

**MULTIFUNCTION METER**  
**MFM2160**



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## 1. INTRODUCTION

### Foreword

Thank you for purchasing the Multifunction Meter (MFM2160).

#### **MFM (Multifunction Meter)**

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

### Notice

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

This manual describes the functions of this product. Our company 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 our 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

Our product names or brand names mentioned in this manual are the trademarks or registered trademarks of masibus.

Adobe, Acrobat, and Postscript are either registered trademarks or trademarks of Adobe Systems Incorporated. All other product names mentioned in this user's manual are trademarks or registered trademarks of their respective companies.

### 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 MFM2160 Multifunction Meter is a device used in electrical systems to measure and monitor various electrical parameters (voltage, current, power, frequency, Energy etc.) Meters are widely used across commercial and industrial sectors, providing critical data for energy management and system optimization. Its four-digit seven-segment display allows the simultaneous display of three parameters.

MFM2160 provides RS485 port supporting Modbus-RTU protocol for communication with THD, Individual Harmonics measurements, Maximum Demand, Min-Max readings.

The MFM2160 can interface with **mLogiView** software, enabling users to configure system parameters and view data values such as voltage, current, power, and more.

### Features

- Available in Accuracy Class 1.0 as per 62053-21 and Class 0.5s / Class 0.2s as per IEC 62053-22
- True RMS measurement
- Field Programmable CT/PT Primary & Secondary
- Isolated RS485 Modbus Communication (Modbus-RTU protocol)
- Available front Pulse LED for site calibration for selected type of energy
- THD measurement for voltage and current, up to 31<sup>st</sup> odd harmonics
- Current and power demand monitoring

- Display of minimum (Low) and maximum (High) values
- 'OLD' register to store the previously cleared energy value
- Monitors Run hours & On hours
- Auto Scrolling feature for easy readability for all parameters
- Favorite page Store feature
- User programmable password protection for Configuration mode
- User Assignable Modbus registers for ease of integration

## Product Ordering Code

### Ordering Code:

| Model   | Accuracy |            | Power Supply |                                          | Data Logging |           | Pulse Output |           | Display |             |
|---------|----------|------------|--------------|------------------------------------------|--------------|-----------|--------------|-----------|---------|-------------|
| MFM2160 | X        |            | X            |                                          | X            |           | X            |           | X       |             |
|         | S        | Class 1.0  | U1           | Aux. Powered<br>85-265VAC/<br>100-300VDC | N            | None      | N            | None      | LCD     | LCD Display |
|         | 1        | Class 0.5s | U2           | Aux. Powered<br>20-60VDC                 | Y            | Required# | Y            | Required# | LED     | LED Display |
|         | 2        | Class 0.2s |              |                                          |              |           |              |           |         |             |

**Note#:** Data logging & Pulse output options are not applicable in LED Display

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       | Quick User Guide         | 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.

|                                                                                                    |                                                                                                                      |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
|  <b>WARNING</b> | <i>This indicates a danger that may result in death or serious injury if not avoided.</i>                            |
|                                                                                                    | <i>This indicates a danger that may result in minor or moderate injury or only a physical damage if not avoided.</i> |

## 2. SPECIFICATIONS

|                     |                                      |
|---------------------|--------------------------------------|
| Type of Measurement | TRUE RMS                             |
| Sampling rate       | 82 Samples/Cycle                     |
| Connection type     | 3P4W / 3P3W / 1P2W (Site selectable) |

| Input Voltage                                   |                                          |
|-------------------------------------------------|------------------------------------------|
| Measuring Voltage range                         | 20VL-N to 300VL-N (34VL-L to 520VL-L)    |
| PT(VT) Primary                                  | 100 V to 1000 KV AC (L-L) (Programmable) |
| Nominal Voltage range (Un)<br>(PT/VT Secondary) | 57.5VL-N to 240VL-N (100VL-L to 415VL-L) |
| Burden                                          | <0.2VA per phase                         |
| Over Voltage                                    | 120% of Un Continuous                    |

| Input Current                             |                                                                                                     |
|-------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Measuring Current range                   | 5mA to 6A                                                                                           |
| CT Ratings Primary                        | 1A/5A to 15000 A (Programmable)                                                                     |
| Nominal Current range (In) (CT Secondary) | 1A or 5A                                                                                            |
| Burden                                    | 1A: <0.1 VA per phase,<br>5A: <0.2VA per phase                                                      |
| Overload                                  | 150% of In Continuous                                                                               |
| Short-time over current                   | 20 x I <sub>max</sub> for 1 sec., 10 x I <sub>max</sub> for 3 sec., 7 x I <sub>max</sub> for 10 sec |

|           |            |
|-----------|------------|
| Frequency | 45 to 65Hz |
|-----------|------------|

| Auxiliary Power Supply |                                                                   |
|------------------------|-------------------------------------------------------------------|
| Power Supply           | Standard: 85-265VAC, 50/60Hz or 100-300VDC<br>Optional: 20-60 VDC |
| Burden                 | < 3.5VA / <1.5W                                                   |

| Measurement Accuracy      |                                                                         |
|---------------------------|-------------------------------------------------------------------------|
| Voltage                   | ±0.5% for Class 1.0 / 0.5s and ±0.2% for Class 0.2s                     |
| Current                   | ±0.5% for Class 1.0 / 0.5s and ±0.2% for Class 0.2s                     |
| Frequency                 | ±0.05% for Class 1.0 / 0.5s / 0.2s                                      |
| Power Factor              | ±0.01 for Class 1.0 and ± 0.005 for Class 0.5s / 0.2s                   |
| Active Power              | ±1.0% for Class 1.0 and ± 0.5% for Class 0.5s and ± 0.2% for Class 0.2s |
| Reactive & Apparent Power | ±1.0% for Class 1.0 and ± 0.5% for Class 0.5s / Class 0.2s              |
| Active Energy             | Class 1.0 as per IEC 62053-21 and Class 0.5s / 0.2s as per IEC 62053-22 |
| Reactive Energy           | Class 1.0 & Class 0.5s as per IEC 62053-24                              |

| Display             |                                                                                                                          |
|---------------------|--------------------------------------------------------------------------------------------------------------------------|
| LED                 | 3 line 4-digit Red LED Display with 0.56" [14.2mm] height,<br>12 digit for energy & 4 digit for Instantaneous parameters |
| Keypad              | 3 buttons for navigation to performing configuration setup & Operation                                                   |
| Protection features | Password protected for set-up & clearing energy<br>and Min / Max data                                                    |

|                                                                                                      |                              |
|------------------------------------------------------------------------------------------------------|------------------------------|
| Green LED Indication                                                                                 | RS485 Communication Activity |
| Red  LED Indication | Energy Pulse                 |

### Environmental

|                         |                                  |
|-------------------------|----------------------------------|
| Operating temperature   | -10°C to +60°C                   |
| Storage temperature     | -25°C to +70°C                   |
| Relative humidity       | Up to 95% non-condensing         |
| IP degree of Protection | IP51 front side, IP30 meter body |
| Isolation               | 4 kV RMS for 1 minute            |
| Impulse withstands      | 6 kV                             |
| Pollution Degree        | 2                                |

### Mechanical

|                       |                                                                                                |
|-----------------------|------------------------------------------------------------------------------------------------|
| Mounting Type         | Panel mount                                                                                    |
| Size                  | 100(W) x 100(H) x 55(D) mm                                                                     |
| Panel Cutout          | 92(W) x 92(H) mm                                                                               |
| Material              | ABS                                                                                            |
| Accessory             | 2 Panel mount clamps                                                                           |
| Weight                | 0.4 kg (approx.)                                                                               |
| Terminal & Cable Size | Barrier type terminal<br>U-type / ring-type termination: maximum up to 4 mm <sup>2</sup> Cable |

### Demand Parameters

|                             |                                    |
|-----------------------------|------------------------------------|
| Total Active Power Demand   | Rising and Maximum Demand          |
| Total Reactive Power Demand | Rising and Maximum Demand          |
| Total Apparent Power Demand | Rising and Maximum Demand          |
| Average Current Demand      | Rising and Maximum Demand          |
| Demand Intervals            | Programmable from 1 to 60 minutes. |
| Demand Calculation Method   | Block & Sliding                    |

### Min - Max Values

|                                                 |                             |
|-------------------------------------------------|-----------------------------|
| Parameters                                      | V, A, PF, Hz, KW, KVAR, KVA |
| Values can be reset through configuration mode. |                             |

### RPM & User assignable Modbus Registers

|                  |                                                         |
|------------------|---------------------------------------------------------|
| RPM              | Field Programmable pole (2-48) and slip (0.0 to 99.99%) |
| Modbus registers | User Assignable 60 Modbus addresses via software        |

### Suppression Current

A minimum current detection threshold of 1 to 99 mA can be configured to ignore induced or insignificant current flowing in the circuit; 5 mA is the default.

### Electromagnetic compatibility (as per IEC 61326-1)

|                                            |                |
|--------------------------------------------|----------------|
| Electrostatic Discharge                    | IEC 61000-4-2  |
| Immunity to Fast transient                 | IEC 61000-4-4  |
| Immunity to surge waves                    | IEC 61000-4-5  |
| Immunity to magnetic fields                | IEC 61000-4-8  |
| Immunity to voltage dips and interruptions | IEC 61000-4-11 |
| Conducted emissions                        | CISPR 11       |
| Radiated emissions                         | CISPR 11       |

### 3. TERMINAL DESCRIPTION

#### 3.1 Terminal Details



**Terminal Connections – Rear View of MFM2160**

| Terminal Name | Description                        |               |
|---------------|------------------------------------|---------------|
| L / +         | (Line): Aux. Power Supply Input    | AUX Supply    |
| N / -         | (Neutral): Aux. Power Supply Input |               |
| VR            | R Phase voltage terminal           | Voltage Input |
| VY            | Y Phase voltage terminal           |               |
| VB            | B Phase voltage terminal           |               |
| VN            | Neutral voltage terminal           |               |
| D+            | Positive data line                 | RS 485        |
| D-            | Negative data line                 |               |
| IR(S1)        | Current in R phase                 | Current Input |
| IR(S2)        | Current Out R phase                |               |
| IY(S1)        | Current in Y phase                 |               |
| IY(S2)        | Current Out Y phase                |               |
| IB(S1)        | Current in B phase                 |               |
| IB(S2)        | Current Out B phase                |               |

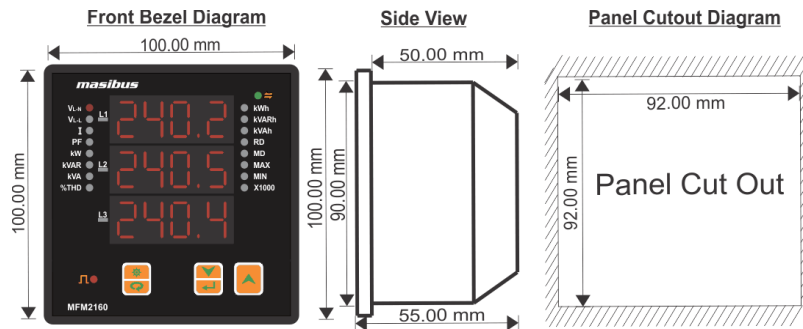


## 4. INSTALLATION AND SAFETY GUIDELINES

### 4.1 Mechanical Installation

For installing the meter: -

- Cut the panel according to the specified dimensions shown below.
- Insert the meter into the panel cutout and secure it by attaching clamps on the rear side. Ensure the clamps are placed diagonally opposite for a firm fit.
- Tighten the screws evenly with the appropriate torque to achieve proper sealing.



### 4.2 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



All wiring must confirm 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.

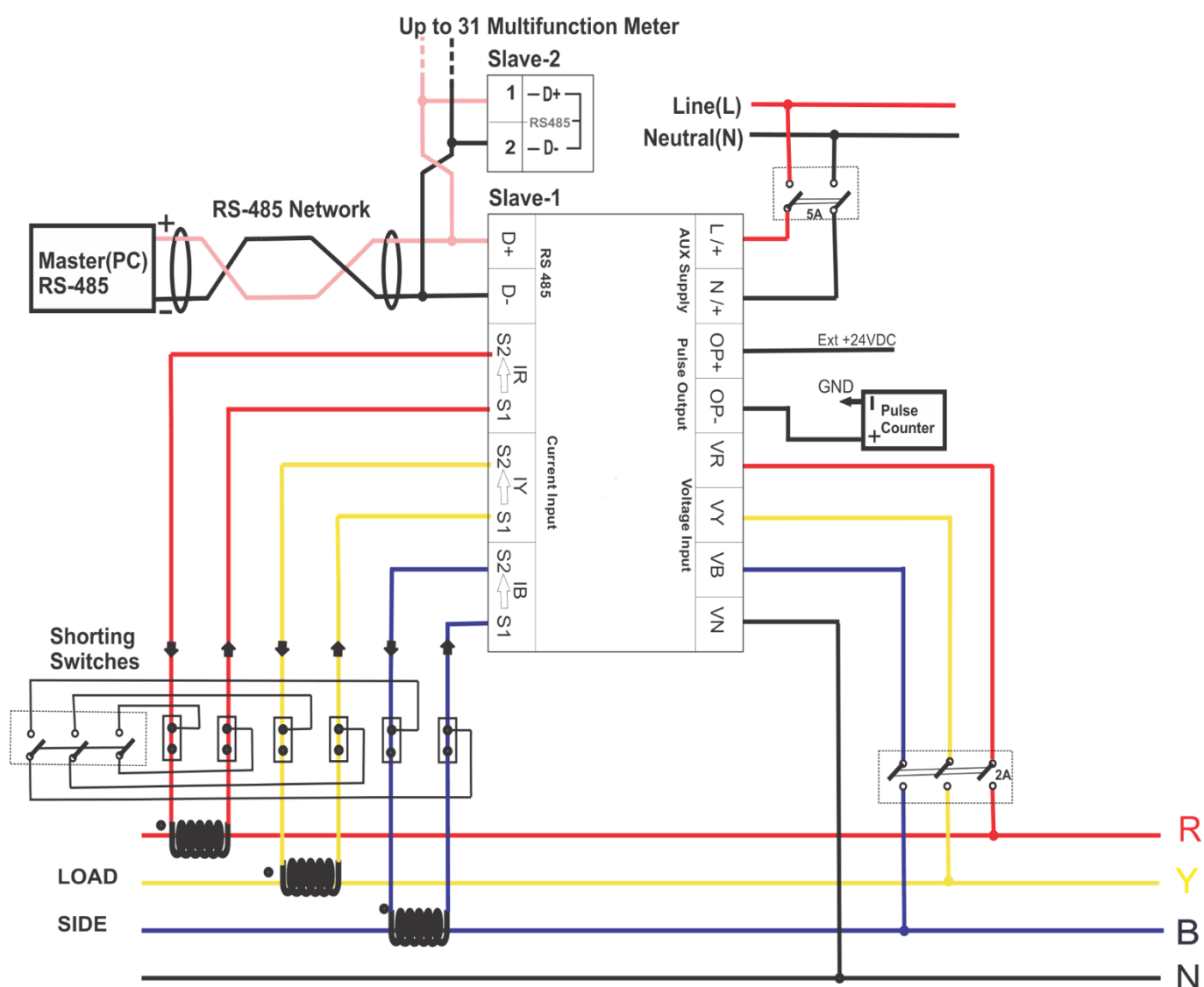
Upon receipt of the shipment remove the unit from the carton and inspect the unit for shipping damage. If any damage due to transit, report and claim with the carrier. Write down the model number and serial number for future reference when corresponding with our Customer Support Division.

