

OPERATING INSTRUCTIONS

MFM309/MFM309-S/MFM309-60Hz



96 x 96

FEATURES

- Measures all power parameters (RMS values of voltage, current, active power, reactive power, apparent power, power factor, frequency)
- Programmable CT primary
- 3 lines, 3 digits per line, LED display
- Auto / Manual page scrolling
- Universal auxiliary supply

SPECIFICATIONS

Display

3 lines, 3 digits per line,
7 segment red LED display, Digit height 0.5"

Display Update Time

2 sec

Electrical Input Type

3 phase - 4 wire and Single phase

Rated input voltage

Line to Neutral : 350 VAC max (25 VAC min)

Rated Input Current

Nominal 5A AC (0.1A min.)
(External CT required to be connected for MFM309-S model)

Auxiliary Supply

90 to 270 VAC/DC, 50 / 60 Hz

Input Frequency

MFM309 : 50 Hz
MFM309-60 Hz : 60 Hz
MFM309-S : 50/60 Hz

Burden

0.2 VA max. @ 5A per phase
0.5 VA max. @ 5A per phase (for MFM309-S model)

CT Primary

Programmable from 5 to 5000

Resolution

Parameters	CT Primary	Resolution
Current	≤ 10	0.01A
	>10 and ≤ 100	0.1A
	>100 and ≤ 1000	1A
	>1000	0.01 kA (K-LED will glow)
kVA / kW / kVAr	≤ 10	0.01k
	>10 and ≤ 400	0.1k
	>400 and ≤ 2800	1k
	>2800	0.01M

Parameters measured/calculated:

Parameters	Measured Values	Unit
Voltage	V_{L-N} , V_{L-L} , Avg $V_{2\phi}$, Avg $V_{3\phi}$	V
Current	I_1 , I_2 , I_3 , I_{avg}	A
Active Power	kW ₁ , kW ₂ , kW ₃	W
Reactive Power	kVar ₁ , kVar ₂ , kVar ₃	VAr
Apparent Power	kVA ₁ , kVA ₂ , kVA ₃	VA
Power Factor	PF ₁ , PF ₂ , PF ₃ , Avg PF	-
Frequency	Hz	Hz

Accuracy Table:

Measurement	Accuracy
Voltage V_{L-N}	$\pm 0.5\%$ of F.S. + 1 digit
Voltage V_{L-L}	$\pm 1\%$ of F.S. + 1 digit
Average Voltage $V_{2\phi}$	$\pm 0.5\%$ of F.S. + 1 digit
Average Voltage $V_{3\phi}$	$\pm 1\%$ of F.S. + 1 digit
Current	$\pm 1\%$ of F.S. + 1 digit

Average current	$\pm 1\%$ of F.S. + 1 digit
Frequency	$\pm 0.1\% \pm 0.1$ Hz
Active Power	$\pm 1\%$ of F.S. + 1 digit
Apparent Power	$\pm 1\%$ of F.S. + 1 digit
Reactive Power	$\pm 1\%$ of F.S. ± 2 digits
Power Factor & Avg PI	± 0.01 PF + 1 digit

NOTE:

The accuracy table is valid at respective operating frequencies only.

Temperature

Operating: 0 to 50 °C ; Storage: -20 to 75 °C

Humidity

95% non condensing

Mounting

Panel mounting

Weight

MFM309-S : 196 gms
MFM309 / MFM309-60Hz : 238 gms

SAFETY SUMMARY

All safety related codifications, symbols and instructions that appear in this operating manual or on the equipment must be strictly followed to ensure the safety of the operating personnel as well as the instrument. If the equipment is not handled in a manner specified by the manufacturer it might impair the protection provided by the equipment.

⚠ CAUTION: Read complete instruction prior to installation and operations of the unit.

⚠ CAUTION: Risk of electric shock.

WIRING GUIDELINES

⚠ CAUTION:

- To prevent the risk of electric shock power supply to the equipment must be kept OFF while doing the wiring arrangement.
- Wiring shall be done strictly according to the terminal layout. Confirm that all connections are correct.
- Use lugged terminals.
- To eliminate electromagnetic interference, use wires with adequate ratings and twists of the same in equal size shall be made.
- Cable used for connection to power source, must have a cross section of 1.5 mm². These wires shall have current carrying capacity of 5A.

MAINTENANCE

- The equipment should be cleaned regularly to avoid blockage of ventilating parts.
- Clean the equipment with a clean soft cloth . Do not use Isopropyl alcohol or any other cleaning agent.

INSTALLATION GUIDELINES

⚠ CAUTION:

- This equipment, being built-in-type, normally becomes a part of main control panel and in such case the terminals do not remain accessible to the end user after installation and internal wiring.
- Conductors must not come in contact with the internal circuitry of the equipment or else it may lead to a safety hazard that may in turn endanger life or cause electrical shock to the operator.
- Circuit breaker or mains switch must be installed between power source and supply terminals to facilitate power 'ON' or 'OFF' function. However this switch or breaker must be installed in a convenient position normally accessible to the operator.
- Before disconnecting the secondary of the external current transformer from the equipment, make sure that the current transformer is short circuited to avoid risk of electrical shock and injury.

