Operating Manual

Installation & Operating Instructions

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REV-D 03/2022

1. Introduction

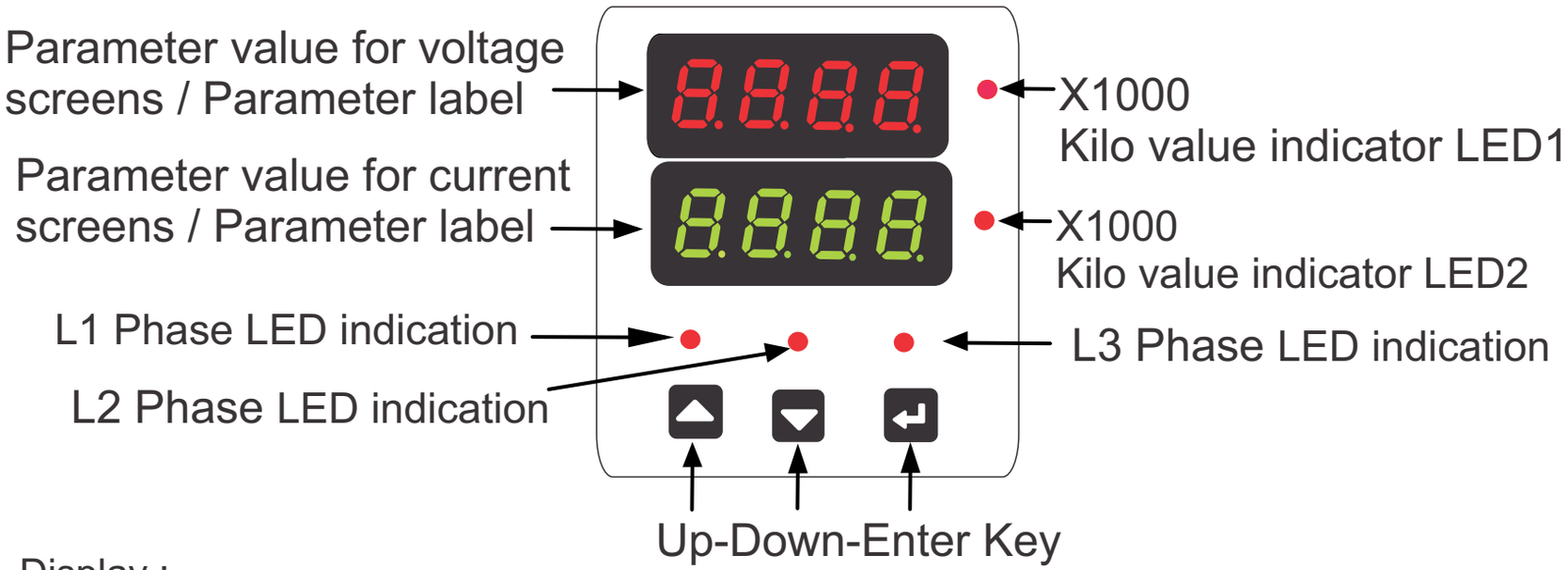
The compact instrument is a modern measurement device with innovative design made for both 3 phase and 1 phase applications.

3-P Model: is a 3-phase variant designed for 3-phase application for voltage measurement from 10V to 600V (L-L) and current measurement from 5mA to 120 mA using RJ-12 input.

1-P 30/60A Model: is a 1-phase variant designed for 1-phase application for voltage measurement from 5.7V to 360V (L-N) and inbuild CT for current measurement from 1A to 36A and 1A to 72A respectively.

Main Features:

- Compact size of 48 x 48
- Voltage, Current, Frequency, RPM, Min/Max Voltage and Current & THD measurement
- Ultra bright 2-line 4-digit LED Display
- Simultaneous display of 2 parameters
- RJ12 input for 3-Phase current for easy error free connection
- Inbuilt CT for 1-Phase application for direct 30/60A measurement
- Optional RS485 for remote monitoring and setting
- Optional configurable multipurpose relay



Display :

Display is ultra bright 2-line, 4-Digit seven segment LED display. Upper row is bright RED and lower row is bright GREEN. Digit height is 9.2 mm for better visibility.
In measurement screen the upper row display shows voltage and lower row display shows current value. For all other parameter, display alternatively displays the label and its value. In the Setup screens, upper row shows label and lower row display shows value.

Keys : 3 Keys are provide for easy setting and scrolling of parameters

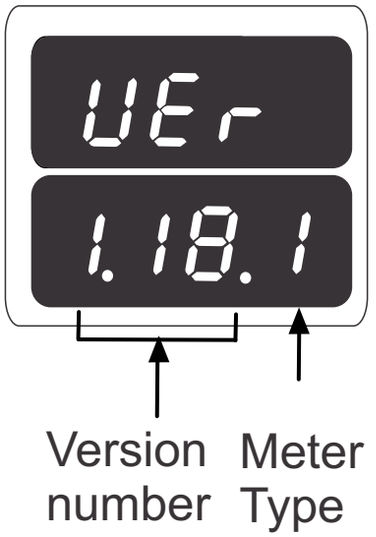
The ▲ key function as UP key
The ▼ key function as DOWN key
The ↵ key function as ENTER key

LED indication :

L1 LED	: Indicates that Phase 1 parameters are being displayed
L2 LED	: Indicates that Phase 2 parameters are being displayed
L3 LED	: Indicates that Phase 3 parameters are being displayed
L1,L2,L3 LED	: Indicates that System parameters are being displayed
L1,L2	: Indicates that parameter between Phase 1 & 2 are being displayed
L2,L3	: Indicates that parameter between Phase 2 & 3 are being displayed
L1,L3	: Indicates that parameter between Phase 3 & 1 are being displayed

Kilo indicator LED1: Indicates that displayed value in upper row is in Kilo i.e. value x 1000
Kilo indicator LED2: Indicates that displayed value in lower row is in Kilo i.e. value x 1000

2. Measurement Reading Screen



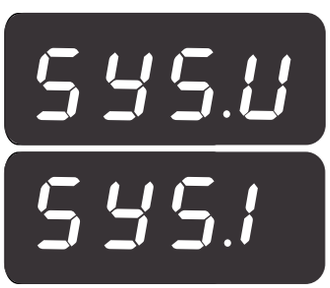
Meter after powered, first shows the VEr (label for Version) in upper row and meter software version along with meter type (1 for 1-P Model and 3 for 3-P Model) in second row as shown beside. After 2 seconds the measurement screens are shown one by one automatically if auto scroll is enabled. If auto scrolling is disabled then use UP and DOWN key to scroll through all measurement screens.

Measurement screens are of following types

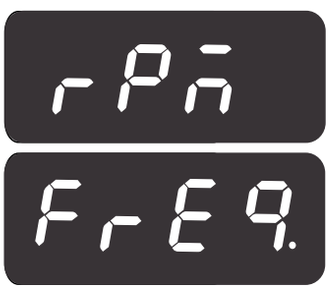
1. **Instantaneous values** : Instantaneous values of voltage L-N, voltage L-L, line current, frequency, RPM, THD voltage and current are shown and corresponding phase L1, L2, L3 LED glows.
2. **Minimum and Maximum values** : Minimum and Maximum measured values from last reset of instantaneous parameter values.
3. **Relay status :** If relay is configured as timer then timer status (ON/OFF) and cycle count/ remaining will be displayed. Also by using ENTER key cycles can be stopped or restarted. If relay is configured as limit then relay status will be indicated.

Table1 lists parameters shown on display as per system type selected for available models.

Following are special screens which have associated parameter mentioned:

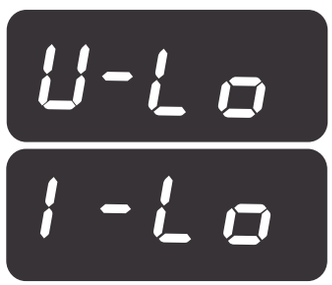


System average voltage and current



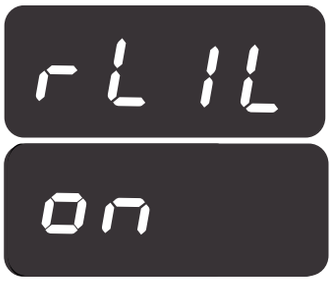
Frequency and rpm

Maximum average voltage, current value



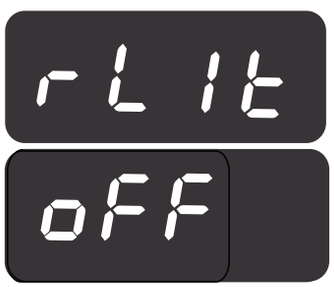
Minimum average voltage, current value

Voltage, current
THD value (optional)

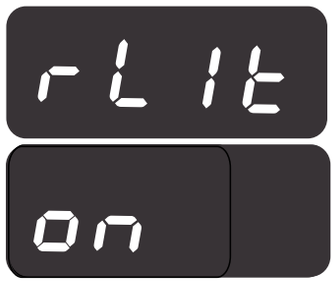


Relay 1 configured
as limit relay and on

Relay 1 configured
as limit relay and off



Relay 1 configured
as timer relay, blinking
label here indicates
option to on/off timer
on this screen using
enter key



Relay 1 configured
as timer relay, blinking
label here indicates
option to on/off timer
on this screen using
enter key

Relay 1 configured
as timer relay and
shows cycle count /
remaining cycle

TABLE 1A : Measurement Screens for 3-P Model

Sr. No.	Parameters	3P 4W	3P 3W	1P 2W
1.	L-N Voltage	✓	✗	✓
2.	L-L Voltage	✓	✓	✗
3.	Current	✓	✓*	✓
4.	System average Voltage/Current	✓	✓	✓
5.	Max System Voltage/Current	✓	✓	✓
6.	Min System Voltage/Current	✓	✓	✓
7.	Frequency / RPM	✓	✓	✓
8.	Phase Voltage and Current THD	✓	✓	✗
9.	System Voltage and Current THD	✓	✓	✓
10.	Timer no. of cycles	✓	✓	✓
11.	Limit Relay	✓	✓	✓

*Note: In 3P3W system, I2 is calculated value

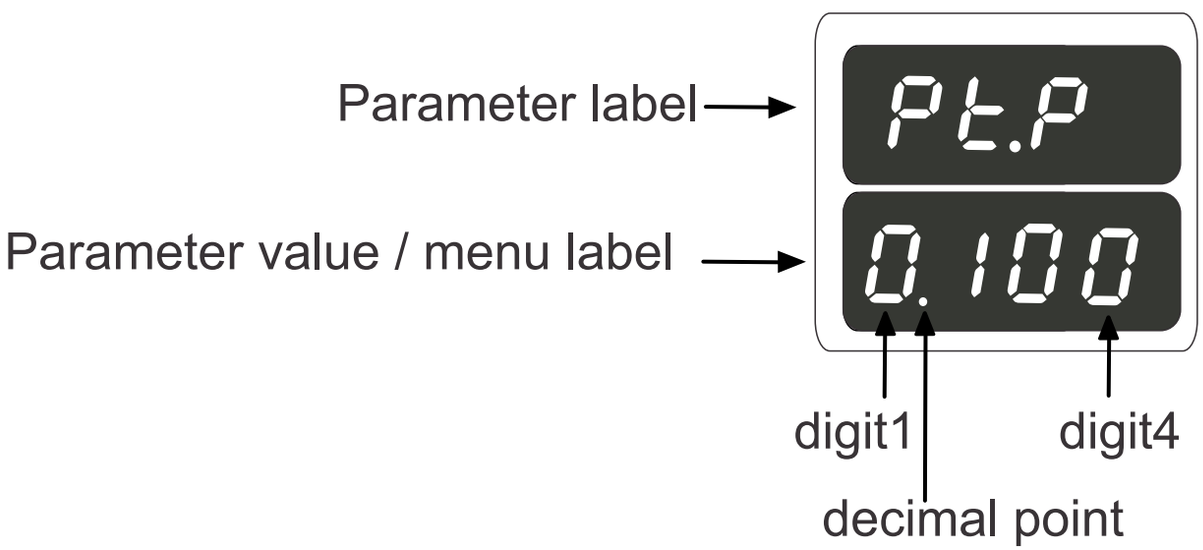
TABLE 1B : Measurement Screens 1-P 30/60A Model

Sr. No.	Parameters	1P 2W
1.	System Voltage/Current	✓
3.	Max System Voltage/Current	✓
4.	Min System Voltage/Current	✓
5.	System Frequency	✓
6.	RPM	✓
7.	System Voltage and Current THD	✓

3. Setup Screen

Upon long-pressing enter key "CodE" screen is displayed. After entering the correct password user can enter in setup for configuration.