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.



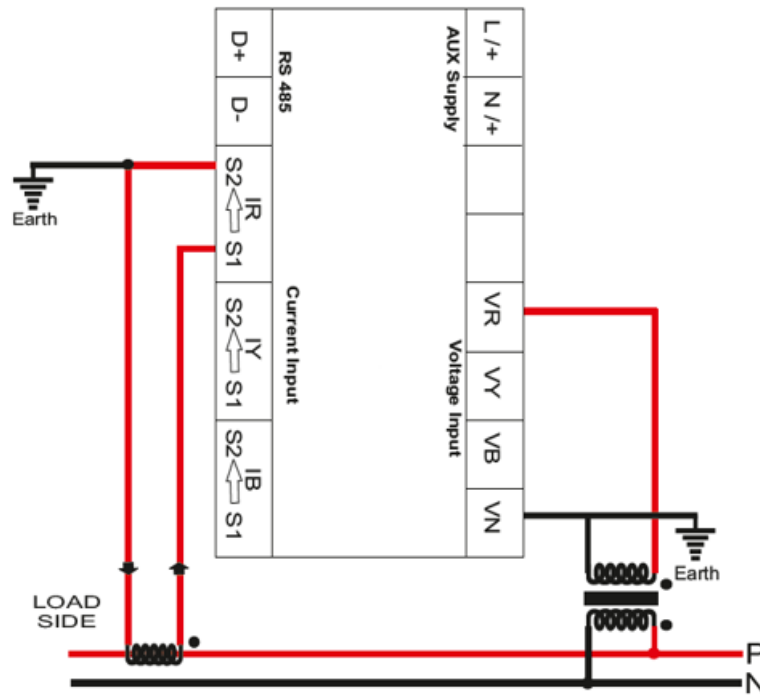
## 5.1 Common Wiring with RS-485 Connections

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



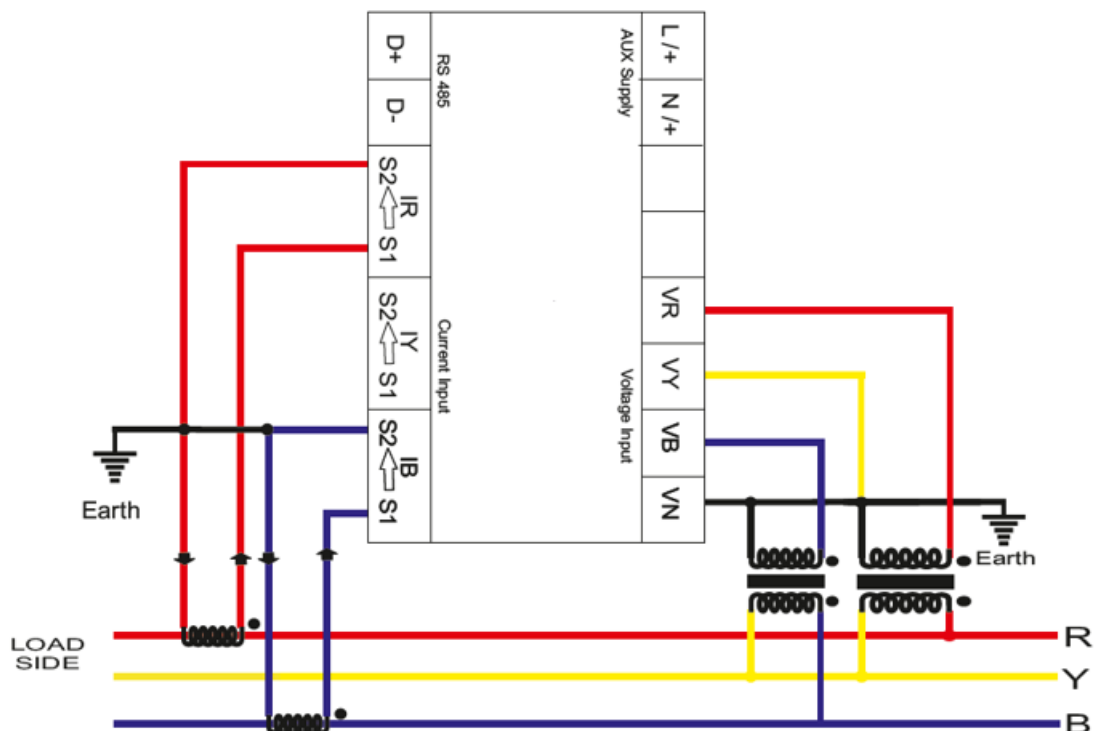
## 5.2 Wiring diagram

### 1) Single Phase Two Wire System

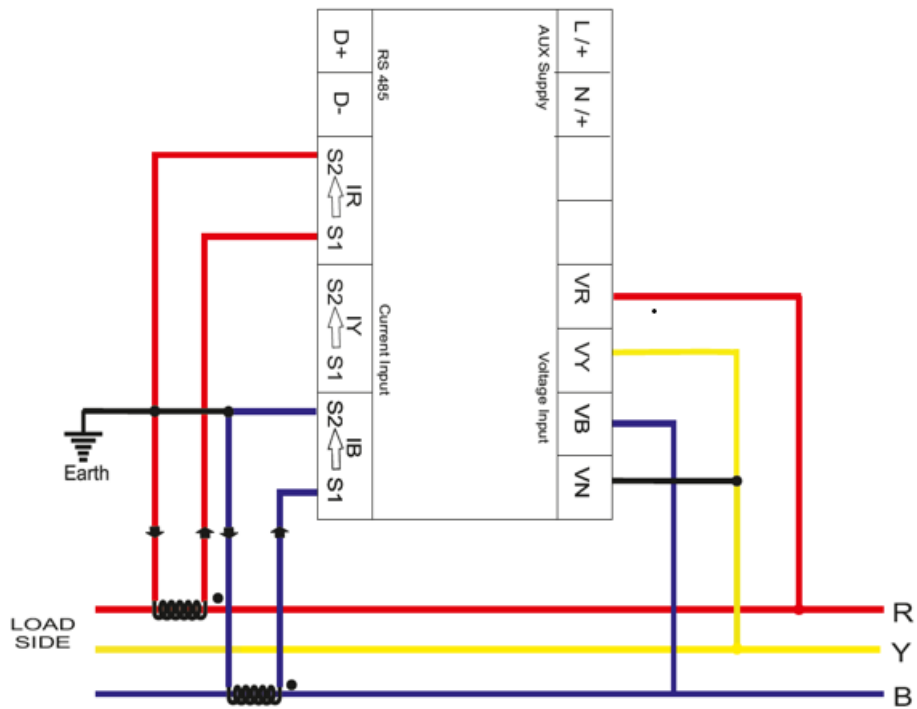


### 2) Three Phase Three Wire System

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

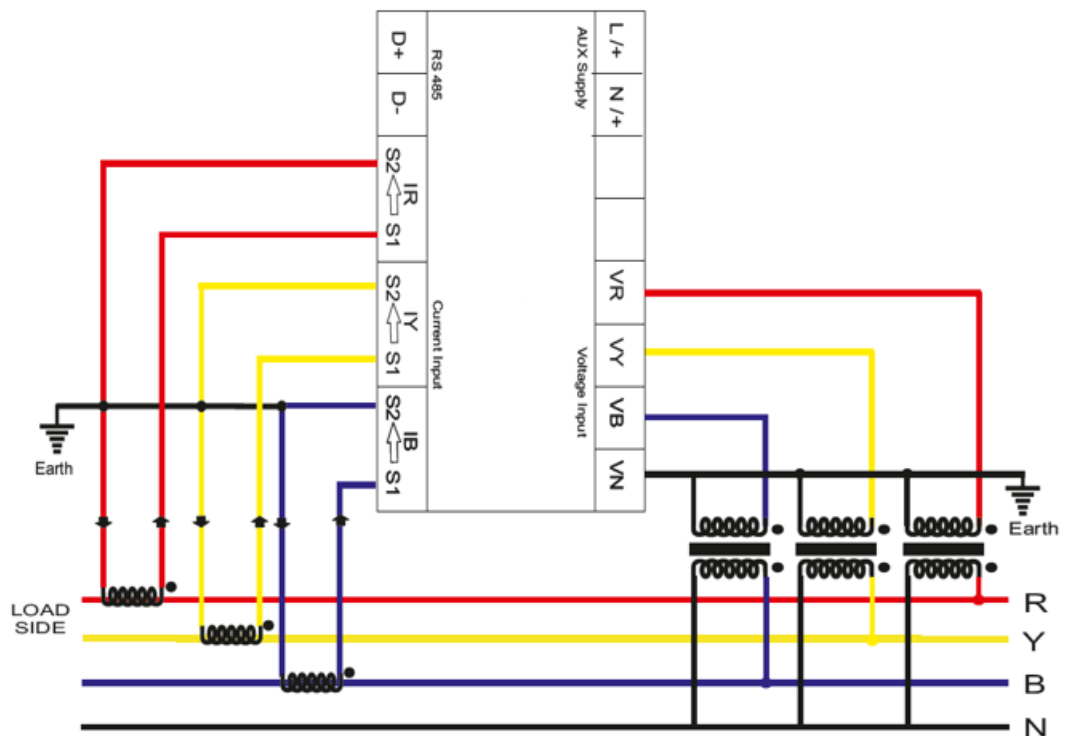


**2B) 3-Wire 2- Element Direct Connection Using 2CTs**

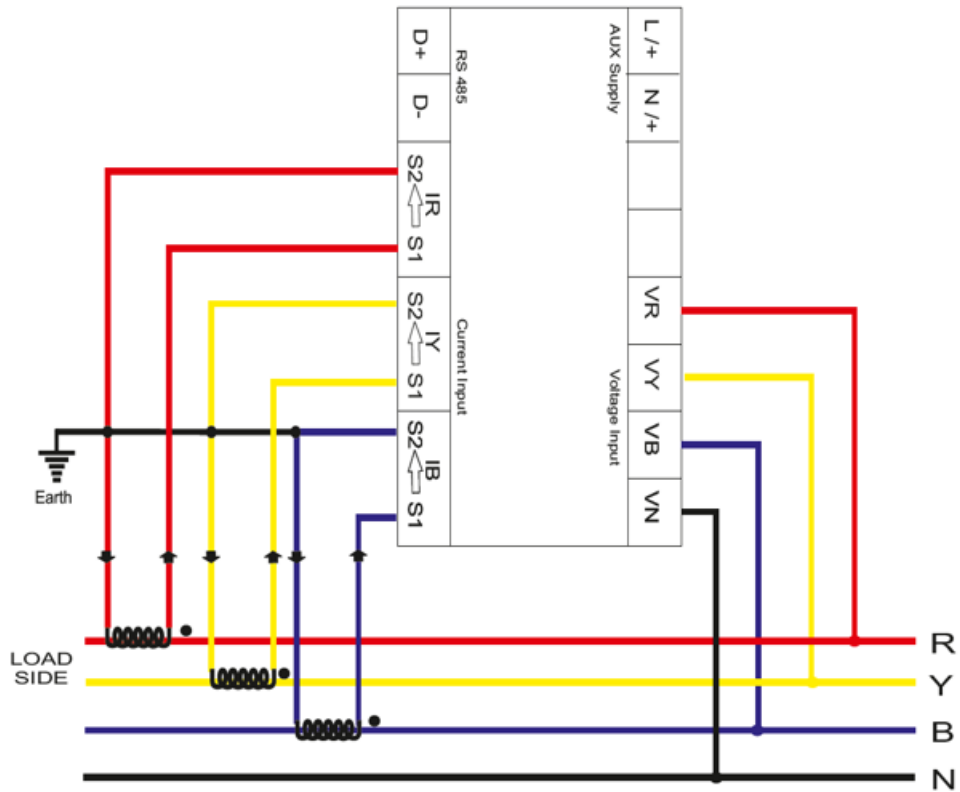


**3) Three Phase Four Wire System**

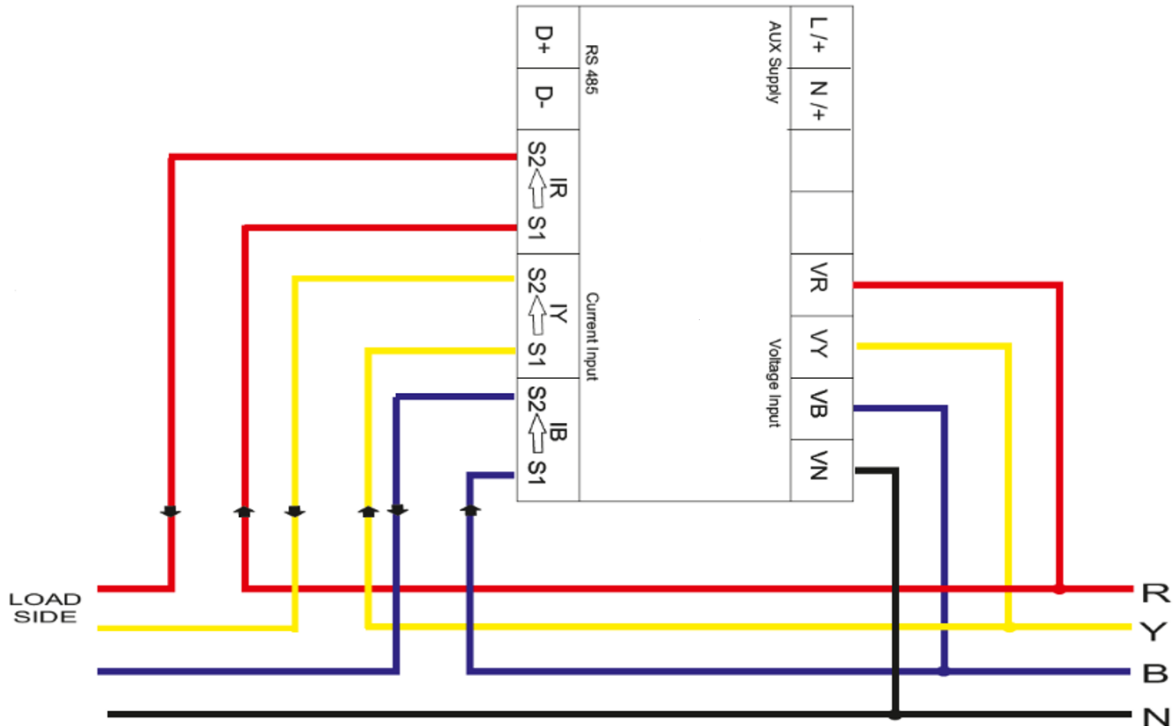
**3A) 4-Wire Wye-3 Element Connection Using 3PTs, 3CTs**



**3B) 4-Wire Wye-3 Element Direct Connection Using 3CTs**



**3C) 4-Wire Direct Connection**



### 5.3 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 MFM2160 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.

