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VARkombi – 12 – PC-TFT

Reactive Power Factor Controller 12 Steps

√Easy to use with English menu
√Advanced dynamic software
√Easy to commissioning
√Large color LCD screen (320 x 240 pixel 3,2")
√Enough number of steps needed (12 steps)
√Quickly and accurately detection power of capacitors
√Normal or fast operation mode selection
√Connecting triphase, double-phase and single-phase capacitor
√Connecting shunt reactors
√Displaying the current and voltage up to the 31. harmonic simultaneously with the graphics
√Total current and voltage harmonics
√Displaying the phase or phases to which connected capacitors in color on the screen
√Making compensation even at low currents (min. 10 mA)
√40 ms measurement, calculation and response time
√Making compensation for the generator according to the second Cos Φ2 set-up
√Displaying many guiding screens
√operating system is used in the micro-processor
√Computer communicated (RS485 MODBUS RTU)
√Password protected
√For balance or unbalance operatings
√Ensuring equal-aging of the capacitors in the same power
√Informing the user for the capacitors losing power
√Measuring temperature
√Following electrical parameters of three phases at the same time

Con-02
RS 485 Ethernet Converter

■Voltage of phases	V(L1,2,3 – N)
■Current of phases	I(L1,2,3 – N)
■**CosΦ** value of phases	CosΦ(1,2,3)
■**TanΦ** value of phases	TanΦ(1,2,3)
■Power factor value of phases	PF(1,2,3)
■Active powers	ΣP,P1,P2,P3
■Inductive reactive powers	ΣQ(ind),Q1(ind),Q2(ind),Q3(ind)
■Capacitive reactive powers	ΣQ(Cap),Q1(Cap),Q2(Cap),Q3(Cap)
■Apparent powers	ΣS,S1,S2,S3
■Total active energy	ΣWh
■Total inductive reactive energy	ΣVARh(ind)
■Total capacitive reactive energy	ΣVARh(Cap)

VARko-112 Reactive Power Factor Controller (Single phase – 12 steps)
VARko-112A Reactive Power Factor Controller (Single phase – 12 steps- Alarm and Fan output)
VARko-106 Reactive Power Factor Controller (Single phase – 6 steps)
VARko-106A Reactive Power Factor Controller (Single phase – 6 steps- Alarm and Fan output)

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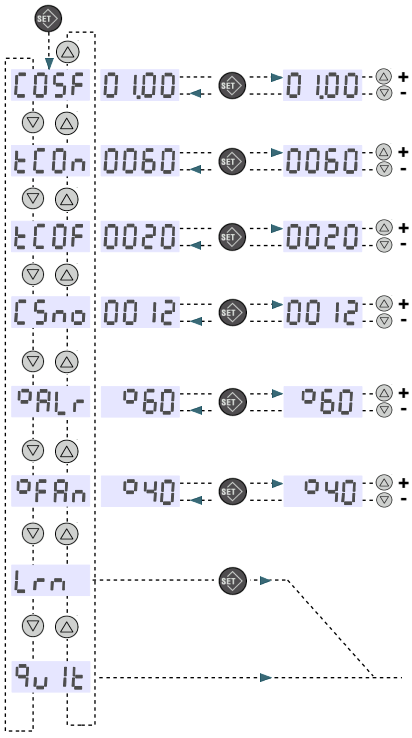
OPERATING MODES

MANUAL MODE:
This is the manual mode. In this mode, device does not switch the banks by its own. It is accessed by pressing down the set button 3 seconds in Main Menu. In this mode, both mode leds are off, '**EL**' text and current display value are continuously interchanged. By pressing down the up button, capacitors are sequentially switched on and by the down button switched off. During the process, the last parameter accessed in the main menu is displayed on the display. By pressing down the set button, system returns to main menu. This mode is used only for testing the system.

LEARNING MODE :
When the device is energized for the first time,it detects the current transformer polarity even if connected in reverse direction and then capacitor switching is done as 'first-in-first-out'. Device starts to calculate each bank's power after every switching. When the device has learned all the capacitor bank's power, it operates in full automatically by the device.

SET UP

►**SEt :** The parameters to be set are under this menu. Desired parameter can be accessed by using the direction buttons. On the display, parameter name and numerical value are shown by interchanging. To change the parameter values, press the set button, using the direction buttons reach the desired value. By pressing down the set button, displayed value is stored and the menu is directed to interchange screen. To quit from set menu, pass to 'quit' section and press Set button on it.



COSΦ: It is the section that Cosφ value is set in the range of ± 0.80 – 1.00
Default value is 1.00

tCOn : (Max. capacitor bank switch on time) It can be adjusted in the range of 3-120 seconds.
Default value is 15 sec.

tCOF : (Max. capacitor bank switch off time) It can be adjusted in the range of 10-60 secs.
Default value is 10 sec.

CSno : It is the section that used to set used capacitor step number. Capacitor step number is set in the range of 3-8/12. Parameter name and capacitor step number are shown by interchanging on the screen.
Default value is 12

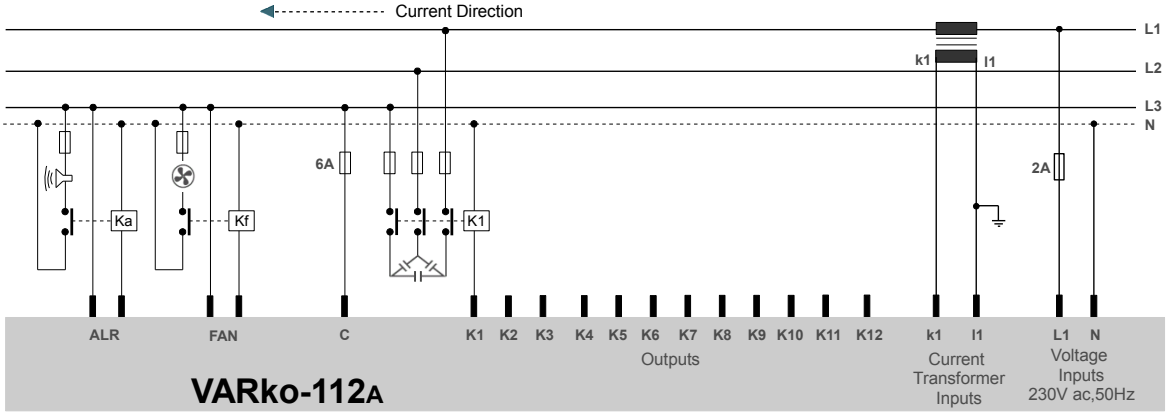
°ALr : It is the set value for over temperature alarm message (°C)
If the temperature exceeds to the alarm set value, then alarm relay is activated and device switches off all steps respectively.

°FAn : The setpoint temperature for the start of the fan(°C)

Lrn : When the newcapacitor/s are connected the system, you shoud start to learning mode. Device starts to calculate each bank's power after every switching .When the device has learned all the capacitor banks' powers, it operates in fully automatically by the device.

quit : Pressing down the set button, device returns to main menu.

Connection Diagram



VARko-112A

VARko-312 Reactive Power Factor Controller

with 3 Phases voltage and current

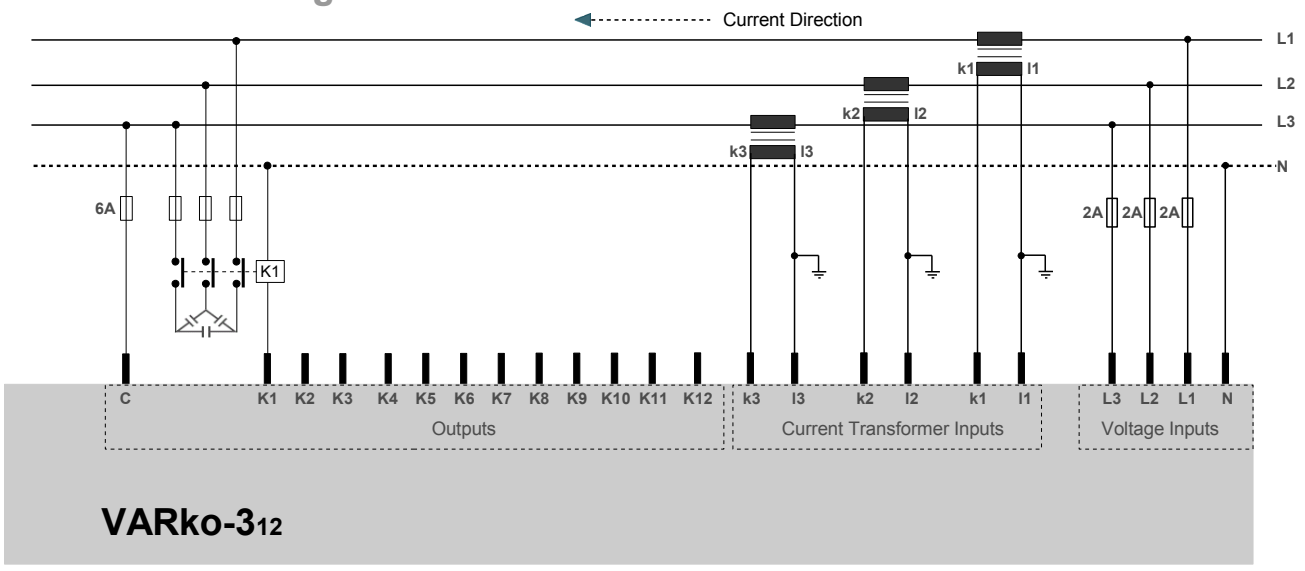
The most important properties of VARko-3xx that make it different from traditional type controllers are ;

1- Measuring current and voltage samples from all 3 phases, calculating active and reactive powers and storing consumed energies,
2- Instead of reaching to target cosΦ value, compensating the system as much as close to real axis between the capacitive and inductive bound values. (Bound values can be changed by the user when desired),
3- Automatic C/k calculation,
4- Automatic learning and monitoring of capacitor bank powers (capacitor bank powers can be set by the user when desired. Device also detects any false setting and corrects it by its own as it operates),
5- Dynamically adjusting of normal region boundaries and capacitor switching on&off times with respect to consumed reactive/active percentage,
6- Extending capacitor bank power life by storing switching on&off times separately for each bank,
7- Automatic learning of current transformer polarities even if (k,l) is connected in reverse direction,
8- Calculating current reactive power value and directly switching on or off the most suitable group instead of sequential switching,
9- Making system tracking and fault detection easier with many hand alarms,
10- Compensation with respect to resultant power factor(Σ cosΦ) calculated as the vectorial sum of three phase powers.

Operating Principles

When the device is energized, it checks first the voltage values. Then, it detects current transformer polarities even if connected in reverse direction. The direction of system's reactive power is calculated through resultant reactive power and resultant power factor. Compensation starts for pulling the system into 'normal region'. Device measures active, inductive (+Q) and capacitive (-Q) powers for each phase and stores the consumed energies. After mathematical calculations, inductive and capacitive percentage values of the system are calculated continuously and the system is kept under control.
Capacitor switching on&off times are calculated separately for each bank. When necessary, the appropriate bank is directly switched if its time is up. Since the Switching Time Values and Normal Region Boundaries are related to consumed energies, they change between the max and min values proportional to percentage energies. During the operation, every capacitor bank's power is calculated when it is switched. Therefore, any change of the capacitor bank's power is detected and stored. Instead of sequential switching of capacitors, the most suitable bank is directly switched. VARko-3xx contains 9 alarms from AL01 to AL09 and 1 alarm relay output to warn and inform the user. Alarms are; over voltage, under voltage, over current, over compensation, under compensation, system fault, capacitor bank fault, phase failure and over temperature. If desired, as much as alarms can disabled by the user. Device also measures the panel temperature and energizes the fan relay when temperature exceeds adjusted fan relay limit (adjusted separately from temperature alarm). 4 different operating modes of the device exist. When the device is energized for the first time, it starts from Mod 1. The device can be restricted to Mode1 or Mode 2 if desired. Otherwise it promotes to full automatic mode, Mode 3, after learning/setting all capacitor bank values.

