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User's Manual

MULTIFUNCTION METER
MFM2160

Masibus Automation And Instrumentation Pvt. Ltd.
B/30, GIDC Electronics Estate,
Sector-25, Gandhinagar-382016, Gujarat, India
☎ +91 79 23287275-77 +91 79 23287281
Email: support@masibus.com
Web: www.masibus.com

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CONTENTS

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. MASIBUS does not guarantee the application of these functions for any particular purpose.

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

Trademarks

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Checking the Contents of the Package

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

Product overview

The 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 Masibus **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 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 31st 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 85-265VAC/ 100-300VDC	N	None	N	None	LCD	LCD Display
	1	Class 0.5s	U2	Aux. Powered 20-60VDC	Y	Required#	Y	Required#	LED	LED Display

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

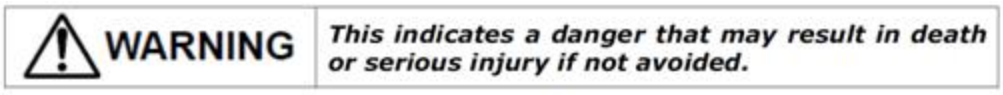
The product is provided with the following accessories according to the model and suffix codes (see the table below). Check that none of them are missing or damaged.

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.



This indicates a danger that may result in minor or moderate injury or only a physical damage if not avoided.

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) (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, 5A: <0.2VA per phase
Overload	150% of In Continuous
Short-time over current	20 x Imax for 1 sec., 10 x Imax for 3 sec., 7 x Imax for 10 sec

Frequency	45 to 65Hz

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

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

Display	
LED	3 line 4-digit Red LED Display with 0.56" [14.2mm] height, 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 and Min / Max data

Green LED Indication	RS485 Communication Activity
Red ⎍⎍ LED Indication	Energy Pulse

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 U-type / ring-type termination: maximum up to 4 mm^2 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	

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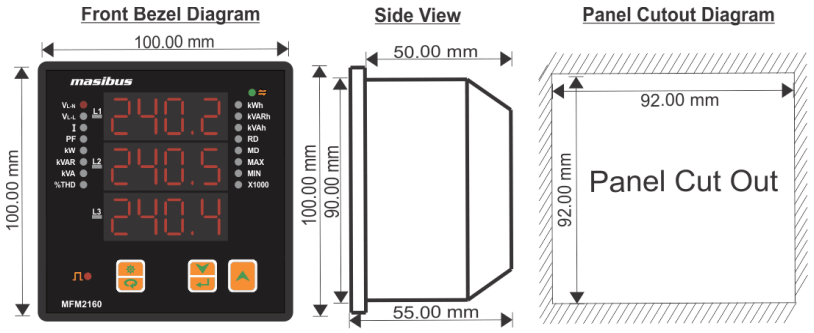
4.INSTALLATION AND SAFETY GUIDELINES

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

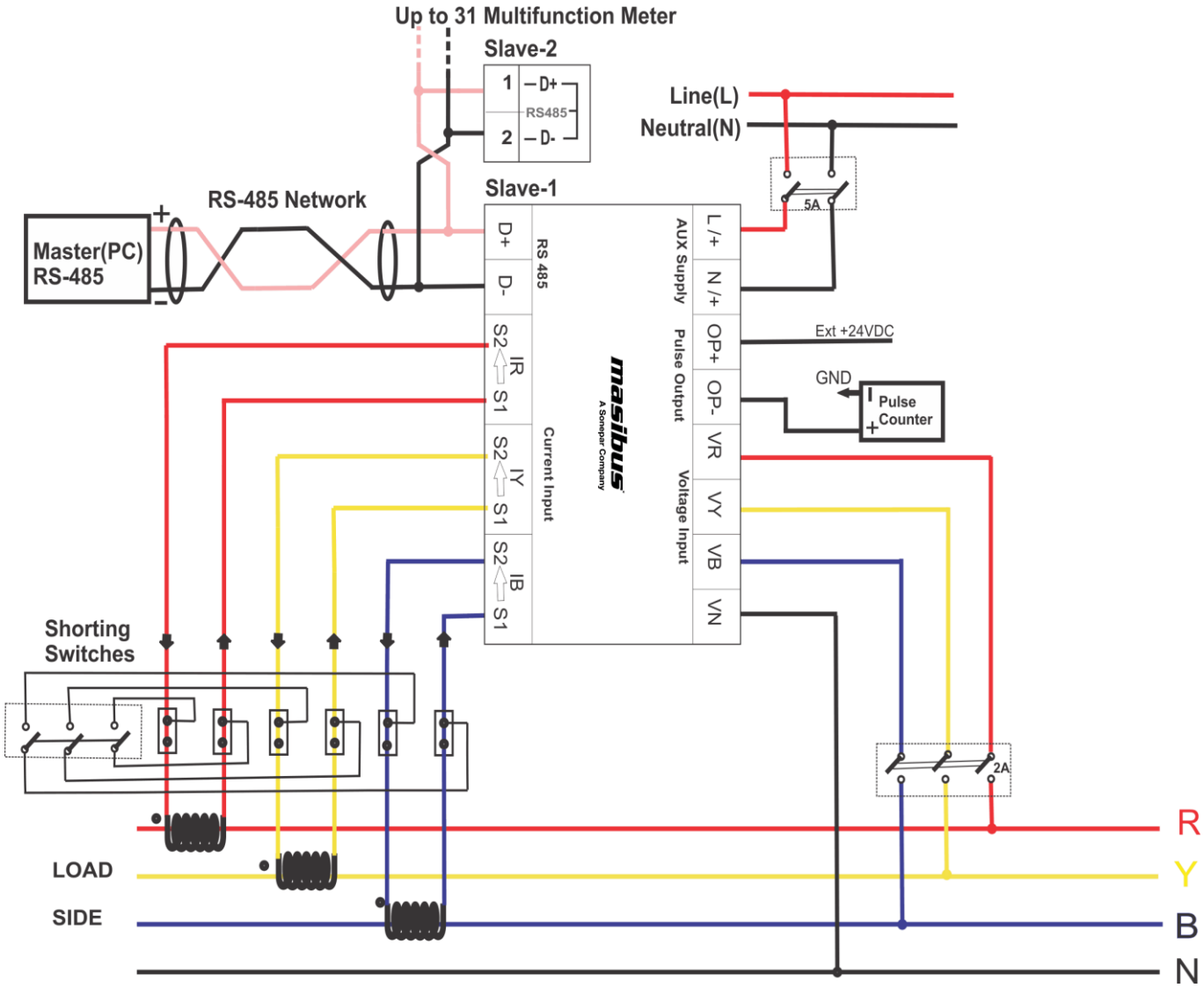
All wiring must confirm appropriate standards of good practice and local codes and regulations. Wiring must be suitable for voltage, current, and temperature rating of the system.
Ensure that all incoming AC power and other power sources are turned OFF before performing any work on the instrument. Protect 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. WIRING DETAILS

