MAPro30 Numerical 3phase+residual O/U Voltage relay

S: STANDARD SAFETY STATEMENTS

S – 1: Attention:

The information in the Safety Section of the equipment documentation is intended to ensure that equipment is properly installed and handled in order to maintain it in a safe condition.

It is assumed that everyone who will be associated with the equipment will be familiar with safety instructions.

When electrical equipment is in operation, dangerous voltages will be present in certain parts of the equipment. Failure to care, incorrect use, or improper use may endanger personnel and equipment and also cause personal injury or physical damage.

Before working in the terminal strip area, the equipment must be isolated.

Proper and safe operation of the equipment depends on appropriate shipping and handling, proper storage, installation and commissioning, and on careful operation, maintenance and servicing. For this reason only qualified personnel may work on or operate the equipment.

S – 1.1: Qualified personnel are individuals who:

• Are familiar with the installation, commissioning, and operation of the equipment and of the system to which it is being connected;

• Are able to safely perform switching operations in accordance with accepted safety engineering practices and are authorized to energize and de-energize equipment and to isolate, ground, and label it;

• Are familiar in the care and use of safety apparatus in accordance with safety engineering practices;

• Are familiar in emergency procedures (first aid).

The equipment documentation gives instructions for its installation, commissioning, and operation. However, the manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact the appropriate FMA technical sales office and request the necessary information.

S – 2: Technical specifications for safety

Unless otherwise stated in the equipment technical manual, the following data is applicable:

S – 2.1: Protective fuse rating

The recommended maximum rating of the external protective fuse for equipments is 16A, high rupture capacity (HRC) Red Spot type NIT, or TIA, or equivalent. Unless otherwise stated in equipment technical manual, the following data is applicable. The protective fuse should be located as close to the unit as possible.
CAUTION - CTs must NOT be fused since open circuiting them may produce lethal hazardous voltages.

S – 2.2: Protective class

IEC 60255-27: 2005, EN 60255-27: 2006
Class I (unless otherwise specified in the equipment documentation). This equipment requires a protective conductor (earth) connection to ensure user safety.

S – 2.3: Installation category

IEC 60255-27: 2005, EN 60255-27: 2006
Installation Category III
Distribution level, fixed installation.
Equipment in this category is qualification tested at 5 kV peak, 1.2/50 µs, 500 Ω, 0.5 J, between all supply circuits and earth and also between independent circuits.

S – 2.4: Environment

The equipment is intended for indoor installation and use only. If it is required for use in an outdoor environment then it must be mounted in a specific cabinet or housing or front covered with special FMA cover which will enable it to meet the requirements of IEC 60529 with the classification of degree of protection IP54 (dust and splashing water protected).

Pollution Degree - Pollution Degree 2 Compliance is demonstrated by reference
Altitude - Operation up to 2000m to safety standards.
IEC 60255-27:2005
EN 60255-27: 2006

I: INTRODUCTION

I – 1: Introducing MAPro3x

The **MAPro3x** range of FMA relays are universal over/under voltage relays.
This type of relays have been designed to control, protect and monitor industrial installations, public distribution networks and substations and for EHV and HV transmission networks.

MAPro3x relays provide comprehensive voltage protection. In addition to its protective functions, each relay offers control and recording features. They can be fully integrated to a control system so protection, control, data acquisition and recording of faults, events and disturbances can be made available.

The relays are equipped on the front panel with a liquid crystal display (LCD) with 2 x 16 back-light alphanumerical characters, a tactile 7 button keypad (to access all settings, clear alarms and read measurements) and 8+1 fully configurable LEDs that indicate the status of **MAPro3x** relays.
In addition, the use of the RS485 communication port makes it possible to read, reinitialize and change the settings of the relays, if required, from a local or remote PC computer loaded with related PC software.

Also it is easily possible to access to events, faults, disturbances, contents of settings via the USB front connector. If you have the system password, you will be able to change the settings via this connector. All of the a.m. facilities are possible by the special **FMA MAPro PC software** installed on a PC or laptop.

Its flexibility of use, reduced maintenance requirements and ease of integration allow the MAPro3x range to provide an adaptable solution for the problems of the protection of electric networks.

I – 2: General considerations

I – 2.1: Receipt of relays

MAPro protective relays, although generally of robust construction, require careful treatment prior to installation on site. Upon receipt, relays should be examined immediately to ensure no damage has been sustained in transit. If damage has been sustained during transit a claim should be made to the transport contractor and also FMA should be promptly notified.

Relays that are supplied not mounted and not intended for immediate installation should be returned to their protective Styrofoam case.

I – 2.2: Electrostatic discharge (ESD)

The relays use components that are sensitive to electrostatic discharges.
The electronic circuits are well protected by the metal case and the internal module should not be withdrawn unnecessarily. When handling the module outside its case, care should be taken to avoid contact with components and electrical connections. If removed from the case for storage, the module should be placed in an electrically conducting antistatic bag.

There are no setting adjustments within the module and it is advised to avoid unnecessary disassembling. Although the printed circuit boards are plugged together, the connectors are a manufacturing aid and not intended for frequent dismantling; in fact considerable effort may be required to separate them. Touching the printed circuit board should be avoided, since complementary metal oxide semiconductors (CMOS) are used, which can be damaged by static electricity discharged from the body.

I – 2.3: Handling of electronic equipment

A person's normal movements can easily generate electrostatic potentials of several thousand volts. Discharge of these voltages into semiconductor devices when handling electronic circuits can cause serious damage, which often may not be immediately apparent *but the reliability of the circuit will have been reduced*.

The electronic circuits are completely safe from electrostatic discharge when housed in the case. Do not expose them to risk of damage by withdrawing modules unnecessarily.

Each module incorporates the highest practicable protection for its semiconductor devices. However, if it becomes necessary to withdraw a module, the following precautions should be taken to preserve the high reliability and long life for which the equipment has been designed and manufactured.

1. Before removing a module, ensure that you are at the same electrostatic potential as the equipment by touching the case which is connected to the protective conductor terminal.
2. Handle the module by its front plate special handle, frame or edges of the printed circuit board. Avoid touching the electronic components, printed circuit track or connectors.
3. Do not pass the module to another person without first ensuring you are both at the same electrostatic potential. Shaking hands achieves equal potential.
4. Place the module on an antistatic surface, or on a conducting surface which is at the same potential as yourself.
5. Store or transport the module in its protective Styrofoam case.

If you are making measurements on the internal electronic circuitry of an equipment in service, it is preferable that you are earthed to the case with a conductive wrist strap.

Wrist straps should have a resistance to ground between 500kΩ – 10MΩ.

If a wrist strap is not available you should maintain regular contact with the case to prevent a build-up of static. Instrumentation which may be used for making measurements should be earthed to the case whenever possible.
More information on safe working procedures for all electronic equipment can be found in BS5783 and IEC 147-OF. It is strongly recommended that detailed investigations on electronic circuitry or modification work should be carried out in a special handling area such as described in the above-mentioned BS and IEC documents.

I – 2.4: Relay mounting

Relays are dispatched either individually or as part of a panel/rack assembly.
If an **MAL-TB01** test block is to be included it should be positioned at the right-hand side of the assembly (viewed from the front). Modules should remain protected by their metal case during assembly into a panel or rack.

For individually mounted relays an outline diagram is supplied in this Technical Guide showing the panel cut-outs and drilling centers.

I – 2.5: Unpacking

Care must be taken when unpacking and installing the relays so that none of the parts is damaged or the settings altered. Relays must only be handled by skilled persons. The installation should be clean, dry and reasonably free from dust and excessive vibration.

The site should be well lit to facilitate inspection. Relays that have been removed from their cases should not be left in situations where they are exposed to dust or damp. This particularly applies to installations which are being carried out at the same time as construction work.

I – 2.6: Storage

If relays are not to be installed immediately upon receipt they should be stored in a place free from dust and moisture in their original cartons.

It is better to care about dust which collects on a carton may, on subsequent unpacking, find its way into the relay, or in damp conditions the carton and packing may become impregnated with moisture.

Storage temperature: –25°C to +70°C.

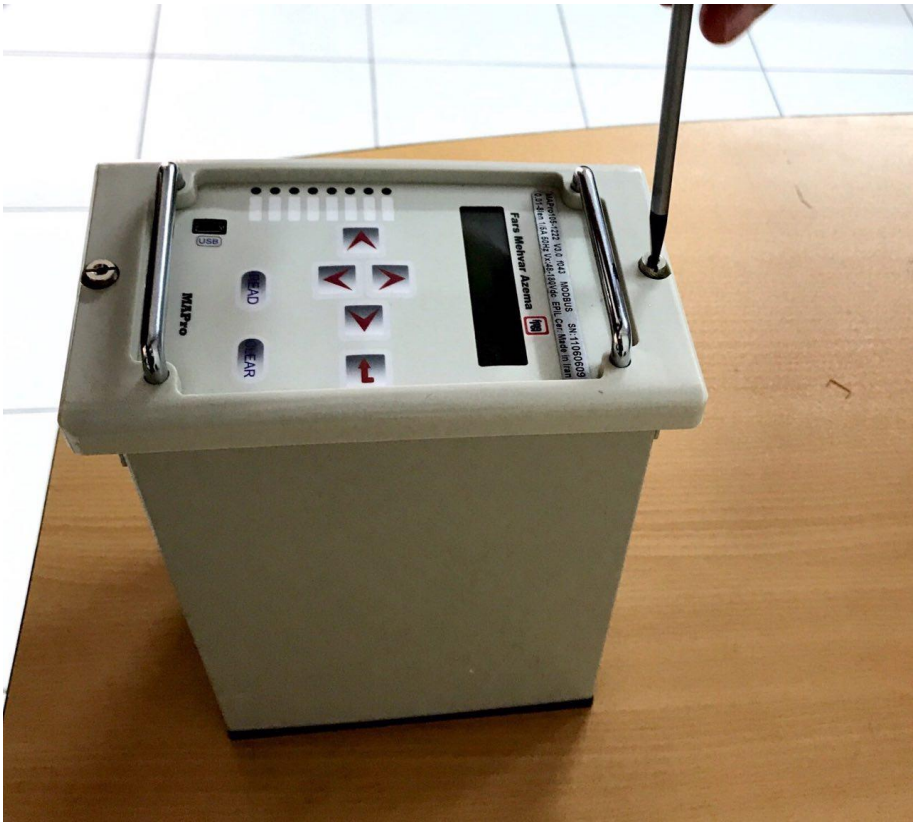
I - 3: Main functions

The following table shows the functions available for the different models of the **MAPro3x** range of relays.

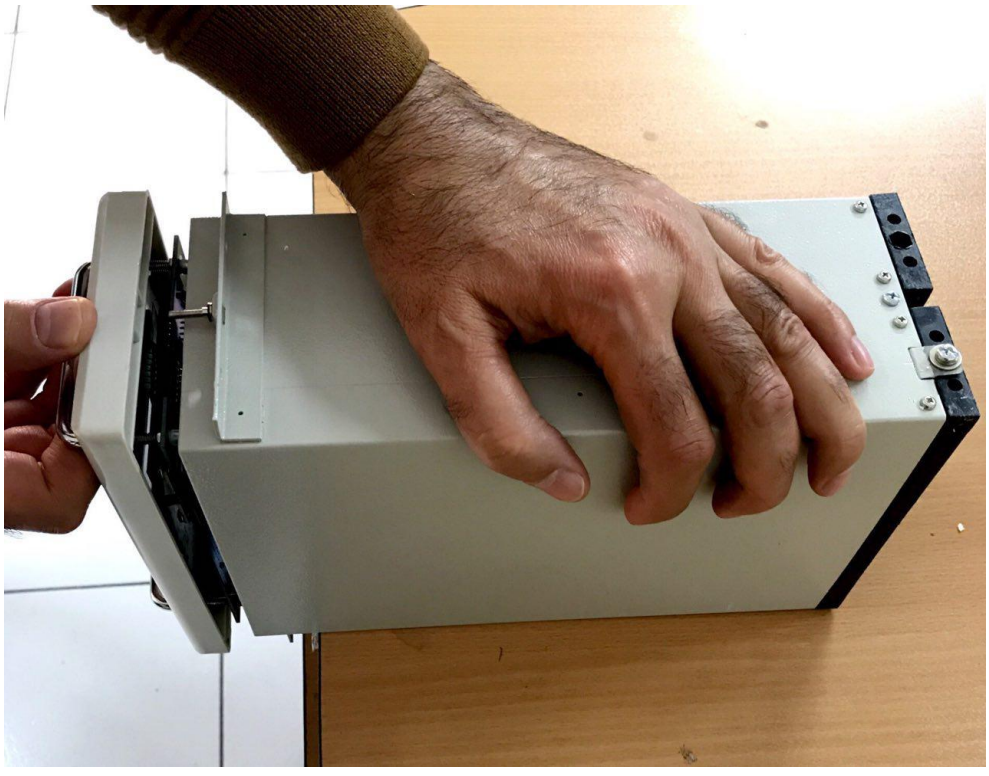
Function	ANCI code	MAPro305 3phase+residual over under voltage(full I/O)	MAPro304 3phase+residual over under voltage	MAPro302 Single phase over under voltage	
Under voltage	27	X	X	X	
Over voltage	59	X	X	X	
Residual over voltage	59N	X	X		
Negative sequence overvoltage	47	X	X		
Positive sequence under voltage	27D	X	X		
Under voltage blocking by digital input		X	X	X	
Under voltage blocking by threshold		X	X	X	
Selectable VT connection		X	X	X	
Overvoltage prot. on Vph-ph or Vph-N		X	X		
Under voltage protection on Vph-ph or Vph-N		X	X		
Latching output contacts		X	X	X	
AND / OR selectable logic for over/under voltage protection		X	X		
Setting groups		2	2	2	
Selective relay & input scheme logic		X	X	X	
Phase angle measurement		X	X		
Frequency measurement		X	X		
True RMS measurement		X	X		
Negative & positive seq. measurement		X	X		
Max value monitoring		X	X		
Event records		X	X	X	
Fault records		X	X	X	
Disturebance records		X	X	X	
USB front communication		X	X	X	
Rear RS485 communication		X	X	X	
No. of digital inputs		5	2	2	
No. of output relays		8+1(for W.D.)	4+1(for W.D.)	4+1(for W.D.)	

I – 4: Installation

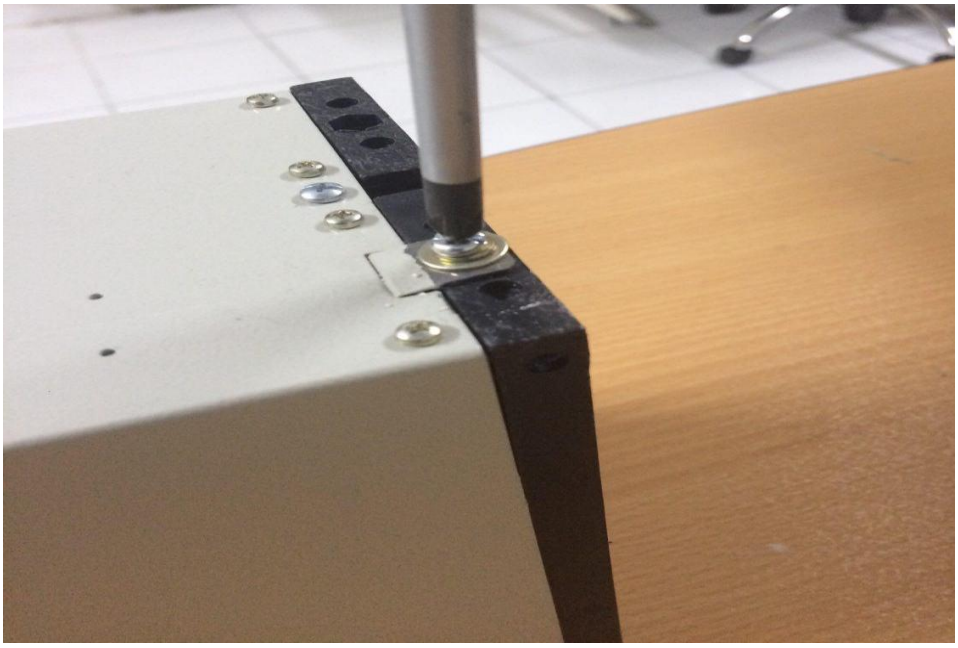
1- Unscrew the upper & lower nuts at the front of relay.