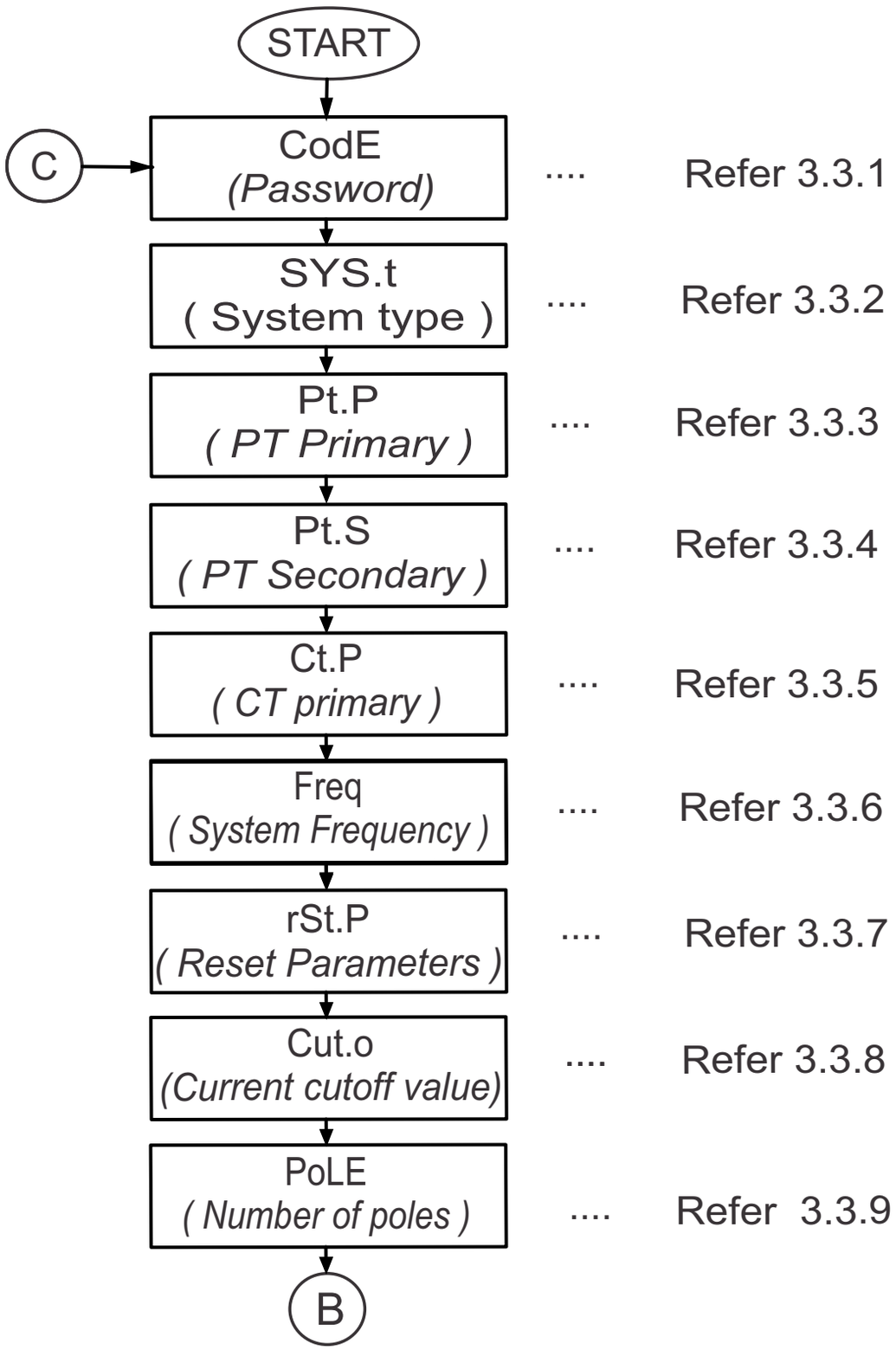
Setup screens have two row format as shown beside:

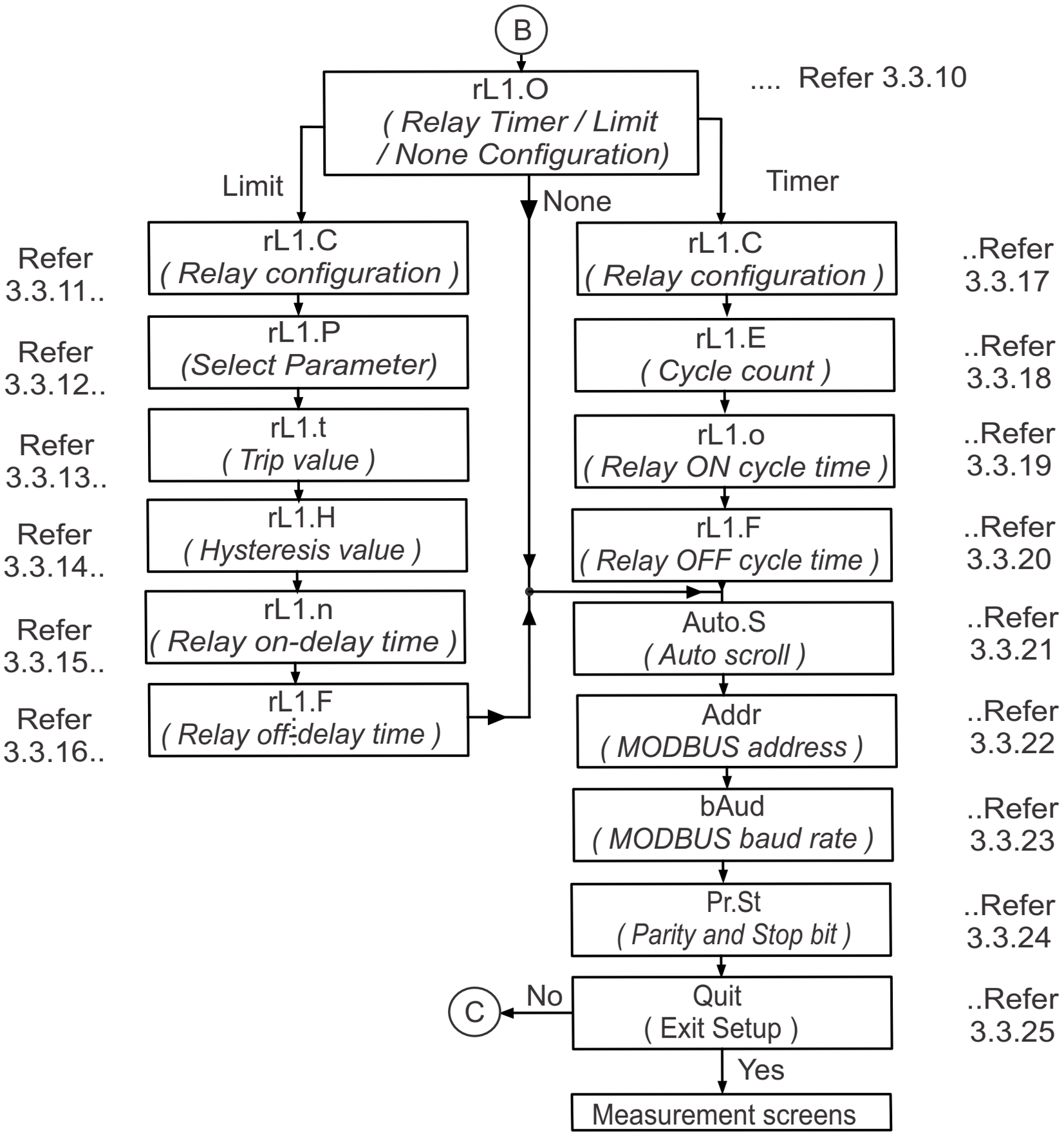


3.1 Setup Screens Flowchart:

Long press enter key to enter into setup menu.

The meter shows only relevant setup screens according to meter model and configuration of relay.




B
rL1.O
(Relay Timer / Limit / None Configuration)
.... Refer 3.3.10
Limit
None
Timer
rL1.C
(Relay configuration)
Refer 3.3.11..
rL1.P
(Select Parameter)
Refer 3.3.12..
rL1.t
(Trip value)
Refer 3.3.13..
rL1.H
(Hysteresis value)
Refer 3.3.14..
rL1.n
(Relay on-delay time)
Refer 3.3.15..
rL1.F
(Relay off-delay time)
Refer 3.3.16..
rL1.C
(Relay configuration)
..Refer 3.3.17
rL1.E
(Cycle count)
..Refer 3.3.18
rL1.o
(Relay ON cycle time)
..Refer 3.3.19
rL1.F
(Relay OFF cycle time)
..Refer 3.3.20
Auto.S
(Auto scroll)
..Refer 3.3.21
Addr
(MODBUS address)
..Refer 3.3.22
bAud
(MODBUS baud rate)
..Refer 3.3.23
Pr.St
(Parity and Stop bit)
..Refer 3.3.24
No
C
Quit
(Exit Setup)
..Refer 3.3.25
Yes
Measurement screens

3.2 Editing of Parameter Value (Setting value)

Upon display of setup parameter label and its value press ENTER key to edit that parameter. Editing of parameter has started is indicated on the lower row display by any of the following indications as point 1 or 2 or 3 as below

1. **Blinking Decimal point (DP) if applicable**
   If any setup parameter has **DP** that needs to be adjusted first then **DP position** starts blinking first. Once DP position is set as desired then left most digit of display blinking starts.

UP key function: UP key **increases** DP position in forward (from left to right) direction till maximum and roll back to minimum allowed position so DP position is moved in all possible positions.

DOWN key function: DOWN key **decreases** DP position in reverse (from right to left) direction till minimum and roll back to maximum allowed position so DP position is moved from all possible positions.

ENTER key function: **Confirms and sets** the DP position and starts editing digit value starting from left most (digit1) to right most (digit4) digit.
The editing of digit is done as explained in following point no.2.

2. **Blinking of left most digit**

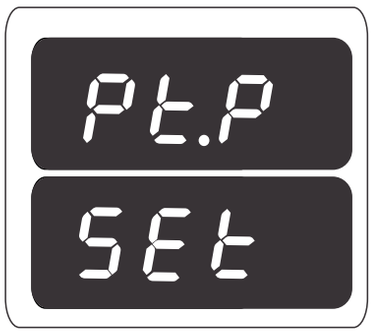
The first left most digit start blinking indicates editing is started, all digits from left most to right most digit are editable.
Use following procedure for editing:

UP key function: UP key **increases** digit value upto maximum limit allowed for that digit and scroll back to 0 or minimum value possible for that digit, so the digit scroll from minimum value to maximum value possible for that digit.

DOWN key function: DOWN key **decreases** digit value upto minimum limit allowed for that digit and scroll back to 9 or maximum value possible for that digit, so the digit scroll from minimum value to maximum value possible for that digit

ENTER key function: **Confirms and sets** the digit value and editing advances to next digit towards right from current position. If all digit positions are done editing then key confirms value of parameter set.

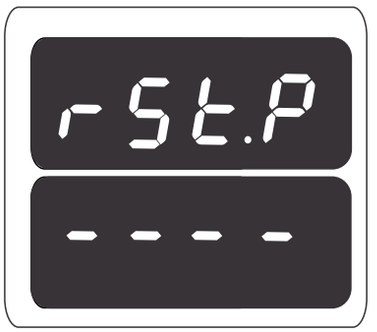
NOTE: Blinking digit position shown by dash " - " in the screens.



3. **Blinking of the entire menu label if applicable**
   If parameter has alphabet menu label instead of digit to be set then whole label starts blinking.

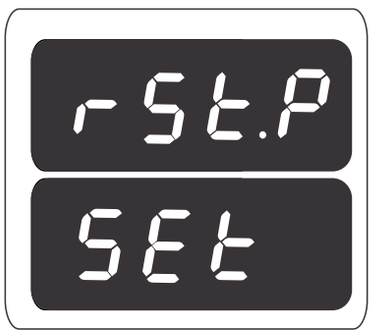
   UP key function: UP key shows **next** menu upto maximum possible menus for that parameter and scroll back to 1st menu option, so that all menus are scrolled.

   DOWN key function: DOWN key shows **previous** menu upto 1st menu and scroll back to maximum possible menus for that parameter back to 1st menu option, so that all menus are scrolled.



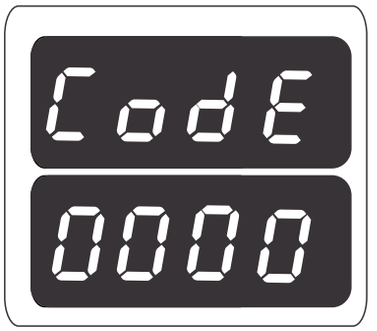
   ENTER key function: **Confirms and sets** the menu and If editing is done then SET is displayed on screen as shown besides:

   Note: Blinking menu option shown by dash " - - - - " in the screens.