Connection Diagram:



VARko-312

VARkombi-PC Reactive Power Factor Controller

RS485 MOD-BUS RTU

General Information

When traditional type reactive power controllers are used, specially for unbalanced 3 phase systems, compensation process gets more complex and for some of the situations it is a nightmare. To overcome this problem, experience, knowledge and scientific background are put together with the help of high technology and VARkombi-PC, 3 phase evaluative reactive power controller, is developed by KAEL Elektronik.

The most important properties of VARkombi-PC that make it different from traditional type controllers are;

1- Measuring current and voltage samples from all 3 phases, calculating active and reactive powers and storing consumed energies,

2- Instead of reaching to target tanΦ value, compensating the system as much as close to real axis between the capacitive and inductive bound values. (Bound values can be changed by the user when desired),

3- Automatic C/k calculation,

4- Automatic learning and monitoring of capacitor bank powers (capacitor bank powers can be set by the user when desired. Device also detects any false setting and corrects it by its own as it operates),

5- Dynamically adjusting of normal region boundaries and capacitor switching on&off times with respect to consumed reactive/active percentage,

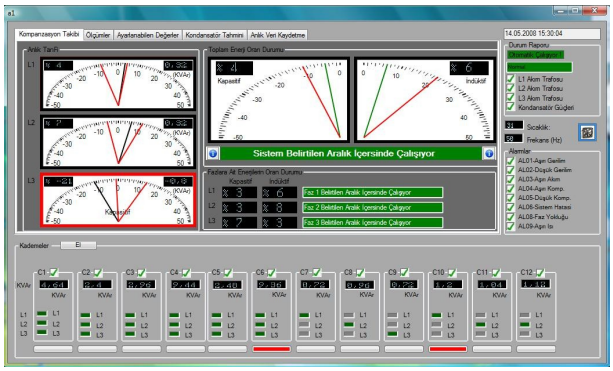
6- Extending capacitor bank power life by storing switching on&off times separately for each bank,

7- Automatic learning of current transformer polarities even if (k,l) is connected in reverse direction,

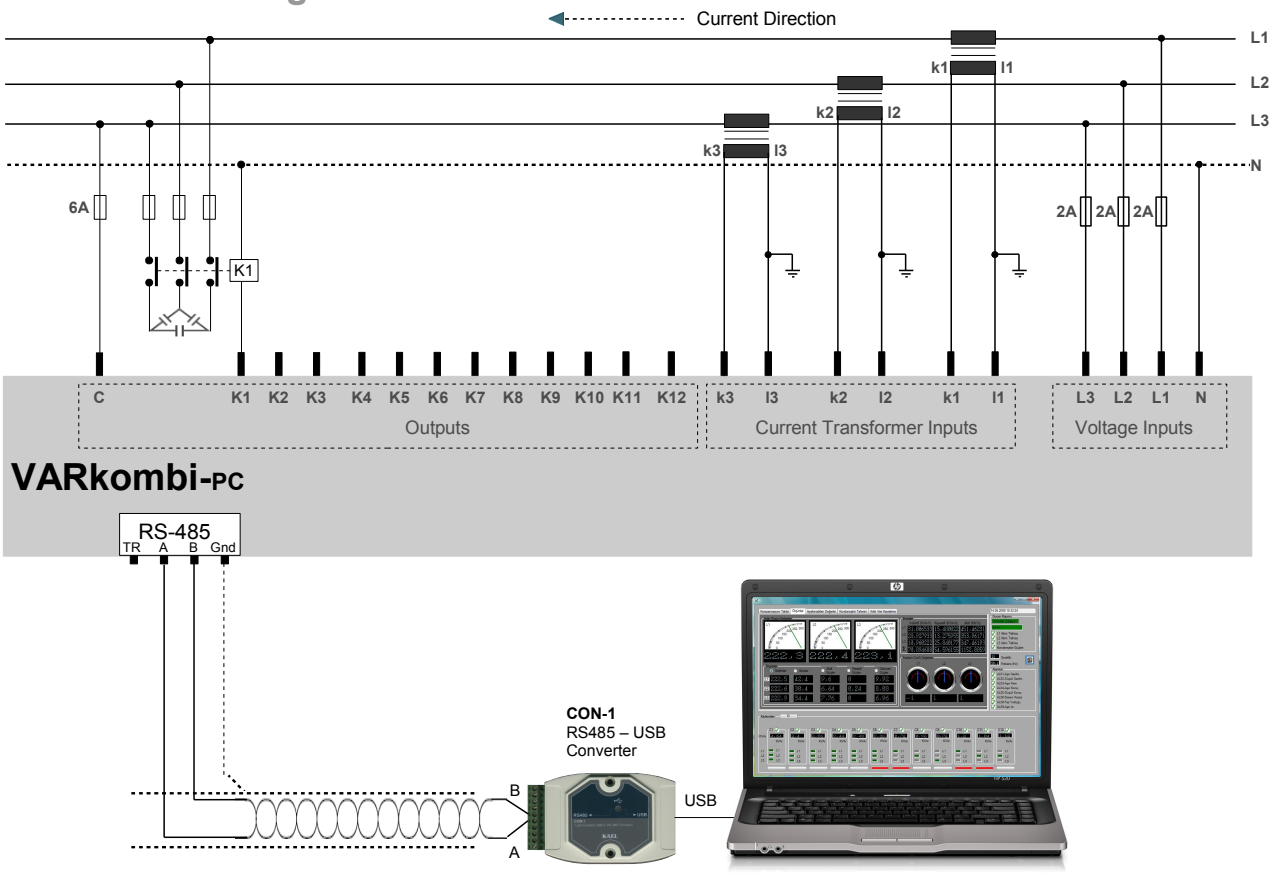
8- Calculating current reactive power value and directly switching on or off the most suitable group instead of sequential switching,

9- Making system tracking and fault detection easier with many hand alarms,

PC Software



Connection Diagram:



MULTISER

01-PC-TFT
02-PC-TFT
03-PC-TFT
04-PC-TFT

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Micro SD
2 – 32 GB

NETWORK ANALYSER & Data Logger

Features

- Easy use with menu
- Wide screen LCD (320 x 240 pixel 3,2")
- Many leading screen displays
- Operating system is used for the microprocessor
- Improved dynamic software
- Ability to enter current and voltage transformer rates
- True RMS
- Voltage, current and harmonic protection
- Multiple alarms
- Memory (upto Micro SD 32GB)
- Password protection
- Waveforms (power, current and voltage)
- Graphical reports (Powers, Voltages, Currents)
- Reports according to date
- 3P&4W, 3P&3W, ARON Connection

MODEL

Measurements can be viewed by RS485 Modbus RTU

VL1,VL2,VL3
VL12,VL23,VL13
IL1,IL2,IL3, I_Neutral,Hz
P1,P2,P3,Q1,Q2,Q3,S1,S2,S3
CosΦ1,CosΦ2,CosΦ3
PFD1,PFD2,PFD3,ΣPF
ΣP,ΣQi,ΣQc,ΣQ,ΣS
imp-exp ΣkWh
imp-exp ΣkVARh(ind)
imp-exp ΣkVARh(cap)
ΣkVAh
3 – 31. harmonics of current
3 – 31. harmonics of voltage

Standard Features

- Voltage
  Current
  Power Factor
  Frequency
  Active Power
  Reactive Power
  Apparent Power
  Active Energy
  Reactive Energy
  Neutral Current
  THD-V and THD-I
- Peak and Demands
- True RMS
- Current Transformer Ratio
- Voltage Transformer Ratio
- Password protection
- 3P&4W,3P&3W, ARON connection

	3 - 31. harmonics	3 - 63. harmonics	Current Unbalance %	Voltage Unbalance %	Voltage, Current and Harmonic Protection	Alarms	Waveforms (signals of Voltage and Current)	Graphic Reports (power, current and voltage)	Alarm Reports by date	Energy Counter for Generator	Working Time	Relay outputs (2)	Digital Inputs (2)	Energy pulse ouputs (2)	RS-485 MODBUS-RTU	Memory (up to MicroSD 32 GB)	Colour TFT (3,2")	96 x 96
MULTISER-01-PC-TFT	■														■	4GB	■	■
MULTISER-02-PC-TFT	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	4GB	■	■
MULTISER-03-PC-TFT	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	4GB	■	■
MULTISER-04-PC-TFT	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	4GB	■	■

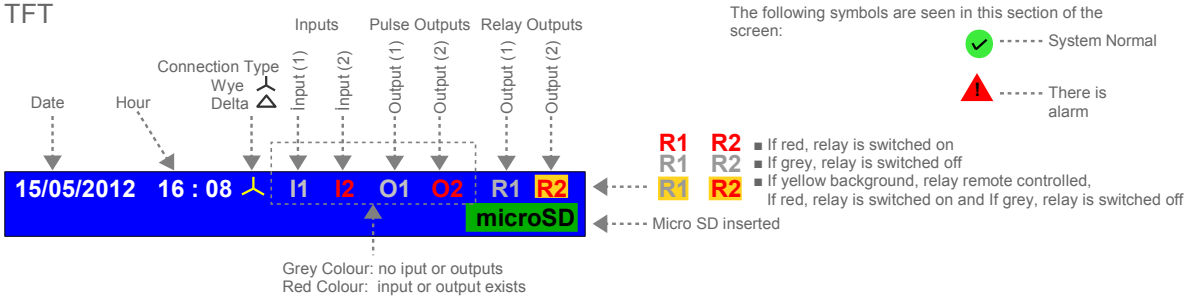
General

As in the whole world, efforts are implemented in our country in all sectors for the management and saving of electric power. Here the most significant issue is to have an energy analyser produced with today's technology which may carry out correct measurements and analysis.

KAEL Elektronik, combined its experiences n the sector and added a brand new energy analyser which is fully equipped in terms of functional richness and with improved software, into the electric sector . The device has a 3,2" colored LCD screen thus the users are provided many facilities with charts and animations. Moreover, it has a very fast microprocessor and an operating system. This enabes it to carry out all the operations simultanesouly. Moreover, the micro SD memory card which may be extended upto 32GB, is the first in the sector.

Information Panel

An Information Panel consisting of easily understandable symbols is placed on top of the screen. This panel, is always at the top irrespective of the section the user uses. Information as date, hour, inputs, pulse outputs, relay outputs, micro SD is inserted or not may be seen simultanesously in this panel. Input and Pulse output is only available on MULTISER -03-PC-TFT

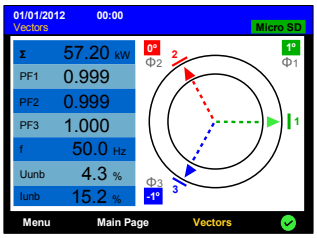


In order to make use easier and more understandable, coloured LCD screen was used. If the keys are not pressed for a long time, the device passes to screensaver mode to extend screen life and the information panel which is displayed only at the top may gradually slide down from the top. When any key is pressed, main screen view is restored.

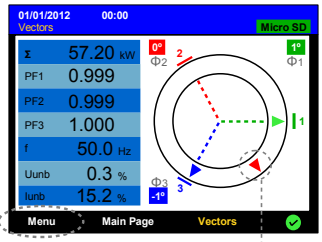
Vectors

In this page, the total active power, power factors for each phase, frequency, percentage of unbalance voltages percentage of unbalance between currents and angular display of currents and voltages on 3 phase vector diagram and angle (ø) may be followed.

In the first start up, it may be checked whether the connections are correct or not by observing the vector diagram. The total active power of the system may be monitored easily.
Information on whether the system is balanced in terms of current and voltage may also be followed.



An example of connection control

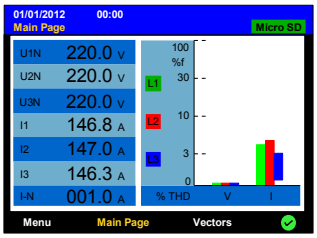


polarities of the output of the current transformer for L2 phase was reverse

Please check the time and date. If they are incorrect than make sure to adjust the real time-date from the settings part in the menu. Otherwise all reports may have incorrect timing.

