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User's Manual

Multifunction Transducer - MFT20
Self - Powered

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Table of Contents

1. INTRODUCTION

Foreword

Thank you for purchasing Multifunction Transducer.
MFT (Multifunction Transducer)

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

Purpose of manual

How to read this manual?

Installer: Read Chapters 3, 4, 5, 6, 10
System designer and new user: Read All Chapters
Expert user: Read Chapters 2, 4, 5, 6, 7, 8

Regarding this user manual

- This manual should be provided to the end user. Keep an extra copy or copies of the manual in a safe place.
- Read this manual carefully to gain a thoroughly understanding of how to operate this product before starting operation.

Notice

The contents of this manual are subject to change without notice as a result 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 MFT is a solid state TRANSDUCER which accurately measures all quantities of the supply including all types of energies. The MFT is based on Microcontroller, with a high degree of programmability.

The MFT meets the Accuracy requirements as per IEC 60688.

The MFT has been programmed to operate as an intelligent front end measuring and storing device and to communicate continuously to a Master, all the data relevant for the purpose of SCADA, through isolated RS-485 port using MODBUS-RTU protocol.
The MFT is normally supplied readily pre-programmed for operation and can be directly installed in the usual manner. The MFT can be read manually or through a Master using MODBUS-RTU Protocol.

Features

- Accuracy class 0.5s / 0.2s as per IEC60688
- Field programmable CT/PT Ratio
- True RMS, Microcontroller based
- 1 lines 4 digit high-visibility LED display 0.32” to display various parameters
- Auto Scaling from Kilo to Mega to Giga units.
- Light weight, Rugged, Reliable & Safe for User
- Self-powered & uses Switch mode power supply
- Isolated RS485 (Modbus-RTU protocol)
- Din Rail mount
- Finger touch proof terminals
- ABS enclosure an insulator so safe for user
- Front panel LED output for calibration & measurement of selected type of energy
- Store energy register efficiently during power failure
- Four Quadrant measurement for Power factor, Power & Energy (Active & Reactive)
- life timer for energy
- ON hours, RUN hours monitoring
- Old register to store the previously cleared energy value and previously cleared RUN hours.
- Stores Last day energy, Min-Max value
- THD measurement for voltage and current, up to the 31st harmonic
- Maximum demand measurement
- Easy configuration of different parameter through front fascia key.

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	User manual	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.

⚠ WARNING	*This indicates a danger that may result in death or serious injury if not avoided.*
	This indicates a danger that may result in minor or moderate injury or only a physical damage if not avoided.

2. SPECIFICATIONS

System type

3Ph4W/ 3Ph3W (Site selectable)

Input

Voltage

Direct Voltage	63.5VL-N to 240VL-N
PT Secondary (Nominal Voltage)	63.5VL-N to 240VL-N Configurable for 3Ph3W or 3Ph4W system
Measurement Method	True RMS
Input circuit consumption	<0.2VA per phase
PT Ratio	Programmable on site
Max continuous input voltage	1.3 x nominal value
Overload Withstand	2 x Nominal value for 5 s
Accuracy Range	50% - Vn - 120% [Minimum Voltage is 57.8V]

Current

Direct Current	0.02A to 6A
Secondary Current	1 to 5A
Measurement Method	True RMS
Input Circuit Consumption	<0.5VA per phase
CT Ratio	Programmable on site
Max continuous input current	2 x nominal value
Overload	20 x Nominal value for 1 s

Starting current	0.1% of Nominal Current (5A Sec.) 0.2% of Nominal Current (1A Sec.)
Frequency	45 to 65Hz

Display

LED Display	1 line 4 digit 0.32” RED 7-segment LED Display
Keys	UP, Down

Measured Parameters

Voltage	L1-L2, L2-L3, L1-L3 and Average (3Ph3W & 3Ph4W)
	L1-N, L2-N, L3-N & average (1Ph & 3Ph4W)
Current	All phase currents, average, sum Neutral Current (3P4W)
Frequency	System Frequency
Power Factor	Phase wise PF & Average PF
Power (Phase wise & Total)	Active Power (W, KW & MW)
	Reactive Power (VAR, KVAR & MVAR)
	Apparent Power (VA, KVA & MVA)
Energy (Phase wise & Total)	Active Energy for Import & Export (Separate) (KWh, MWh & GWh)
	Reactive Energy for Import & Export (Separate) (KVARh, MVARh & GVARh)
	Apparent Energy (KVAh, MVAh & GVAh)
Demand	Maximum Power Demand on KW/KVA Maximum Current Demand (Block/Sliding for 15/30 minutes window)
Power Quality	THD & Harmonics for each Voltage and Current (3rd to 31st odd) Phase wise DPF & Average DPF (Displacement Power Factor)

Percentage Voltage & Current Unbalance (Amplitude method)
ON hour ,RUN hour (up to 65000 hours Recording)
Last day Energy for Total, Old Energy for Total, Old Overflow Count & Old Load Hours, Min-Max Value (V, I, PF, Frequency, Total w, Total VAR, Total VA)
15 minute values (configurable 15 minute/1 hour) of Active Energy Import, Active Energy Export, Reactive Energy Import and Reactive Energy Export
Configuration parameters is password protected through front key pad

Accuracy Class 0.5 as per IEC 60688 for below parameters:

- Phase Voltage
- Phase Current
- Power Factor
- Frequency
- Active & Reactive Power*
- Active & Reactive Energy* (Import & Export)

(*PF 0.5 Lag-1.0 - 0.8 Lead Applicable for Power & Energy Parameter)

Test Compliance

Voltage test	As per IEC 60688
Impulse Withstand	As per IEC 60688
Electromagnetic Compatibility	As per IEC 60688 (IEC61000-4, level 1)
Permanent Overload Protection	As per IEC 60688
Temporary Overload Protection	As per IEC 60688
High Frequency Disturbance	As per IEC 60688 (IEC61000-4-4)
Shock Resistance	As per IEC 60068-2-27
Vibration Strength	As per IEC 60068-2-6
Temperature Rise	As per IEC 60688

Output

RS485 - Communication Output

Interface	RS485
Baud rate	2400, 4800, 9600, 19200, 38400 (Selectable)
Parity bit	None ,with 1 or 2 stop bit Odd or Even, with 1 or 2 stop bit
Protocol	Modbus-RTU

Supply

Supply	Self-powered from direct voltage/PT
Consumption	3.0 VA

Isolation (Withstanding voltage)

- Between primary terminals* and secondary terminals**:
  At least 3000V AC for 1 minute

* Primary terminals indicate Voltage Input terminals and CT Input terminals.
** Secondary terminals indicate Communication Output.

Insulation resistance: 200MΩ or more at 500 V DC between Primary terminals and Earth ground

Environmental

Operating temperature	0 ... 45 ... 55…60 °C
Storage temperature	-40º to 85ºC
Usage Group	III as per IEC60688
Relative humidity	25-95% non-condensing
Warm up time	5 minutes
Installation Category	CAT III for < 300V AC
Protection Class	II
Pollution Degree	2
Ingress protection	Housing IP40, Terminals IP20
External magnetic field	0.5 mT

Physical

Mounting Type	DIN Rail
Dimension (in mm)	70H x 100W x 112D
Case Material	ABS, with fireproofing finish
Weight	0.5 Kg
Terminations	Can accept up to 4.0 mm^2 wire

Configuration and View Software for programming the transducer at Site:
Windows based software; it is possible to configure the transducer on site through RS-485(MODBUS) interface

2.1 List of available Features

Parameters	Features	On Display	On Modbus
BASIC	Voltage (L-N)	✓	
	Voltage (L-L)	✓	
	Current	✓	
	Frequency	✓	
	%V Unbalance	C	
	%A Unbalance	C	
Power	Active Power	✓	
	Reactive Power	✓	
	Apparent Power	C	
	Power Factor	✓	
Energy	Active Energy Import & Export	✓	
	Reactive Energy Import & Export	✓	
	Apparent Energy	C	
	Overflow Energy Count For System Energy	C	
	Old Energy for total	C	
	Previous block energy value	C	
Min-Max & Day Energy	Last Day Energy	C	
	Min-Max (Low-High) Value	C	
Demand (Power & Current)	Maximum Demand(W/VA & I) with Date & Time	C	
	Rising Demand (W/VA & I)	C	
Harmonics (Voltage & Current)	% THD	C	
	% Harmonics [Up to 31st Odd]	C	
Hour	ON Hour	C	
	RUN Hour, OLD RUN Hour (Total)	C	

NOTE:
In above table:

- '**C**' means available only on **communication**

3. FRONT PANEL PICTURE

3.1 Front Panel Picture

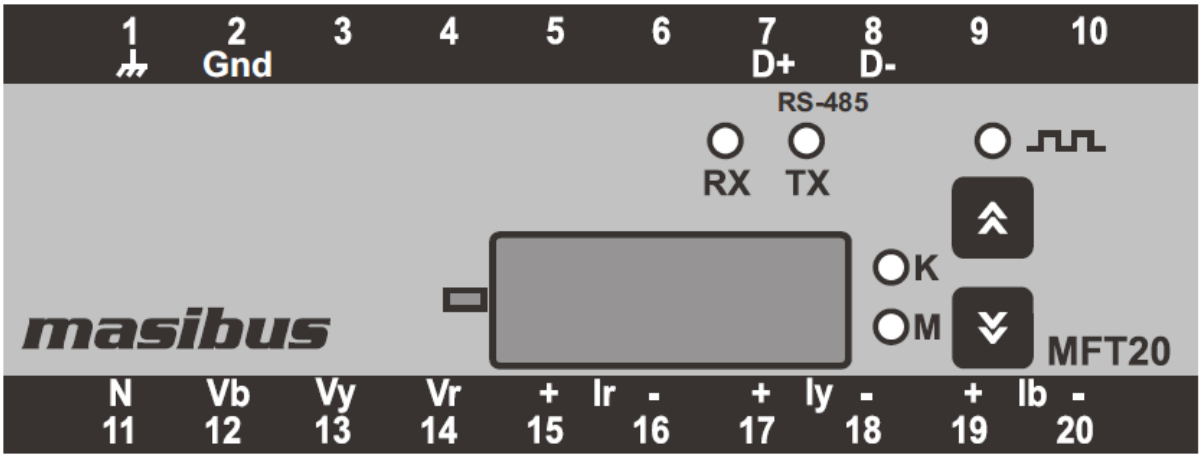


Fig-3.1 Detail of front panel – With LED and Keypad

3.2 Key Functions

UP key

RUN mode:
- To enter into the run mode groups.

PROGRAM mode:
- To scroll the value upward in edit mode and also work as shift key.

DOWN key

RUN mode:
- To scroll pages in downward direction to look at different parameters.

PROGRAM mode:
- To edit the value downward in edit mode and scroll through the parameters and also work as back key.