3.3 Setup Parameters

3.3.1 Code (Password)



The Screen shown is used for authentication purpose. Using key function as explained in section 3.2 value can be changed.
Correct password results in setup parameter editing
else meter will show "Err" message and 2 chances given to set value else meter will exit to the measurement screen.
If correct value is entered then new password for meter can be set here on same screen.
Default code is 0000 and can be changed to any value from 0000 to 9999.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.2 System Type

The screen is used to set system type. Depending upon user's network type (3P4W/3P3W/1P2W) the meter system type must be configured.
Using key function as explained in section 3.2 value of parameter can be changed.

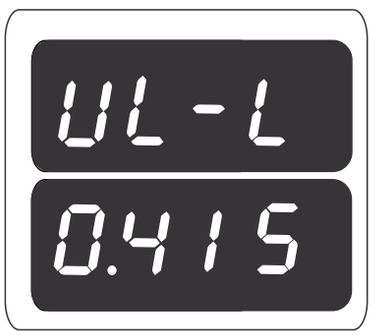
The option for screen are as follows:
1P2- 1 phase 2 Wire system
3P3 - 3 phase 3 Wire system
3P4 - 3 phase 4 Wire system
As per system type measurement screens get changed.
Default value is 3P4 for 3-P Model and 1P2 for 1-P 30/60A Model.
System type is not editable for 1-P 30/60A Model.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.3 PT primary

The screen is used to set PT primary. Depending upon user's system Voltage level external potential transformer must be selected and meter must be configured for the selected PT.

Using key function as explained in section 3.2 value of parameter can be changed.

The value shown by default is in kilo volt so X1000 LED1 is on in first row also the value is always Line to line (which is indicated on display as screen alternates between PT.P and VL-L) for 3-P Model and line to neutral (which is indicated on display as screen alternates between PT.P and VL-N) for 1-P 30/60A Model. To change value of PT primary first DP value need to set to desired place then change the digits values as required.



Overload indication values and relay limit parameter values are derived with respect to this value.

The Minimum value of parameter is 100 and Maximum value is 7999k for 3-P Model.

The Minimum value of parameter is 57 and 4618k for 1-P Model.

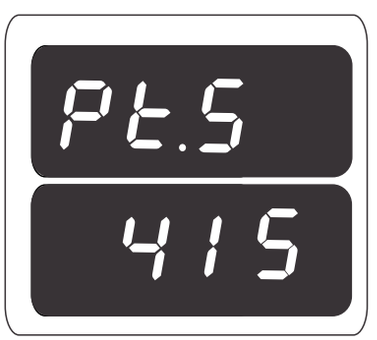
Min and Max measurement parameter values get reset if value of PT primary is changed.

After editing completed:

Using UP key next menu parameter will be displayed,

Using DOWN key previous menu parameter will be displayed,

Using Enter key parameter value can be edited and set again.



3.3.4 PT Secondary

The screen is used to change PT secondary. PT Secondary has to configured in similar way as PT Primary.

Using key function as explained in section 3.2 value of parameter can be changed.

The value shown in volts and line to line for 3-P Model and line to neutral for 1-P Model, indicated on display just as explained for PT Primary.

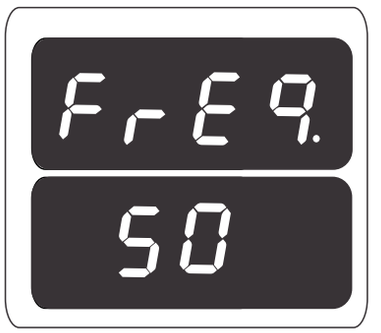
For better measurement of values less than or equal to 110 VLL or 63.5 VLN, use nominal voltage as 110/63.5 or less as desired.
The Minimum value of parameter is 100 and Maximum value is 500 for 3-P Model.
The Minimum value of parameter is 57 and 300 for 1-P Model.
Min and max measurement parameter values get reset if value of PT secondary is changed.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.5 CT Primary

The screen is used to set CT primary. Depending upon user system current an external Current Transformer must be selected and meter must be configured for that selected CT.
Using key function as explained in section 3.2, value of parameter can be changed.
The Minimum value of parameter is 1 and Maximum value is 9999, and is only editable for 3-P Model.
For 1-P Model, 30/60 is displayed (read-only) corresponding to 1-P 30/60 A model.
Min and max measurement parameter values get reset if value of CT Primary is changed.
Overload indication values and relay limit parameter values are derived with respect to this value.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.6 System Frequency

The screen is used to set system frequency parameter.
Using key function as explained in section 3.2, option of parameter can be changed.
The options are 50/60 Hz.
Default value is 50.

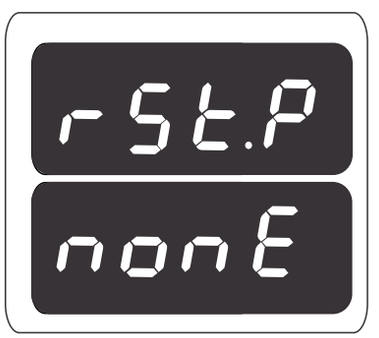


After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.7 Reset parameter

The screen is used to set option for reset parameter.
Using key function as explained in section 3.2, option of parameter can be changed.
The below options are possible:

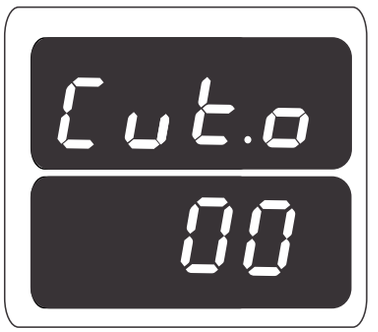
1. None - Do not reset any parameter
2. Hi Lo - Reset Hi and Lo values i.e. minimum and maximum values of measurement parameters
3. Fact - Factory reset i.e. all programmable parameters set to their factory default values. Meter restart after this option is selected



Default menu option is "none".
After editing completed
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.8 Current cutoff value (Applicable for 3-P Model only)

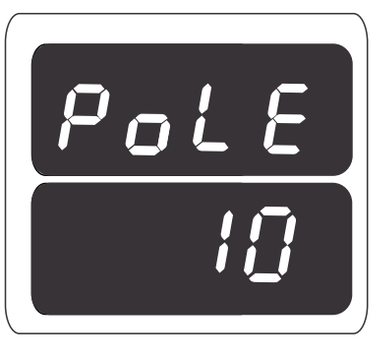
The screen is used to set current cutoff limit. If user system are subjected to noise then cutoff can be applied, below which meter reads zero.



Using key function as explained in section 3.2, parameter value can be changed.
Parameter value range is 0 to 30 mA
0 means feature is disabled.
Default value is 0.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.9 Number of poles

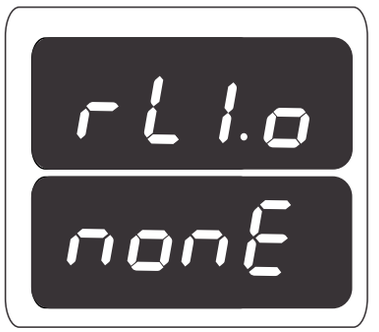
The screen is used to set Number of poles. No. of poles in a motor load decides its synchronous speed. If meter is used to monitor a motor load then its synchronous speed (in RPM) can be read from VAF meter.



RPM = 120f/p,
where f is system frequency and p is stator no. of poles.
Using key function as explained in section 3.2, parameter value can be changed.
Parameter value range is 2 to 60 (as poles necessarily comes in pairs so the parameter value is multiple of 2).
Default value is 10.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.10 Relay output select

The screen is used to set output option of relay.



Using key function as explained in section 3.2, relay menu can be changed.

Parameter values are:

1. None (nonE) - Relay is not activated.
2. Limit (Limt) - Relay is assigned as limit relay, which can be used to control or for indication that configured electrical parameter is not in band as specified by limits.
3. Timer (timr) (optional): Relay is assigned for timer function. This function can be use to turn on/off some control circuit based on precise timing. Relay switches according to number of cycles set in counter register and cycle on and off time.

Default value is None.

After editing completed:

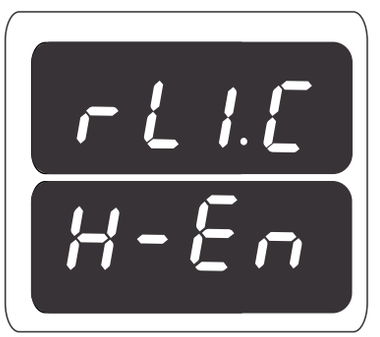
Using UP key next menu parameter will be displayed,

Using DOWN key previous menu parameter will be displayed,

Using Enter key parameter value can be edited and set again.

3.3.11 Limit Relay : Relay configuration

The screen is used to set relay ON configuration. Using key function as explained in section 3.2, relay can be assigned as one of the following parameter. The configurations are:



1. High Energize (H-En)
2. Low Energize (L-En)
3. High De-energize (HdEn)
4. Low De-energize (LdEn)

Default value is High Enerzise.

Refer the following sections for detailed description.

After editing completed:

Using UP key next menu parameter will be displayed,

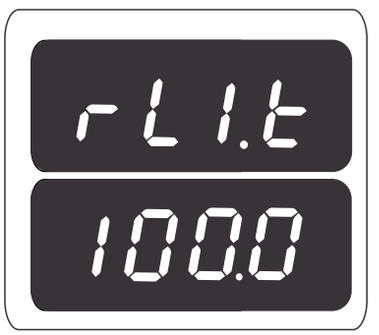
Using DOWN key previous menu parameter will be displayed,

Using Enter key parameter value can be edited and set again.

3.3.12 Limit Relay : Relay Parameter

The screen is used to set relay parameter in limit function.
Using key function as explained in section 3.2, relay can be assigned any one of the parameter.
The parameter are listed in table 2.
Default value is parameter 3 i.e. I1 Current.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.13 Limit Switch : Trip Point



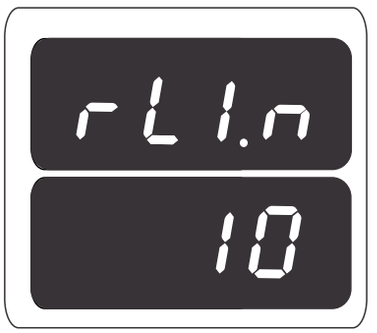
The screen is used to set trip point for relay operation.
Using key function as explained in section 3.2, the parameter can be changed.
The trip point are listed in table 2.
Default value is parameter 100%.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.14 Limit Switch : Hysteresis point

The screen is used to set hysteresis point for relay operation.
Using key function as explained in section 3.2, the parameter can be changed.
Value range from 0.5 to 50%.
Default value is parameter 20%.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.15 Limit Switch : On delay

The screen is used to set trip delay value in seconds, after fault condition is triggered. If fault condition is removed during this wait period relay will not activate.



Using key function as explained in section 3.2, the parameter can be changed.

Value range from 1 to 60.

Default value is parameter 10.

After editing completed:

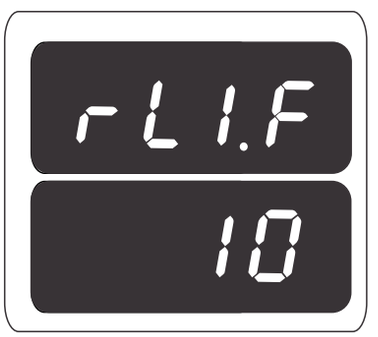
Using UP key next menu parameter will be displayed,

Using DOWN key previous menu parameter will be displayed,

Using Enter key parameter value can be edited and set again.

3.3.16 Limit Switch : Off delay

The screen is used to set reset delay value in seconds, after fault condition is recovered. Relay will not reset to normal during this wait period after fault condition removed.



Using key function as explained in section 3.2, the parameter can be changed.

Value range from 1 to 60.

Default value is parameter 10.

After editing completed:

Using UP key next menu parameter will be displayed,

Using DOWN key previous menu parameter will be displayed,

Using Enter key parameter value can be edited and set again.

Limit Switch :

Limit switch can be used to monitor the measured parameter (Ref. TABLE 2) in relation to a set limit. The limit switch can be configured in one of the four mode given below:-

1) Hi-alarm & Energized Relay
2) Hi-alarm & De-Energized Relay
3) Lo-alarm & Energized Relay
4) Lo-alarm & De-Energized Relay

With User selectable Trip point, Hysteresis, On Delay & Off delay.

Hi- Alarm: If Hi-Alarm Energized or Hi-Alarm De-Energized option is selected then relay will get energized or De-energized, if selected parameter is greater than trip point.

Lo-Alarm: If Lo-Alarm Energized or Lo-Alarm De-Energized option is selected then relay will get energized or De-energized, if selected parameter is less than trip point.

