OPERATING MANUAL FOR

TVM/MDC

(Model: PCM 9505)

(UNIVERSAL METER)

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CONTENTS

TRIVECTOR METER / MD CONTROLLER

1. General Features

ICD **TVM/MDC-PCM 9505** is designed with latest state of art technolgy. It offers high accuracy, reliability and also real value for money. This next generation micro controller based instruments monitors over 40 vital parameters and does not require any external Transducers. This instrument is most suitable for measuring all electrical parameters and demand control in three phase industrial applications.

The Unit monitors over more than 40 parameters and records more than 30 items. These informations are shown on a 4 row Graphical LCD display with backlit . Eight keys are provided on the front panel of the meter to access these informations quickly and easily. The front panel is provided with antiglare feature for improved readability.

The measurement parameters include total and phase wise values of voltage, current, kVA, kW, kVAr and power factor. Also measured frequency and energy values including kVAh, kWh, kVArh (Lag & Lead) and average PF.

The Unit also measures demand parameters like rising demand, maximum demand and predicted demand. The demand calculations are performed only on kVA / KW (selectable) demand. All voltage, current and power readings are true R.M.S including harmonics. The power measurement is done for the full four quadrants. The demand and energy readings are provided with reverse lock showing only the imported energy consumed by the consumer so as to match with the existing E.B. meter

PCM 9505 records TOD MD for eight zones. The timing of the TOD zones are programmable at site in 8 different time slots. It additionally record high and low profile for the demand and also generates demand profile consisting of 10 demand levels. A counter is associated with each demand level and it gets incremented whenever the demand has exceeded the corresponding demand level..

The unit has a in-built feature of time of the day (TOD) metering. The 24 hour duration is divided into Eight zones. The timing of the TOD zones are programmable at site in 8 different time slots. The meter also got facility, to register all the energy consumptions like kVAh, kWh, kVArh. It computes all the parameters and updates them in every 2 seconds. During starting of Integration cycle, PD is updated after 2 minutes, in rest of the cycle it is updated for every 1 minute.

The unit (PCM 9505) is provided with four relay outputs. The relay contacts are rated for 5A at 240 VAC. The relays are energised during the following conditions. (Relay ON status is indicated by respective LEDs)

Relay - 1 : Predicted demand > setpoint1
(Activated only after 5 min for 15 min integration & 10 min for 30 minutes integration cycle respectively)

Relay - 2 : Rising demand $\geq$ setpoint1 or setpoint% as programmed

Relay - 3 : Rising demand $\geq$ setpoint2 or setpoint% as programmed

Relay - 4 : Block kWh $\geq$ set kWh as programmed in set point 3

The setpoint 1, 2 & 3 are programmable through keypad. The setpoints can be programmed seperately for peak & non-peak periods.

These Relay outputs 2, 3 & 4 are momentary contacts and can be wired to remote hooters / Annunciator or can be used for automatic shut down of circuit breakers via contactors.

The relays (RL1, RL2 RL3 & RL4) can be acknowledged through relay acknowledge key. Once acknowledged, the RL1 relay & LED activates after 3 minutes, whereas RL2 & RL3 activates only in next integration cycle and RL4 activates on next time slot zone.

The unit is also provided with a optional RS 485 optically isolated communication port supporting MODBUS - RTU protocol. The port is very useful in networking the meters in multidrop communication and to collect datas in a centralised control room using any standard SCADA software packages like Cimplicity, Intellution, Wonderware, Citect etc.

2. Installation

2.1 Mounting

The unit is housed in a ABS Plastic enclosure of dimension 144(H)x144(W)x80(D) mm. The meter is suitable for panel mounting and has reliable mounting clamps to hold the meter to the panel.

The panel cutout for fixing the meter is 140 X 140 mm. The depth behind the panel is 80 mm. Always extra space is to be provided for the connectors and wiring. The cut out should be punched with proper tool and should be free from burrs. Insert the meter through the panel cut out from front and fix the mounting clamps provided with the meter on both side. Tighten the fixing clamps with limit amount of force so as to hold the meter in position.

2.2 Wiring

2.2.1 Selection of PT & CT

The measurement of voltage and current is done using the PT voltage and CT current inputs. So the accuracy of measurement is determined by the accuracy and phase shift produced by the PT's and CT's.So it is recommended to use PT's and CT's of instrument class 0.2 or better.

Also the PT's and CT's should have adequate VA rating to support the burden on the secondary side of them. The primary rating of the CT has to be selected such that the load variation lies between the dynamic range of the CT. (30% to 80% of the primary current).

2.2.2 Voltage signal connections

The Unit directly accepts voltages upto 415VAC R.M.S line to line (240VAC R.M.S line to neutral) with 10% over load capacity in case of LT meters and 110VAC R.M.S line to line (63.5 VAC R.M.S line to Neutral) with 10% over load capacity in case of HT meters. The primary of the PT is field programmable upto 999.999 kV (In HT meters).

(For 3 Phase) There are voltage input terminals marked as R, Y, B & N . The three phase input voltage should be connected to those terminals.

(For single phase) there are two voltage input terminals marked as per requirement.The single phase input voltage should be connected to those terminals.

2.2.3 Current signal connections

The Unit current inputs can accept 5A / 1A AC R.M.S (field selectable) for connecting external CT's. The CT Primary & Secondary value is field programmable. The current inputs has over load capability of 120% In both the cases.

(For 3 watt measurement) There are three pairs of terminals marked Ir (M,L), Iy (M,L) and Ib (M,L) for the connection of external CT's.

(For 1 Watt measurement), terminals marked as M,L are provided for connecting External CTs.

For proper measurements, the polarity of the CT's must be connected properly. The CT wiring must be properly done by de-energising the CT secondary by shorting it through a shorting block.The primary current of CT is field programmable upto 9999A.

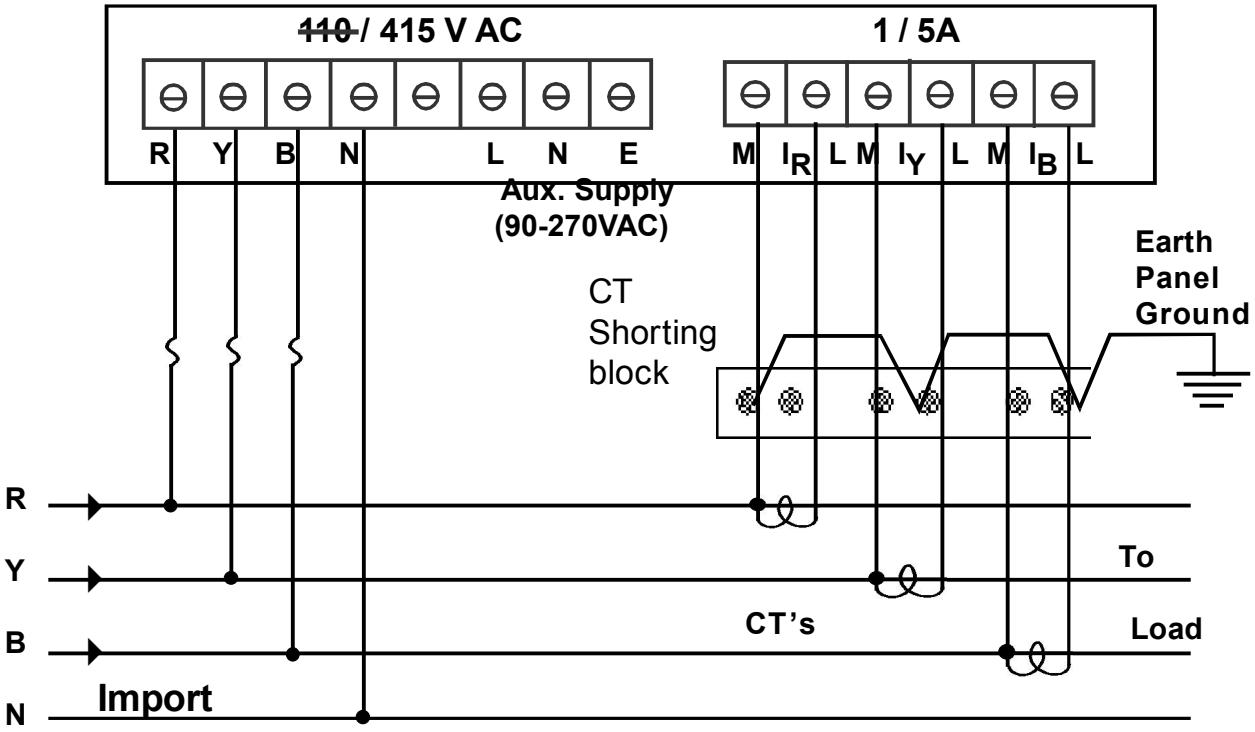
PCM 9505 Current input burden : 0.25VA per phase

Note : For Every change of LT ⟷ HT or 1A ⟷ 5A or 3 Wire ⟷ 4 Wire the instrument should be switched OFF and then made ON.

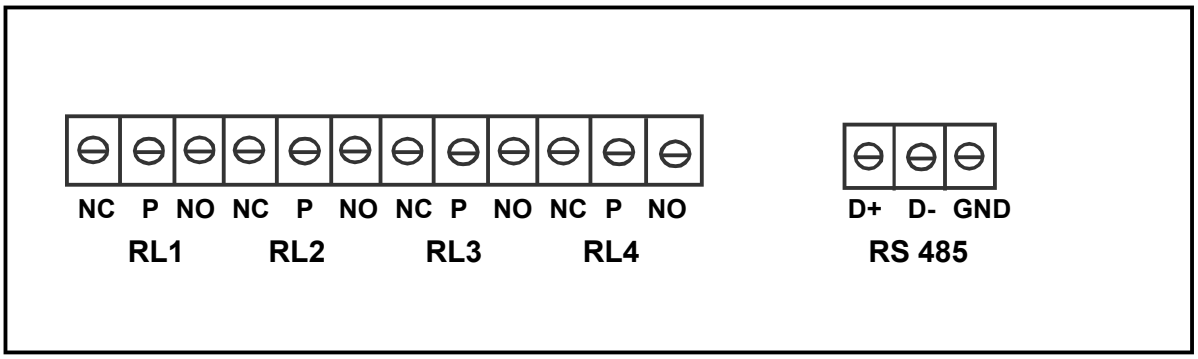
3. Wiring Diagram

3.1) Three phase four wire LT systems (3 watt meter measurement)

Voltage Input : Direct 240 VAC P-N (-20% to +10%)
Current input : 5/1A provided through 3 CT's