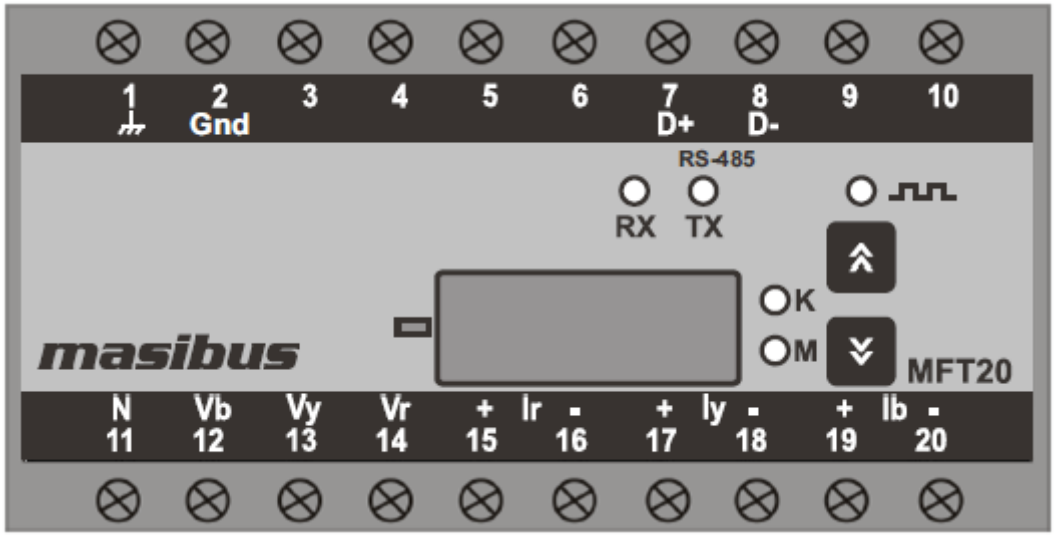
UP + DOWN key

RUN mode:
- To enter into the configuration mode.

PROGRAM mode:
- To save the value in EEPROM.

4. TERMINAL CONNECTIONS

4.1 Front Panel Terminal Connections



Terminal No.	Description	
1	Earth	Earth Terminal
2	Gnd [RS-485]	RS-485 Ground
7	D+ [RS-485]	RS-485 Connection
8	D- [RS-485]	
11	N [Neutral for Voltage input]	Three Phase Voltage Inputs
12	Vb[Voltage B-Phase]	
13	Vy [Voltage Y-Phase]	
14	Vr [Voltage R-Phase]	
15	IR+ [Current In R-Phase]	Three Phase Current Inputs
16	IR- [Current Out R-Phase]	
17	IY+ [Current In Y-Phase]	
18	IY- [Current Out Y-Phase]	
19	IB+ [Current In B-Phase]	
20	IB- [Current Out B-Phase]	

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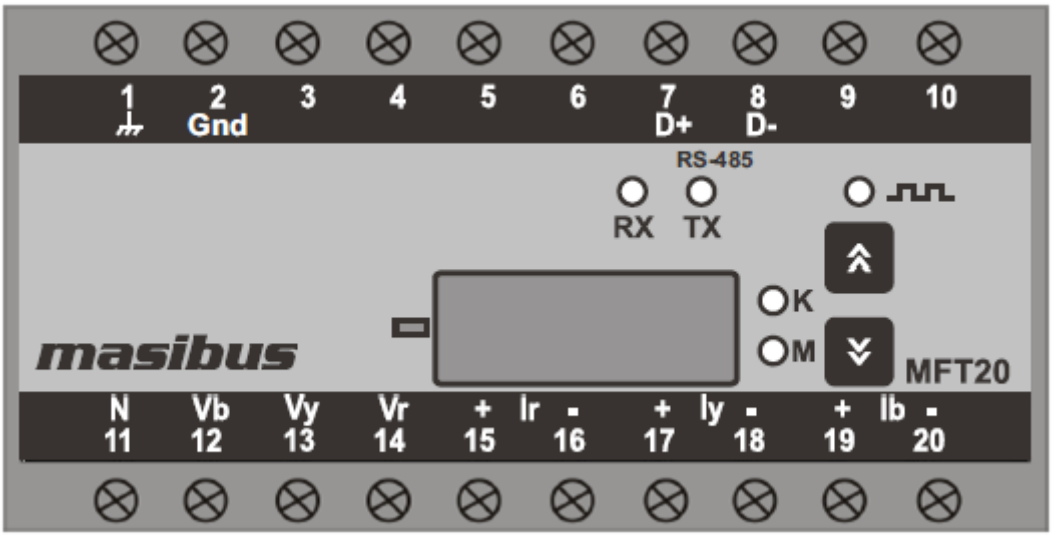
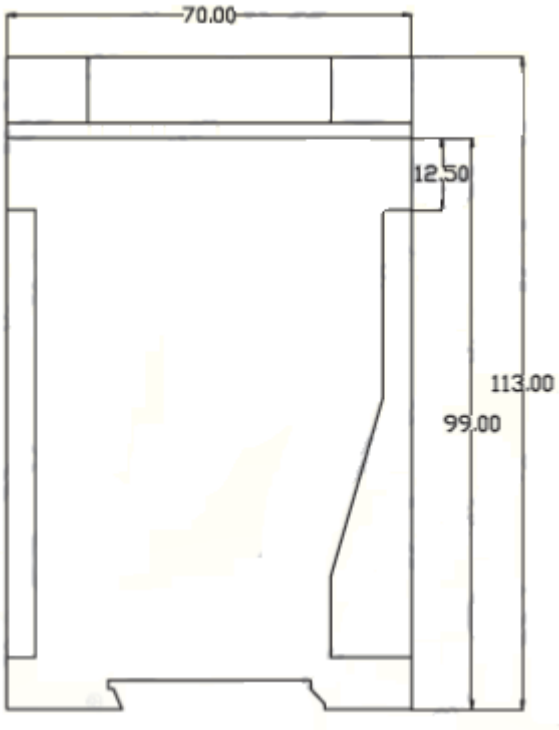
5. MECHANICAL GUIDELINE

5.1 Front View



5.2 Side View



6. INSTALLATION GUIDELINE

6.1 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

Read the instructions in this manual before performing installation and take note of the following precautions:

- *All wiring must confirm to 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.*
- *Read this manual thoroughly before connecting the device to the current carrying circuits. During operation of the device, hazardous voltages are present on input terminals. Failure to observe precautions can result in serious or even fatal injury or damage to equipment.*
- *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*

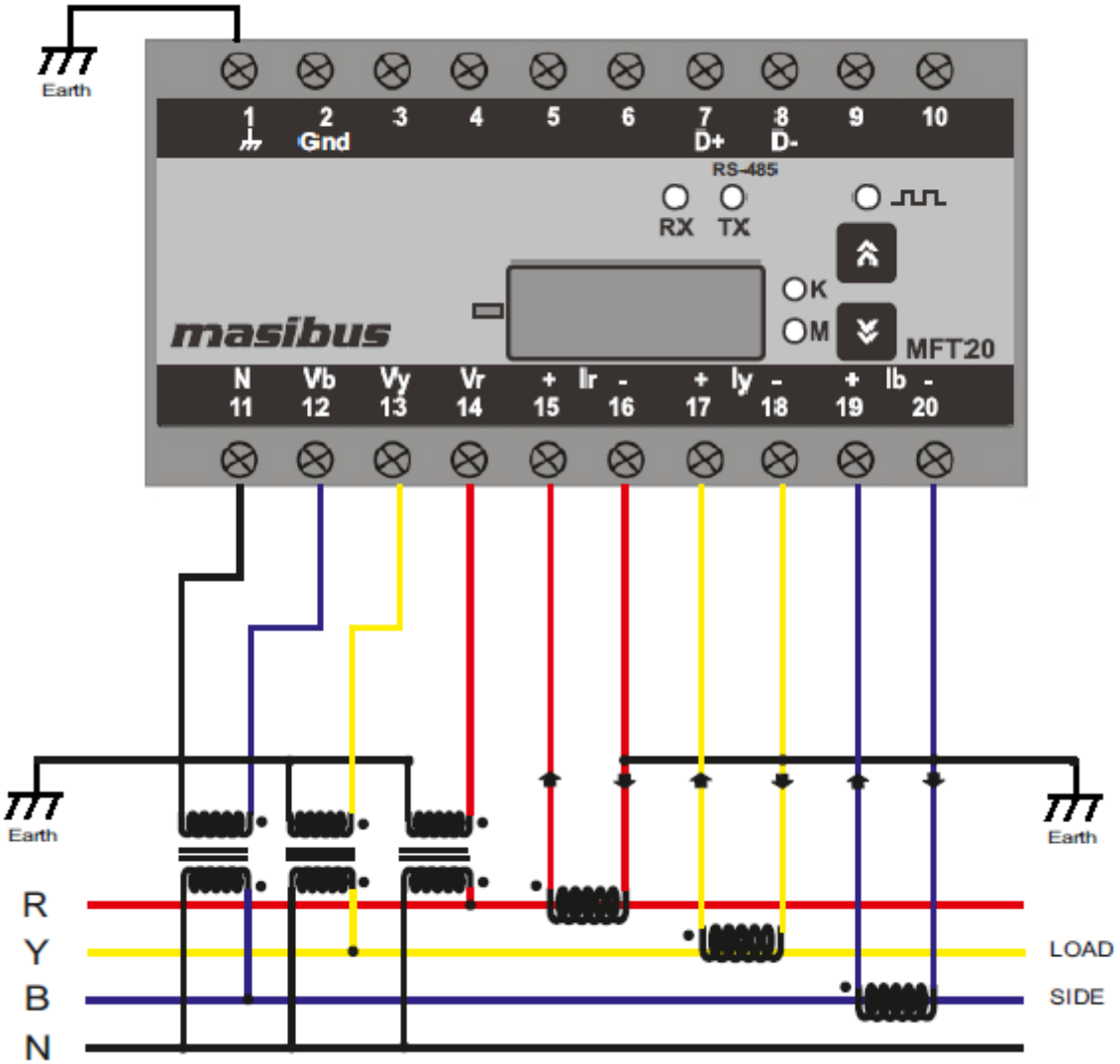
number and serial number for future reference when corresponding with our Customer Support Division.

