



Multifunction Meter

INTRODUCTION

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 multi-line backlit LCD display allows for the simultaneous display of four parameters. MFM2160 provides RS485 port supporting Modbus-RTU protocol for communication with THD, Individual Harmonics measurements, Maximum Demand, RTC, Min-Max readings. More than basic metering, it optionally provides Energy pulse output and Data logging features. The MFM2160 can interface with mLogiView software, allowing users to Configure parameters such as system settings and data logging, and retrieve logged data through the software.

Features

- Available in Accuracy Class 1.0 and Class 0.5s and Class 0.2s
- True RMS measurement
- Four-line alphanumeric LCD display with 7 digits for energy and 5 digits for instantaneous parameters
- Field Programmable CT/PT Primary & Secondary
- Four Quadrant measurements with identification
- 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 odd harmonics
- Current and power demand monitoring
- Display of minimum and maximum values
- ‘OLD’ register to store previously cleared energy value
- Monitors Run hours & On hours
- Auto Scaling from Kilo to Mega to Giga
- 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
- Energy Pulse output & Data logging - optional

Specification

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

Input Voltage	
Measuring Voltage range	20VL-N to 300VL-N (34VL-L to 520VL-L)
PT(VT) Rating Primary	100 V to 2000 KV AC (L-L) (Programmable)
Nominal Voltage range (Un) (PT/VT Secondary)	57.5VL-N to 300VL-N (100VL-L to 520VL-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 / 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
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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% 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 & 0.5s & 0.2s as per IEC 62053-24
Apparent Energy	Class 1.0 & Class 0.5s & Class 0.2s

Display	
LCD	Large multi-line backlit LCD Display 3 lines of 5 digits – Height: 9.10 x Width: 5.33 mm last line of 7 digits – Height: 7.00 x Width: 3.97mm Bar Graph for % Load for each phase
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	RS485 Communication Activity Indication
Red LED	Energy Pulse Indication

Modbus Communication	
Interface & Protocol	RS485 Port and Modbus RTU: 2 Wires, Half-duplex

Baud rate	2400, 4800, 9600, 19200, 38400 bps (default 9600 bps)
Parity bit & Stop bit	None with 1 or 2 stop bit, Odd or Even with 1 or 2 stop bit
Firmware update	Firmware update through communication port

Energy Pulse Output - Optional	
Type	Wh / VARh / VAh
Rating	24VDC, 20mA
Pulse rate	Programmable from 100 to 60000 pulses per Energy
Pulse duration	20 msec ± 10%
Output Type	Open collector [External Excitation Required]

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 U-type / ring-type termination: maximum up to 4 mm² Cable

Demand Parameters	
Total Active Power Demand	Rising, Maximum and Maximum Demand Time Stamp
Total Reactive Power Demand	Rising, Maximum and Maximum Demand Time Stamp
Total Apparent Power Demand	Rising, Maximum and Maximum Demand Time Stamp
Average Current Demand	Rising, Maximum and Maximum Demand Time Stamp
Demand Intervals	Programmable from 1 to 60 minutes.
Demand Calculation Method	Block & Sliding
Demand Sync. Method	RTC based Sync

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

Data Logging – Optional	
Method	Periodic Time based, Load Profile based
Time Interval	1min, 5min,10min,15min, 30min, 45min, 60min, 8h,12h, 24h.
Parameters (Programmable up to 34 Parameters)	Voltage, Current, Power Factor, Frequency, Total Power & Energy (Active, Reactive, Apparent) with Time stamp Only Set through communication
No. of Records	524288 / ((No of Parameters +2) * 8)

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

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

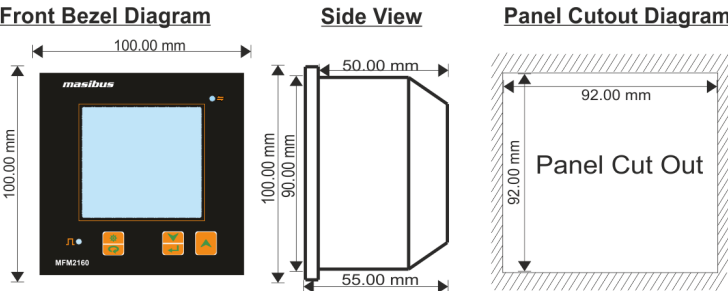
All wiring must confirm appropriate standards of good practice and local codes and regulations. Wiring must be suitable for voltage, current, and temperature rating of the system. Ensure that all incoming AC power and other power sources are turned OFF before performing any work on the instrument. Protect 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 an instrument to a power source if it is damaged. To prevent a 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 an 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.