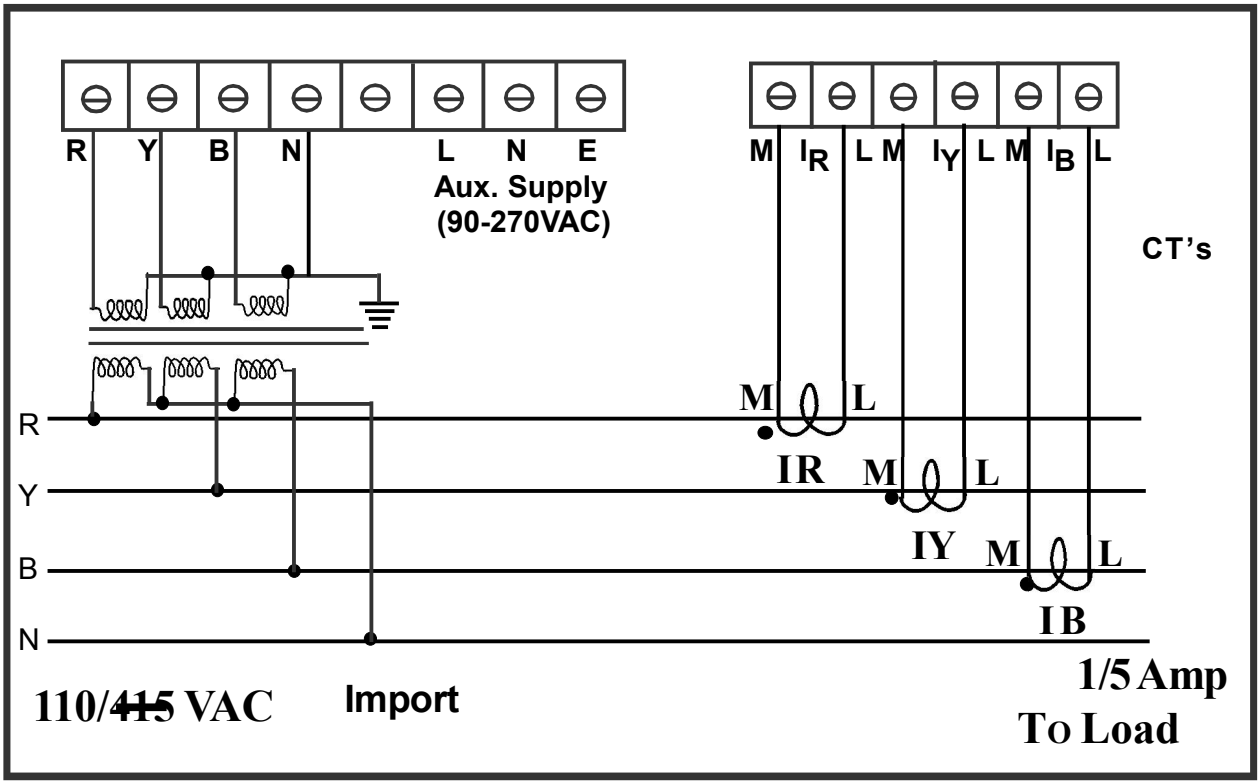
3.2) Relay & Communication Terminals



3.2) Three phase four wire HT systems (3 watt meter measurement)

Voltage Input : Direct 110 VAC L-L (Through PT)

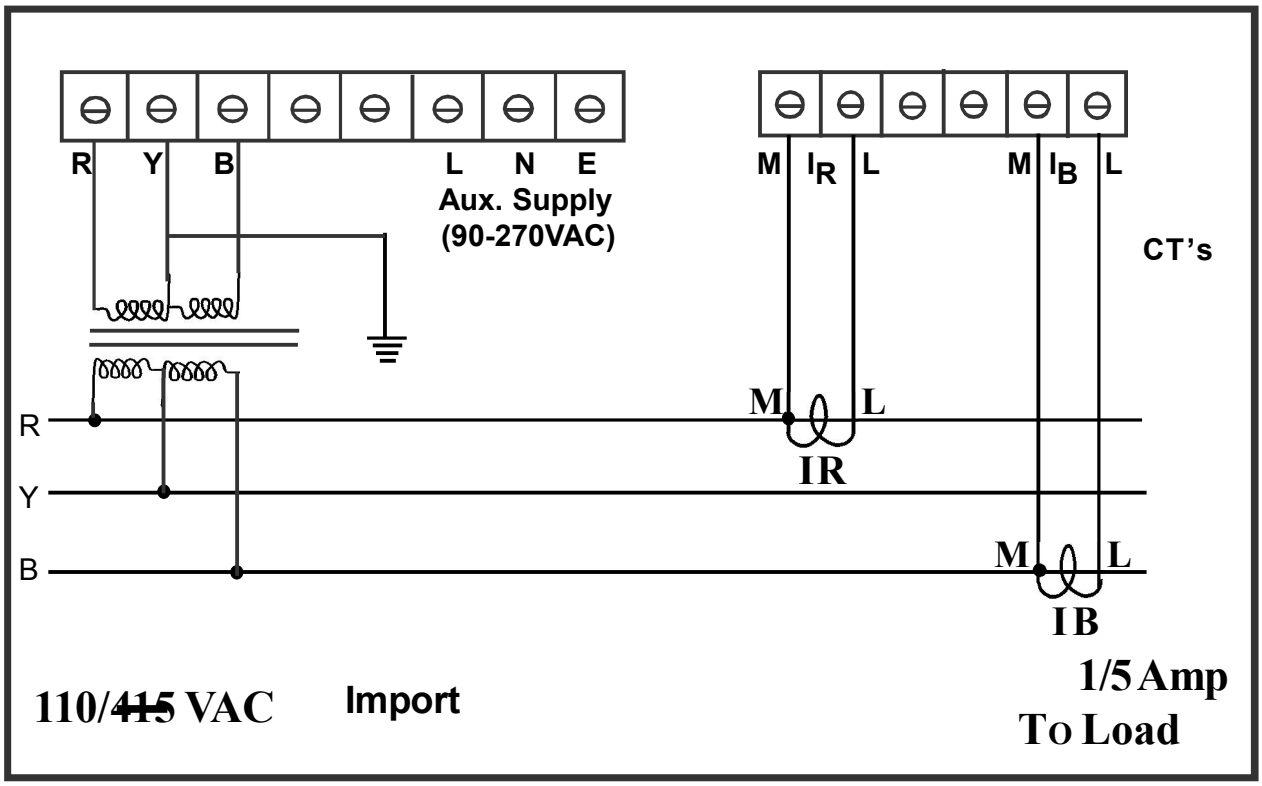
Current input : 5/1A provided through 3 CT's



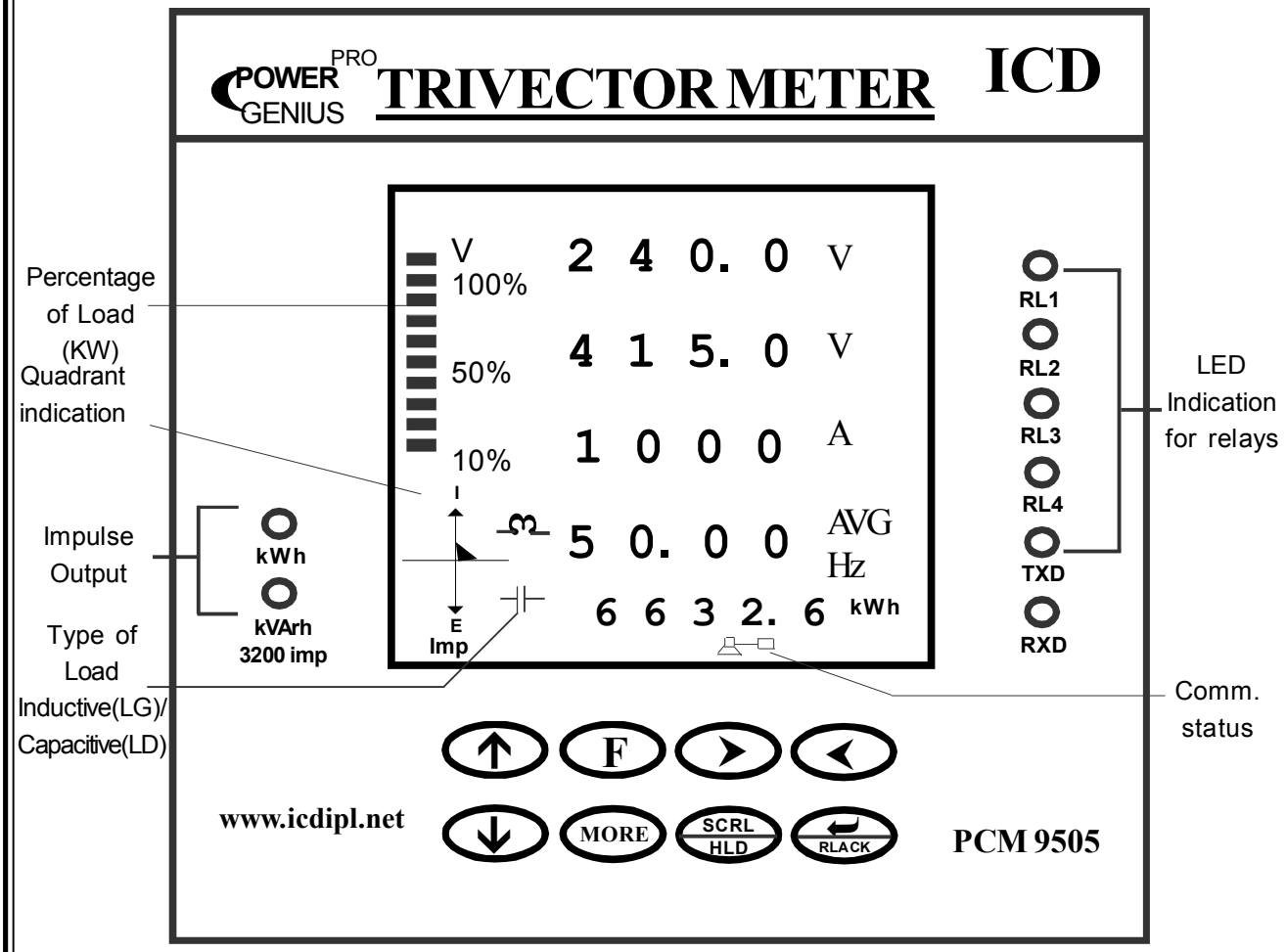
3.3) Three phase three wire HT systems (2 watt meter measurement)

Voltage Input : Direct 110 VAC L-L (Through PT)

Current input : 5/1A provided through 3 CT's



4. Front Panel Features (PCM 9505)



Front panel of the Unit consists of

a) Graphical LCD display which is used to display various electrical parameters and program mode settings.

b) 4 Nos of red LEDs are provided for indicating respective relay status (RL1, RL2, RL3 & RL4).

c) 2 Nos of 3 mm red & green LEDs are provided to indicate communication status. These LED's are not provided for the meters without communication port.

d) 2 x 4 matrix keypad are provided to select the various electrical parameters in the normal operating mode and to configure various items in the program mode. Key descriptions & changing the configuration items are given in next page

e) The Impulse LEDs flashes proportinally according to the active & reactive power consumed . It produces pulses at a rate of 3200 imp/ Kwh and 3200 imp/kVArh. Itis useful for calibration and cross checking.

4.1 Key description

Keys	Description	Program mode	Run mode
F	Function Key	*(To select submenus under selected menu)*	*(To view further subpages of the selected page)*
▶	Shift Key	*(To move between digits & to select parameters)*	---
▲	Increment Key	*(To increment the selected digit & to select parameters)*	---
⬆	Page Up key	----	*(To scroll Up Display pages)*
⬇	Page down key	----	*(To scroll down Display pages)*
MORE	MORE key	----	*(To view further subpages of the pages & subpages)*
SCRL / HLD	Scroll/ Hold Key	----	*(To scroll the display pages automatically. Toggle between HOLD / SCROLL mode)*
↵ / RL.ACK	Enter / Relay Acknowledge	*(To store the modifications)*	*(To acknowledge the relays & LED)*

(Note : For meters without controller, No Relay acknowledge is provided in Enter key.)

4.2 Changing the configuration Items

In program mode, after selecting the configuration item through Index key, It can be altered by using shift, Increment & Enter key.

The shift (▶) key is used to select the digit one by one. The selected digit is shown by flashing that digit.

The Increment (▲) key is used to increment the selected digit. The increment key Increments the digit from 0 to 9 and then wraps down to zero once again.

Once the required values are set in the configuration items press the Enter (↵) key to store it in memory. If the change is accepted the display Indicates 'E' or else an error message is displayed as 'Err'.

Once the configuration Items are programmed hold in the ▶ & ▲ keys together for 3 seconds to return back to normal operating mode.

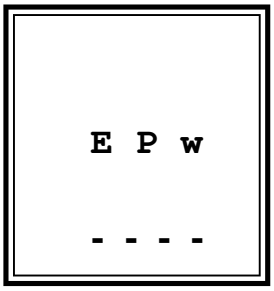
5. Programming Instructions

All meters are to be programmed properly to work in a particular Installation. The various items that are to be programmed are shown in the table below.

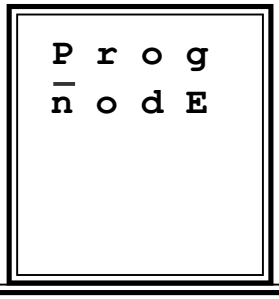
Configuration Item	**TVM/MDC**
New pass word	*All meters*
Primary & secondary Voltage/Current	*All meters*
Device Id	*Meters with Communication Interface only*
RD Set1, RD Ser2 & KWh Set	*Meters with controller*
Clock, Calender & TOD	*All Meters*
Energy & Runhour reset	*All meters*
Demand reset	*All meters*

The meters are provided with password facility to prevent alteration of configuration items by unauthorised persons. The configuration Items of the meter may be changed by the following sequence given below.