2- Withdraw the relay from its case.



3- Unscrew the Earth screw at the back of relay case.



4- Fix the relay case on the panel and fasten the screws then put & fix the relay in its case. Fasten the front upper & lower nuts and back earth connection screw.

T: Technical Data & Function Characteristics

T – 1 Protection Functions

T - 1.1: Phase over voltage:

-Phase voltage protection is based on fundamental frequency.

-Phase voltage setting range: 5.0 to 265V step of 0.1V

-Thresholds: 3 independent levels, V>, V>>, V>>>

-V> setting range: 5 to 265V

-V>> setting range: 5 to 265V

-V>>> setting range: 5 to 265V

Note: V>>> threshold can only be assigned to DMT operation.

-Hysteresis: 95%

-Shortest operation time: <70 mSec (Instantaneous operation)

-Drop out time: <60 mSec

-Definite time delay (for trip &reset): 0 to 600 Sec step of 0.01 Sec

-IDMT curve for trip: IEC standard inverse curve

-IDMT curve for reset (optional): IEC standard inverse curve

-Time multiplier setting: Trip: 0.01 to 9.9, step of 0.01

Reset (optional): 0.01 to 3.2, step of 0.01

T - 1.2: Phase under voltage:

-Phase voltage protection is based on fundamental frequency.

-Phase voltage setting range: 1.0 to 130V step of 0.1V

-Thresholds: 3 independent levels, V<, V<<,V<<<

-V< setting range: 1 to 130V

-V<< setting range: 1 to 130V

-V<<< setting range: 1 to 130V

Note: V<<< threshold can only be assigned to DMT operation.

-Hysteresis: 105%

-Shortest operation time: <70 mSec (Instantaneous operation)

-Drop out time: <60 mSec

-Definite time delay (for trip &reset): 0 to 600 Sec step of 0.01 Sec

-IDMT curve for trip: IEC standard inverse curve

-IDMT curve for reset (optional): IEC standard inverse curve

-Time multiplier setting: Trip: 0.01 to 9.9, step of 0.01

Reset (optional): 0.01 to 3.2, step of 0.01

- Blocking facility: 1- By digital inputs, 1 or 2 or none

2- By threshold, range: 0 – 50V step of 0.1V

T - 1.3: Residual over voltage protection

-Residual voltage protection is based on fundamental frequency.

-Residual voltage setting range: 5.0 to 265V step of 0.1V

-Thresholds: 3 independent levels, $V_r>$, $V_r>>$, $V_r>>>$

-$V_r>$ setting range: 5.0 to 265V step of 0.1

-$V_r>>$ setting range: 5.0 to 265V step of 0.1

-$V_r>>>$ setting range: 5.0 to 265V step of 0.1

Note: $V_r>>>$ threshold can only be assigned to DMT operation.

-Hysteresis: 95%

-Shortest operation time: <70 mSec (Instantaneous operation)

-Drop out time: <60 mSec

-Definite time delay (for trip &reset): 0 to 600 Sec, step of 0.01 Sec

-IDMT curve for trip: IEC standard inverse curve

-IDMT curve for reset (optional): IEC standard inverse curve

-Time multiplier setting: Trip: 0.01 to 9.90, step of 0.01

Reset (optional): 0.01 to 3.2, step of 0.01

T - 1.4: Negative sequence over voltage protection

-This protection is based on fundamental frequency.

-Voltage setting range: 5.0 to 265V step of 0.1V

-Threshold: one level, V2>

-V2> setting range: 5.0 to 265 V, step of 0.1

-Hysteresis: 95%

-Shortest operation time: <70 mSec (Instantaneous operation)

-Drop out time: <60 mSec

-Definite time delay (for trip &reset):0 to 150 Sec, step of 0.01 Sec

-IDMT curve for trip: IEC standard inverse curve

-IDMT curves for reset (optional): IEC standard inverse curve

T - 1.5: Positive sequence under voltage protection

- This protection is based on fundamental frequency.

-Phase voltage setting range: 1.0 to 130V step of 0.1V

-Threshold: one independent level, V1<

-V1< setting range: 1 to 130V

-Hysteresis: 105%

-Shortest operation time: <70 mSec (Instantaneous operation)

-Drop out time: <60 mSec

-Definite time delay (for trip &reset): 0 to 150 Sec step of 0.01 Sec

-IDMT curve for trip: IEC standard inverse curve

-IDMT curve for reset (optional): IEC standard inverse curve

-Time multiplier setting: Trip: 0.01 to 9.9, step of 0.01

Reset (optional): 0.01 to 3.2, step of 0.01

- Blocking facility: 1- By digital inputs, 1 or 2 or none

2- By threshold, range: 0 – 50V step of 0.1V

T – 2: Recording

T - 2.1: Event recording

-Capacity: 75 events (saved in log memory)

-Event types: Any change in settings

Change in state of digital inputs

Automation function alarms

Pick up

-Data: Event label + date & time (accuracy: 10mSec)

T - 2.2: Fault recording

-Capacity: 10 faults (saved in log memory)

-Fault types: Any selected protection trip or alarm

-Data: Protection label

AC measurements (3 phase & earth RMS)

Fault magnitude

Fault date & time (time accuracy: 10 mSec)

Also faults can be observed via front display by pressing “READ” key and scrolling faults by “up” & “down” keys

Events and faults are recorded in txt format.

The accordance of the event and fault files with the original generated ones can be checked by “CRC check” tab in PC software.

T - 2.3: Disturbance recording

-Capacity: 10 records (saved in log memory)

-Record sampling rate: 16 samples/cycle

-Pre fault time: 200mSec (10 cycles)

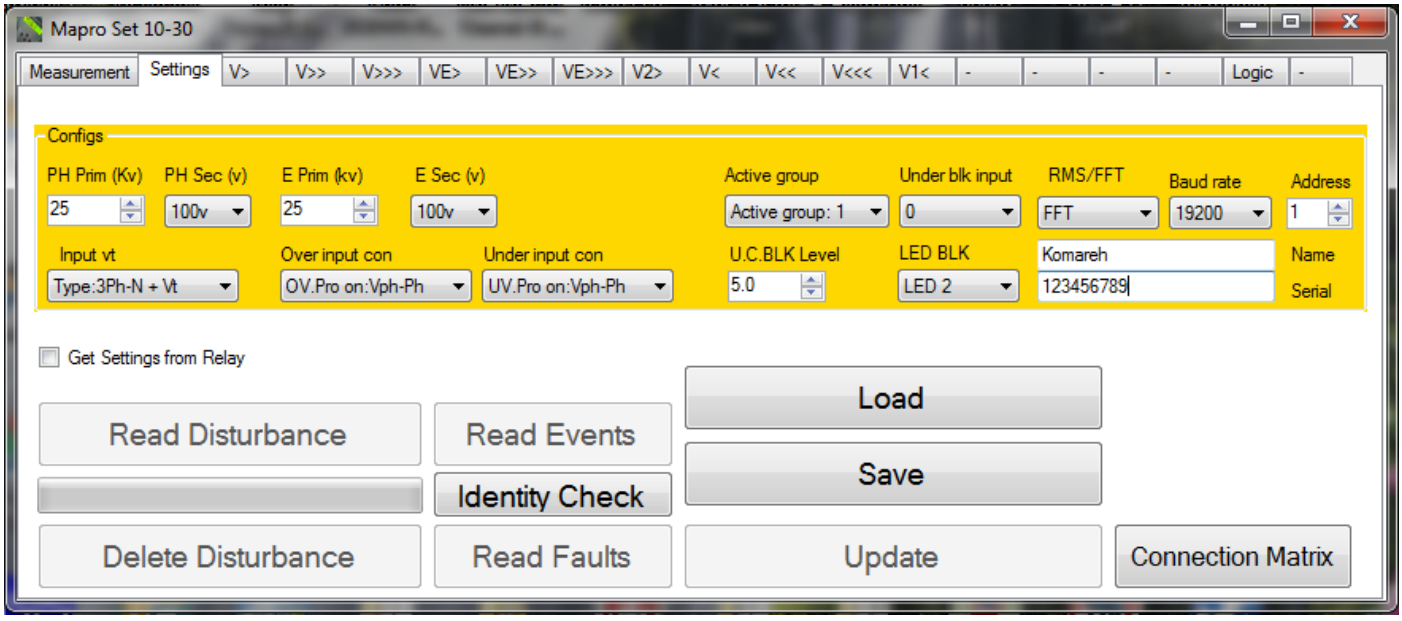
-post fault time: 5 Sec.s

-Data: According to Com trade format

-Trigger: Pick up

Along with disturbance data another file can be received which, contains the No. of relays configured in Hex format for different protections.

Disturbance files can be received or deleted via front USB port by PC software.



T - 2.4: Time and date setting

The time and date of relay can be set and updated according to PC time and date by an option of PC software when relay is connected to PC or laptop.

The relay time and date can be observed on display by pressing ***"up"*** key *when you are not in setting menus*. By pressing ***"CLEAR"*** key you will return to main menu.

T - 2.5: Measurements monitoring:

Measurements, containing the following items, are shown on display via measurement menu:

- VA(IR), VB(IS), VC(IT) and Vr rms values
- V1(positive sequence) and V2(negative sequence) rms values
- V2/V1 ratio
- Vn – Vfn (true rms minus rms value of fundamental frequency)

  (means the total rms value of harmonics)
- Max of V_A, V_B, V_C from the last resetting. Any time you can reset the Max values by pressing ***"up"*** key when you are observing any of them.
- Phase angle (Θ) of V_B and V_C related to V_A in degrees (V_A = 0).

T – 3: Communication

T - 3.1: RS485 (rear connector, twisted pair wire)

-Protocol: MODBUS RTU

-Baud rate: 19200, 38400

-Connector: screw type/cable shoe

-Application: Transfer of information & remote programming

T - 3.2: USB (front connector)

-Connector: Mini USB standard connector

-Application: Information extraction & system programming by a local PC or laptop

T – 4: Inputs & outputs

T - 4.1: AC inputs

-Phase voltage inputs: for 3 phase connections

-Residual voltage input

-Frequency: 50 Hz

-Burden: phase & residual: <0.35VA

-Voltage thermal withstand:

Continuous 550Vph - ph eff
10 seconds 700Vph - ph eff

T - 4.2: Logic inputs & outputs

-Logic inputs: Independent optical isolated

Burden <10mA

Voltage range 35 to 150Vdc

Recognition time <5mSec

-Logic outputs: Dry contacts

Contact ratings: AC max 10A/250V, 50W resistive, 25W

Inductive with L/R 40mSec

DC max 0.3A/135V, 40W L/R 30mSec

Contact operation time: <10mSec

Contact electrical & mechanical operate lifetime:

>100000 times (at rated load)

T - 4.3: Power supply

-Aux. voltage range: 55 to 160Vac/dc

-Ripple: <8%

-Burden: 3W min, 6.8W max with all output relays energized.

T - 4.4: Accuracy

-O.C. thresholds: +/- 2.5%

-Trip time: Definite time: +/-2%, min: 70mSec

- Inverse curves: +/-5% min: 70mSec

T – 4.5: Accuracy tables related to operate & reset times

Functions Range Operate Reset Timer Accuracy

Under voltage protection

(V<, V<< and V<<<) DT: Vs ±2% op. time: ±2% Greater of 2% or 70ms

IDMT: V operate = Vs ±2% Greater of 5% or 70ms

Reset: (1.02-1.05) V operate

Overvoltage protection

(V>, V>> and V>>>) DT: Vs ±2%op. time: ±2% Greater of 2% or 70ms

IDMT: V operate = Vs ±2% Greater of 5% or 70ms

Reset: (0.94-0.98) V operate

Residual voltage protection

(V0>, V0>> and V0>>>) DT: Vs ±2%op. time: ±2% Greater of 2% or 70ms

IDMT: V operate = Vs ±2% Greater of 5% or 70ms

Reset: (0.94-0.98) V operate

T - 4.6: Inverse time curve

-The mathematical inverse time relation is:

IDMT: $$t = \frac{1}{\left|\left[\left(\frac{V}{V_S}\right)-1\right]\right|}$$

NOTE: In all above relation, TMS (Time Multiplier Setting) is supposed to be 1, else TMS should be multiplied by t.

NOTE: In above relations, t is trip time, V is the value of fundamental frequency of voltage at tripping time, and V_s is the threshold voltage setting.

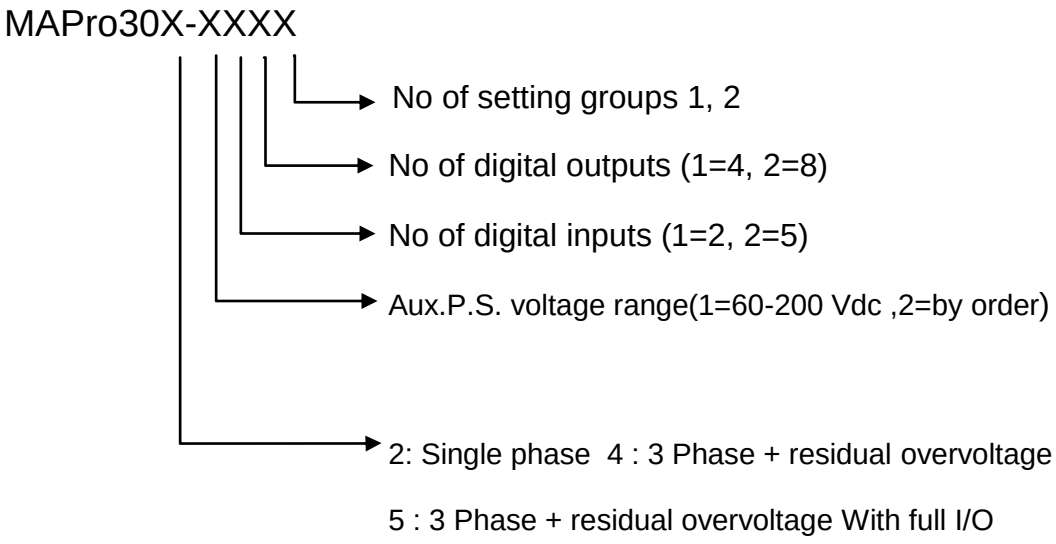
T - 4.7: Inverse time curve for reset timer(optional)

-The mathematical inverse time relations for reset is:

IDMT: $$t = \frac{1}{\left|\left[\left(\frac{V}{V_S}\right)-1\right]\right|}$$

NOTE: In all above relations, TMS (Time Multiplier Setting) is supposed to be 1, else t should be multiplied by TMS.

