





MFM 03
ER Multifunction Meter
USER MANUAL

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Multi-Function Meter



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A. TECHNICAL SPECIFICATIONS

Accuracy	Class 0.5S -IS 14697:1999
Secondary Voltage rating	3 Ph 4W - 3x110VAC(L-L) , 3x63.5VAC (L-N)
Voltage Range	-40% to +20% of Vref
Secondary Current Rating	1A or 5A
Rated Max. Current	120% I_b
Starting Current	0.1% of I_b
Power Factor	4 quadrant operation
Frequency	50 Hz \pm 5%
Load characteristics	1.5 Watts & 8 VA in potential circuit 1 VA in current circuit
Features	Uni - directional / Bi - directional (Programmable) Programmable CT / PT Ratios Reset mode - Auto monthly.
Electromagnetic compatibility	IS 14697 (Class 0.5S)
Case Material	Metal Box (Flush Mounting) Protected to - IP51 - IEC 60687 / IS 14697 (Class 0.5)
Insulation Properties & HV insulation resistance	IS 14697 :1999
Temperature	0°C to 55°C for operation
Humidity	<95% RH non condensing
Weight	< 2.5 Kgs for CT operated

1. GENERAL

- Meter measures **Active, Reactive and Apparent** energies on 3 phase 4 wire system in all four quadrants.
- **4 Energy accumulators** – kWh, kVARh lag, kVARh lead & kVAh in **forward and reverse** direction.
- **Instantaneous parameters** – voltage, current, frequency, power factor, Power, rising demand, Phase Status, date & time
- **Data** Collection is possible through either RS485 or RS232
- **Maximum Demand** registers with programmable Integration Periods & Energy Types.
- **Various Tamper records** are available for voltage / current .
- Meter can be configured as an **Uni – Directional /Bi - Directional** Meter.
- **MD Reset Feature**– Auto monthly.
- **KWh & kVARh pulse output LEDs** available on front panel.
- **LCD** to display selected parameters.
- **Keys** on the front panel to **scroll through display parameters** .
- Rugged Metal casing.
- Conforms to Standards:
CBIP88, IEC 60687, IS14697, IEC 61036

2. DESIGN

2.1 THEORY OF OPERATION

The meter consists of the following sections.

2.1.1 ANALOG SECTION

High precision CTs and voltage dividers to step down input current and voltages which are fed to an Application Specific Integrated Circuit that gives the data output to be processed by the Digital Section.

2.1.2 DIGITAL PROCESSING SECTION

The Microcontroller controls all the analog and digital sections. The metering data is processed, from the data given by the ASIC for the calculation of various types of data for the meters.

All the processed data are stored in the Non Volatile Memory. A high precision RTC keeps track of the date and time for all the measurement activities. The interface is through LCD panel, KeyBoard, IR Optical Port, RS 232 and RS 485 ports.

2.1.3 POWER SUPPLY SECTION

Self Powered. The Switched Mode Power Supply supplies power to the internal circuitry, which operates for a wide range of input voltages.

2.2 HARDWARE

The hardware of the meter has been designed to make it rugged and reliable.

2.2.1. Compact

The meter is designed using Surface Mount Technology, which makes it light weight and compact

2.2.2. Efficient

Switched Mode Power Supply is used for meter operation, which reduces the burden per phase of the meter making it more efficient.

An extended temperature LCD is used for displaying various parameters. The power consumption of LCD is lesser than that of LED displays so the meter is more efficient than most of the meters which use LED displays.

2.2.3. Features

- **Keys** – Five keys are provided on the front panel for scrolling through the display.
- **LCD** – The meter uses an extended temperature LCD, which displays various parameters.
- **Battery** – Rechargeable Ni-Cd battery is provided for RTC.

2.2.4. Data safety

- Non-Volatile Flash Memory is used to store the metering data. This ensures data safety in case of power failures. The data will be retained for 10 years in case of power failures.
- **RTC with battery backup** is used for time keeping.
- **Watch dog timer** is used to monitor the processing activities, which ensures the reliable operation of the meter.
- The meter is designed to conform to IEC standards for **EMI/EMC**, which makes the system immune to Electromagnetic Interference.

