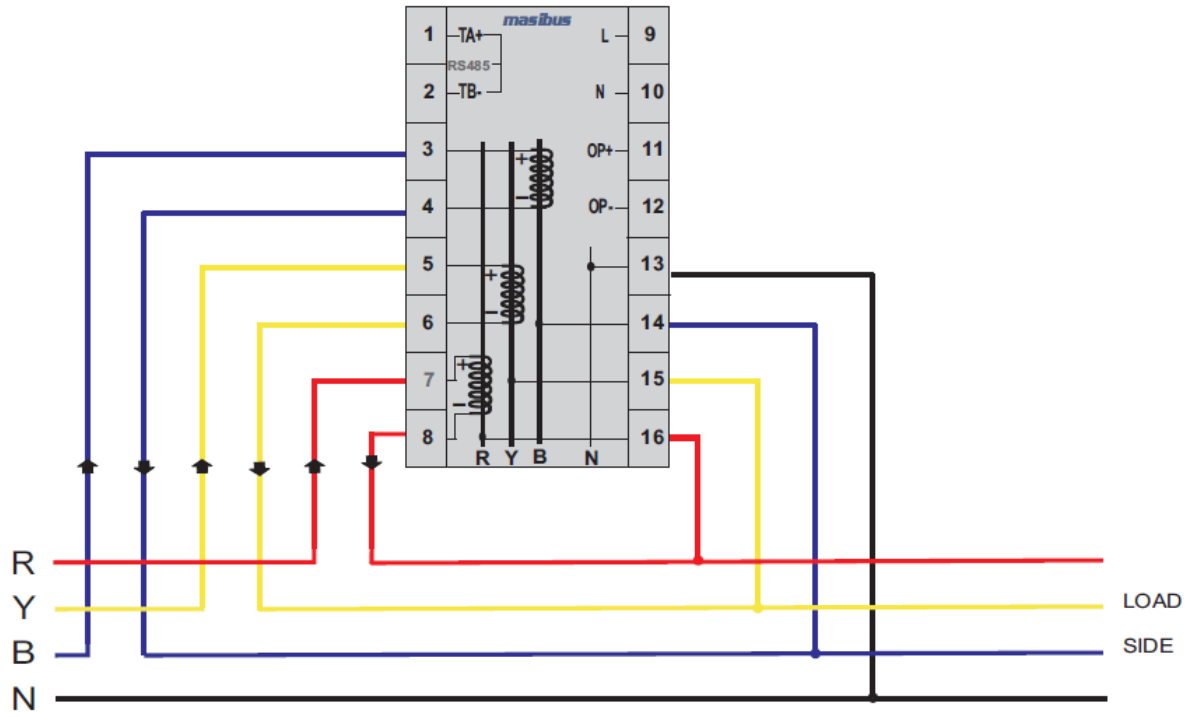
a) 4-Wire Wye-3 Element Connection Using 3PTs, 3CTs