With power applied to the meter hold in the ▶ & ▲ keys (shift and Incr) together for 3 seconds.



The display Indicates Program enter password. The password set in the menu, “new password” has to be entered by using Shift, Incr and enter keys (Refer changing the configuration items for using Shift, Incr and Enter keys).



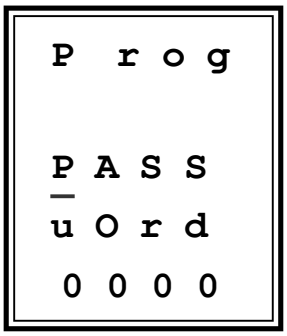
After valid password is entered the meter enters into program mode by showing it in display.

Special Note :

*If the user enters the 'Enter pass word' for the first time, or if the user fails to remember the password entered in 'New pass word', the default password **0386** can be entered.*

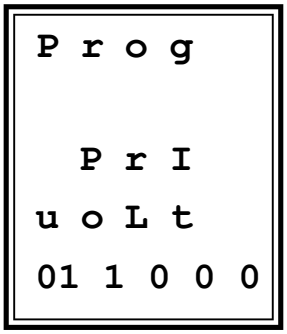
The configuration Items can be selected by pressing the Index (#) key. Top row in displays are used to differentiate the various configuration items. The displays for various configuration item are given below,

Page 1(Under New password Menu)



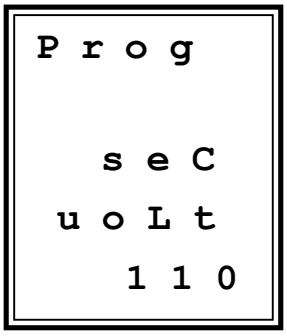
Press F Key

New Password set to prevent unauthorised persons entry *(Range : 0000 - 9999)*



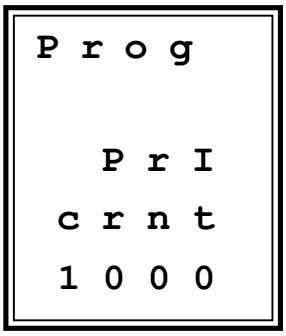
Press F Key

Primary Volatage setting
(Range : 0 - 999999 VAC)



Press F Key

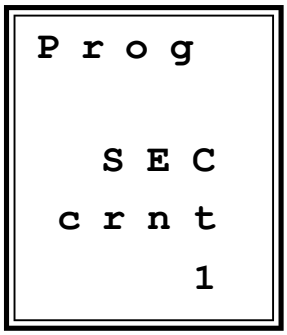
Secondary Voltage selectable
(110V/415 VAC)



Primary Current setting

(Range : 0 - 9999 AC)

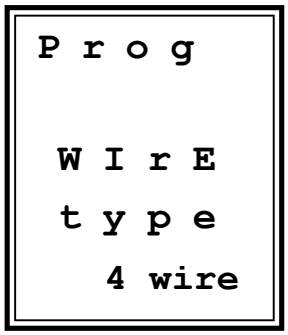
Press F Key



Secondary Current selectable

(1/5 AC)

Press F Key



3 watt/2 watt selection

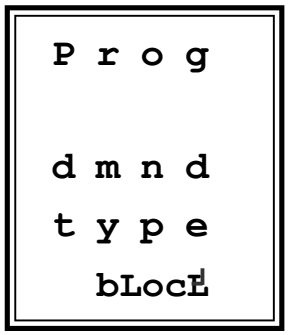
(4 wire - 3watt, 3wire - 2watt)

Pressing '**F**' key again repeats from New password menu in cyclic manner

Page 2(Under Demand Menu)

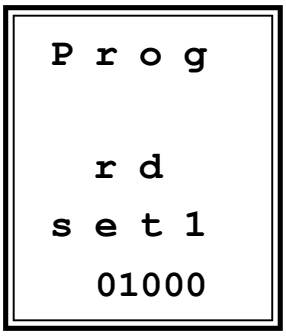
Demand selection for either kVA or kW

Press F Key



Demand type can be selected for either block window type i.e.,normal type of sliding window type

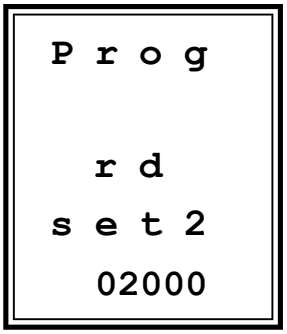
Press F Key



Setpoint1 for RL2 (relay & LED)(00000 -99999)

(when RD value reaches the setpoint1 %, RL2 activates)

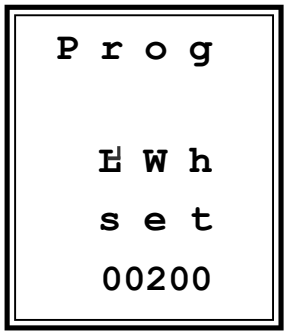
Press F Key



Setpoint2 for RL3 (relay & LED)(00000 -99999)

(when RD value reaches the setpoint2 %, RL3 activates)

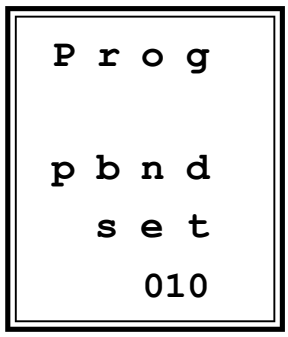
Press F Key



kWh set for RL4 (relay & LED)(00000 -99999)

(when Block kWh(resets for zone changes) value reaches the set kWh, RL4 activates)

Press F Key

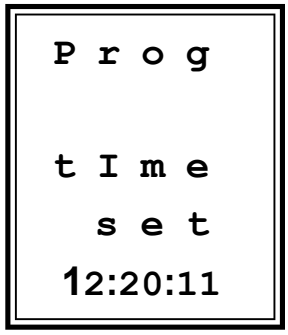


Profile band (000 - 999)

(Profile band is associated with setpoint1 & completion of Integration cycle -15min/30min)

Pressing '**F**' key again repeats from demand select menu in cyclic manner

Page 3(Under Time Menu)

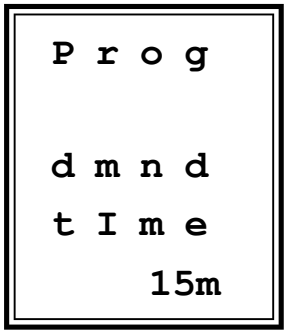


Clock -hh.mm.ss (00.00.00 - 23.59.59)

Press F Key

Date setting - dd.mm.yy (01.01.01 - 31.12.98)

Press F Key



Demand time selection. (15min/ 30min)

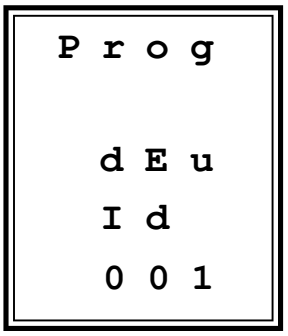
(Demand time can be selected using ▶ or ▲ & ↵ keys)

Press F Key

LCD Power save Enabled/Disabled is selected using Shift or Increment key and pressing Enter key. *(If it is Enabled, then backlit is automatically switched off when there is no any key press for 3 minutes. Pressing any key will make backlit ON. If LCD power save is Disabled, then backlit is switched on permanently)*

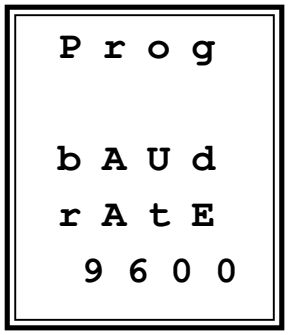
Pressing '**F**' key again repeats from time set menu in cyclic manner

Page 4(Under Communication Menu)



Device address (for meters with communication interface only *(Range:001 - 255)*

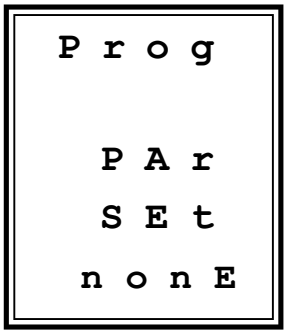
Press F Key



Baude Rate setting for Communication speed

(Range : 4800 / 9600 / 19200 / 38400)

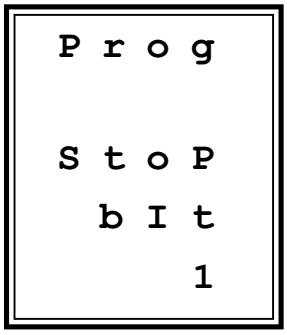
Press F Key



Parity Set Either we can select

(None / Odd / Even)

Press F Key

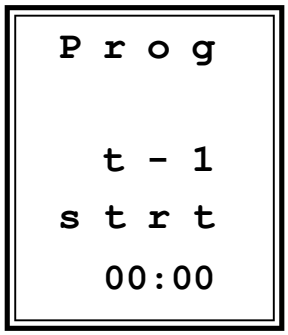


Stop bit, Either we can select

(1 / 2)

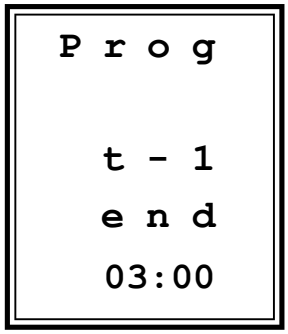
Pressing '**F**' key again repeats from dev id set menu in cyclic manner

Page 5(Under Time Zone Menu)



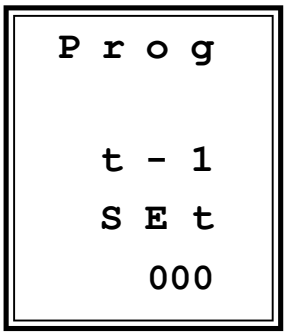
Time Slot 1 Start time setting - hh.mm (00.00 - 23.59)

Press F Key



Time Slot 1 End time setting - hh.mm (00.00 - 23.59)

Press F Key

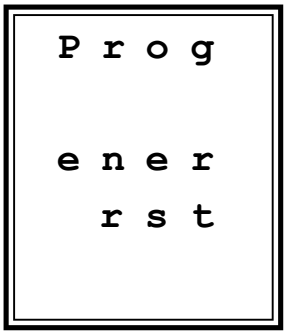


Time Slot 1 TOD Zone (1-8) & set% of relay (000 - 256%)
(MD is accumulated in set zone for the time set between start & End of the slot & the relays RL2 & RL3 activates based on set% of respective setpoint of relays)

Pressing '**F**' key again repeats from t-1 start menu in cyclic manner

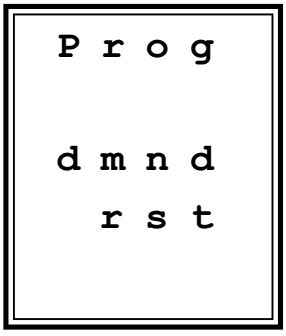
Pressing ⬆ & F keys Page 6, 7, 8, 9, 10, 11 & 12 continues similarly for Time Slot 2, 3, 4, 5, 6, 7 & 8 respectively.

Page 13(Under Energy Reset Menu)



Energy reset. (kWh,kVAh & kVArh value in all mode is made reset by pressing "Enter" key & displays shows 'dOnE')

Press F Key



Maximum Demand reset. (MD value is made reset by pressing "Enter" key & displays shows 'dOnE')

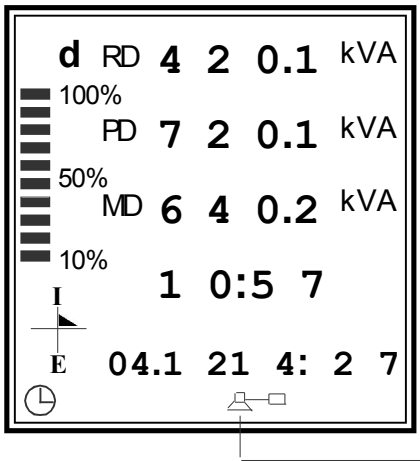
Pressing '**F**' key again repeats Energy reset menu in cyclic manner

6. Run Mode display pages

When power is applied to the meter the starting message consisting of model no., and the run mode is selected automatically. In Run mode the power parameters are shown in different pages. These pages are accessed using the "⬆,⬇,F & MORE " keys provided on the front panel. The available display pages are given below.