2.3 SOFTWARE

The software has been developed using modular concept.

2.3.1 ENERGY ACCUMULATORS

8 Energy accumulators record the following energies –

1. Forward Active Energy
2. Forward Lagging (Inductive) Reactive Energy
3. Forward Leading (Capacitive) Reactive Energy
4. Forward Apparent Energy

5. Reverse Active Energy
6. Reverse Lagging (Inductive) Reactive Energy
7. Reverse Leading (Capacitive) Reactive Energy
8. Reverse Apparent Energy

- **Cumulative energies**

All eight energy types get accumulated from the time of installation. These accumulators are the sum total of energies recorded and cannot be reset by performing any type of reset.

2.3.2 MAXIMUM DEMAND (MD) REGISTERS

Integration period of 1 to 30 minutes

MD Registers

These are the MDs, for the present billing period, i.e. from the time of latest reset. If a reset is performed, these values are pushed to backups and these registers get cleared.

2.3.2.1. Method of MD calculation

Normal or Block method: At the end of each fixed integration period, average power for that period is calculated. If this value is greater than the already existing value then this is stored as the MD.

For example,

MD No.	Method	Integration Period
MD1	Block	30 min.

2.3.3 RESET

2.3.3.1 RESET MODES

Meter can be configured for one of following modes of reset: -

1. **Manual Reset (optional)**

The meter can be reset manually by operating a push button on the front panel. Lockout days, i.e. no. of days before which another manual reset can be performed is factory programmable (28days).

2. **Auto Monthly Reset (Default)**

The meter can be reset automatically on the first day of the month on 00.00 hours.

OR

3. **Auto Monthly and Manual Reset(optional)**

Both auto monthly and manual reset options are available together.

2.3.4 INSTANTANEOUS PARAMETERS

- **Voltages and Currents** – The instantaneous values of current and voltage are available phasewise.
- **Frequency** – The meter calculates the instantaneous value of the system frequency.
- **Power Factor (PF)** – The meter calculates the instantaneous PF of Individual Phases and also average P.F.
- **Instantaneous Power** – The meter calculates instantaneous active, reactive & apparent power of Individual Phases and also total power.

2.3.5 COMMUNICATION INTERFACE

2.3.5.1 DATA COLLECTION

The Data can be downloaded through either RS 485 (MODBUS protocol) or RS 232 communication.

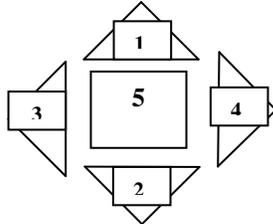
2.3.6 ACCURACY TESTS

The meter supports different means for testing accuracy.

2.3.6.1 PULSE COUNTING METHOD

kWh & kVArh pulse output LEDs are provided on the front panel.

2.4 KEYS AND THEIR FUNCTIONS:



1. UP/INCR Key - for incrementing digits
2. Down/DECR key - for decrementing digits
3. Left key - for previous screen
4. Right key - for next screen
5. Reset/Enter key

MODE:

1. AUTO
2. MANUAL (a) BLOCK-1 ,(b) BLOCK-2
3. PROGRAM

AUTO MODE: (Default mode)

Displays the values in LCD in meter , automatically scrolls through the display at an interval programmer by the user(1 second will be the default).

MANUAL MODE:

Press the Right Key once, The display shows "n A n U A L"

**a). Now press ENTER KEY the display shows "b L o C t 1"
(Press enter key to select block 1),Again press Right Key to select block 2
and the display shows " b L o C t 2".(Press enter key to select block 2)**

BLOCK 1:

All the display parameters in Auto Mode will be displayed in this block

Note: (AUTO SCROLLING WILL NOT TAKE PLACE IN THIS MODE)

BLOCK 2:

Will display last TAMPER data,Tamper Occurrence time and date.Tamper Restored date and time.

Cumulative "POWER ON " hours since installation.