b) 4-Wire Wye-3 Element Direct Connection Using 3CTs

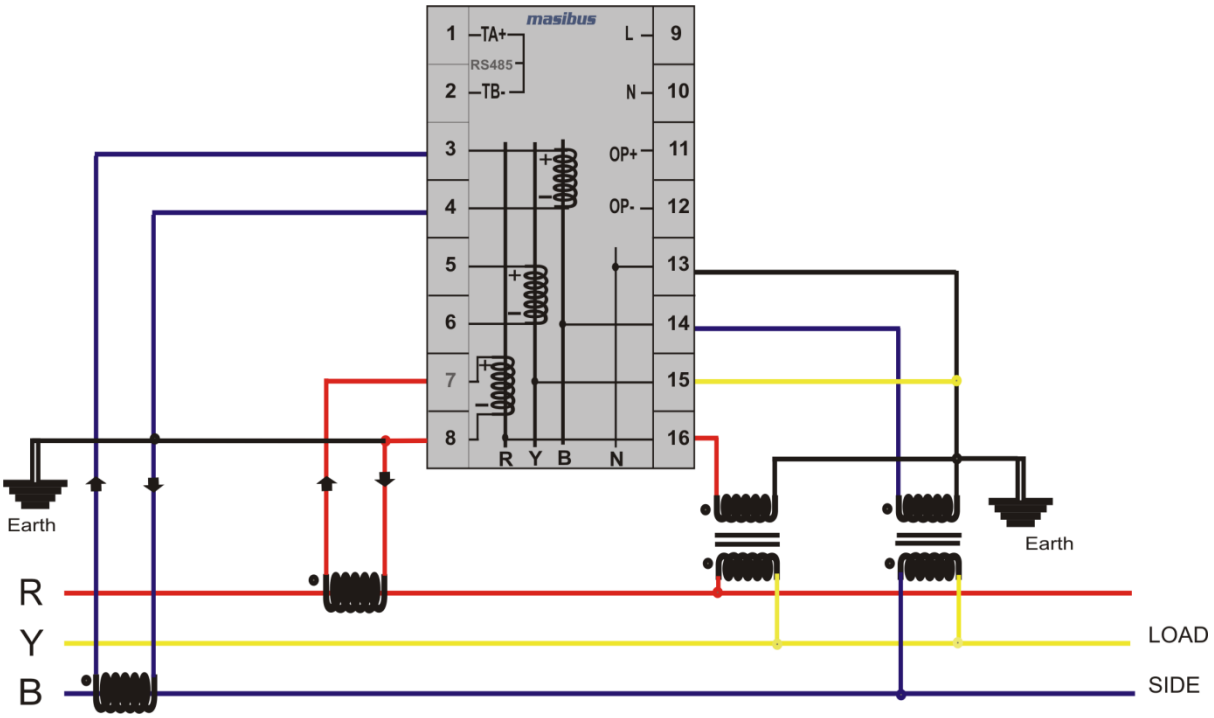


c) 4-Wire Direct Connection

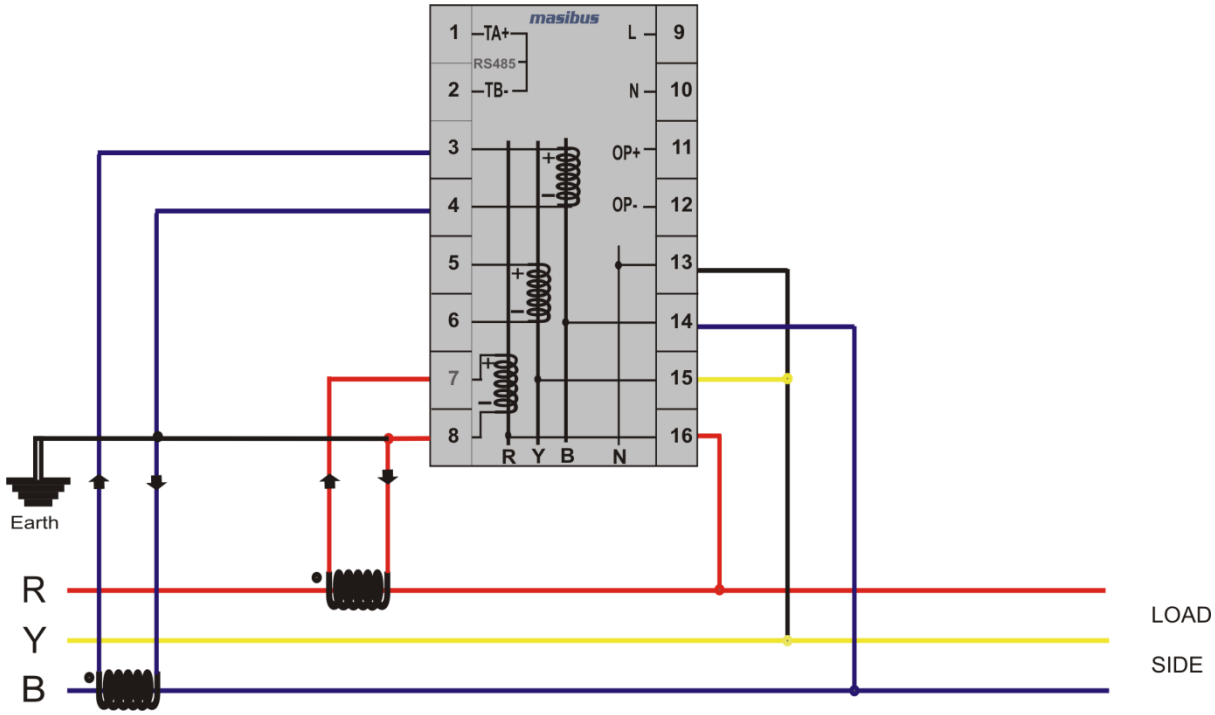


6.3.2 Three Phase Three Wire System

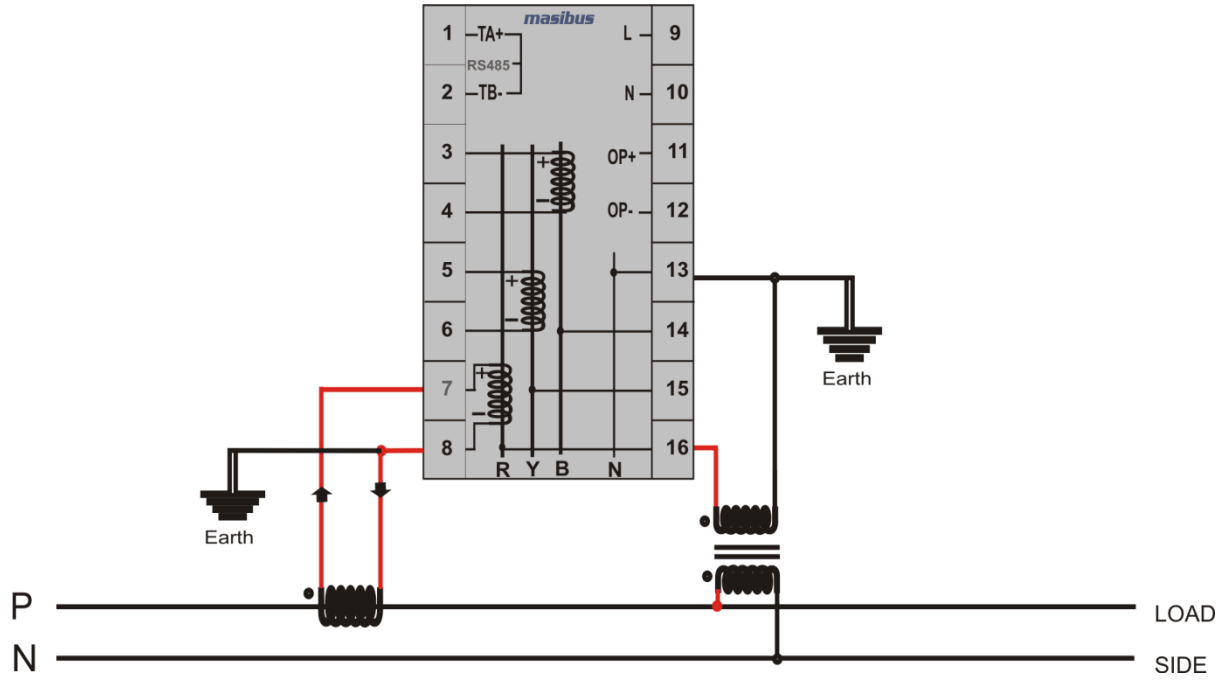
a) 3-Wire 2- Element Open Delta Connection Using 2PTs, 2CTs



b) 3-Wire 2- Element Direct Connection Using 2CTs



6.3.3 Single Phase Two Wire Configuration



Note: -*For Single Phase Two Wire, system should be 3P4W and Do not consider Average Voltage, Average Current & Average PF on the display or MODBUS.*

6.4 PTs and CTs

Large electrical installations have high voltages and currents, which may exceed the direct connection rating of the meter. In this case, Potential Transformers (PTs) and Current Transformers (CTs) are used to precisely “step down” or reduce the voltage and current level to suit the meter rating. Potential Transformers usually have a full-scale output of 110V ac RMS line-line and Current Transformers, a full-scale output of 5A or sometimes 1A.