6.1 Demand Page(Page1)

a)



Rising demand for kVA/kW

Predective kVA/kW

Maximum demand for kVA/kW

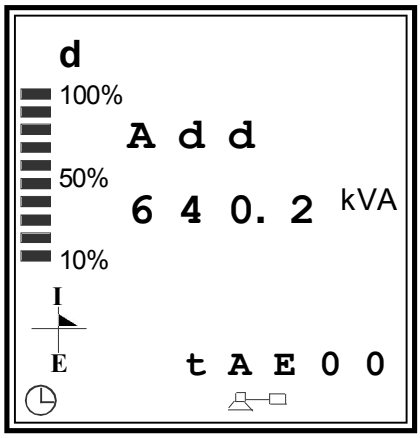
Demand time

MD KVA/kW peak value captured Date, Month & time.

Communication Connected

Press F(Function) Key

b)

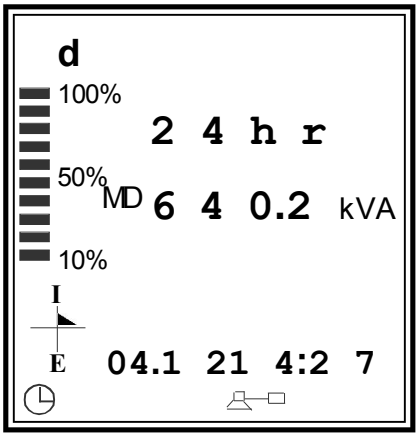


Additional/Remove load in kVA/kW

Time available to exceed set point (tAE)

Press F(Function) Key

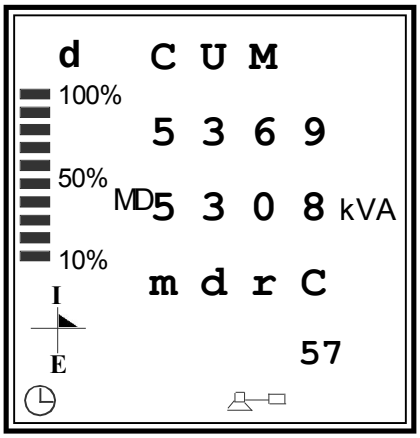
c)



24 Hour MD kVA/kW with its date & time

Press F(Function) Key

d)



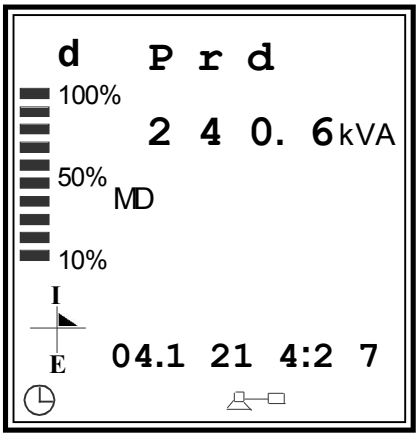
Cummulative MD kW

MD reset count

Pressing '**F**' key again repeats page 1 - (a) menu in cyclic manner

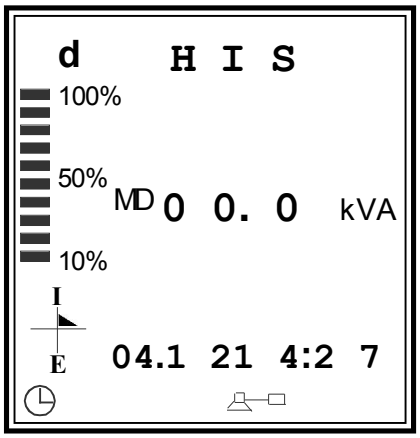
6.1.1 Under Demand Page1 (a)

Press MORE Key



Previous Rd with it's date & time

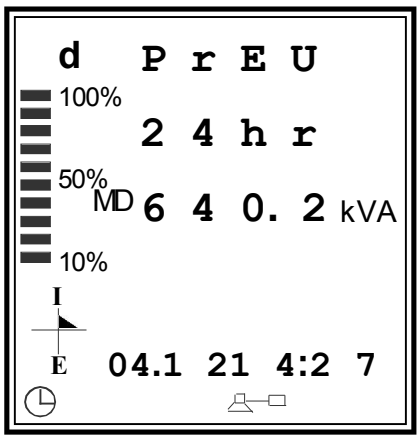
Press MORE Key



History MD kVA(Previous) with its date & time

6.1.2 Under Demand Page (c)

Press MORE Key

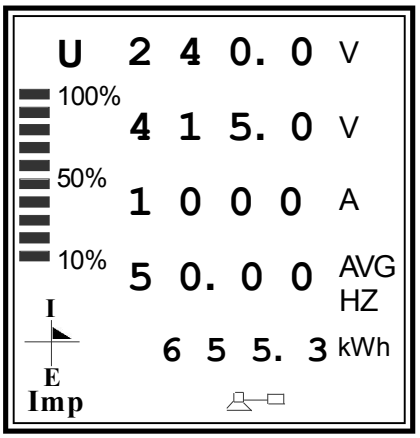


Previous 24 Hour MD kVA/kW with its date & time

Press ↑ Key

6.2 Under Voltage/Current Page(Page2)

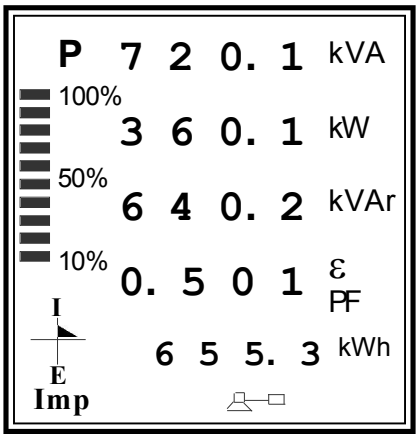
a)



Average Phase Voltage, Line Voltage, Current, Frequency and kWh.

Press F(Function) Key

b)



Total kVA

Total kW

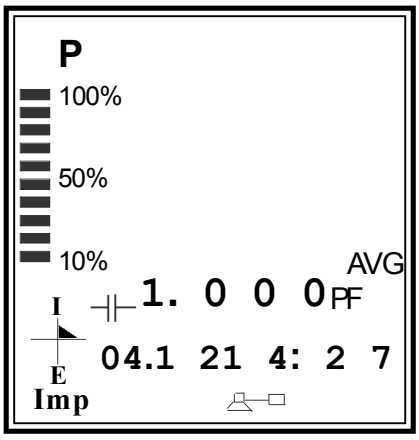
Total kVAr

Average PF

Total accumulated kWh

Press F(Function) Key

c)

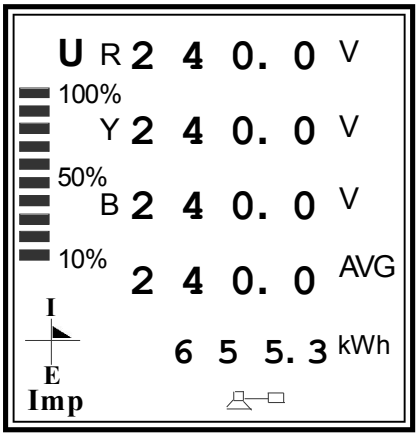


Average PF with it's date & time

Pressing '**F**' key again repeats raising page 2 - (a) menu in cyclic manner

6.2.1 Under Page2 (a)

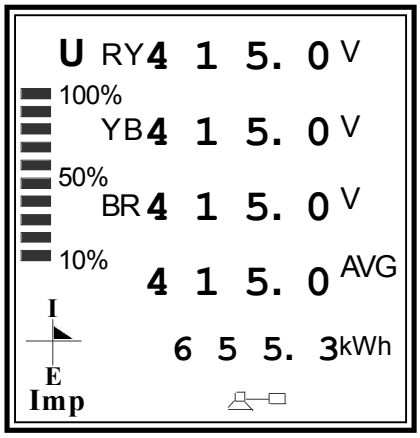
Press MORE Key



Individual Phase Voltages, Average Phase Voltage & kWh

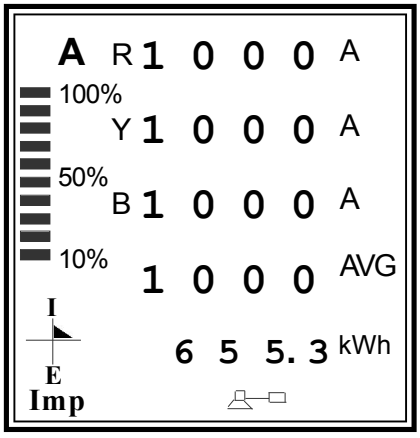
Press MORE Key

Press MORE Key



Individual Line Voltages, Average Line Voltage & kWh

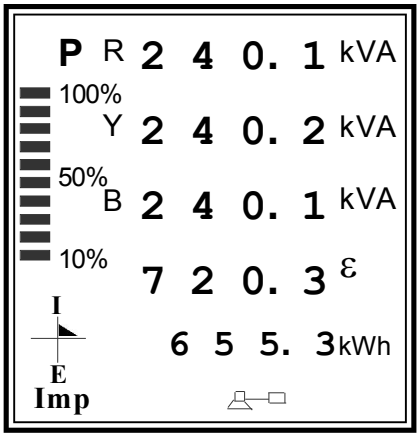
Press MORE Key



Individual Line Currents, Average Current & kWh

6.2.2 Under Page2 (b)

Press MORE Key



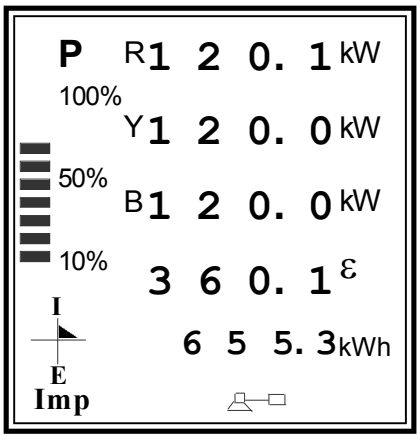
Individual kVA (R, Y & B)

Total kVA

Total accumulated kWh

Press MORE Key

Press MORE Key

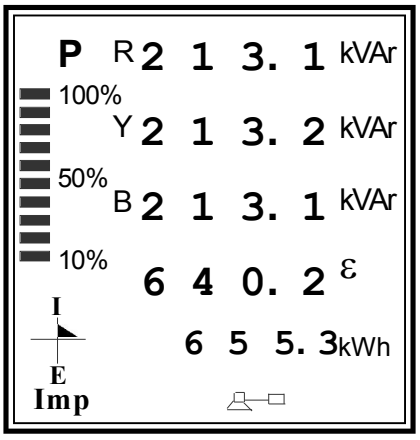


Individual kW (R, Y & B)

Total kW

Total accumulated kWh

Press MORE Key

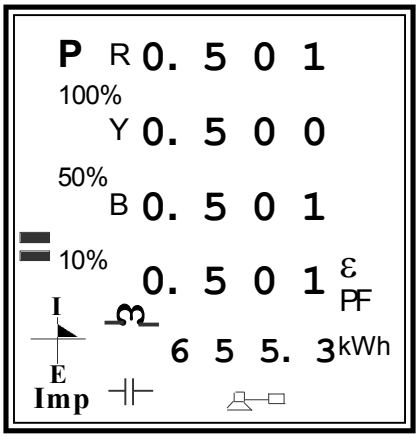


Individual kVAr (R, Y & B)