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.



Terminal Description



Terminal details

AUX Supply: -

- L/ + (Line): Aux. Power Supply Input
- N/ – (Neutral): Aux. Power Supply Input

Pulse Output: -

- OP+: Positive Pulse output line
- OP-: Negative Pulse output line

Voltage Input: -

- VR: R Phase voltage terminal
- VY: Y Phase voltage terminal
- VB: B Phase voltage terminal
- VN: Neutral voltage terminal

RS 485: -

- D+: Positive data line
- D -: Negative data line

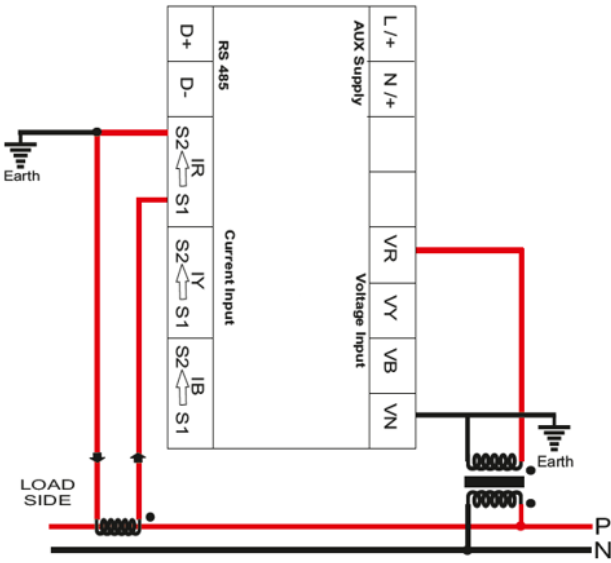
Current Input: -

- IR(S1): Current In R phase
- 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