- *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.*

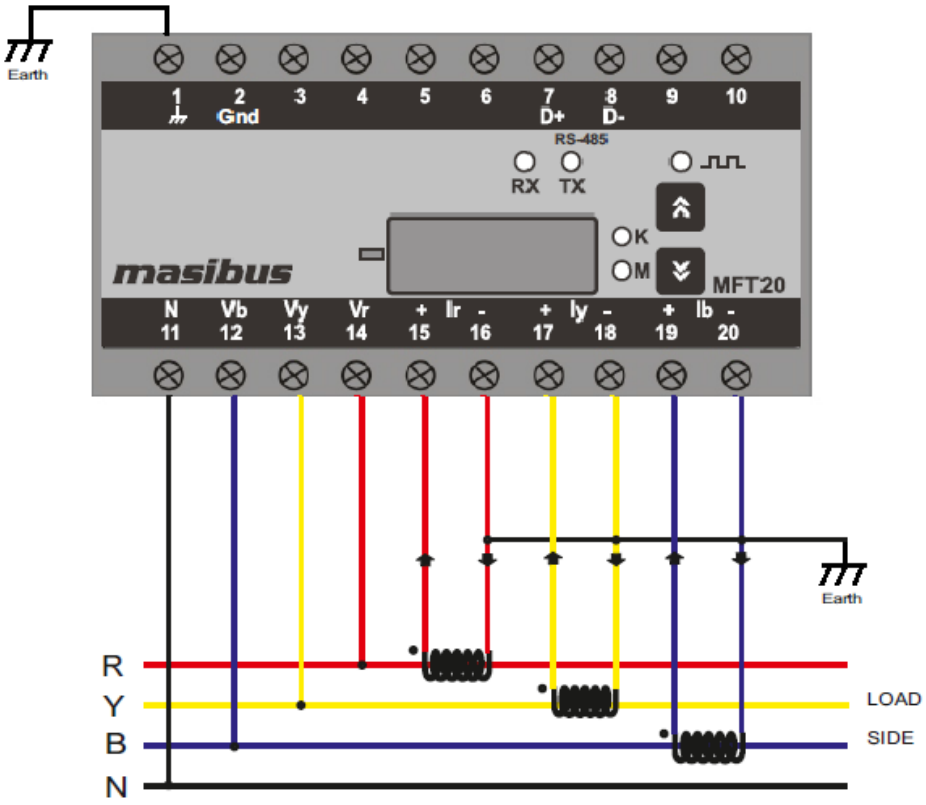
6.2 Terminal Wiring Details

6.2.1 Three Phase Four Wire System

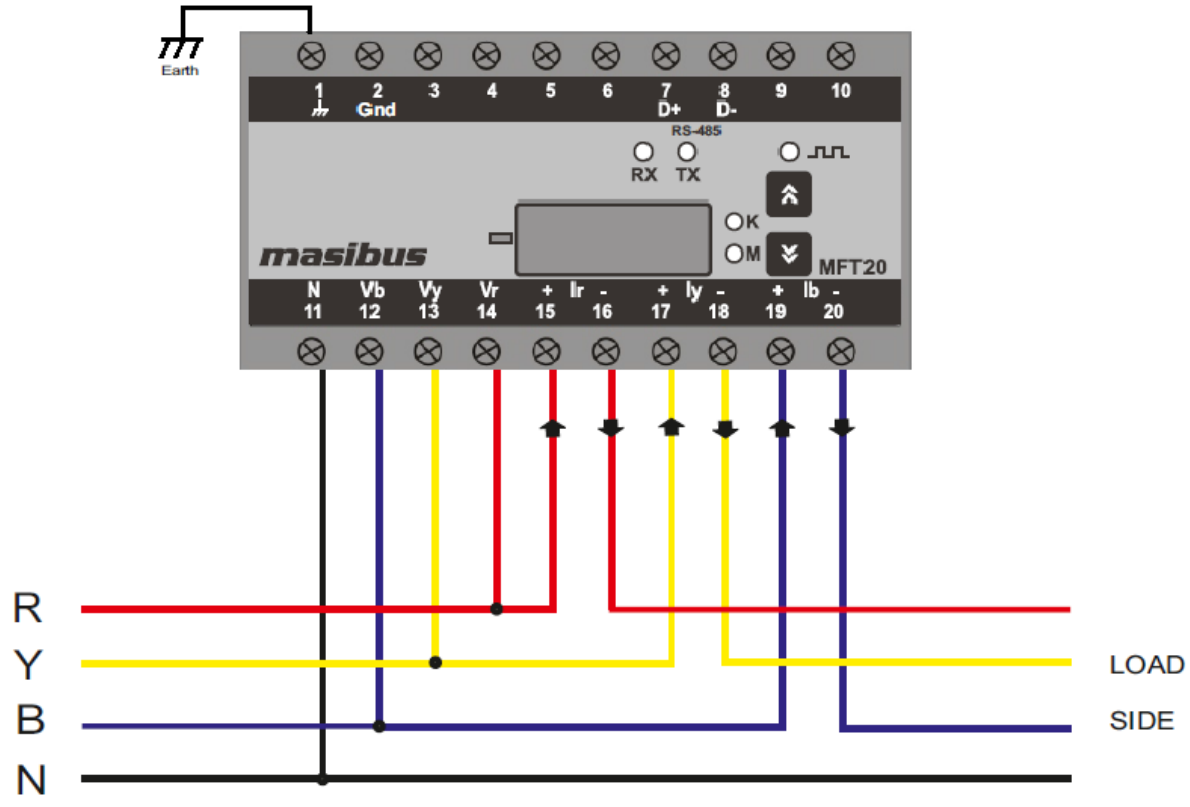
a) 4-Wire Wye-3 Element Connection Using 3PTs, 3CTs