The PTs (Potential Transformers) and CTs (Current Transformers) must be planned, installed and tested by a qualified electrical contractor before wiring the meter. The accuracy of the measurement also depends on the accuracy and phase – angle error of the PTs and CTs. Instrument Class 0.5 or better PTs and CTs are recommended. Do not use protection class CTs to feed the Multifunction meter 2160-A; as they have poor accuracy and phase characteristics.

Ensure that the CT primary rating has been selected so that your normal load variation lies between 40% and 80% of its full scale. If your CT is over-rated, say if the load is always less than 10% of the CT primary rating, accuracy suffers.

6.4.1 PT, CT Wiring

The PTs and CTs must have adequate VA rating to support the burden (loading) on the secondary. You may want to support the auxiliary supply burden from one of the PTs. CT wiring can impose additional burden (loading) on the CT. For example, if the CT has a 5A secondary and the wire resistance is 1.0 Ω, then the CT has to support an additional burden of 5VA. The wiring distance from the CT secondary to meter should be such that, VA of wire path between meter and CT along with VA of meter should not exceed the VA rating of CT, otherwise the CT could get over-burdened and give large errors.

Multifunction meter PM-2160-A should be conveniently located for easy connections of voltage (PT) and Current (CT) signals.

Note:- Common Modbus details are given in following chapter, all above mentioned features are available as described based on model selection.

7. MODBUS DETAILS

RS – 485 interface is provided to communicate with the meter. The interface is available at the terminals. (Refer Wiring Details)

When controllers are setup to communicate on a Modbus network using RTU (Remote Terminal Unit) mode, each 8–bit byte in a message contains two 4–bit Hexadecimal characters. The main advantage of this mode is that, it's greater Character density allows better data throughput than ASCII for the same baud rate.
Use only following function codes for data read/write purpose

CODE	MEANING	ACTION
03	Read holding registers	Obtains current binary value in one or more holding registers.
04	Read Input registers	Obtains current binary value in one or more Input registers.
06	Preset single register	Place a specific binary value into a holding register.

7.1 Modbus Register Map for 3P4W parameters

Data read Query = [0 x Slave Id], [0 x Fun. Code], [0 x ADD. High], [0 x ADD. Low], [0 x No. of data word, High], [0 x No. of data word. Low] [0 x CRC Low] [0 x CRC High]

Function Code = 0X04
Address – between 30001 to 30121
No. of data word ≤ 122 & in multiple of 2 as all data are of 4 Bytes [Long & Real]. Enter only Even value (data word length).

Response = [0 x Slave Id], [0 x Fun. Code], [Byte count], [Data High], [Data Low] …... [Data. High], [Data. Low] [0 x CRC Low] [0 x CRC High]
***[Data Format:** Long & Real]*

S. No.	Address	Measured parameter	words	Multiplication Factor (if data type is long)
1	30001	Frequency	2	0.01
2	30003	1. PF	2	0.001
3	30005	2. PF	2	0.001
4	30007	3. PF	2	0.001
5	30009	A. PF	2	0.001
6	30011	1. Vrms	2	0.1
7	30013	2. Vrms	2	0.1
8	30015	3. Vrms	2	0.1
9	30017	A. Vrms	2	0.1
10	30019	Vrms 1*2	2	0.1
11	30021	Vrms 2*3	2	0.1
12	30023	Vrms 3*1	2	0.1
13	30025	1. Irms	2	0.001
14	30027	2. Irms	2	0.001
15	30029	3. Irms	2	0.001
16	30031	A. Irms	2	0.001
17	30033	Reserved	-	-
18	30035	1. Watt	2	1
19	30037	2. Watt	2	1
20	30039	3. Watt	2	1
21	30041	S. Watt	2	1
22	30043	1. Var	2	1

23	30045	2. Var	2	1
24	30047	3. Var	2	1
25	30049	S. Var	2	1
26	30051	1. VA	2	1
27	30053	2. VA	2	1
28	30055	3. VA	2	1
29	30057	S. VA	2	1
30	30059	1. Wh-Import	2	0.1
31	30061	2. Wh-Import	2	0.1
32	30063	3. Wh-Import	2	0.1
33	30065	T. Wh-Import	2	0.1
34	30067	1. Wh-Export	2	0.1
35	30069	2. Wh-Export	2	0.1
36	30071	3. Wh-Export	2	0.1
37	30073	T. Wh-Export	2	0.1
38	30075	1. Varh-Import	2	0.1
39	30077	2. Varh-Import	2	0.1
40	30079	3. Varh-Import	2	0.1
41	30081	T. Varh-Import	2	0.1
42	30083	1. Varh-Export	2	0.1
43	30085	2. Varh-Export	2	0.1
44	30087	3. Varh-Export	2	0.1
45	30089	T. Varh-Export	2	0.1
46	30091	1. Vah	2	0.1
47	30093	2. Vah	2	0.1
48	30095	3. Vah	2	0.1
49	30097	T. Vah	2	0.1
50	30099	Rising Demand	2	0.1
51	30101	Real Date	2	-
52	30103	Real Time	2	-
53	30105	Maximum Demand	2	0.1
54	30107	MD Date	2	-
55	30109	MD Time	2	-
56	30111	1. Phase Angle	2	0.01
57	30113	2. Phase Angle	2	0.01
58	30115	3. Phase Angle	2	0.01
59	30117	V. Unbalance	2	0.01
60	30119	I . Unbalance	2	0.01
61	30121	Reserved	2	0.01

Energy Overflow Count:

Function Code = 0X04

Address – between 30150 to 30154

No. of data word ≤ 5 & in multiple of 1 as all data are of 2 Bytes [Decimal].