Note: For Lo-Alarm configuration, set the values of trip point & hysteresis such that % trip point + % hysteresis should be less than 120% Value.

Trip Point: Trip point can be set in the range as specified in TABLE 2 of nominal value for Hi-Alarm & 10% to 120 % of nominal value for Lo-Alarm.

TABLE 2 : Parameters for Limit output

Parameter No.	Parameter	3P 4W	3P 3W	1P 2W	Trip Point Set Range	100% Value
0	Voltage L1	✓	✗	✓	10 - 120 %	Vnom (L-N)
1	Voltage L2	✓	✗	✗	10 - 120 %	Vnom (L-N)
2	Voltage L3	✓	✗	✗	10 - 120 %	Vnom (L-N)
3	Current I1	✓	✓	✓	10 - 120 %	Inom
4	Current L2	✓	✓	✗	10 - 120 %	Inom
5	Current I3	✓	✓	✗	10 - 120 %	Inom
21	Average Voltage	✓	✓	✗	10 - 120 %	Nom
23	Average Current	✓	✓	✗	10 - 120 %	Nom
35	Frequency	✓	✓	✓	10 - 90 %	66 Hz (1)
100	Voltage L12	✓	✓	✗	10 - 120 %	Vnom (L-L)
101	Voltage L23	✓	✓	✗	10 - 120 %	Vnom (L-L)
102	Voltage L31	✓	✓	✗	10 - 120 %	Vnom (L-L)

Note : Parameters 0,1,2 are L-N Voltage for 3P 4W & L-L Voltage for 3P 3W.

(1) For Frequency 0% corresponds to 45 Hz and 100% corresponds to 66 Hz.

Hysteresis

Hysteresis can be set in the range of 0.5% to 50 % of set trip point. If Hi-alarm Energized or Hi-alarm De-energized is selected then relay will get De-energized or Energized respectively, if set parameter value is less than Hysteresis. Similarly if Lo-alarm Energized or Lo-alarm De-Energized is selected then relay will get De-energized or Energized respectively, if set parameter value is more than Hysteresis.

Note : In case of Lo-alarm if trip point is set greater than 80% then the maximum hysteresis can be set such that the total Trip point + Hysteresis (% of trip point value) will not exceed 120% of range.

For example :If trip point is set at 90%, then maximum 33.3% hysteresis should be set such that, [90 + 29.99 (33.3% of 90)] = 120.

Note:

Setting of Hysteresis and trip value is to be verified by user so that trip and reset value of relay parameter should lie within Minimum and Maximum range of that parameter.

Energizing Delay:

The energizing delay can be set in the range from 1 to 60 seconds.

De-Energizing Delay:

The De-energizing delay can be set in the range from 1 to 60 seconds.

Examples of configuration:

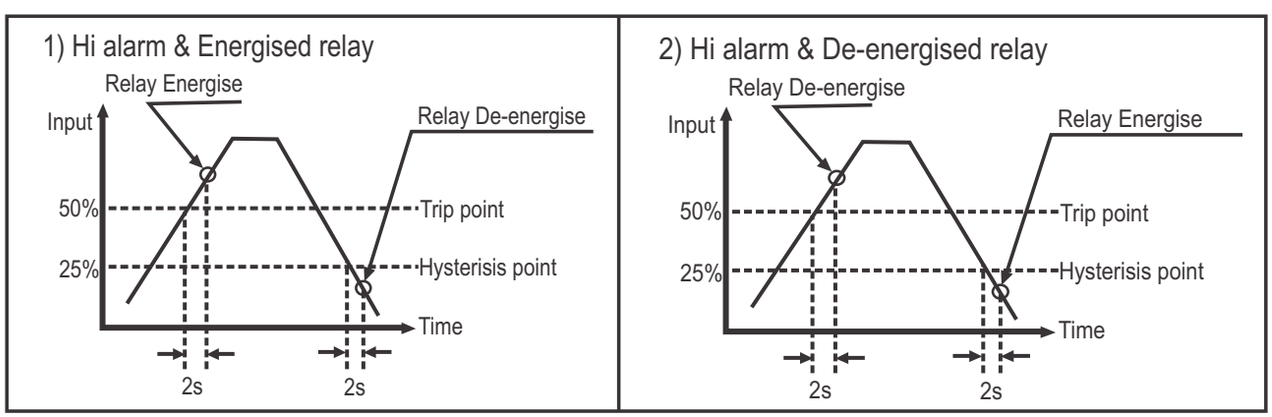
Parameter No. 3 (Current 1)

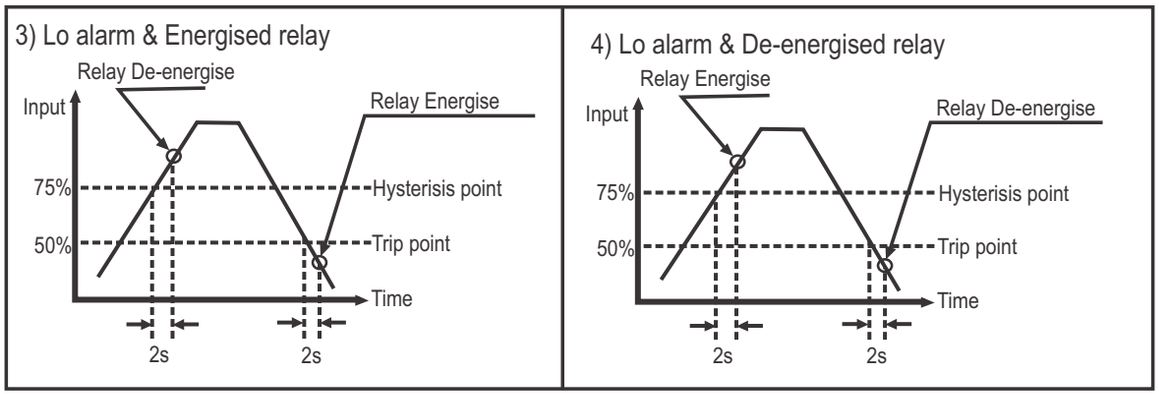
Trip Point= 50%

Hysteresis = 50% of trip point

Energising Delay: 2 sec

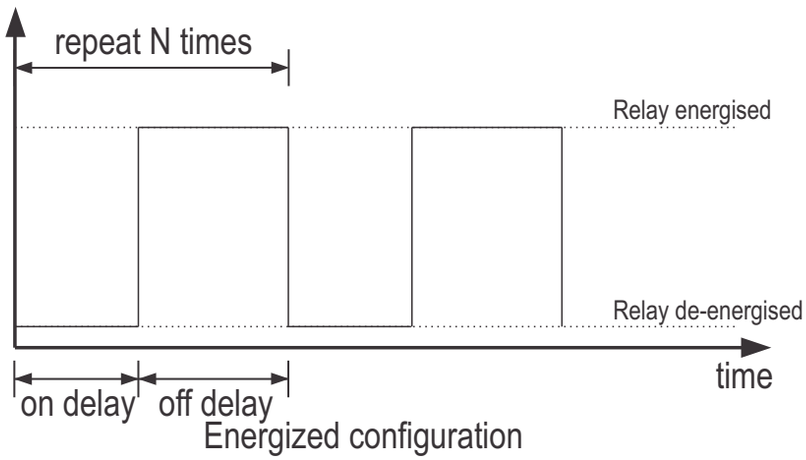
De-energising Delay: 2 sec



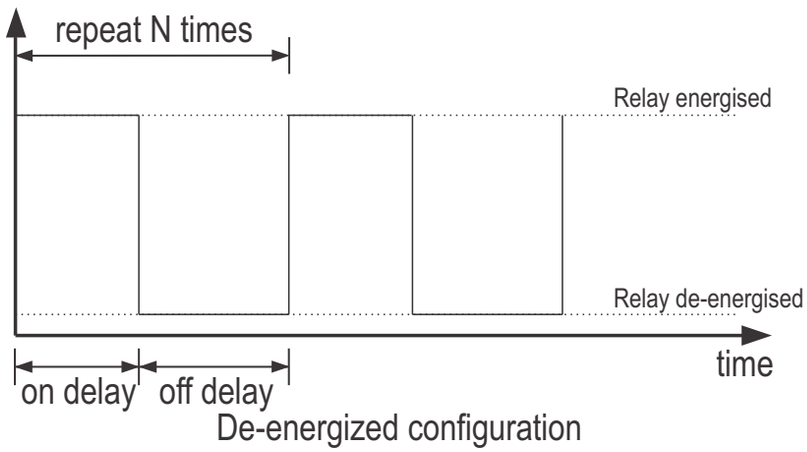


Timer Output:

Timer output can be used to operate the Relay in a cyclic manner. The user can define the ON period and OFF period and also the number of times this cycle is to be repeated. The number of Cycles (N) can be 1 to 999. The counting is shown on a measurement screen as explained before.

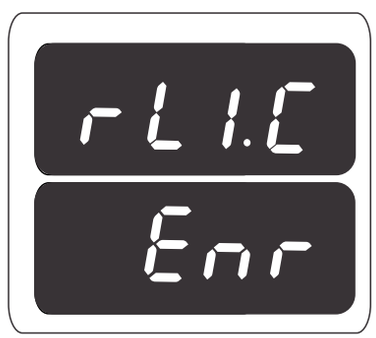


Energized configuration



De-energized configuration

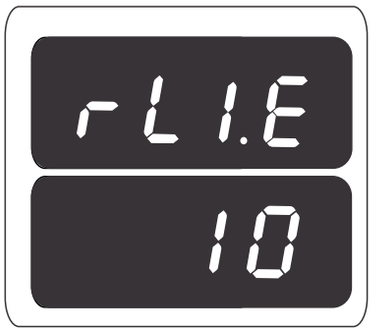
3.3.17 Timer Relay: Relay configuration (optional)



The screen is used to set relay ON configuration.
Using key function as explained in section 3.2, relay can be assigned as one of the following parameter.
The configurations are:
1. Energize (Enr)
2. De-energize (dEnr)
Default value is Energize
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

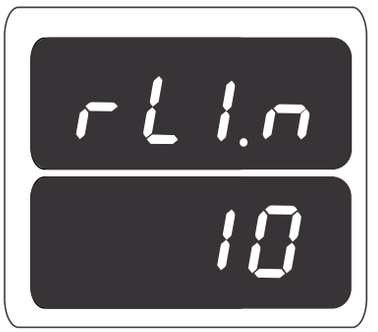
3.3.18 Timer relay : Relay timer cycles

The screen is used to change relay timer cycles.
Using key function as explained in section 3.2, number of cycles to be counted can be changed. Relay switches according to number of cycles set in counter register.
Value range from 1 to 999.
Default value is 10.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.



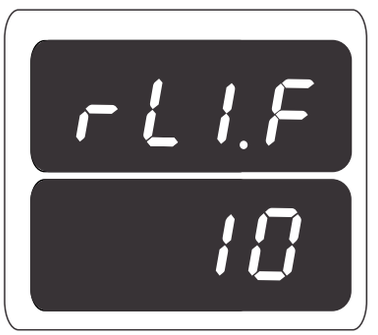
3.3.19 Timer relay : ON relay time (Seconds)

The screen is used to set on cycle time of timer value in seconds
Using key function as explained in section 3.2, the parameter can be changed.
Value range from 1 to 60.
Default value is parameter 10.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.



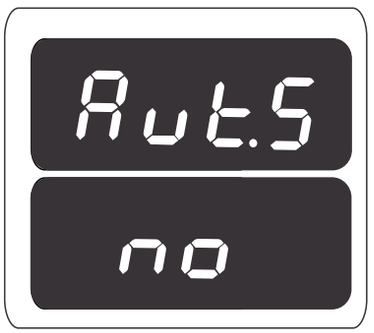
3.3.20 Timer relay : OFF relay time (Seconds)

The screen is used to set off cycle time value in seconds
Using key function as explained in section 3.2, the parameter can be changed.
Value range from 1 to 60.
Default value is parameter 10.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.



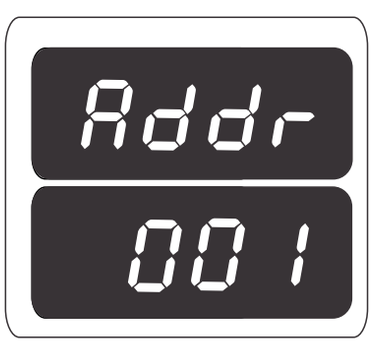
3.3.21 Auto scroll display

The screen is used to set auto scrolling function.
Using key function as explained in section 3.2, menu option can be assigned as one of the following parameter options.
YES - Measurement screens will autoscroll with fixed delay
NO - Autoscrolling disabled
Default value is parameter: No.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.