Total kVAr

Total accumulated kWh

Press MORE Key



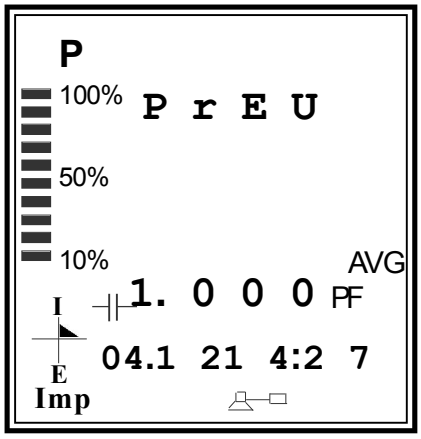
Individual PF (R, Y & B)

Average PF

Total accumulated kWh

6.2.3 Under Page2 (c)

Press MORE Key

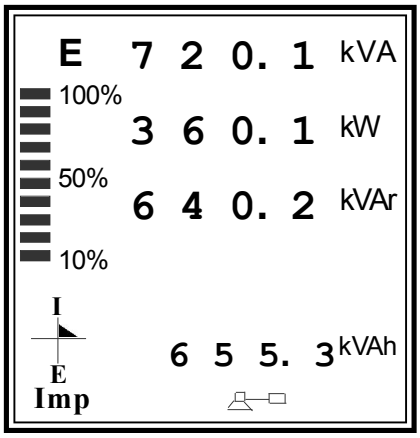


Previous Average PF with it's date & time

Press ↑ Key

6.3 Under Energy Page(Page3)

a)



Total kVA

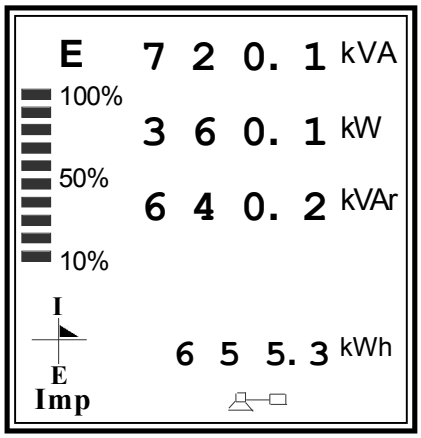
Total kW

Total kVAr

Total accumulated kVAh in Import mode

Press F(Function) Key

b)



Total kVA

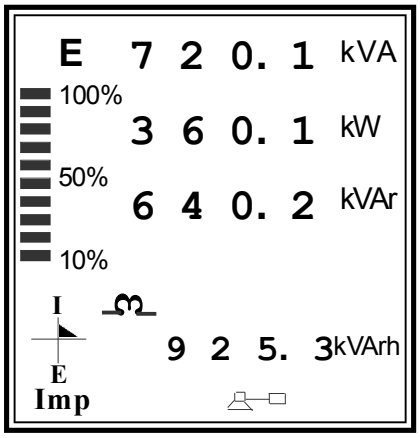
Total kW

Total kVAr

Total accumulated kWh in Import mode

c)

Press F(Function) Key



Total kVA

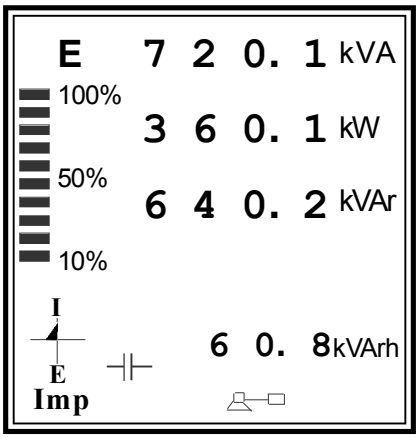
Total kW

Total kVAr

Total accumulated Lag kVArh in Import mode

d)

Press F(Function) Key



Total kVA

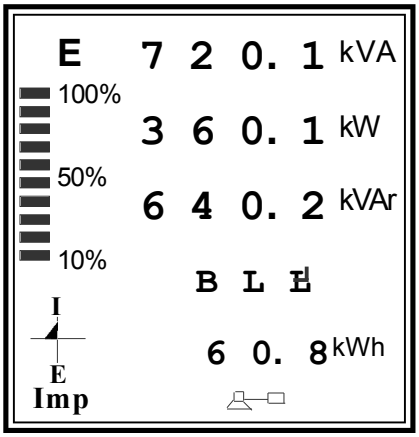
Total kW

Total kVAr

Total accumulated Lead kVArh in Import mode

e)

Press F(Function) Key



Total kVA

Total kW

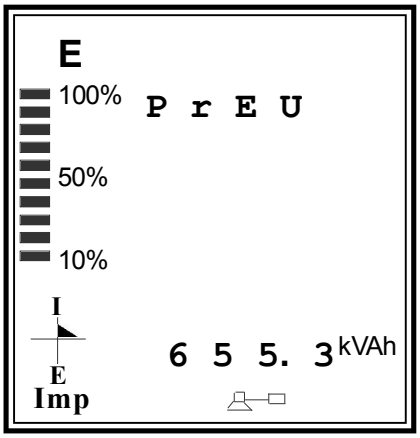
Total kVAr

Total accumulated Block kWh in Import mode,

Pressing '**F**' key again repeats raising page 3 - (a) menu in cyclic manner

6.3.1 Under Page3 (a)

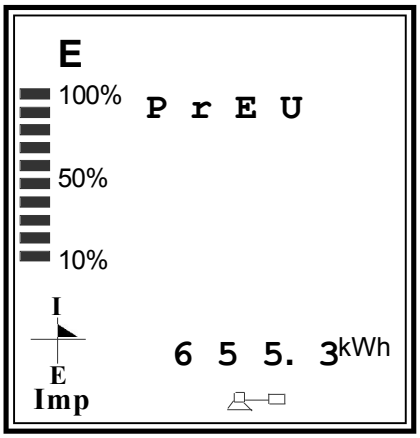
Press MORE Key



Prev kVAh in Import mode

6.3.2 Under Page3 (b)

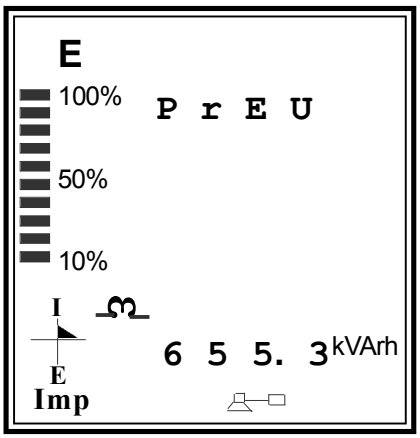
Press MORE Key



Prev kWh in Import mode

6.3.3 Under Page3 (c)

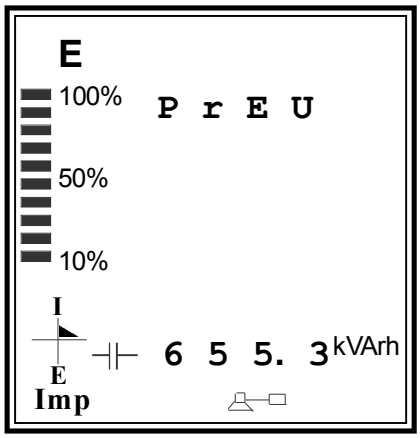
Press MORE Key



Prev Lag kVArh in Import mode

6.3.4 Under Page3 (d)

Press MORE Key



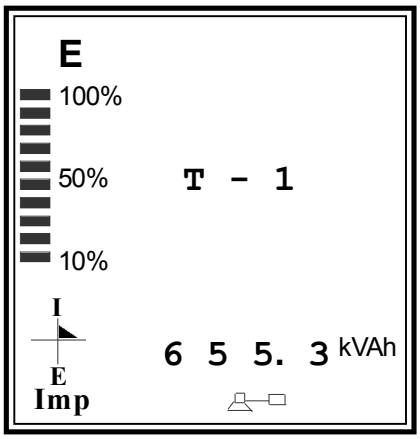
Prev Lead kVArh in Import mode

Press ↑ Key

6.4 Under Time zone T - 1 Page(Page4)

Press F(Function) Key

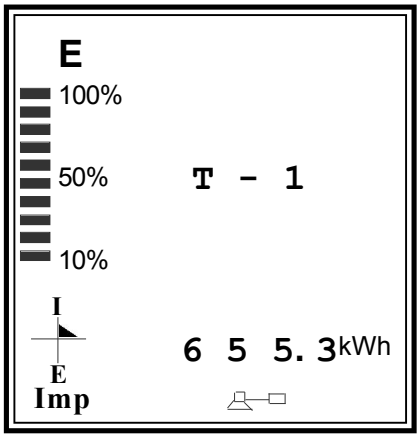
a)



Total accumulated kVAh of T-1 Zone in Import mode

Press F(Function) Key

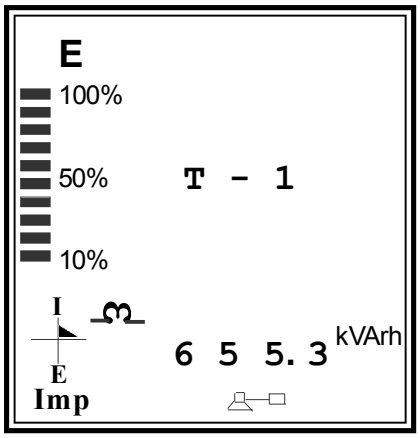
b)



Total accumulated kWh of T-1 Zone in Import mode

Press F(Function) Key

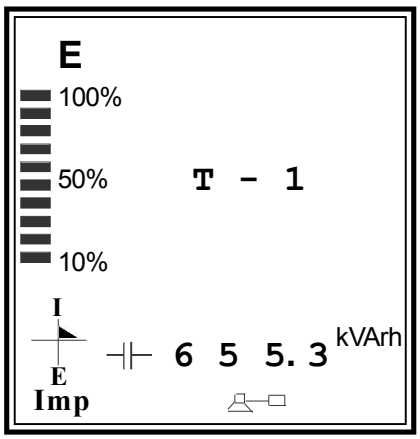
c)



Total accumulated Lag kVArh of T-1 Zone in Import mode

Press F(Function) Key

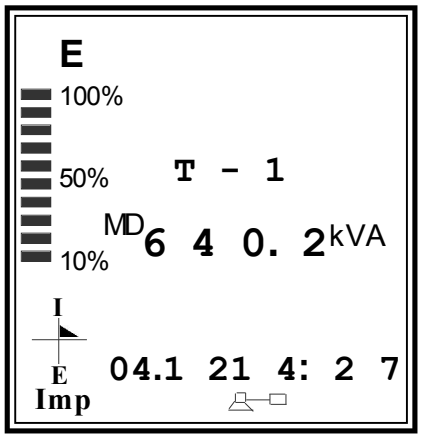
d)



Total accumulated Lead kVArh of T-1 Zone in Import mode

Press F(Function) Key

e)