#### 5.3.1 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  $\Omega$ , 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 MFM2160 should be conveniently located for easy connections of voltage (PT) and Current (CT) signals.

## 6. FRONT PANEL DESCRIPTION

### 6.1 LED Indication Description



| No | Parameter                | Description                    |
|----|--------------------------|--------------------------------|
| 1  | VL-N                     | Line to neutral voltage        |
| 2  | VL-L                     | Line to line voltage           |
| 3  | I                        | Current                        |
| 4  | PF                       | Power factor                   |
| 5  | KW                       | Active power                   |
| 6  | KVAR                     | Reactive power                 |
| 7  | KVA                      | Apparent power                 |
| 8  | %THD                     | Total harmonics distortion (%) |
| 9  | kWh                      | Active energy                  |
| 10 | kVARh                    | Reactive energy                |
| 11 | kVAh                     | Apparent energy                |
| 12 | RD                       | Rising demand Value            |
| 13 | MD                       | Maximum demand Value           |
| 14 | MAX                      | Maximum Value                  |
| 15 | MIN                      | Minimum Value                  |
| 16 | X1000                    | X 1000 multiplier              |
| 17 | RS-485                   | RS – 485 Communication         |
| 18 | Negative sign            | Indicate Negative Value/Export |
| 19 | Pulse $\square$          | Energy Pulse                   |
| 20 | L1, L2, L3 Seven Segment | for data                       |

## 6.2 Key Functions



### Enter Key

#### Run Mode:

- ❖ Press & hold the key for 5 seconds to enter into Configuration Mode.

#### Configuration Mode:

- ❖ Press the key to view values of parameters.
- ❖ Press the key to edit values of parameters.
- ❖ Press the key to save the final value entered by the user.



### DEC Key

#### Run Mode:

- ❖ Press the key to move to the next page in the upward direction.
- ❖ Press & hold the key for 5 seconds to navigate to the Maximum-Minimum pages.
- ❖ If already in the Maximum-Minimum pages, press & hold the key for 5 seconds will return to Run Mode.

#### Configuration Mode:

- ❖ Press the key to move the selection bar to the next parameter in the upward direction.
- ❖ Press the key to Shift to the side digit in Edit Mode.
- ❖ Press the key to exit from Edit Mode and return to Configuration Mode.



### INC Key

#### Run Mode:

- ❖ Press the key to move to the next page in the downward direction.
- ❖ Press & hold the key for 5 seconds to navigate to the first page of Run Mode, which displays Voltage.

#### Configuration Mode:

- ❖ Press the key to move the selection bar to the next parameter in the downward direction.
- ❖ Press the key to increment the value in Edit Mode.



## 7. Meter Functionality

### 7.1 Run mode Display

#### Line to Neutral Voltage (V L-N)



Displays line to neutral Voltage of three phases.

**1<sup>st</sup> Row:** Shows R Phase VLN (e.g., 240.2 V)

**2<sup>nd</sup> Row:** Shows Y Phase VLN (e.g., 240.5 V)

**3<sup>rd</sup> Row:** Shows B Phase VLN (e.g., 240.4 V)

#### Line to Line Voltage (V L- L)



Displays line to line voltage of three phases.

**1<sup>st</sup> Row:** Shows R-Y VLL (e.g., 415.7 V)

**2<sup>nd</sup> Row:** Shows Y-B VLL (e.g., 415.6 V)

**3<sup>rd</sup> Row:** Shows B-R VLL (e.g., 415.6 V)

#### Line Current (Ampere)



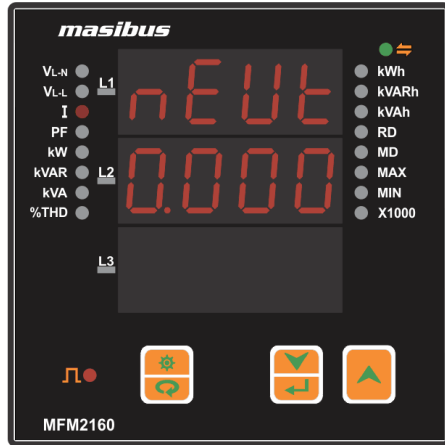
Displays phase current of three phases.

**1<sup>st</sup> Row:** Shows R Phase Current (e.g., 5.000 A)

**2<sup>nd</sup> Row:** Shows Y Phase Current (e.g., 4.999 A)

**3<sup>rd</sup> Row:** Shows B Phase Current (e.g., 5.001 A)

### Neutral Current (Ampere)



Displays neutral current.  
(e.g.: 0.000 A)

### Frequency (Hz)



Displays system frequency.  
(e.g.: 49.99 Hz)

### Power Factor (PF)



Displays Power factor of Three phases.

**1<sup>st</sup> Row:** Shows R Phase PF (e.g., 0.499)

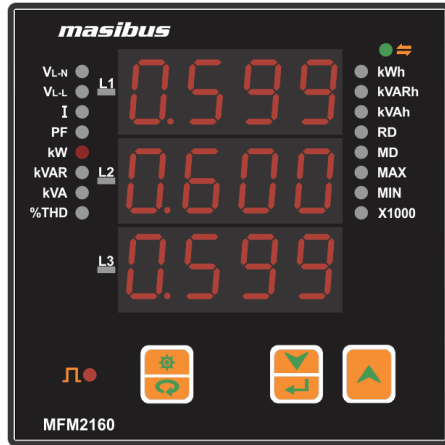
**2<sup>nd</sup> Row:** Shows Y Phase PF (e.g., 0.500)

**3<sup>rd</sup> Row:** Shows B Phase PF (e.g., 0.500)

If the **first digit** of the 3 lines shows “L”, it indicates the power factor is **Inductive (Lagging)**.

If the **first digit** of the 3 lines shows “C”, it indicates the power factor is **Capacitive (Leading)**.

### Active Power (kW)



Displays active power (KW) of three phases.

- 1<sup>st</sup> Row:** Shows R Phase Active Power (e.g., 0.599 kW)
- 2<sup>nd</sup> Row:** Shows Y Phase Active Power (e.g., 0.600 kW)
- 3<sup>rd</sup> Row:** Shows B Phase Active Power (e.g., 0.599 kW)

### Reactive Power (kVAR)



Displays reactive power (KVAR) of three phases.

- 1<sup>st</sup> Row:** Shows R Phase Reactive Power (e.g., 1.040 kVAR)
- 2<sup>nd</sup> Row:** Shows Y Phase Reactive Power (e.g., 1.039 kVAR)
- 3<sup>rd</sup> Row:** Shows B Phase Reactive Power (e.g., 1.040 kVAR)

### Apparent Power (kVA)



Displays apparent power (KVA) of three phases.

- 1<sup>st</sup> Row:** Shows R Phase Apparent Power (e.g., 1.200 kVA)
- 2<sup>nd</sup> Row:** Shows Y Phase Apparent Power (e.g., 1.200 kVA)
- 3<sup>rd</sup> Row:** Shows B Phase Apparent Power (e.g., 1.200 kVA)

### Average Line to Neutral Voltage (VL-N)



Displays average of line to neutral voltage.  
(e.g.: 239.9 V)

### Average Line to Line Voltage (VL- L)



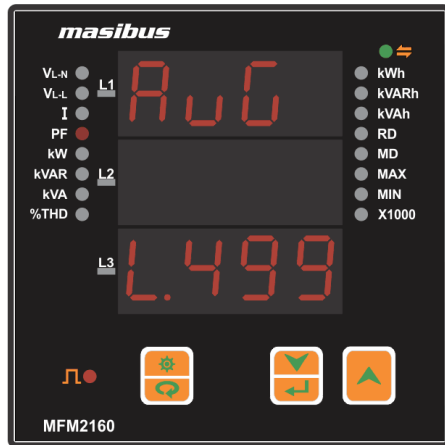
Displays average of line to line voltage.  
(e.g.: 415.6 V)

### Average Line Current (Ampere)



Displays average of line current.  
(e.g.: 5.001 A)

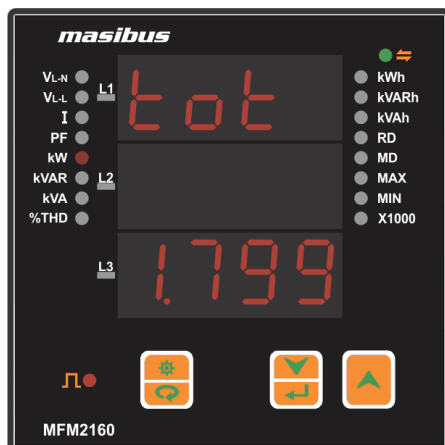
### Average Power Factor (PF)



Displays Average of Power factor.  
(e.g.: 0.499 PF)

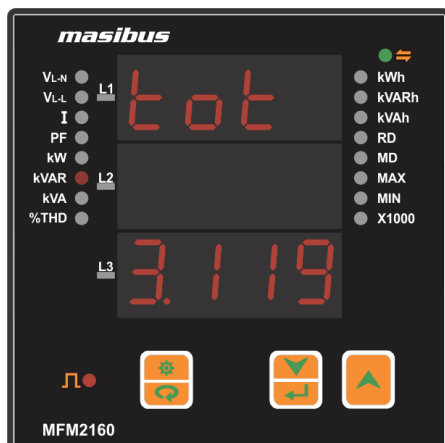
If the **first digit** of the 3<sup>rd</sup> line shows “**L**”, it indicates the power factor is **Inductive (Lagging)**.  
If the **first digit** of the 3<sup>rd</sup> line shows “**C**”, it indicates the power factor is **Capacitive (Leading)**.

### Total Active Power (kW)



Displays Total of Active power (KW).  
(e.g.: 1.799 kW)

### Total Reactive Power (kVAR)



Displays Total of Reactive power (KVAR).  
(e.g.: 3.119 kVAR)

### Total Apparent Power (kVA)



Displays Total of Apparent power (KVA).  
(e.g.: 3.600 kVA)

### Total Active(kW), Reactive(kVAR), Apparent(kVA) Power



Displays Total of Active power, Reactive power, Apparent power.

- 1<sup>st</sup> Row:** Shows Total Active Power (e.g., 1.799 kW)
- 2<sup>nd</sup> Row:** Shows Total Reactive Power (e.g., 3.119 kVAR)
- 3<sup>rd</sup> Row:** Shows Total Apparent Power (e.g., 3.600 kVA)

### Active import energy (kWh)



Displays total import active energy of three phase.  
(e.g.: 95.458 KWh)

### Active export energy (kWh)



Displays total export active energy of three phase.  
L3 Negative sign represents Export Energy  
(e.g.: 126.720 kWh)

### Reactive import energy (kVARh)



Displays total import reactive energy of three phase.  
(e.g.: 1211.646 kVARh)

### Reactive export energy (kVARh)



Displays total export reactive energy of three phase.  
L3 Negative sign represents Export Energy  
(e.g.: 15891.578 kVARh)

### Reactive Lag energy (KVARh)



Displays total Lag reactive energy of three phase.  
The string “**LAG**” will appear on the display for **2 seconds**, after which the actual value will be shown again.  
(e.g.: 8.599 KVARh Lag)

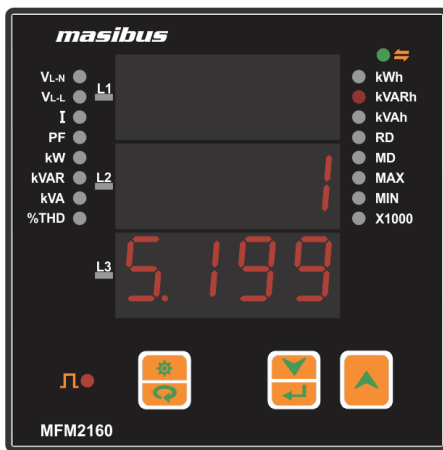


### Reactive Lead energy (KVARh)



Displays total Lead reactive energy of three phase.  
The string “**Lead**” will appear on the display for **2 seconds**, after which the actual value will be shown again.  
(e.g.: 15.199 KVARh Lead)





### Apparent import energy (kVAh)



Displays total import apparent energy of three phase.  
(e.g.: 124.845 KVAh)

### Apparent export energy (kVAh)



Displays total export apparent energy of three phase.  
L3 Negative sign represents Export Energy  
(e.g.: 4.863 KVAh)

### THD (Voltage)



Displays Total harmonics distortion (%) of voltage of three phases.

**1<sup>st</sup> Row:** Shows R Phase V THD (e.g., 17.34 %)

**2<sup>nd</sup> Row:** Shows Y Phase V THD (e.g., 15.49 %)

**3<sup>rd</sup> Row:** Shows B Phase V THD (e.g., 11.49 %)

### THD (Current)



Displays Total harmonics distortion (%) of Current of three phases.

**1<sup>st</sup> Row:** Shows R Phase I THD (e.g., 0.345 %)

**2<sup>nd</sup> Row:** Shows Y Phase I THD (e.g., 0.345 %)

**3<sup>rd</sup> Row:** Shows B Phase I THD (e.g., 0.355 %)

### Rising Demand (Power)



Displays Rising Demand of active power, reactive power and apparent power.