***[Data Format:** Only in Decimal]*

S. No.	Address	Measured parameter	words	Multiplication Factor (if data type is long)
1	30150	Wh I -ovcnt	1	-
2	30151	Wh E-ovcnt	1	-
3	30152	VARh I-ovcnt	1	-
4	30153	VARh E-ovcnt	1	-
5	30154	VAh -ovcnt	1	-

Harmonics:

Function Code = 0X04
Address – between 30200 to 30294
No. of data word ≤ 96 & in multiple of 2 as all data are of 4 Bytes [Long & Real].
Enter only Even value (data word length).
[Data Format:** long & Real**]

S. No.	Address	Measured parameter	words	Multiplication Factor (if data type is long)
1	30200	3rd VrHar	2	0.01
2	30202	5th VrHar	2	0.01
3	30204	7th VrHar	2	0.01
4	30206	9th VrHar	2	0.01
5	30208	11th VrHar	2	0.01
6	30210	13th VrHar	2	0.01
7	30212	15th VrHar	2	0.01
8	30214	Total Vrthd	2	0.01
9	30216	3rd VyHar	2	0.01
10	30218	5th VyHar	2	0.01
11	30220	7th VyHar	2	0.01
12	30222	9th VyHar	2	0.01
13	30224	11th VyHar	2	0.01
14	30226	13th VyHar	2	0.01
15	30228	15th VyHar	2	0.01
16	30230	Total Vythd	2	0.01
17	30232	3rd VbHar	2	0.01
18	30234	5th VbHar	2	0.01
19	30236	7th VbHar	2	0.01
20	30238	9th VbHar	2	0.01
21	30240	11th VbHar	2	0.01
22	30242	13th VbHar	2	0.01
23	30244	15th VbHar	2	0.01
24	30246	Total Vbthd	2	0.01
25	30248	3rd IrHar	2	0.01
26	30250	5th IrHar	2	0.01
27	30252	7th IrHar	2	0.01
28	30254	9th IrHar	2	0.01
29	30256	11th IrHar	2	0.01
30	30258	13th IrHar	2	0.01
31	30260	15th IrHar	2	0.01
32	30262	Total Irthd	2	0.01
33	30264	3rd IyHar	2	0.01
34	30266	5th IyHar	2	0.01
35	30268	7th IyHar	2	0.01
36	30270	9th IyHar	2	0.01
37	30272	11th IyHar	2	0.01
38	30274	13th IyHar	2	0.01
39	30276	15th IyHar	2	0.01
40	30278	Total Iythd	2	0.01
41	30280	3rd IbHar	2	0.01
42	30282	5th IbHar	2	0.01
43	30284	7th IbHar	2	0.01
44	30286	9th IbHar	2	0.01
45	30288	11th IbHar	2	0.01
46	30290	13th IbHar	2	0.01

47	30292	15th IbHar	2	0.01
48	30294	Total Ibthd	2	0.01

ON Hour / LOAD Hour / IDLE Hour / Power Interruption Count:

Function Code = 0X04
Address – between 30301 to 30311
No. of data word ≤ 11 & in multiple of 1 as all data are of 2 Bytes [Decimal].
***[Data Format:** Only in Decimal]*

S. No.	Address	Measured parameter	words	Multiplication Factor (if data type is long)
1	30301	ON HOUR	1	-
2	30302	ON MIN	1	-
3	30303	LOAD HOUR	1	-
4	30304	LOAD MIN	1	-
5	30305	IDLE HOUR	1	-
6	30306	IDLE MIN	1	-
7	30307	PWR INTR. COUNT	1	-
8	30308	IMPORT RUN HOUR	1	-
9	30309	IMPORT RUN MIN	1	-
10	30310	EXPORT RUN HOUR	1	-
11	30311	EXPORT RUN MIN	1	-

Power ON/OFF Date & Time:

Function Code = 0X04
Address – between 30350 to 30356
No. of data word ≤ 8 & in multiple of 2 as all data are of 4 Bytes [Long & Real].
Enter only Even value (data word length).
***[Data Format:** long & Real]*

S. No.	Address	Measured parameter	words	Multiplication Factor (if data type is long)
1	30350	Power Off Date	2	-
2	30352	Power Off Time	2	-
3	30354	Power On Date	2	-
4	30356	Power On Time	2	-

7.2 Modbus Register Map for 3P3W Parameters

Data read Query = [0 x Slave Id], [0 x Fun. Code], [0 x ADD. High], [0 x ADD. Low], [0 x No. of data word, High], [0 x No. of data word. Low] [0 x CRC Low] [0 x CRC High]

Function Code = 0X04
Address – between 30001 to 30121
No. of data word ≤ 122 & in multiple of 2 as all data are of 4 Bytes [Long & Real].

Response = [0 x Slave Id], [0 x Fun. Code], [Byte count], [Data High], [Data Low] …... [Data. High], [Data. Low] [0 x CRC Low] [0 x CRC High]
***[Data Format:** long & Real]*

S. No.	Address	Measured parameter	words	Multiplication Factor (if data type is long)
1	30001	Frequency	2	0.01
2	30003	1_2. PF	2	0.001
3	30005	Reserved	-	-
4	30007	3_2. PF	2	0.001
5	30009	A. PF	2	0.001
6	30011	Vrms 1*2	2	0. 1
7	30013	Vrms 3*1	2	0. 1