5.1 Common Wiring with RS-485 Connections

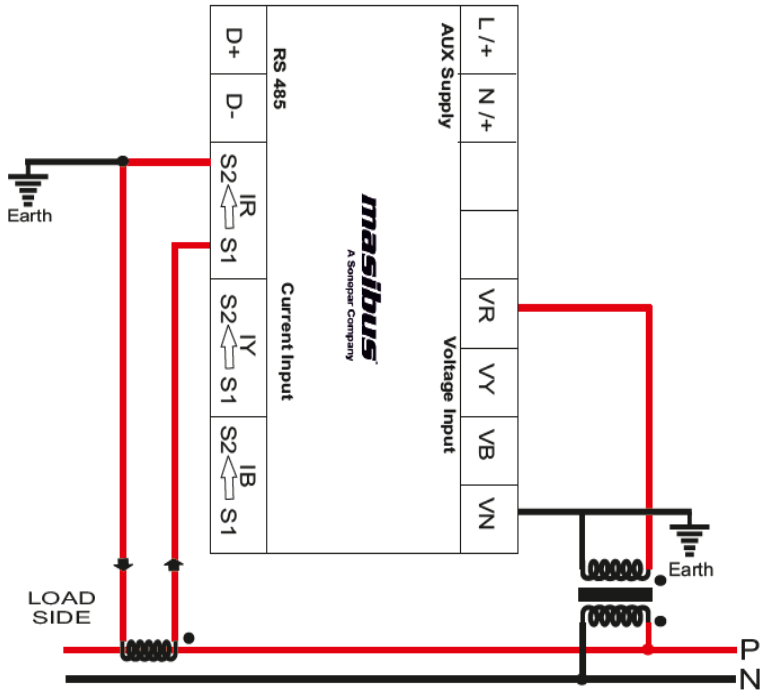
Recommended wiring for Aux Supply, Voltage input & Current Input along with RS-485 Connections