**1<sup>st</sup> Row:** Shows Rising Demand of Active Power (e.g., 0.236 kW)

**2<sup>nd</sup> Row:** Shows Rising Demand of Reactive Power (e.g., 0.410 kVAR)

**3<sup>rd</sup> Row:** Shows Rising Demand of Apparent Power (e.g., 0.473 kVA)

### Maximum Demand (Power)



Displays Maximum Demand of active power, reactive power and apparent power.

**1<sup>st</sup> Row:** Shows Maximum Demand of Active Power (e.g., 1.286 kW)

**2<sup>nd</sup> Row:** Shows Maximum Demand of Reactive Power (e.g., 2.450 kVAR)

**3<sup>rd</sup> Row:** Shows Maximum Demand of Apparent Power (e.g., 9.433 kVA)

### Rising Demand & Maximum Demand (Current)



Displays Rising Demand and Maximum Demand of Average Current.

**1<sup>st</sup> Row:** Shows Rising Demand of Average Current (e.g., 1.850 A)

**3<sup>rd</sup> Row:** Shows Maximum Demand of Average Current (e.g., 4.450 A)

### Voltage Unbalance (%)



Displays Percentage of Voltage Unbalance.  
(e.g.: 0.250 %)

### Current Unbalance (%)



Displays Percentage of Current Unbalance.  
(e.g.: 2.015 %)

### On hour



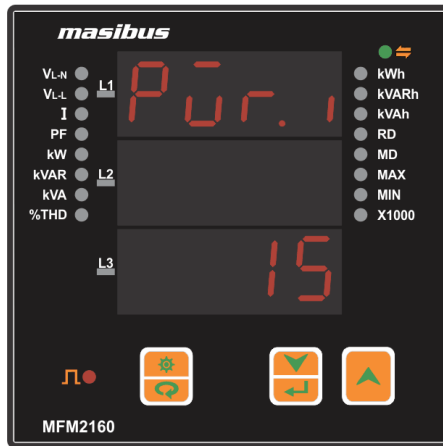
Displays on hour.  
The period for which the meter (Aux. supply) is ON  
(e.g.: 250 Hours)

### Run hour



Displays Run hour.  
It indicates the period the Load (Current) is ON and has run.  
(e.g.: 31 Hours)

### Power interruption count



Displays power interruption Count.  
Number of power interruption count means the number of Auxiliary Supply interruptions.  
(e.g.: 15 count)

### RPM



Displays RPM which is based on System frequency, number of poles and slip.  
(e.g.: 3000 RPM)

#### NOTE:

- If device is operating in a 3P3W system then Voltage(L-N), Y phase current, Neutral current, Phase wise PF will not show on display.
- If the device is operating in a 1P2W system, Voltage (L-L) and Neutral Current will not be displayed. Only the single-phase values will be shown on the display.

### Max – Min (High -Low) Pages:

Press and hold the DEC key for 5 seconds to display the parameter values.

To exit, press and hold the DEC key again for 5 seconds.

#### Max Voltage (VL-N)



Displays Maximum line to neutral Voltage of three phases.

**1<sup>st</sup> Row:** Shows Maximum value of R phase VLN (e.g., 240.8 V)

**2<sup>nd</sup> Row:** Shows Maximum value of Y phase VLN (e.g., 240.6 V)

**3<sup>rd</sup> Row:** Shows Maximum value of B phase VLN (e.g., 239.3 V)

#### Min Voltage (VL-N)



Displays Minimum line to neutral Voltage of three phases.

**1<sup>st</sup> Row:** Shows Maximum value of R phase VLN (e.g., 165.4 V)

**2<sup>nd</sup> Row:** Shows Maximum value of Y phase VLN (e.g., 165.6 V)

**3<sup>rd</sup> Row:** Shows Maximum value of B phase VLN (e.g., 165.4 V)

#### Max – Min Average Voltage (VL-N)



Displays Maximum and Minimum of average line to neutral voltage

**2<sup>nd</sup> Row:** Shows Maximum Value of Average VLN (e.g., 245.4 V)

**3<sup>rd</sup> Row:** Shows Minimum Value of Average VLN (e.g., 165.4 V)

### Max Voltage (VL-L)



Displays Maximum line to line voltage of three phases.

**1<sup>st</sup> Row:** Shows Maximum Value of R-Y VLL (e.g., 415.2 V)

**2<sup>nd</sup> Row:** Shows Maximum Value of Y-B VLL (e.g., 415.1 V)

**3<sup>rd</sup> Row:** Shows Maximum Value of B-R VLL (e.g., 415.9 V)

### Min Voltage (VL-L)



Displays Minimum line to line voltage of three phases.

**1<sup>st</sup> Row:** Shows Minimum Value of R-Y VLL (e.g., 411.7 V)

**2<sup>nd</sup> Row:** Shows Minimum Value of Y-B VLL (e.g., 412.5 V)

**3<sup>rd</sup> Row:** Shows Minimum Value of B-R VLL (e.g., 410.5 V)

### Max - Min Average Voltage (VL-L)



Displays Maximum and Minimum of average line-to-line voltage.

**2<sup>nd</sup> Row:** Shows Maximum Value of Average VLL (e.g., 416.6 V)

**3<sup>rd</sup> Row:** Shows Minimum Value of Average VLL (e.g., 413.6 V)

### Max Current (Ampere)



Displays Maximum phase current of three phases.

**1<sup>st</sup> Row:** Shows Maximum value of R phase current (e.g., 5.002 A)

**2<sup>nd</sup> Row:** Shows Maximum value of Y phase current (e.g., 4.999 A)

**3<sup>rd</sup> Row:** Shows Maximum value of B phase current (e.g., 5.001 A)

### Min Current (Ampere)



Displays Minimum phase current of three phases.

**1<sup>st</sup> Row:** Shows Maximum value of R phase current (e.g., 4.990 A)

**2<sup>nd</sup> Row:** Shows Maximum value of Y phase current (e.g., 4.880 A)

**3<sup>rd</sup> Row:** Shows Maximum value of B phase current (e.g., 4.985 A)

### Max - Min Average Current (Ampere)



Displays Maximum and Minimum of average current.

**2<sup>nd</sup> Row:** Shows Maximum Value of Average Current (e.g., 5.002 A)

**3<sup>rd</sup> Row:** Shows Minimum Value of Average Current (e.g., 4.995 A)



### Max - Min Frequency (Hz)



Displays maximum and Minimum of system frequency.

**2<sup>nd</sup> Row:** Shows Maximum Value of System Frequency (e.g., 49.99 Hz)

**3<sup>rd</sup> Row:** Shows Minimum Value of System Frequency (e.g., 49.58 Hz)

### Max - Min Lead Average Power Factor (PF)



Displays Maximum and Minimum average Capacitive (Lead) Power factor.

**2<sup>nd</sup> Row:** Shows Maximum Value of Lead PF (e.g., 0.995)

**3<sup>rd</sup> Row:** Shows Minimum Value of Lead PF (e.g., 0.990)

### Max - Min Lag Average Power Factor (PF)



Displays Maximum and Minimum average Inductive (Lag) Power factor.

**2<sup>nd</sup> Row:** Shows Maximum Value of Lag PF (e.g., 0.992)

**3<sup>rd</sup> Row:** Shows Minimum Value of Lag PF (e.g., 0.990)

### Max Active Power (kW)



Displays Maximum active power of three phases.

**1<sup>st</sup> Row:** Shows Maximum Value of R-Phase Active Power (e.g., 1.200 kW)

**2<sup>nd</sup> Row:** Shows Maximum Value of Y-Phase Active Power (e.g., 1.260 kW)

**3<sup>rd</sup> Row:** Shows Maximum Value of B-Phase Active Power (e.g., 1.250 kW)

### Min Active Power (kW)



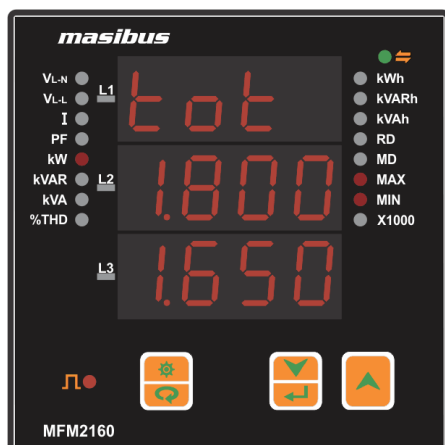
Displays Minimum active power of three phases.

**1<sup>st</sup> Row:** Shows Minimum Value of R-Phase Active Power (e.g., 0.599 kW)

**2<sup>nd</sup> Row:** Shows Minimum Value of Y-Phase Active Power (e.g., 0.600 kW)

**3<sup>rd</sup> Row:** Shows Minimum Value of B-Phase Active Power (e.g., 0.599 kW)

### Max - Min Total Active Power (kW)



Displays Maximum and minimum of Total active power.

**2<sup>nd</sup> Row:** Shows Maximum Value of Total Active Power (e.g., 1.800 kW)

**3<sup>rd</sup> Row:** Shows Minimum Value of Total Active Power (e.g., 1.650 kW)

### Max Reactive Power (kVAR)



Displays Maximum reactive power of three phases.

**1<sup>st</sup> Row:** Shows Maximum Value of R-Phase reactive Power (e.g., 1.250 kVAR)

**2<sup>nd</sup> Row:** Shows Maximum Value of Y-Phase reactive Power (e.g., 1.280 kVAR)

**3<sup>rd</sup> Row:** Shows Maximum Value of B-Phase reactive Power (e.g., 1.290 kVAR)

### Min Reactive Power (kVAR)



Displays Minimum reactive power of three phases.

**1<sup>st</sup> Row:** Shows Minimum Value of R-Phase reactive Power (e.g., 0.540 kVAR)

**2<sup>nd</sup> Row:** Shows Minimum Value of Y-Phase reactive Power (e.g., 0.600 kVAR)

**3<sup>rd</sup> Row:** Shows Minimum Value of B-Phase reactive Power (e.g., 0.560 kVAR)

### Max - Min Total Reactive Power (kVAR)



Displays Maximum and minimum of Total Reactive power.

**2<sup>nd</sup> Row:** Shows Maximum Value of Total Reactive Power (e.g., 1.700 kVAR)

**3<sup>rd</sup> Row:** Shows Minimum Value of Total Reactive Power (e.g., 1.450 kVAR)

### Max Apparent Power (kVA)



Displays Maximum apparent power of three phases.

**1<sup>st</sup> Row:** Shows Maximum Value of R-Phase apparent Power (e.g., 1.199 kVA)

**2<sup>nd</sup> Row:** Shows Maximum Value of Y-Phase apparent Power (e.g., 1.195 kVA)

**3<sup>rd</sup> Row:** Shows Maximum Value of B-Phase apparent Power (e.g., 1.194 kVA)

### Min Apparent Power (kVA)



Displays Minimum apparent power of three phases.

**1<sup>st</sup> Row:** Shows Minimum Value of R-Phase apparent Power (e.g., 0.640 kVA)

**2<sup>nd</sup> Row:** Shows Minimum Value of Y-Phase apparent Power (e.g., 0.650 kVA)

**3<sup>rd</sup> Row:** Shows Minimum Value of B-Phase apparent Power (e.g., 0.670 kVA)

### Max - Min Total Apparent Power (kVA)



Displays Maximum and minimum of Total Apparent power.

**2<sup>nd</sup> Row:** Shows Maximum Value of Total Apparent Power (e.g., 1.800 kVA)

**3<sup>rd</sup> Row:** Shows Minimum Value of Total Apparent Power (e.g., 1.730 kVA)

## Message on Display :-

### X1000 LED Indication



If the **×1000 LED** is **ON**, multiply the displayed value by **1000** to obtain the actual value.

**Example:**

- L1 = 1,997,000 kW
- L2 = 1,993,000 kW
- L3 = 1,996,000 kW

### High Message on Display



If the value is **greater than 9,999,000.0**, the message **“HIGH”** will be shown on the display.

**(Applicable only in Power pages)**

## 7.2 Configuration Mode

Press & Hold the ENTER key to 5 sec to enter into Configuration Mode.

The password screen will appear where you need to enter the password. If the password is correct, you will gain access to Configuration Mode; otherwise, you cannot proceed.

Once in Configuration Mode, a selection bar will appear. You can use the INC and DEC keys to navigate between Parameters.

❖ Below listed parameters you can edit into configuration mode.