8	30015	Vrms 2*3	2	0. 1
9	30017	A_Vrms	2	0. 1
10	30019	Reserved	-	-
11	30021	Reserved	-	-
12	30023	Reserved	-	-
13	30025	1. Irms	2	0.001
14	30027	Reserved	-	-
15	30029	3. Irms	2	0.001
16	30031	A. Irms	2	0.001
17	30033	Reserved	-	-
18	30035	1_2. Watt	2	1
19	30037	Reserved	-	-
20	30039	3_2. Watt	2	1
21	30041	S. Watt	2	1
22	30043	1_2. Var	2	1
23	30045	Reserved	-	-
24	30047	3_2. Var	2	1
25	30049	S. Var	2	1
26	30051	1_2. VA	2	1
27	30053	Reserved	-	-
28	30055	3_2. VA	2	1
29	30057	S. VA	2	1
30	30059	1_2. Wh-Import	2	0.1
31	30061	Reserved	-	-
32	30063	3_2. Wh-Import	2	0.1
33	30065	T. Wh-Import	2	0. 1
34	30067	1_2. Wh-Export	2	0. 1
35	30069	Reserved	-	-
36	30071	3_2. Wh-Export	2	0. 1
37	30073	T. Wh-Export	2	0. 1
38	30075	1_2. Varh-Import	2	0. 1
39	30077	Reserved	-	-
40	30079	3_2. Varh-Import	2	0. 1
41	30081	T. Varh-Import	2	0. 1
42	30083	1_2. Varh-Export	2	0. 1
43	30085	Reserved	-	-
44	30087	3_2. Varh-Export	2	0. 1
45	30089	T. Varh-Export	2	0. 1
46	30091	1_2. Vah	2	0. 1
47	30093	Reserved	-	-
48	30095	3_2. Vah	2	0. 1
49	30097	T. Vah	2	0. 1
50	30099	Rising Demand	2	0. 1
51	30101	Real Date	2	
52	30103	Real Time	2	
53	30105	Maximum Demand	2	0.1
54	30107	MD Date	2	
55	30109	MD Time	2	
56	30111	1_2. Phase Angle	2	0.01
57	30113	Reserved	-	-
58	30115	3_2. Phase Angle	2	0.01
59	30117	V. Unbalance	2	0.01
60	30119	I. Unbalance	-	-

61	30121	Reserved	2	0.01

Modbus map for 3P4W & 3P3W:

Function Code = 0X04
Address – between 32001 to 32033
No. of data word ≤ 34 & in multiple of 2 as all data are of 4 Bytes [Long & Real].
[Data Format:** long & Real**]

S. No.	Address	Measured parameter		words	Multiplication Factor
		3P4W	3P3W		(if data type is long)
1	32001	Frequency	Frequency	2	0.01
2	32003	1. Vrms	Vrms 1*2	2	0.1
3	32005	2. Vrms	Vrms 3*1	2	0.1
4	32007	3. Vrms	Vrms 2*3	2	0.1
5	32009	A. Vrms	A_Vrms	2	0.1
6	32011	1. Irms	1. Irms	2	0.001
7	32013	2. Irms	Reserved	2	0.001
8	32015	3. Irms	3. Irms	2	0.001
9	32017	A. Irms	A. Irms	2	0.001
10	32019	S. Watt	S. Watt	2	1
11	32021	S. Var	S. Var	2	1
12	32023	S. VA	S. VA	2	1
13	32025	T. Wh-Import	T. Wh-Import	2	0.1
14	32027	T. Wh-Export	T. Wh-Export	2	0.1
15	32029	T. Varh-Import	T. Varh-Import	2	0.1
16	32031	T. Varh-Export	T. Varh-Export	2	0.1
17	32033	T. Vah	T. Vah	2	0.1

Energy Overflow Count:

Function Code = 0X04
Address – between 30150 to 30154
No. of data word ≤ 5 & in multiple of 1 as all data are of 2 Bytes [Decimal].
[Data Format:** Only in Decimal**]

S. No.	Address	Measured parameter	words	Multiplication Factor (if data type is long)
1	30150	Wh I -ovcnt	1	-
2	30151	Wh E-ovcnt	1	-
3	30152	VARh I-ovcnt	1	-
4	30153	VARh E-ovcnt	1	-
5	30154	VAh -ovcnt	1	-

Harmonics:

Function Code = 0X04
Address – between 30200 to 30294
No. of data word ≤ 96 & in multiple of 2 as all data are of 4 Bytes [Long & Real].
[Data Format:** long & Real**]

S. No.	Address	Measured parameter	words	Multiplication Factor (if data type is long)
1	30200	3rd VrHar	2	0.01

2	30202	5th VrHar	2	0.01
3	30204	7th VrHar	2	0.01
4	30206	9th VrHar	2	0.01
5	30208	11th VrHar	2	0.01
6	30210	13th VrHar	2	0.01
7	30212	15th VrHar	2	0.01
8	30214	Total Vrthd	2	0.01
9	30216	Reserved	-	-
10	30218	Reserved	-	-
11	30220	Reserved	-	-
12	30222	Reserved	-	-
13	30224	Reserved	-	-
14	30226	Reserved	-	-
15	30228	Reserved	-	-
16	30230	Reserved	-	-
17	30232	3rd VbHar	2	0.01
18	30234	5th VbHar	2	0.01
19	30236	7th VbHar	2	0.01
20	30238	9th VbHar	2	0.01
21	30240	11th VbHar	2	0.01
22	30242	13th VbHar	2	0.01
23	30244	15th VbHar	2	0.01
24	30246	Total Vbthd	2	0.01
25	30248	3rd IrHar	2	0.01
26	30250	5th IrHar	2	0.01
27	30252	7th IrHar	2	0.01
28	30254	9th IrHar	2	0.01
29	30256	11th IrHar	2	0.01
30	30258	13th IrHar	2	0.01
31	30260	15th IrHar	2	0.01
32	30262	Total Irthd	2	0.01
33	30264	Reserved	-	-
34	30266	Reserved	-	-
35	30268	Reserved	-	-
36	30270	Reserved	-	-
37	30272	Reserved	-	-
38	30274	Reserved	-	-
39	30276	Reserved	-	-
40	30278	Reserved	-	-
41	30280	3rd IbHar	2	0.01
42	30282	5th IbHar	2	0.01
43	30284	7th IbHar	2	0.01
44	30286	9th IbHar	2	0.01
45	30288	11th IbHar	2	0.01
46	30290	13th IbHar	2	0.01
47	30292	15th IbHar	2	0.01
48	30294	Total Ibthd	2	0.01

ON Hour / LOAD Hour / IDLE Hour / Power Interruption Count:

Function Code = 0X04
Address – between 30301 to 30311
No. of data word ≤ 11 & in multiple of 1 as all data are of 2 Bytes [Decimal].