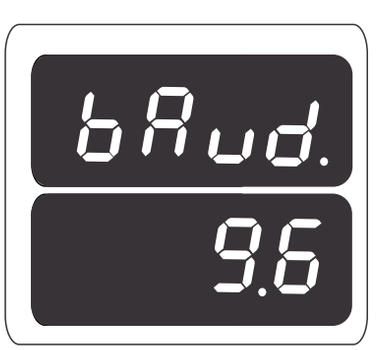
3.3.22 RS485 MODBUS device Address (optional)

The screen is used to set device address for MODBUS communication. Using key function as explained in section 3.2, the parameter can be changed.
Parameter Range: 1-247.
Default value of parameter is 1.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.



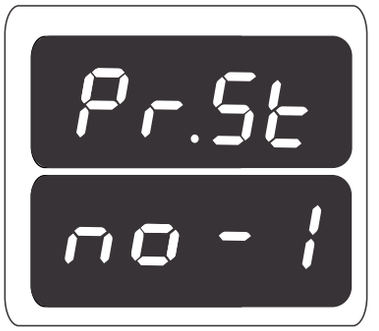
3.3.23 RS485 MODBUS Communication Baud Rate

The screen is used to set baud rate for MODBUS communication.
Using key function as explained in section 3.2, menu option can be assigned as one of the following parameter Baud rate options:
4.8 kbps, 9.6 kbps, 19.2 kbps, 38.4 kbps, 57.6 kbps.
Default value is parameter : 9.6 kbps.
After editing completed:
Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.



3.3.24 RS485 MODBUS Communication Parity and Stop bit

The screen is used to set parity and stop bit for MODBUS communication.



Using key function as explained in section 3.2, menu option can be assigned as one of the following:

no - 1 : No parity and 1 stop bit
no - 2 : No parity and 2 stop bit
odd - 1 : Odd parity and 1 stop bit
even - 1 : Even parity and 1 stop bit

Default value is parameter: no-1.

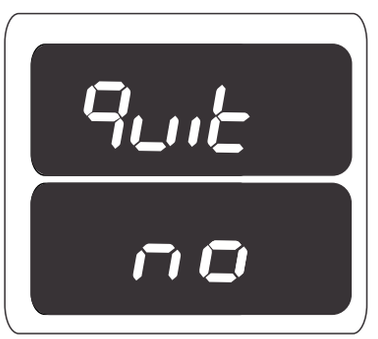
After editing completed:

Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

3.3.25 Exit from Setup Menu

The screen is used to exit from setup menu to measurement screens.

If no is selected then setup menu will be scrolled again.



Using key function as explained in section 3.2, menu option can be assigned as one of the following:

Yes : Exit from setup to measurement
No : Continue in setup for editing

Default value is parameter: No.

After editing completed:

Using UP key next menu parameter will be displayed,
Using DOWN key previous menu parameter will be displayed,
Using Enter key parameter value can be edited and set again.

4. MODBUS Communication :

This instrument supports MODBUS (RS485) RTU protocol (2-wire) .
Connection should be made using twisted pair shielded cable. All "A or negative (-)" and "B or positive (+)" connections are daisy chained together. The screens should also be connected to the “Gnd” terminal. To avoid the possibility of loop currents, an Earth connection should be made at one point on the network. Loop (ring) topology does not require any termination load. Line topology may or may not require terminating loads depending on the type and length of cable used. The impedance of the termination load should match the impedance of the cable and be at both ends of the line. The cable should be terminated at each end with a 120 Ohm (1/4 Watt min.) resistor.

RS 485 network supports maximum length of 1.2km. Including the Master, a maximum of 32 instruments can be connected in RS485 network.The permissible address range for the instrument is between 1 and 247 for 32 instruments. Broadcast Mode (address 0) is not allowed.

The maximum latency time for the instrument is 300ms i.e. this is the amount of time that can pass before the first response character is output.

After sending any query through software (of the Master) , it must allow 300ms of time to elapse before assuming that the VAF Meter is not going to respond. If slave does not respond within 300 ms, Master can ignore the previous query and can issue fresh query to the slave.

The each byte in RTU mode has following format.

	8-bit binary, hexadecimal 0-9, A-F 2 hexadecimal characters contained in each 8-bit field of the message
Format of Data Bytes	4 bytes (32 bits) per parameter. Floating point format (to IEEE 754) Most significant byte first.
Error Checking Bytes	2 byte Cyclic Redundancy Check (CRC)
Byte format	1 start bit, 8 data bits, least significant bit sent first 1 bit for even/odd parity 1 stop bit if parity is used; 1 or 2 bits if no parity

Communication Baud Rate is user selectable from the front panel between 4800, 9600, 19200, 38400, 57600 bps.

Function code

03	Read Holding Registers	Read content of read /write location (4X)
04	Read input Registers	Read content of read only location (3X)
10	Presets Multiple Registers	Set the content of read / write locations (4X)

Exception Cases : An exception code will be generated when VAF Meter receives Modbus query with valid parity & error check but which contains some other error (e.g. Attempt to set floating point variable to an invalid value) The response generated will be "Function code" ORed with HEX (80H). The exception codes are listed below

01	Illegal function	The function code is not supported by VAF Meter
02	Illegal Data Address	Attempt to access an invalid address or an attempt to read or write part of a floating point value
03	Illegal Data Value	Attempt to set a floating point variable to an invalid value

4.1 Accessing 3 X Register for Reading Measured Values

Two consecutive 16 bit registers represent one parameter. Refer table 3 for the addresses of 3X registers (Parameters measured by the instruments).
Each parameter is held in the 3X registers. Modbus Code 04 is used to access all parameters.

Example

To read parameter ,
Voltage L3 : Start address= 04 (Hex) Number of registers = 02

Note : Number of registers = Number of parameters x 2

Each Query for reading the data must be restricted to 20 parameters or less. Exceeding the 20 parameter limit will cause a ModBus exception code to be returned.

Query

01 (Hex)	04 (Hex)	00 (Hex)	04(Hex)	00 (Hex)	02(Hex)	30 (Hex)	0A (Hex)
Device Address	Function Code	Start Address High	Start Address Low	Number of Registers Hi	Number of Registers Lo	CRC Low	CRC High

Start Address High : Most significant 8 bits of starting address of the parameter requested.
Start Address low :Least significant 8 bits of starting address of the parameter requested.
Number of register Hi : Most significant 8 bits of Number of registers requested.
Number of register Lo : Least significant 8 bits of Number of registers requested.

(Note : Two consecutive 16 bit register represent one parameter.)

Response: Volt3 (219.25V)

01 (Hex)	04 (Hex)	04 (Hex)	43(Hex)	5B (Hex)	41(Hex)	21 (Hex)	6F (Hex)	9B (Hex)
Device Address	Function Code	Byte Count	Data Register1 High Byte	Data Register1 Low Byte	Data Register2 High Byte	Data Register2 Low Byte	CRC Low	CRC High

Byte Count : Total number of data bytes received.
Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter requested.
Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter requested.
Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter requested.
Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter requested.

(Note : Two consecutive 16 bit register represent one parameter.)

TABLE 3 : 3 X and 4 X register addresses for measured parameters

Address (3X)	Address (4X)	Parameter Number	Parameter	Hex Address	
				High Byte	Low Byte
30001	40001	0	Voltage L1	00	00
30003	40003	1	Voltage L2	00	02
30005	40005	2	Voltage L3	00	04
30007	40007	3	Current I1	00	06
30009	40009	4	Current I2	00	08
30011	40011	5	Current I3	00	0A
30013	40013	6	---	00	0C
30015	40015	7	---	00	0E
30017	40017	8	---	00	10
30019	40019	9	---	00	12
30021	40021	10	---	00	14
30023	40023	11	---	00	16
30025	40025	12	---	00	18
30027	40027	13	---	00	1A
30029	40029	14	---	00	1C
30031	40031	15	---	00	1E
30033	40033	16	---	00	20
30035	40035	17	---	00	22
30037	40037	18	---	00	24
30039	40039	19	---	00	26
30041	40041	20	----	00	28
30043	40043	21	Average Voltage	00	2A
30045	40045	22	Voltage Sum	00	2C
30047	40047	23	Average Current	00	2E
30049	40049	24	Current Sum	00	30
30051	40051	25	---	00	32
30053	40053	26	---	00	34
30055	40055	27	---	00	36
30057	40057	28	---	00	38
30059	40059	29	---	00	3A

TABLE 3 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Hex Address	
				High Byte	Low Byte
30061	40061	30	---	00	3C
30063	40063	31	---	00	3E
30065	40065	32	---	00	40
30067	40067	33	---	00	42
30069	40069	34	---	00	44
30071	40071	35	Frequency	00	46
30073	40073	36	---	00	48
30075	40075	37	---	00	4A
30077	40077	38	---	00	4C
30079	40079	39	---	00	4E
30081	40081	40	---	00	50
30083	40083	41	---	00	52
30085	40085	42	---	00	54
30087	40087	43	---	00	56
30089	40089	44	---	00	58
30091	40091	45	---	00	5A
30093	40093	46	---	00	5C
30095	40095	47	---	00	5E
30097	40097	48	---	00	60
30099	40099	49	---	00	62
30101	40101	50	---	00	64
30103	40103	51	---	00	66
30105	40105	52	---	00	68
30107	40107	53	---	00	6A
30109	40109	54	---	00	6C
30111	40111	55	---	00	6E
30113	40113	56	Voltage Average Maximum	00	70
30115	40115	57	Voltage Average Minimum	00	72
30117	40117	58	Current Average Maximum	00	74
30119	40119	59	Current Average Minimum	00	76

TABLE 3 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Hex Address	
				High Byte	Low Byte
30121	40121	60	RPM	00	78
30123	40123	61	---	00	7A
30125	40125	62	---	00	7C
30127	40127	63	---	00	7E
30129	40129	64	---	00	80
30131	40131	65	---	00	82
30133	40133	66	---	00	84
30135	40135	67	---	00	86
30137	40137	68	---	00	88
30139	40139	69	---	00	8A
30141	40141	70	---	00	8C
30143	40143	71	---	00	8E
30145	40145	72	---	00	90
30147	40147	73	--	00	92
30149	40149	74	Voltage THD L1%	00	94
30151	40151	75	Voltage THD L2%	00	96
30153	40153	76	Voltage THD L3%	00	98
30155	40155	77	Current THD I1%	00	9A
30157	40157	78	Current THD I2%	00	9C
30159	40159	79	Current THD I3%	00	9E
30161	40161	80	System Voltage THD %	00	A0
30163	40163	81	System Current THD %	00	A2
30165	40165	82	---	00	A4
30167	40167	83	---	00	A6
30169	40169	84	---	00	A8
30171	40171	85	---	00	AA
30173	40173	86	—---	00	AC
30175	40175	87	—---	00	AE
30177	40177	88	—---	00	B0
30179	40179	89	---	00	B2

TABLE 3 : Continued...

Address (3X)	Address (4X)	Parameter Number	Parameter	Hex Address	
				High Byte	Low Byte
30181	40181	90	Relay1 Status	00	B4
30183	40183	91	---	00	B6
30185	40185	92	---	00	B8
30187	40187	93	--	00	BA
30189	40189	94	Timer ON delay	00	BC
30191	40191	95	Timer OFF delay	00	BE
30193	40193	96	Timer cycle counts	00	C0
30195	40195	97	---	00	C2
30197	40197	98	---	00	C4
30199	40199	99	---	00	C6
30201	40201	100	Voltage L12	00	C8
30203	40203	101	Voltage L23	00	CA
30205	40205	102	Voltage L31	00	CC
30207	40207	103	---	00	CE

4.2 Accessing 4 X Register for Reading & Writing Parameter Values

Each parameter setting is held in the 4X registers. ModBus code 03 is used to read the current setting and code 10 is used to write/change the setting.
Refer **Table** 4 for 4 X Register addresses.

Example : Reading System type

System type : Start address= 177A (Hex) Number of registers = 02

Note :Number of registers = Number of Parameters x 2

Query

Device Address	01 (Hex)
Function Code	03 (Hex)
Start Address High	17 (Hex)
Start Address Low	7A (Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02 (Hex)
CRC Low	E0 (Hex)
CRC High	66 (Hex)

Start Address High : Most significant 8 bits of starting address of the parameter requested.
Start Address low : Least significant 8 bits of starting address of the parameter requested.
Number of register Hi : Most significant 8 bits of Number of registers requested.
Number of register Lo : Least significant 8 bits of Number of registers requested.
(Note : Two consecutive 16 bit register represent one parameter.)