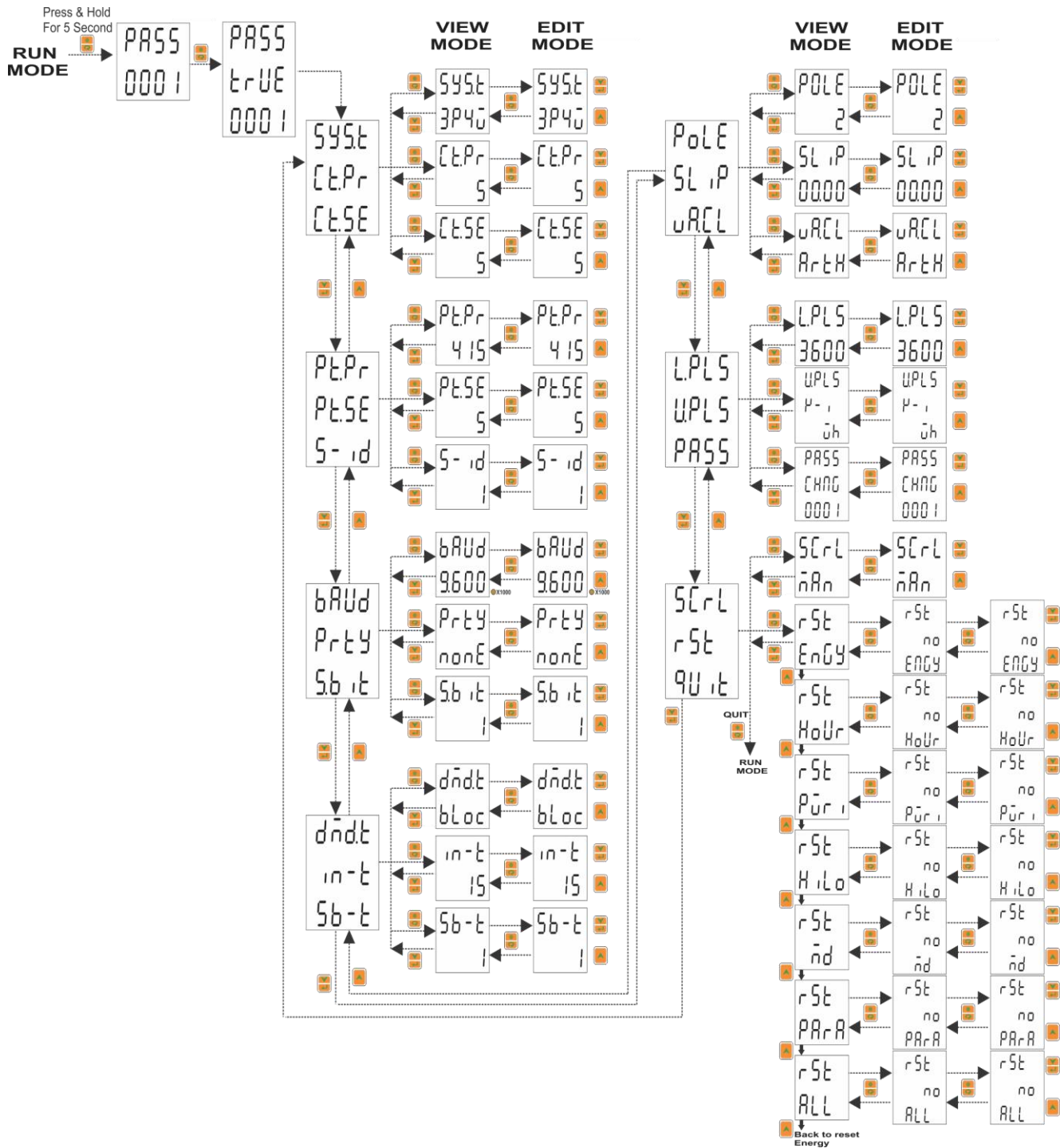
| S.NO | Display | Function                       | Range or selection                                                                                                        | Default    |
|------|---------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------|------------|
| 1    | SYST    | System type                    | 1p2w,3p3w,3p4w                                                                                                            | 3p4w       |
| 2    | CT.Pr   | CT Primary                     | 1A /5A -15000A                                                                                                            | 5A         |
| 3    | CT.SE   | CT Secondary                   | 1A or 5A                                                                                                                  | 5A         |
| 4    | PT.Pr   | PT Primary                     | 100V - 1000KV                                                                                                             | 415V       |
| 5    | PT.SE   | PT Secondary                   | 100V - 415V                                                                                                               | 415V       |
| 6    | S-ID    | Slave ID                       | 1 - 247                                                                                                                   | 1          |
| 7    | BAUD    | Baud rate                      | 2400,4800,9600,<br>19200,38400                                                                                            | 9600       |
| 8    | PRTY    | Parity Bit                     | None, odd, even                                                                                                           | None       |
| 9    | SBIT    | Stop Bit                       | 1 or 2                                                                                                                    | 1          |
| 10   | DMND    | Demand type                    | Block, Slide                                                                                                              | Block      |
| 11   | INT     | Interval Time (Min)            | 1-60                                                                                                                      | 15         |
| 12   | SUB     | Sub Interval Time (Min)        | 1-60                                                                                                                      | 1          |
| 13   | POLE    | Pole                           | 2 - 48                                                                                                                    | 2          |
| 14   | SLIP    | Slip (%)                       | 00.00 – 99.99                                                                                                             | 00.00      |
| 15   | VA.CL   | VA Calculation Method          | Arithmetic or Vector                                                                                                      | Arithmetic |
| 16   | L.PLS   | Pulse Constant                 | 100 - 60000                                                                                                               | 3600       |
| 17   | U.PLS   | Pulse Unit                     | KWh (Imp – Exp),<br>KVARh (Imp – Exp),<br>KVAh (Imp – Exp),<br>MWh (Imp – Exp),<br>MVARh (Imp – Exp),<br>MVAh (Imp – Exp) | Kwh (Imp)  |
| 18   | PRSS    | Password change                | 0001-9999                                                                                                                 | 0001       |
| 19   | SCRL    | Display Scroll                 | Auto, Manual                                                                                                              | Manual     |
| 20   | RSR     | Reset                          |                                                                                                                           |            |
| 20.1 | ENGY    | Reset energy*                  | No / Yes                                                                                                                  | No         |
| 20.2 | HOHR    | Reset on and load hour         | No / Yes                                                                                                                  | No         |
| 20.3 | PRC     | Reset Power interruption count | No / Yes                                                                                                                  | No         |
| 20.4 | HL0     | Reset Max – Min Values         | No / Yes                                                                                                                  | No         |
| 20.5 | MD      | Reset Maximum demand           | No / Yes                                                                                                                  | No         |
| 20.6 | PRPR    | Reset Parameters**             | No / Yes                                                                                                                  | No         |
| 20.7 | ALL     | Reset ALL***                   | No / Yes                                                                                                                  | No         |
| 21   | QUIT    | QUIT                           |                                                                                                                           |            |

\* After reset energy the current value of energy is reflected on old energy registers.

\*\*By selecting 'PARA', all configured parameters will be reset, and default settings will be restored.

\*\*\*In Reset Mode, selecting 'All' will reset Energy, Operating Hours, Power Interruption Count, and Maximum Demand.

Pressing the ENTER key on 'QUIT', will return to run mode.



## 8. 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, its 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.         |

### 8.1 Modbus Register Map for 3P4W, 3P3W and 1P2W parameters

**Function Code** = 0X04

**Data Format** = Swapped Float (As Per IEEE 754 Standard)

**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]

**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]

| Registers for Instantaneous Parameters |                |            |                                  |        |       |      |
|----------------------------------------|----------------|------------|----------------------------------|--------|-------|------|
| S. No.                                 | Modbus Address | Parameters | Description                      | Unit   | Words | Type |
| 1                                      | 30001          | V1 LN      | R Phase to Neutral Voltage       | Volt   | 2     | R    |
| 2                                      | 30003          | V2 LN      | Y Phase to Neutral Voltage       | Volt   | 2     | R    |
| 3                                      | 30005          | V3 L N     | B Phase to Neutral Voltage       | Volt   | 2     | R    |
| 4                                      | 30007          | VLN Avg    | Average Voltage Phase to Neutral | Volt   | 2     | R    |
| 5                                      | 30009          | V12 LL     | RY Voltage                       | Volt   | 2     | R    |
| 6                                      | 30011          | V23 LL     | YB Voltage                       | Volt   | 2     | R    |
| 7                                      | 30013          | V31 LL     | BR Voltage                       | Volt   | 2     | R    |
| 8                                      | 30015          | VLL Avg    | Average Voltage Phase to phase   | Volt   | 2     | R    |
| 9                                      | 30017          | I1         | R Phase Line current             | Ampere | 2     | R    |
| 10                                     | 30019          | I2         | Y Phase Line current             | Ampere | 2     | R    |
| 11                                     | 30021          | I3         | B Phase Line current             | Ampere | 2     | R    |
| 12                                     | 30023          | I Avg      | Average Line Current             | Ampere | 2     | R    |
| 13                                     | 30025          | In         | Neutral Line current             | Ampere | 2     | R    |
| 14                                     | 30027          | Freq       | Frequency                        | Hz     | 2     | R    |
| 15                                     | 30029          | PF1        | R Phase Power factor             | --     | 2     | R    |
| 16                                     | 30031          | PF2        | Y Phase Power factor             | --     | 2     | R    |
| 17                                     | 30033          | PF3        | B Phase Power factor             | --     | 2     | R    |
| 18                                     | 30035          | PF Avg     | Average Power factor             | --     | 2     | R    |
| 19                                     | 30037          | P1         | R Phase Active Power             | W      | 2     | R    |
| 20                                     | 30039          | P2         | Y Phase Active Power             | W      | 2     | R    |
| 21                                     | 30041          | P3         | B Phase Active Power             | W      | 2     | R    |
| 22                                     | 30043          | P Tot      | Total Active Power               | W      | 2     | R    |
| 23                                     | 30045          | Q1         | R- Phase Reactive Power          | VAR    | 2     | R    |
| 24                                     | 30047          | Q2         | Y- Phase Reactive Power          | VAR    | 2     | R    |
| 26                                     | 30049          | Q3         | B- Phase Reactive Power          | VAR    | 2     | R    |
| 26                                     | 30051          | Q Tot      | Total Reactive Power             | VAR    | 2     | R    |



|                                        |       |               |                                          |        |   |   |
|----------------------------------------|-------|---------------|------------------------------------------|--------|---|---|
| 27                                     | 30053 | S1            | R- Phase Apparent Power                  | VA     | 2 | R |
| 28                                     | 30055 | S2            | Y- Phase Apparent Power                  | VA     | 2 | R |
| 29                                     | 30057 | S3            | B- Phase Apparent Power                  | VA     | 2 | R |
| 30                                     | 30059 | S Tot         | Total Apparent Power                     | VA     | 2 | R |
| 31                                     | 30061 | A1            | R Phase current to voltage Angle         | Degree | 2 | R |
| 32                                     | 30063 | A2            | Y Phase current to voltage Angle         | Degree | 2 | R |
| 33                                     | 30065 | A3            | B Phase current to voltage Angle         | Degree | 2 | R |
| 34                                     | 30067 | V1 THD        | R phase Voltage THD                      | %      | 2 | R |
| 35                                     | 30069 | V2 THD        | Y Phase Voltage THD                      | %      | 2 | R |
| 36                                     | 30071 | V3 THD        | B Phase Voltage THD                      | %      | 2 | R |
| 37                                     | 30073 | Avg V THD     | Average Voltage THD                      | %      | 2 | R |
| 38                                     | 30075 | I1 THD        | R Phase Current THD                      | %      | 2 | R |
| 39                                     | 30077 | I2 THD        | Y Phase Current THD                      | %      | 2 | R |
| 40                                     | 30079 | I3 THD        | B Phase Current THD                      | %      | 2 | R |
| 41                                     | 30081 | Avg I THD     | Average Current THD                      | %      | 2 | R |
| 42                                     | 30083 | DPF1          | R phase Displacement Power factor        | --     | 2 | R |
| 43                                     | 30085 | DPF2          | Y phase Displacement Power factor        | --     | 2 | R |
| 44                                     | 30087 | DPF3          | B phase Displacement Power factor        | --     | 2 | R |
| 45                                     | 30089 | DPF Avg       | Average Displacement Power factor        | --     | 2 | R |
| 46                                     | 30091 | V.unbl        | Voltage Unbalance                        | %      | 2 | R |
| 47                                     | 30093 | I.unbl        | Current Unbalance                        | %      | 2 | R |
| 48                                     | 30095 | RPM           | Rotation per minute                      | --     | 2 | R |
| 49                                     | 30097 | IA1           | R phase Active Current                   | Ampere | 2 | R |
| 50                                     | 30099 | IA2           | Y phase Active Current                   | Ampere | 2 | R |
| 51                                     | 30101 | IA3           | B phase Active Current                   | Ampere | 2 | R |
| 52                                     | 30103 | Ia avg        | Average Active Line Current              | Ampere | 2 | R |
| 53                                     | 30105 | IR1           | R phase Reactive Current                 | Ampere | 2 | R |
| 54                                     | 30107 | IR2           | Y phase Reactive Current                 | Ampere | 2 | R |
| 55                                     | 30109 | IR3           | B phase Reactive Current                 | Ampere | 2 | R |
| 56                                     | 30111 | Ir avg        | Average Reactive line current            | Ampere | 2 | R |
| <b>Registers for Energy Parameters</b> |       |               |                                          |        |   |   |
| 1                                      | 30151 | KWh (Im)      | Active Energy Import                     | KWh    | 2 | R |
| 2                                      | 30153 | KWh (Ex)      | Active Energy Export                     | KWh    | 2 | R |
| 3                                      | 30155 | KWh net       | Active Energy Net (Import - Export)      | KWh    | 2 | R |
| 4                                      | 30157 | KWh Tot       | Active Energy Total (Import + Export)    | KWh    | 2 | R |
| 5                                      | 30159 | KVAh (Im)     | Apparent Energy Import                   | KVAh   | 2 | R |
| 6                                      | 30161 | KVAh (Ex)     | Apparent Energy Export                   | KVAh   | 2 | R |
| 7                                      | 30163 | KVAh net      | Apparent Energy Net (Import - Export)    | KVAh   | 2 | R |
| 8                                      | 30165 | KVAh Tot      | Apparent Energy Total (Import + Export)  | KVAh   | 2 | R |
| 9                                      | 30167 | KVArh (Im)    | Reactive Energy Import (Q1+Q2)           | KVArh  | 2 | R |
| 10                                     | 30169 | KVArh (Ex)    | Reactive Energy Export (Q3+Q4)           | KVArh  | 2 | R |
| 11                                     | 30171 | KVArh net     | Reactive Energy Net (Import - Export)    | KVArh  | 2 | R |
| 12                                     | 30173 | KVArh Tot     | Reactive Energy Total (Import + Export)  | KVArh  | 2 | R |
| 13                                     | 30175 | KVArh (L-Im)  | Reactive Energy – Inductive import (Q1)  | KVArh  | 2 | R |
| 14                                     | 30177 | KVArh (C-Im)  | Reactive Energy – Capacitive import (Q2) | KVArh  | 2 | R |
| 15                                     | 30179 | KVArh (L-Ex)  | Reactive Energy - Inductive export (Q3)  | KVArh  | 2 | R |
| 16                                     | 30181 | KVArh (C-Ex)  | Reactive Energy - Capacitive export (Q4) | KVArh  | 2 | R |
| 17                                     | 30183 | KVArh (L-Tot) | Reactive Energy Lag Total                | KVArh  | 2 | R |
| 18                                     | 30185 | KVArh (C-Tot) | Reactive Energy Lead Total               | KVArh  | 2 | R |
| <b>Phase Wise Energy Registers</b>     |       |               |                                          |        |   |   |
| 1                                      | 30187 | KWh1 (Im)     | R Phase Active Energy Import             | KWh    | 2 | R |
| 2                                      | 30189 | KWh2 (Im)     | Y Phase Active Energy Import             | KWh    | 2 | R |
| 3                                      | 30191 | KWh3 (Im)     | B Phase Active Energy Import             | KWh    | 2 | R |
| 4                                      | 30193 |               | Total Active Energy Import               | KWh    | 2 | R |
| 5                                      | 30195 | KWh1 (Ex)     | R Phase Active Energy Export             | KWh    | 2 | R |
| 6                                      | 30197 | KWh2 (Ex)     | Y Phase Active Energy Export             | KWh    | 2 | R |
| 7                                      | 30199 | KWh3 (Ex)     | B Phase Active Energy Export             | KWh    | 2 | R |
| 8                                      | 30201 |               | Total Active Energy export               | KWh    | 2 | R |