Main Page

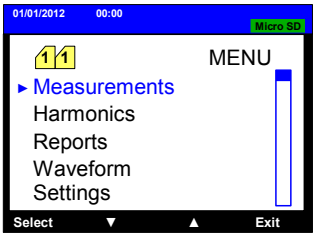
Voltage, neutral current, total harmonic distortion for currents and voltages which are among the electrical measurements mostly required by users may be followed in this screen.



1. MENU

This is the section where many electrical measurements and formed reports may be followed more exhaustively and settings are made. Parameters in the menu may be accessed with direction keys and the parameter is entered with selection key and parameter is left with the exit key.

NOTE: Settings may only be accessed by means of a password.

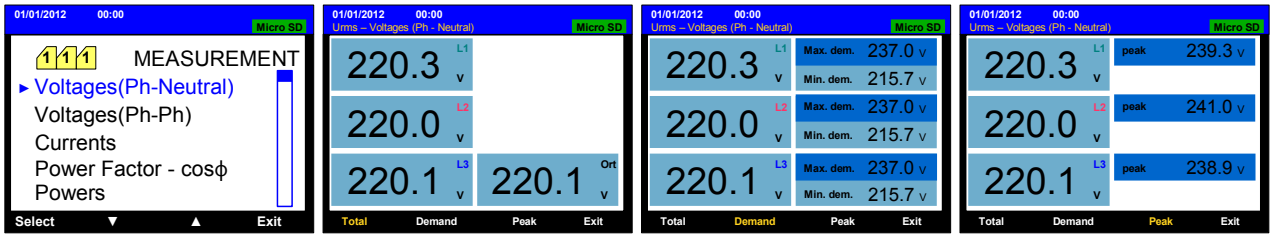


1 1 Measurements

Voltage and current for 3 phase and the peaks, demands, power factor, import and export energy may be monitored in details in the measurement menu.

1 1 1 Voltages (Phase-neutral)

Phase-neutral voltages for 3 phases, their averages, peak and demand values are found in this menu. Deletion of demand and peaks and setting the demand period may be done in the demand operations section in Settings menu.

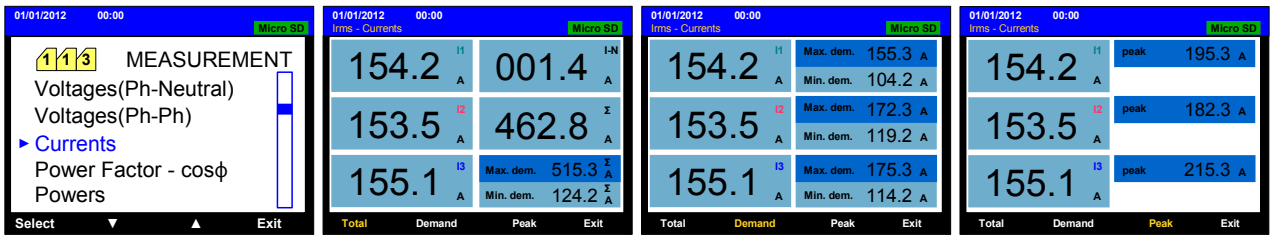


1 1 2 Voltages (phase-phase)

Phase-phase voltages for 3 phases, their averages, peak and demand values are found in this menu. Deletion of demand and peaks and setting the demand period may be done in the demand operations section in Settings menu.

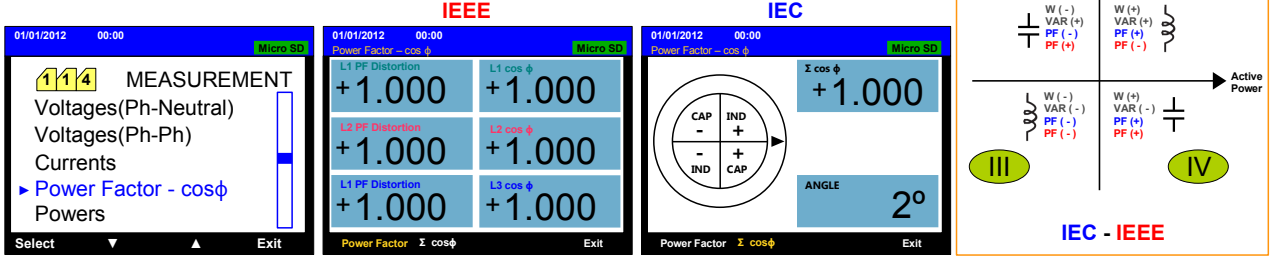
1 1 3 Currents

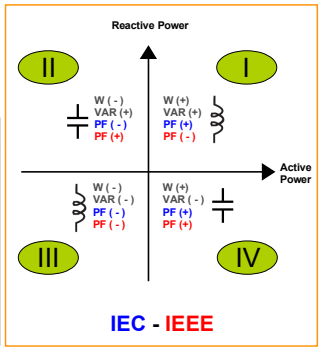
Currents for three phase, neutral current, total current and their peak-demand values are found in this menu. Deletion of demand and peaks and setting the demand period may be done in the demand operations section in Settings menu.



1 1 4 Power Factor - cosϕ

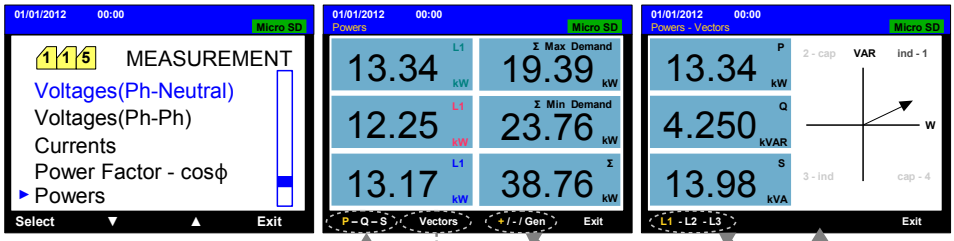
Both power factors and cosø and total cosø and angle values may be followed in this menu. It may be followed by a chart in which section the total cosø is.





115 Powers

This is the section where either for each section or total active, reactive, apparent powers and total demand may be followed. Import, export powers and powers of the generator may be accessed through “+/-Gen” key. Furthermore, active, reactive, apparent power values and their directions on vectoral plane for each phase may be monitored with each vector key. Deletion of demand and peaks and setting the demand period may be done in the demand operations section in Settings menu.



Yellow indicates to which power value it belongs, for ex: here “P”” is yellow and means that the power values on the screen belongs to active power. “Q” reactive power and “S” apparent power may be accessed by pressing the button respectively.

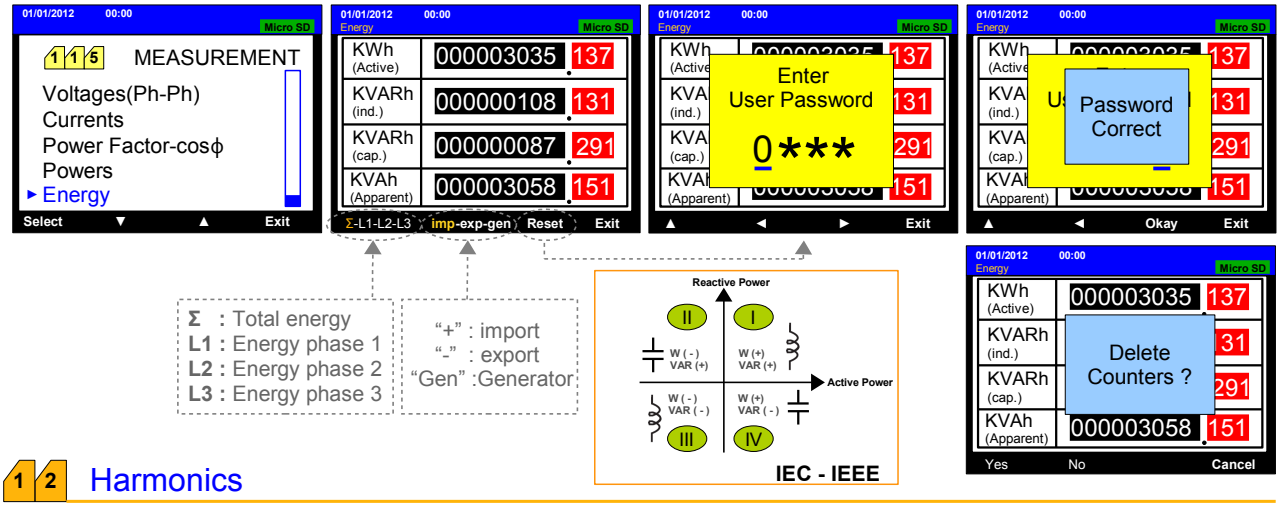
“+” : import
“-” : export
“Gen” :Generator

It means values of phase with yellow colour is indicated.

116 Energy

This is the section where active, reactive (inductive and capacitive) and apparent energies consumed per each phase and total active, total reactive (inductive and capacitive) and total apparent energies consumed by the whole system is followed. Counters will be zero When reset key is pressed . The screen where user password is entered appears. When password is entered, the question “Delete counters?” appears on the screen. If yes is pressed all counters are deleted.

For operations of entering the password, please see the password operations section in the SETTINGS menu.

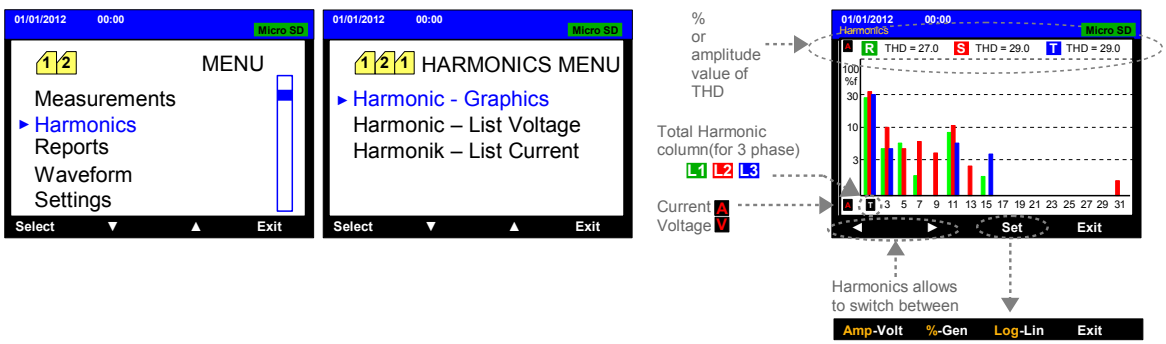


Σ : Total energy
L1 : Energy phase 1
L2 : Energy phase 2
L3 : Energy phase 3

“+” : import
“-” : export
“Gen” :Generator

12 Harmonics

This displays harmonic amplitude of both current and voltage values and % values for the three phases in coloured graphic screen in linear or logarithmic form upto 31st harmonic.



% or amplitude value of THD

Total Harmonic column(for 3 phase)
L1 L2 L3

Current A
Voltage V

Harmonics allows to switch between

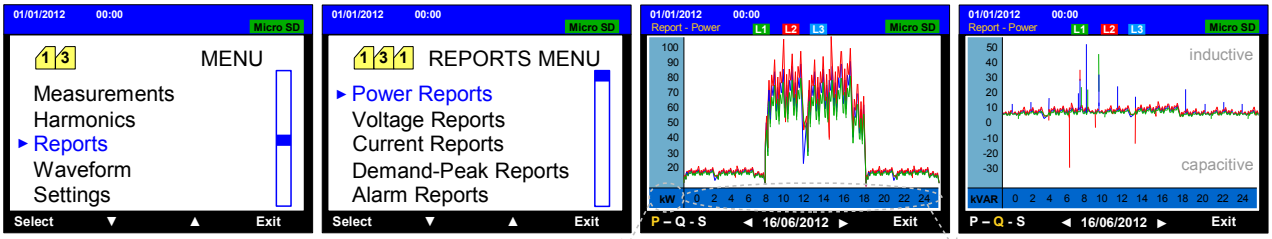
Amp-Volt : Current or voltage
% - Gen : % or amplitude
Log – Lin : linear or logarithmic.