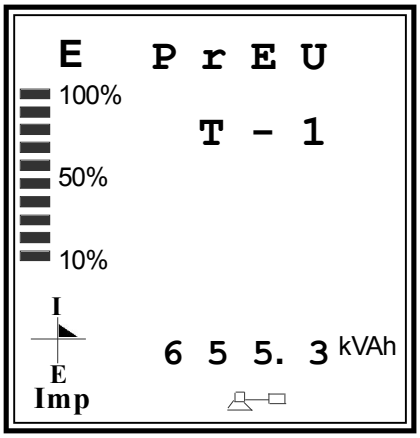


Maximum Demand of kVA/kW of T-1 Zone time period and its occurance time period

Pressing '**F**' key again repeats raising page 4 - (a) menu in cyclic manner

6.4.1 Under Time Zone T - 1 Page(a)

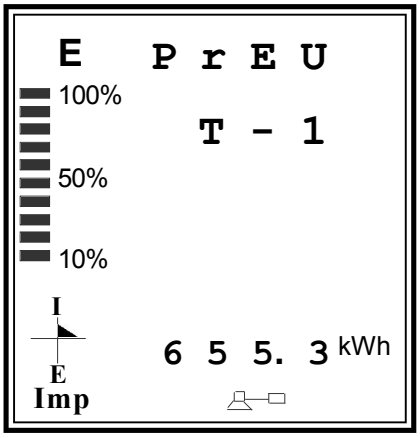
Press MORE Key



Previous kVAh of T-1 Zone in Import mode

6.4.2 Under Time Zone T - 1 Page(b)

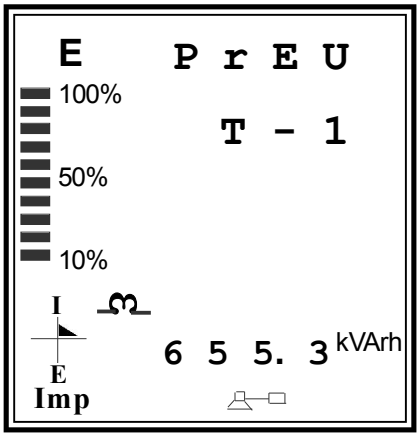
Press MORE Key



Previous kWh of T-1 Zone in Import mode

6.4.3 Under Time Zone T - 1 Page(c)

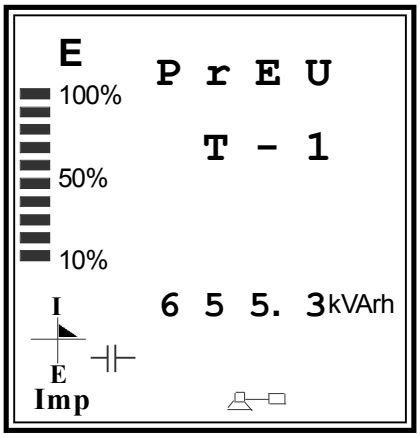
Press MORE Key



Previous Lag kVArh of T-1 Zone in Import mode

6.4.4 Under Time Zone T - 1 Page(d)

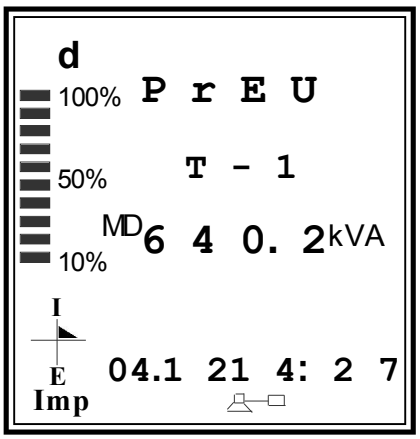
Press MORE Key



Previous Lead kVArh of T-1 Zone in Import mode

6.4.5 Under Time Zone T - 1 Page(e)

Press MORE Key

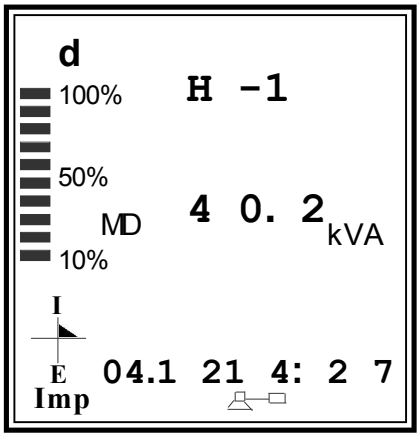


Previous MD kVA of T-1 Zone

Note: Page 5-11 are similar to Page4 for T2 to T8 respectively

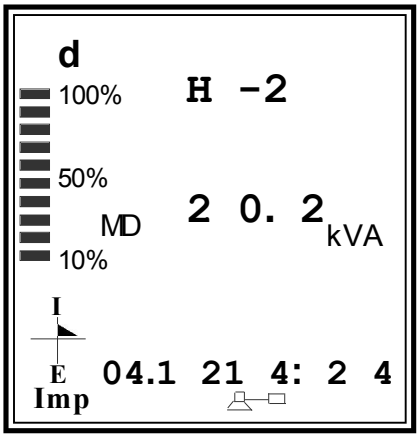
6.12 Under History Page(Page12)

a)



Maximum demand history, with date & Time is displayed. Totally 5 Historys are maintained (When MD is made reset, the value shifts to History1 and again if MD is made reset, then value shifts to history1 and value from history1 shifts to history2 and history2 to history3 & continues so on)

b)



MD History - 2 with its date & time

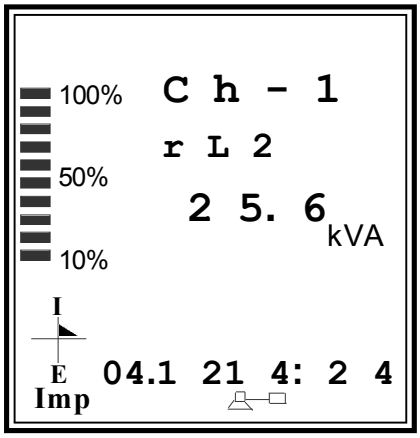
Press F(Function) Key

Similar pages will appear for MD History - 3-5 with its date & time

Pressing '**F**' key again repeats raising page 12 - (a) menu in cyclic manner

6.13 Under Relay History Page(Page13)

a)

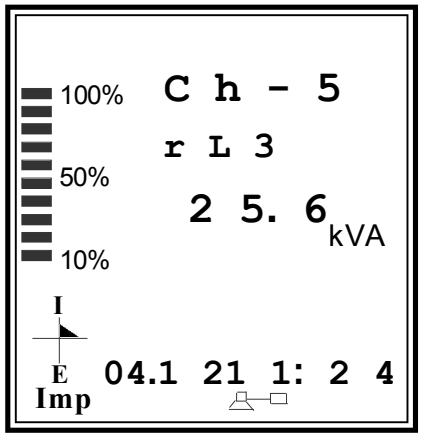


Channel 1 - 5

Relay history with relay number (For RL2 - RL4), with date & Time is displayed. Totally 5 Historys are maintained (In integration cycle, the recent kVA value at which relay activates, is moved to history Ch1with Relay Number and Ch1 history shifts to Ch2 history and Ch2 history to Ch3 history & continues so on)

Press F(Function) Key

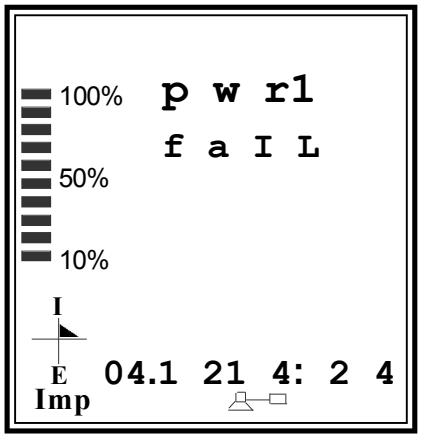
e)



Pressing '**F**' key again repeats raising page 13 - (a) menu in cyclic manner

6.14 Under Power Fail/Resume History Page(Page14)

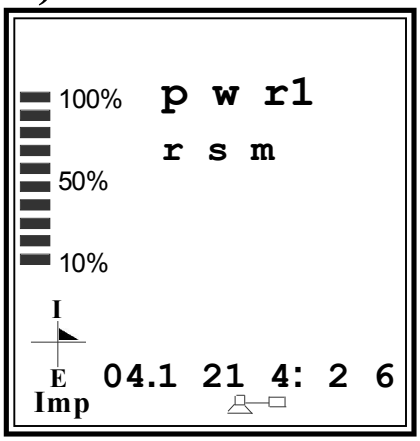
a)



Power fail History, with date & Time is displayed. Totally 3 Historys are maintained (Date and time at which instrument gets power fail and resumed are moved to history pwr1. If power fails again Pwr1 history shifts to Pwr2 history and Pwr2 history to Pwr3 history)

Press F(Function) Key

b)

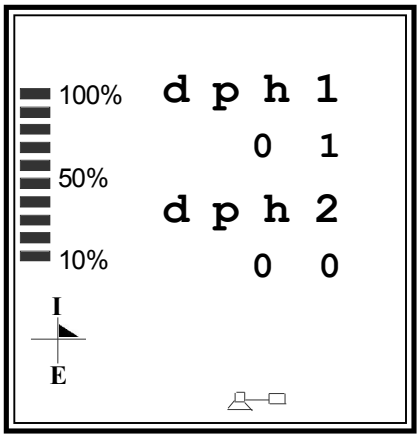


Power Resume History 1 , with date & Time is displayed. Similarly History 2 and 3 status are displayed in further pages.

Pressing '**F**' key again repeats raising page 14 - (a) menu in cyclic manner

6.15 Under Demand profile Page(Page15)

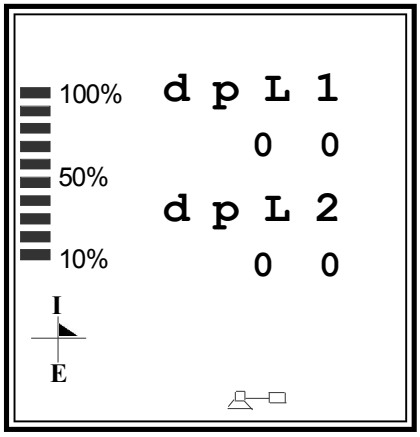
a)



Demand Profile high 1 & 2 - 00 to 99

Press F(Function) Key

b)



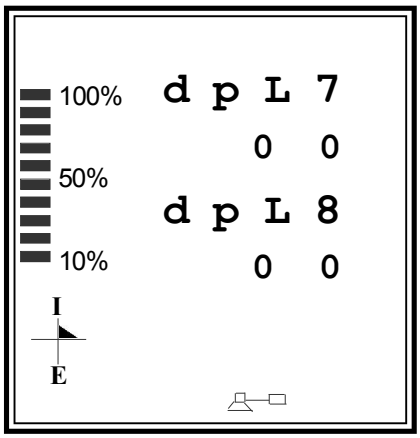
Demand Profile low 1 & 2 - 00 to 99

Press F(Function) Key

|

Similar display pages for Demand Profile low 3 to 6

e) |

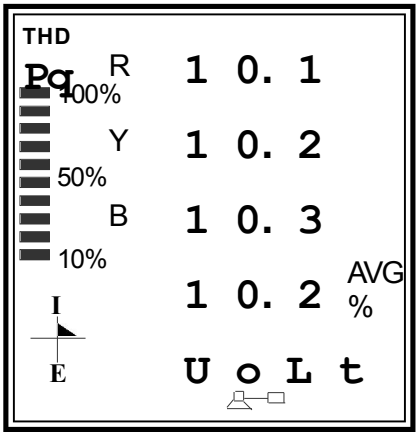


Demand Profile low 7 & 8 - 00 to 99

Pressing '**F**' key again repeats raising page 15 - (a) menu in cyclic manner

6.16 Under Power Quality - THD Page(Page16)

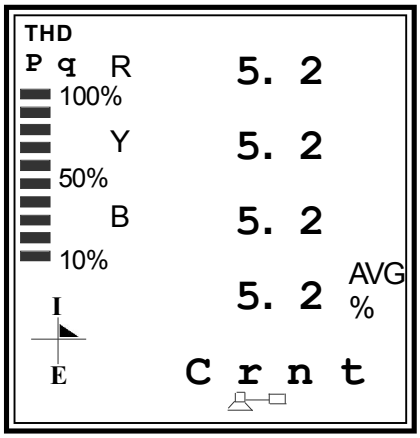
a)



Percentages of 3 Phase Voltage THD and its average

Press F(Function) Key

b)

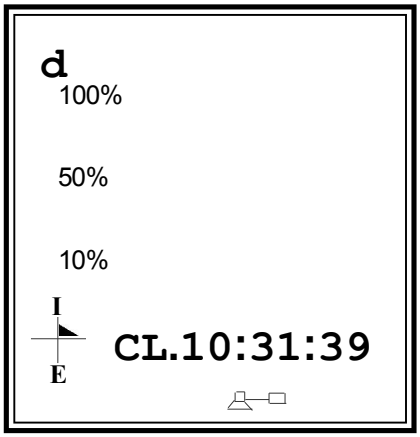


Percentages of 3 Phase Current THD and its average

Pressing '**F**' key again repeats raising page 16 - (a) menu in cyclic manner

6.17 Under Clock Page(Page17)

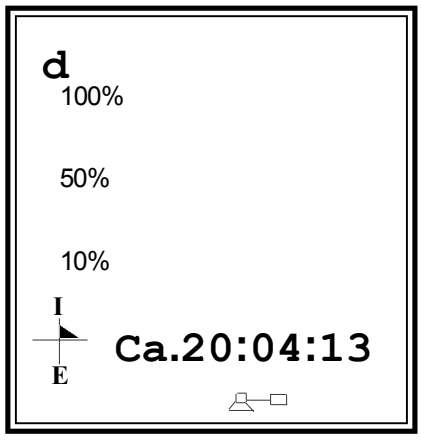
a)