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

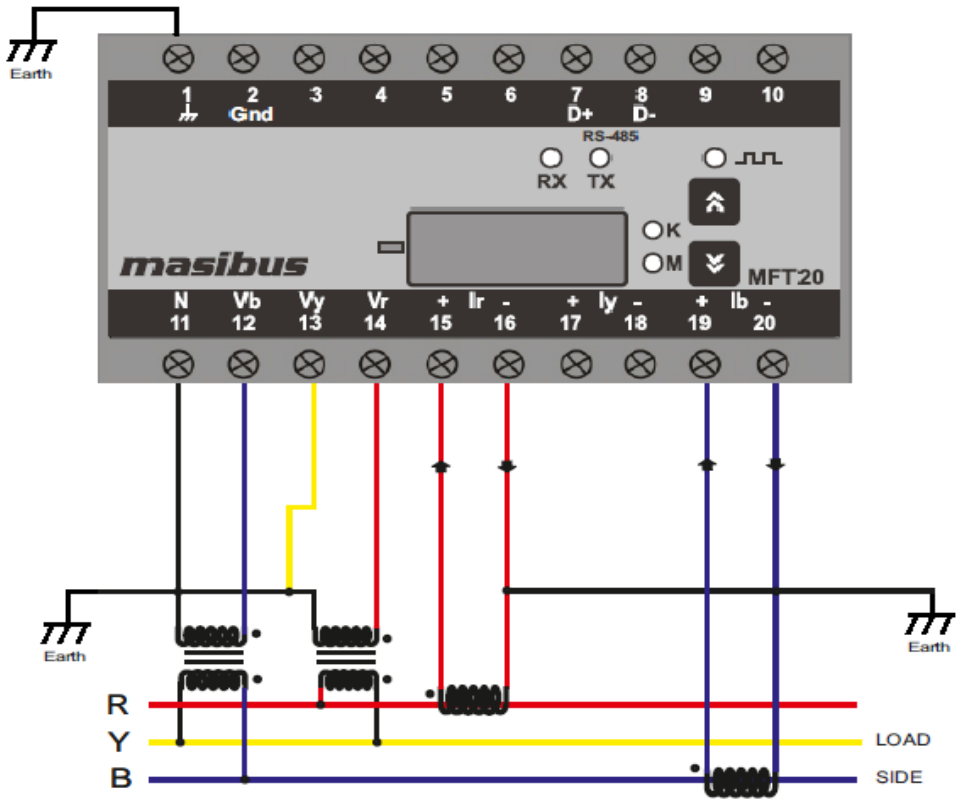


a) 4-Wire Direct Connection

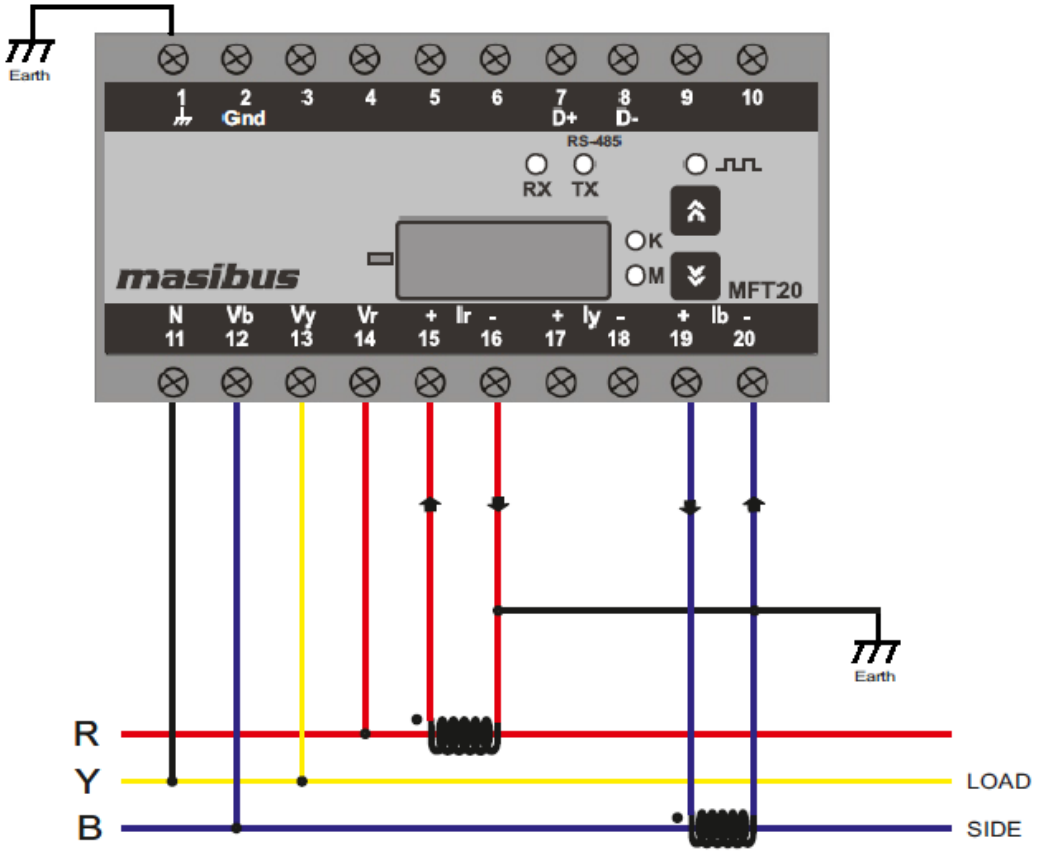


6.2.2 Three Phase Three Wire System

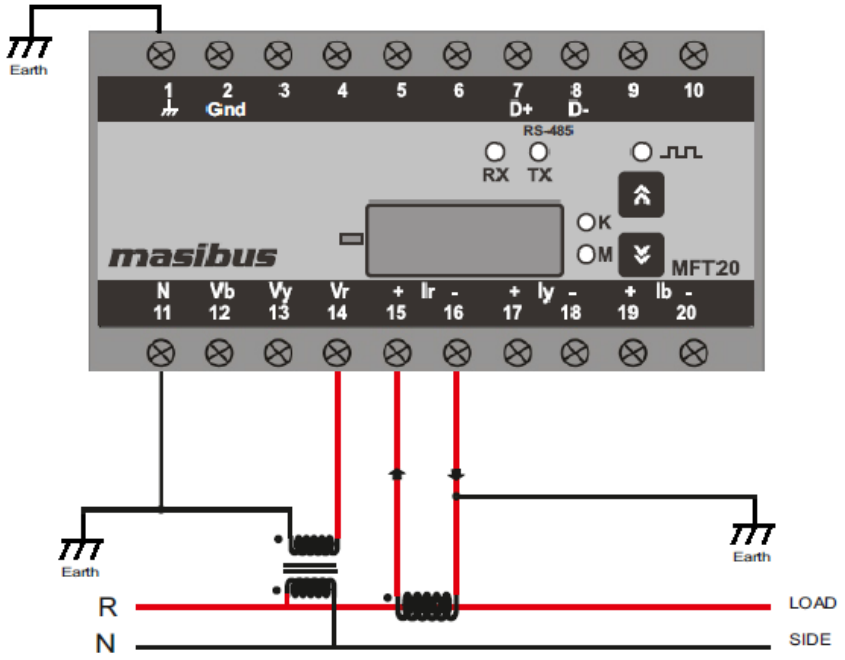
a) 3-Wire 2- Element Open Delta Connection Using 2PTs, 2CTs



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



6.2.3 Single Phase Two Wire Configuration



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

- We should recommended connection of earth terminal for the protection and reliable communication of the MFT.
- We have also provided Ground terminal (Gnd) of the RS-485 communication.
  In the worst condition of RS-485 Modbus communication, i.e. Communication frequently break between master and slaves devices (Query and Responses are frequently missing). In that case, Used Ground terminal (Gnd) of the slave device. For that, loop all the RS-485 Ground terminal (Gnd) of all the slave devices (MFT20) and connect them to RS-485 ground of the Master device.

6.3 PTs and CTs

Large electrical installations have high voltages and currents, which may exceed the direct connection rating of the MFT. 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 Transducer 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 transducer. The accuracy of the measurement also depends on the accuracy and phase – angle error of the PTs and CTs. Instrument Class 1 or better PTs and CTs are recommended. Do not use protection class CTs to feed the MFT; 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.

6.3.1 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 supply burden from the PTs. CTs 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 instrument should be such that, VA of wire path between MFT and CT along with VA of MFT should not exceed the VA rating of CT, otherwise the CT could get over-burdened and give large errors.
MFT should be conveniently located for easy connections of voltage (PT) and Current (CT) signals.

7. CONFIGURATION GUIDELINES

7.1 Modes of Operation

MFT has two mode of operation:

- Run Mode
- Configuration Mode

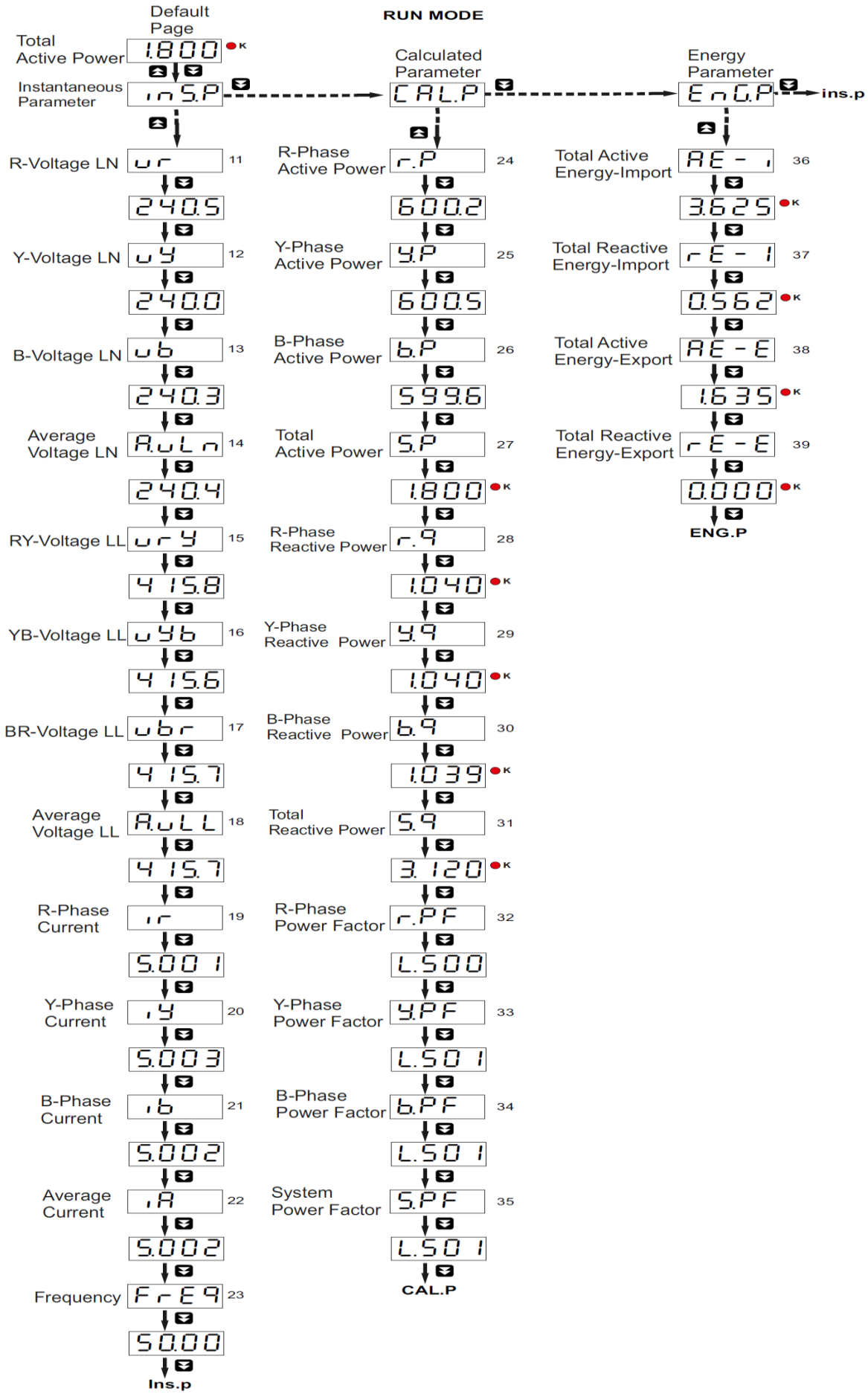
7.2 Run Mode Detail

At power ON, the unit by default goes into RUN Mode. The Default page (Value of Total Active Power) is displayed, just after flash of MT20 display.

When the user presses any key, it will enter in run mode parameters. Run mode parameter distinguishes between three groups. ins.p (instantaneous parameters), cal.p (calculated parameters) , eng.p (energy parameters).

These groups include various parameters as shown in the below fig. Users can see three groups one by one by pressing DOWN key. User want to go to a particular group, press the UP key. Groups contain parameters names and their values like (Vr, Vr value etc). Users can see the parameter name and its value by pressing the DOWN key (refer below fig.). User can only exit from that group only by pressing down key until the last parameter value comes and then again pressing DOWN key, going back to where the user entered. By Pressing both keys at a same time , the user can directly go into the configuration mode from the RUN mode.

The sequence of pages, which can be observed in RUN Mode, is shown in below fig.

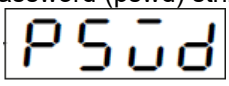

RUN MODE
Default Page
Total Active Power
1.800
Instantaneous Parameter
ins.P
Calculated Parameter
CAL.P
Energy Parameter
EnG.P
ins.p
R-Voltage LN
11
240.5
Y-Voltage LN
12
240.0
B-Voltage LN
13
240.3
Average Voltage LN
14
240.4
RY-Voltage LL
15
415.8
YB-Voltage LL
16
415.6
BR-Voltage LL
17
415.7
Average Voltage LL
18
415.7
R-Phase Current
19
5.001
Y-Phase Current
20
5.003
B-Phase Current
21
5.002
Average Current
22
5.002
Frequency
23
50.00
Ins.p
R-Phase Active Power
24
600.2
Y-Phase Active Power
25
600.5
B-Phase Active Power
26
599.6
Total Active Power
27
1.800
R-Phase Reactive Power
28
1.040
Y-Phase Reactive Power
29
1.040
B-Phase Reactive Power
30
1.039
Total Reactive Power
31
3.120
R-Phase Power Factor
32
L.500
Y-Phase Power Factor
33
L.501
B-Phase Power Factor
34
L.501
System Power Factor
35
L.501
CAL.P
Total Active Energy-Import
36
3.625
Total Reactive Energy-Import
37
0.562
Total Active Energy-Export
38
1.635
Total Reactive Energy-Export
39
0.000
ENG.P

3-Phase 4-Wire

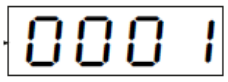
Note1:-Above screens are only for information of RUN MODE pages, values inside the screens are not actual.
Note2:- In the **3-Phase 3-Wire** system below Run pages are not displayed.
Page no. 15, 16, 17, 18, 20, 25, 29, 33 are not displayed in Run mode.

7.3 Configuration Mode Detail

The Configuration Mode can be entered by pressing the INC & DEC key both at same time. Once the key is pressed, the unit prompts for password (pswd) string as shown below.

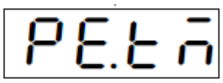


After pressing INC key, the unit prompts 0001 as shown below.



Factory default password is 0001.If you have configured this password as per your choice then apply that password by setting blinking cursor position using two keys: INC key to shift cursor position, DOWN to change the digit value. When the value is set and then press both the key at same time to enter in to configuration mode if the password is correct. If applied password is incorrect, it will show false message and automatically comes out to Run mode.

If the entered password is correct, it will flash as True message and following screen is displayed.