1 3 1 Power Reports

It is used to observe the power values (active, reactive and apparent) saved in the memory of the device (micro SD 4 GB) chronologically in graphical form. The 3 colours in the screen symbolize 3 phases separately thus

- Maximum loading status of distribution transformers
- First start-up and operation-stop hours of the machinery in the plant
- Maximum power consumption for all operations
- Determination of machinery or devices left operating during night time
- THours of elongated electricity cut-off for all operations

may easily be monitored and it constitutes a ground for taking the required measurements. Note: Date may be changed with keys ◄ and ►

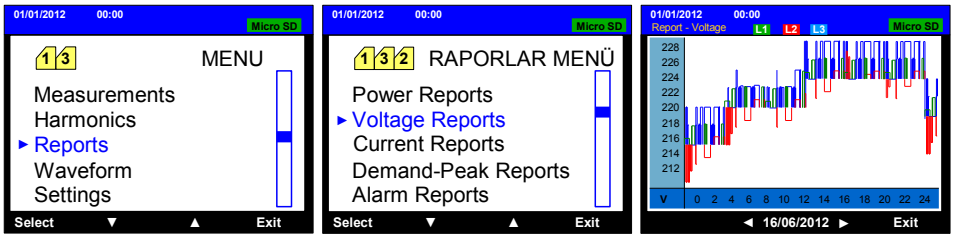


1 3 2 Voltage Reports

It is used to observe the voltage values per phase saved in the memory of the device (micro SD 4 GB) chronologically in graphical form. The 3 colours in the screen symbolize 3 phases separately thus;

- whether very high or very low voltage values are achieved in various times of the day (in particular in there are devices that frequently get broken, network voltage is monitored)
- Hours of elongated electricity cut-off may easily be monitored and it constitutes the ground for the required measurements.

NOTE : Date may be changed with keys ◄ and ►

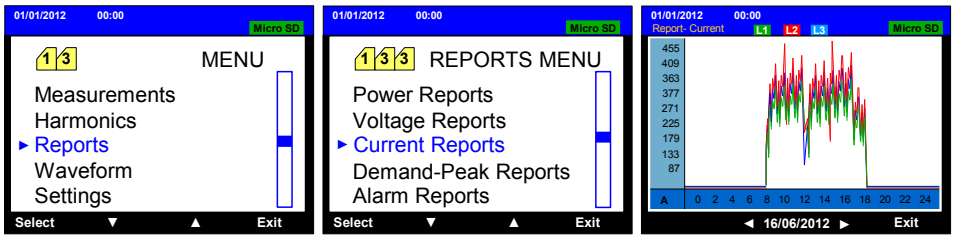


1 3 3 Current Reports

It is used to observe the current values saved in the memory of the device (micro SD 4 GB) chronologically in graphical form. Thus:

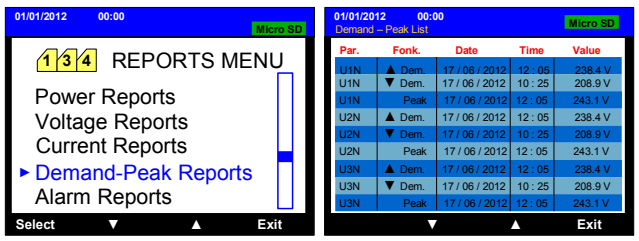
- Maximum load currents of the distribution transformers
- Maximum current value determination for all operations may be possible (it may be used to determine whether the existing power switch and fuse values are suitable or not)

NOTE : Date may be changed with keys ◄ and ►



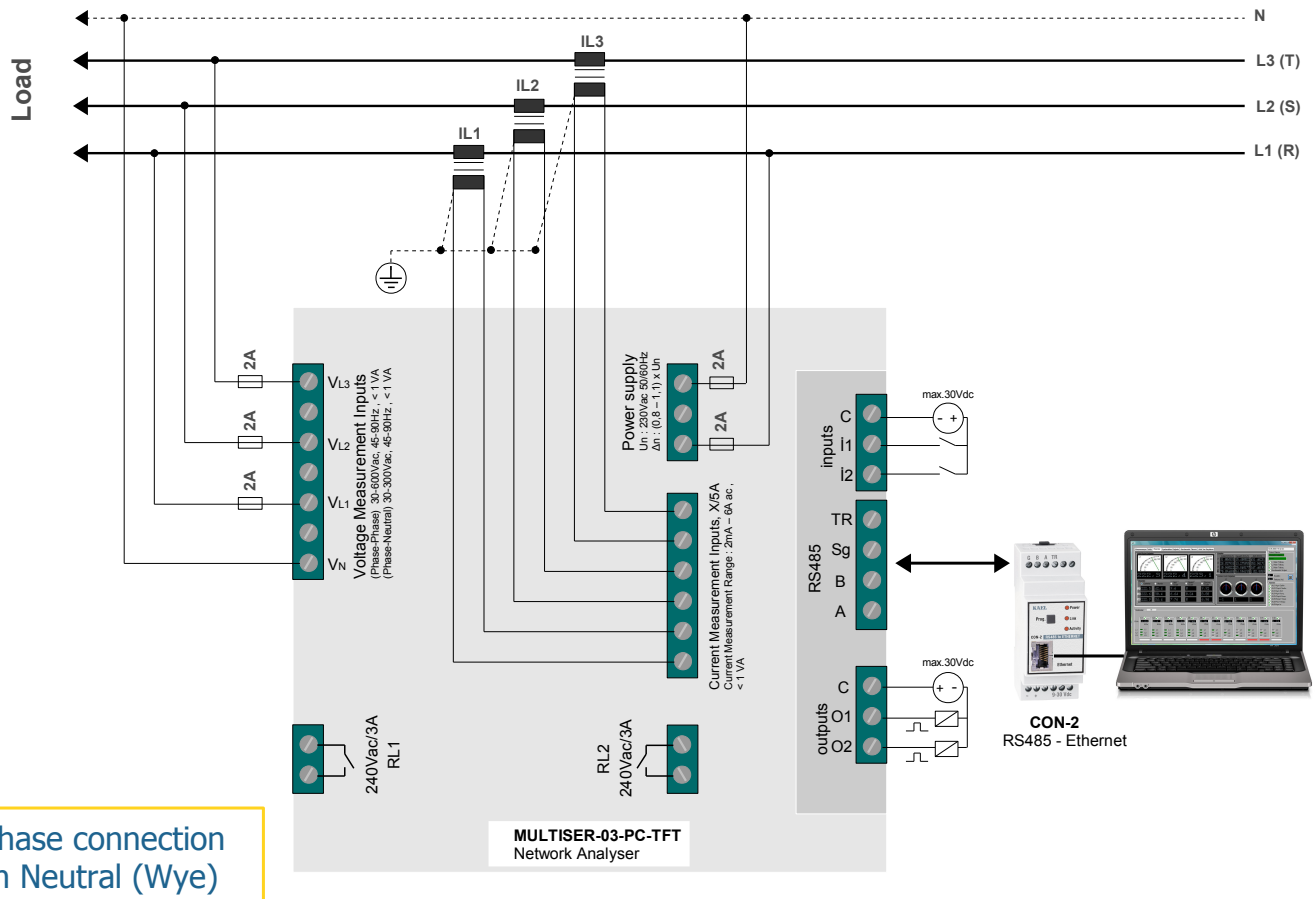
1 3 4 Demand - Peak Reports

This is the menu where maximum demand, minimum demand and peak values of the below given electrical magnitudes may be accessed. It is used to monitor latest formation date, time and value of those parameters saved in the memory of the device as a list.
For deletion of demand and peaks and determination of demand time may be done from the demand operations section of the SETTINGS menu. Other parameter pages may be accessed with ▲ and ▼ keys.