***[Data Format:** Only in Decimal]*

S. No.	Address	Measured parameter	words	Multiplication Factor (if data type is long)
1	30301	ON HOUR	1	-
2	30302	ON MIN	1	-
3	30303	LOAD HOUR	1	-
4	30304	LOAD MIN	1	-
5	30305	IDLE HOUR	1	-
6	30306	IDLE MIN	1	-
7	30307	PWR INTR. COUNT	1	-
8	30308	IMPORT RUN HOUR	1	-
9	30309	IMPORT RUN MIN	1	-
10	30310	EXPORT RUN HOUR	1	-
11	30311	EXPORT RUN MIN	1	-

Power ON/OFF Date & Time:

Function Code = 0X04
Address – between 30350 to 30356
No. of data word ≤ 8 & in multiple of 2 as all data are of 4 Bytes [Long & Real].
***[Data Format:** long & Real]*

S. No.	Address	Measured parameter	words	Multiplication Factor (if data type is long)
1	30350	Power Off Date	2	-
2	30352	Power Off Time	2	-
3	30354	Power On Date	2	-
4	30356	Power On Time	2	-

Note: If data type is **long** in multifunction meter then set **Swapped long** in Modbus master. If data type is **Real** in Multifunction meter then set **Swapped Float** in Modbus master.
Note: Energy will be in Kilo for Real data type and for Long data type multiply with constant stated to get energy in Kilo unit.
Note: *Ignore address which are not mentioned in the memory map as they are useful in 3P4W mode.*
Note: For Time & Date
Real Date & MD Date : DDMMYY *e.g. If it is 250112 than Date: 25/01/12*
Real Time : HHMMSS *e.g. If it is 135015 than Time: 13:50:15*
MD Time: HHMM *e.g. If it is 1350 than Time: 13:50*
Note: Rising Demand and Max Demand will be in Kilo for float & Long value.
Note: Ignore value for **Reserved** in Modbus Memory Map.

7.3 Modbus Register Map for configuration parameters

Read Holding Register

Data read Query = [0 x Slave Id], [0 x Fun. Code], [0 x ADD. High], [0 x ADD. Low], [0 x No. of data word, High], [0 x No. of data word. Low] [0 x CRC Low] [0 x CRC High]

Function Code = 0X03
Address – between 40101 to 40130
No. of data word ≤ 24 & in multiple of 1 as all data are of 2 Bytes [Decimal].

Response = [0 x Slave Id], [0 x Fun. Code], [Byte count], [Data High], [Data Low] ……. [Data. High], [Data. Low] [0 x CRC Low] [0 x CRC High]

Preset Single Holding Register

Data write Query = [0 x Slave Id], [0 x Fun. Code], [0 x ADD. High], [0 x ADD. Low], [0 x Data High], [0 x Data Low], [0 x CRC Low] [0 x CRC High]

Function Code = 0X06
Address – Any Single Register between 40101 to 40130
Data = Data of 1 word, as all data are of 2 Bytes [Decimal].

Response = [0 x Slave Id], [0 x Fun. Code], [0 x ADD. High], [0 x ADD. Low], [0 x Data High], [0 x Data Low], [0 x CRC Low] [0 x CRC High]

***[Data Format:** only in Decimal]*

S. No.	Address	Measured parameter	words	Minimum value	Maximum value
1	40101	Password	1	1	9999
2	40102	Slave address	1	1	247
3	40103	Baud rate (9600, 19200, 38400)	1	9600	38400
4	40104	*[1]Energy type	1	0	9
5	40105	System type (0 – 3P4W, 1 – 3P3W)	1	0	1
6	40106	PF1 type (read only value)	1	0	2
7	40107	PF2 type (read only value)(For 3P4W only)	1	0	2
8	40108	PF3 type (read only value)	1	0	2
9	40109	Total PF type(read only value)	1	0	2
10	40110	*[2]CT Ratio – High byte	1		
11	40111	*[2]CT Ratio – low byte	1		
12	40112	*[2]PT Ratio – high byte	1		
13	40113	*[2]PT Ratio – low byte	1		
14	40114	Rated Voltage (64,110,120,240)	1	64	240
15	40115	Rated Current (1,5)	1	1	5
16	40116	Pulse constant (KWH)*[3]	1	100	60000
17	40121	Data type (0-Real,1-Long)	1	0	1
18	40122	Demand Type (0-KW, 1-KVA)	1	0	1
19	40123	Demand Method (0-BLOCK, 1-SLIDE)	1	0	1
20	40124	Interval Time	1	15	30
21	40125	Sub Interval Time*[4]	1	1	10
22	40126	Real Sec& Min [SSMM]	1	0	5959
23	40127	Real Hour & Date [HHDD]	1	1	2331
24	40128	Real Month & Year[MMYY]	1	100	1299
25	40129	Reset Individual Reg.*[5] (Write only)	1	77	84
26	40130	Reset all (Write only) *[6]	1	85	85

Notes

*[1] Energy type has ten options
0 – KWH Import
1 – KWH Export
2 – KVARH – Import
3 – KVARH – Export
4 – KVAH
5 – MWH Import
6 – MWH Export
7 – MVARH – Import
8 – MVARH – Export
9 – MVAH

*2 Maximum CT & PT Ratio value is 9999999 i.e. maximum value is 9999.999 & minimum value is 1000 i.e. 1.000
For entering CT and PT ratio refer the below example.

*3 Energy Pulse output must be in multiple of 100

*4 Sub interval Time
It is applicable for Sliding window only
For 15 minute Interval time it is limited to 1, 3 or 5
For 30 minute Interval time it is limited to 1, 2,3,5,6 or 10

*5 Reset Individual register

Value (Write only)		Reset register
77	-	Wh-Import
78	-	Wh-Export
79	-	Varh-Import
80	-	Varh-Export
81	-	Reset All Energy
82	-	Hours Reset (ON, LOAD, IDLE Hour)
83	-	Power Interruption Count Reset
84	-	Maximum Demand Reset

*6 To reset all the parameters write 85 to address 40130.