|                                        |       |             |                                |       |   |   |
|----------------------------------------|-------|-------------|--------------------------------|-------|---|---|
| 9                                      | 30203 | KWh1 net    | R Phase Active Energy net      | KWh   | 2 | R |
| 10                                     | 30205 | KWh2 net    | Y Phase Active Energy net      | KWh   | 2 | R |
| 11                                     | 30207 | KWh3 net    | B Phase Active Energy net      | KWh   | 2 | R |
| 12                                     | 30209 |             | Total Active Energy net        | KWh   | 2 | R |
| 13                                     | 30211 | KWh1 Tot    | R Phase Active Energy Total    | KWh   | 2 | R |
| 14                                     | 30213 | KWh2 Tot    | Y Phase Active Energy Total    | KWh   | 2 | R |
| 15                                     | 30215 | KWh3 Tot    | B Phase Active Energy Total    | KWh   | 2 | R |
| 16                                     | 30217 |             | Total Active Energy total      | KWh   | 2 | R |
| 17                                     | 30219 | KVAh1 (Im)  | R Phase Apparent Energy Import | KVAh  | 2 | R |
| 18                                     | 30221 | KVAh2 (Im)  | Y Phase Apparent Energy Import | KVAh  | 2 | R |
| 19                                     | 30223 | KVAh3 (Im)  | B Phase Apparent Energy Import | KVAh  | 2 | R |
| 20                                     | 30225 |             | Total Apparent Energy Import   | KVAh  | 2 | R |
| 21                                     | 30227 | KVAh1 (Ex)  | R Phase Apparent Energy Export | KVAh  | 2 | R |
| 22                                     | 30229 | KVAh2 (Ex)  | Y Phase Apparent Energy Export | KVAh  | 2 | R |
| 23                                     | 30231 | KVAh3 (Ex)  | B Phase Apparent Energy Export | KVAh  | 2 | R |
| 24                                     | 30233 |             | Total Apparent Energy export   | KVAh  | 2 | R |
| 25                                     | 30235 | KVAh1 net   | R Phase Apparent Energy net    | KVAh  | 2 | R |
| 26                                     | 30237 | KVAh2 net   | Y Phase Apparent Energy net    | KVAh  | 2 | R |
| 27                                     | 30239 | KVAh3 net   | B Phase Apparent Energy net    | KVAh  | 2 | R |
| 28                                     | 30241 |             | Total Apparent Energy net      | KVAh  | 2 | R |
| 29                                     | 30243 | KVAh1 Tot   | R Phase Apparent Energy Total  | KVAh  | 2 | R |
| 30                                     | 30245 | KVAh2 Tot   | Y Phase Apparent Energy Total  | KVAh  | 2 | R |
| 31                                     | 30247 | KVAh3 Tot   | B Phase Apparent Energy Total  | KVAh  | 2 | R |
| 32                                     | 30249 |             | Total Apparent Energy total    | KVAh  | 2 | R |
| 33                                     | 30251 | KVArh1 (Im) | R Phase Reactive Energy Import | KVArh | 2 | R |
| 34                                     | 30253 | KVArh2 (Im) | Y Phase Reactive Energy Import | KVArh | 2 | R |
| 35                                     | 30255 | KVArh3 (Im) | B Phase Reactive Energy Import | KVArh | 2 | R |
| 36                                     | 30257 |             | Total Reactive Energy Import   | KVArh | 2 | R |
| 37                                     | 30259 | KVArh1 (Ex) | R Phase Reactive Energy Export | KVArh | 2 | R |
| 38                                     | 30261 | KVArh2 (Ex) | Y Phase Reactive Energy Export | KVArh | 2 | R |
| 39                                     | 30263 | KVArh3 (Ex) | B Phase Reactive Energy Export | KVArh | 2 | R |
| 40                                     | 30265 |             | Total Reactive Energy export   | KVArh | 2 | R |
| 41                                     | 30267 | KVArh1 net  | R Phase Reactive Energy net    | KVArh | 2 | R |
| 42                                     | 30269 | KVArh2 net  | Y Phase Reactive Energy net    | KVArh | 2 | R |
| 43                                     | 30271 | KVArh3 net  | B Phase Reactive Energy net    | KVArh | 2 | R |
| 44                                     | 30273 |             | Total Reactive Energy net      | KVArh | 2 | R |
| 45                                     | 30275 | KVArh1 Tot  | R Phase Reactive Energy Total  | KVArh | 2 | R |
| 46                                     | 30277 | KVArh2 Tot  | Y Phase Reactive Energy Total  | KVArh | 2 | R |
| 47                                     | 30279 | KVArh3 Tot  | B Phase Reactive Energy Total  | KVArh | 2 | R |
| 48                                     | 30281 |             | Total Reactive Energy total    | KVArh | 2 | R |
| 49                                     | 30283 | KVArh1 lag  | R Phase Reactive Energy Lag    | KVArh | 2 | R |
| 50                                     | 30285 | KVArh2 lag  | Y Phase Reactive Energy Lag    | KVArh | 2 | R |
| 51                                     | 30287 | KVArh3 lag  | B Phase Reactive Energy Lag    | KVArh | 2 | R |
| 52                                     | 30289 |             | Total Reactive Energy Lag      | KVArh | 2 | R |
| 53                                     | 30291 | KVArh1 lead | R Phase Reactive Energy Lead   | KVArh | 2 | R |
| 54                                     | 30293 | KVArh2 lead | Y Phase Reactive Energy Lead   | KVArh | 2 | R |
| 55                                     | 30295 | KVArh3 lead | B Phase Reactive Energy Lead   | KVArh | 2 | R |
| 56                                     | 30297 | KVArh3 lead | total Reactive Energy Lead     | KVArh | 2 | R |
| <b>Registers for Current harmonics</b> |       |             |                                |       |   |   |
| 1                                      | 30301 | 3rd IrHar   | 3rd R-phase current harmonic   | %     | 2 | R |
| 2                                      | 30303 | 5th IrHar   | 5th R-phase current harmonic   | %     | 2 | R |
| 3                                      | 30305 | 7th IrHar   | 7th R-phase current harmonic   | %     | 2 | R |
| 4                                      | 30307 | 9th IrHar   | 9th R-phase current harmonic   | %     | 2 | R |
| 5                                      | 30309 | 11th IrHar  | 11th R-phase current harmonic  | %     | 2 | R |
| 6                                      | 30311 | 13th IrHar  | 13th R-phase current harmonic  | %     | 2 | R |
| 7                                      | 30313 | 15th IrHar  | 15th R-phase current harmonic  | %     | 2 | R |
| 8                                      | 30315 | 17th IrHar  | 17th R-phase current harmonic  | %     | 2 | R |
| 9                                      | 30317 | 19th IrHar  | 19th R-phase current harmonic  | %     | 2 | R |

|                                        |       |             |                                           |   |   |   |
|----------------------------------------|-------|-------------|-------------------------------------------|---|---|---|
| 10                                     | 30319 | 21st IrHar  | 21st R-phase current harmonic             | % | 2 | R |
| 11                                     | 30321 | 23rd IrHar  | 23rd R-phase current harmonic             | % | 2 | R |
| 12                                     | 30323 | 25th IrHar  | 25th R-phase current harmonic             | % | 2 | R |
| 13                                     | 30325 | 27th IrHar  | 27th R-phase current harmonic             | % | 2 | R |
| 14                                     | 30327 | 29th IrHar  | 29th R-phase current harmonic             | % | 2 | R |
| 15                                     | 30329 | 31st IrHar  | 31st R-phase current harmonic             | % | 2 | R |
| 16                                     | 30331 | 3rd IyHar   | 3rd Y-phase current harmonic              | % | 2 | R |
| 17                                     | 30333 | 5th IyHar   | 5th Y-phase current harmonic              | % | 2 | R |
| 18                                     | 30335 | 7th IyHar   | 7th Y-phase current harmonic              | % | 2 | R |
| 19                                     | 30337 | 9th IyHar   | 9th Y-phase current harmonic              | % | 2 | R |
| 20                                     | 30339 | 11th IyHar  | 11th Y-phase current harmonic             | % | 2 | R |
| 21                                     | 30341 | 13th IyHar  | 13th Y-phase current harmonic             | % | 2 | R |
| 22                                     | 30343 | 15th IyHar  | 15th Y-phase current harmonic             | % | 2 | R |
| 23                                     | 30345 | 17th IyHar  | 17th Y-phase current harmonic             | % | 2 | R |
| 24                                     | 30347 | 19th IyHar  | 19th Y-phase current harmonic             | % | 2 | R |
| 25                                     | 30349 | 21st IyHar  | 21st Y-phase current harmonic             | % | 2 | R |
| 26                                     | 30351 | 23rd IyHar  | 23rd Y-phase current harmonic             | % | 2 | R |
| 27                                     | 30353 | 25th IyHar  | 25th Y-phase current harmonic             | % | 2 | R |
| 28                                     | 30355 | 27th IyHar  | 27th Y-phase current harmonic             | % | 2 | R |
| 29                                     | 30357 | 29th IyHar  | 29th Y-phase current harmonic             | % | 2 | R |
| 30                                     | 30359 | 31st IyHar  | 31st Y-phase current harmonic             | % | 2 | R |
| 31                                     | 30361 | 3rd IbHar   | 3rd B-phase current harmonic              | % | 2 | R |
| 32                                     | 30363 | 5th IbHar   | 5th B-phase current harmonic              | % | 2 | R |
| 33                                     | 30365 | 7th IbHar   | 7th B-phase current harmonic              | % | 2 | R |
| 34                                     | 30367 | 9th IbHar   | 9th B-phase current harmonic              | % | 2 | R |
| 35                                     | 30369 | 11th IbHar  | 11th B-phase current harmonic             | % | 2 | R |
| 36                                     | 30371 | 13th IbHar  | 13th B-phase current harmonic             | % | 2 | R |
| 37                                     | 30373 | 15th IbHar  | 15th B-phase current harmonic             | % | 2 | R |
| 38                                     | 30375 | 17th IbHar  | 17th B-phase current harmonic             | % | 2 | R |
| 39                                     | 30377 | 19th IbHar  | 19th B-phase current harmonic             | % | 2 | R |
| 40                                     | 30379 | 21st IbHar  | 21st B-phase current harmonic             | % | 2 | R |
| 41                                     | 30381 | 23rd IbHar  | 23rd B-phase current harmonic             | % | 2 | R |
| 42                                     | 30383 | 25th IbHar  | 25th B-phase current harmonic             | % | 2 | R |
| 43                                     | 30385 | 27th IbHar  | 27th B-phase current harmonic             | % | 2 | R |
| 44                                     | 30387 | 29th IbHar  | 29th B-phase current harmonic             | % | 2 | R |
| 45                                     | 30389 | 31st IbHar  | 31st B-phase current harmonic             | % | 2 | R |
| 46                                     | 30391 | Total Irthd | R phase current Total harmonic distortion | % | 2 | R |
| 47                                     | 30393 | Total Iythd | Y phase current Total harmonic distortion | % | 2 | R |
| 48                                     | 30395 | Total Ibthd | B phase current Total harmonic distortion | % | 2 | R |
| 49                                     | 30397 | Avg. Ithd   | Average current Total harmonic distortion | % | 2 | R |
| <b>Registers for Voltage harmonics</b> |       |             |                                           |   |   |   |
| 1                                      | 30401 | 3rd VrHar   | 3rd R-phase voltage harmonic              | % | 2 | R |
| 2                                      | 30403 | 5th VrHar   | 5th R-phase voltage harmonic              | % | 2 | R |
| 3                                      | 30405 | 7th VrHar   | 7th R-phase voltage harmonic              | % | 2 | R |
| 4                                      | 30407 | 9th VrHar   | 9th R-phase voltage harmonic              | % | 2 | R |
| 5                                      | 30409 | 11th VrHar  | 11th R-phase voltage harmonic             | % | 2 | R |
| 6                                      | 30411 | 13th VrHar  | 13th R-phase voltage harmonic             | % | 2 | R |
| 7                                      | 30413 | 15th VrHar  | 15th R-phase voltage harmonic             | % | 2 | R |
| 8                                      | 30415 | 17th VrHar  | 17th R-phase voltage harmonic             | % | 2 | R |
| 9                                      | 30417 | 19th VrHar  | 19th R-phase voltage harmonic             | % | 2 | R |
| 10                                     | 30419 | 21st VrHar  | 21st R-phase voltage harmonic             | % | 2 | R |
| 11                                     | 30421 | 23rd VrHar  | 23rd R-phase voltage harmonic             | % | 2 | R |
| 12                                     | 30423 | 25th VrHar  | 25th R-phase voltage harmonic             | % | 2 | R |
| 13                                     | 30425 | 27th VrHar  | 27th R-phase voltage harmonic             | % | 2 | R |
| 14                                     | 30427 | 29th VrHar  | 29th R-phase voltage harmonic             | % | 2 | R |