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



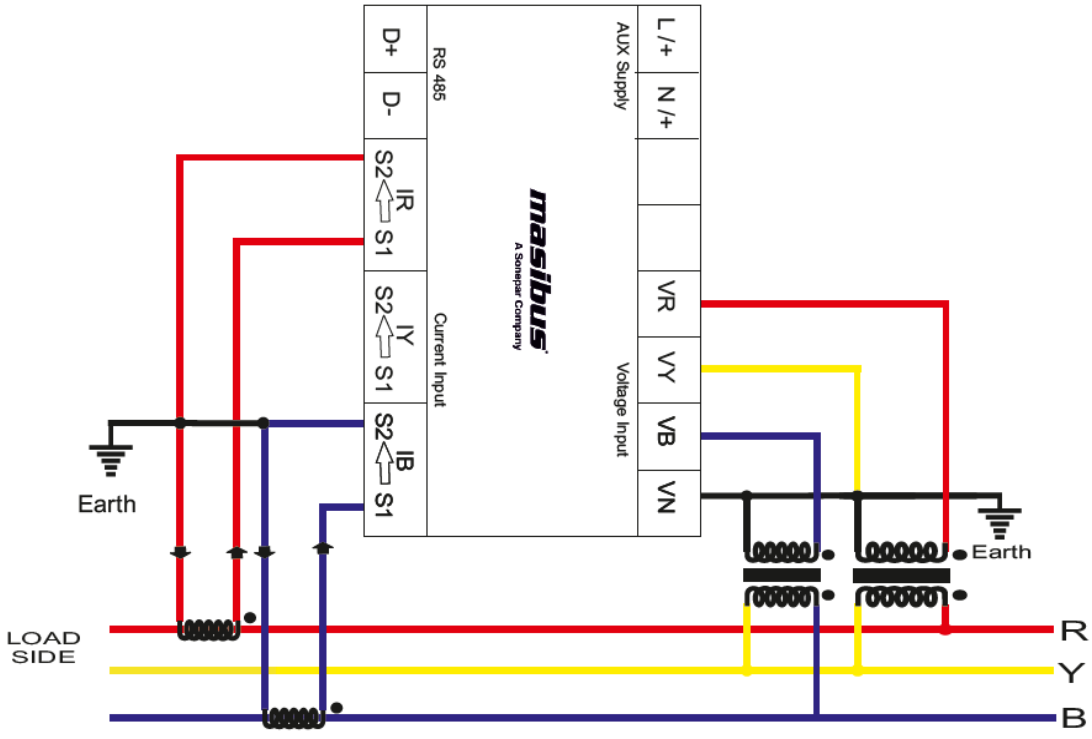
5.2 Wiring diagram

1) Single Phase Two Wire System

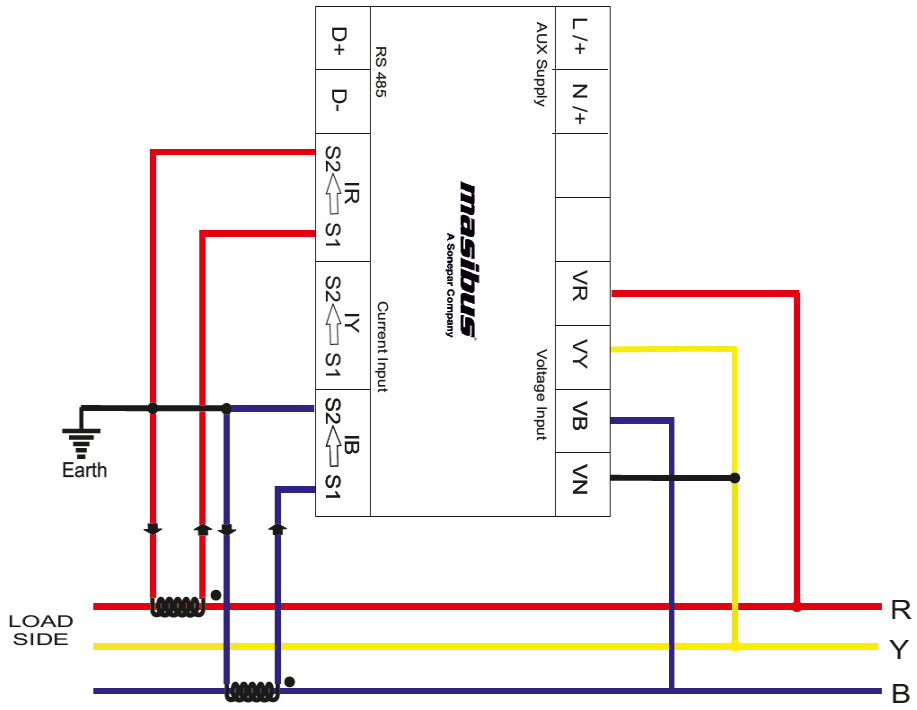


2) Three Phase Three Wire System

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

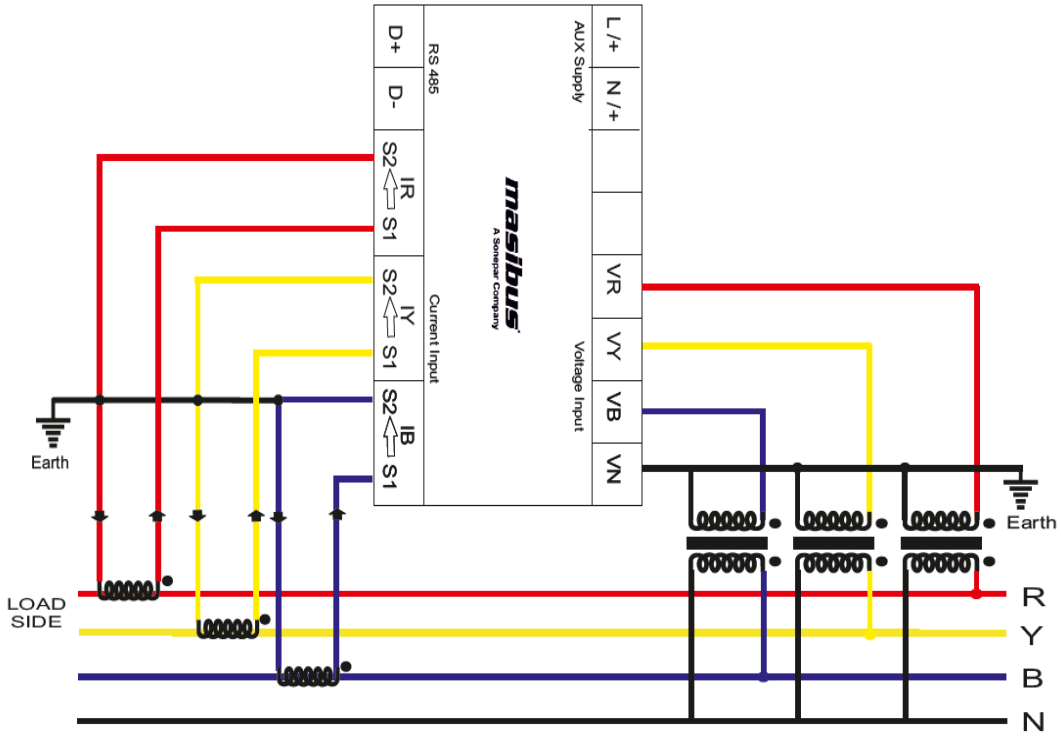


2B) 3-Wire 2- Element Direct Connection Using 2CTs



3) Three Phase Four Wire System

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



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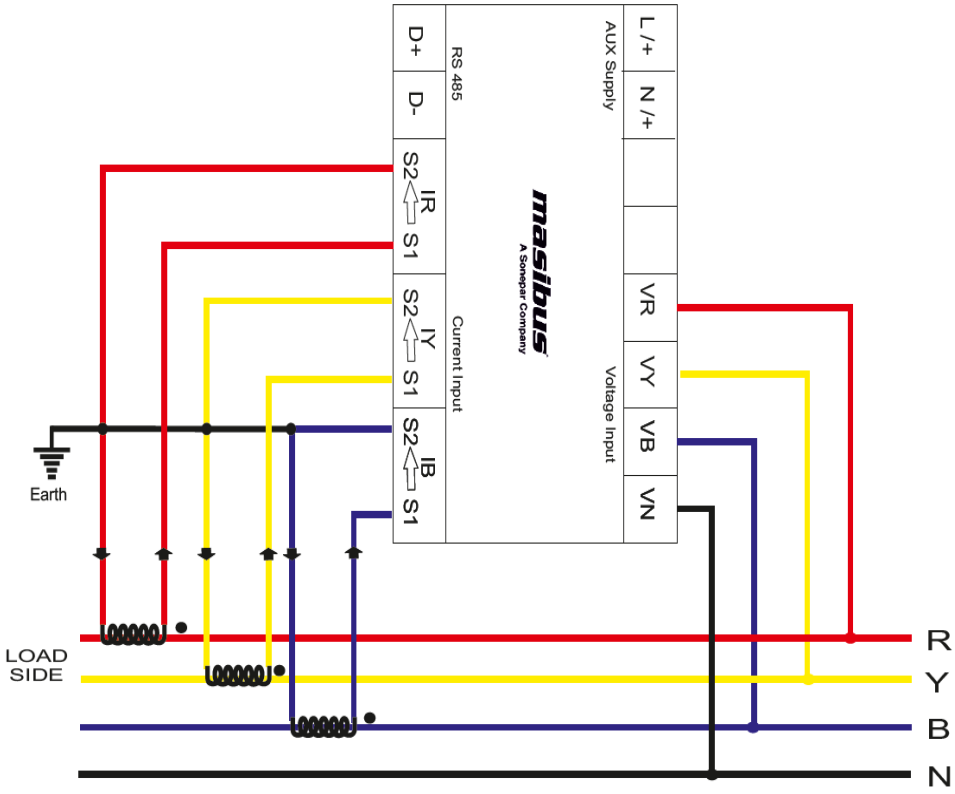
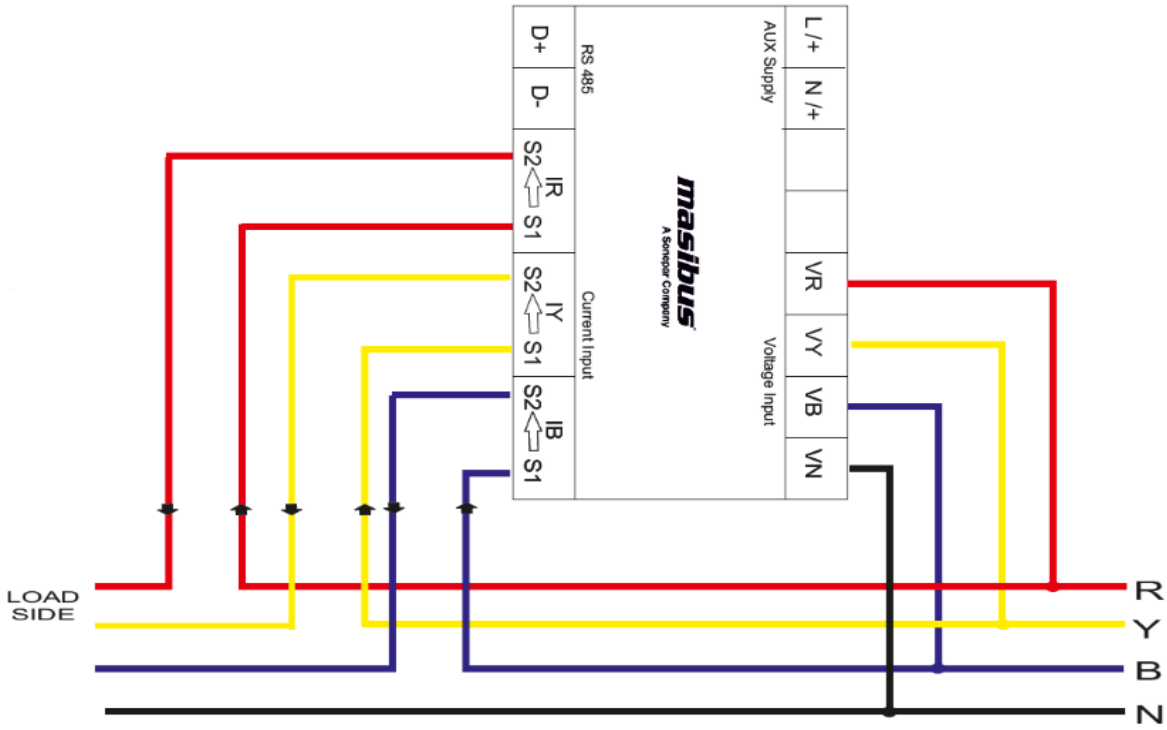
3B) 4-Wire Wye-3 Element Direct Connection Using 3CTs