⚠ CAUTION:

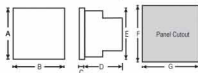
- The equipment shall not be installed in environmental conditions other than those mentioned in this manual.
- The equipment does not have a built-in-type fuse. Installation of external fuse of rating 275 VAC/1 A for electrical circuitry is highly recommended.
- Thermal dissipation of equipment is met through ventilation holes provided on chassis of equipment. Such ventilation holes shall not be obstructed else it can lead to a safety hazard.

MECHANICAL INSTALLATION:

For installing the meter

- Prepare the panel cutout with proper dimensions as shown below :

OVERALL DIMENSIONS (All dimensions in mm)



MODEL	OM	A	B	C	D	E	F	G
MFM309	99	99	5	46	91	92	92	92

2. Push the meter into the panel. Secure the meter in its place by pushing the clamp on the rear side. The screws of the panel of the clamp must be in the farthest forward slot.

CAUTION:

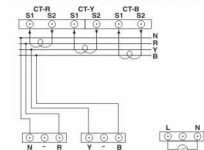
The equipment in its installed state must not come in close proximity to any heating sources, caustic vapours, oils, steam, or other unwanted process byproducts.

EMC Guidelines:

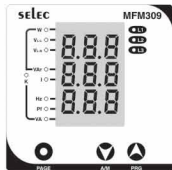
1. Use proper input power cables with shortest connections and twisted type.
2. Layout of connecting cables shall be away from any internal EMI source.

TERMINAL CONNECTIONS:

MFM 309 / MFM309-S / MFM309-60Hz



FRONT PANEL DESCRIPTION



LED	DESCRIPTION
K	Kilo
W	Active power
VL-L	Line to Line Voltage
VL-N	Line to Neutral Voltage
VAR	Reactive Power
I	Current
Hz	Frequency
Pf	Power Factor
VA	Apparent Power
L1	Line 1 or R- phase
L2	Line 2 or Y- phase
L3	Line 3 or B-phase

Key Description

Sl. No.	Functions	Key press
1	To scroll through the pages in forward direction in manual mode.	⬆ + ⬆ to next pages
2	To scroll through the pages in reverse direction in manual mode.	⬆ + ⬇ to previous pages
3	To toggle between auto/manual scrolling.	⬇ (A/M) for 3 sec
4	To enter in to configuration mode.	⬇ (A/M) + ⬆ (PRG) for 3 sec
5	To increase and decrease the CT Primary value.	⬆ + ⬆ Increase ⬆ + ⬇ Decrease

NOTE :

- 1) Continuous operation of ⬆ + ⬇/⬆ makes update speed faster in 3 stage after 7 seconds.
- 2) CT updates in steps of 5 after CT setting has reached to 100, in steps of 10 after CT setting has reached 1000. Eg : After 1000, the display increments to 1.01, 1.0101. Hence, to set CT primary as 1600, program 'CT' as 1.60

CONFIGURATION SCHEME

- 1) Continuous pressing ⬇ (A/M) + ⬆ (PRG) for 3 second initiates the programming mode.
- 2) Program settings are as given below:

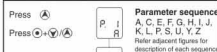
Key press	Display	Description
⬆ + ⬇/⬆	CT Primary	Default setting: <input type="text" value="5"/> Range: 5 to 5000 A
⬆ + ⬇/⬆	Display shows	When CT is 1000

2. To select no. of pages for display in auto mode

Default setting:



3. To select parameter sequence for different pages



NOTE : The parameter sequence is to be selected from A...Z for each page.

For eg : if the user wants to display 7 pages to display the parameter sequences A (Line to Line-Voltages), C (Current of each phase), E, F, J (Voltage of each phase), K (PF of each phase), L (kW of each phase) consecutively, the following programming sequence must be followed :
Operation mode : AUTO
No. of pages (PGS) - 7
Parameter sequence for -
Page 1 : A, Page 2 : C, Page 3 : E, Page 4 : F
Page 5 : J, Page 6 : K, Page 7 : L

NOTE :

- 1) Press ⬇ (A/M) + ⬆ (PRG) for 3 seconds to come out of programming.
- 2) The unit will auto exit program mode after 60 seconds of inactivity.

DISPLAY PARAMETER PAGE DESCRIPTION

There are two methods to scroll through the different parameters on the display.
1) Auto mode
2) Manual mode
Auto mode:
In auto mode, it allows you to monitor as many no. of pages as is programmed in the parameter 2 above (AUTO : PGS) sequentially, at an interval of 5 seconds without any key press. Each page contains 3 parameters.

NOTE :

1. By default the unit works in auto mode.
2. Page 1, Page 2, Page 3 and Page 4 display sequence A, C, E, F respectively as shown in the adjacent figures.