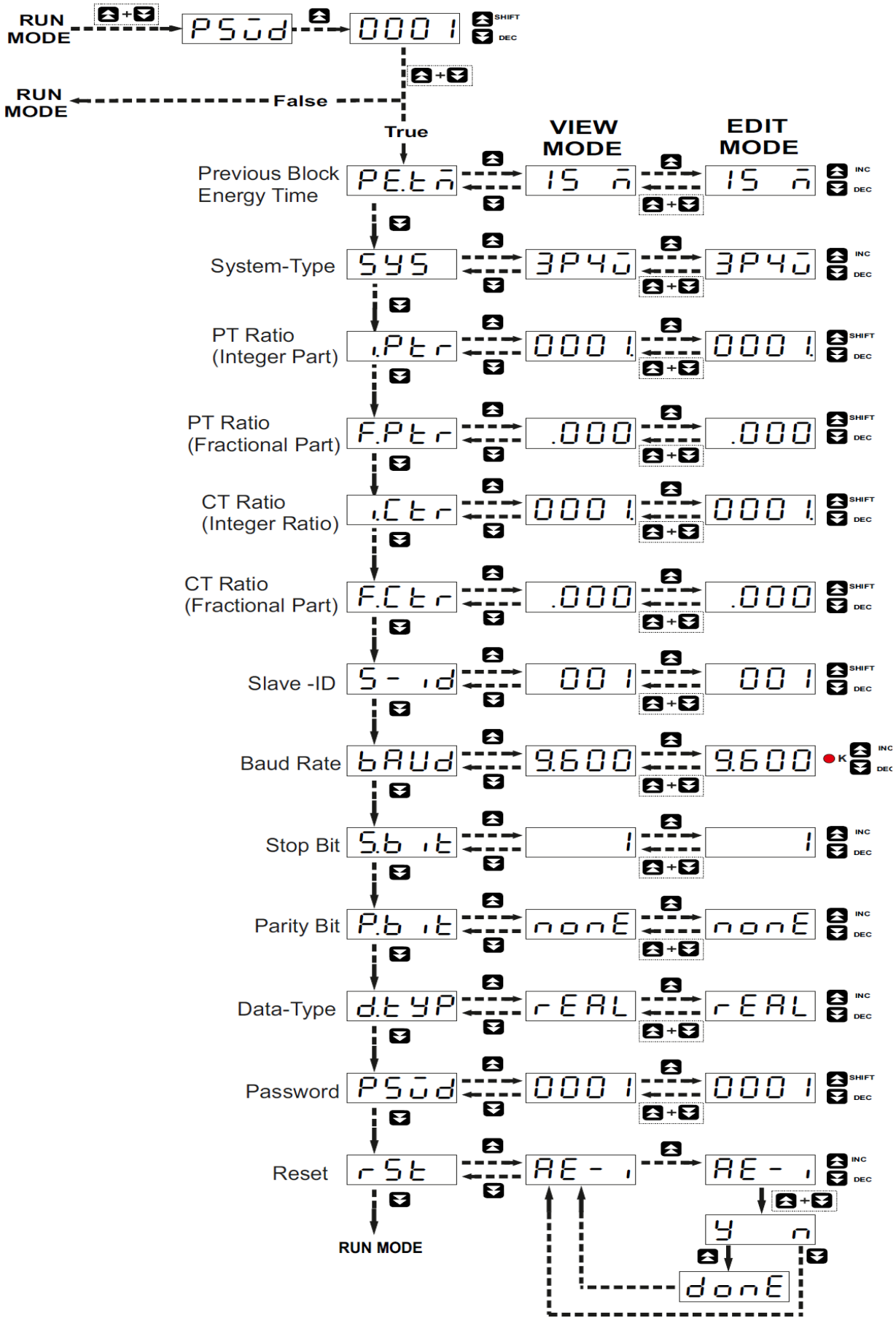


The sequence of pages, which can be observed in Configuration Mode, is shown in below fig.
List of configuration parameters is shown by pressing DEC key still the last RST parameter, After that once by press DEC key its goes to RUN mode, from where was you entered.

In the configuration mode, from that you want to view the parameter then you need to press INC key for viewing particular parameter value.

If you are in Configuration mode and more than 1 minute you have not pressing any keys then automatically it's goes to RUN mode from where you entered.

CONFIGURATION MODE



7.4 Edit Mode Detail

It is goes into the EDIT mode (Blinking ON) by pressing INC key from the VIEW mode.

1. **Previous block energy time (PE.TM) :**
   There are two option 15 minute (15 M) and 1 hour (1 Hr) for the previous block energy measurement.
   By pressing INC and DEC key, you can select any one from that after by pressing both the keys it is saved in EEPROM.
   Previous block energy time parameter calculation always start from zero when powered ON. Same for the changes made to edit mode of previous block energy time.

2. **System type (SYS) :**
   There are two option 3 phase 4 wire (3P4W) and 3 phase 3 wire (3P3W) for the System type.
   By pressing INC and DEC key, you can select any one from that after by pressing both the keys it is saved in EEPROM.

3. **PT Ratio - Integer part (I.PTR) :**
   PT Ratio – Fractional part (F.PTR):
   It is PT Ratio (Potential Transformer ratio). It's value are separated in two parts one is integer part (means value before the decimal point) and another is fractional part(means value after the decimal point).
   By setting blinking cursor position using two keys: INC key to shift cursor position, DEC key to change the digit value. When the value is set and then press both the key at same time to save in EEPROM.
   e.g.1
   PT Primary = 66KV, PT Secondary = 110V
   Therefore **PTR** = 66KV / 110V = 600.000
   In this PTR value is separated in two parts
   I.PTR = 600 and F.PTR=.000
   e.g.2
   PT Primary = 15.6KV, PT Secondary = 110V
   Therefore **PTR** = 15.6KV / 110V = 141.818
   In this PTR value is separated in two parts
   I.PTR = 141 and F.PTR=.818
4. **CT Ratio - Integer part (I.CTR) :**
   CT Ratio – Fractional part (F.CTR):
   It is CT Ratio (Current Transformer ratio). Same as PTR.

5. **Slave Address (S-Id) :**
   Slave Address should be between 1 and 247.
   By setting blinking cursor position using two keys: INC key to shift cursor position, DEC key to change the digit value. When the value is set and then press both the key at same time to save in EEPROM.

6. **Baud rate (baud) :**
   There are five options like 2400, 4800, 9600,19200 and 38400. By pressing INC and DEC key, you can select any one from that, after by pressing both the keys it is saved in EEPROM.

7. **Stop bit (S.bit) :**
   There are two options like 1-stop bit & 2-stop bit. By pressing INC and DEC key, you can select any one from that, after by pressing both the keys it is saved in EEPROM.

8. **Parity bit (P.bit) :**
   There are three options like None, odd & Even parity bit. By pressing INC and DEC key, you can select any one from that, after by pressing both the keys it is saved in EEPROM.

9. **Data type (d.typ) :**
   There are two options like Float (Real) & Long. By pressing INC and DEC key, you can select any one from that, after by pressing both the keys it is saved in EEPROM.

Note: If data type is **Real** in multifunction transducer then set **float** in Modbus master. If data type is **long** in Multifunction transducer then set **long** in Modbus master.

10. **Password (pswd) :**
    Password should be between 1 and 9999.
    By setting blinking cursor position using two keys: INC key to shift cursor position, DEC key to change the digit value. When the value is set and then press both the key at same time to save in EEPROM.

11. **Reset (rst) :**
    There are ten options for Reset as per below table. By pressing INC and DEC key, you can select any one from that, after by pressing both the keys, it will show the option for Yes(Y) & No(n) for user confirmation. If the user want to reset, for that press the INC key it will flash the done message and automatically goes to view mode. If the user does not want to reset then press the DEC key to goes in view mode.

RESET OPTION	DESCRIPTION
AE-I	ActiveEnergy Import
RE-I	Reactive Energy Import
AE-E	Active Energy Export
RE-E	Reactive Energy Export
ENGY	All Energy
HOUR	Hours
LO.HI	Low-High Value
MD	Maximum Demand
PB-E	Previous Block Energy
ALL	All Reset

7.5 Maximum Demand

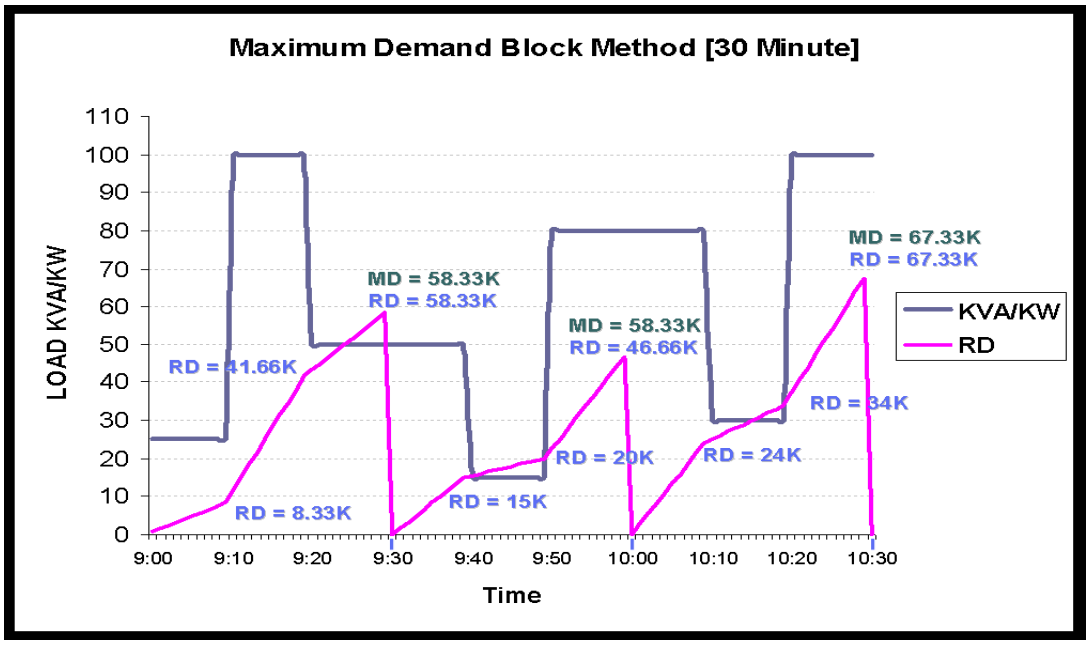
MD is calculated on: for KW / KVA.
MD calculation method / Demand type(dtyp): BLOCK / SLIDE.
Interval time for MD calculation: 15 / 30 minutes.
When MD calculation method is SLIDE than need to select Sub Interval time (Sb. Time) for MD calculation, so in SLIDE method every selected Sb. Time, Unit will calculate MD with consideration of previous demands up to In. Time.

In **BLOCK WINDOW,** Say if the integration time is 15 minutes then value of max demand will be updated at every 15 minutes. Demand is calculated by accumulating power every second. That is called Rising Demand. Rising Demand is calculated at every second and stored to FRAM, Maximum Demand is calculated every 15 minutes in sync with Real Time, If power fails and at the next power ON, if 15 min window has changed than it will calculate Max Demand.