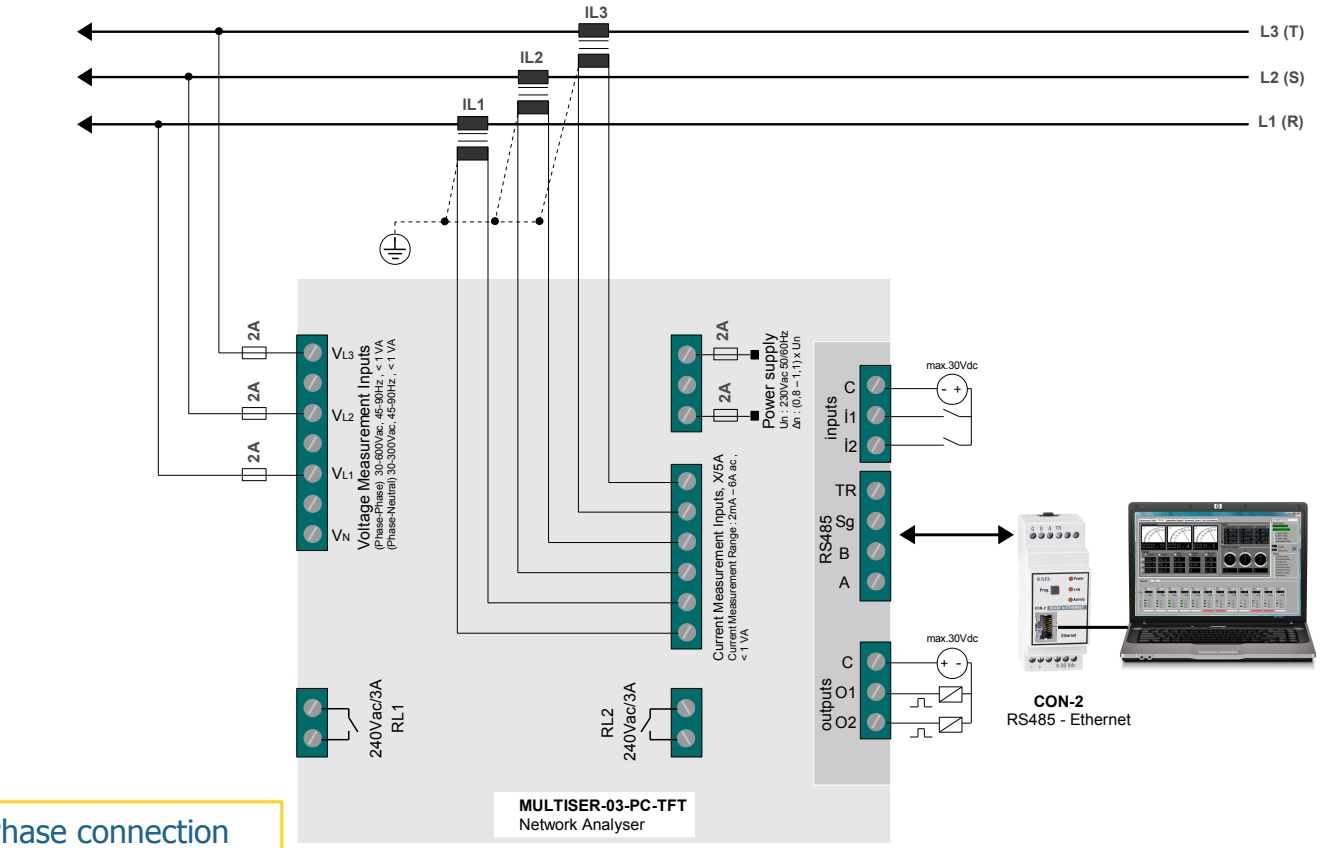


▲ **Dem.** : maximum demand
▼ **Dem.** : minimum demand
Peak : peak value

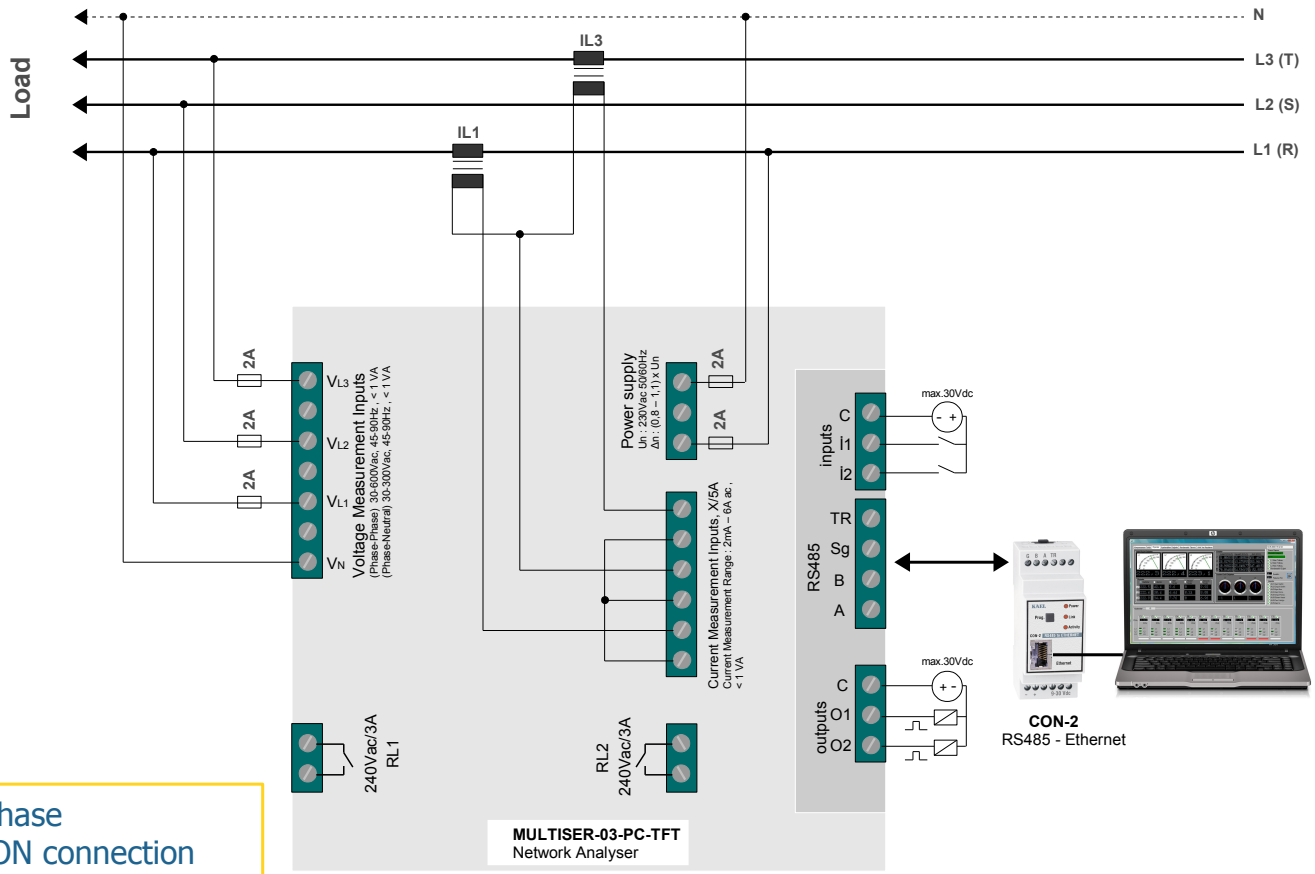
Connections



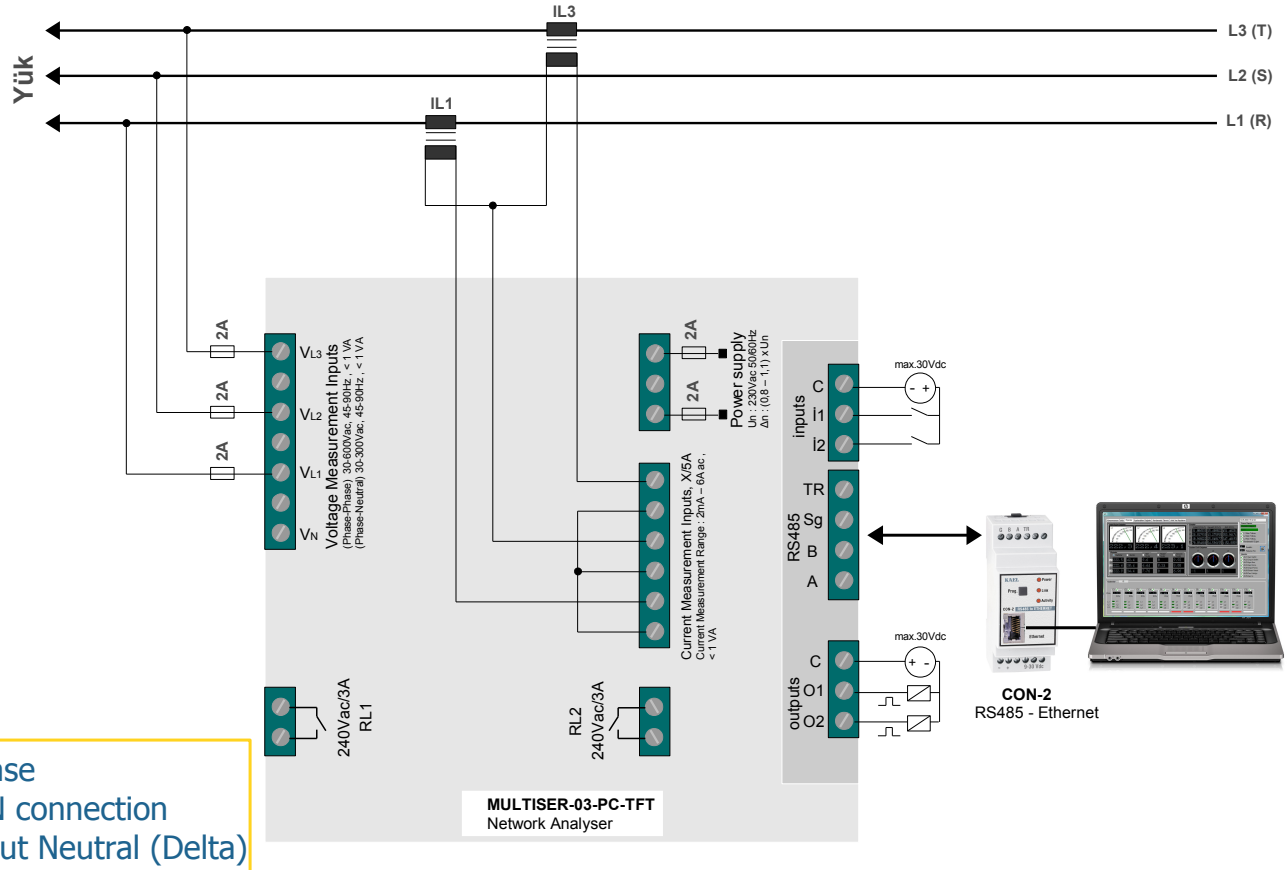
3-Phase connection with Neutral (Wye)



3-Phase connection without Neutral (Delta)



3-Phase
ARON connection
with Neutral (Wye)

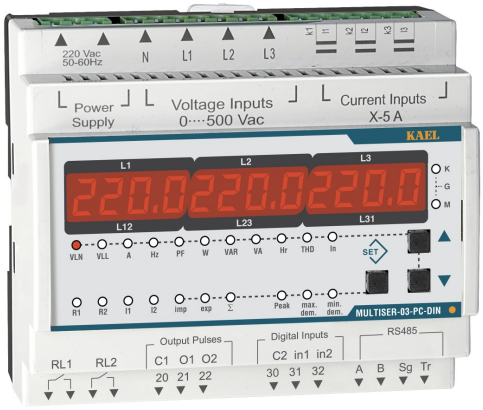


3-Phase
ARON connection
without Neutral (Delta)

MULTISER 03-PC-96 02-PC-96 01-PC-96 01-96

MULTISER 03-PC-DIN 02-PC-DIN 01-PC-DIN 01-96

NETWORK ANALYSER



TÜV SÜD · GOST-R · CE · ISO 9001:2008

www.kael.com.tr

KAEL Mühendislik Elektronik Tic. ve San. Ltd.Şti.

PARAMETERS:	MULTISER-03-PC	MULTISER-02-PC	MULTISER-01-PC	MULTISER-01
Ct : current transformer ratio (1...5000)	■	■	■	■
Ut : voltage transformer ratio (1...4000)	■	■	■	■
Denn Set : Demand SET	■	■	■	■
PIN: (Pasword)	■	■	■	■
PULS oUt : Pulse out	■			
PULS In : Digital input	■			
rELE oUt : Settings of Relay outputs	■	■		
bUS rtU : Settings of Modbus RTU	■	■	■	
CLr : clear	■	■	■	■
Coon tyPE : connection type	■	■	■	■
rES ALL PAr : reset all values	■	■	■	■

MODEL

With RS485 MODBUS RTU	Standart Benefits	ALARMS (Over Voltage – Under Voltage and Voltage Unbalance)	ALARMS (Over Current – Under Current and Current Unbalance)	ALARMS (Phase sequence–Phase failure Over THD-V and Over THD-I	2 Relay Outputs	2 Digital inputs	2 Pulse Outputs for energies	RS-485 MODBUS-RTU	LED display	96 x 96	DIN
VL1,VL2,VL3 VL12,VL23,VL13 IL1,IL2,IL3,I-Neutral,Hz P1,P2,P3,Q1,Q2,Q3,S1,S2,S3 CosΦ1,CosΦ2,CosΦ3 PFD1,PFD2,PFD3,ΣPF ΣP,ΣQi,ΣQc,ΣQ,ΣS imp-exp ΣkWh imp-exp ΣkVARh(ind) imp-exp ΣkVARh(cap) ΣkVAh 3 – 31. harmonics for currents 3 – 31. harmonics for voltages	■ Voltage Current Power Factor Frequency Active Power Reactive Power Apparent Power Active Energy Reactive Energy Neutral Current THD-V and THD-I ■ Peaks and Demands ■ True RMS ■ Current and Voltage Transformer Ratio ■ Password ■ 3P&4W , 3P&3W , ARON connection										
MULTISER-01-96									■	■	
MULTISER-01-PC-96	■							■	■	■	
MULTISER-02-PC-96	■	■	■	■	■			■	■	■	
MULTISER-03-PC-96	■	■	■	■	■	■	■	■	■	■	
MULTISER-01-DIN	■								■		■
MULTISER-01-PC-DIN	■							■	■		■
MULTISER-02-PC-DIN	■	■	■	■	■			■	■		■
MULTISER-03-PC-DIN	■	■	■	■	■	■	■	■	■		■

Introduction

The device was designed to measure, report and analyse the electrical magnitudes in the 3-phase electric network and both design and software were produced by KAEL engineers. The state-of-the-art technologies were inserted in this device and both menus which facilitate the use of the user and the required features were included.

All the information and warnings you need to know concerning the device were described in the user operation manual. Please read this manual carefully before engaging with the device. Please do not take any action before consulting with our company for any matters not clearly understood.