Note: Block 1 display parameters will not appear in block 2

To exit out from Manual Mode press LEFT + RIGHT keys -> exits manual mode and gets into Auto Mode.

PROGRAM MODE:

Once manual mode is displayed press the RIGHT KEY once again to select PROGRAM mode, The display Shows " P r o G r A n "

Press ENTER KEY to get into Programming mode.

Display shows .

" Sr 01 SEC" => The Auto scrolling interval is set to 1 Second.

Now press the INCR/DECR key to set the required time (99 second maximum) Now press ENTER to update the setting (Failing to press enter will not store the updated setting)

**To skip the present menu and select the next menu press RIGHT KEY.
Repeat this step Till the desired menu is selected. (in program mode the following settings can be done)**

PROGRAMMING MODE:

In PROGRAM MODE the following parameters are programmable.

1.Scan Rate: UP and DOWN key used to Increment or Decrement the scan rate.
ENTER key is used to store the selected parameter in the Program mode, then control moves to next parameter. Pressing RIGHT / LEFT key Control moves to next / Previous parameter in the program Mode.

2. Communication : Displays as "**co rS 485**" default, press up or down key for the selection of 232 communication, Displays as "**co rS 232**" and press enter for updating the selected communication.
3. PT Ratio: UP and DOWN key used to Increment or Decrement the PT Ratio. ENTER key is used to store the selected parameter in the Program mode, then control moves to next parameter. Pressing RIGHT / LEFT key Control moves to next / Previous parameter in the program Mode.
4. CT Ratio: UP and DOWN key used to Increment or Decrement the CT Ratio. ENTER key is used to store the selected parameter in the Program mode, then Control moves to next parameter. Pressing RIGHT / LEFT key Control moves to next / Previous parameter in the program Mode.
5. Energy Configuration : Bi-directional or Uni-directional Selectable.(Displays as "**ConF bi**" (**Bi-directional**) and press up key for "**ConF Uni**" (**Uni-directional**) Press enter key for updating energy configuration.
6. Measurment Type: UP and DOWN key used to toggle the measurement type. ENTER key is used to store the selected parameter in the Program mode, then control moves to next parameter. Pressing RIGHT / LEFT key Control moves to next / Previous parameter in the program Mode.
7. MD Register Selection: UP and DOWN key used to Increment or Decrement the MD Register. ENTER key is used to store the selected parameter in the Program mode, then control moves to next parameter. Pressing RIGHT / LEFT key Control moves to next / Previous parameter in the program Mode.
8. Load Survey Settings: UP and DOWN key used to Increment or Decrement the Load survey integration period. ENTER key is used to store the selected parameter in the Program mode, then control moves to next parameter. Pressing RIGHT / LEFT key Control moves to next / Previous parameter in the program Mode.
9. Vah Configuration: UP and DOWN key used to toggle Vah Configuration. ENTER key is used to store the selected parameter in the Program mode, then control moves to next parameter. Pressing RIGHT / LEFT key Control moves to next / Previous parameter in the program Mode.
10. Tamper Setting: UP and DOWN key used to Increment or Decrement the tamper settings. ENTER key is used to store the selected parameter in the Program mode, then control moves to next parameter. Pressing RIGHT / LEFT key Control moves to next / Previous parameter in the program Mode.
11. Persistence Period: UP and DOWN key used to Increment or Decrement the Persistence period. ENTER key is used to store the selected parameter in the Program mode, then control moves to next parameter. Pressing RIGHT / LEFT key Control moves to next / Previous parameter in the program Mode.
12. Slave ID: UP and DOWN key used to Increment or Decrement the Slave ID. ENTER key is used to store the selected parameter in the Program mode, then control moves to next parameter. Pressing RIGHT / LEFT key Control moves to next / Previous parameter in the program Mode.

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13. Communication Interface: UP and DOWN key used to toggle the communication Protocol. ENTER key is used to store the selected parameter in the Program mode, then control moves to next parameter. Pressing RIGHT / LEFT key Control moves to next / Previous parameter in the program Mode.