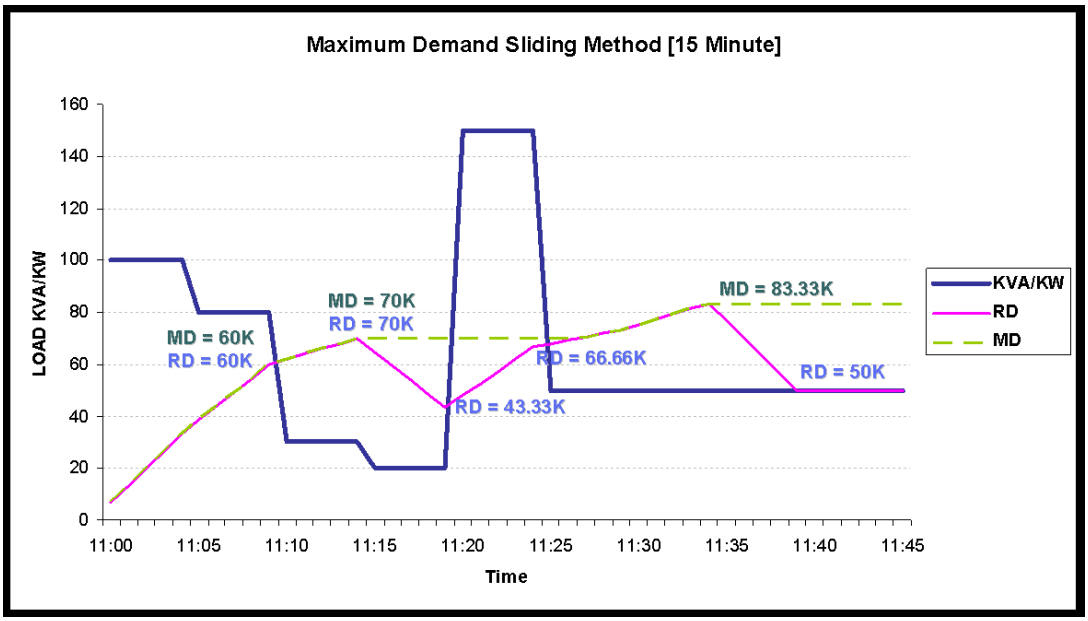
In **SLIDDING WINDOW,** Say if the interval time is 30 minutes and Sb. Time is 2 min, then value of max demand will be updated at every 2 minutes. Demand is calculated by accumulating power every 2 minutes.. Power for Demand will be averaged based on Sb.Time it means it will be averaged for 120 seconds and then it will be taken in to demand array. Rising Demand is calculated at every 2 minutes averaging last 15 values from Demand array and stored to FRAM. If power fails and at the next power ON, It will start from initial values so Rising Demand will stabilize after 30 minutes in this case.

E.g.

1. Block Method [30 Minute Window]



2. Sliding Method [15 Minute Window]



For Constant KVA, RD will get stable after 15 minutes.

8. MODBUS DETAILS

RS – 485 interface is provided to communicate with the MFT. 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, it's 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 parameters

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 = 0X04
Address – between 30001 to 30119
No. of data word ≤ 120 & in multiple of 2 as all data are of 4 Bytes [Long & Float (Real)]. Enter only Even value (data word length).

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]
***[Data Format:** Long & Float (Real)]*

Sr. No.	Address	Measured parameter		words	Multiplication Factor (if data type is long)
		3P4W	3P3W		
1	30001	Frequency	Frequency	2	0.01
2	30003	R. PF	RY. PF	2	0.001
3	30005	Y. PF	Reserved	2	0.001
4	30007	B. PF	BY. PF	2	0.001
5	30009	S. PF	S. PF	2	0.001
6	30011	R. Vrms	Vrms RY	2	0.1
7	30013	Y. Vrms	Vrms BR	2	0.1
8	30015	B. Vrms	Vrms YB	2	0.1
9	30017	A. Vrms	A_Vrms LL	2	0.1
10	30019	Vrms RY	Reserved	2	0.1
11	30021	Vrms YB	Reserved	2	0.1
12	30023	Vrms BR	Reserved	2	0.1
13	30025	R. Irms	R. Irms	2	0.001
14	30027	Y. Irms	Y. Irms	2	0.001
15	30029	B. Irms	B. Irms	2	0.001
16	30031	A. Irms	A. Irms	2	0.001
17	30033	I_neutral	Reserved	2	0.001
18	30035	R. Watt	RY. Watt	2	1
19	30037	Y. Watt	Reserved	2	1

20	30039	B. Watt	BY. Watt	2	1
21	30041	S. Watt	S. Watt	2	1
22	30043	R. Var	RY. Var	2	1
23	30045	Y. Var	Reserved	2	1
24	30047	B. Var	BY. Var	2	1
25	30049	S. Var	S. Var	2	1
26	30051	R. VA	RY. VA	2	1
27	30053	Y. VA	Reserved	2	1
28	30055	B. VA	BY. VA	2	1
29	30057	S. VA	S. VA	2	1
30	30059	R. KWh-Import	RY. KWh-Import	2	0.1
31	30061	Y. KWh-Import	Reserved	2	0.1
32	30063	B. KWh-Import	BY. KWh-Import	2	0.1
33	30065	T. KWh-Import	T. KWh-Import	2	0.1
34	30067	R. KWh-Export	RY. KWh-Export	2	0.1
35	30069	Y. KWh-Export	Reserved	2	0.1
36	30071	B. KWh-Export	BY. KWh-Export	2	0.1
37	30073	T. KWh-Export	T. KWh-Export	2	0.1
38	30075	R. KVarh-Import	RY. KVarh-Import	2	0.1
39	30077	Y. KVarh-Import	Reserved	2	0.1
40	30079	B. KVarh-Import	BY. KVarh-Import	2	0.1
41	30081	T. KVarh-Import	T. KVarh-Import	2	0.1
42	30083	R. KVarh-Export	RY. KVarh-Export	2	0.1
43	30085	Y. KVarh-Export	Reserved	2	0.1
44	30087	B. KVarh-Export	BY. KVarh-Export	2	0.1
45	30089	T. KVarh-Export	T. KVarh-Export	2	0.1
46	30091	R. KVah	RY. KVah	2	0.1
47	30093	Y. KVah	Reserved	2	0.1
48	30095	B. KVah	BY. KVah	2	0.1
49	30097	T. KVah	T. KVah	2	0.1
50	30099	A.Vrms_LL	Reserved	2	0.1
51	30101	Sum. Irms	Sum. Irms	2	0.001
52	30103	R. Phase Angle	RY. Phase Angle	2	0.01
53	30105	Y. Phase Angle	Reserved	2	0.01
54	30107	B. Phase Angle	BY. Phase Angle	2	0.01
55	30109	R. DPF	RY. DPF	2	0.001
56	30111	Y. DPF	Reserved	2	0.001
57	30113	B. DPF	BY. DPF	2	0.001
58	30115	S. DPF	S. DPF	2	0.001
59	30117	V. Unbalance	V. Unbalance	2	0.01
60	30119	I . Unbalance	I. Unbalance	2	0.01

Current Harmonics:

Function Code = 0X04
Address – between 30301 to 30397
No. of data word ≤ 98 & in multiple of 2 as all data are of 4 Bytes [Long & Float (Real)].
Enter only Even value (data word length).
[Data Format: *long & Float(Real)* ***]***

S. No.	Address	Measured parameter		words	Multiplication Factor (if data type is long)
		3P4W	3P3W		
1	30301	3rd IrHar	3rd IrHar	2	0.01
2	30303	5th IrHar	5th IrHar	2	0.01
3	30305	7th IrHar	7th IrHar	2	0.01
4	30307	9th IrHar	9th IrHar	2	0.01

5	30309	11th IrHar	11th IrHar	2	0.01
6	30311	13th IrHar	13th IrHar	2	0.01
7	30313	15th IrHar	15th IrHar	2	0.01
8	30315	17th IrHar	17th IrHar	2	0.01
9	30317	19th IrHar	19th IrHar	2	0.01
10	30319	21th IrHar	21th IrHar	2	0.01
11	30321	23th IrHar	23th IrHar	2	0.01
12	30323	25th IrHar	25th IrHar	2	0.01
13	30325	27th IrHar	27th IrHar	2	0.01
14	30327	29th IrHar	29th IrHar	2	0.01
15	30329	31th IrHar	31th IrHar	2	0.01
16	30331	3rd IyHar	Reserved	2	0.01
17	30333	5th IyHar	Reserved	2	0.01
18	30335	7th IyHar	Reserved	2	0.01
19	30337	9th IyHar	Reserved	2	0.01
20	30339	11th IyHar	Reserved	2	0.01
21	30341	13th IyHar	Reserved	2	0.01
22	30343	15th IyHar	Reserved	2	0.01
23	30345	17th IyHar	Reserved	2	0.01
24	30347	19th IyHar	Reserved	2	0.01
25	30349	21th IyHar	Reserved	2	0.01
26	30351	23th IyHar	Reserved	2	0.01
27	30353	25th IyHar	Reserved	2	0.01
28	30355	27th IyHar	Reserved	2	0.01
29	30357	29th IyHar	Reserved	2	0.01
30	30359	31th IyHar	Reserved	2	0.01
31	30361	3rd IbHar	3rd IbHar	2	0.01
32	30363	5th IbHar	5th IbHar	2	0.01
33	30365	7th IbHar	7th IbHar	2	0.01
34	30367	9th IbHar	9th IbHar	2	0.01
35	30369	11th IbHar	11th IbHar	2	0.01
36	30371	13th IbHar	13th IbHar	2	0.01
37	30373	15th IbHar	15th IbHar	2	0.01
38	30375	17th IbHar	17th IbHar	2	0.01
39	30377	19th IbHar	19th IbHar	2	0.01
40	30379	21th IbHar	21th IbHar	2	0.01
41	30381	23th IbHar	23th IbHar	2	0.01
42	30383	25th IbHar	25th IbHar	2	0.01
43	30385	27th IbHar	27th IbHar	2	0.01
44	30387	29th IbHar	29th IbHar	2	0.01
45	30389	31th IbHar	31th IbHar	2	0.01
46	30391	Total Irthd	Total Irthd	2	0.01
47	30393	Total Iythd	Total Iythd	2	0.01
48	30395	Total Ibthd	Total Ibthd	2	0.01
49	30397	Avg. Ithd	Avg. Ithd	2	0.01

Voltage Harmonics:

Function Code = 0X04
Address – between 30401 to 30497
No. of data word ≤ 98 & in multiple of 2 as all data are of 4 Bytes [Long & Float (Real)].
Enter only Even value (data word length).
[Data Format: *long & Float(Real)* ***]***