Real Time Clock(RTC)

Press F(Function) Key

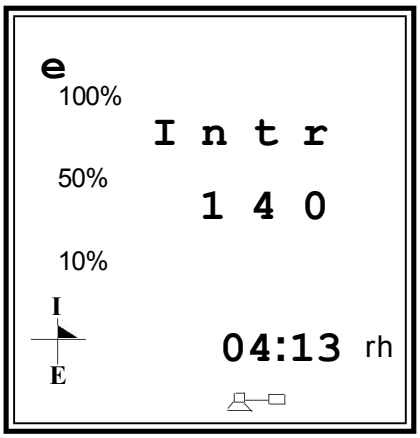
b)



Calender

Press F(Function) Key

c)

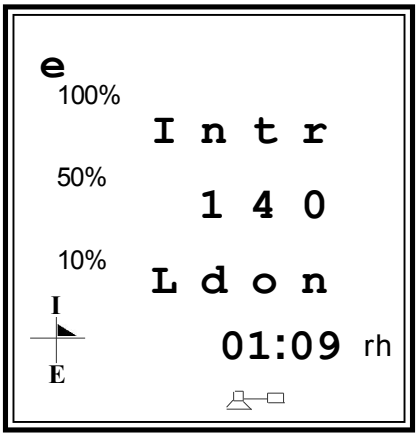


Instrument Reset(ON/OFF) counter

Run hour for Instrument in ON condition

Press F(Function) Key

d)



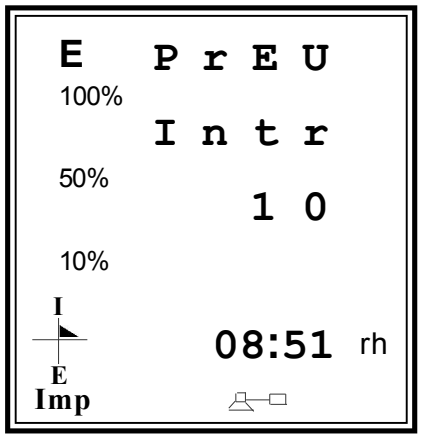
Instrument Reset(ON/OFF) counter

Load ON Run hour

Pressing '**F**' key again repeats raising page 17 - (a) menu in cyclic manner

6.17.3 Under Clock Page(c)

Press MORE Key

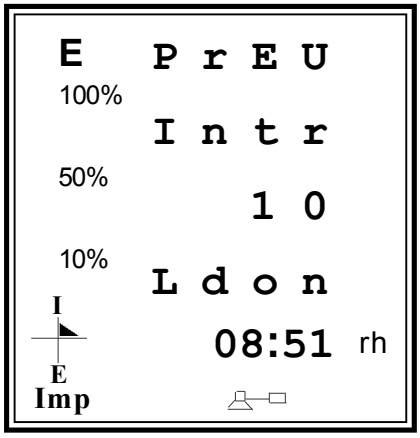


Previous Instrument Reset(ON/OFF) counter

Previous Run hour for Instrument in ON condition

6.17.4 Under Clock Page(d)

Press MORE Key



Previous Instrument Reset(ON/OFF) counter

Previous Load ON Run hour

The above pages are given for 3 phase 4 wire LT meters. For HT meters, the resolution and units will change as given in technical specifications.The display pages, sequence and parameters can be altered based on user requirement (to be mention while ordering).

7. Functional Description

When instrument is switched ON, it shows “PCM 9505” for a while and displays the RD Value. Initially when the unit is powered it selects run mode - Hold mode.

Control Action :

4 Nos of Relays & associated LEDs are provided for controlling action. RL2, RL3, RL4 are associated with setpoints 1 , 2 & kWh set, RL1 is associated with predictive demand. RL1 (relay & LED) activates after 2 min of demand time when the PD is greater than setpoint. It will reactivate after 1 min, from when relay is acknowledged.

RL2 & RL3 (relay & LED) activates based on the set% in the slot. E.g If S1=300 & S2 = 400 & set% = 200, then RL2 activates at 600kVA (200% of 300kVA) and RL3 activates at 800 kVA (200% of 400kVA) and these are recorded in control history. RL4 activates if Block kWh exceeds the kWh set. These relay output can be acknowledged, “Rl.ACk” key provided in the front panel of the Unit.

Predictive Demand :

Predictive Demand is the average instant kVA which is sampled and updated in every 1 minute. During starting of the integration cycle, it is displayed after 2 min.

Rising Demand :

Rising Demand is the integration of instant kVA for the selected demand time.

Maximum Demand :

Maximum Demand is the maximum kVA, which is unaltered even during power failure. This value get altered only if MD value is made reset or kVA value greater than existing MD value occurs. This is applicable of MD values in eight zones.

Sliding Window Function :

In sliding window function the RD KVA value reaches gradually upto 15 / 30 mins and it never comes back to zero untill the load is present. When the load is removed suddenly during any of the integration cycle, The increased KVA value decreses reversely to that of preveoius RD cycle during next cycle.

Example:

Applied voltage = 415 VAC
and CT ratio = 400/5A with unity PF
Total KVA = 288 KVA
1 min. RD value = 288 /15 = 19.2 RD per minute.
19.2 x 15 min. = 288 RD kVA

i) According to instant value (instant kVA = 288) the RD value will increased tep by step and finally reached to 288 RD kVA after competion of 15/30 min. cycle.

ii) If kVA is zero, now the RD value gets decreasing and reaches to zero at the end of 15 / 30 mins during next RD cycle.

Condition 1) RD never comes to zero, when instant kVA is present.

Condition 2) RD value getting zero immediately, after completion of current zone time.

Illustration

Demand time RD 1st cycle (15minutes)

Duration end time	Instant KVA	RD KVA
1st min.	288 (100% load)	19.2
2nd min.	288	38.4
3rd min .	288	57.6
4th min .	144 (50% load)	67.2
5th min .	144	76.8
6th min .	144	86.4
7th min .	288	105.6
8th min .	288	124.8
9th min.	288	144.0
10th min.	144	153.6
11th min .	144	163.2
12th min .	144	172.8
13th min	0 (kVA = 0)	172.8
14th min .	0	172.8
15th min .	0	172.8

Demand time RD 2nd Cycle (still load (kVA) is zero) is as follows:

Duration end time	RD KVA
1st min.	153.6
2ndmin.	134.4
3rd min.	115.2
4th min.	105.6
5th min.	96.0
6th min.	86.4
7th min.	67.2
8th min.	48.0
9th min.	28.8
10th min.	19.2
11th min.	9.6
12th min.	0

Block kWh :

Block kWh is similar to normal kWh but gets reset automatically if zone changes.

Profile Band :

It is the Band value associated with setpoint1 at the completion of each cycle.

Eg : Let the setpoint1(S1) be 1000 kVA and Profile band be 100 kVA

Demand Profile	**S1**	**PB**	**RD**
1Ph (High Profile1)	1000 +	(1*100)	1100
2Ph(High Profile2)	1000 +	(2*100)	1200
1PL (Low Profile1)	1000 -	(1*100)	900
2PL (Low Profile2)	1000 -	(2*100)	800
3PL (Low Profile3)	1000 -	(3*100)	700
4PL (Low Profile4)	1000 -	(4*100)	600
5PL (Low Profile5)	1000 -	(5*100)	500
6PL (Low Profile6)	1000 -	(6*100)	400
7PL (Low Profile7)	1000 -	(7*100)	300
8PL (Low Profile8)	1000 -	(8*100)	200

At the end of the cycle (15/30 min integration), if RD value is 1150, the profile band falls between 1Ph & 2Ph, Hence 1 count is incremented to ”1Ph” or if RD value is 1225, then 1 count is incremented to “2Ph”. If RD vaue is 550, the profile band falls between 5PL & 4 PL, then 1 count get incremented to 5PL or if RD value is 250, then 1 count is incremented to “8PL”. Similar way counts get incremented at the respective levels depending on the raising demand during completion of integration cycle. The count resets, when MD value is made reset.

Time Zone :

Eight Time Zones are provided in program mode, so that user can set the timings & set% based on peak & Non-peak hours. Eight Zones are provided in the run mode, in which MD value is clipped based on the timings set in the slots.

Add/ Remove Loads :

During integration cycle, there is necessity to add or remove loads. This is indicated in run mode by displayin message “Add 100” or “rmV 100” in run mode under Page1. The load value is calculated as below

$$\left\{ \frac{\textbf{(setpoint - PD) * DT}}{\textbf{(DT - IT)}} \right\}$$ where

(PD - Predictive demand; DT - Demand time(15/30); IT - Integration demand Time)

If resultant is +ve, then displayed as “Add xxx”, insisting to add load or else if the resultant is -ve, then displayed as ‘rmV xxx”, insisting to remove excess Load. During starting of the integration cycle, it is displayed after 2 min and updated for every 1 min

tAE (Time available to exceed setpoint) :

Time available to exceed set point. During starting of the integration cycle, it is displayed after 2 min and updated for every 1 min. This is calculated as below

$$\left\{ \frac{\textbf{Setpoint * Demand time (15/30)}}{\textbf{Predictive demand}} \right\} - \textbf{Integration DemandTime}$$

8. Communication Port Details

The PCM 9505 is provided with a optically Isolated RS 485 communication Port, which is an optional Feature and has to bespecified at the time of ordering. The communication protocol used is MODBUS - RTU or MODBUS-ASCII (to be specified while ordering). Using the communication Port, the meters can be connected in multi drop network and data can be collected in a centralised control room using any standard SCADA Software.

The communication between the PC and the instrument would be in Master slave mode. P.C acts as a master and sends a command message (query) containing the slave Id, function code and address of the information required. The command is received by all the slaves. The slave whose address is matching with that of the command address would respond with the requested data.

The communication settings are,

Protocol	:	MODBUS RTU
Baud rate	:	9600
Data bit	:	8
Parity	:	None
Stop bit	:	1
Starting Address	:	40001
Data Type	:	UINT
Communicating mode	:	Half Duplex

The above configuration are to be done in any standard scada package for collecting the data.

The instrument is provided with screwable 3 pin phoenix connector for connecting the communication cable at the rear side. Terminal details are (From left to right)

D+D- Gnd

The address of the parameters are as follows.