By Pressing LEFT + ENTER Control Moves to **Self-test**.

The Display shows **“SELF t S t “**
Now Press ENTER KEY Once.

Now display shows **“d I S P t S t “**, (Press ENTER KEY to check the display, **ALL THE SEGMENTS SHOULD DISPLAY**). To skip Display test Press **RIGHT KEY** once .

Now the display shows **“LED : oFF kWh”** now if INCR KEY is pressed the display shows **“LED : on”** and the KWH LED should glow. now press DECR/DOWN key to switch off the KWh LED ,Now the display shows **“LED : oFF kWh”**. Now press right key to check KVArh Led and follow the same steps as above. To the next display press **RIGHT KEY** once.

Next display is the Communication Test, displays as **“Con tSt”**. Press enter once, the display comes as **th :** ,then press enter once again the displays shows as **th : 176** .To skip from this display press **RIGHT KEY** once.

Next Display is Equipment Address, Displays as **“Eq AddrESS 001”** comes default. Press **RIGHT KEY** for next screen.

Next display is Slave ID of the meter, Display will show as **“S
Id 00000001.”**

For assistance please contact the address below or call :

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2.4 **DISPLAY PARAMETERS :**

MANUAL MODE:

BLOCK1 PARAMETERS:

1.TIME

HH:MM:SS

2.DATE

DD-MM-YY

3. R SYSTEM VOLTAGE (L-N)

U1
XXXXXXXX

4. Y SYSTEM VOLTAGE (L-N)

5. B SYSTEM VOLTAGE (L-N)

6. R SYSTEM CURRENT (L-N)

A1
XXXXXXXX

7. Y SYSTEM CURRENT (L-N)

8. B SYSTEM CURRENT (L-N)

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9. SUPPLY FREQUENCY

Fr	XXXXXXXX
----	----------

10.R PHASE ACTIVE POWER

1	XXXXXXXX	KW
Pr		

11.Y PHASE ACTIVE POWER

12.B PHASE ACTIVE POWER

13.TOTAL ACTIVE POWER

T	XXXXXXXX	KW
Pr		

14. R PHASE REACTIVE POWER

1	XXXXXXXX	KVAr
Pr		

15. Y PHASE REACTIVE POWER

16. B PHASE REACTIVE POWER

17.TOTAL REACTIVE POWER

T	XXXXXXXX	KVAr
Pr		

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18. R PHASE APPARENT POWER

1	XXXXXXXXXX	
Pr		KVA

19. Y PHASE APPARENT POWER

20. B PHASE APPARENT POWER

21. TOTAL APPARENT POWER

T	XXXXXXXXXX	
Pr		KVA

22. R PHASE PF

		PF
1	XXXXXXXXXX	

23. Y PHASE PF

24. B PHASE PF

25. TOTAL PF

		PF
T	XXXXXXXXXX	

26. PHASE STATUS

UrybCryb

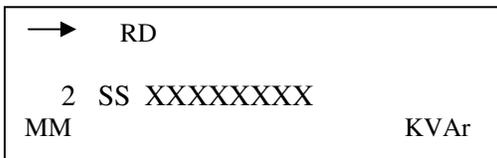
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- Uryb → If R phase voltage is missing then it will display U yb
- If Y phase voltage is missing it will display Ur b
- If B phase voltage is missing it will display Ury
- Cryb-> If R phase current is missing then it will display C yb
- If Y phase current is missing it will display Cr b
- If B phase current is missing it will display Cry
- If R phase current is reverse then it will display C1yb
- If Y phase current is reverse it will display Cr1b
- If B phase current is reverse it will display Cry1

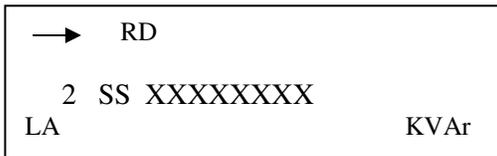
27.RISING DEMAND 1

MM && SS indicate elapsed time

1 -> RD1



AND



Toggle between above display format every second is register selected is Forward lag reactive power.