S. No.	Address	Measured parameter		words	Multiplication Factor (if data type is long)
		3P4W	3P3W		
1	30401	3rd VrHar	3rd VrHar	2	0.01
2	30403	5th VrHar	5th VrHar	2	0.01
3	30405	7th VrHar	7th VrHar	2	0.01
4	30407	9th VrHar	9th VrHar	2	0.01
5	30409	11th VrHar	11th VrHar	2	0.01
6	30411	13th VrHar	13th VrHar	2	0.01
7	30413	15th VrHar	15th VrHar	2	0.01
8	30415	17th VrHar	17th VrHar	2	0.01
9	30417	19th VrHar	19th VrHar	2	0.01
10	30419	21th VrHar	21th VrHar	2	0.01
11	30421	23th VrHar	23th VrHar	2	0.01
12	30423	25th VrHar	25th VrHar	2	0.01
13	30425	27th VrHar	27th VrHar	2	0.01
14	30427	29th VrHar	29th VrHar	2	0.01
15	30429	31th VrHar	31th VrHar	2	0.01
16	30431	3rd VyHar	Reserved	2	0.01
17	30433	5th VyHar	Reserved	2	0.01
18	30435	7th VyHar	Reserved	2	0.01
19	30437	9th VyHar	Reserved	2	0.01
20	30439	11th VyHar	Reserved	2	0.01
21	30441	13th VyHar	Reserved	2	0.01
22	30443	15th VyHar	Reserved	2	0.01
23	30445	17th VyHar	Reserved	2	0.01
24	30447	19th VyHar	Reserved	2	0.01
25	30449	21th VyHar	Reserved	2	0.01
26	30451	23th VyHar	Reserved	2	0.01
27	30453	25th VyHar	Reserved	2	0.01
28	30455	27th VyHar	Reserved	2	0.01
29	30457	29th VyHar	Reserved	2	0.01
30	30459	31th VyHar	Reserved	2	0.01
31	30461	3rd VbHar	3rd VbHar	2	0.01
32	30463	5th VbHar	5th VbHar	2	0.01
33	30465	7th VbHar	7th VbHar	2	0.01
34	30467	9th VbHar	9th VbHar	2	0.01
35	30469	11th VbHar	11th VbHar	2	0.01
36	30471	13th VbHar	13th VbHar	2	0.01
37	30473	15th VbHar	15th VbHar	2	0.01
38	30475	17th VbHar	17th VbHar	2	0.01
39	30477	19th VbHar	19th VbHar	2	0.01
40	30479	21th VbHar	21th VbHar	2	0.01
41	30481	23th VbHar	23th VbHar	2	0.01
42	30483	25th VbHar	25th VbHar	2	0.01
43	30485	27th VbHar	27th VbHar	2	0.01
44	30487	29th VbHar	29th VbHar	2	0.01
45	30489	31th VbHar	31th VbHar	2	0.01
46	30491	Total Vrthd	Total Vrthd	2	0.01

47	30493	Total Vythd	Total Vythd	2	0.01
48	30495	Total Vbthd	Total Vbthd	2	0.01
49	30497	Avg. Vthd	Avg. Vthd	2	0.01

Energy Overflow Count:

Function Code = 0X04
Address – between 30501 to 30516
No. of data word ≤ 16 & in multiple of 1 as all data are of 2 Bytes [Decimal].
***[Data Format:** Only in Decimal]*

S. No.	Address	Measured parameter	words	Multiplication Factor (if data type is long)
1	30501	Wh I –ovcnt	1	-
2	30502	Wh E-ovcnt	1	-
3	30503	VARh I-ovcnt	1	-
4	30504	VARh E-ovcnt	1	-
5	30505	VAh –ovcnt	1	-
6	30506	Old Wh I -ovcnt	1	-
7	30507	Old Wh E-ovcnt	1	-
8	30508	Old VARh I-ovcnt	1	-
9	30509	Old VARh E-ovcnt	1	-
10	30510	Old VAh -ovcnt	1	-
11	30511	ON HOUR	1	-
12	30512	ON MIN	1	-
13	30513	RUN HOUR	1	-
14	30514	RUN MIN	1	-
15	30515	Old RUN HOUR	1	-
16	30516	Old RUN MIN	1	-

Min Max Value: It will log Min Max from Last Reset

Function Code = 0X04
Address – between 30151 to 30265
No. of data word ≤ 116 & in multiple of 2 as all data are of 4 Bytes [Long & Float (Real)].
***[Data Format:** long & Float (Real)]*

S. No.	Address	Measured parameter		words	Multiplication Factor
		3P4W	3P3W		(if data type is long)
1	30151	R.Vrms Max	Vrms RY Max	2	0.1
2	30153	Y.Vrms Max	Vrms BR Max	2	0.1
3	30155	B.Vrms Max	Vrms YB Max	2	0.1
4	30157	A.Vrms Max	A.Vrms LL Max	2	0.1
5	30159	R.Vrms Min	Vrms RY Min	2	0.1
6	30161	Y.Vrms Min	Vrms BR Min	2	0.1
7	30163	B.Vrms Min	Vrms YB Min	2	0.1
8	30165	A.Vrms Min	A.Vrms LL Min	2	0.1
9	30167	R.Irms Max	R.Irms Max	2	0.001
10	30169	Y.Irms Max	Reserved	2	0.001
11	30171	B.Irms Max	B.Irms Max	2	0.001
12	30173	A.Irms Max	A.Irms Max	2	0.001
13	30175	R.Irms Min	R.Irms Min	2	0.001
14	30177	Y.Irms Min	Reserved	2	0.001

15	30179	B.Irms Min	B.Irms Min	2	0.001
16	30181	A.Irms Min	A.Irms Min	2	0.001
17	30183	R.PF Max	RY.PF Max	2	0.001
18	30185	Y.PF Max	Reserved	2	0.001
19	30187	B.PF Max	BY.PF Max	2	0.001
20	30189	S.PF Max	S.PF Max	2	0.001
21	30191	R.PF Min	RY.PF Min	2	0.001
22	30193	Y.PF Min	Reserved	2	0.001
23	30195	B.PF Min	BY.PF Min	2	0.001
24	30197	S.PF Min	S.PF Min	2	0.001
25	30199	Frequency Max	Frequency Max	2	0.01
26	30201	Frequency Min	Frequency Min	2	0.01
27	30203	S.Watt Max	S.Watt Max	2	1
28	30205	S.Watt Min	S.Watt Min	2	1
29	30207	S.VAR Max	S.VAR Max	2	1
30	30209	S.VAR Min	S.VAR Min	2	1
31	30211	S.VA Max	S.VA Max	2	1
32	30213	S.VA Min	S.VA Min	2	1
33	30215	Old T. KWh-Import	Old T. KWh-Import	2	0.1
34	30217	Old T. KWh-Export	Old T. KWh-Export	2	0.1
35	30219	Old T. KVarh-Import	Old T. KVarh-Import	2	0.1
36	30221	Old T. KVarh-Export	Old T. KVarh-Export	2	0.1
37	30223	Old T. KVah	Old T. KVah	2	0.1
38	30225	Day KWh-Import	Day KWh-Import	2	0.1
39	30227	Day KWh-Export	Day KWh-Export	2	0.1
40	30229	Day KVarh-Import	Day KVarh-Import	2	0.1
41	30231	Day KVarh-Export	Day KVarh-Export	2	0.1
42	30233	Day KVah	Day KVah	2	0.1
43	30235	Real Date	Real Date	2	1
44	30237	Real Time	Real Time	2	1
45	30239	Rising Demand	Rising Demand	2	0.1
46	30241	Max Demand	Max Demand	2	0.1
47	30243	Md Date	Md Date	2	1
48	30245	Md Time	Md Time	2	1
49	30247	Rising Demand Current	Rising Demand Current	2	0.001
50	30249	Max Demand Current	Max Demand Current	2	0.001

51	30251	Md Date Current	Md Date Current	2	1
52	30253	Md Time Current	Md Time Current	2	1
53	30255	Previous block T. KWh-Import	Previous block T. KWh-Import	2	0.1
54	30257	Previous block T. KVarh-Import	Previous block T. KVarh-Import	2	0.1
55	30259	Previous block T. KWh-Export	Previous block T. KWh-Export	2	0.1
56	30261	Previous block T. KVarh-Export	Previous block T. KVarh-Export	2	0.1
57	30263	Date_Previous block Energy	Date_Previous block Energy	2	1
58	30265	Time_Previous block Energy	Time_Previous block Energy	2	1

Note: If data type is **long** in multifunction transducer then set **long** in Modbus master. If data type is **Real** in Multifunction transducer then set **Float** in Modbus master.
Note: Energy will be in Kilo for Float (Real) data type and for Long data type multiply with constant stated to get energy in Kilo unit.
Note: *Ignore address which are not mentioned in the memory map as they are useful in 3P4W mode.*

Note: For Time & Date

Real Date & MD Date : DDMMYY	*e.g. If it is 250112 than Date: 25/01/12*
Real Time : HHMMSS	*e.g. If it is 135015 than Time: 13:50:15*
MD Time: HHMM	*e.g. If it is 1350 than Time: 13:50*
Previous block energy time: HHMM	*e.g. If it is 1350 than Time: 13:50*

Note: Rising Demand and Max Demand will be in Kilo for float & Long value.
Note: Ignore value for **Reserved** in Modbus Memory Map.

8.2 User Assignable Registers

The MFT20 contains the 60 user assignable registers in the address range of 2001 to 2119 (see Table 8-1), 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 8-2). 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 119 is mapped to registers 301 to 360.

For example, if you want to read registers 17 (A. Vrms - Average Voltage, float / long) and 65 (T.KWh Import - Total Active energy import, float / long) via registers 2001-2003, then do the following:
- write 17 to register 301
- write 65 to register 302

Reading from registers 2001-2003 will return the Voltage reading in registers 2001, and the KWh reading in register 2003.
Default data type is float (Real).

Table 8-1 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 [Float (Real) / Long]. Enter only Even value (data word length).