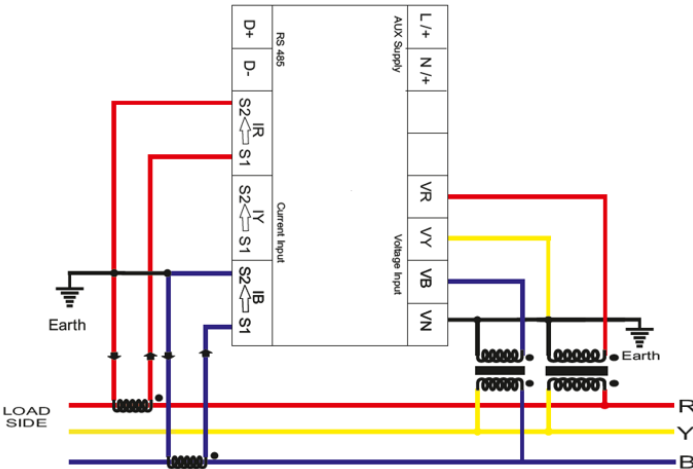
Wiring Diagram

1) Single Phase Two Wire System

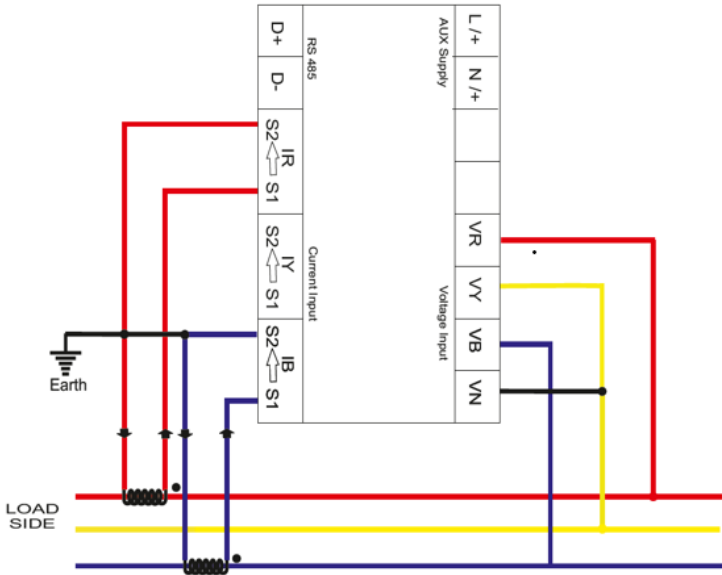


2) Three Phase Three Wire System

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

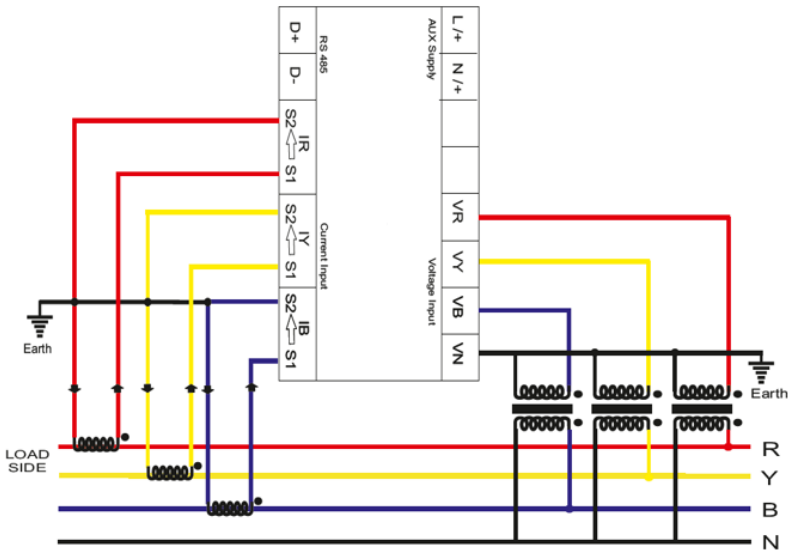


2B) 3-Wire 2- Element Direct Connection Using 2CTs

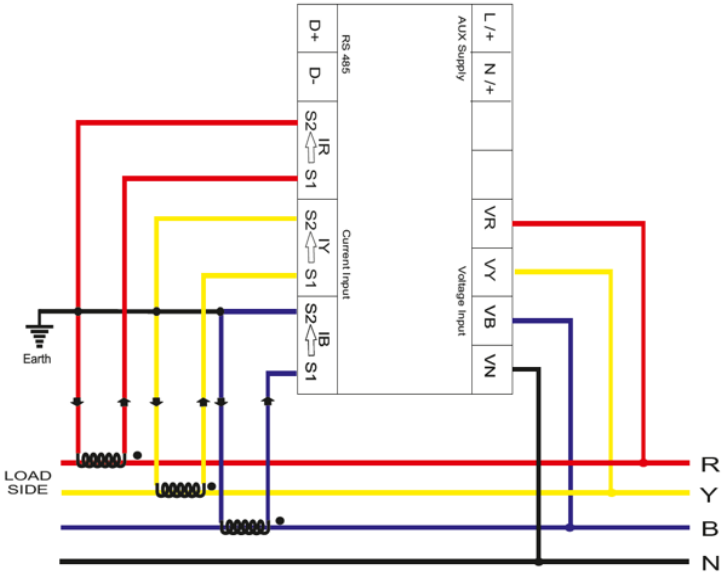


3) Three Phase Four Wire System

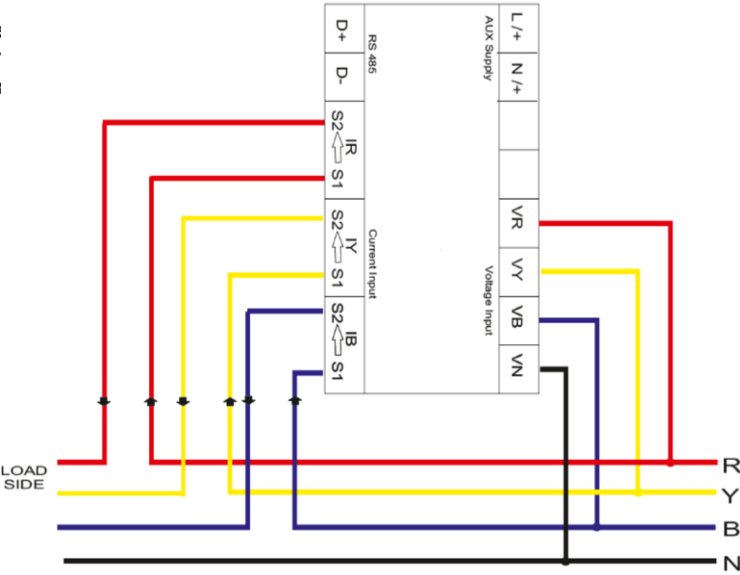
3A) 4-Wire Wye-3 Element Connection Using 3PTs, 3CTs