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 Ω, then the CT has to support an additional burden of 5VA. The wiring distance from the CT secondary to meter should be such that, VA of wire path between meter and CT along with VA of meter should not exceed the VA rating of CT, otherwise the CT could get over-burdened and give large errors.

Multifunction Meter MFM2160 should be conveniently located for easy connections of voltage (PT) and Current (CT) signals.

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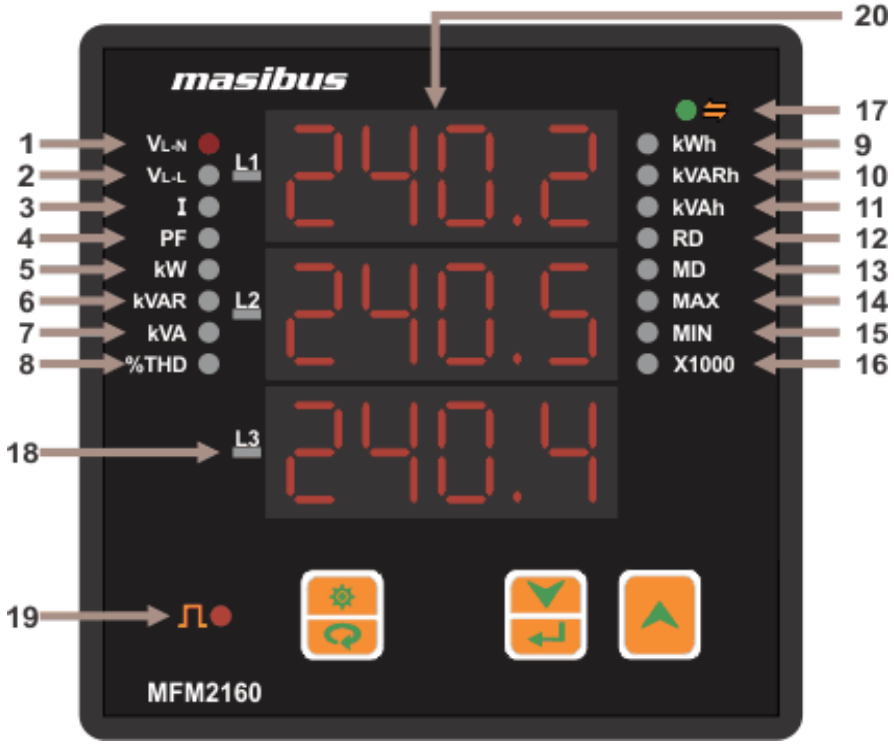
6. FRONT PANEL DESCRIPTION

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 ⎍	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.