Response: System Type (3phase 4 wire = 3)

Device Address	01 (Hex)
Function Code	03 (Hex)
Byte Count	04 (Hex)
Data Register1 High Byte	40 (Hex)
Data Register1Low Byte	40 (Hex)
Data Register2 High Byte	00 (Hex)
Data Register2 Low Byte	00(Hex)
CRC Low	EE (Hex)
CRC High	27 (Hex)

Byte Count : Total number of data bytes received.
Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter requested.
Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter requested.
Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter requested.
Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter requested.
(Note : Two consecutive 16 bit register represent one parameter.)

Example : Writing System type

System type : Start address= 177A (Hex) Number of registers = 02

Query : (Change System type to 3phase 3wire = 2)

Device Address	01 (Hex)
Function Code	10 (Hex)
Starting Address Hi	17 (Hex)
Starting Address Lo	7A(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
Byte Count	04 (Hex)
Data Register-1High Byte	40 (Hex)
Data Register-1 Low Byte	00(Hex)
Data Register-2 High Byte	00(Hex)
Data Register-2 Low Byte	00(Hex)
CRC Low	8A (Hex)
CRC High	C4 (Hex)

Byte Count : Total number of data bytes sent.

Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter being written.

Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter being written.

Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter being written.

Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter being written.

(Note : Two consecutive 16 bit register represent one parameter.)

Response

Device Address	01 (Hex)
Function Code	10 (Hex)
Start Address High	17 (Hex)
Start Address Low	7A(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
CRC Low	65 (Hex)
CRC High	A5 (Hex)

Start Address High : Most significant 8 bits of starting address of the parameter written.
Start Address low :Least significant 8 bits of starting address of the parameter written.
Number of register Hi : Most significant 8 bits of Number of registers written.
Number of register Lo : Least significant 8 bits of Number of registers written.

(Note : Two consecutive 16 bit register represent one parameter.)

TABLE 4 : 4 X register addresses

Address (Register)	Param-eter No.	Parameter	Read/ Write	Modbus Start Addr.(H)		Default	
				High Byte	Low Byte	3P	1P
46003	1	—---		17	72	--	--
46005	2	---		17	74	--	--
46007	3	---		17	76	--	--
46009	4	---		17	78	--	--
46011	5	System type	R/Wp	17	7A	3	1
46013	6	---		17	7C	--	--
46015	7	Reset parameters	R/Wp	17	7E	0	0
46017	8	Number of poles	R/Wp	17	80	10	10
46019	9	RS485 setup code	R/Wp	17	82	4	4
46021	10	Node address	R/Wp	17	84	1	1
46023	11	---	R/Wp	17	86	--	--
46025	12	---	R/Wp	17	88	--	--
46027	13	---	R/Wp	17	8A	--	--
46029	14	---	R/Wp	17	8C	--	--
46031	15	---	R/Wp	17	8E	--	--
46033	16	System Nominal Frequency	R/Wp	17	90	50	50
46035	17	PT primary	R/Wp	17	92	415	240
46037	18	CT primary	R/Wp	17	94	5	30/60
46039	19	---	R/Wp	17	96	--	--
46041	20	---	R/Wp	17	98	--	--
46043	21	---	R/Wp	17	9A	--	--
46045	22	---	R/Wp	17	9C	--	--
46047	23	PT Secondary	R/Wp	17	9E	415	240
46049	24	Relay output (Limit / Timer)	R/Wp	17	A0	0	--
46051	25	Relay parameter select / Timer Relay counting cycles	R/Wp	17	A2	0/10	--
46053	26	Limit Relay trip point	R/Wp	17	A4	100	--
46055	27	Limit Relay hysteresis point	R/Wp	17	A6	20	--
46057	28	Limit Relay on delay / Timer Relay ON cycle time	R/Wp	17	A8	60/10	--
46059	29	Limit Relay off delay / Timer Relay OFF cycle time	R/Wp	17	AA	40/10	--

TABLE 4 : continued...

Address (Register)	Param-eter No.	Parameter	Read/ Write	Modbus Start Addr. Hex		Default 3P/1P
				High Byte	Low Byte	
46061	30	Limit Relay configuration / Timer Relay configuration	R/Wp	17	AC	HEn/Enr
46063	31	---	R/Wp	17	AE	--
46065	32	---	R/Wp	17	B0	--
46067	33	---	R/Wp	17	B2	--
46069	34	---	R/Wp	17	B4	--
46071	35	---	R/Wp	17	B6	--
46073	36	--	R/Wp	17	B8	--
46075	37	--	R/Wp	17	BA	--
46077	38	Password	R/Wp	17	BC	0000
46079	39	Autoscroll	R/Wp	17	BE	No
46081	40	30mA Noise cuttoff	R/Wp	17	C0	0
46083	41	---	R/Wp	17	C2	--
46085	42	---	R/Wp	17	C4	--
46087	43	---	R/Wp	17	C6	--
46089	44	Timer Relay Start / Stop	R/Wp	17	C8	0
46091	45	---	R/Wp	17	CA	--
46093	46	---	R/Wp	17	CC	--
46095	47	---	R/Wp	17	CE	--
46097	48	---	R/Wp	17	D0	--
46099	49	---	R/Wp	17	D2	--
46101	50	---	R/Wp	17	D4	--
46103	51	---	R/Wp	17	D6	--
46105	52	---	R/Wp	17	D8	--
46107	53	---	R/Wp	17	DA	--
46109	54	---	R/Wp	17	DC	--

Explanation for 4 X register :

NOTE: Writing any invalid values (non-applicable values) to any of the following locations will result in modbus error.

Address	Parameter	Description
46003	-----	-----
46005	-----	-----
46007	—----	—----
46009	—----	—----
46011	System Type	This address is used to set the System type. Write one of the following value to this address. 1: 1 Phase 2 Wire 2: 3 Phase 3 Wire **3**: 3 Phase 4 Wire**.** Only programmable for 3P Model.
46013	—----	—----
46015	Reset Parameters	This address is used to reset different parameters. Write specific value to this register to reset the corresponding parameter. Following are the values to reset various data. **3:** Hi Lo parameter **7:** Reset All data **8**: Factory Reset
46017	Number of Poles	Set number of poles. Only even values can be set as poles always comes in pairs.
46019	Rs485 Set-up Code	This address is used to set the baud rate, Parity and Number of stop bits. Refer **TABLE 6** for details.
46021	Node Address	Used to set Device address between 1 and 247 for MODBUS

Address	Parameter	Description
46023	—---	—---
46025	—---	—---
46027	—---	—---
46029	—---	—---
46031	—---	—---
46033	System Nominal Frequency	This address allows the user to set System frequency. The options are 50/60 Hz. Default value is 50 Hz.
46035	PT Primary	This address allows the user to set PT Primary value. For 3-phase variant settable range is 100 VL-L to 7999 kVL-L. For 1-phase variant settable range is 57 VL-N to 4618 kVL-N
46037	CT Pimary	This address allows the user to set CT Primary value. The settable range is 1 to 9999. Only programmable for 3-phase variant.

Address	Parameter	Description
46039	——-	——-
46041	——-	——-
46043	——-	——-
46045	-----	——-
46047	PT secondary	This address is used to read and write the PT secondary value. For 3-phase variant settable range is 100 VL-L to 500 VL-L. For 1-phase variant settable range is 57 VL-N to 300 VL-N
46049	Relay output select	This address is used to select the Relay operation as Timer/Limit. Write one of the following values to this address. **0:** None **2**: Limit **3**: Timer
46051	Relay 1 Para select / No. of Cycles	This address is used to assign the Parameter to Relay/ timer cycles. Limit relay: Refer **TABLE 2** Timer relay: No of cycles: 1-999
46053	Limit 1 Trip Point	This address is used to set the trip point in %. Refer Table 2 for values.
46055	Limit 1 Hysteresis	This address is used to set the hysteresis between 0.5% to 50.0%.
46057	Relay 1 On (Energize) Delay / On Time	This address is used to set the Energizing delay for Limit function or On delay for timer function in seconds in range of 1 to 60.
46059	Relay 1 Off (De-Energize) Delay/ Off Time	This address is used to set the De-energizing delay for Limit function or Off delay for timer function in seconds in range of 1 to 60.

Address	Parameter	Description
46061	Limit / Timer Configuration Select	This address is used to set the Configuration for Relay 1 Refer **TABLE** 5.
46063		
46065	—---	—---
46067	—---	—---
46069	—---	—---
46071	—---	—---
46073	—---	—---
46075	—---	—---
46077	Password	This address allows the user to set password for authentication purpose. Range of password is 0000 to 9999.
46079	Autoscroll	This address allows the user to set auto-scrolling for display screen.
46081	30 mA noise cutoff	This address allows the user to set current cut-off value. Only for 3P model. Range is 0 to 30mA.
46083	—---	—---

Address	Parameter	Description
46085	-----	-----
46087	—---	—---
46089	Timer start stop	This address is used to start or stop timer cycles in timer mode. 0: Stop timer 1: Start timer
46091	—---	—---
46093	—---	—---

TABLE 5: Relay Configuration

For Limit Relay

Code	Configuration
0	Hi - alarm & energised Relay
1	Hi - alarm & De-energised Relay
2	Lo - alarm & Energised Relay
3	Lo - alarm & De-energised Relay

For Timer relay

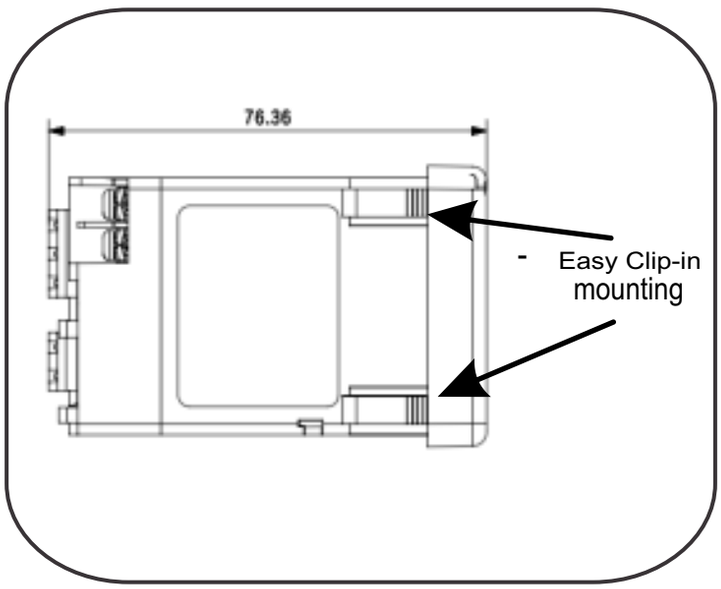
Code	Configuration
0	Energize
1	De-energize

TABLE 6: RS485 Configuration

Decimal. No.	Baud Rate	Parity	Stop Bit
0	4800	None	1
1	4800	None	2
2	4800	Even	1
3	4800	Odd	1
4	9600	None	1
5	9600	None	2
6	9600	Even	1
7	9600	Odd	1
8	19200	None	1
9	19200	None	2
10	19200	Even	1
11	19200	Odd	1
12	38400	None	1
13	38400	None	2
14	38400	Even	1
15	38400	Odd	1
16	57600	None	1
17	57600	None	2
18	57600	Even	1
19	57600	Odd	1

5. Installation

Mounting of the instrument is featured with easy “Clip- in” mounting. Push the instrument in panel slot (size 48 x48 mm), it will click fit into panel with the four integral retention clips on two sides of instrument.



As the front of the enclosure conforms to IP 54. additional protection to the panel may be obtained by the use of an optional panel gasket. The terminals at the rear of the product should be protected from liquids.

The instrument should be mounted in a reasonably stable ambient temperature and where the operating temperature is within the specification . Vibration should be kept to a minimum and the product should not be mounted where it will be subjected to excessive direct sunlight.

Caution

1. In the interest of safety and functionality this product must be installed by a qualified engineer, abiding by any local regulations.
2. Voltages dangerous to human life are present at some of the terminal connections of this unit. Ensure that all supplies are de-energised before attempting any connection/ disconnection.
3. These products do not have internal fuses therefore external fuses must be used to ensure safety under fault conditions. Refer section 5.4 for details.

5.1 EMC Installation Requirements

This product has been designed to meet the certification of the EU directives when installed to a good code of practice for EMC in industrial environments, e.g.

1. Screened output and low signal input leads or have provision for fitting RF suppression components, such as ferrite absorbers, line filters etc., in the event that RF fields cause problems.

Note: It is good practice to install sensitive electronic instruments that are performing critical functions, in EMC enclosures that protect against electrical interference which could cause a disturbance in function.

2. Avoid routing leads alongside cables and products that are, or could be, a source of interference.
3. To protect the product against permanent damage, surge transients must be limited to 2kV pk. It is good EMC practice to suppress differential surges to 2kV at the source. The unit has been designed to automatically recover in the event of a high level of transients. In extreme circumstances it may be necessary to temporarily disconnect the auxiliary supply for a period of greater than 5 seconds to restore correct operation.
4. ESD precautions must be taken at all times when handling this product.