Tel: +90 232 877 14 84 (pbx) Fax: +90 232 877 14 49
Factory: Atatürk Mh. 78. Sok. No:10 Ulucak Köyü Kemalpaşa İzmir- TURKIYE

WARNINGS

1- The device shall be engaged by competent and licensed persons in conformity with the instructions set forth in the operation manual. In case required, controls shall be carried out by such persons also.
2- Do not open the inside of the device or cause to be opened. There are no parts inside the device which the user or anyone else may intervene.
3- Use the device according to assembly instructions
4- Before making electrical connection to the terminals of the device, make sure there is no electric power on the cables and terminals. The switchboard shall not have electric power on.
5- The fuses used in the device are of 1A FF type.
6- Make sure to fix the device on the switchboard firmly without swings with the apparatus given with the device.
7- Do not touch the keys on the front panel of the device with any substance other than your finger.
8- Wipe the device only with dry cloths after making sure the electric energy of the device is cut-off. Water or chemicals used for cleaning may cause damage to the device.
9- Before activating (energizing) your device please make sure that the terminal connections are made according to the connection scheme and without causing any contact problems (loose connection or contact of multiple copper cables).
10. The above measurements and warnings are for your safety. Kael Elektronik Ltd Şti or the dealer may not be held liable for any inconveniences when those warnings are not observed.

Features

- Easy use with menu
- Improved dynamic software
- Ability to enter current and voltage transformer rates
- True RMS
- Voltage, current and harmonic protection
- Multiple alarms
- Password protection
- 3P&4W, 3P&3W, ARON Connection

Measurements

- Voltage (V1N, V2N, V3N , V12, V23, V13)
- Current (I1, I2, I3, ΣI)
- Power Factor (PF1, PF2, PF3)
- **cosΦ** values (CosΦ1, CosΦ2, CosΦ3,)
- Frequency (Hz)
- Active Power (ΣP)
- Inductive Reactive Power [ΣQ(ind)]
- Capacitive Reactive Power [ΣQ(cap)]
- Apparent Power (ΣS)
- Active Energy (ΣkWh)
- Inductive Reactive Energy (ΣkVARh(ind))
- Capacitive Reactive Energy (ΣkVARh(cap))
- Neutral Current (I(N))
- Total harmonic distortion for current and voltage (THD-V ve THD-I)
- Peak and Demands

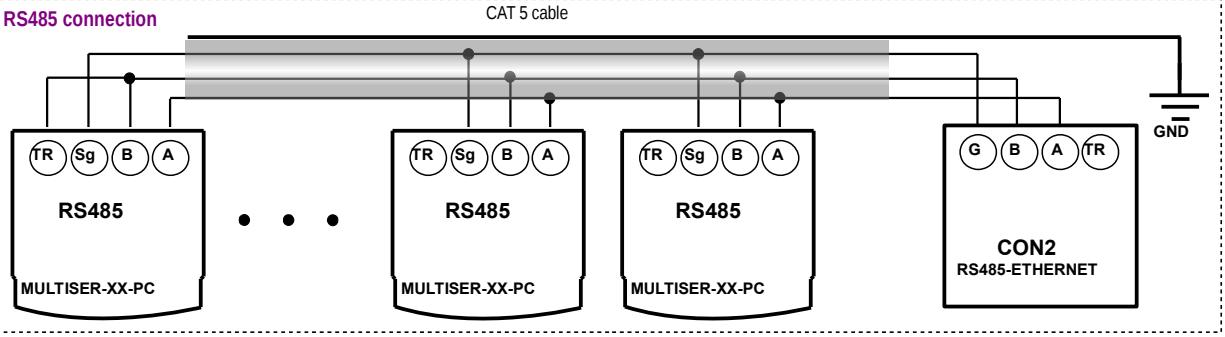
Inputs & Outputs

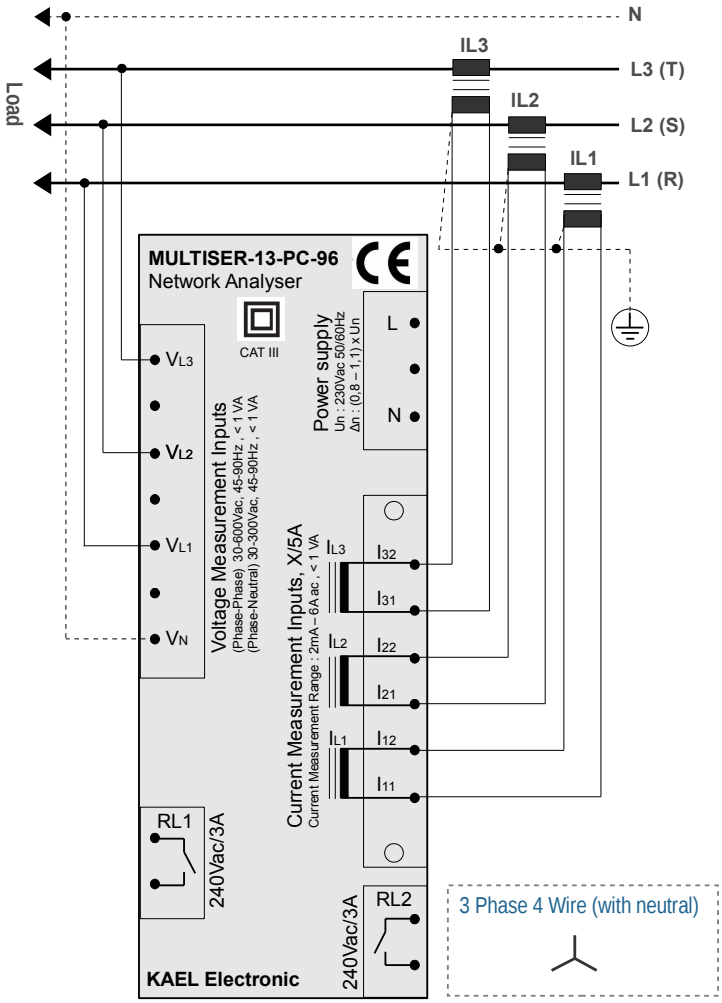
- Relay Output (2pcs)
- Pulse Output (2pcs)
- Digital Inputs (2pcs)
- RS-485 MODBUS-RTU

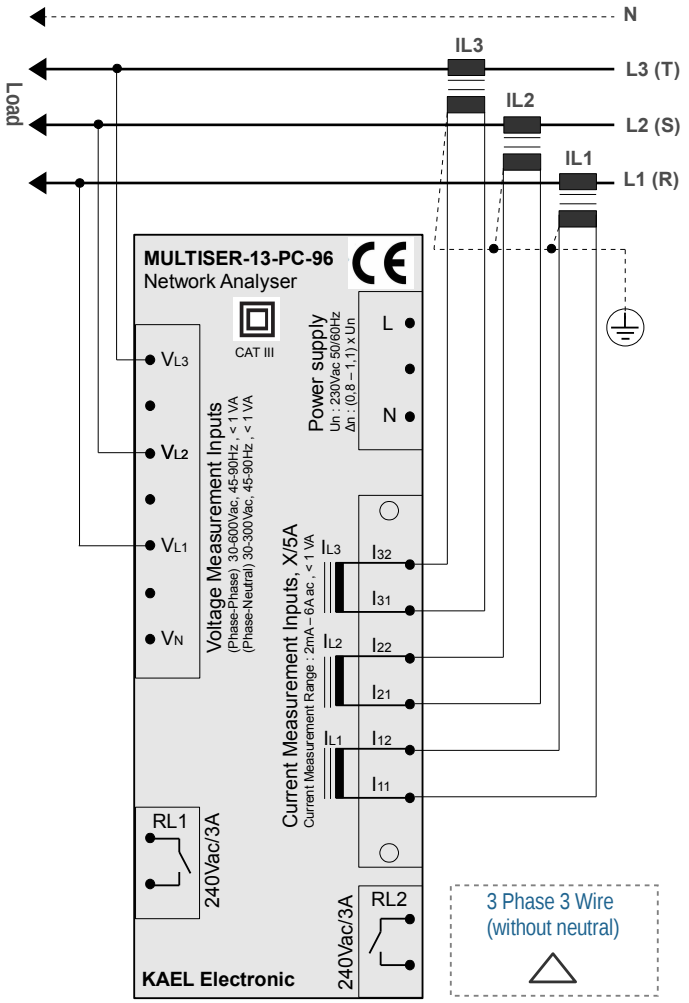
Making the Connections

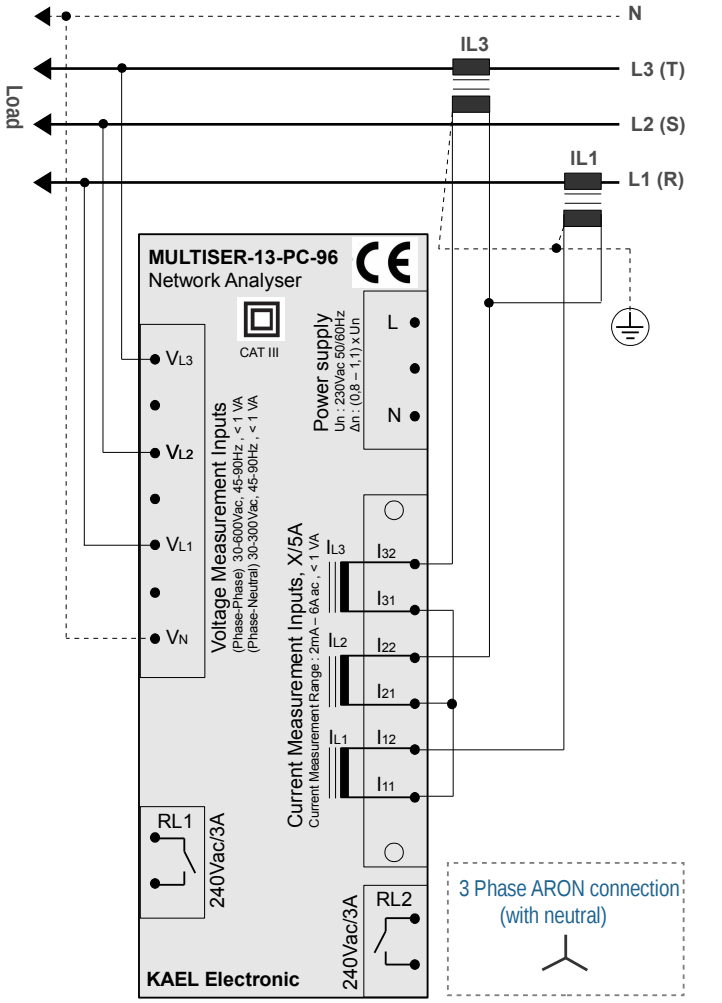
- The connections of the system must be made when it is out of power.
- The connections of the device shall be connected as shown in the connection scheme.
- The current and voltage connections shall be connected in a manner that they are placed on the same phase same current transformer and with the same direction. Connection scheme must be observed.
- The value of the current transformer chosen shall not be less than the real load value and X/5 amperes. Moreover, it is recommended to chose class 0,5.
- Fuses to be used shall be FF type. Fuses to be used shall be chosen according to given current values.
- RS485 connection shall be made.
- Do not supply power to the device before all the connections are checked by means of a measurement apparatus.
- The terminals for currents and voltage are suitable for cables with 2,5mm2 cross- section.
- Pulse outputs, Inputs and RS485 terminals are suitable to max. 1,5 mm2 cables
- CAT5 (category 5) cables are recommended for RS485 connection