7.1 Run mode Display

Line to Neutral Voltage (V L-N)

Displays line to neutral Voltage of three phases.

1st Row: Shows R Phase VLN (e.g., 240.2 V)
2nd Row: Shows Y Phase VLN (e.g., 240.5 V)
3rd 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.

1st Row: Shows R-Y VLL (e.g., 415.7 V)
2nd Row: Shows Y-B VLL (e.g., 415.6 V)
3rd Row: Shows B-R VLL (e.g., 415.6 V)

Line Current (Ampere)

Displays phase current of three phases.

1st Row: Shows R Phase Current (e.g., 5.000 A)
2nd Row: Shows Y Phase Current (e.g., 4.999 A)
3rd 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.

1st Row: Shows R Phase PF (e.g., 0.499)
2nd Row: Shows Y Phase PF (e.g., 0.500)
3rd 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.

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

Reactive Power (kVAR)

Displays reactive power (KVAR) of three phases.

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

Apparent Power (kVA)

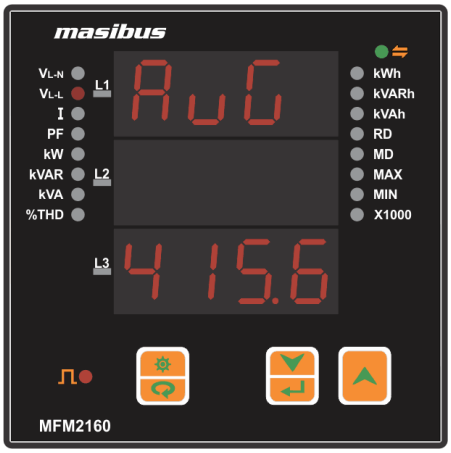
Displays apparent power (KVA) of three phases.

1st Row: Shows R Phase Apparent Power (e.g., 1.200 kVA)
2nd Row: Shows Y Phase Apparent Power (e.g., 1.200 kVA)
3rd Row: Shows B Phase Apparent Power (e.g., 1.200 kVA)

Average Line to Neutral Voltage (VL-N)

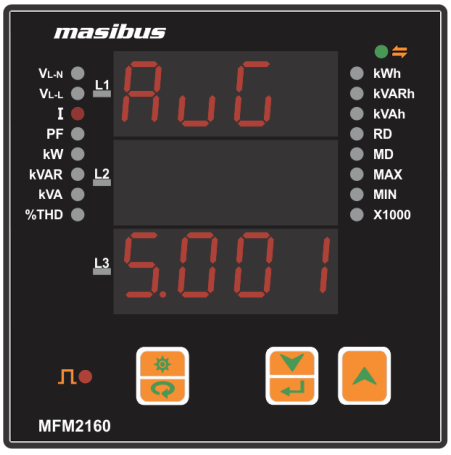
Displays average of line to neutral voltage.
(e.g.: 239.9 V)

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)

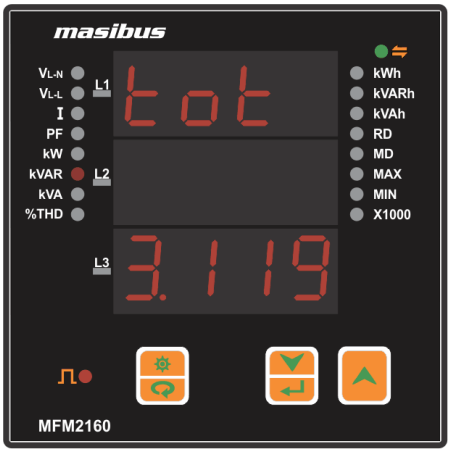
Displays Average of Power factor.
(e.g.: 0.499 PF)

If the **first digit** of the 3rd line shows **"L"**, it indicates the power factor is **Inductive (Lagging)**.
If the **first digit** of the 3rd line shows **"C"**, it indicates the power factor is **Capacitive (Leading)**.

Total Active Power (kW)

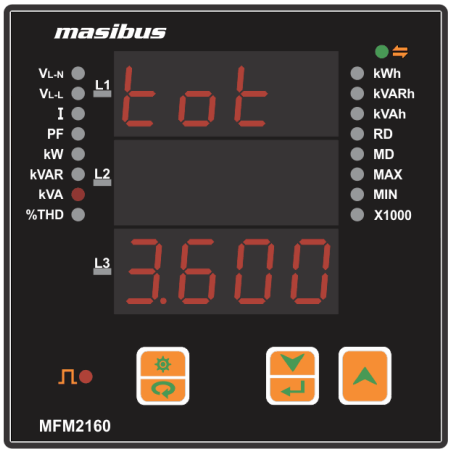
Displays Total of Active power (KW).
(e.g.: 1.799 kW)

Total Reactive Power (kVAR)



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

Total Apparent Power (kVA)



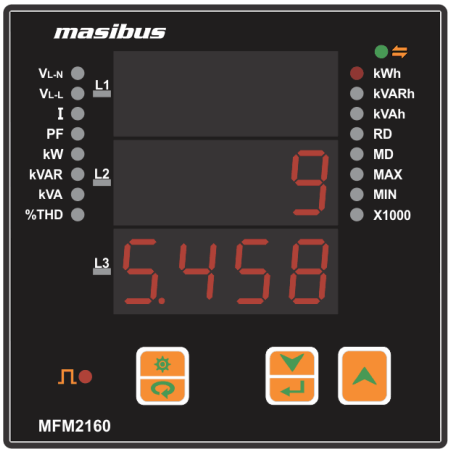
Displays Total of Apparent power (KVA).
(e.g.: 3.600 kVA)

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

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

1st Row: Shows Total Active Power (e.g., 1.799 kW)
2nd Row: Shows Total Reactive Power (e.g., 3.119 kVAR)
3rd 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)