|                                     |       |              |                                               |        |   |   |
|-------------------------------------|-------|--------------|-----------------------------------------------|--------|---|---|
| 15                                  | 30429 | 31st VrHar   | 31st R-phase voltage harmonic                 | %      | 2 | R |
| 16                                  | 30431 | 3rd VyHar    | 3rd Y-phase voltage harmonic                  | %      | 2 | R |
| 17                                  | 30433 | 5th VyHar    | 5th Y-phase voltage harmonic                  | %      | 2 | R |
| 18                                  | 30435 | 7th VyHar    | 7th Y-phase voltage harmonic                  | %      | 2 | R |
| 19                                  | 30437 | 9th VyHar    | 9th Y-phase voltage harmonic                  | %      | 2 | R |
| 20                                  | 30439 | 11th VyHar   | 11th Y-phase voltage harmonic                 | %      | 2 | R |
| 21                                  | 30441 | 13th VyHar   | 13th Y-phase voltage harmonic                 | %      | 2 | R |
| 22                                  | 30443 | 15th VyHar   | 15th Y-phase voltage harmonic                 | %      | 2 | R |
| 23                                  | 30445 | 17th VyHar   | 17th Y-phase voltage harmonic                 | %      | 2 | R |
| 24                                  | 30447 | 19th VyHar   | 19th Y-phase voltage harmonic                 | %      | 2 | R |
| 25                                  | 30449 | 21st VyHar   | 21st Y-phase voltage harmonic                 | %      | 2 | R |
| 26                                  | 30451 | 23rd VyHar   | 23rd Y-phase voltage harmonic                 | %      | 2 | R |
| 27                                  | 30453 | 25th VyHar   | 25th Y-phase voltage harmonic                 | %      | 2 | R |
| 28                                  | 30455 | 27th VyHar   | 27th Y-phase voltage harmonic                 | %      | 2 | R |
| 29                                  | 30457 | 29th VyHar   | 29th Y-phase voltage harmonic                 | %      | 2 | R |
| 30                                  | 30459 | 31st VyHar   | 31st Y-phase voltage harmonic                 | %      | 2 | R |
| 31                                  | 30461 | 3rd VbHar    | 3rd B-phase voltage harmonic                  | %      | 2 | R |
| 32                                  | 30463 | 5th VbHar    | 5th B-phase voltage harmonic                  | %      | 2 | R |
| 33                                  | 30465 | 7th VbHar    | 7th B-phase voltage harmonic                  | %      | 2 | R |
| 34                                  | 30467 | 9th VbHar    | 9th B-phase voltage harmonic                  | %      | 2 | R |
| 35                                  | 30469 | 11th VbHar   | 11th B-phase voltage harmonic                 | %      | 2 | R |
| 36                                  | 30471 | 13th VbHar   | 13th B-phase voltage harmonic                 | %      | 2 | R |
| 37                                  | 30473 | 15th VbHar   | 15th B-phase voltage harmonic                 | %      | 2 | R |
| 38                                  | 30475 | 17th VbHar   | 17th B-phase voltage harmonic                 | %      | 2 | R |
| 39                                  | 30477 | 19th VbHar   | 19th B-phase voltage harmonic                 | %      | 2 | R |
| 40                                  | 30479 | 21st VbHar   | 21st B-phase voltage harmonic                 | %      | 2 | R |
| 41                                  | 30481 | 23rd VbHar   | 23rd B-phase voltage harmonic                 | %      | 2 | R |
| 42                                  | 30483 | 25th VbHar   | 25th B-phase voltage harmonic                 | %      | 2 | R |
| 43                                  | 30485 | 27th VbHar   | 27th B-phase voltage harmonic                 | %      | 2 | R |
| 44                                  | 30487 | 29th VbHar   | 29th B-phase voltage harmonic                 | %      | 2 | R |
| 45                                  | 30489 | 31st VbHar   | 31st B-phase voltage harmonic                 | %      | 2 | R |
| 46                                  | 30491 | Total Vrthd  | R phase Voltage Total harmonic distortion     | %      | 2 | R |
| 47                                  | 30493 | Total Vythd  | Y phase Voltage Total harmonic distortion     | %      | 2 | R |
| 48                                  | 30495 | Total Vbthd  | B phase Voltage Total harmonic distortion     | %      | 2 | R |
| 49                                  | 30497 | Avg. Vthd    | Average Voltage Total harmonic distortion     | %      | 2 | R |
| Registers for Demand Parameters     |       |              |                                               |        |   |   |
| 1                                   | 30601 | RD_KWT       | Rising/Present demand of Active Power Total   | KW     | 2 | R |
| 2                                   | 30603 | MD_KWT       | Maximum/Peak demand of Active Power Total     | KW     | 2 | R |
| 3                                   | 30609 | RD_KVART     | Rising/Present demand of Reactive Power Total | KVAR   | 2 | R |
| 4                                   | 30611 | MD_KVART     | Maximum/Peak demand of Reactive Power Total   | KVAR   | 2 | R |
| 5                                   | 30617 | RD_KVAT      | Rising/Present demand of Apparent Power Total | KVA    | 2 | R |
| 6                                   | 30619 | MD_KVAT      | Maximum/Peak demand of Apparent Power Total   | KVA    | 2 | R |
| 7                                   | 30625 | RD_lavg      | Rising/Present demand of Average Current      | Ampere | 2 | R |
| 8                                   | 30627 | MD_lavg      | Maximum/Peak demand of Average Current        | Ampere | 2 | R |
| Registers for Old Energy Parameters |       |              |                                               |        |   |   |
| 1                                   | 30651 | Old_KWh (Im) | Old Active Energy Import                      | KWh    | 2 | R |
| 2                                   | 30653 | Old_KWh (Ex) | Old Active Energy Export                      | KWh    | 2 | R |

|                                                                                                      |       |                   |                                              |        |   |   |
|------------------------------------------------------------------------------------------------------|-------|-------------------|----------------------------------------------|--------|---|---|
| 3                                                                                                    | 30655 | Old_KWh net       | Old Active Energy Net (Import - Export)      | KWh    | 2 | R |
| 4                                                                                                    | 30657 | Old_KWh Tot       | Old Active Energy Total (Import + Export)    | KWh    | 2 | R |
| 5                                                                                                    | 30659 | Old_KVAh (Im)     | Old Apparent Energy Import                   | KVAh   | 2 | R |
| 6                                                                                                    | 30661 | Old_KVAh (Ex)     | Old Apparent Energy Export                   | KVAh   | 2 | R |
| 7                                                                                                    | 30663 | Old_KVAh net      | Old Apparent Energy Net (Import - Export)    | KVAh   | 2 | R |
| 8                                                                                                    | 30665 | Old_KVAh Tot      | Old Apparent Energy Total (Import + Export)  | KVAh   | 2 | R |
| 9                                                                                                    | 30667 | Old_KVArh (Im)    | Old Reactive Energy Import (Q1+Q2)           | KVArh  | 2 | R |
| 10                                                                                                   | 30669 | Old_KVArh (Ex)    | Old Reactive Energy Export (Q3+Q4)           | KVArh  | 2 | R |
| 11                                                                                                   | 30671 | Old_KVArh net     | Old Reactive Energy Net (Import - Export)    | KVArh  | 2 | R |
| 12                                                                                                   | 30673 | Old_KVArh Tot     | Old Reactive Energy Total (Import + Export)  | KVArh  | 2 | R |
| 13                                                                                                   | 30675 | Old_KVArh (L-Tot) | Old Reactive Energy Lag Total                | KVArh  | 2 | R |
| 14                                                                                                   | 30677 | Old_KVArh (C-Tot) | Old Reactive Energy Lead Total               | KVArh  | 2 | R |
| 15                                                                                                   | 30679 | Old_KVArh (L-Im)  | Old Reactive Energy - Inductive import (Q1)  | KVArh  | 2 | R |
| 16                                                                                                   | 30681 | Old_KVArh (L-Ex)  | Old Reactive Energy - Inductive export (Q3)  | KVArh  | 2 | R |
| 17                                                                                                   | 30683 | Old_KVArh (C-Im)  | Old Reactive Energy - Capacitive import (Q2) | KVArh  | 2 | R |
| 18                                                                                                   | 30685 | Old_KVArh (C-Ex)  | Old Reactive Energy - Capacitive export (Q4) | KVArh  | 2 | R |
| <b>Registers for Min-Max Parameters - It will record the Min and Max values from the last reset.</b> |       |                   |                                              |        |   |   |
| 1                                                                                                    | 30701 | V1 LN_Max         | Maximum Voltage of R Phase                   | Volt   | 2 | R |
| 2                                                                                                    | 30703 | V2 LN_Max         | Maximum Voltage of Y Phase                   | Volt   | 2 | R |
| 3                                                                                                    | 30705 | V3 LN_Max         | Maximum Voltage of B Phase                   | Volt   | 2 | R |
| 4                                                                                                    | 30707 | Vavg LN_Max       | Maximum Voltage of Average LN                | Volt   | 2 | R |
| 5                                                                                                    | 30709 | V1 LN_Min         | Minimum Voltage of R Phase                   | Volt   | 2 | R |
| 6                                                                                                    | 30711 | V2 LN_Min         | Minimum Voltage of Y Phase                   | Volt   | 2 | R |
| 7                                                                                                    | 30713 | V3 LN_Min         | Minimum Voltage of B Phase                   | Volt   | 2 | R |
| 8                                                                                                    | 30715 | Vavg LN_Min       | Minimum Voltage of Average LN                | Volt   | 2 | R |
| 9                                                                                                    | 30717 | V12 LL_Max        | Maximum Voltage of RY Phase-Phase            | Volt   | 2 | R |
| 10                                                                                                   | 30719 | V23 LL_Max        | Maximum Voltage of YB Phase-Phase            | Volt   | 2 | R |
| 11                                                                                                   | 30721 | V31 LL_Max        | Maximum Voltage of BR Phase-Phase            | Volt   | 2 | R |
| 12                                                                                                   | 30723 | Vavg LL_Max       | Maximum Voltage of Average LL                | Volt   | 2 | R |
| 13                                                                                                   | 30725 | V12 LL_Min        | Minimum Voltage of RY Phase-Phase            | Volt   | 2 | R |
| 14                                                                                                   | 30727 | V23 LL_Min        | Minimum Voltage of YB Phase-Phase            | Volt   | 2 | R |
| 15                                                                                                   | 30729 | V31 LL_Min        | Minimum Voltage of BR Phase-Phase            | Volt   | 2 | R |
| 16                                                                                                   | 30731 | Vavg LL_Min       | Minimum Voltage of Average LL                | Volt   | 2 | R |
| 17                                                                                                   | 30733 | I1_Max            | Maximum Current of R Phase                   | Ampere | 2 | R |
| 18                                                                                                   | 30735 | I2_Max            | Maximum Current of Y Phase                   | Ampere | 2 | R |
| 19                                                                                                   | 30737 | I3_Max            | Maximum Current of B Phase                   | Ampere | 2 | R |
| 20                                                                                                   | 30739 | Iavg_Max          | Maximum Current of Average                   | Ampere | 2 | R |
| 21                                                                                                   | 30741 | I1_Min            | Minimum Current of R Phase                   | Ampere | 2 | R |
| 22                                                                                                   | 30743 | I2_Min            | Minimum Current of Y Phase                   | Ampere | 2 | R |
| 23                                                                                                   | 30745 | I3_Min            | Minimum Current of B Phase                   | Ampere | 2 | R |
| 24                                                                                                   | 30747 | Iavg_Min          | Minimum Current of Average                   | Ampere | 2 | R |
| 25                                                                                                   | 30749 | Freq_Max          | Maximum Frequency                            | Hz     | 2 | R |
| 26                                                                                                   | 30751 | Freq_Min          | Minimum Frequency                            | Hz     | 2 | R |
| 27                                                                                                   | 30753 | P1_Max            | Maximum Active power of R Phase              | W      | 2 | R |
| 28                                                                                                   | 30755 | P2_Max            | Maximum Active power of Y Phase              | W      | 2 | R |
| 29                                                                                                   | 30757 | P3_Max            | Maximum Active power of B Phase              | W      | 2 | R |
| 30                                                                                                   | 30759 | Ptot_Max          | Maximum Active power of Total                | W      | 2 | R |
| 31                                                                                                   | 30761 | P1_Min            | Minimum Active power of R Phase              | W      | 2 | R |
| 32                                                                                                   | 30763 | P2_Min            | Minimum Active power of Y Phase              | W      | 2 | R |
| 33                                                                                                   | 30765 | P3_Min            | Minimum Active power of B Phase              | W      | 2 | R |

|                                 |       |               |                                   |       |   |   |
|---------------------------------|-------|---------------|-----------------------------------|-------|---|---|
| 34                              | 30767 | Ptot_Min      | Minimum Active power of Total     | W     | 2 | R |
| 35                              | 30769 | Q1_Max        | Maximum Reactive power of R Phase | VAR   | 2 | R |
| 36                              | 30771 | Q2_Max        | Maximum Reactive power of Y Phase | VAR   | 2 | R |
| 37                              | 30773 | Q3_Max        | Maximum Reactive power of B Phase | VAR   | 2 | R |
| 38                              | 30775 | Qtot_Max      | Maximum Reactive power of Total   | VAR   | 2 | R |
| 39                              | 30777 | Q1_Min        | Minimum Reactive power of R Phase | VAR   | 2 | R |
| 40                              | 30779 | Q2_Min        | Minimum Reactive power of Y Phase | VAR   | 2 | R |
| 41                              | 30781 | Q3_Min        | Minimum Reactive power of B Phase | VAR   | 2 | R |
| 42                              | 30783 | Qtot_Min      | Minimum Reactive power of Total   | VAR   | 2 | R |
| 43                              | 30785 | S1_Max        | Maximum Apparent power of R Phase | VA    | 2 | R |
| 44                              | 30787 | S2_Max        | Maximum Apparent power of Y Phase | VA    | 2 | R |
| 45                              | 30789 | S3_Max        | Maximum Apparent power of B Phase | VA    | 2 | R |
| 46                              | 30791 | Stot_Max      | Maximum Apparent power of Total   | VA    | 2 | R |
| 47                              | 30793 | S1_Min        | Minimum Apparent power of R Phase | VA    | 2 | R |
| 48                              | 30795 | S2_Min        | Minimum Apparent power of Y Phase | VA    | 2 | R |
| 49                              | 30797 | S3_Min        | Minimum Apparent power of B Phase | VA    | 2 | R |
| 50                              | 30799 | Stot_Min      | Minimum Apparent power of Total   | VA    | 2 | R |
| 51                              | 30801 | PF1_L_Max     | Maximum Lagging PF of R phase     | --    | 2 | R |
| 52                              | 30803 | PF2_L_Max     | Maximum Lagging PF of Y phase     | --    | 2 | R |
| 53                              | 30805 | PF3_L_Max     | Maximum Lagging PF of B phase     | --    | 2 | R |
| 54                              | 30807 | PFavg_L_Max   | Maximum Lagging PF of Average     | --    | 2 | R |
| 55                              | 30809 | PF1_L_Min     | Minimum Lagging PF of R phase     | --    | 2 | R |
| 56                              | 30811 | PF2_L_Min     | Minimum Lagging PF of Y phase     | --    | 2 | R |
| 57                              | 30813 | PF3_L_Min     | Minimum Lagging PF of B phase     | --    | 2 | R |
| 58                              | 30815 | PFavg_L_Min   | Minimum Lagging PF of Average     | --    | 2 | R |
| 59                              | 30817 | PF1_C_Max     | Maximum Leading PF of R phase     | --    | 2 | R |
| 60                              | 30819 | PF2_C_Max     | Maximum Leading PF of Y phase     | --    | 2 | R |
| 61                              | 30821 | PF3_C_Max     | Maximum Leading PF of B phase     | --    | 2 | R |
| 62                              | 30823 | PFavg_C_Max   | Maximum Leading PF of Average     | --    | 2 | R |
| 63                              | 30825 | PF1_C_Min     | Minimum Leading PF of R phase     | --    | 2 | R |
| 64                              | 30827 | PF2_C_Min     | Minimum Leading PF of Y phase     | --    | 2 | R |
| 65                              | 30829 | PF3_C_Min     | Minimum Leading PF of B phase     | --    | 2 | R |
| 66                              | 30831 | PFavg_C_Min   | Minimum Leading PF of Average     | --    | 2 | R |
| Registers for Prev block energy |       |               |                                   |       |   |   |
| 1                               | 30851 | BLK_KWH_IMP   | Previous block T. KWh-Import      | KWh   | 2 | R |
| 2                               | 30853 | BLK_KVARH_IMP | Previous block T. KVarh-Import    | KVarh | 2 | R |
| 3                               | 30855 | BLK_KVAH_IMP  | Previous block T. KVah-Import     | KVah  | 2 | R |
| 4                               | 30857 | BLK_KWH_EXP   | Previous block T. KWh-Export      | KWh   | 2 | R |
| 5                               | 30859 | BLK_KVARH_EXP | Previous block T. KVarh-Export    | KVarh | 2 | R |
| 6                               | 30861 | BLK_KVAH_EXP  | Previous block T. KVah-Export     | KVah  | 2 | R |