Example:
For entering CTR value 1234.567, convert 1234567 in to hexadecimal i.e. 2D687.
Now enter lower four byte (D687) at 40111 and higher four byte (0012) at 40110 addresses respectively.

PF type has three options 0 – Unity
1 – Lag
2 – Lead

NOTE:-
MODBUS Time out 4 Sec or more.

7.4 Exception Responses

Exception response is a notification of an error. The exception response codes are listed in the table below. When a slave detects one of these errors, it sends a response to the master consisting of slave address, function code, error code and error check field.
To indicate that the response is a notification of an error, the high order bit of the function code is set to 1.

CODE	NAME	MEANING
01	Illegal Function	The message function received is not an allowable action for slave.
02	Illegal Data Address	The address referenced in the data field is not an allowable address for the addressed slave location.
03	Illegal Data Value	The value referenced in the data field is not allowable in the addressed slave location.
06	Slave Device Busy	The slave is engaged in processing a program command. The master should retransmit the message later when slave is free.

Example

Query Message

SLAVE ADDR	FUNCTION CODE	H.O START ADDR	L.O START ADDR	H.O NO OF REG	L.O NO OF REG	ERROR CHECK FIELD	ERROR CHECK FIELD
0x0A	0x01	0x00	0x24	0x00	0x02	0xFC	0xBB

The query requests the status of input 0036 in slave no. 10. Since the function is an invalid function for 2160-A, so the following error response will be generated.

Response Message

SLAVE ADDR	FUNCTION CODE	EXCEPTION CODE	ERROR CHECK	ERROR CHECK
0x0A	0x81	0x01	0xF0	0x52

The function field is the original function code with the high order bit set and exception code 01 indicates an illegal function field.
When slave device that is Multifunction meter is in the PROGRAM mode, a busy state is transmitted indicating that slave device is busy and the master should retransmit the message later when the slave is free. So here exception code 0x06 is transmitted. Response message is shown below.

Response Message

SLAVE ADDR	FUNCTION CODE	EXCEPTION CODE	ERROR CHECK	ERROR CHECK
Device ID	Fun. Code + 0x80	0x06	0xC3	0x02

7.4.1 Read Holding Register (Function Code 03)

To get value of configuration parameters (CT Ratio, PT Ratio, Pls/KWh, Baud, Slave address etc.), you have to use function code **03.** Here the addressing allows up to Maximum **24** registers (Words) to be obtained at each request.

7.4.2 Preset Single Register (Function Code 06)

Function (06) will overwrite controller memory.

Function (06) allows the user to modify the contents of a holding register for configuration parameter. The values are provided in binary, up to the maximum capacity of the controller and unused higher bits must be set to zero.

Example

This example will set the CT Ratio value in slave number 17. Here CT Ratio and PT ratio requires 2 integer register for each. So you should write higher integer and lower integer value to get whole Ratio value. Suppose you want to write CT RATIO = 5,then you have to take 5000 to write because in unit side this 5000 will be divided by 1000 i.e. you will get 5.Now Hex value of 5000 is 0x1388,so you will take 0x00 for higher integer register and 0x1388 for lower integer register. The address of CT Higher integer is 0x6D and value to be programmed is 0x0000.

Similarly you can do for lower integer and also for PT RATIO. The normal response to a preset single register request is to transmit the query message after the register has been altered,

If the value is an illegal value then the response message will be an exception response (Error Message). For the details of maximum and minimum values of any parameter refer to manual.

8. IMPORTANT NOTES

Before starting Installed Meter, Go through these notes:

General Setting & Condition for CT, PT ratio

- Confirm the connection configuration
- Confirm that all energy parameters, Hour parameters, MD parameters & Power Interruption counter are going to start from zero, if not, make them zero by **All Regs Rst**.
- Vrated and Irated should be set equal to PT secondary P-N Voltage and CT secondary Current Respectively.
- Apply proper CT – PT Ratio as per requirement, which must pass the below mathematical conditions for 3P3W and 3P4W.
  For 3P4W
  3x1.2xVratedx1.2xIratedx CT Ratio x PT Ratio < 2,000,000,000
  For 3P3W
  2x1.2x√3xVratedx1.2xIratedx CT Ratio x PT Ratio < 2,000,000,000
- Select Energy type for LED Blinking as per your requirement.
- Confirm that Meter is calibrated.
- For Serial communication, MODBUS-RTU, RS485, you will get real/long data from measurement.
- Factory set Password to access the Program mode is 0001.
- Some parameters in configuration are only for factory purposes so please don't disturb these parameters like V rated, I rated & System.
- For 3p3w system, Display Menu will be changed and for modbus communication, follow the address map for 3p3w.Program mode will be same.

ON Hour, LOAD Hour, IDLE Hour& Power Interruption Count

- **ON Hour**: The period for which the meter (supply) is ON
- **LOAD Hour**: Indicates the period the Load is ON and has run. This counter accumulates as long as the load is greater than the starting current (0.1% of the Irate) set.
- **IDLE Hour**: Indicates the period of difference between ON Hour and LOAD Hour.
  (ON, LOAD, IDLE Display two quantity Hours and Minute.
- **Power Interruption Count**: Number of Supply Outages, means the number of Auxiliary Supply interruptions. If the meter Auxiliary Supply is from a UPS then the INTR (number of interruptions) will be zero (as long as the UPS stays ON), even if the Voltage Signals did die out from time to time.
  It shows last Power OFF & Power ON time. [Available with RTC option only]