5.2 Wiring

Input connections are made directly to screw-type terminals with indirect wire pressure. Numbering is clearly marked on the connector. Choice of cable should meet local regulations.

Note: It is recommended to use wire with lug for connection with instrument, refer to figure shown in Section 6.2 for lug dimensions.

5.3 Auxiliary Supply

The instrument should ideally be powered from a dedicated supply, however it may be powered from the signal source, provided the source remains within the limits of the chosen auxiliary voltage.

For disconnecting the device a switch or a circuit breaker shall be included at the site and shall be within reach of the operator. The specification are as below:
For aux atleast 1.2 times of applied power supply.
For measuring input atleast 1.2 times of applied measuring input.

5.4 Fusing

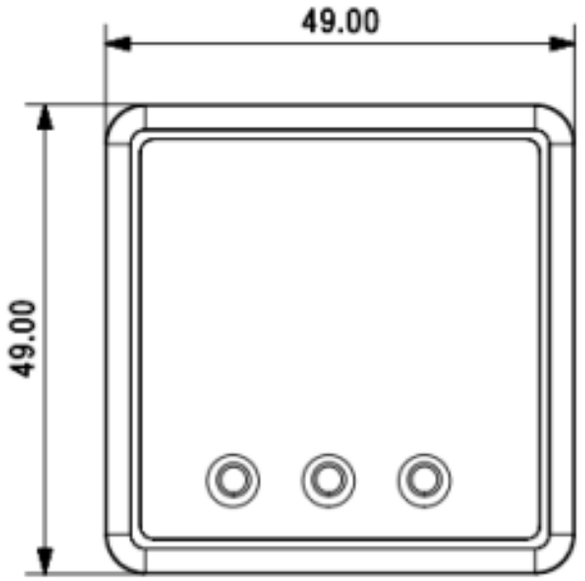
It is recommended that all votage lines be fitted with 1A HRC fuses.

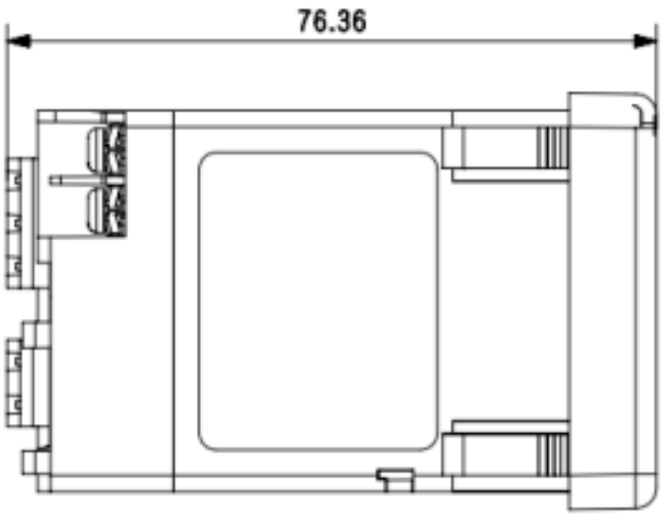
5.5 Earth/Ground Connections

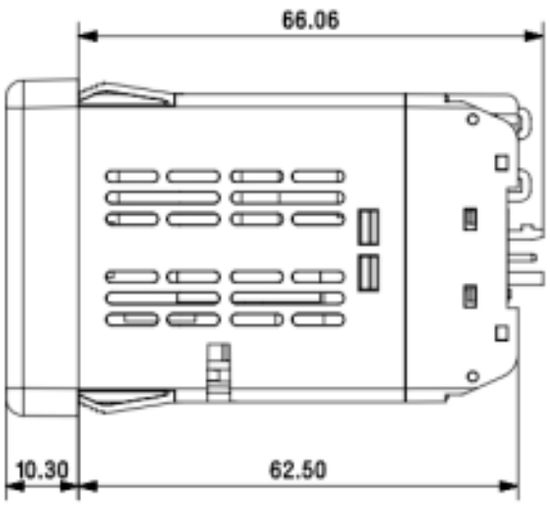
For safety reasons, panels and accesoriess should be grounded in accordance with relative electrical and safety standards.

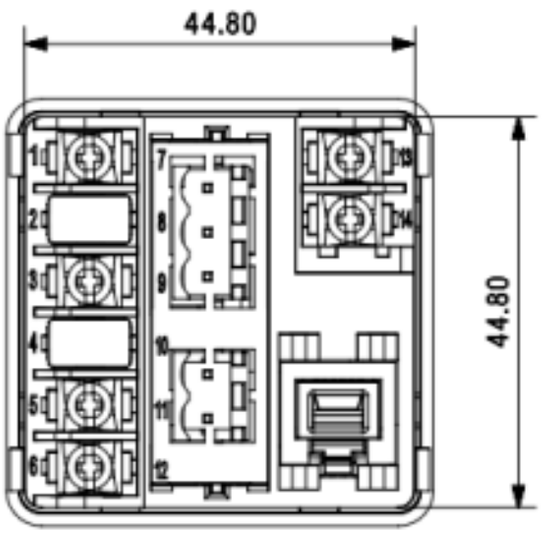
5.6 Case Dimensions and Panel Cut Out

A.) 3-P Model

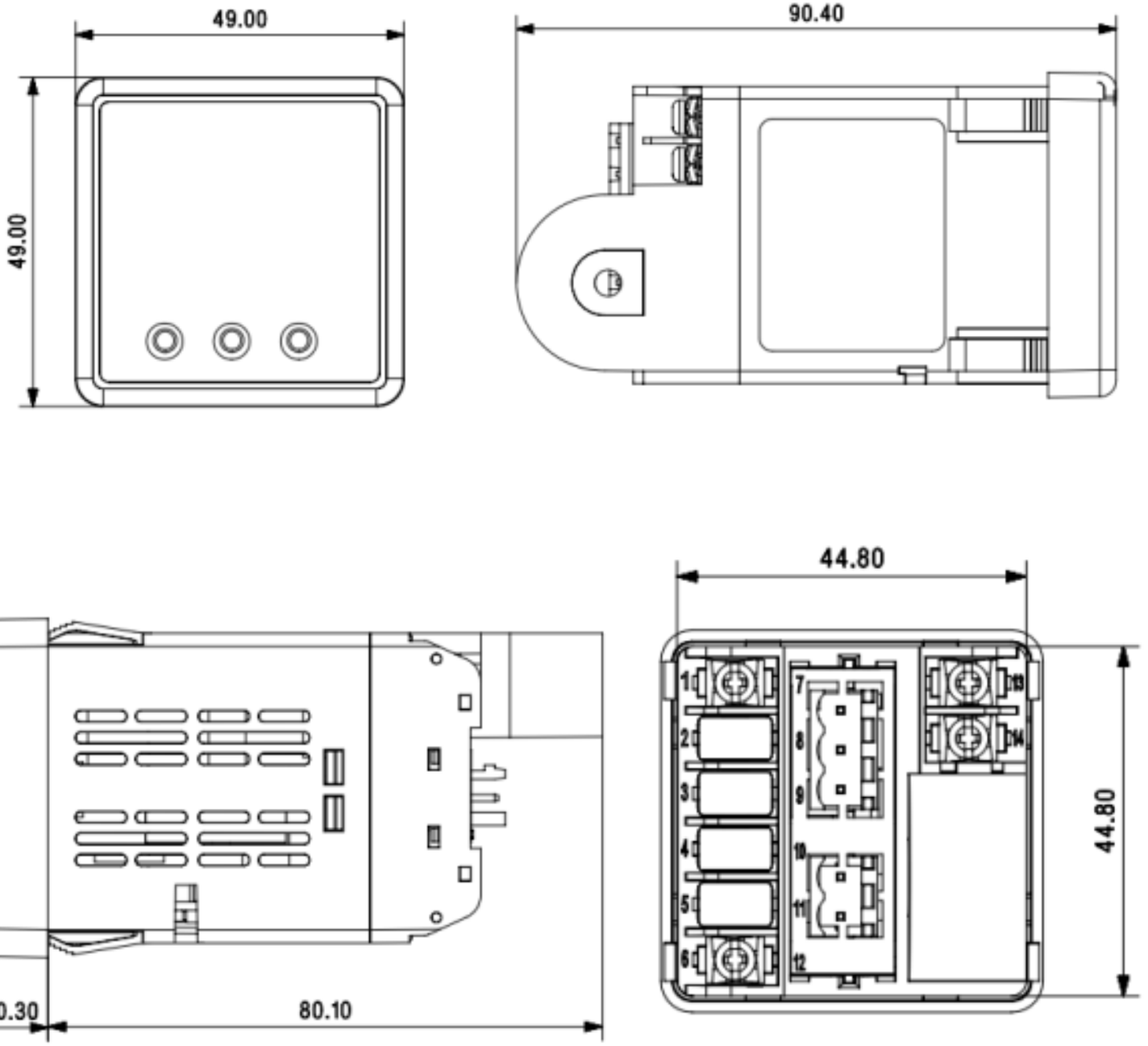






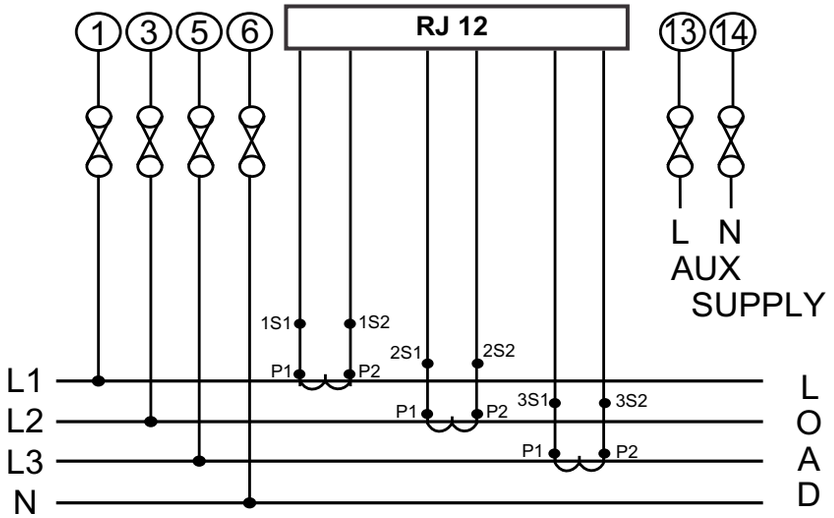


B.) 1-P 30/60A Model:

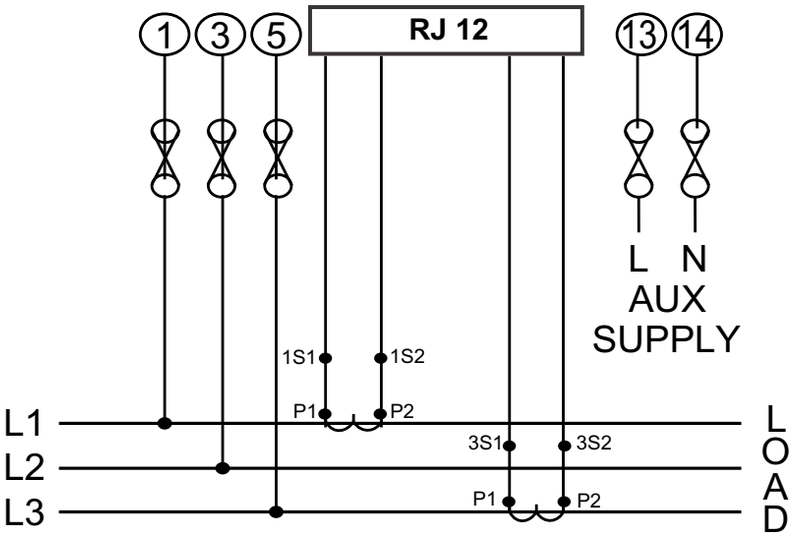


6. Connection Diagram

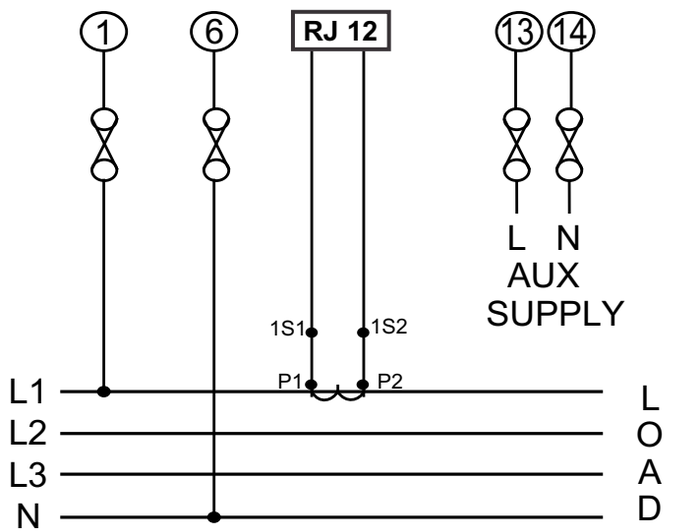
6.1 3-P Model:



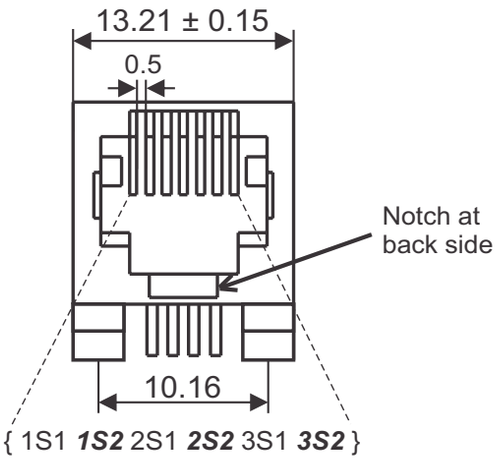
a) 3 Phase 4 Wire



b) 3 Phase 3 Wire



c) Single Phase Load



Meter Side RJ 12 Connection

7. Specification

7.1 3-P Model:

Operating Measuring Ranges:

Voltage Range	10VLL 600VLL
Current Range	5mA 120mA
Frequency	45…65 Hz
True RMS	Measures distorted waveform upto 15th harmonics

Input Voltage:

Nominal input voltage (Vn)	100-500 VLL (57.7 - 288.7 VLN) AC RMS
Max continuous input voltage	120% of Nominal value
Nominal input voltage burden	0.3 VA approx. at 240 VLN
System PT secondary values	100VLL to 500 VLL programmable on site
System PT primary values	100VLL to 7999 kVLL programmable on site

Input Current:

Nominal input current (In)	100mA AC RMS
System CT primary values	1A to 9999 A
Max continuous input current	120% of Nominal current
Nominal input current burden	0.1 VA approx. per phase

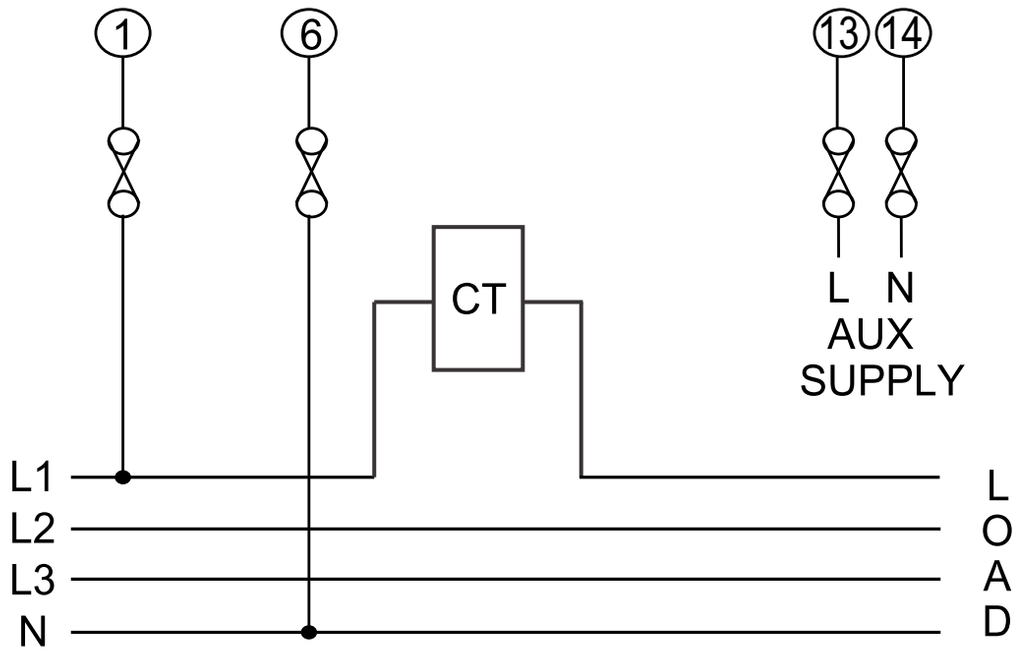
Auxiliary Supply:

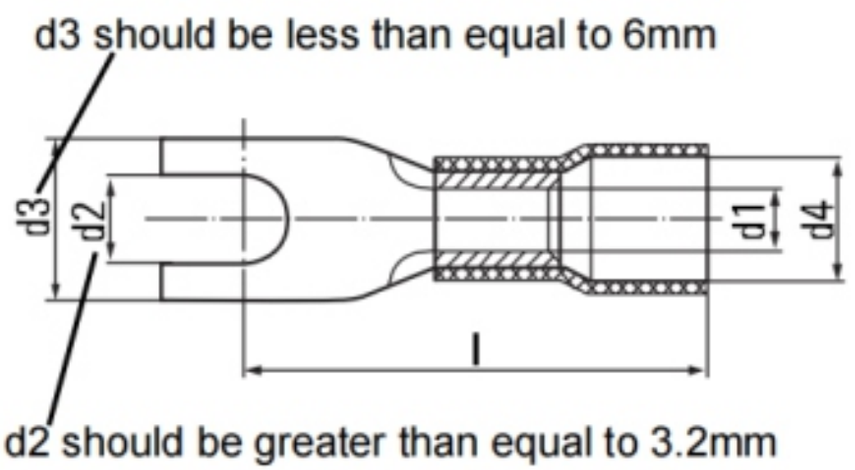
Higher AC-DC External Aux.	60-280V AC-DC (230 V AC/DC Nominal)
Lower AC-DC External Aux.	20-60V AC/DC (24 V AC / 48 V DC Nominal)
Frequency range	45 to 65 Hz
VA burden	Less than 5 VA Approx.

Interfaces:

Relay	250 VAC, 5 A AC 30VDC, 5A DC

6.2 1-P 30/60A Model:





Lug for Voltage and Aux Connections

Overload Withstand:

Voltage	2 x Nominal value for 1 second, repeated 10 times at 10 second intervals

Reference conditions for Accuracy:

Reference temperature	23°C ±2°C
Input waveform	Sinusoidal (distortion factor 0.005)
Input frequency	50 or 60 Hz ±2%
Auxiliary supply voltage	Nominal Value ±1%
Auxiliary supply frequency	Nominal Value ±1%
Total Harmonics distortion	THD-V < 30 % at Vn upto 15th harmonics (Individual 15th harmonics < 30 %) THD-I < 50 % at In upto 15th harmonics (Individual 15th harmonics < 30 %)

Display update rate:

Response time to step input	Less than 1 second

Accuracy:

Voltage	± 0.5 % of Nominal Voltage (20... 100% of Nominal value)
Current	± 0.5 % of Nominal Current (10... 100% of Nominal value)
Frequency	± 0.2 % of mid frequency
%THD Accuracy	± 4%

Influence of Variations:

Temperature coefficient : (for nominal value range of use -20°C to 60°C)	0.025 % /°C for Voltage and Frequency 0.05 % /°C for Current

Applicable Standards:

EMC	IEC 61326 - 1 : 2012,Table 2
Safety	IEC 61010-1-2010 , Permanently connected use
IP for water & dust	IEC 60529

Environmental:

Operating temperature	-20°C to +60°C
Storage temperature	-30°C to +70°C
Relative humidity	0... 90% non condensing
Warm up time	Minimum 3 minute
Shock	Half sine wave, Peak acceleration 30gn (300 m/s^2),duration 18ms 3 axis- 6 Shocks in each axis
Vibration	10... 55 Hz, 0.15mm amplitude
Altitude	2000 m max

Enclosure:

Front	IP 54
Back	IP 20

Mechanical:

Housing dimensions	49 x 49 x 74.6 mm^3
Panel cut-out	45 x 45 mm^2
Back depth with/without Modbus	76.4 mm, 64.3 mm
Packed/Unpacked Weight	140 gm, 112 gm
Clamp Screw Size	M3
Cable size for Voltage and Aux	2.5 mm^2
Cable size for Relay and Modbus	2.5 mm^2
Torque to be applied	0.3 N-m to 0.5 N-m

Safety:

Pollution degree	2
Installation category	III
High Voltage Test	3.3 kV AC, 50Hz for 1 minute between aux. and measuring inputs 2.2 kV AC, 50Hz for 1 minute between aux. and Modbus and relay

7.2 1-P 30/60A Model:

Operating Measuring Ranges:

Voltage Range	5.77VLN ..... 360VLN (AC-RMS)
Current Range:	1-P 30 A Model: 1A .....36A (AC-RMS)
	1-P 60 A Model: 1A.....72A (AC-RMS)
Frequency	45…65 Hz

Input Voltage:

Nominal input voltage	57.7-300V L-N
Max continuous input voltage	120% of Nominal value
Nominal input voltage burden	0.3 VA approx. at 240 VLN
System PT secondary values	57VLN to 300VLN programmable on site
System PT primary values	57VLN to 4618kVLN programmable on site

Input Current:

Nominal input current	1-P 30 A Model: 30A
	1-P 60 A Model: 60A
Max continuous input current	120% of Nominal current
Nominal input current burden	0.1 VA approx.

Auxiliary Supply:

Higher AC-DC External Aux.	60-280V AC-DC (230 V AC/DC Nominal)
Lower AC-DC External Aux.	20-60V AC/DC (24 V AC / 48 V DC Nominal)
Frequency range	45 to 65 Hz
VA burden	5 VA Approx.

Interfaces:

MODBUS	RS485
	Baud rate: 4.8,9.6,19.2,38.4,57.6 kbps

Overload Withstand:

Voltage	2 x Nominal value for 1 second, repeated 10 times at 10 second intervals
Current	20 x Nominal value for 1 second, repeated 5 times at 5 second intervals

Reference conditions for Accuracy:

Reference temperature	23°C ±2°C
Input waveform	Sinusoidal (distortion factor 0.005)
Input frequency	50 or 60 Hz ±2%
Auxiliary supply voltage	Nominal Value ±1%
Auxiliary supply frequency	Nominal Value ±1%
Total Harmonics distortion	THD-V < 30 % at Vn upto 15th harmonics (Individual 15th harmonics < 30 %) THD-I < 50 % at In upto 15th harmonics (Individual 15th harmonics < 30 %)

Display update rate:

Response time to step input	Less than 1 second

Accuracy:

Voltage	± 0.5 % of Nominal Voltage (20... 100% of Nominal value)
Current	± 0.5 % of Nominal Current (10... 100% of Nominal value)
Frequency	± 0.2 % of mid frequency
%THD Accuracy	±4%

Influence of Variations:

Temperature coefficient : (For nominal value range of -20°C to 60°C)	0.025 % /°C for Voltage and Frequency 0.05 % /°C for Current

Applicable Standards:

EMC	IEC 61326 - 1 : 2012, Table 2
Safety	IEC 61010-1-2010, Permanently connected use
IP for water & dust	IEC 60529

Environmental:

Operating temperature	-20°C to +60°C
Storage temperature	-30°C to +70°C
Relative humidity	0... 90% non condensing
Warm up time	Minimum 3 minute
Shock	Half sine wave, Peak acceleration 30gn (300 m/s^2), duration of 18ms 3 axis - 6 shocks in each axis
Vibration	10... 55 Hz, 0.15mm amplitude
Altitude	2000 m max

Enclosure:

Front	IP 54
Back	IP 20

Mechanical:

Housing dimensions	49 x 49 x 90.4 mm^3
Panel cut-out	45 x 45 mm^2
Back depth with/without Modbus	80.1 mm
Packed/Unpacked Weight	145 gm, 115 gm
Clamp Screw Size	M3
Cable size for Voltage and Aux	2.5 mm^2
Cable size for Modbus	2.5 mm^2
Cable size for Current	90.25 mm^2
Torque to be applied	0.3 N-m to 0.5 N-m

Safety:

Pollution degree	2
Installation category	III
High Voltage Test	3.3 kV AC, 50Hz for 1 minute between aux. and measuring inputs 2.2 kV AC, 50Hz for 1 minute between aux. and modbus

The Information contained in these installation instructions is for use only by installers trained to make electrical power installations and is intended to describe the correct method of installation for this product. However, Manufacturer has no control over the field condition which influence product installation.

It is the user's responsibility to determine the suitability of the installation method in the user's field conditions. Manufacturer only obligations are those in Manufacturer standard Conditions of Sale for this product and in no case will Manufacturer be liable for any other Incidental, indirect or consequential damages arising from the use or misuse of the products.

REV-D 03/2022