T – 5: Ordering code:



T – 6: Connection guide for Mapro304/305 3ph+EF terminal

3Phase +residual voltage relay terminal
(5 input 8 output) Rev. 2

Back view

Terminal No.	Description	Terminal No.	Description
1	Voltage input of phase A	2	Voltage input of phase A
3	Voltage input of phase B	4	Voltage input of phase B
5	Voltage input of phase C	6	Voltage input of phase C
7	Residual Voltage input	8	Residual Voltage input
9		10	
11		12	
13		14	
15		16	
17		18	WD Relay COM
19		20	WD Relay N.O.
21		22	WD Relay N.C.
23	Aux power supply + input	24	Aux power supply - input
25	RS485 A	26	RS485 B
27	RS485 Ter. Res.	28	RS485 GND

Terminal No.	Description	Terminal No.	Description
29	Input 2	30	Input 5 (Only for MAPro 305)
31	Input 2	32	Input 5 (Only for MAPro 305)
33	input 1	34	Input 4 (Only for MAPro 305)
35	input 1	36	Input 4 (Only for MAPro 305)
37	Relay 4 N.O.	38	Input 3 (Only for MAPro 305)
39	Relay 4 COM	40	Input 3 (Only for MAPro 305)
41	Relay 3 N.O.	42	Relay 8 N.O. (Only for MAPro 305)
43	Relay 3 COM	44	Relay 8 COM (Only for MAPro 305)
45	Relay 2 N.O.	46	Relay 7 N.O. (Only for MAPro 305)
47	Relay 2 N.C.	48	Relay 7 COM (Only for MAPro 305)
49	Relay 2 COM	50	Relay 6 N.O. (Only for MAPro 305)
51	Relay 1 N.O.	52	Relay 6 COM (Only for MAPro 305)
53	Relay 1 N.C.	54	Relay 5 N.O. (Only for MAPro 305)
55	Relay 1 COM	56	Relay 5 COM (Only for MAPro 305)

T – 6: Connection guide for MAPro302 terminal

Sensitive Earth Fault Relay
(2 input 4 output) Rev. 2

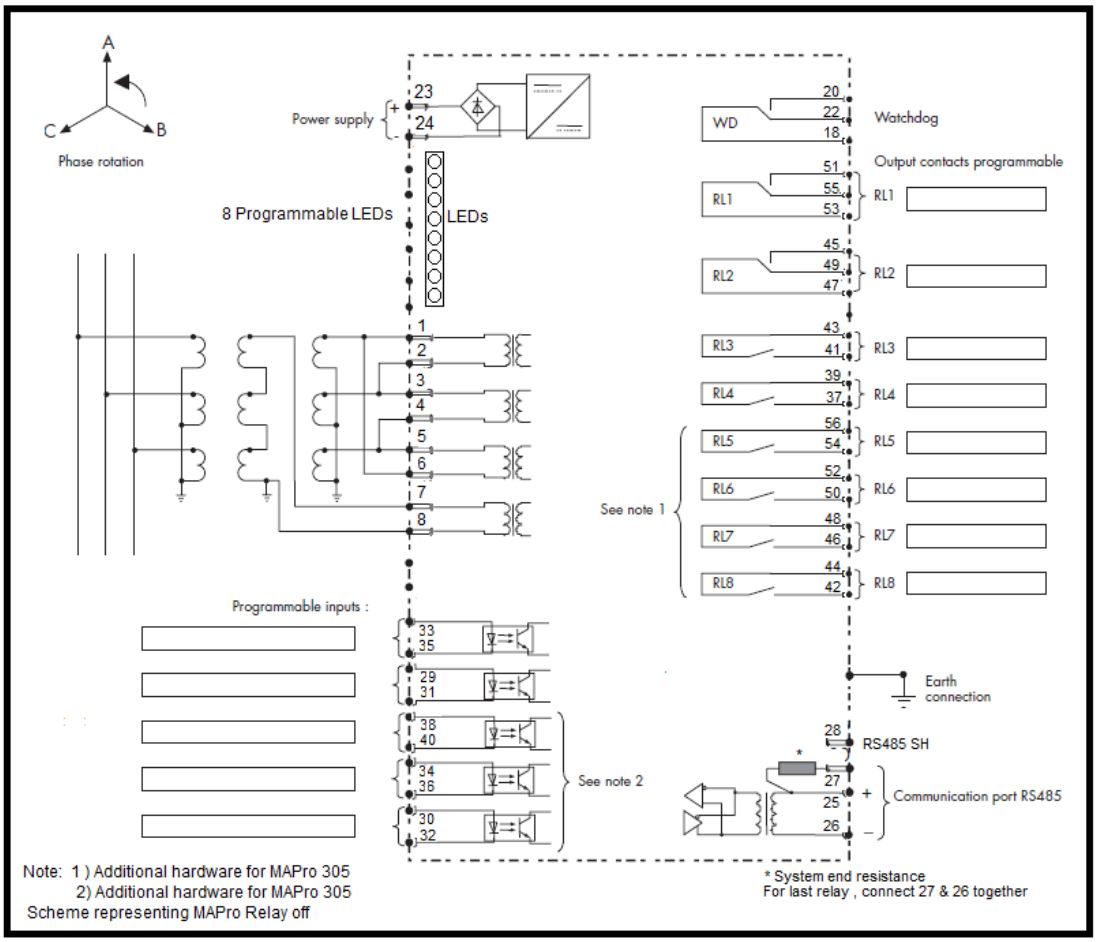
Terminal No.	Description	Terminal No.	Description
1		2	
3		4	
5		6	
7	Voltage input	8	Voltage input
9		10	
11		12	
13		14	
15		16	
17		18	WD Relay COM
19		20	WD Relay N.O.
21		22	WD Relay N.C.
23	Aux power supply + input	24	Aux power supply - input
25	RS485 A	26	RS485 B
27	RS485 Ter. Res.	28	RS485 GND

Back view

Terminal No.	Description	Terminal No.	Description
29	Input 2	30	
31	Input 2	32	
33	input 1	34	
35	input 1	36	
37	Relay 4 N.O.	38	
39	Relay 4 COM	40	
41	Relay 3 N.O.	42	
43	Relay 3 COM	44	
45	Relay 2 N.O.	46	
47	Relay 2 N.C.	48	
49	Relay 2 COM	50	
51	Relay 1 N.O.	52	
53	Relay 1 N.C.	54	
55	Relay 1 COM	56	

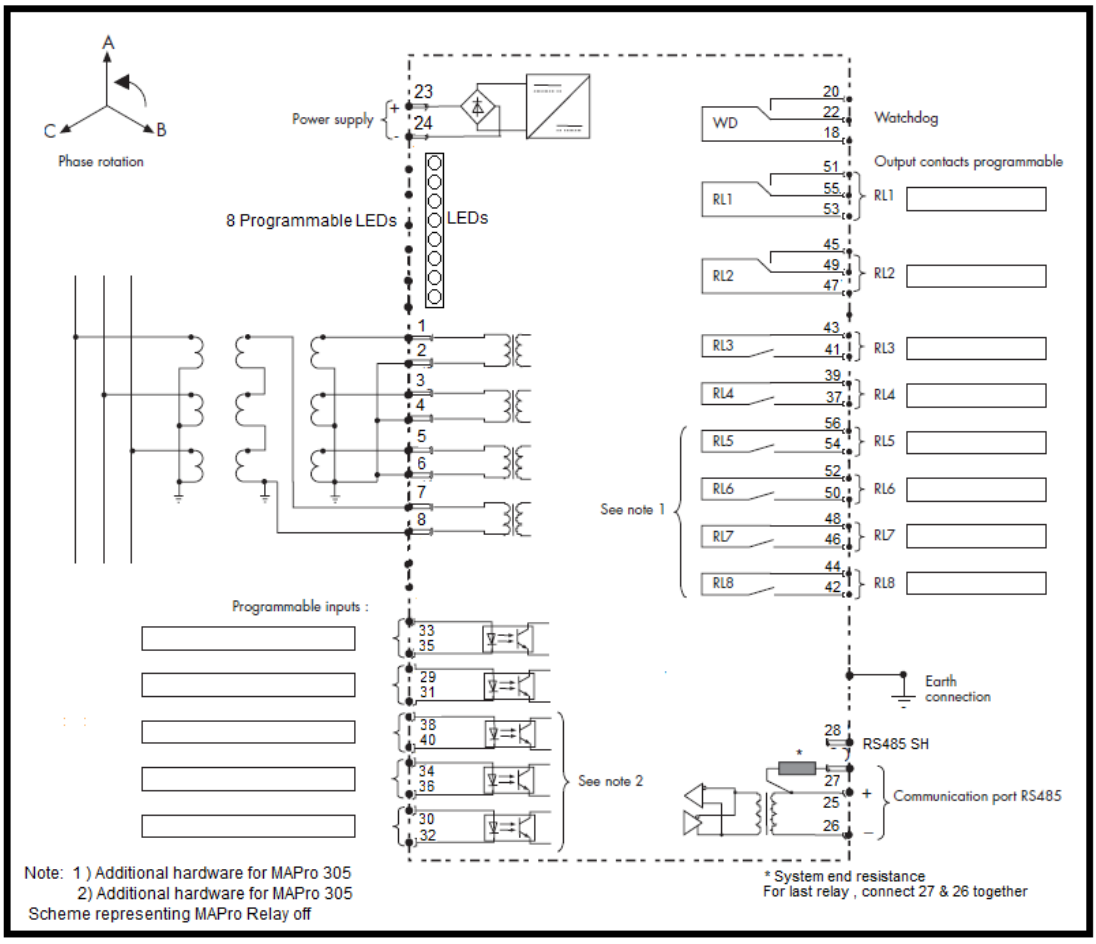
T – 7: Wiring diagrams

T – 7.1: 3ph – ph & residual VT connection



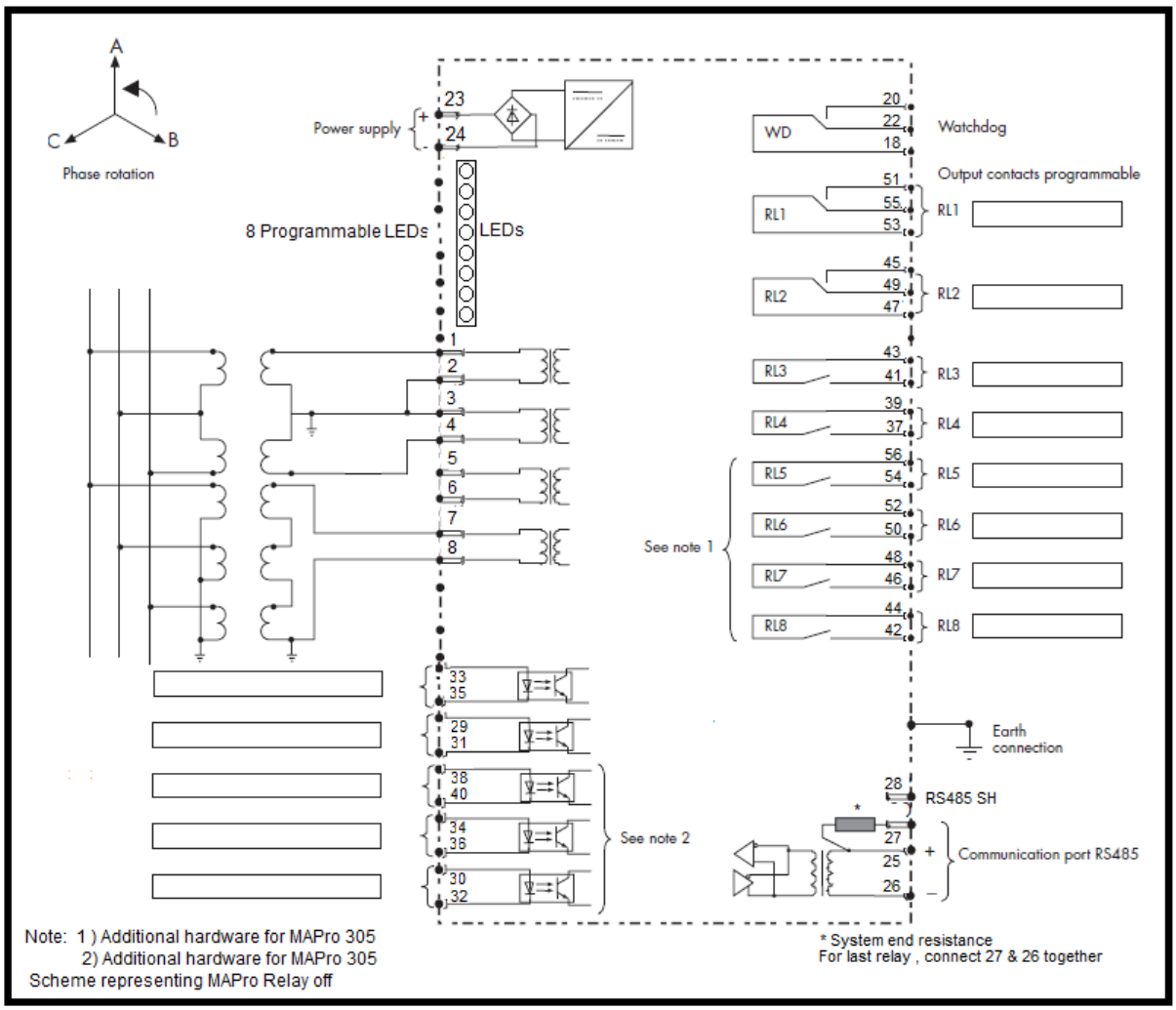
3 VTs (PHASE-PHASE) + RESIDUAL VT CONNECTION

T – 7.2: 3ph – N & residual VT connection



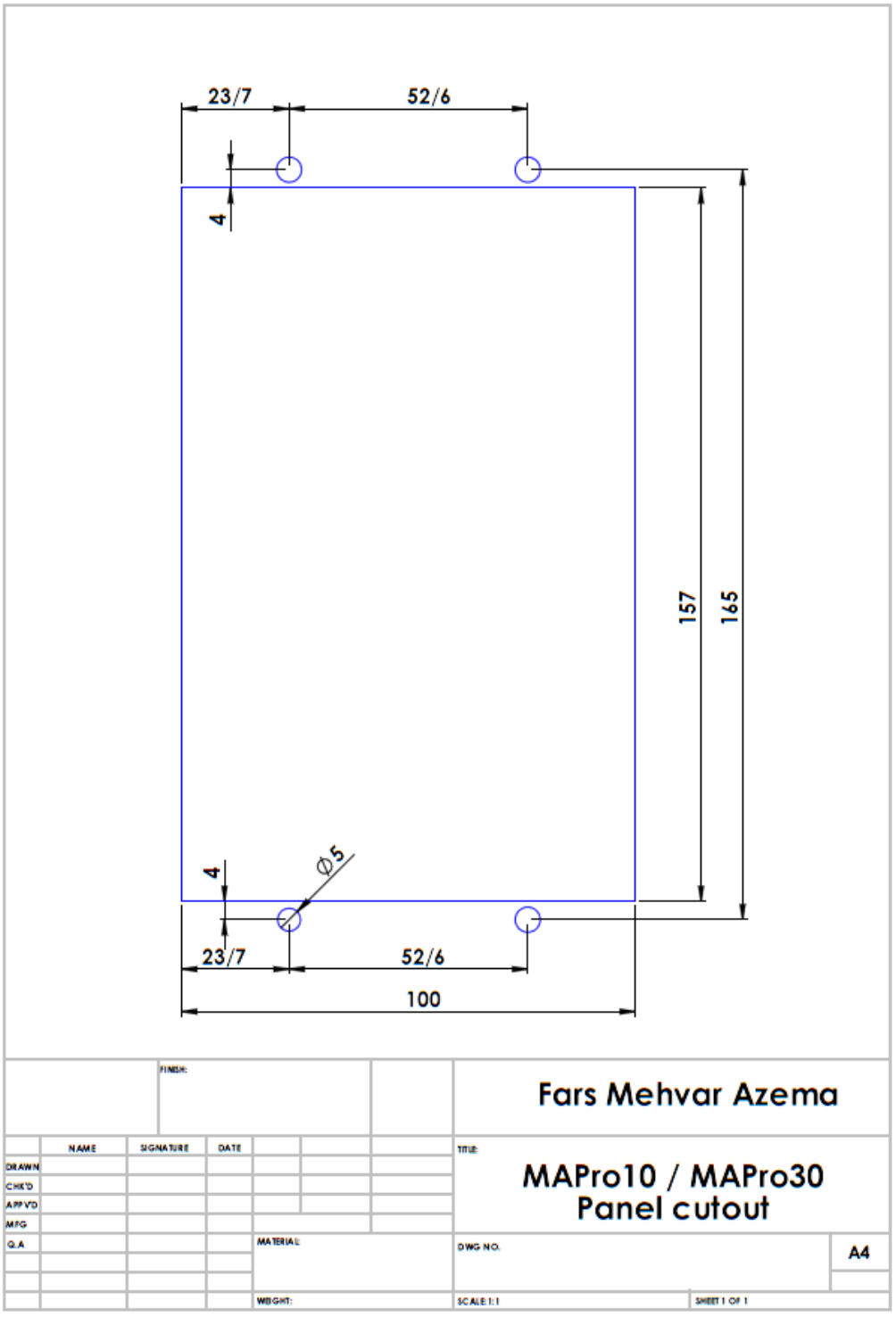
3 VTs + RESIDUAL VT CONNECTION

T – 7.3: 2ph – ph & residual VT connection



2 VTs + RESIDUAL VT CONNECTION

T – 8: Cutout dimensions for MAPro10 & MAPro30 relays



T – 9: Technical specifications according to standard:

T – 9.1: MECHANICAL SPECIFICATIONS

Design
Modular FMA Full draw-out Case – 4U (out with automatic CT shorting in the case of the relay)
Mounting
Rack or flush mounting.
Connections

* Rear (double fasten + M4 screw per connection)*

Enclosure Protection
Front Panel: IEC 60529: 2001:

* IP 52 – Protection (front panel) against dust and dripping water

* IP 10 – Product safety protection for the rear due to live connections on the terminal block

Dimensions
Height: 4U (177mm) Depth: 250mm Width: 100mm
Weight
Approx.: 3.0 Kg

T – 9.2: ENVIRONMENTAL CONDITIONS

Ambient Temperature Range
Per IEC 60255-6: 1988
Operating temperature range:
Continuous Withstand: –25 to +55°C (or –13°F to +131°F)

Storage Temperature Range: –25 to +70°C (or –28°F to +158°F)

Tested as per IEC 60068-2-1:2007:
–25°C storage (96 hours) –40°C operation

IEC 60068-2-2-2007: +85°C storage
+85°C operation

Note 1: The upper limit is permissible for a single 6- hour duration within any 24 hour period.