Energy Pulse O/P Constant Setting

- For Front Blinking LED, select energy type (i.e.-import/KWh-export/KVARh-Import/KVARh-Export/KVAh/MWh-Import/MWh-Export/MVARh-Import/MVARh - Export/MVAh) as per your requirement using Program mode, from OUTPUT and set the value of constant. But here you can get maximum output pulse frequency (& LED Blinking rate) up to 50 msec. so whenever you are using this feature; you should set value of Meter-Constant such a way so it will not cross the limit of 50 ms pulse frequency.
- As pulse frequency is 50 msec, i.e. in one second maximum 20 pulses can be obtained, hence in one hour maximum 72000 pulses can be obtained.
  Total no of impulses/second can be calculated as below
  (Vrate * Irate * CTR * PTR * Pulse Constant in Wh)/3600 <= 20.
  - Example: Meter specification
  - V rated = 240V, I rated = 5A, CT ratio = 40 and PT ratio = 100,
  - Above meter can consume maximum of 4.8MWatt.
    I.e. For 3600 pulses/KWh [3.6 pulses/Wh], it will generate 4800 pulses/sec as per above equation, [240*5*40*100*3.6/3600 = 4800] so it will not work for the meter as it is more than 20 pulses/sec
    I.e. For 2000 pulses/MWh [0.002 pulses/Wh], it will generate 2.666 pulses/sec as per above equation, [240*5*40*100*0.002/3600 = 2.66] so it will work for the meter as it is **less than 20 pulses/sec**
    This is for single phase only, in case of three phases, energy will be multiplied by three in 3p4w and hence pulses should be calculated for three phase energy.

Energy Calculation

Below formula used for finding the Total Active Energy Import.

Total Active Energy = [Running Active Energy (Import) + (WH-I Ov.count * 400G)] (Import)

- **Example**:
  Let's WH-I Ov.count = 5, Active[Im] = 20.3268 GWh then

  Actually measured Total Active Energy (Import) = [20.3268 G + (5 * 400G)]
  = 2020.3268 GWh

  Above calculation is same for other energy (Active Export, Reactive Import, Reactive Export, and Apparent Energy) can be find out using respective Ov.count and running energy.

Energy Overflow Time Calculation

- When data type selected for modbus is FLOAT, Total apparent Energy will overflow from 400GVAhr then auto reset Apparent Energy, but when the ov.count of this energy (VA Ov.count > 99) then meter will auto reset all energy parameter. This includes Active import and export energy, Reactive Import and Export energy and apparent energy. Such condition of overflow occurrence is depending on CT ratio and PT ratio.

Example:

For 110V V rated, and 1 A I rated multifunction meter is set for 100A and 66KV line with CT Ratio of 100 and PT Ratio of 600.

- PT Primary = 66KV, PT Secondary = 110V Therefore select Vrated = 110V.
  PTR = 66KV/110V=600 select.
  CT Primary=100A, CT Secondary=1A Therefore select Irated = 1A.
  CTR = 100A/1A=100 select in meter.
- Energy consumed per hour will be 66kV X 100Amps = 6600KVAHr.
- Time to overflow in Hr. = 400GVAhr / 6600KvaHr = 60606 Hr
- Days = 60606 /24 = 2525 Days
- Years = 2525 / 365 = 6.91 Years / Total of Three Phase.
- But our Apparent Energy Overflow Count Range are 1 to 99, therefore
  Total Time to overflow in Years = 6.91*99 = 684.09 Years / Total of Three Phase.
- User has to manually reset **All Regs Rst,** when installing the meter first time.
- As above for 100A and 66KV line, PT Primary = 66KV, PT Secondary = 110V Therefore Vrated = 110V select. PTR = 66KV/110V=600 select.
- CT Primary=100A, CT Secondary=1A Therefore Irated = 1A select. CTR = 100A/1A=100 select in meter.

Energy Resolution on Modbus

- Resolution of the energy parameter on the Modbus when data is transmitted in LONG format is 100VAhr/Whr/VARhr rather than 1VAhr/Whr/VARhr, which is possible when FLOAT data type is used. Because of the limitation of the Long Data type and to avoid frequent reset, Data is transmitted in with above-mentioned resolution.
- Due to this resolution on display of the Meter will not be same as ON ModBus data, when data is transmitted in LONG format. Multiplication factor given on master side is 0.0001.

Example:

Lets say on modbus data transmitted is 20098798 then on the master side it will be 20098798 * 0.0001 = 2009.8798 MWhr/MVAhr/MVARhr.
Which gives the resolution of the 0.1KWhr/KVAhr/KVARhr as described above.

9. TROUBLESHOOTING TIPS

The information in Table 9– 1 describes potential problems and their possible causes. It also describes checks you can perform or possible solutions for each. After referring to this table, if you cannot resolve the problem, contact our sales representative.

Table 9– 1: Troubleshooting

Potential Problem	Possible Cause	Possible Solution
The display is blank with black light OFF after applying control power to the Multifunction Meter.	The Multifunction meter may not be receiving the necessary Power.	Verify that the Multifunction meter line (L) and neutral (N) terminals are Receiving the necessary power.
The data being displayed is inaccurate or not what you expect.	Incorrect setup values.	Check that the correct values have been entered for Multifunction meter setup parameters (CT and PT ratings, System Type).
	Incorrect voltage inputs.	Check Multifunction meter voltage input terminals to verify that adequate voltage is present.
	Multifunction meter is wired improperly.	Check that all CTs and PTs are connected correctly (proper polarity is observed) and that they are energized. Check shorting terminals.
Cannot communicate with Multifunction meter from a remote personal computer.	Multifunction meter address is incorrect.	Check to see that the Multifunction meter is correctly addressed.
	Multifunction meter baud rate (parity, stop bit) is incorrect.	Verify that the baud rate of the Multifunction meter matches the baud rate of all other devices on its communications link.
	Communications lines are improperly connected.	Verify the Multifunction meter communications connections interchange [A+] & [B-] lines

If these troubleshooting tips do not solve your problem then, please contact technical support at either nearest area office or Main Head Office as given on the first page.

Display Details for Run Mode and Configuration Mode

1. **Annexure A2 – Display Details for LED based PM2160-A**
2. **Annexure A3 – Display Details for LCD Panel based PM2160-A**