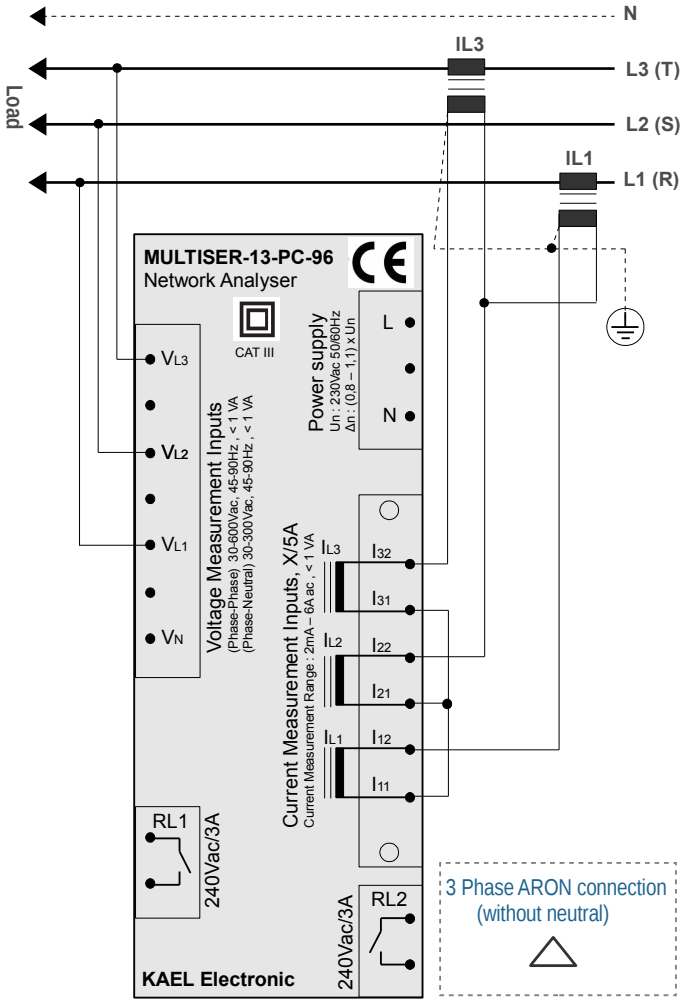
RS485 connection

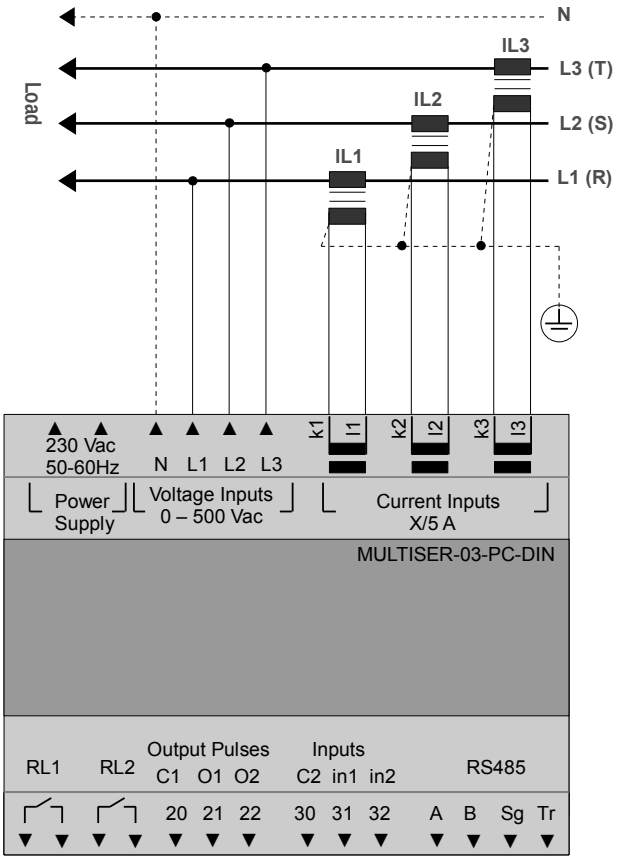



N
IL3
L3 (T)
IL2
L2 (S)
IL1
L1 (R)
Load
MULTISER-13-PC-96
Network Analyser
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0.8 –1,1) x Un
L
N
VL3
VL2
VL1
VN
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
I32
I31
IL2
I22
I21
IL1
I12
I11
RL1
240Vac/3A
RL2
240Vac/3A
KAEL Electronic
3 Phase 4 Wire (with neutral)

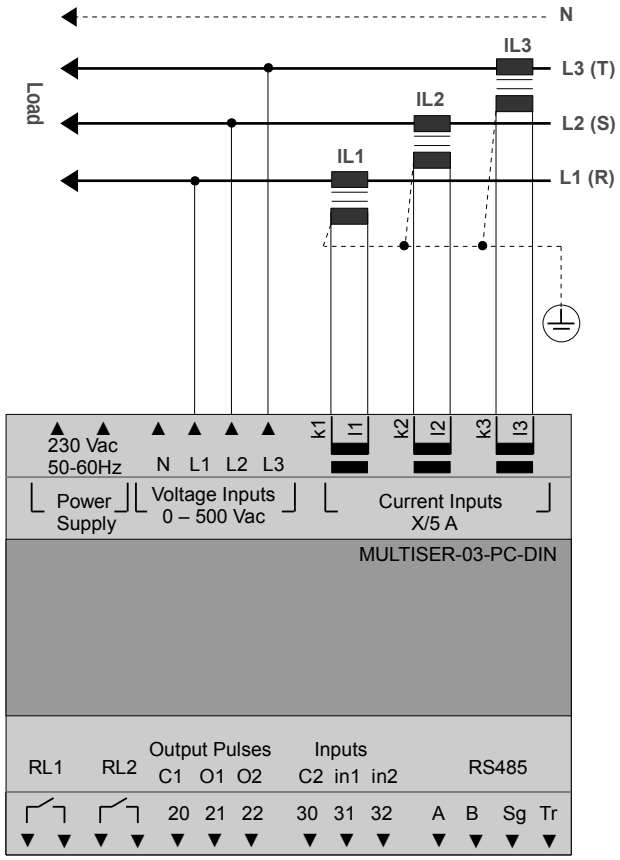

N
IL3
L3 (T)
IL2
L2 (S)
IL1
L1 (R)
Load
MULTISER-13-PC-96
Network Analyser
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0.8 –1,1) x Un
L
N
VL3
VL2
VL1
VN
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
I32
I31
IL2
I22
I21
IL1
I12
I11
RL1
240Vac/3A
RL2
240Vac/3A
KAEL Electronic
3 Phase 3 Wire
(without neutral)


N
IL3
L3 (T)
IL2
L2 (S)
IL1
L1 (R)
Load
MULTISER-13-PC-96
Network Analyser
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0.8 –1,1) x Un
L
N
VL3
VL2
VL1
VN
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
I32
I31
IL2
I22
I21
IL1
I12
I11
RL1
240Vac/3A
RL2
240Vac/3A
KAEL Electronic
3 Phase ARON connection
(with neutral)

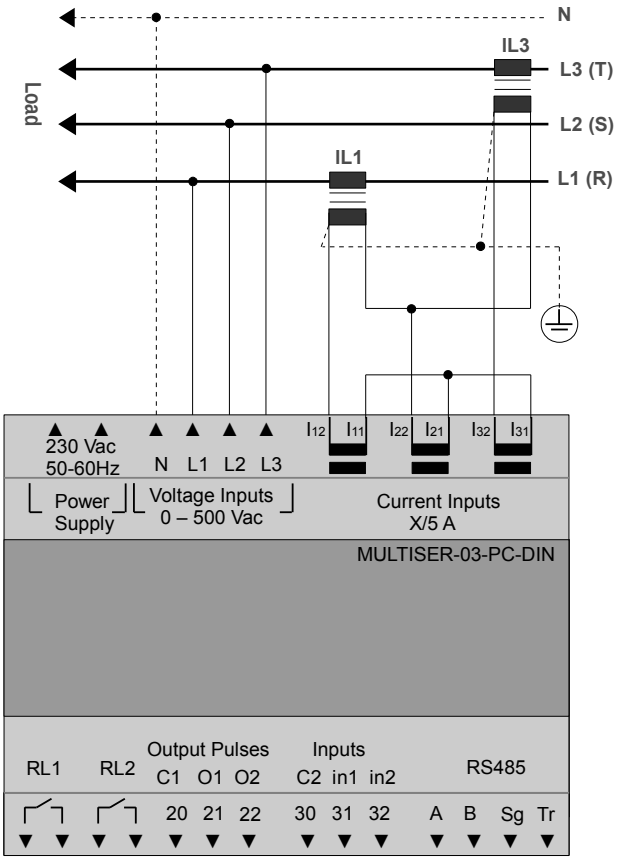

N
IL3
L3 (T)
IL2
L2 (S)
IL1
L1 (R)
Load
MULTISER-13-PC-96
Network Analyser
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0.8 –1,1) x Un
L
N
VL3
VL2
VL1
VN
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
I32
I31
IL2
I22
I21
IL1
I12
I11
RL1
240Vac/3A
RL2
240Vac/3A
KAEL Electronic
3 Phase ARON connection
(without neutral)



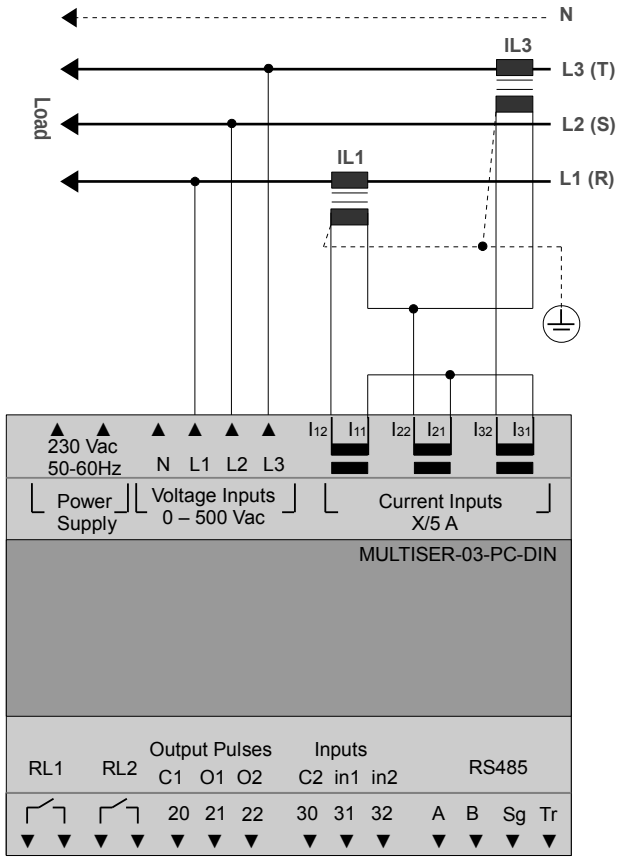
3 Phase 4 Wire (with neutral)



3 Phase 3 Wire (without neutral)



3 Phase ARON connection (with neutral)



3 Phase ARON connection (without neutral)

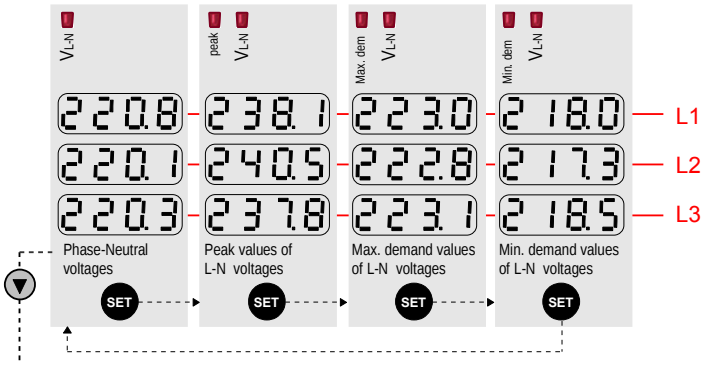
MEASUREMENTS

(VL-N, VL-L, I, I-neutral, Hz, THD-V, THD-I, CosΦ, W, VAr, VA, ΣW, ΣVAR, ΣVA, ΣWh, ΣVArh, ΣVAh)

The above parameters can be reached step by step using arrow keys. Related leds lights up and displays the corresponding parameter value which is displayed at the same time.