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

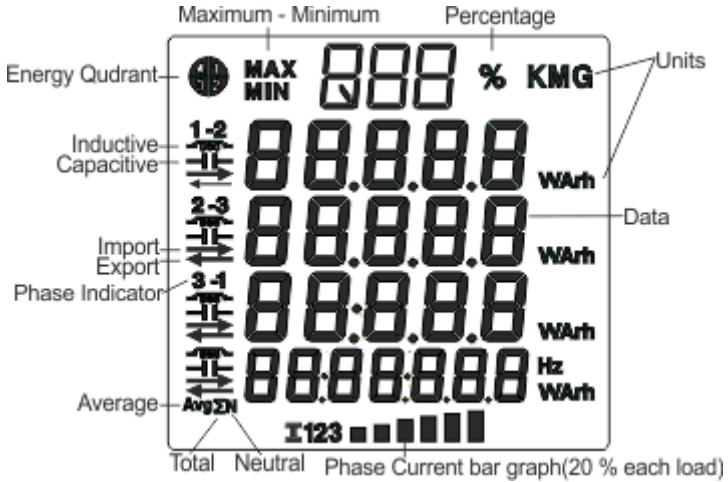


3C) 4-Wire Direct Connection



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

Front Panel Description



Enter Key

Run Mode:

- ❖ Press the key to enter into Configuration Mode.

Configuration Mode:

- ❖ Press the key to enter into edit mode, scroll mode, reset mode, run mode, backlight mode, data logging mode and for Quit from configuration mode.
- ❖ 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.
- ❖ Hold the key for 5 seconds to navigate to the Maximum-Minimum pages.
- ❖ If already in the Maximum-Minimum pages, holding 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 View Mode.



INC Key

Run Mode:

- ❖ Press the key to move to the next page in the downward direction.
- ❖ 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.

Run Mode - Meter Navigation		
Page no	Parameter	Parameter description
1	Voltage(L-N)	Displays line to neutral Voltage of three phases and average.
2	Voltage(L-L)	Displays line to line voltage of three phases and average.
3	Ampere	Displays phase current of three phases and Average current.
4	Neutral Current	Displays neutral current.
5	Frequency	Displays system frequency.
6	Power factor	Displays Power factor of Three phase and System Power factor.
7	Active Power(P)	Displays active power of three phases and total active power.
8	Reactive Power(Q)	Displays reactive power of three phases and total reactive power.
9	Apparent Power(S)	Displays apparent power of three phases and total apparent power.
10	P, Q,S Total power	Displays Total of Active power, Reactive power, Apparent power.
11	Phase 1 (V, A,PF,W)	Displays voltage, current, power factor and Active power of first phase(R).
12	Phase 2 (V, A,PF,W)	Displays voltage, current, power factor and Active power of Second phase(Y).
13	Phase 3 (V, A,PF,W)	Displays voltage, current, power factor and Active power of Third phase(B).
14	Average (V, A,PF,W)	Displays average value of voltage, current, power factor and Total Active power.
15	Active import energy (Im)	Displays total import active energy of three phases.
16	Active export energy (ex)	Displays total export active energy of three phases.
17	Active Net energy (net)	Displays total net active energy of three phases.
18	Active Total energy (Total)	Displays total active energy of three phases.
19	Apparent import energy (Im)	Displays total import apparent energy of three phase.
20	Apparent export energy (ex)	Displays total export apparent energy of three phase.
21	Apparent Net energy (net)	Displays total net apparent energy of three phase.
22	Apparent Total energy (Total)	Displays total apparent energy of three phase.
23	Reactive import energy (Im)	Displays total import reactive energy of three phase.
24	Reactive export energy (ex)	Displays total export reactive energy of three phase.
25	Reactive Lag energy	Displays total Lag reactive energy of three phase.
26	Reactive Lead energy	Displays total Lead reactive energy of three phase.
27	Reactive Net energy (net)	Displays total net reactive energy of three phase.
28	Reactive Total energy (Total)	Displays total reactive energy of three phase.
29	Reactive Energy Import (Q1) (Inductive)	Displays Total Inductive (Q1) Import reactive energy.