Ambient Humidity Range
Humidity:

* Per IEC 60068-2-78: 2001:

* Per IEC 60068-2-30: 2005:

Solar radiation
Avoid exposure of the front panel to direct solar radiation.

T – 9.3: MECHANICAL ENVIRONMENT

Vibration Test

IEC 60255-21-1:1988

Vibration response Class 2 – 1g
Vibration endurance Class 2 – 2g

Shock and Bump Test

IEC 60255-21-2:1988

Shock response Class 2 – 10g
Shock withstand Class 1 – 15g
Bump Class 1 – 10g

Seismic Test

IEC 60255-21-3:1993: Class 2.

T – 9.4: PRODUCT SAFETY

Compliance is demonstrated by reference to generic safety standards: IEC 60255-27:2005 EN 60255-5:2001

T – 9.5: TYPE TESTS

Insulation

Rated insulation: 300
PER IEC 60255-5: 2000,

High Voltage (Dielectric) Withstand

Per IEC 60255-5: 2000, 2 kV rms AC, 1 minute:

Between all case terminals connected together, and the case earth, and between all terminals of independent circuits (RS232 ports excepted).

2.0kVrms for one minute between all terminals and case earth

2.0kVrms for one minute between all terminals of independent circuits, including contact circuits

1.5kVrms for one minute across dedicated normally open contacts of output relays.

1.5kVrms AC for 1 minute, across open contacts and across open contacts of changeover output relays.

Impulse Voltage Withstand Test

Per IEC 60255-5: 2000
The product will withstand without damage impulses of 1.2 / 50 µs, peak value: 5 kV, 0.5J across:

* Each independent circuit and the case with the terminals of each independent circuit connected together.
* Independent circuits with the terminals of each independent circuit connected together.

* Terminals of the same circuit except normally open metallic contacts.

ELECTROMAGNETIC COMPATIBILITY (EMC)

DC Supply Interruption

Per IEC60255-11:1979:
The product will withstand a 20ms interruption in the auxiliary voltage in its quiescent condition

AC Ripple on DC Supply

Per IEC60255-11:1979:
The product will operate with 12% AC ripple on the DC auxiliary supply without any additional measurement errors

Disturbances on AC Supply

Per IEC61000-4-11:1994:
The products satisfies the requirements of EN61000 - 4 - 11 for voltage dips and short interruptions.

1 MHz Burst High Frequency Disturbance Test

Per IEC 60255-22-1: 2008, Class III,
Common-mode test voltage: 2.5 kV,
Differential test voltage: 1.0 kV,
Test duration: 2 s, Source impedance: 200 Ω

Electrical Fast Transient or Burst Requirements

Per IEC 60255-22-4: 2002
The product complies with all classes up to and including Class A 4kV without any mal-operations or additional measurement errors.

Fast transient disturbances on terminal block, communications (common mode only)	2kV, 5ns rise time, 50ns decay time, 5kHz repetition time, 15ms burst, repeated every 300ms for 1min in each polarity, with a 50Ω source impedance.
Fast transient disturbances on power supply, I/O signal, data and control lines (common mode only)	4kV, 5ns rise time, 50ns decay time, 2.5kHz repetition time, 15ms burst, repeated every 300ms for 1min in each polarity, with a 50Ω source impedance.

Per IEC 61000-4-4: 2004.
The product complies with all classes up to and including Level 4 4kV without any mal-operations or additional measurement errors:

Fast transient disturbances on power supply (common mode only)	2kV, 5ns rise time, 50ns decay time, 5kHz repetition time, 15ms burst, repeated every 300ms for 1min in each polarity, with a 50Ω

	source impedance.
Fast transient disturbances on I/O signal, data and control lines (common mode only)	2kV, 5ns rise time, 50ns decay time, 5kHz repetition time, 15ms burst, repeated every 300ms for 1min in each polarity, with a 50Ω source impedance.

Immunity to Electrostatic Discharge

Per IEC 60255-22-2: 1997 & IEC61000-4-2:2001
The product will withstand application of all discharge levels up to the following without Mal - operation:
15 kV discharge in air to user interface, display, and exposed metalwork.
8 kV discharge in air to all communication ports.
8 kV point contact discharge to any part of the front of the product.

Conducted Emissions
Per EN 55022: 1998:
0.15 – 0.5MHz, 79dBµV (quasi peak) 66dBµV (average)
0.5 – 30 MHz, 73 dBµV (quasi peak) 60dBµV (average).

Radiated Emissions
Per EN 55022: 1998:
30 - 230MHz, 40dBµV/m at 10m measurement distance
230 – 1GHz, 47 dBµV/m at 10m measurement distance.

Immunity to Radiated Electromagnetic Energy
Per IEC 60255-22-3: 2000, Class III & IEC61000-4-3:2002
Test field strength, frequency band 80 to 1000 MHz:
10 V/m, test using AM: 1 kHz / 80%, at 80 to 1GHz,
30 V/m, test using AM: 1 kHz / 80%, at 80 to 900MHz and 1.4GHz to 2.0GHz

Conducted Immunity
Per IEC 60255-22-6: 2001

Surge Immunity
Per IEC 60255-22-5: 2002
Class IV: 4kV common mode 12Ω source impedance, 2kV differential mode 2Ω source impedance – power supply
Class IV: 4kV common mode 42Ω source impedance, 2kV differential mode 42Ω source impedance – Opto inputs, relays, CT, VT
Class IV - 4kV common mode 2Ω source impedance applied to cable screen – terminal block communications

Power Frequency Magnetic Field Immunity

Per IEC 61000-4-8:2001, class V: 100A/m quiescent condition, 1000A/m short duration (1-3s)

Pulse Magnetic Field Immunity
Per IEC 61000-4-9:2001, class V: 1000A/m pulse (5 positive, 5 negative)

Damped Oscillatory Magnetic Field
Per IEC 61000-4-10:2001, class V: 100A/m @100kHz / 1MHz 2 second burst duration
Oscillatory Waves Immunity
Per IEC 61000-4-12:2001:
2.5kV peak between independent circuits and case earth
1.0kV peak across terminals of the same circuit
EMC compliance
EN50081-2: 1994
EN60952-2: 1995
Product Specific Standards were used to establish conformity: EN50263: 2000

U: USER GUIDE

U – 1: Comparison of different models

U – 1.1: MAPro 305

This type of voltage relay has the following protection functions on 3 power lines:

- **Over voltage,** in 3 **independent** configurable levels V>, V>>, V>>>. All of these levels can be configured in their own menus. V> and V>> levels can protect in DMT (definite time) and IDMT (inverse curve) modes. Also definite reset time can be defined. Each of 8 LEDs can be selected as pick up or trip or both indications. There are 8 output relays that can be configured in any way that user wants for each level (each of them and any combination of them can be selected). V>>> is specified for fast and fixed time operation. So it dose not contain IDMT and pick up LED and reset time.
- If “input VT connection” is selected as type “3PH – N” from setting menu, the over voltage protection function can be based on “Vph – ph” or “Vph – N” from *setting menu* on PC software.
- Pick up voltage level is the same as threshold setting and drop out voltage level is 95% of threshold setting.
- **Under voltage,** in 3 **independent** configurable levels V<, V<<, V<<<. All of these levels can be configured in their own menus. V< and V<< levels can protect in DMT (definite time) and IDMT (inverse curve) modes. Also definite reset time can be defined. Each of 8 LEDs can be selected as pick up or trip or both indications. There are 8 output relays that can be configured in any way that user wants for each level (each of them and any combination of them can be selected). V<<< is specified for fast and fixed time operation. So it dose not contain IDMT and pick up LED and reset time.
- Under voltage protection can be blocked in two ways:
- 1- By defining a threshold voltage from ***configuration menu*** on relay or ***setting menu*** on PC software. In this case if all 3 phase voltages are below this defined threshold, under voltage protections, if is active, will be blocked.
- 2- By selecting inputs 1 or 2 from ***configuration menu*** on relay or ***setting menu*** on PC software. In this case, if selected input is high, under voltage protections, if is active, will be blocked.
- If both options are active, their effect is with ***OR logic***.

- If “input VT connection” is selected as type “3PH – N” from setting menu, the under voltage protection function can be based on “Vph – ph” or “Vph – N” from *setting menu* on PC software.
- Pick up (descent) voltage level is the same as threshold setting and drop out voltage level is 105% of threshold setting.
- **Positive sequence under voltage,** one configurable level V1<. V1< can protect in DMT (definite time) and IDMT (inverse curve) modes. Also definite reset time can be defined. Each of 8 LEDs can be selected as pick up or trip or both indications. There are 8 output relays that can be configured in any way that user wants for each level (each of them and any combination of them can be selected).
- Pick up (descent) voltage level is the same as threshold setting and drop out voltage level is 105% of threshold setting.
- **Negative sequence over voltage,** one configurable level V2>. V2> can protect in DMT (definite time) and IDMT (inverse curve) modes. Also definite reset time can be defined. Each of 8 LEDs can be selected as pick up or trip or both indications. There are 8 output relays that can be configured in any way that user wants for each level (each of them and any combination of them can be selected).
- Pick up voltage level is the same as threshold setting and drop out voltage level is 95% of threshold setting.
- **Residual over voltage,** in 3 **independent** configurable levels VE>, VE>>, VE>>>. All of these levels can be configured in their own menus. VE> and VE>> levels can protect in DMT (definite time) and IDMT (inverse curve) modes. Also definite reset time can be defined. Each of 8 LEDs can be selected as pick up or trip or both indications. There are 8 output relays that can be configured in any way that user wants for each level (each of them and any combination of them can be selected). VE>>> is specified for fast and fixed time operation. So it dose not contain IDMT and pick up LED and reset time.
- Pick up voltage level is the same as threshold setting and drop out voltage level is 95% of threshold setting.

U – 1.2: MAPro 304

The functions of MAPro 304 is completely the same as MAPro 305 except that it has 2 digital inputs instead of 5 inputs, and it has 4 configurable output relays instead of 8 relays. ***So in settings of this type, be careful not to select relays 5 to 8 for any of protection functions.***

U – 1.3: MAPro 302

This type has only one analog input for voltage, so it is applicable for one phase over and under voltage protection. The functions are phase over voltage, and under voltage. The setting related menus are the same as similar functions in MAPro 304. it has 2 digital inputs, and 4 configurable output relays. ***So in settings of this type, be careful not to select relays 5 to 8 for any of protection functions.***

U – 2: User interfaces

U – 2.1: Relay

Display: 2x16 character LCD with backlight to access settings from relay or observing settings or measurements.

LED: one blinking green to show, - external & internal power supply safety
- CPU correct operation

Eight red LED, all of them not fixed and configurable for any function operation

Right & left keys: to move between different menus

Up & down keys: to increment or decrement parameters or view fault information or showing date & time

CLEAR key: to going to main menu from other menus or reset LED or relays which are operated and latched, if the operation condition is not still continued. To turn off the trip LED which is latched after each trip, keep CLEAR key pushed for 3 seconds.

READ key: to access to faults information

USB connector, for PC or laptop connection

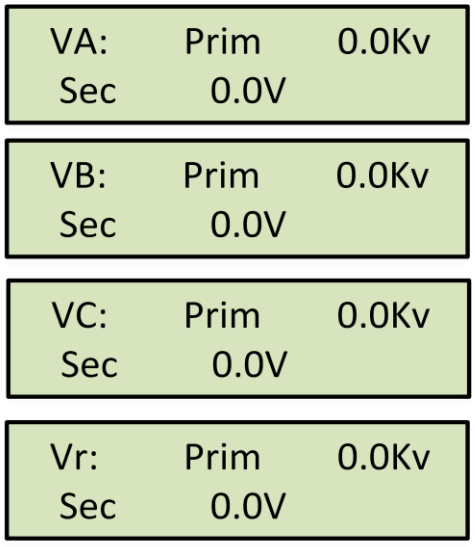
Label tape, positioned on top of front panel, contains the relay main specifications.

Back terminal block: the connection guide is given in **T – 6**, **T – 7**, **T – 8** sections.

U – 2.2: Relay front keyboard & display different menu contents

MAPro 30

Menu Contents



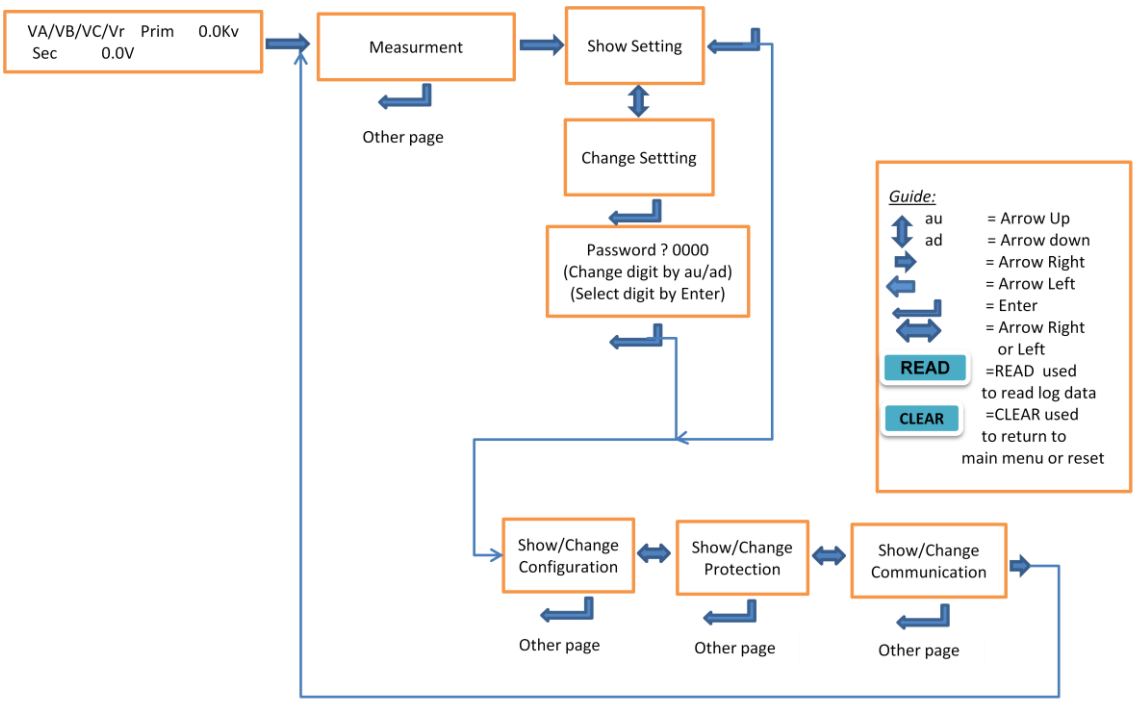
*The following information are shown in the **main menu** for each analog input **one after another:***