Address	Register Contents	Type
32001	Assigned register #2001	Float / Long
32003	Assigned register #2003	Float / Long
32005	Assigned register #2005	Float / Long
…	…	…
32119	Assigned register #2119	Float / Long

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 119 , 151 to 265, 301 to 397, 401 to 497
40302	Mapped address for register #2003	Decimal	R/W	1 to 119 , 151 to 265, 301 to 397, 401 to 497
40303	Mapped address for register #2005	Decimal	R/W	1 to 119 , 151 to 265, 301 to 397, 401 to 497
…	…	…	…	…
40360	Mapped address for register #2119	Decimal	R/W	1 to 119 , 151 to 265, 301 to 397, 401 to 497

8.3 Modbus Register Map for configuration parameters

Preset Single 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
Address – Any Single Register between 40101 to 40154
Data = Data of 1 word, as all data are of 2 Bytes [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]

S. No.	Address	Measured parameter	Words	Minimum value	Maximum value
1	40101	Password	1	1	9999
2	40102	Slave address	1	1	247
3	40103	Baud rate (2400,4800,9600, 19200,38400)	1	2400	38400
4	40104	Energy type (see Table 2)	1	0	19
5	40105	System type (see Table 3) (see note 4)	1	0	1
6	40106	PF1 type (read only value)	1	0	2

		(see Table 4)			
7	40107	PF2 type (read only value) (For 3P4W only) (see Table 4)	1	0	2
8	40108	PF3 type (read only value) (see Table 4)	1	0	2
9	40109	System PF type(read only value) (see Table 4)	1	0	2
10	40110	CT Ratio – High byte (see note 2)	1	0	152
11	40111	CT Ratio – low byte (see note 2)	1	1000	65535
12	40112	PT Ratio – high byte (see note 2)	1	0	152
13	40113	PT Ratio – low byte (see note 2)	1	1000	65535
14	40116	Pulse constant	1	1	60000
15	40117	Stop bit	1	1	2
16	40118	Parity bit (0-none, 1-odd, 2-even)	1	0	2
17	40119	Previous energy block time (0 – for 15 min, 1 – for 1 hour)	1	0	1
18	40121	Data type(see Table 6) (see note 3)	1	0	1
19	40122	Demand Type (0-KW, 1-KVA)	1	0	1
20	40123	Demand Method (0-BLOCK, 1-SLIDE)	1	0	1
21	40124	Interval Time (15/30)	1	15	30
22	40125	Sub Interval Time (see note 7)	1	1	10
23	40126	Real Sec& Min [SSMM]	1	0	5959
24	40127	Real Hour & Date [HHDD]	1	1	2331
25	40128	Real Month & Year[MMYY]	1	100	1299
26	40130	Reset All/Individual Energy Reg.(Write only)(see Table 5)	1	79	90
27	40154	Low Current noise cutoff (between 2 to 10mA) (see note 6)	1	2	10

Note 2: Maximum CT & PT Ratio value is 9999999 i.e. maximum values is 9999.999 & minimum value is 1000 i.e. 1.000

For entering CT and PT ratio refer the below example.

Example:

For entering CTR value 1234.567, convert 1234567 in to hexadecimal i.e. 12D687.
Now enter lower four byte (D687) at 40111 and higher four byte (0012) at 40110 addresses respectively.

Note 3: If data type is **long** in MFT then set **long** in Modbus master.
If data type is **Real** in MFT then set **Float** in Modbus master.

Note 4: ignore address which is not mentioned in the memory map as they are useful in 3P4W mode, do proper wiring as stated in Wiring detail section.

Note 5: Energy will be in Kilo for float value and for Long data type multiply with constant stated to get energy in Kilo unit.

Note 6: This parameter allows the user to set Low noise current cutoff in mA (2 to 10). Setting 5 will display measured currents as 0 below 5 mA. (Default Value is 5mA)

Note 7: Sub interval Time

It is applicable for Sliding window only
For 15 minute Interval time it is limited to 1, 3 or 5
For 30 minute Interval time it is limited to 1, 2,3,5,6 or 10

Table 2:

Value	Energy type for Pulse Output
0	KWh Import
1	10 KWh Import
2	100 KWh Import
3	MWh Import
4	KWh Export
5	10 KWh Export
6	100 KWh Export
7	MWh Export
8	KVarh Import
9	10 KVarh Import
10	100 KVarh Import
11	MVarh Import
12	KVarh Export
13	10 KVarh Export
14	100 KVarh Export
15	MVarh Export
16	KVah
17	10 KVah
18	100 KVah
19	MVah

Table 3:

Value	System Type
0	3P4W
1	3P3W

Table 4:

Value(read only)	PF Type
0	Unity
1	Lag
2	Lead

Table 5:

Value(write only)	Reset Energy Register
79	Previous block energy
80	Active Import
81	Active Export
82	Reactive Import
83	Reactive Export
84	Apparent
85	All Energy
86	Hours Reset

87	Min - Max Reset
88	Power Interruption count
89	Max Demand Reset
90	All Reset

Table 6:

Value	Data Type
0	Long
1	Float (Real)

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
01	Illegal Function	The message function received is not an allowable action for slave.
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.
06	Slave Device Busy	The slave is engaged in processing a program command. The master should retransmit the message later when slave is free.

Example

Query Message

SLAVE ADDR	FUNCTION CODE	H.O START ADDR	L.O START ADDR	H.O NO OF REG	L.O NO OF REG	ERROR CHECK FIELD	ERROR CHECK FIELD
0x0A	0x01	0x00	0x24	0x00	0x02	0xFC	0xBB

The query requests the status of input 0036 in slave no. 10. Since the function is an invalid function for MFT, so the following error response will be generated.

Response Message

SLAVE ADDR	FUNCTION CODE	EXCEPTION CODE	ERROR CHECK	ERROR CHECK
0x0A	0x81	0x01	0xF0	0x52

The function field is the original function code with the high order bit set and exception code 01 indicates an illegal function field.
When slave device that is Multifunction transducer is in the PROGRAM mode, a busy state is transmitted indicating that slave device is busy and the master should retransmit the message later when the slave is free. So here exception code 0x06 is transmitted. Response message is shown below.

Response Message

SLAVE ADDR	FUNCTION CODE	EXCEPTION CODE	ERROR CHECK	ERROR CHECK
Device ID	Fun. Code + 0x80	0x06	0xC3	0x02

8.3.1 Read Holding Register (Function Code 03)

To get value of configuration parameters (CT Ratio, PT Ratio, Pls/KWh, Baud, Slave address etc.), you have to use function code **03.**

8.3.2 Preset Single Register (Function Code 06)

Function (06) will overwrite controller memory.

Function (06) allows the user to modify the contents of a holding register for configuration parameter. The values are provided in binary, up to the maximum capacity of the controller and unused higher bits must be set to zero.

Example

This example will set the CT Ratio value in slave number 17. Here CT Ratio and PT ratio requires 2 integer register for each. So you should write higher integer and lower integer value to get whole Ratio value. Suppose you want to write CT RATIO = 5,then you have to take 5000 to write because in unit side this 5000 will be divided by 1000 i.e. you will get 5.Now Hex value of 5000 is 0x1388,so you will take 0x00 for higher integer register and 0x1388 for lower integer register. The address of CT Higher integer is 40110 and value to be programmed is 0x0000, the address of CT Lower integer is 40111 and value to be programmed is 0x1388.

Similarly you can do for PT RATIO. The normal response to a preset single register request is to transmit the query message after the register has been altered,

If the value is an illegal 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 Transducer, Go through these notes:

General Setting & Condition for CT, PT ratio

- Confirm the connection configuration
- Confirm that all energy parameters, Hour parameters, MD parameters & Previous block energy are going to start from zero, if not, make them zero by **All Regs Rst**.
- Apply proper CT – PT Ratio as per requirement, which must pass the below mathematical conditions for 3P3W and 3P4W.
  For 3P4W
  3x1.2xVratedx1.2xIratedx CT Ratio x PT Ratio < 2,000,000,000
  For 3P3W
  2x1.2x√3xVratedx1.2xIratedx CT Ratio x PT Ratio < 2,000,000,000
- Confirm that Transducer is calibrated.
- For Serial communication, MODBUS-RTU, RS485, you will get float/long data from measurement.
- Factory set Password to access the Program mode is 0001.
- For 3p3w system, Display Menu will be changed and for Modbus communication, follow the address map for 3p3w.Configuration mode will be same.
- Select Energy type for LED Blinking as per your requirement.

ON Hour & RUN (LOAD) Hour

- **ON Hour**: The period for which the Transducer (supply) is ON
- **RUN (LOAD) Hour**: Indicates the period the Load is ON and has run. This counter accumulates as long as the load is greater than the starting current set.

Last Day Energy & Min-Max Value

Last Day Energy Value: Transducer will store Last Day Energy on same register in Modbus and will maintain Last day Energy and update it at 00:00 every day.
Min Max [Low High] Value: Min Max Value will be available as standard feature for all Ordering Code and will be available only on Modbus. It will log Min Max [Low High] from Last Reset

Energy Calculation

Below formula used for finding the Total Active Energy Import when the energy is roll over to 400G.
Total Active Energy = [Running Active Energy (Import) + (WH-I Ov.count * 400G)] (Import)

- **Example**:
  Let's WH-I Ov.count = 5, Active[Im] = 20.3268 GWh then

  Actually measured Total Active Energy (Import) = [20.3268 G + (5 * 400G)]
  = 2020.3268 GWh

  Above calculation is same for other energy (Active Export, Reactive Import, Reactive Export, and Apparent Energy) can be find out using respective Ov.count and running energy.

Energy Overflow Time Calculation

- When data type selected for modbus is FLOAT, Total Active Energy will overflow from 400GWh then auto reset Active Energy, Total Reactive Energy will overflow from 400GVARh then auto reset Reactive Energy, Total apparent Energy will overflow from 400GVAh then auto reset Apparent Energy, but when the ov.count of this energy (VA Ov.count > 99) then transducer will auto reset all energy parameter. This includes Active import and export energy, Reactive Import and Export energy and apparent energy. Such condition of overflow occurrence is depending on CT ratio and PT ratio.

Example:

For 110V V rated, and 1 A I rated multifunction transducer is set for 100A and 66KV line with CT Ratio of 100 and PT Ratio of 600.

- PT Primary = 66KV, PT Secondary = 110V Therefore select
  PTR = 66KV/110V=600.
  CT Primary=100A, CT Secondary=1A Therefore select
  CTR = 100A/1A=100 in transducer.
- Energy consumed per hour will be 66kV X 100Amps = 6600KVAHr.
- Time to overflow in Hr. = 400GVAHr / 6600KVAHr = 60606
- Days = 60606 /24 = 2525 Days
- Years = 2525 / 365 = 6.91 Years / Total of Three Phase.
- But our Apparent Energy Overflow Count Range are 1 to 99, therefore
  Total Time to overflow in Years = 6.91*99 = 684.09 Years / Total of Three Phase.
- User has to manually reset **All Regs Rst,** when installing the transducer first time.

10. TROUBLESHOOTING TIPS

The information in Table 9–1 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 9– 1: Troubleshooting

Potential Problem	Possible Cause	Possible Solution
The display is blank after applying supply Power to the MFT.	The MFT may not be receiving the necessary Power.	Verify that the MFT Vr,VY,Vb and neutral (VN) terminals are Receiving the necessary power Because it is self-powered.
The data being displayed is inaccurate or not what you expect.	Incorrect setup values.	Check that the correct values have been entered for MFT setup parameters (CTR and PTR ratings, System Type).
	Incorrect voltage inputs.	Check MFT voltage input terminals to verify that adequate voltage is present.
	MFT 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 MFT from a remote personal computer.	MFT address is incorrect.	Check to see that the MFT is correctly addressed.
	MFT baud rate (parity, stop bit) is incorrect.	Verify that the baud rate of the MFT matches the baud rate of all other devices on its communications link.
	Communications lines are improperly connected.	Verify the MFT 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.**

UNSTABLE READING

Check for loose connections.
First verify that all conventional instrumentation norms have been followed for wiring. Try using shielded cable for sensor input.

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.