30	Reactive Energy Import (Q2) (Capacitive)	Displays Total Capacitive (Q2) Import reactive energy.
31	Reactive Energy Export (Q3) (Inductive)	Displays Total Inductive (Q3) Export reactive energy.
32	Reactive Energy Export (Q4) (Capacitive)	Displays Total Capacitive (Q4) Export reactive energy.
33	Rising Demand	Displays Rising Demand of active power, reactive power, apparent power and average Current.
34	Maximum Demand (W)	Displays maximum Active power demand with Time & date stamp
35	Maximum Demand (VAr)	Displays maximum Reactive power demand with Time & date stamp
36	Maximum Demand (VA)	Displays maximum Apparent power demand with Time & date stamp
37	Maximum Demand (A)	Displays maximum Current demand with Time & date stamp
38	Voltage and Current unbalance	Displays Voltage and Current unbalance.
39	Phase angle	Displays Phase angle between Voltage and current of Three phase.
40	THD (Voltage)	Displays Total harmonics distortion of voltage of three phase.
41	THD (Current)	Displays Total harmonics distortion of Current of three phase.
42	On hour & Run hour	Displays on hour and run hour.
43	Power interruption count	Displays power interruption Count
44	Communication Information	Displays Communication Information about slave id, Stop bit, Parity bit, Baud rate.
45	RTC	Displays Real time clock
46	RPM	Displays Rpm which is based on System frequency.
47	Data log	Displays data log records and no. of days left to memory full. Or IF Data logging memory is full, display shows full memory indication

Percentage bar for phase-wise line current

The percentage graph will always be displayed in the footer along with other displays, cycling through phase 1 line current, phase 2 line current, and phase 3 line current. **The bar represents 20%, 40%, 60%, 80%, 100%, and 120% of Imax.**

Note:

- ✓ **Current always in ampere.**
- ✓ **Data log page only displays when you Start Data logging. Otherwise, it's not showing.**
- ✓ **Device run on 3P3W then Y phase current, Voltage(L-N), Phase 1((V, A, PF, W) , Phase 2((V, A, PF, W) , Phase 3((V, A, PF, W) will not show on display.**

Maximum – Minimum 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.

Page no	Parameter	Parameter description
1	Max Voltage (L-N)	Displays Maximum line to neutral Voltage of three phase and Maximum average line to neutral voltage.
2	Min Voltage (L-N)	Displays Minimum line to neutral Voltage of three phase and Minimum average line to neutral voltage.
3	Max Voltage (L-L)	Displays Maximum line to line voltage of three phase and Maximum average line to line voltage.
4	Min Voltage (L-L)	Displays Minimum line to line voltage of three phase and Minimum average line to line voltage.
5	Max Ampere	Displays Maximum phase current of three phase and Maximum Average current.
6	Min Ampere	Displays Minimum phase current of three phase and Minimum Average current.
7	Max Frequency	Displays maximum system frequency.
8	Min Frequency	Displays Minimum System Frequency.
9	Max Capacitive Power factor	Displays Maximum Capacitive Power factor of Three phase and Maximum Capacitive average Power factor.
10	Min Capacitive Power factor	Displays Minimum Capacitive Power factor of Three phase and Minimum Inductive average Power factor.
11	Max Inductive Power factor	Displays Maximum Inductive Power factor of Three phase and Maximum Inductive average Power factor.
12	Min Inductive Power factor	Displays Minimum Inductive Power factor of Three phase and Minimum Inductive average Power factor.
13	Max Active Power(P)	Displays Maximum active power of three phase and Maximum total active power
14	Min Active Power(P)	Displays Minimum active power of three phase and Minimum total active power
15	Max Reactive Power(Q)	Displays Maximum reactive power of three phase and Maximum total reactive power.
16	Min Reactive Power(Q)	Displays Minimum reactive power of three phase and Minimum total reactive power.
17	Max Apparent Power(S)	Displays Maximum apparent power of three phase and total Maximum apparent power
18	Min Apparent Power(S)	Displays Minimum apparent power of three phase and total Minimum apparent power

S.NO	Display	Function	Range or selection	Default
1	CTPr	CT Primary	1A /5A -15000A	5A
2	CTSEc	CT Secondary	1A or 5A	5A
3	PTPr1	PT Primary	100V - 2000KV	415V
4	PTSEc	PT Secondary	100V - 520V	415V
5	Slave ID	Slave ID	1 - 247	1
6	Baud	Baud rate	2400,4800,9600, 19200,38400	9600
7	Parity Bit	Parity Bit	None, odd, even	None
8	Stop Bit	Stop Bit	1 or 2	1
9	Password	Password	0001-9999	1
10	System	System	3p3w,3p4w	3p4w
11	Time	Time	HH: MM: SS	-
12	Date	Date	DD: MM: YY	-
13	Demand type	Demand type	Block, Slide	Block
14	Interval Time	Interval Time	1-60	15
15	Sub Interval Time	Sub Interval Time	1-60	1
16	RPM	RPM		-
16.1	Pole	Pole	2 - 48	2
16.2	Slip	Slip	00.00 – 99.99	00.00
17	VA Calculation Method	VA Calculation Method	Arithmetic or Vector	Arithmetic
18	Pulse Output	Pulse Output		-
18.1	Constant	Constant	100 - 60000	3600
18.2	Unit	Unit	Wh / VARh / VAh	Kwh (Imp)