-Phase angle related to R(input 1)in degrees

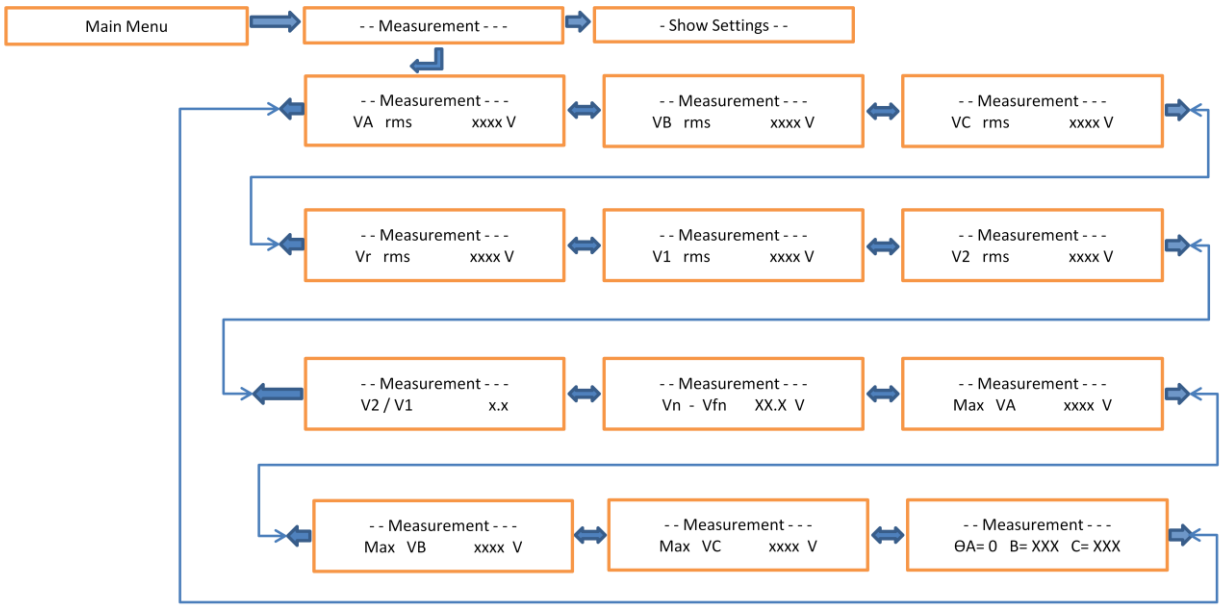
-Secondary current of external CT in Ampers as Is

-Primary current of external CT in Ampers as Ip

Main Menu Contents

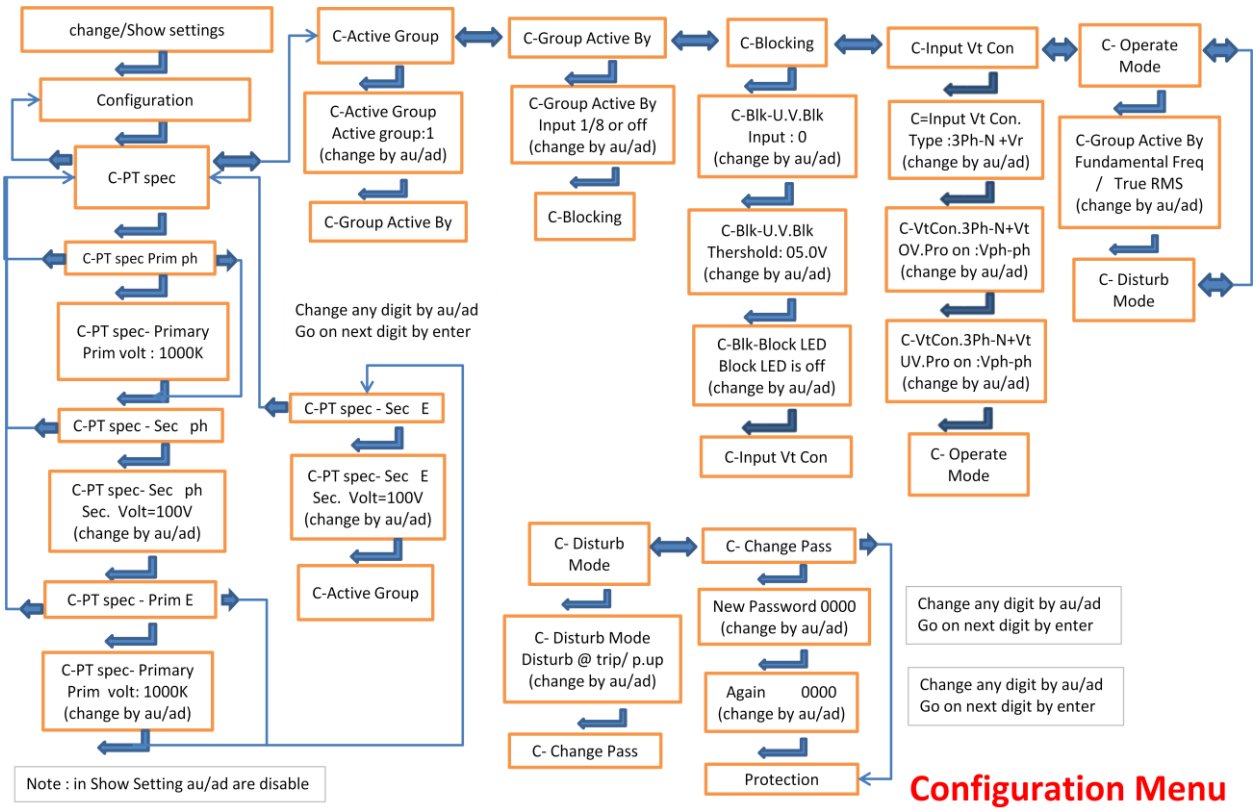


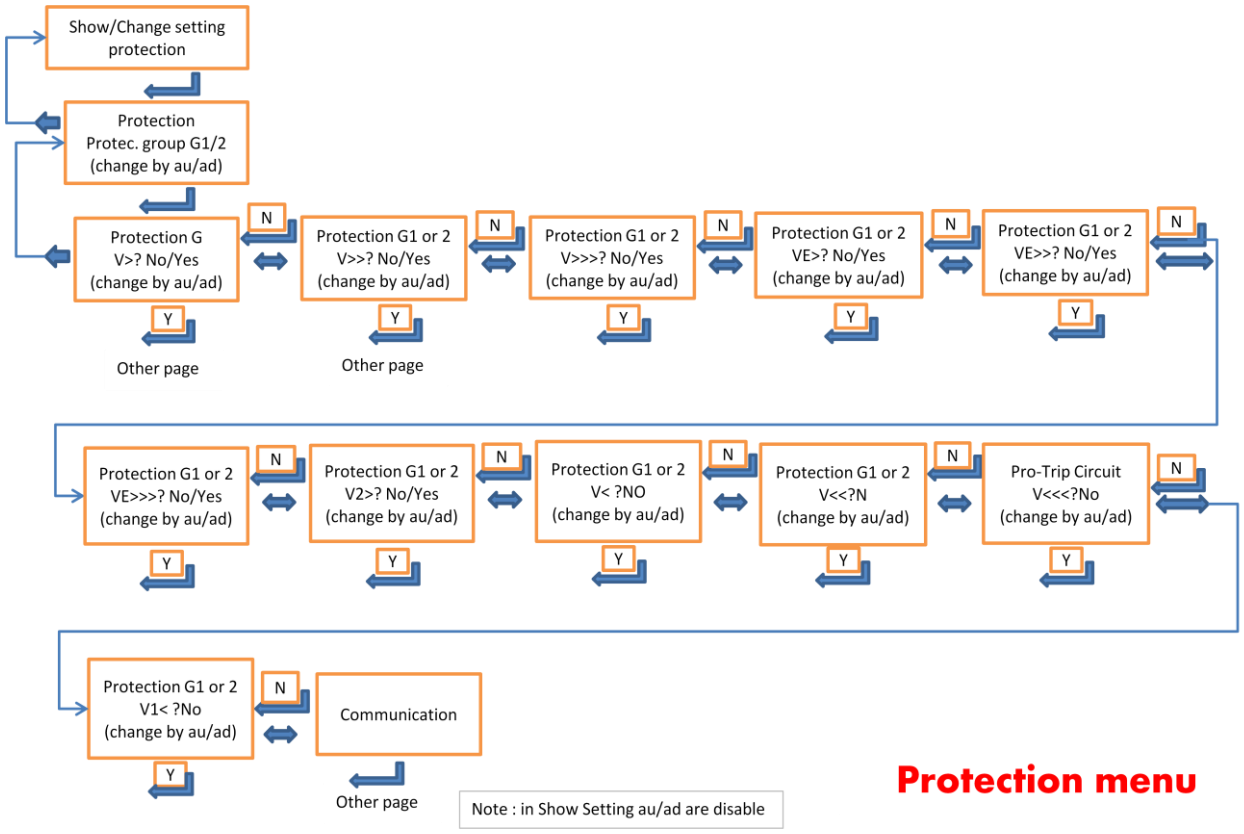
Menu Headings

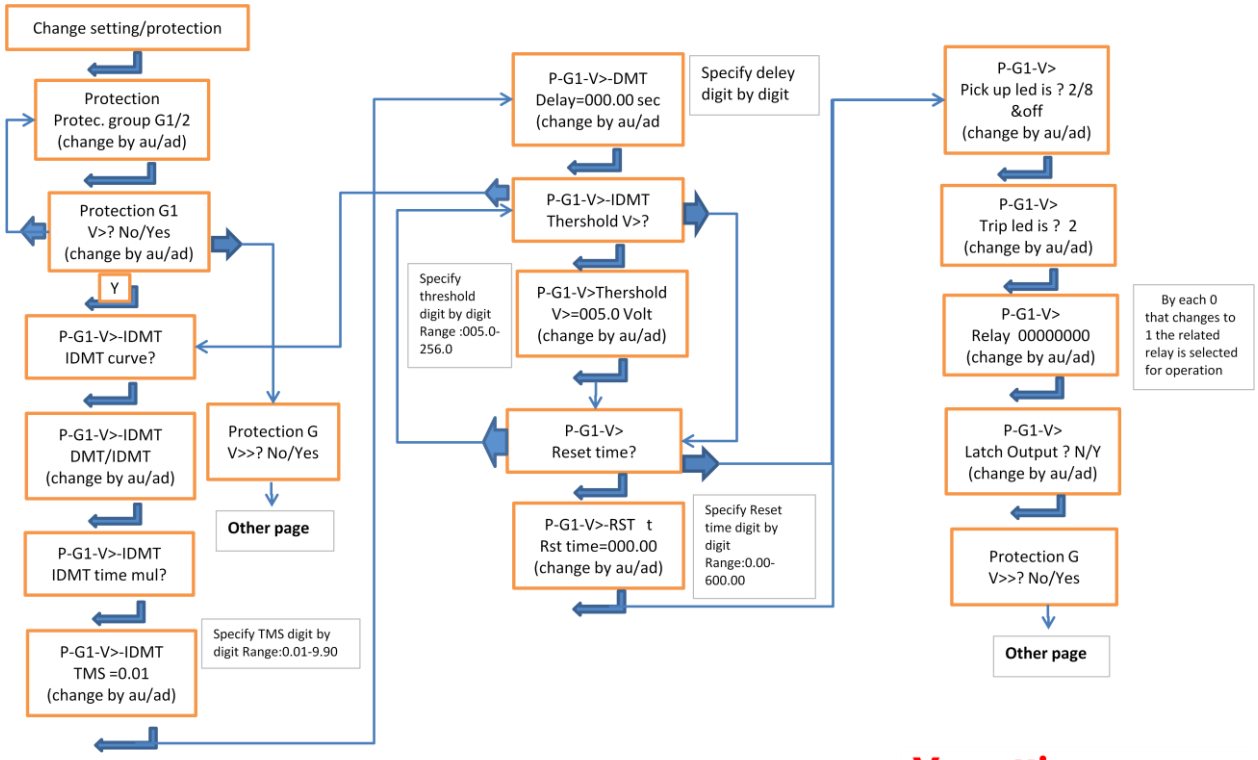


In each of Measurement submenus by pressing it goes to "Show Settings" menu

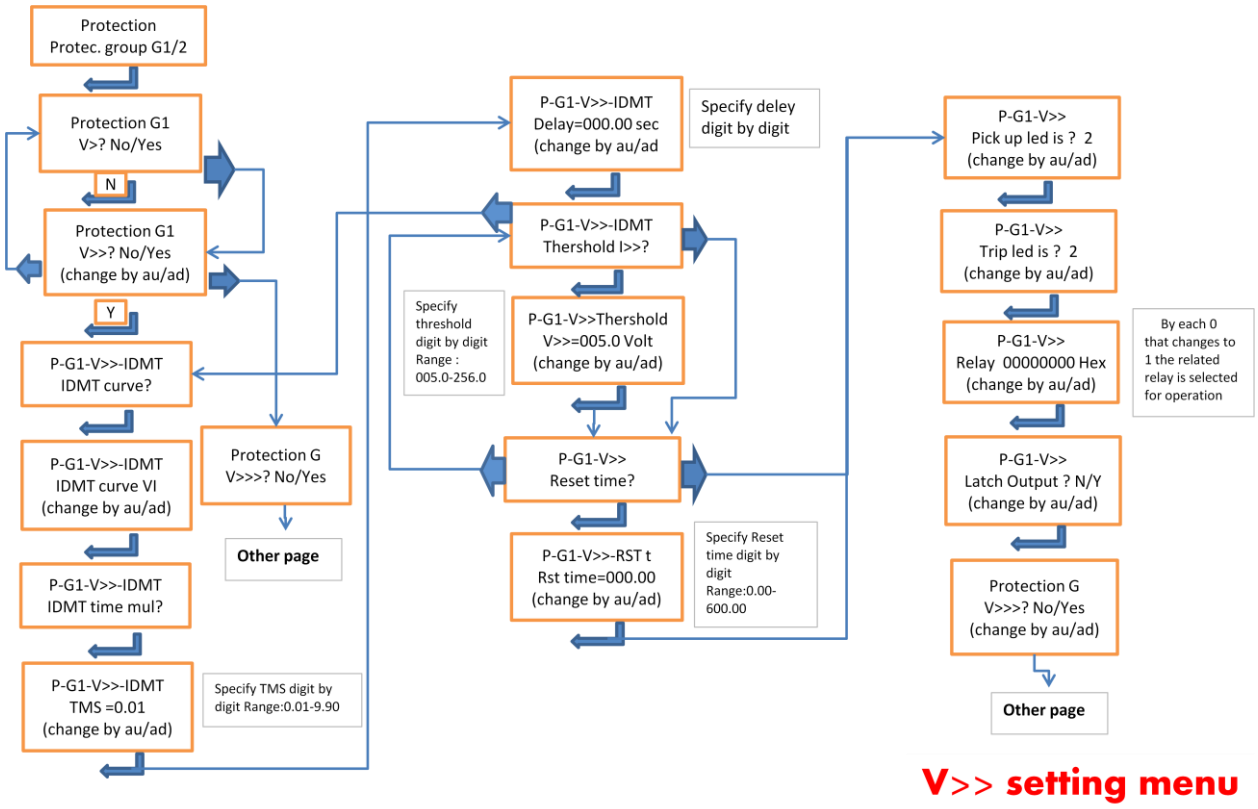
Measurement Menu


change/Show settings
Configuration
C-PT spec
C-PT spec Prim ph
C-PT spec- Primary
Prim volt : 1000K
C-PT spec - Sec ph
C-PT spec- Sec ph
Sec. Volt=100V
(change by au/ad)
C-PT spec - Prim E
C-PT spec- Primary
Prim volt: 1000K
(change by au/ad)
Note : in Show Setting au/ad are disable
C-Active Group
C-Active Group
Active group:1
(change by au/ad)
C-Group Active By
Change any digit by au/ad
Go on next digit by enter
C-PT spec - Sec E
C-PT spec- Sec E
Sec. Volt=100V
(change by au/ad)
C-Active Group
C-Group Active By
C-Group Active By
Input 1/8 or off
(change by au/ad)
C-Blocking
C-Blocking
C-Blk-U.V.Blk
Input : 0
(change by au/ad)
C-Blk-U.V.Blk
Thershold: 05.0V
(change by au/ad)
C-Blk-Block LED
Block LED is off
(change by au/ad)
C-Input Vt Con
C-Input Vt Con
C=Input Vt Con.
Type :3Ph-N +Vr
(change by au/ad)
C-VtCon.3Ph-N+Vt
OV.Pro on :Vph-ph
(change by au/ad)
C-VtCon.3Ph-N+Vt
UV.Pro on :Vph-ph
(change by au/ad)
C- Operate
Mode
C- Operate
Mode
C-Group Active By
Fundamental Freq
/ True RMS
(change by au/ad)
C- Disturb
Mode
C- Disturb
Mode
C- Disturb Mode
Disturb @ trip/ p.up
(change by au/ad)
C- Change Pass
C- Change Pass
New Password 0000
(change by au/ad)
Again 0000
(change by au/ad)
Protection
Change any digit by au/ad
Go on next digit by enter
Change any digit by au/ad
Go on next digit by enter
Configuration Menu