Manual mode:

In manual mode, using the ⬆ + ⬇/⬆ / ⬆ keys, different parameter pages can be viewed. In manual mode, the displayed page is seen until you manually change the page. This is as described by the adjacent figures.

Error indications

Error	Description
Ctrr	CT reverse

Clr error occurs if

1. The CT secondary wires S1 & S2 are swapped in wiring.
2. The CT inputs are not connected to their respective phases i.e. CT1 to R phase, CT2 to Y phase and CT3 to B phase

NOTE: Ctrr error displayed only on Active Power Page and Power Factor Page

NOTE :

- Shows LED ON or Blinks. Blinking rate is 0.3 sec OFF and 1.7 sec ON.
- Shows LED OFF.

PARAMETER SEQUENCE A :



Display shows the line to line Voltage (V_{LL})

- 1) V_L
- 2) V_Y
- 3) V_B

Press ⬆ + ⬆ to go in to next page

PARAMETER SEQUENCE C :



Display shows the Current of each Phase

- 1) I_1
- 2) I_2
- 3) I_3

*The CT primary set at 5.

Press \leftarrow + \rightarrow to go in to next page

PARAMETER SEQUENCE F :



Display shows -

- 1) Average V_{LN}
 - 2) Average current
 - 3) Average power factor
- L1, L2, L3 LEDs blinks

*The CT primary set at 5.

Press \leftarrow + \rightarrow to go in to next page

PARAMETER SEQUENCE H :



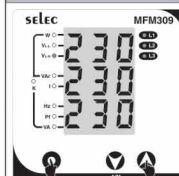
Display shows -

- 1) V_{LN}
 - 2) Current of L2
 - 3) Power factor of L2
- L2 LED blinks

*The CT primary set at 5.

Press \leftarrow + \rightarrow to go in to next page

PARAMETER SEQUENCE J :



Display shows the Line to Neutral Voltage of each Phase

- 1) V_{LN}
- 2) V_{LN}
- 3) V_{LN}

Press \leftarrow + \rightarrow to go in to next page

PARAMETER SEQUENCE E :



Display shows -

- 1) Average V_{LN}
 - 2) Average current
 - 3) Frequency
- L1, L2, L3 LEDs blinks

*The CT primary set at 5.

Press \leftarrow + \rightarrow to go in to next page

PARAMETER SEQUENCE G :



Display shows -

- 1) V_{LN}
 - 2) Current of L1
 - 3) Power factor of L1
- L1 LED blinks

*The CT primary set at 5.

Press \leftarrow + \rightarrow to go in to next page

PARAMETER SEQUENCE I :



Display shows -

- 1) V_{LN}
 - 2) Current of L3
 - 3) Power factor of L3
- L3 LED blinks

*The CT primary set at 5.

Press \leftarrow + \rightarrow to go in to next page

PARAMETER SEQUENCE K :



Display shows the Power Factor of each Phase.

- 1) Pf of L1
- 2) Pf of L2
- 3) Pf of L3

*The CT primary set at 5.

Press \leftarrow + \rightarrow to go in to next page

PARAMETER SEQUENCE L :



Display Active Power of each Phase shows

- 1) kW of L1
- 2) kW of L2
- 3) kW of L3

*The CT primary set at 5.

Press + to go in to next page

PARAMETER SEQUENCE S :



Display shows Apparent Power of each Phase

- 1) kVA of L1
- 2) kVA of L2
- 3) kVA of L3

*The CT primary set at 5.

Press + to go in to next page

PARAMETER SEQUENCE Y :



Display shows -

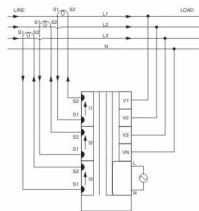
- 1) Active power (kW) of L2
- 2) Reactive power (kVAR) of L2
- 3) Apparent power (kVA) of L2

*The CT primary set at 5.

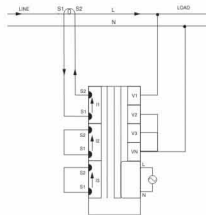
Press + to go in to next page

WIRING DIAGRAM

3 PHASE 4-WIRE WIRING DIAGRAM



SINGLE PHASE WIRING DIAGRAM



(Specifications subject to change as development is a continuous process)

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PARAMETER SEQUENCE P :



Display shows Reactive Power of each Phase

- 1) kVAR of L1
- 2) kVAR of L2
- 3) kVAR of L3

*The CT primary set at 5.

Press + to go in to next page

PARAMETER SEQUENCE U :



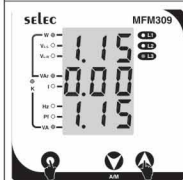
Display shows -

- 1) Active power (kW) of L1
- 2) Reactive power (kVAR) of L1
- 3) Apparent power (kVA) of L1

*The CT primary set at 5.

Press + to go in to next page

PARAMETER SEQUENCE Z :



Display shows -

- 1) Active power (kW) of L3
- 2) Reactive power (kVAR) of L3
- 3) Apparent power (kVA) of L3

*The CT primary set at 5.

Press + to go in to next page