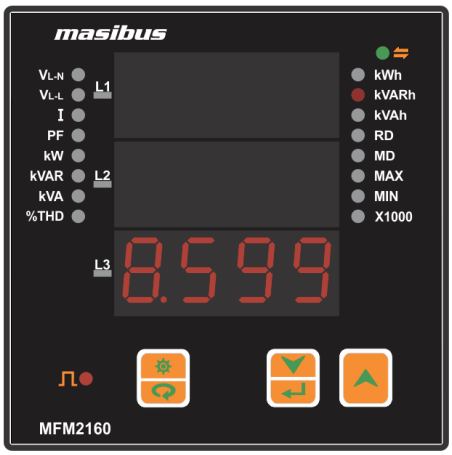
Reactive import energy (kVARh)

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)

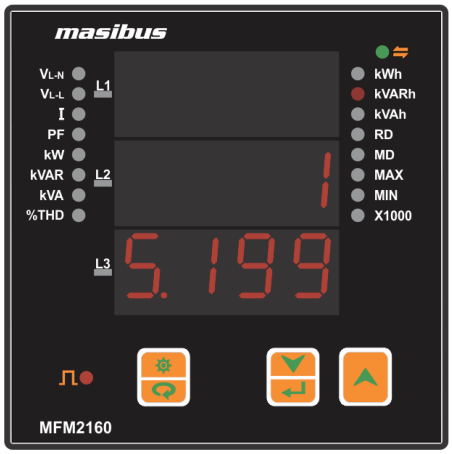
Reactive Lag energy (KVARh)



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.

1st Row: Shows R Phase V THD (e.g., 17.34 %)
2nd Row: Shows Y Phase V THD (e.g., 15.49 %)
3rd Row: Shows B Phase V THD (e.g., 11.49 %)

THD (Current)

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

1st Row: Shows R Phase I THD (e.g., 0.345 %)
2nd Row: Shows Y Phase I THD (e.g., 0.345 %)
3rd Row: Shows B Phase I THD (e.g., 0.355 %)

Rising Demand (Power)

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

1st Row: Shows Rising Demand of Active Power (e.g., 0.236 kW)
2nd Row: Shows Rising Demand of Reactive Power (e.g., 0.410 kVAR)
3rd 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.

1st Row: Shows Maximum Demand of Active Power (e.g., 1.286 kW)
2nd Row: Shows Maximum Demand of Reactive Power (e.g., 2.450 kVAR)
3rd 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.

1st Row: Shows Rising Demand of Average Current (e.g., 1.850 A)
3rd Row: Shows Maximum Demand of Average Current (e.g., 4.450 A)

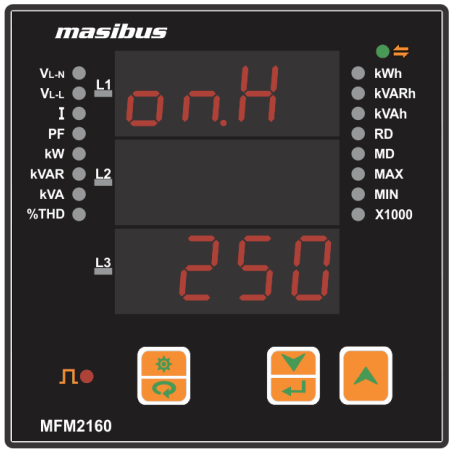
Voltage Unbalance (%)

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

Current Unbalance (%)

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

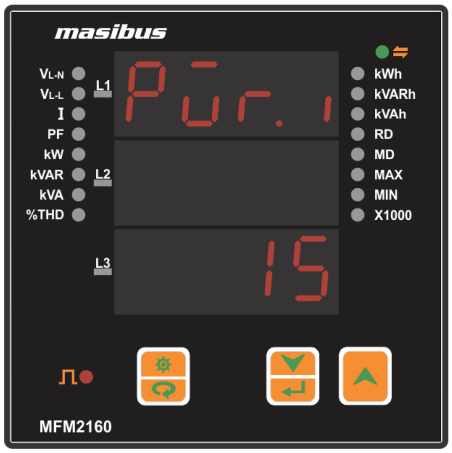
On hour



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.

1st Row: Shows Maximum value of R phase VLN (e.g., 240.8 V)
2nd Row: Shows Maximum value of Y phase VLN (e.g., 240.6 V)
3rd 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.

1st Row: Shows Maximum value of R phase VLN (e.g., 165.4 V)
2nd Row: Shows Maximum value of Y phase VLN (e.g., 165.6 V)
3rd 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

2nd Row: Shows Maximum Value of Average VLN (e.g., 245.4 V)
3rd 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.

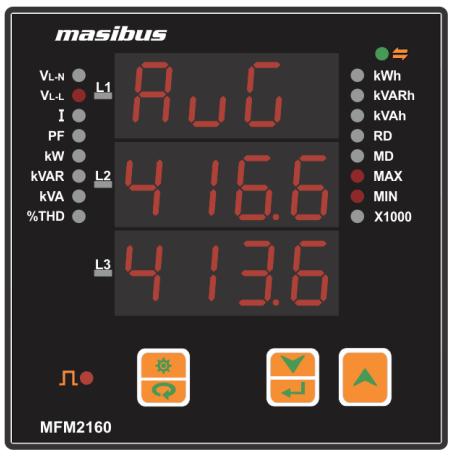
1st Row: Shows Maximum Value of R-Y VLL (e.g., 415.2 V)
2nd Row: Shows Maximum Value of Y-B VLL (e.g., 415.1 V)
3rd Row: Shows Maximum Value of B-R VLL (e.g., 415.9 V)

Min Voltage (VL-L)

Displays Minimum line to line voltage of three phases.

1st Row: Shows Minimum Value of R-Y VLL (e.g., 411.7 V)
2nd Row: Shows Minimum Value of Y-B VLL (e.g., 412.5 V)
3rd 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.