- Indicate forward
- ← Indicate reverse

LA indicate lag

LE indicate lead

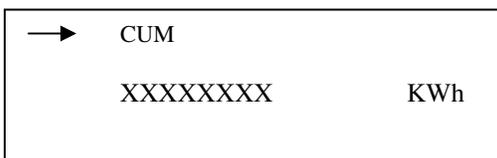
2 -> RD2

28.RISING DEMAND 2 (kVAr LE)

29.RISING DEMAND 3 (kVA)

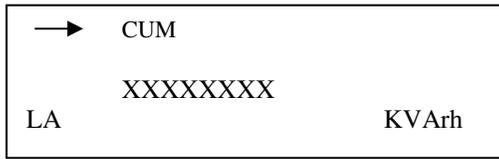
30.RISING DEMAND 4 (kW)

31.FORWARD ACTIVE ENERGY

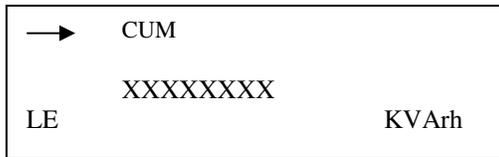


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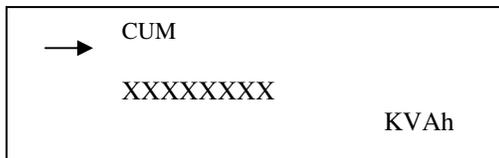
32. FORWARD LAG REACTIVE ENERGY



33. FORWARD LEAD REACTIVE ENERGY

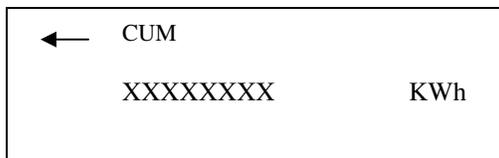


33. FORWARD APPARENT ENERGY

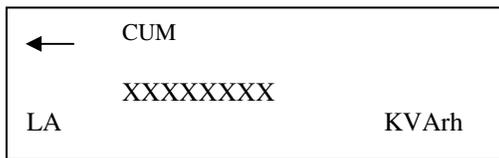


→ WILL NOT BE INDICATED IF EQUIPMENT IS SELECTED FOR UNIDIRECTIONAL MODE.

34. REVERSE ACTIVE ENERGY



35. REVERSE LAG REACTIVE ENERGY



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36. REVERSE LEAD REACTIVE ENERGY

←	CUM	
	XXXXXXXX	
LE		KVArh

37. REVERSE APPARENT ENERGY

←	CUM	
	XXXXXXXX	
		KVAh

38. MAXIMUM DEMAND 1

→	MD	
1	XXXXXXXX	KW

REVERSE ARROW WILL BE INDICATED IF REVERSE ACTIVE REGISTER SELECTED

39. MAXIMUM DEMAND 1 OCCURRED TIME

	MD	
1	HH:MM:SS	
OC		

40. MAXIMUM DEMAND 1 OCCURRED DATE

	MD	
1	DD-MM-YY	
OC		

41. MAXIMUM DEMAND 2 (kVA_r LA)

42. MAXIMUM DEMAND 2 OCCURRED TIME

43. MAXIMUM DEMAND 2 OCCURRED DATE

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44. MAXIMUM DEMAND 3 (kVAr LE)