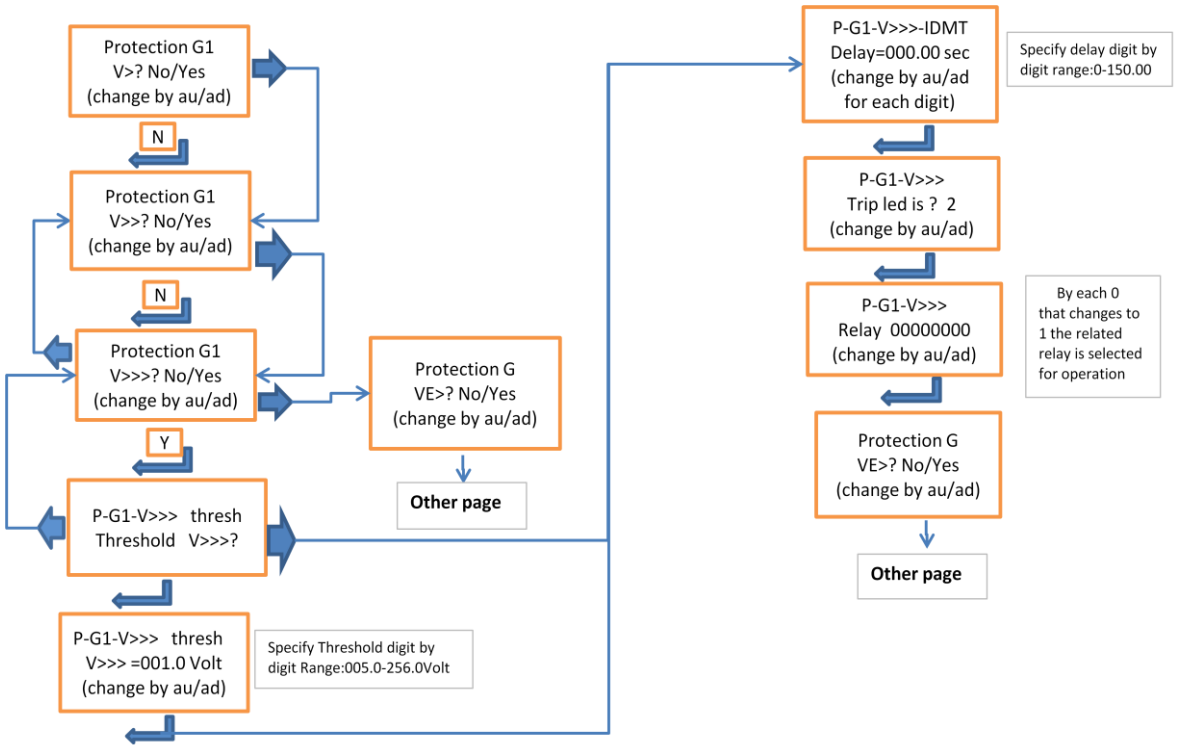

Show/Change setting protection
Protection Protec. group G1/2 (change by au/ad)
Protection G V>? No/Yes (change by au/ad)
Protection G1 or 2 V>>? No/Yes (change by au/ad)
Protection G1 or 2 V>>>? No/Yes (change by au/ad)
Protection G1 or 2 VE>? No/Yes (change by au/ad)
Protection G1 or 2 VE>>? No/Yes (change by au/ad)
Protection G1 or 2 VE>>>? No/Yes (change by au/ad)
Protection G1 or 2 V2>? No/Yes (change by au/ad)
Protection G1 or 2 V< ?NO (change by au/ad)
Protection G1 or 2 V<<?N (change by au/ad)
Pro-Trip Circuit V<<<?No (change by au/ad)
Protection G1 or 2 V1< ?No (change by au/ad)
Communication
N
Y
Other page
Other page
Other page
Note : in Show Setting au/ad are disable
Protection menu