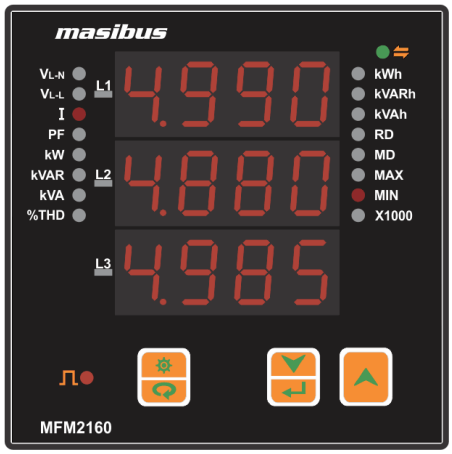
2nd Row: Shows Maximum Value of Average VLL (e.g., 416.6 V)
3rd Row: Shows Minimum Value of Average VLL (e.g., 413.6 V)

Max Current (Ampere)

Displays Maximum phase current of three phases.

1st Row: Shows Maximum value of R phase current (e.g., 5.002 A)
2nd Row: Shows Maximum value of Y phase current (e.g., 4.999 A)
3rd Row: Shows Maximum value of B phase current (e.g., 5.001 A)

Min Current (Ampere)



Displays Minimum phase current of three phases.

1st Row: Shows Maximum value of R phase current (e.g., 4.990 A)
2nd Row: Shows Maximum value of Y phase current (e.g., 4.880 A)
3rd 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.

2nd Row: Shows Maximum Value of Average Current (e.g., 5.002 A)
3rd Row: Shows Minimum Value of Average Current (e.g., 4.995 A)

Max - Min Frequency (Hz)

Displays maximum and Minimum of system frequency.

2nd Row: Shows Maximum Value of System Frequency (e.g., 49.99 Hz)
3rd 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.

2nd Row: Shows Maximum Value of Lead PF (e.g., 0.995)
3rd 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.

2nd Row: Shows Maximum Value of Lag PF (e.g., 0.992)
3rd Row: Shows Minimum Value of Lag PF (e.g., 0.990)

Max Active Power (kW)

Displays Maximum active power of three phases.

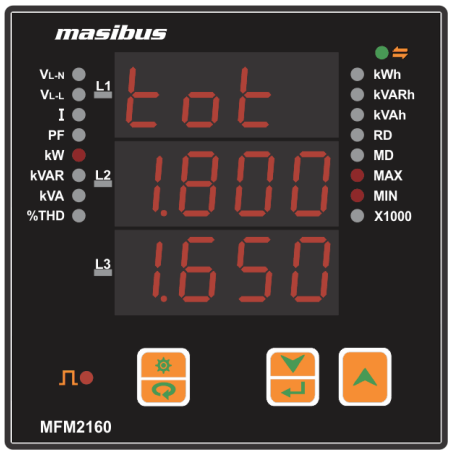
1st Row: Shows Maximum Value of R-Phase Active Power (e.g., 1.200 kW)
2nd Row: Shows Maximum Value of Y-Phase Active Power (e.g., 1.260 kW)
3rd Row: Shows Maximum Value of B-Phase Active Power (e.g., 1.250 kW)

Min Active Power (kW)

Displays Minimum active power of three phases.

1st Row: Shows Minimum Value of R-Phase Active Power (e.g., 0.599 kW)
2nd Row: Shows Minimum Value of Y-Phase Active Power (e.g., 0.600 kW)
3rd 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.

2nd Row: Shows Maximum Value of Total Active Power (e.g., 1.800 kW)
3rd Row: Shows Minimum Value of Total Active Power (e.g., 1.650 kW)

Max Reactive Power (kVAR)

Displays Maximum reactive power of three phases.

1st Row: Shows Maximum Value of R-Phase reactive Power (e.g., 1.250 kVAR)
2nd Row: Shows Maximum Value of Y-Phase reactive Power (e.g., 1.280 kVAR)
3rd 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.

1st Row: Shows Minimum Value of R-Phase reactive Power (e.g., 0.540 kVAR)
2nd Row: Shows Minimum Value of Y-Phase reactive Power (e.g., 0.600 kVAR)
3rd 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.

2nd Row: Shows Maximum Value of Total Reactive Power (e.g., 1.700 kVAR)
3rd Row: Shows Minimum Value of Total Reactive Power (e.g., 1.450 kVAR)

Max Apparent Power (kVA)

Displays Maximum apparent power of three phases.

1st Row: Shows Maximum Value of R-Phase apparent Power (e.g., 1.199 kVA)
2nd Row: Shows Maximum Value of Y-Phase apparent Power (e.g., 1.195 kVA)
3rd 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.

1st Row: Shows Minimum Value of R-Phase apparent Power (e.g., 0.640 kVA)
2nd Row: Shows Minimum Value of Y-Phase apparent Power (e.g., 0.650 kVA)
3rd 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.

2nd Row: Shows Maximum Value of Total Apparent Power (e.g., 1.800 kVA)
3rd Row: Shows Minimum Value of Total Apparent Power (e.g., 1.730 kVA)

Massage 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 Massage 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