**Function Code** = 0X04

**Data Format** = Unsigned int

**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]

**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]

| Registers for Device Status |       |                 |                 |     |   |   |
|-----------------------------|-------|-----------------|-----------------|-----|---|---|
| 1                           | 30501 | ON HOUR         | ON HOUR         | Hr  | 1 | R |
| 2                           | 30502 | ON MIN          | ON MIN          | Min | 1 | R |
| 3                           | 30503 | RUN HOUR        | RUN HOUR        | Hr  | 1 | R |
| 4                           | 30504 | RUN MIN         | RUN MIN         | Min | 1 | R |
| 5                           | 30505 | PWR INTR. COUNT | PWR INTR. COUNT | --  | 1 | R |



**Function Code** = 0X04

**Data Format** = Swapped Double

**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]

**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]

| Registers for Energy Parameters (As Per IEEE 754 Standard) |                |               |                                |       |       |      |
|------------------------------------------------------------|----------------|---------------|--------------------------------|-------|-------|------|
| S. No.                                                     | Modbus Address | Parameters    | Description                    | Unit  | Words | Type |
| 1                                                          | 30551          | KWh (Im)      | Active Energy Import           | kWh   | 4     | R    |
| 2                                                          | 30555          | KWh (Ex)      | Active Energy Export           | kWh   | 4     | R    |
| 3                                                          | 30559          | KVAh (Im)     | Apparent Energy Import         | kVAh  | 4     | R    |
| 4                                                          | 30563          | KVAh (Ex)     | Apparent Energy Export         | kVAh  | 4     | R    |
| 5                                                          | 30567          | KVArh (Im)    | Reactive Energy Import (Q1+Q2) | kVArh | 4     | R    |
| 6                                                          | 30571          | KVArh (Ex)    | Reactive Energy Export (Q3+Q4) | kVArh | 4     | R    |
| 7                                                          | 30575          | KVArh (L-Tot) | Reactive Energy Lag Total      | kVArh | 4     | R    |
| 8                                                          | 30579          | KVArh (C-Tot) | Reactive Energy Lead Total     | kVArh | 4     | R    |

## 8.2 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

**Data Format** = 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

**Data Format** = 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]

| Registers for Configuration parameters |         |                                          |               |               |       |               |
|----------------------------------------|---------|------------------------------------------|---------------|---------------|-------|---------------|
| S.No.                                  | Address | Parameter                                | Minimum value | Maximum value | Words | Default value |
| 1                                      | 40104   | PT Primary - HIGH BYTE #                 | 0             | 15            | 1     | 0             |
| 2                                      | 40105   | PT Primary - LOW BYTE #                  | 100           | 65535         | 1     | 415           |
| 3                                      | 40106   | PT Secondary                             | 100           | 415           | 1     | 415           |
| 4                                      | 40107   | CT Primary                               | 1 / 5         | 15000         | 1     | 5             |
| 5                                      | 40108   | CT Secondary                             | 1             | 5             | 1     | 5             |
| 6                                      | 40109   | Password                                 | 0001          | 9999          | 1     | 0001          |
| 7                                      | 40110   | Slave address                            | 1             | 247           | 1     | 1             |
| 8                                      | 40111   | Baud rate (2400,4800,9600,19200,38400)   | 2400          | 38400         | 1     | 9600          |
| 9                                      | 40112   | Parity bit (0 = None, 1 = Odd, 2 = Even) | 0             | 2             | 1     | 0             |
| 10                                     | 40113   | Stop bit                                 | 1             | 2             | 1     | 1             |
| 11                                     | 40114   | System type                              | 0             | 2             | 1     | 0             |

|    |       |                                                                   |      |       |   |      |
|----|-------|-------------------------------------------------------------------|------|-------|---|------|
|    |       | (0 = 3P4W, 1 = 3P3W, 2 = 1P2W)                                    |      |       |   |      |
| 12 | 40115 | Apparent power calculation<br>(0 = Arithmetic, 1 = Vector)        | 0    | 1     | 1 | 0    |
| 13 | 40116 | Pulse constant                                                    | 100  | 60000 | 1 | 3600 |
| 14 | 40117 | Energy type (Refer table 1)                                       | 0    | 11    | 1 | 0    |
| 15 | 40118 | Demand method<br>(0 = Block, 1 = SLIDE)                           | 0    | 1     | 1 | 0    |
| 16 | 40119 | interval time (Min)                                               | 1    | 60    | 1 | 15   |
| 17 | 40120 | sub interval time (Min)                                           | 1    | 60    | 1 | 1    |
| 18 | 40121 | POLE                                                              | 2    | 48    | 1 | 2    |
| 19 | 40122 | SLIP (%)                                                          | 0000 | 9999  | 1 | 0000 |
| 20 | 40123 | Previous block energy time<br>(0 = 15 min, 1 = 60 min, 2 = 5 min) | 0    | 2     | 1 | 0    |
| 21 | 40124 | Real Sec & Min [SSMM]                                             | 0    | 5959  | 1 | 0000 |
| 22 | 40125 | Real Hour & Date [HHDD]                                           | 1    | 2331  | 1 | 0001 |
| 23 | 40126 | Real Month & Year [MMYY]                                          | 100  | 1299  | 1 | 0125 |
| 24 | 40127 | Low Current noise Cut-off                                         | 1    | 99    | 1 | 5    |
| 25 | 40128 | Reset ALL/ Individual Reg.<br>(Refer table 2)                     | 79   | 85    | 1 |      |
| 26 | 40135 | Voltage Display on Modbus<br>(0 = Volt, 1 = Kilovolt)             | 0    | 1     | 1 | 0    |
| 27 | 40136 | Power Display on Modbus<br>(0 = watt, 1 = Kilowatt)               | 0    | 1     | 1 | 0    |

**IF you Want to Enter Direct long Value of PT primary you can use this register.**

| Registers for PT primary |         |            |               |               |                  |               |
|--------------------------|---------|------------|---------------|---------------|------------------|---------------|
| S.No.                    | Address | Parameter  | Minimum value | Maximum value | Words            | Default value |
| 1                        | 40101   | PT Primary | 100           | 1000000       | 2 (Swapped Long) | 415           |

# For entering PT Primary into Modbus: -

**Example:**

For entering PT Primary value 220000, convert into hexadecimal i.e. 35B60

Now enter lower four byte (Hex value : 5B60 / Decimal Value : 23392) at 40105 and higher four byte (Hex Value : 0003 / Decimal Value : 3 ) at 40104 addresses respectively

**High byte - 3, Low byte – 23392**

**Table 1:**

| Value | Energy type for Pulse Output |
|-------|------------------------------|
| 0     | KWh Import                   |
| 1     | KWh Export                   |
| 2     | KVarh Import                 |
| 3     | KVarh Export                 |
| 4     | KVah Import                  |
| 5     | KVah Export                  |
| 6     | MWh Import                   |
| 7     | MWh Export                   |
| 8     | MVarh Import                 |
| 9     | MVarh Export                 |
| 10    | MVah Import                  |
| 11    | MVah Export                  |

**Table 2:**

| Value (write only) | Reset Energy Register          |
|--------------------|--------------------------------|
| 79                 | PREV block energy              |
| 80                 | All Energy                     |
| 81                 | Hours Reset                    |
| 82                 | MAX-MIN Reset                  |
| 83                 | Power interruption count reset |
| 84                 | Maximum demand reset           |
| 85                 | All                            |



### 8.3 User Assignable Registers

MFM2160 contains the 60 user assignable registers in the address range of 2001 to 2119 (see Table 8.3.1), any of which you can map to either register address accessible in the instrument. Registers that reside in different locations may be accessed by a single request by re-mapping them to adjacent addresses in the user assignable registers area.

The actual addresses of the assignable registers which are accessed via addresses 2001 to 2119 are specified in the user assignable register map (see Table 8.3.2). This map occupies addresses from 301 to 360, where map register 301 should contain the actual address of the register accessed via assignable register 2001, register 302 should contain the actual address of the register accessed via assignable register 2003, and so on.

To build your own register map, write to map registers (301 to 360) the actual addresses you want to read from via the assignable area (2001 to 2119).

By default, register address 1 to 115 is mapped to registers 301 to 360.

For example, if you want to read registers 27 (Frequency) and 95 (RPM) via registers 2001-2003, then do the following:

- write 27 to register 301
- write 95 to register 302

Reading from registers 2001-2003 will return the Frequency reading in registers 2001, and the RPM reading in register 2003.

**Table 8.3.1 User Assignable Registers**

**Function Code** = 0X04

**Address** – between 32001 to 32119

**No. of data word** ≤ 120 & in multiple of 2 as all data are of 4 Bytes [Swapped Float]. Enter only Even value (data word length).

| Address      | Register Contents       | Type          |
|--------------|-------------------------|---------------|
| <b>32001</b> | Assigned register #2001 | Swapped Float |
| <b>32003</b> | Assigned register #2003 | Swapped Float |
| <b>32005</b> | Assigned register #2005 | Swapped Float |
| ...          | ...                     | ...           |
| <b>32119</b> | Assigned register #2119 | Swapped Float |

**Table 8-2 User Assignable Register Map**

**Function Code** = 0X06

**Address** – Any Single Register between 40301 to 40360

**Data** = Data of 1 word, as all data are of 2 Bytes [Decimal].

| Address      | Register contents                 | Type    | R/W | Range                                                                                                    |
|--------------|-----------------------------------|---------|-----|----------------------------------------------------------------------------------------------------------|
| <b>40301</b> | Mapped address for register #2001 | Decimal | R/W | 1 to 115, 151 to 185, 187 to 297, 651 to 685, 851 to 863, 301 to 397, 401 to 497, 601 to 631, 701 to 831 |
| <b>40302</b> | Mapped address for register #2003 | Decimal | R/W | 1 to 115, 151 to 185, 187 to 297, 651 to 685, 851 to 863, 301 to 397, 401 to 497, 601 to 631, 701 to 831 |
| <b>40303</b> | Mapped address for register #2005 | Decimal | R/W | 1 to 115, 151 to 185, 187 to 297, 651 to 685, 851 to 863, 301 to 397, 401 to 497, 601 to 631, 701 to 831 |
| ...          | ...                               | ...     | ... | ...                                                                                                      |

|       |                                   |         |     |                                                                                                          |
|-------|-----------------------------------|---------|-----|----------------------------------------------------------------------------------------------------------|
| 40360 | Mapped address for register #2119 | Decimal | R/W | 1 to 115, 151 to 185, 187 to 297, 651 to 685, 851 to 863, 301 to 397, 401 to 497, 601 to 631, 701 to 831 |
|-------|-----------------------------------|---------|-----|----------------------------------------------------------------------------------------------------------|

## 8.4 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                                                                                                |
|------|----------------------|--------------------------------------------------------------------------------------------------------|
| 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.               |

### Note:

If the value is an illegal data 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.

## 9. IMPORTANT NOTES

Before starting Installed Meter, Go through these notes:

- 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 Reset**.
- **ON Hour**: The period for which the meter (Aux. supply) is ON
- **RUN (LOAD) Hour**: Indicates the period the Load is ON and has run. This counter accumulates if the load is greater than the starting current (0.1% of the In) set.
- **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.

### Energy Pulse O/P Constant Setting:

- For Front Blinking LED, select energy type (i.e. KWh-import / KWh-export / KVARh-Import / KVARh-Export / KVAh-Import / KVAh-Export / MWh-Import / MWh-Export / MVARh-Import / MVARh-Export / MVAh-Import / MVAh-Export) as per your requirement using configuration mode from pulse Output and set the value of pulse 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  
 $(CT \text{ Primary} * PT \text{ Primary} * \text{Pulse Constant in Wh}) / 3600 \leq 20$ .
  - Example: Meter specification CT Primary = 200 A and PT Primary = 11000 V
  - Above meter can consume maximum of 2.2MWatt.  
I.e. For 3600 pulses/KWh [3.6 pulses/Wh], it will generate 2200 pulses/sec as per above equation,  $[200 * 11000 * 3.6 / 3600 = 2200]$  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,  $[200 * 11000 * 0.002 / 3600 = 1.22]$  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 Overflow:

- When the Total Apparent Energy (sum of Import and Export) exceeds the limit of **999,999,999.999 kVAh**, the meter will automatically reset all accumulated energy parameters. This automatic reset includes Total Active Energy (Import, Export, Net, and Total), Total Reactive Energy (Import, Export, Net, and Total), and Total Apparent Energy (Import, Export, Net, and Total).
- The values prior to the reset are stored in the Old Energy Registers, which can be accessed through the Modbus registers.

## 10. TROUBLESHOOTING TIPS

The information in Table 10– 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 10– 1: Troubleshooting**

| Potential Problem                                                             | Possible Cause                                                    | Possible Solution                                                                                                                       |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| The display is blank 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 is incorrect.              | Verify that the baud rate & Parity 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 [D+] & [D-] lines                                                 |

### UNIT NOT TURNING ON

The problem can be bad connection / power of incorrect rating.

First check, power on terminal of the instrument itself if it is not present then the fault is in power chord.

**⚠ One must take care while dealing with Power wirings because it may create electrical shock.**

***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.***