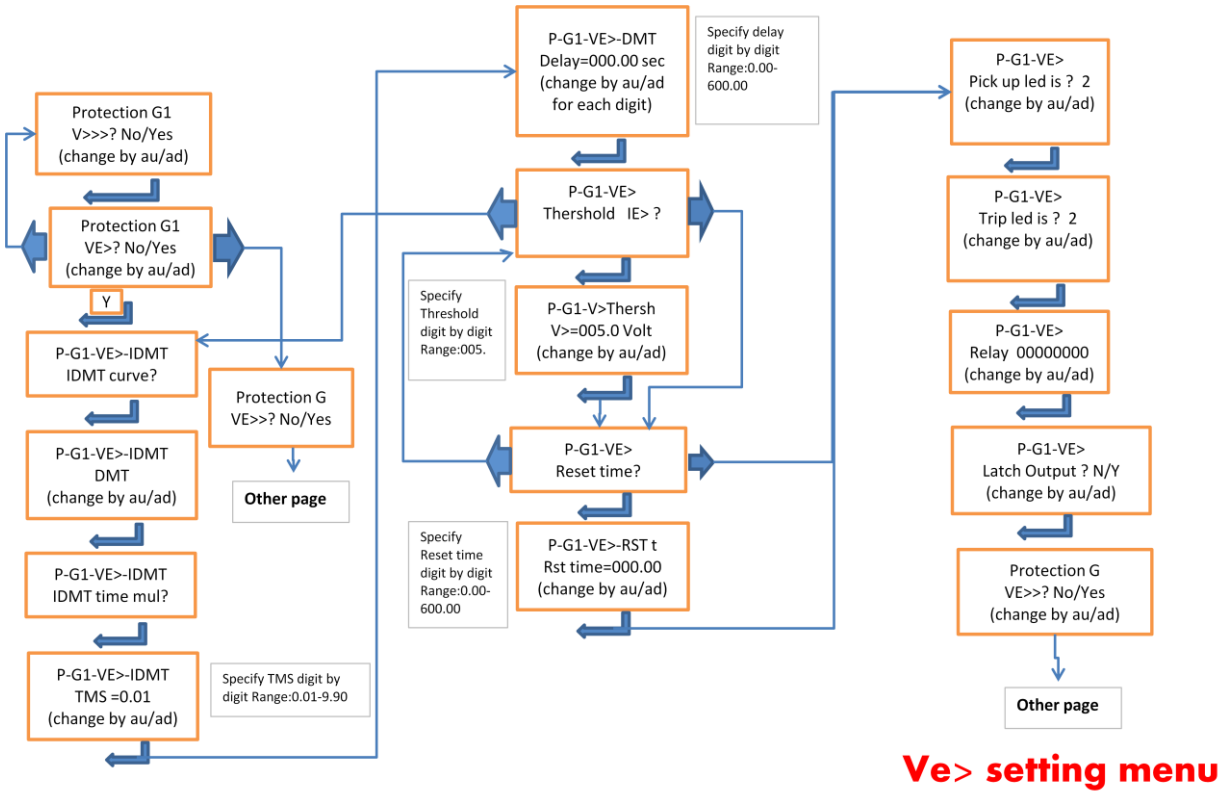
V> setting menu



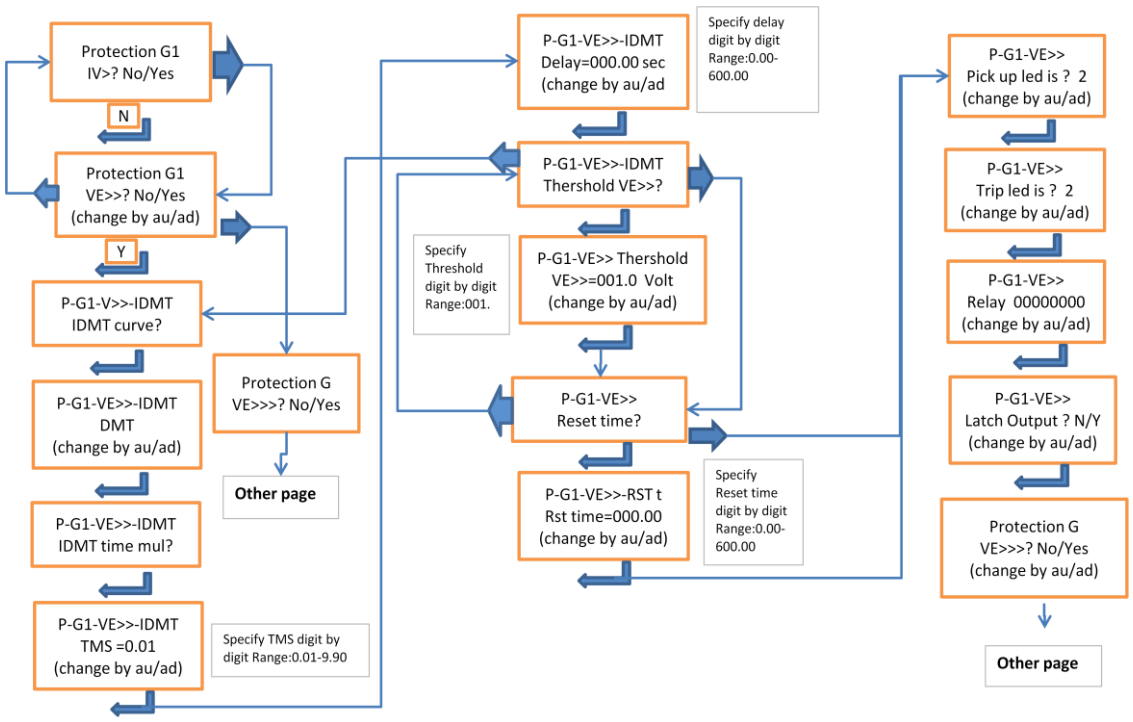
V>> setting menu



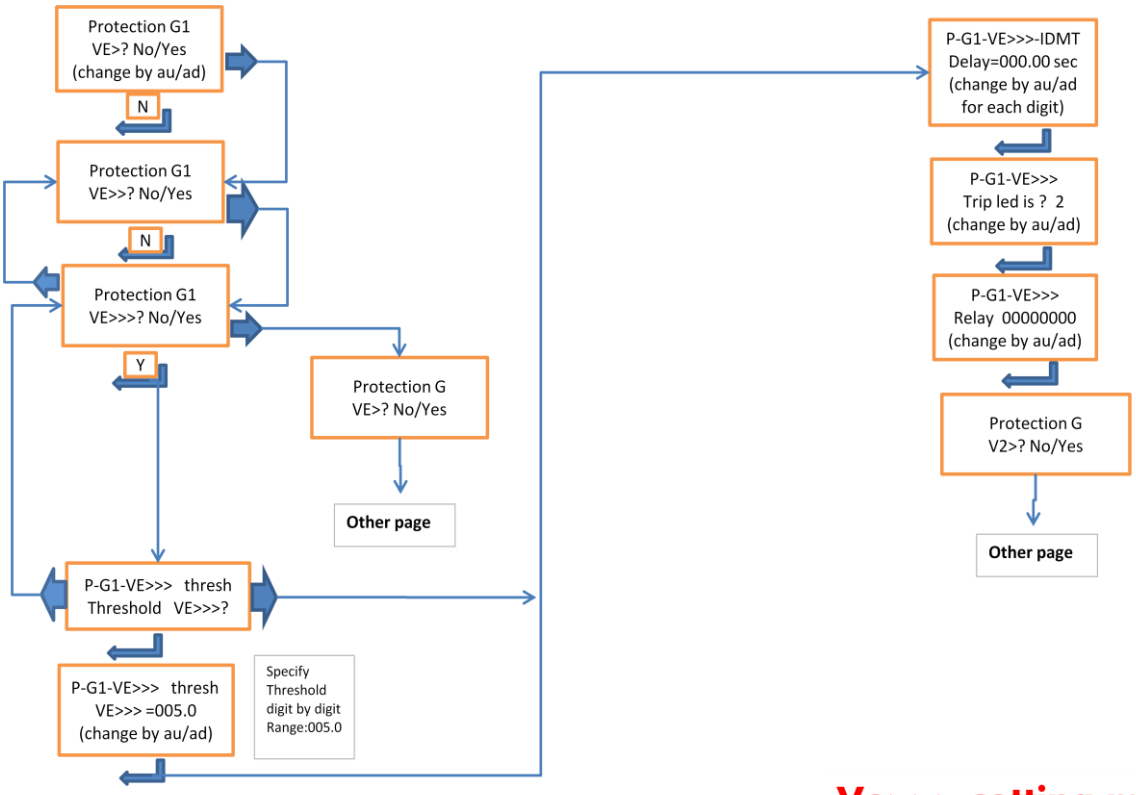
V>>> setting menu



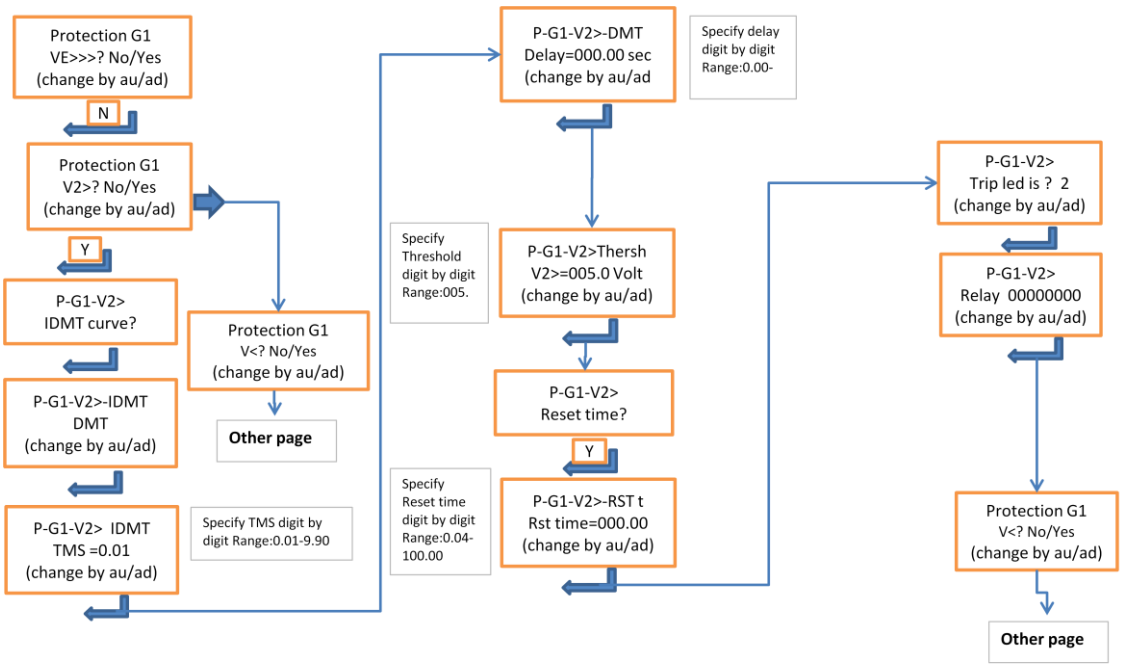
Ve> setting menu



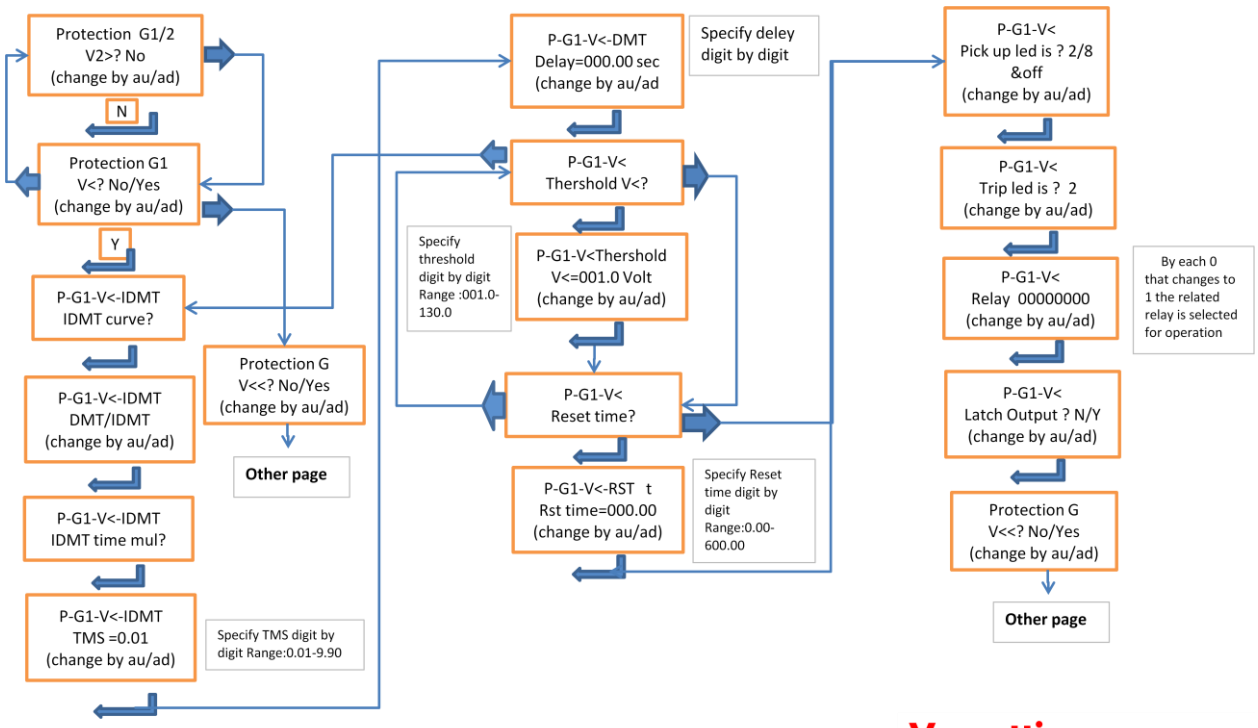
Ve>> setting menu



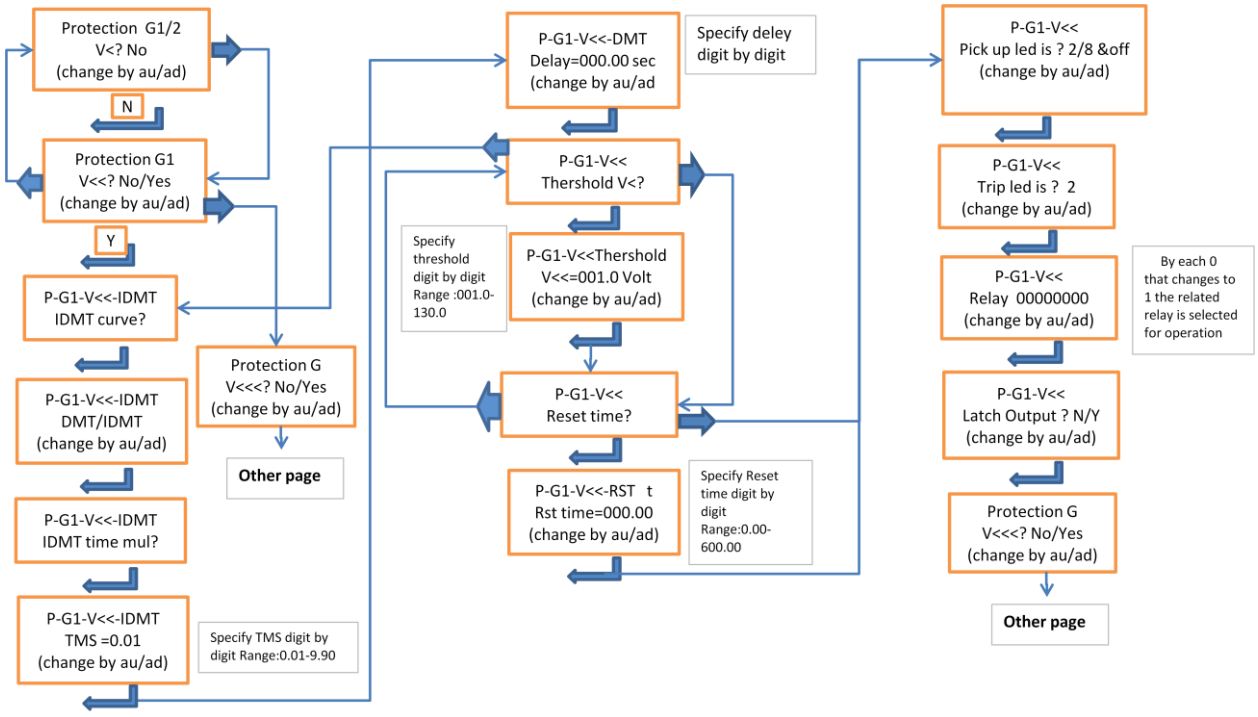
Ve>>> setting menu



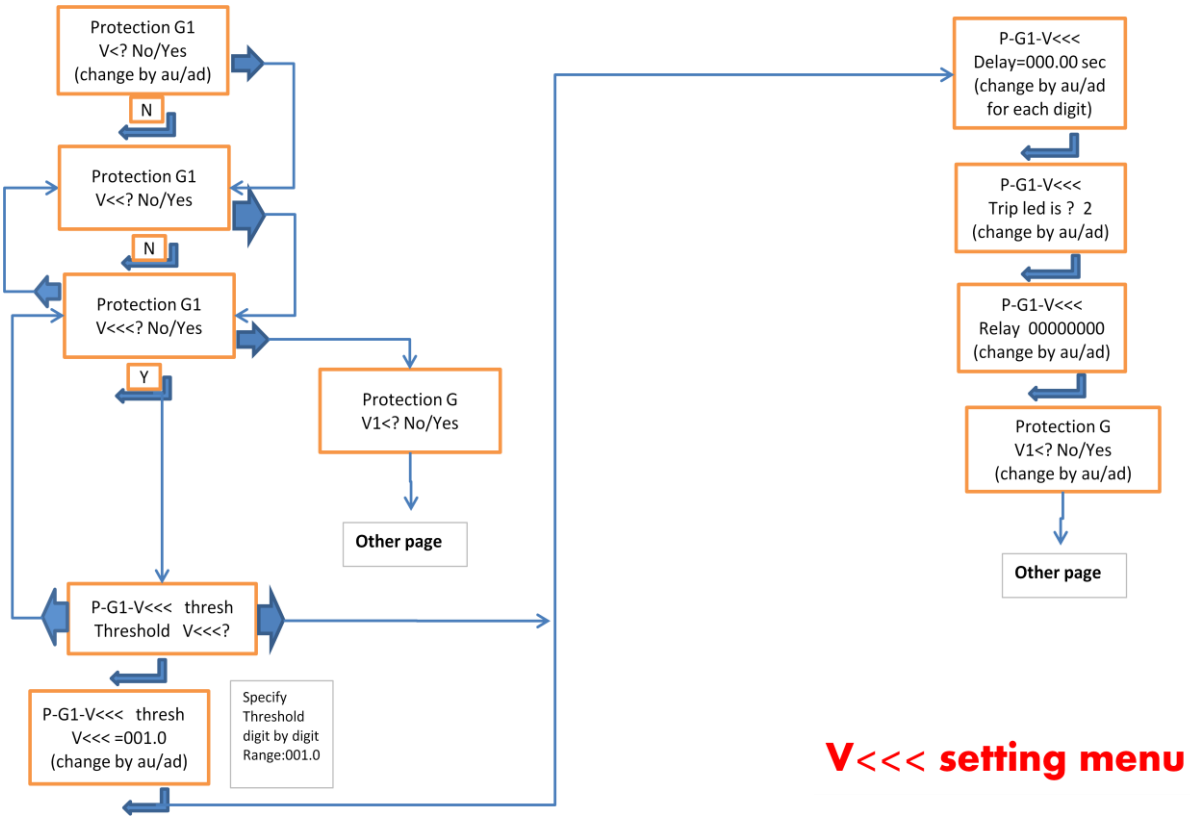
V2> setting menu



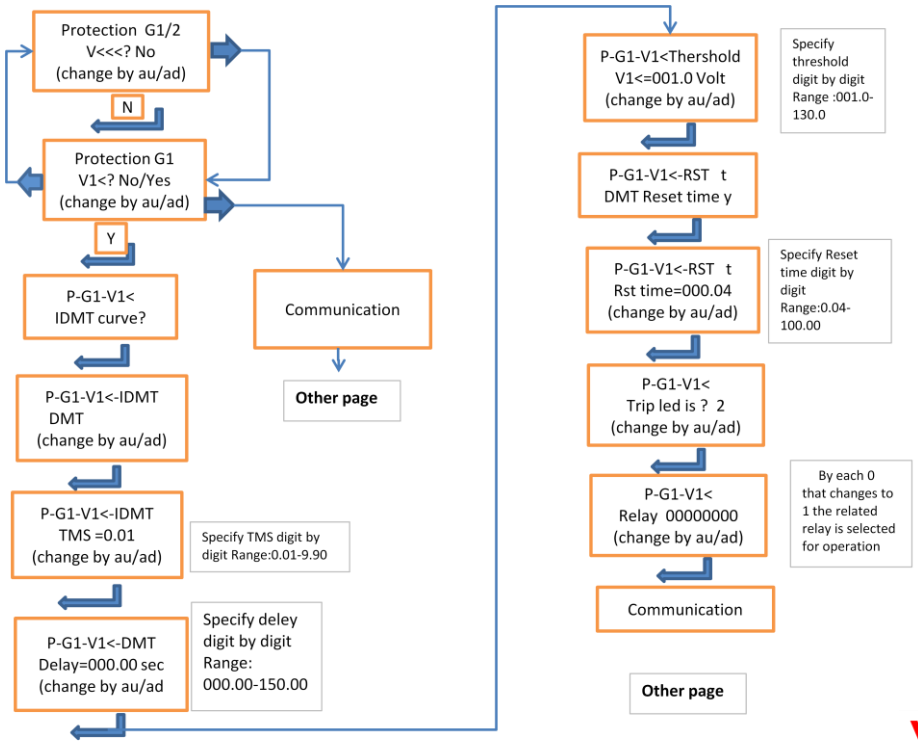
V< setting menu



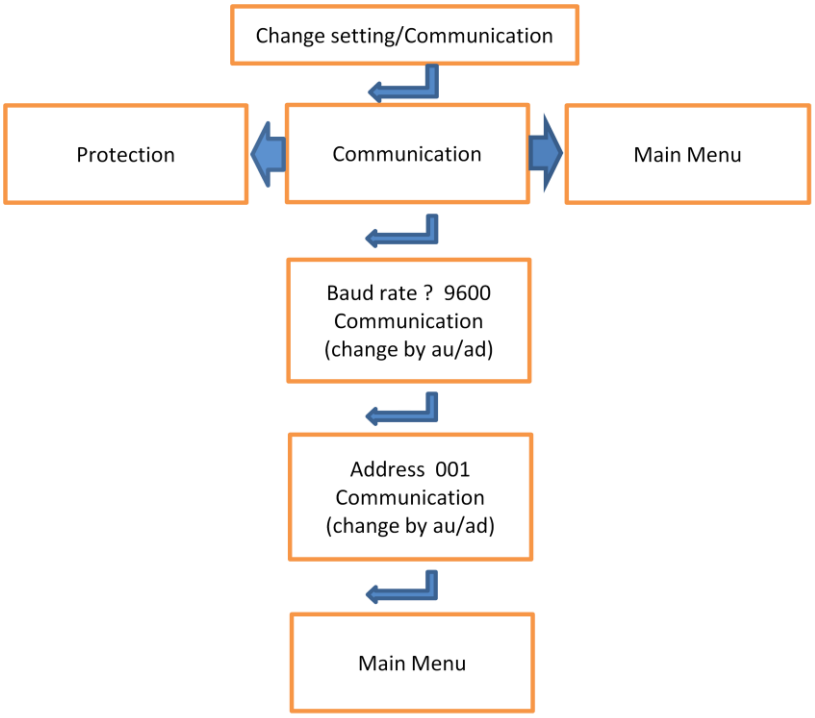
V<< setting menu



V<<< setting menu



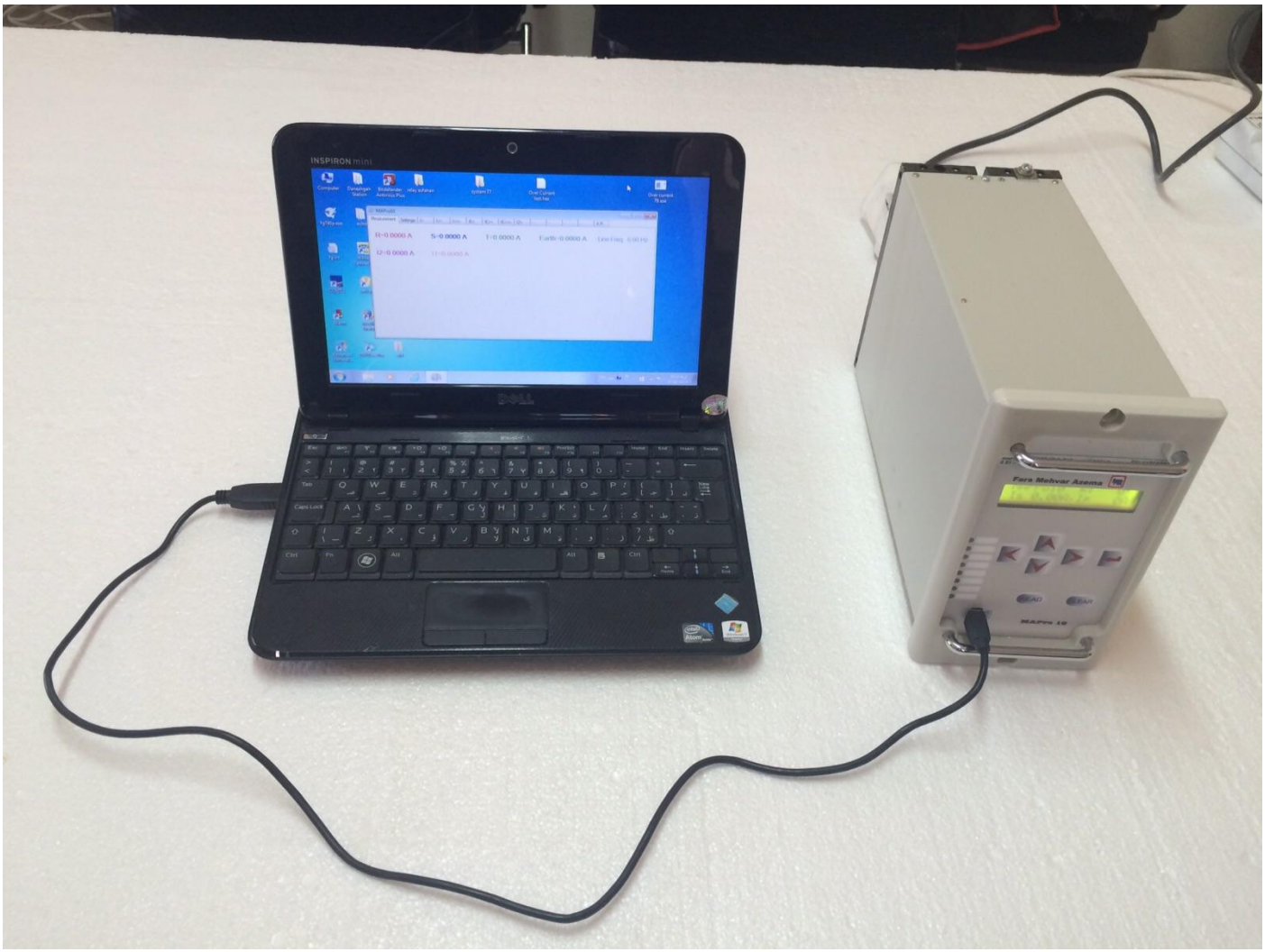
V1< setting menu



Communication Setting Menu

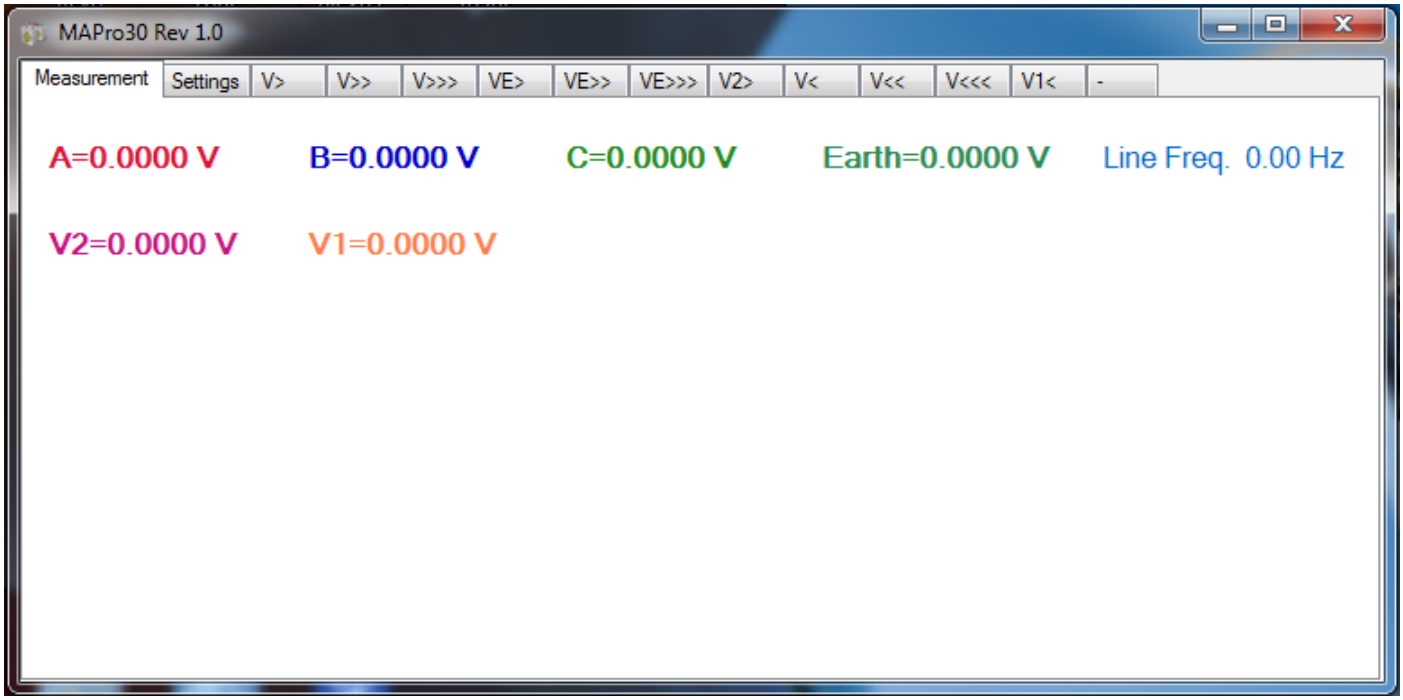
U – 2.3: PC software to Relay

System Setting with PC



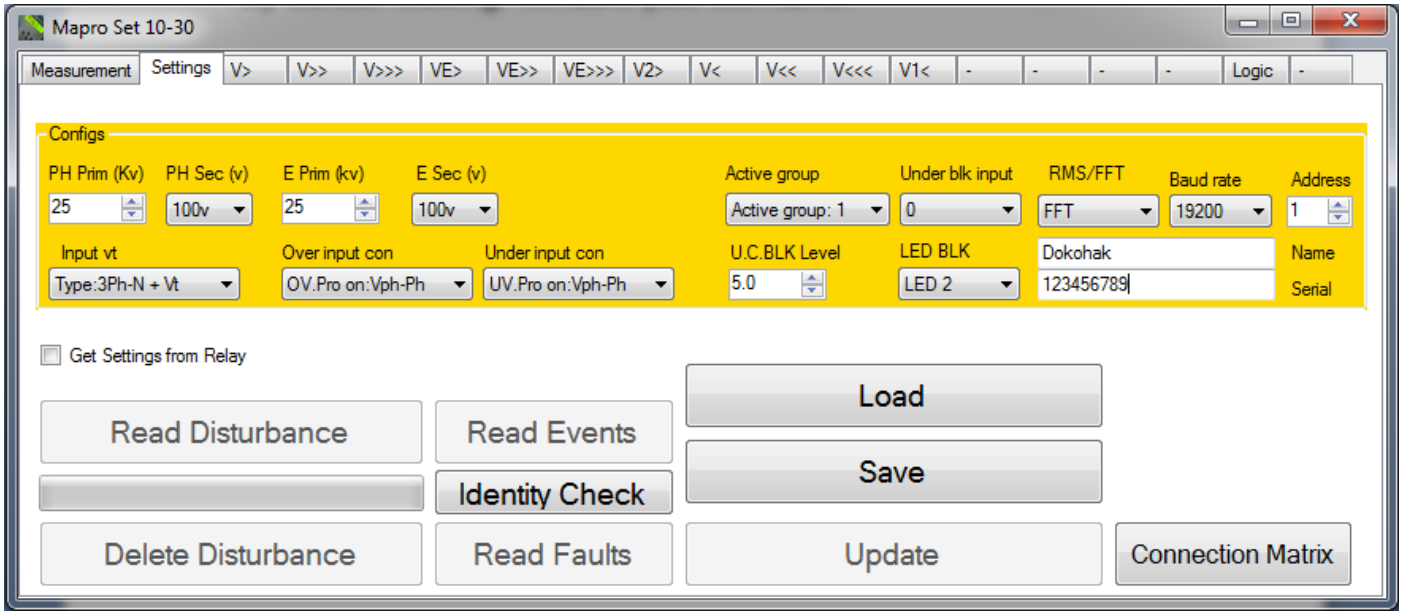
- Connect system with USB cable to PC.
- Install driver (FTDI driver)
- Run “ MAPro Setting.exe” Program.

After it you have below menu.



- Use these menus for system setting.

- By select “setting” window you will have:

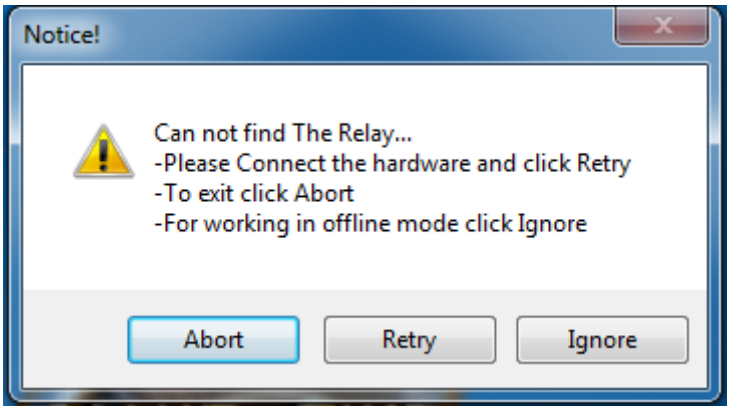


- In this window you have all relay settings.

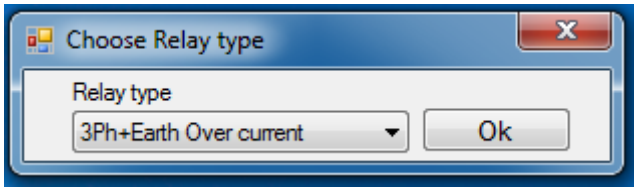