Scroll Mode:

- ❖ Press the DEC key to move the selection bar to Scroll Mode.
- ❖ Press ENTER key to enter into scroll mode.
- ❖ Press ENTER key to switch between Manual Scroll and Auto Scroll.
- ❖ In Auto Scroll, pages will change automatically one by one.
- ❖ In Manual Scroll, pages will change only when the INC or DEC key is pressed.
- ❖ To view the next page, press the DEC key. To view the previous page, press the INC key.

Reset Mode:

- ❖ Press the INC key to move the selection bar to Reset Mode.
- ❖ Press ENTER key to enter into Reset Mode.

In this mode, you can reset the following parameters:

- Energy
- Hour (On and Run Hour)
- Power Interruption Count
- Max-Min Values
- Maximum Demand

- Configuration Parameters
- Reset All

By default, the selection bar will be on Energy Reset.

- ❖ Press ENTER key, and the device will prompt: “Yes“ or “NO”.
- ❖ If select yes, then particular parameter will be reset & if Select no then parameter will be not reset.
- ❖ If yes, move the selection bar to YES and press ENTER key to reset.
- ❖ If no, move the selection bar to NO and press ENTER key.
- ❖ After resetting Energy, the value will become zero, and the previous value will be stored in the Old Energy Register,
- ❖ Accessible via Modbus communication also.
- ❖ Use the INC and DEC keys to select other parameters.
- ❖ If All is selected, all parameter values will reset to zero.
- ❖ For exit from Reset mode press enter key on Quit.

Run Mode:

- ❖ Press the INC key to move the selection bar to Run Mode.
- ❖ Press ENTER key to enter Run Mode.
- ❖ In Run Mode, Configuration Mode will be turned off. To return to Configuration Mode, you must re-enter the password.

Backlight Mode:

- ❖ Press the INC key to move the selection bar to Backlight Mode.
- ❖ Press ENTER key to enter into backlight mode.
- ❖ Press ENTER key to toggle between Backlight ON and Backlight AUTO.
- ❖ Backlight ON: The backlight always remains on.
- ❖ Backlight AUTO: The backlight turns off automatically if no key is pressed within 1 minute. Press any key to turn it on again.

Data logging Mode:

In Data Logging mode, **mLogiView** software allows you to choose the parameters to log, configure the logging interval and method, and retrieve the recorded data easily.

- ❖ Press the INC key to move the selection bar to Data logging mode.
- ❖ Press Enter key to configure data logging parameters.

In this mode, must set following data logging parameters.

S.No.	Display	DL Parameters	Selection	Default
1	DL Method	Data logging method	Periodic or load profile	Periodic
2	Interval Time	Interval Time	1,5,10,15,30,45,60 Min 8,12,24 Hr	15 Min
3	Memory status	Memory status	(Overwrite) Yes or No *	No
4	Logging	Logging	Start or stop	Stop

- ❖ In data logging method must select Periodic method or load profile method by using INC or DEC key.
- ❖ Press enter key to save data logging method.
- ❖ In Interval Time have to select time (1, 5, 10, 15, 30, 45, 60) Min (8,12,24) Hour by using INC or DEC key,
- ❖ Press enter key to save Interval time.

FOR, exit from Interval time must press DEC key.

- ❖ In Memory status, when logging memory is Not full Then cannot edit overwrite option.

- ❖ In memory status, when logging memory is full then can edit overwrite option, when selecting yes then logging memory is overwritten and if you want previous data must ensure to retrieve data before selecting yes, otherwise you cannot retrieve data. When, selecting no then logging memory is not overwritten.

FOR, exit from Memory status must press DEC key.

- ❖ In Logging must select start and stop logging by using INC or DEC key.
- ❖ Press Enter key to save selection.
- ❖ For exit from Data logging mode press enter on Quit.

Quit:

- ❖ Press the INC key to move the selection bar to Quit.
- ❖ Press ENTER key to exit Configuration Mode.

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
	2	Class 0.2s								

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

For operation manual please visit www.masibus.com

Specifications are subject to change without notice due to Continuous improvements.

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