45. MAXIMUM DEMAND 3 OCCURRED TIME

46. MAXIMUM DEMAND 3 OCCURRED DATE

47. MAXIMUM DEMAND 4 (kVA)

48. MAXIMUM DEMAND 4 OCCURRED TIME

49. MAXIMUM DEMAND 4 OCCURRED DATE

50. CUMULATIVE MAXIMUM DEMAND1

→	CUM	MD	
1	XXXXXXXX		KW

REVERSE ARROW WILL BE INDICATED IF REVERSE ACTIVE REGISTER SELECTED

52. CUMULATIVE MAXIMUM DEMAND2

→	CUM	MD	
2	XXXXXXXX		KVAr
LA			

REVERSE ARROW WILL BE INDICATED IF REVERSE LAG REACTIVE REGISTER SELECTED

53. CUMULATIVE MAXIMUM DEMAND3

→	CUM	MD	
3	XXXXXXXX		KVAr
LE			

REVERSE ARROW WILL BE INDICATED IF REVERSE LEAD REACTIVE REGISTER SELECTED

54. CUMULATIVE MAXIMUM DEMAND4

→	CUM	MD	
4	XXXXXXXX		KVA

REVERSE ARROW WILL BE INDICATED IF REVERSE APPARENT REGISTER SELECTED

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55.MD RESET COUNT

rC	XXXXXXXX
----	----------

56.POWER ON HOURS SINCE LAST RESET

Ph	XXXXXXXX	LAST
----	----------	------

57.AVERAGE PF

AU	XXXXXXXX	PF
----	----------	----

58. PT RATIO

Pt	XXXXXXXX
----	----------

59. CT RATIO

Ct	XXXXXXXX
----	----------

60.TAMPER COUNT OF VOLTAGE FAILURE

1 tC	XXXXXXXX
---------	----------

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61.TAMPER COUNT OF CURRENT FAILURE

2	XXXXXXXX
tC	

62.TAMPER COUNT OF VOLTAGE UNBALANCE

3	XXXXXXXX
tC	

63.TAMPER COUNT OF CURRENT UNBALANCE

4	XXXXXXXX
tC	

64.TAMPER COUNT OF CURRENT REVERSAL

5	XXXXXXXX
tC	

65.CUMULATIVE FORWARD ACTIVE ENERGY SINCE LAST RESET

→	CUM	LAST
	XXXXXXXX	KWh

66. CUMULATIVE FORWARD LAG REACTIVE ENERGY SINCE LAST RESET

→	CUM	LAST
LA	XXXXXXXX	KVArh

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67. CUMULATIVE FORWARD LEAD REACTIVE ENERGY SINCE LAST RESET

→	CUM	LAST
	XXXXXXXX	
LE		KVArh

68. FORWARD APPARENT ENERGY SINCE LAST RESET

→	CUM	LAST
	XXXXXXXX	
		KVAh

REVERSE ENERGIES WILL NOT BE INDICATED IF EQUIPMENT IS SELECTED FOR UNIDIRECTIONAL MODE

69. REVERSE ACTIVE POWER SINCE LAST RESET

←	CUM	LAST
	XXXXXXXX	
		KWh

70. REVERSE LAG REACTIVE ENERGY SINCE LAST RESET

←	CUM	LAST
	XXXXXXXX	
LA		KVArh

71. REVERSE LEAD REACTIVE ENERGY SINCE LAST RESET

←	CUM	LAST
	XXXXXXXX	
LE		KVArh

72. REVERSE APPARENT ENERGY SINCE LAST RESET

←	CUM	LAST
	XXXXXXXX	
		KVAh

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REVERSE ARROW WILL BE INDICATED IF REVERSE ACTIVE REGISTER SELECTED
73. MAXIMUM DEMAND 1 SINCE LAST RESET

→	MD	LAST
1	XXXXXXXX	KW

74. MAXIMUM DEMAND 2 SINCE LAST RESET

→	MD	LAST
2	XXXXXXXX	
LA		KVAr

75. MAXIMUM DEMAND 3

→	MD	LAST
3	XXXXXXXX	
LE		KVAr

76. MAXIMUM DEMAND 4

→	MD	LAST
4	XXXXXXXX	
		KVA

77. LAST RESET DATE

		LAST
Rt	XX-XX-XX	

78. LAST RESET TIME

		LAST
Rt	XX:XX:XX	

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79 AVERAGE PF SINCE LAST RESET

		PF	LAST
AU	XXXXXX		

BLOCK 2 PARAMETERS:

1.LAST OCCURRED TAMPER ID

OC	TAMPER X
----	----------

X -> 1 TO 5

2.LAST TAMPER OCCURED DATE

OC	XX-XX-XX
----	----------

3.LAST TAMPER OCCURED TIME

OC	XX:XX:XX
----	----------

4.LAST RESTORED TAMPER ID

C RE	XX:XX:XX
---------	----------

5.LAST TAMPER RESTORATION DATE

C RE	XX-XX-XX
---------	----------

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6. LAST TAMPER RESTORATION TIME

C XX:XX:XX
RE

7. POWER ON HOURS SINCE LAST RESET

LAST
Ph XXXXXX

PROGRAM MODE:

1. SCAN RATE

Sr XX SEC

2. PT RATIO

PT XXXXXXXX

3. CT RATIO

CT XXXXXXXX

4. MEASUREMENT TYPE

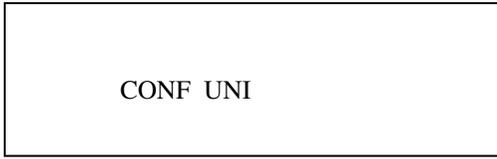
CONFIGURE FOR BI-DIRECTIONAL MODE

CONF BI

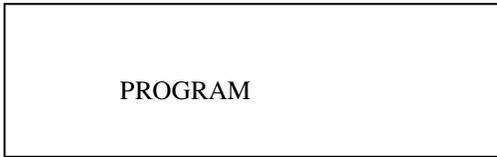
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OR

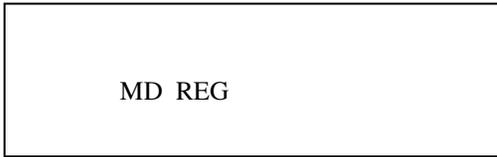
CONFIGURE FOR UNIDIRECTIONAL MODE



5. MD REGISTER



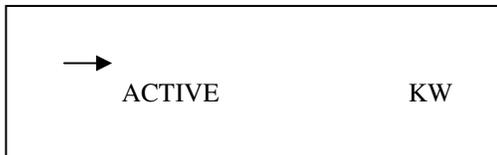
OR



TOGGLE BETWEEN ABOVE SCREEN, IF YOU PRESS ENTER WHILE DISPLAYING ABOVE SCREEN THEN WE WILL ENTER TO SELECT MAXIMUM 4 REGISTER AMONG 8 REGISTERS.