For set new data, you can set every condition and update it. Then go to next page, also you can eliminate mark of “ Update Setting from Relay “

and after it set all pages and finally use ”Update All” or use update page by page.

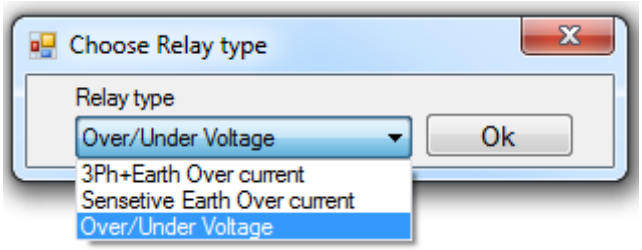
If no connection to system, after running the “MAPro Setting” program you have this menu,



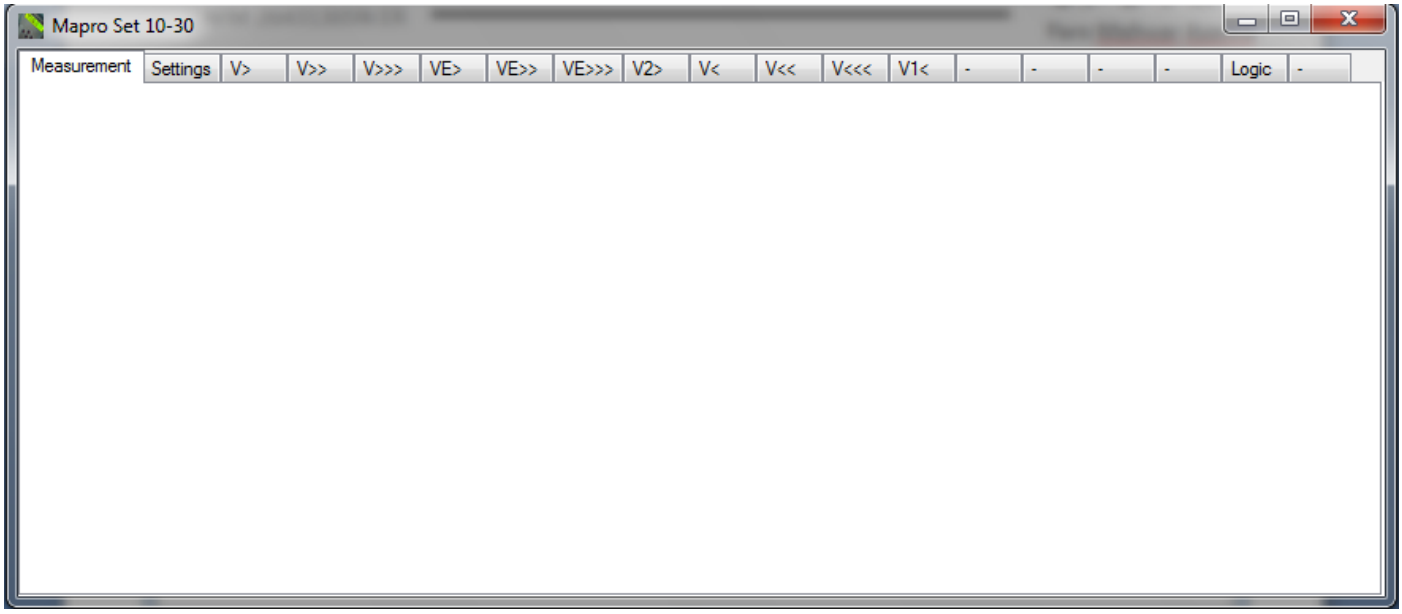
By select Ignore, you will have



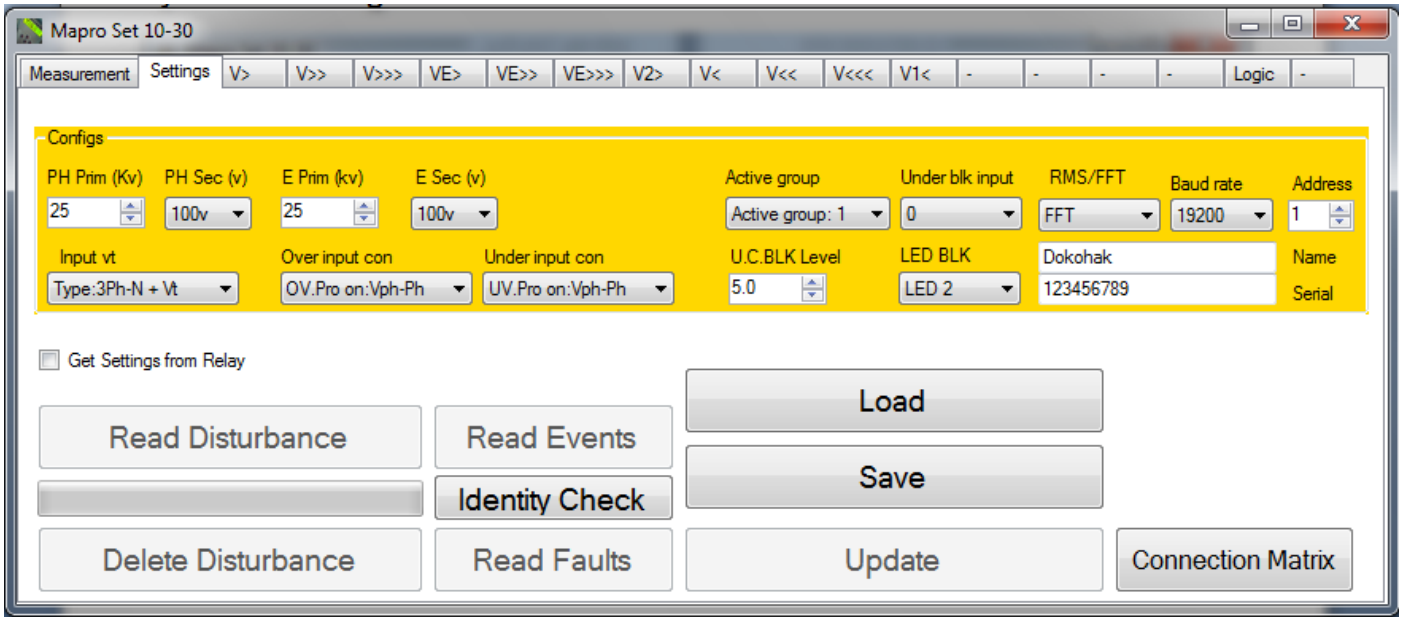
After selecting relay type (3Ph+Earth Over current or sensitive Earth Over current or Over/Under Voltage) you will have it’s setting menu.



For example if select Over/Under Voltage you have:



By select setting window :

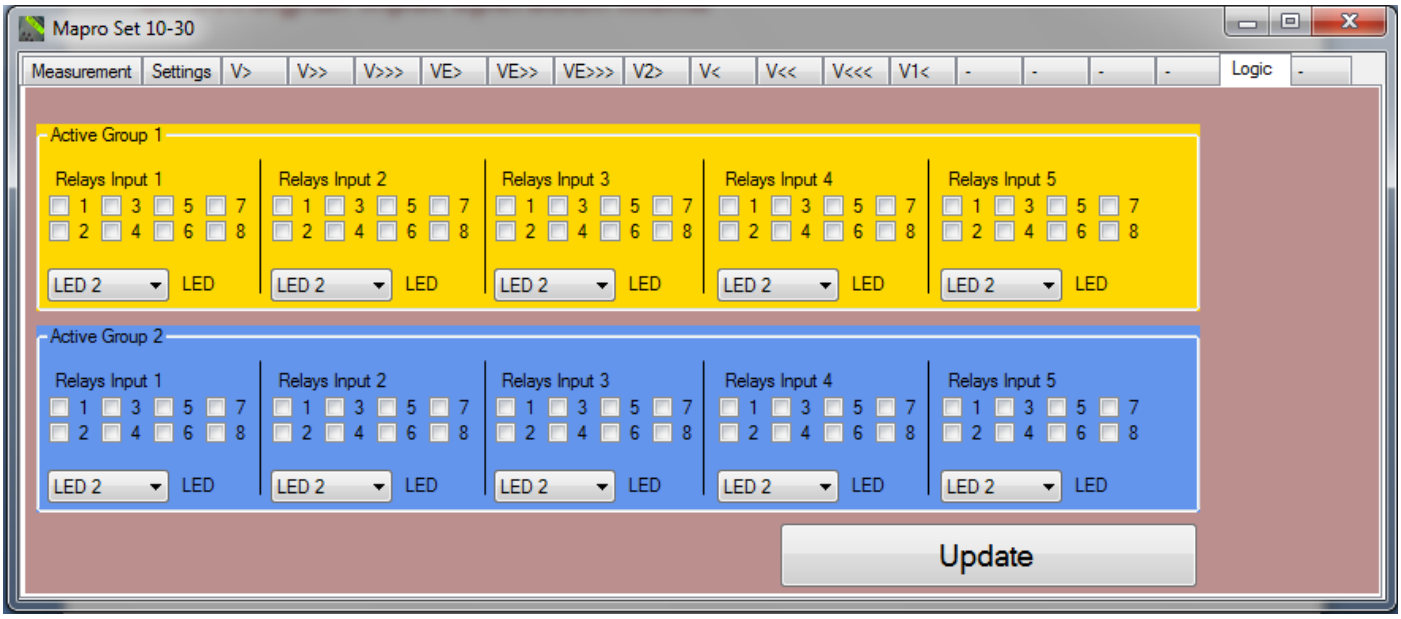


Also for set V> you have this menu:

After set all data you can save it.

By connect the Relay to PC and run “MAPro Setting.exe” program you can “Load” it and use “Update All” to update settings on Relay.

Direct digital input operation menu



Direct digital input operation menu

From this menu, you can specify each of digital inputs, to activate each of outputs relays or LEDs in both groups.