Sl.No	Parameter	Address	Resolution	
			LT	HT
1	R - Voltage	40001	0.1	0.01
2	Y - Voltage	40002	0.1	0.01
3	B - Voltage	40003	0.1	0.01
4	RY Voltage	40004	0.1	0.01
5	YB Voltage	40005	0.1	0.01
6	BR Voltage	40006	0.1	0.01
7	R Current	40007	0.1	1
8	Y Current	40008	0.1	1
9	B Current	40009	0.1	1
10	Total kVA	40010	0.1	1
11	Total kW	40011	0.1	1
12	Total kVAr	40012	0.1	1
13	Total PF	40013	0.001	0.001
14	Frequency	40014	0.01	0.01
15	kWH MSB	40015	0.1	1
16	kWH LSB	40016	0.1	1
17	Meter Type / Load ON Runhour MSB	40017		
18	Load ON Runhour LSB	40018		
19	Import / Export	40019		
20	kVAh MSB	40020	0.1	1
21	kVAh LSB	40021	0.1	1
22	Lag kVArh MSB	40022	0.1	1
23	Lag kVArh LSB	40023	0.1	1
24	Lead kVArh MSB	40024	0.1	1
25	Lead kVArh LSB	40025	0.1	1
26	RD kVA / kW	40026	0.1	1
27	Demand Time hh:mm	40027		
28	PRD kVA / kW	40028	0.1	1
29	Date/Month	40029		
30	Hour/Minute	40030		

Sl.No	Parameter	Address	Resolution	
			LT	HT
31	Predictive demand kVA / kW	40031	0.1	1
32	MD kVA / kW	40032	0.1	1
33	Date/Month	40033		
34	Hour/Minute	40034		
35	R Voltage THD	40035	0.1	0.1
36	Y Voltage THD	40036	0.1	0.1
37	B Voltage THD	40037	0.1	0.1
38	R Current THD	40038	0.1	0.1
39	Y Current THD	40039	0.1	0.1
40	B Current THD	40040	0.1	0.1
41	Power fail Date/Month	40041		
42	Year/Hour	40042		
43	Minute/Second	40043		
44	Power resume Date/Month	40044		
45	Year/Hour	40045		
46	Minute/Second	40046		
47	Zone-1 kVAh	40047,48	0.1	1
48	Zone-2 kVAh	40049,50	0.1	1
49	Zone-3 kVAh	40051,52	0.1	1
50	Zone-4 kVAh	40053,54	0.1	1
51	Zone-5 kVAh	40055,56	0.1	1
52	Zone-6 kVAh	40057,58	0.1	1
53	Zone-7 kVAh	40059,60	0.1	1
54	Zone-8 kVAh	40061,62	0.1	1
55	Zone-1 kWh	40063,64	0.1	1
56	Zone-2 kWh	40065,66	0.1	1
57	Zone-3 kWh	40067,68	0.1	1
58	Zone-4 kWh	40069,70	0.1	1
59	Zone-5 kWh	40071,72	0.1	1
60	Zone-6 kWh	40073,74	0.1	1
61	Zone-7 kWh	40075,76	0.1	1
62	Zone-8 kWh	40077,78	0.1	1

Sl.No	Parameter	Address	Resolution	
			LT	HT
63	Zone-1 Lag kVArh	40079,80	0.1	1
64	Zone-2 Lag kVArh	40081,82	0.1	1
65	Zone-3 Lag kVArh	40083,84	0.1	1
66	Zone-4 Lag kVArh	40085,86	0.1	1
67	Zone-5 Lag kVArh	40087,88	0.1	1
68	Zone-6 Lag kVArh	40089,90	0.1	1
69	Zone-7 Lag kVArh	40091,92	0.1	1
70	Zone-8 Lag kVArh	40093,94	0.1	1
71	Zone-1 Lead kVArh	40095,96	0.1	1
72	Zone-2 Lead kVArh	40097,98	0.1	1
73	Zone-3 Lead kVArh	40099,100	0.1	1
74	Zone-4 Lead kVArh	40101,02	0.1	1
75	Zone-5 Lead kVArh	40103,04	0.1	1
76	Zone-6 Lead kVArh	40105,06	0.1	1
77	Zone-7 Lead kVArh	40107,08	0.1	1
78	Zone-8 Lead kVArh	40109,10	0.1	1
79	Zone-1 MD kVA	40111	0.1	1
80	Date/Month	40112		
81	Hour/Minute	40113		
82	Zone-2 MD kVA	40114	0.1	1
83	Date/Month	40115		
84	Hour/Minute	40116		
85	Zone-3 MD kVA	40117	0.1	1
86	Date/Month	40118		
87	Hour/Minute	40119		
88	Zone-4 MD kVA	40120	0.1	1
89	Date/Month	40121		
90	Hour/Minute	40122		
91	Zone-5 MD kVA	40123	0.1	1
92	Date/Month	40124		
93	Hour/Minute	40125		

Sl.No	Parameter	Address	Resolution	
			LT	HT
94	Zone-6 MD kVA	40126	0.1	1
95	Date/Month	40127		
96	Hour/Minute	40128		
97	Zone-7 MD kVA	40129	0.1	1
98	Date/Month	40130		
99	Hour/Minute	40131		
100	Zone-8 MD kVA	40132	0.1	1
101	Date/Month	40133		
102	Hour/Minute	40134		

Note:

a) Σ PF Calculation : If P.F < 1000 PF is in Lag (P.F = PF)
If P.F > 1000 PF is in Lead P.F = (PF-1000)

b) Σ kWh Calculation : Σ kWh = (kWh MSB * 65536) + kWH LSB

c) Meter Type / Runhour MSB : 256

d) Q = Meter Type : 03 = LT 3W, 04 = LT 2W, 05 = HT 3W,
06 = HT 2W

e) Imp. & Exp. status : 0 = Import, 1 = Export

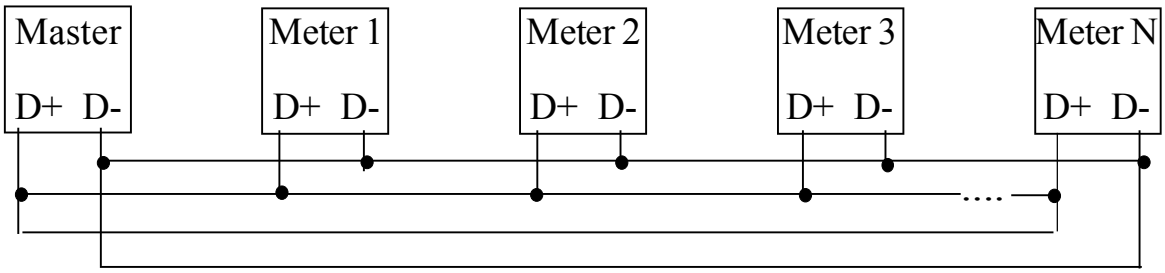
f) R : Runhour MSB

g) Total Runhour : (Runhour MSB * 65536) + Runhour LSB

8.1 Communication connection diagram

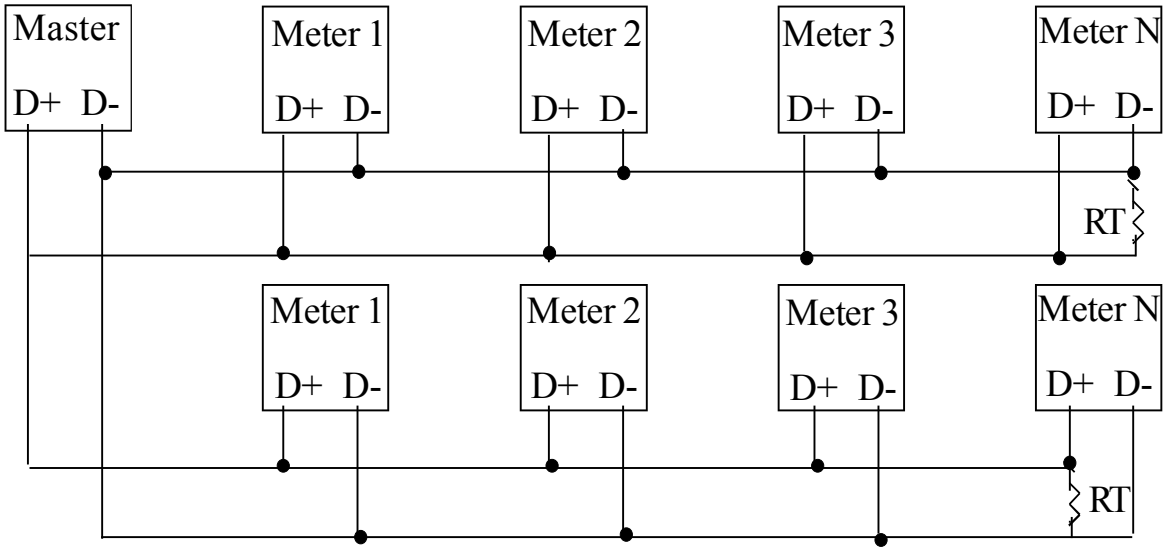
When connecting the meters in multidrop communication network, the following methods are to be adopted for trouble free communication.

1. **Loop Topology**



In this method, the communication continous to work even if there is a breakage in any one of the Loop. Termination resistors are not required.

2. **Straight line Topology**



In this method termination resistor RT (60 -100 Ω) of value equal to characteristic Impedance of the cable used may be required to avoid reflection loses.

It is recommended to use proper & suitable communication cable for trouble free communication.

9. Technical specification (class 0.5)

Type	: **TRIVECTOR METER / MD CONTROLLER**
Model	: **PCM 9505**
Application	: LT / HT Application (Field selectable)
Voltage Input (Line to Line)	: **LT :** 415 VAC/HT :110VAC RMS (-20% to +10%)
Current Input	: 1 / 5A AC R.M.S. (Field selectable)
Over Load Capacity	: 10A Max continuous, 50A max for 3 seconds
Working Load Range	: 0.5% to120% of load current
Frequency	: 45.00 to 55.00Hz
Measurement Method	: 3 / 2 Watt Meter (Field selectable)
Accuracy	: **Class 0.5** as per **IS 14697** **Class 0.2** (Ordering option)
Parameter shown	: 1. Phase & Line Voltages for 3Ph.& Avg. Voltage 2. 3 Phase & Total Current(s) 3. 3 Phase & Total kVA, kW, kVAr & Avg. PF 4. Input Frequency, kWh, kVAh, kVArh (Import). 5. TOD kVAh, kWh, kVArh (Import) & Max.Demand with date & Time for 8 zones 6. Rising Demand kVA, Predicted Demand kVA & Integration Time. 7. Max. Demand kVA & 24 Hours max. demand (kVA) with Date & Time. 8. Cumulative Max. Demand & MD Reset Count
Parameter storage	: In non-volatile EERAM

Display	: Seven segment GRAPHICAL LCD display with Backlit
LCD Power Save	: Provided, LCD backlit goes OFF when there is no key press for 3 minutes, to enhance the life of LCD. The backlit is switched ON, when any key is pressed.
Display page selection	: By set of keys provided in front panel.
Calibration pulse O/P	: Provided thru' IR LED in front panel of the meter for kWh & kVArh
Meter Constant	: 3200imp/kWh & kVArh as ordering option
Programmable	: PT Primary, PT Secondary, CT Primary, CT Secondary, Device ID, Demand time,TOD, Real time Clock & Date
Energy & Runhour Reset	: Facility with password protection
Parameters storage	: In non-volatile EERAM (including Energy & Runhour)
Display page selection	: By set of keys provided in front panel.
THD Accuracy	: ± 2%OFS for % values (for loads > 20%)
Burden on Voltage I/P	: 0.25VA per phase
Burden on Current I/P	: 0.25 V A per phase
PC Interface (Optional)	: An optically isolated RS 485 O/P is available with MODBUS-RTU protocol.
Isolation	: 2 kV Isolation for 1 minute between communication and other circuits.

Parameter displayed : (Class 0.5 / 0.2)

Parameter	Range	Resolution	Accuracy
R, Y, B Voltage	50 - 280 V AC	0.1V/0.001kV(LT/HT)	±0.5%+2Least digit
RY, YB, BR Voltage	90 - 485 V AC	0.1V/0.01kV(LT/HT)	±0.5%+2Least digit
Current	0 - 100 A AC > 100 A AC	0.1 A (LT & HT) 1 A (LT & HT)	±0.5%+2Least digit
kVA/KW/kVAr 3 Phase & total	0 -1000 KVA/KW/KVAr >1000 kVA/KW / kVAr	0.1kV A/KW / kVAr 1 kVA /KW / kVAr	±0.5 %+2Least digit ±0.5%+2Least digit
3Phase Power factor & Avg PF	0.0Lg - Unity - 0.0Ld	0.001 (LT & HT)	±0.5 %+2Least digit
Frequency	40.00 - 60.00 Hz	0.01Hz(LT & HT)	±0.5 %+2Least digit
kWh, KVAh & kVarh	9999999.9	0.1 (LT/HT)	Class 0.5 as per IS 14697
Run Hour	9999.59 Hours Max.	1 Minute	± 3 sec/day

Auxiliary Supply : 90 - 270V AC

Burden on Auxiliary I/P : 4 VA

Operating Temperature : 10ºC to 55ºC

Box Dimension : 144(W) x144(H) x80(D) mm

Cutout : 142 x 142 mm

Mounting : Panel

Enclosure : ABS Plastic case

Weight : 500 g (Approximately)