FOLLOWING ARE REGISTERS

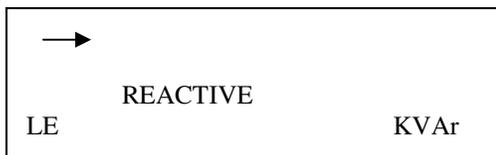
A) FORWARD ACTIVE



B) FORWARD LAG REACTIVE

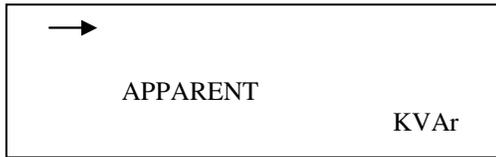


C) FORWARD LEAD REACTIVE

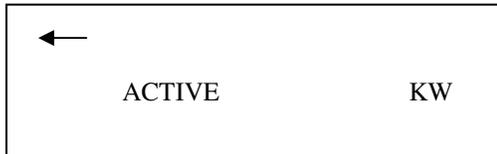


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D) FORWARD APPARENT



E) REVERSE ACTIVE



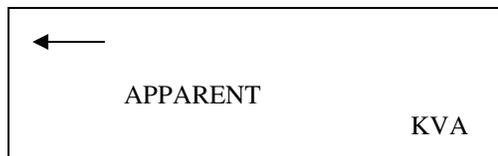
F) REVERSE LAG REACTIVE



G) REVERSE LEAD REACTIVE

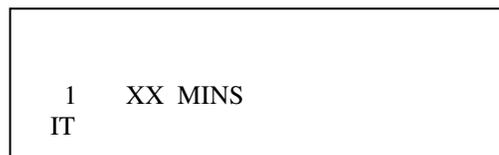


H) REVERSE APPARENT

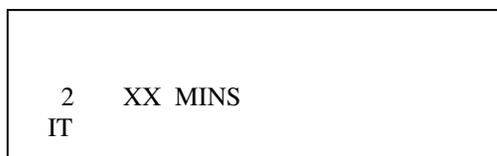


6).INTEGRATION PERIOD

A). INTEGRATION PERIOD 1



B). INTEGRATION PERIOD 2



Multi-Function Meter

C). INTEGRATION PERIOD 3

3 XX MINS
IT

D).INTEGRATION PERIOD 4

4 XX MINS
IT

7. LOAD SURVEY SETTING

SER XX M
LD

8.Vah CONFIGURATION

H CONF UPF
UA

OR

H CONF LEAD
UA

9.TAMPER SETTING

TAMPER

IF WE PRESS ENTER KEY THEN WE CAN PROGRAM TAMPER SETTING
FOLLOWING ARE TAMPER SETTINGS

Multi-Function Meter

A).VOLTAGE HIGH FAIL THRESHOLD

T1 XXXXXXXX

B). VOLTAGE LOW FAIL THRESHOLD

T2 XXXXXXXX

C). CURRENT FAIL THRESHOLD

T3 XXXXXXXX

D).VOLTAGE UNBALANCE

T4 XXXXXXXX

E). CURRENT UNBALANCE

T5 XXXXXXXX

10. PERSISTANCE PERIOD

PERSIST

OR

PERIOD

Multi-Function Meter

IF WE PRESS ENTER KEY THEN WE CAN PROGRAM PERIOD

XX MIN

11) SLAVE ID

S XXXXXXXX
ID

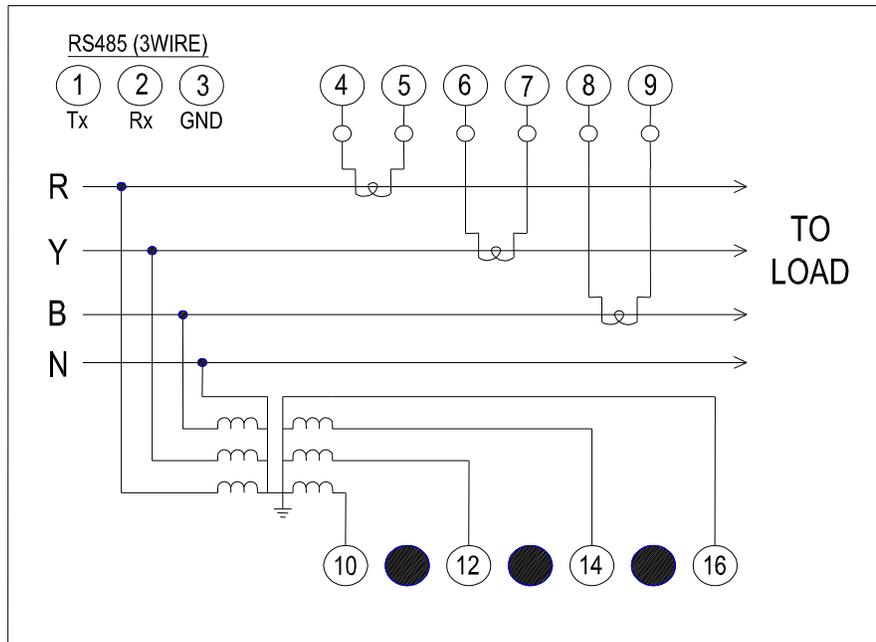
12) COMMUNICATION INTERFACE

Co rS 485

OR

Co rS 232

2.6 WIRING DIAGRAM FOR THREE PHASE FOUR WIRE METER



WIRING DIAGRAM - HT/LT 3Phase 4Wire CT/PT OPERATED FLUSH MFM 3N

The policy of Easun Reyrolle is one of continuous improvement and development. The company therefore reserves the right to supply equipment which may differ slightly from described and illustrated in this publication.

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