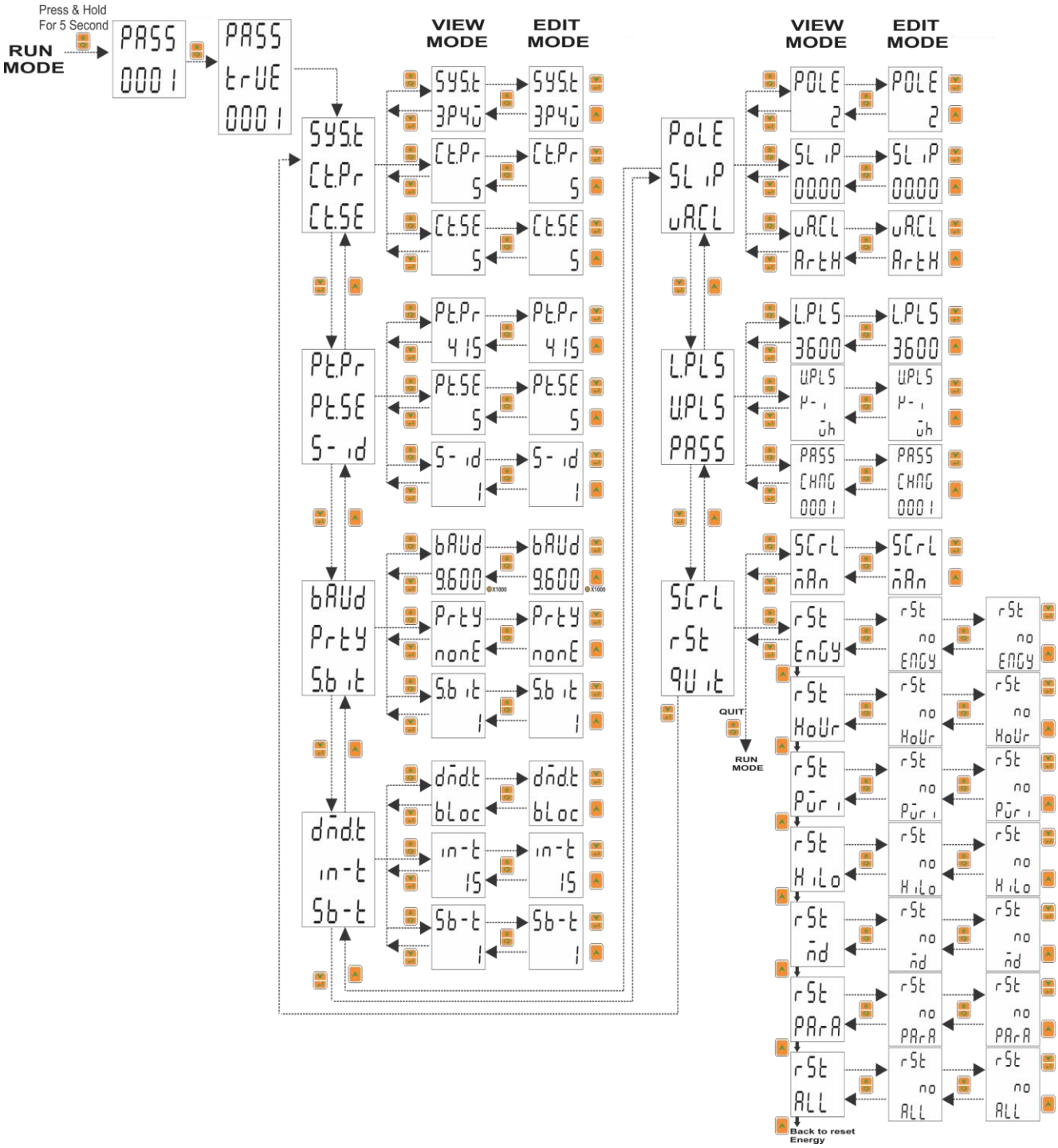
Press & Hold the ENTER key to 5 sec to enter into Configuration Mode.
The password screen will appear where you need to enter the password. If the password is correct, you will gain access to Configuration Mode; otherwise, you cannot proceed.
Once in Configuration Mode, a selection bar will appear. You 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	SYS .t	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, 19200,38400	9600
8	PrtY	Parity Bit	None, odd, even	None
9	S .b it	Stop Bit	1 or 2	1
10	dmd .t	Demand type	Block, Slide	Block
11	IN-t	Interval Time (Min)	1-60	15
12	Sb-t	Sub Interval Time (Min)	1-60	1
13	POLE	Pole	2 - 48	2
14	SL IP	Slip (%)	00.00 – 99.99	00.00
15	uA .CL	VA Calculation Method	Arithmetic or Vector	Arithmetic
16	L .PLS	Pulse Constant	100 - 60000	3600
17	U .PLS	Pulse Unit	KWh (Imp – Exp), KVARh (Imp – Exp), KVAh (Imp – Exp), MWh (Imp – Exp), MVARh (Imp – Exp), MVAh (Imp – Exp)	Kwh (Imp)
18	PASS	Password change	0001-9999	0001
19	SCrL	Display Scroll	Auto, Manual	Manual
20	rSt	Reset		
20.1	EnGY	Reset energy*	No / Yes	No
20.2	HoUr	Reset on and load hour	No / Yes	No
20.3	PUr i	Reset Power interruption count	No / Yes	No
20.4	H iLo	Reset Max – Min Values	No / Yes	No
20.5	md	Reset Maximum demand	No / Yes	No
20.6	PArA	Reset Parameters**	No / Yes	No
20.7	ALL	Reset ALL***	No / Yes	No
21	QU it	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
Registers for Energy Parameters						
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
Phase Wise Energy Registers						
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
Registers for Current harmonics						
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
Registers for Voltage harmonics						
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_Iavg	Rising/Present demand of Average Current	Ampere	2	R
8	30627	MD_Iavg	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-Im)	Old Reactive Energy - Inductive import (Q1)	KVArh	2	R
14	30677	Old_KVArh (C-Im)	Old Reactive Energy - Capacitive import (Q2)	KVArh	2	R
15	30679	Old_KVArh (L-Ex)	Old Reactive Energy - Inductive export (Q3)	KVArh	2	R
16	30681	Old_KVArh (C-Ex)	Old Reactive Energy - Capacitive export (Q4)	KVArh	2	R
17	30683	Old_KVArh (L-Tot)	Old Reactive Energy Lag Total	KVArh	2	R
18	30685	Old_KVArh (C-Tot)	Old Reactive Energy Lead Total	KVArh	2	R
Registers for Min-Max Parameters - It will record the Min and Max values from the last reset.						
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 (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 (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 (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. (Refer table 2)	79	85	1	
26	40135	Voltage Display on Modbus (0 – Volt, 1 – Kilovolt)	0	1	1	0
27	40136	Power Display on Modbus (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
32001	Assigned register #2001	Swapped Float
32003	Assigned register #2003	Swapped Float
32005	Assigned register #2005	Swapped Float
…	…	…
32119	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
40301	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
40302	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
40303	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 Primary * PT Primary * Pulse Constant in Wh)/3600 <= 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.