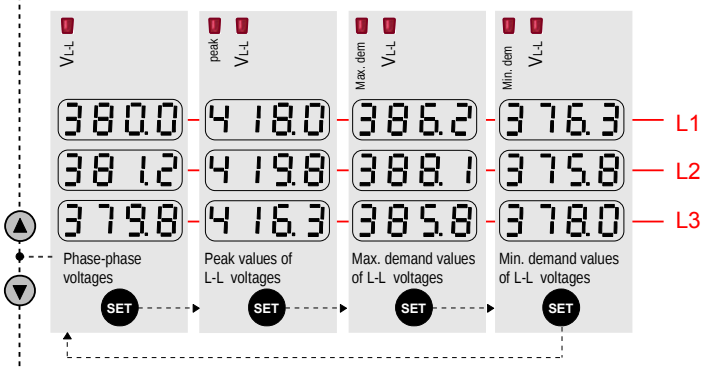
Voltages of phase to neutral (VL-N)

Phase-to-neutral voltages , their peak and demand values can be found in this menu. Demand and peak values are cleared in (cLr UL-n) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



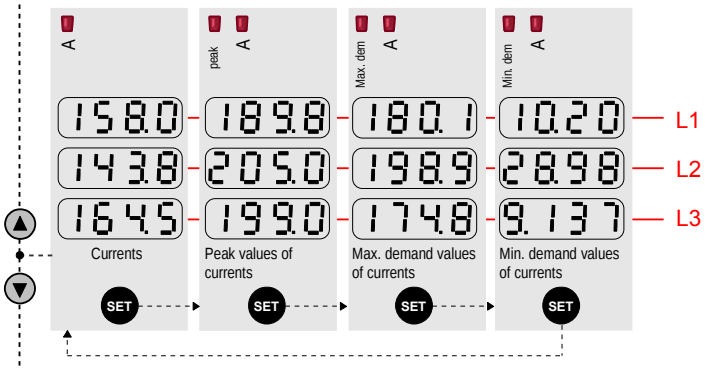
Voltages of phase to phase (VL-L)

Phase-to-phase voltages , their peak and demand values can be found in this menu. Demand and peak values are cleared in (cLr UL-L) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



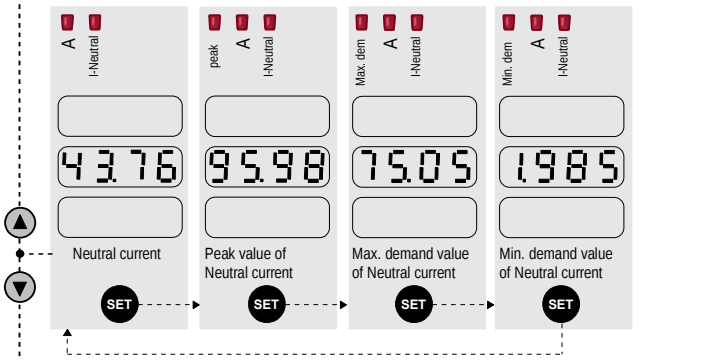
Currents (I1, I2, I3)

Phase currents , their peak and demand values can be found in this menu. Demand and peak values are cleared in (cLr A) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



Neutral Current (I-Neutral)

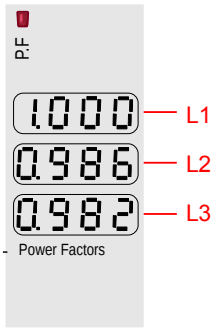
Neutral current , its peak and demand values can be found in this menu. Demand and peak values are cleared in (cLr A) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



MEASUREMENTS

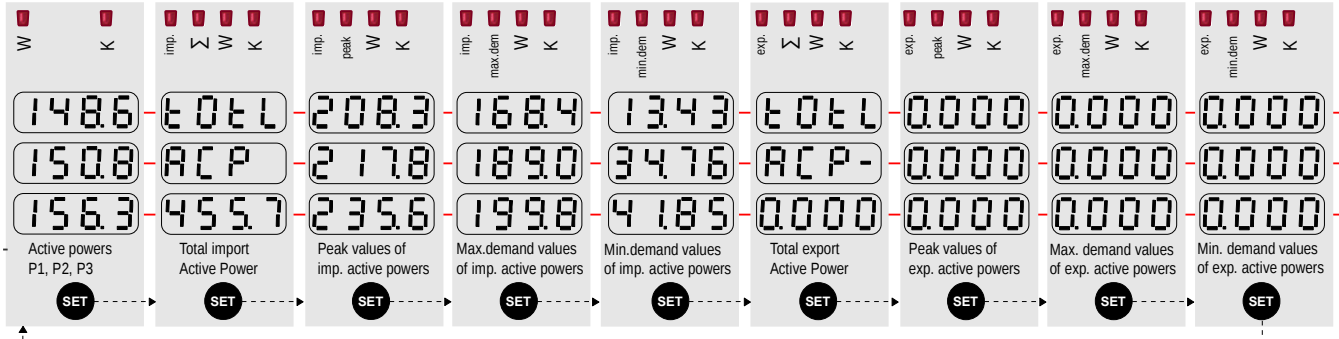
Frequency (Hz)

Power Factor (P.F)



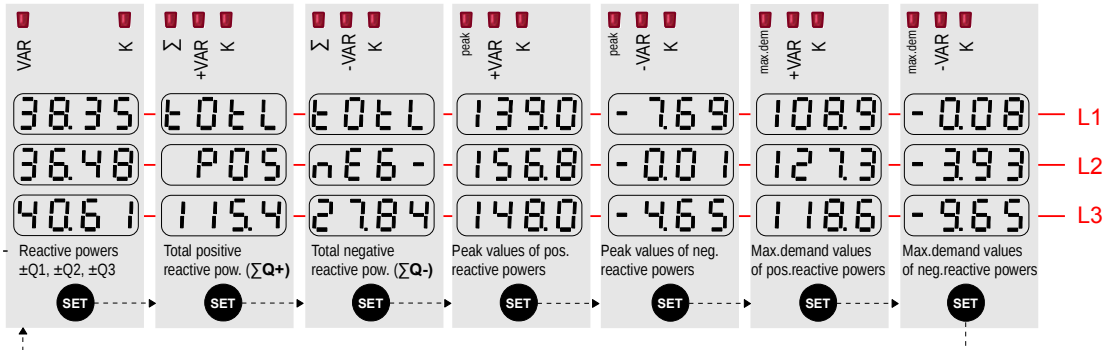
Active Power (P1, P2, P3, ∑P)

Active powers for each phases, total active power , their peak and demand values are in this menu. Demand and peak values are cleared in (cLr P) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



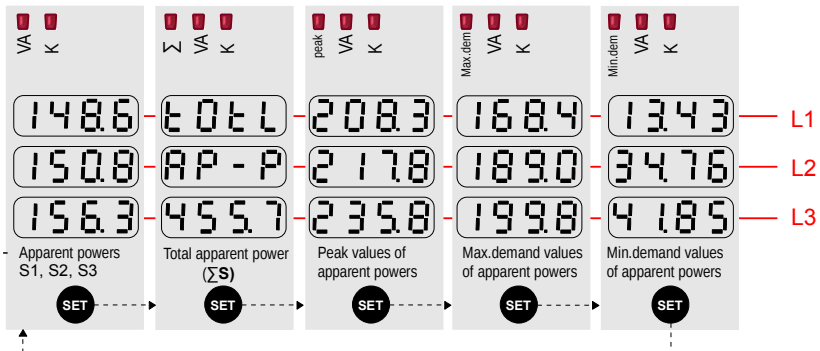
Reactive Power (+Q1, -Q1, +Q2, -Q2, +Q3, -Q3, ∑Q+, ∑Q-)

Reactive powers for each phases, total positive and negative reactive power , their peak and demand values are in this menu. Demand and peak values are cleared in (cLr q) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



Apparent Power (S1,S2,S3, ∑S)

Apparent powers for each phases, total apparent power , their peak and demand values are in this menu. Demand and peak values are cleared in (cLr S) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



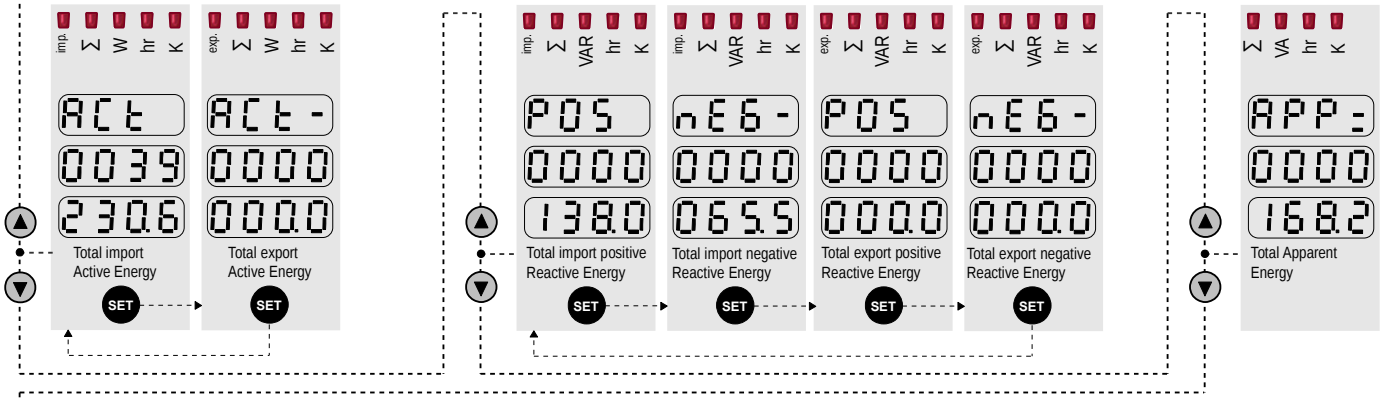
MEASUREMENTS

MEASUREMENTS

Active Energy (KWhr,MWhr,GWhr)
Total import and export active energy can be monitored. Energies can be deleted in (CLR Energy) menu.

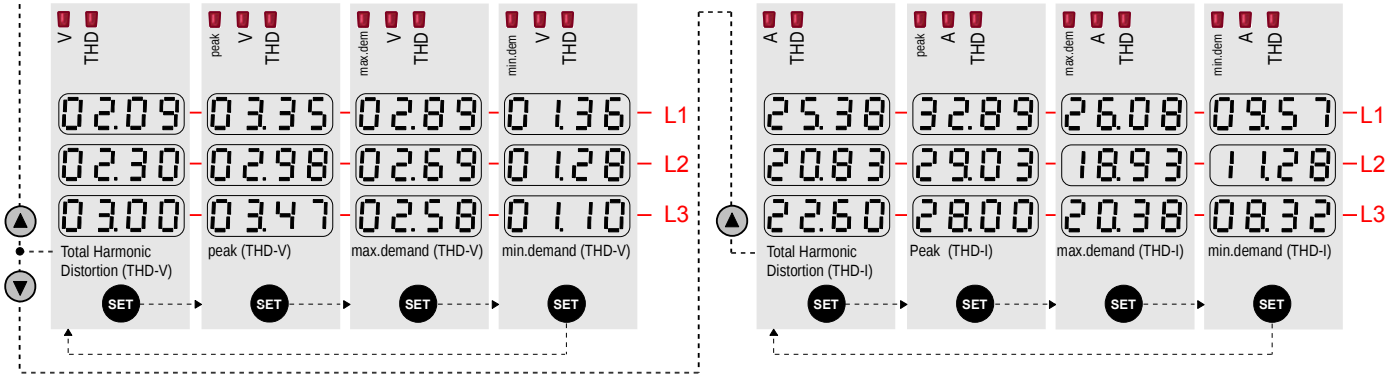
Reactive Energy (KVARhr,MVARhr,GVARhr)
Total import/export positive and negative energy can be monitored . Energies can be deleted in (CLR Energy) menu.

Apparent Energy (KVAhr)
App. Energy can be deleted in (CLR Energy) menu.



Total Harmonic Distortion for Voltages (THD-V %)
Total Harmonic Distortion for Voltages, their peak and demand values can be monitored in this menu. Demand and peak values can be deleted in (CLR thdU) menu. Also setting of the demand time can be set in (dEnn SEt) menu.

Total Harmonic Distortion for Currents (THD-I %)
Total Harmonic Distortion for currents, their peak and demand values can be monitored in this menu. Demand and peak values can be deleted in (CLR thd I) menu. Also setting of the demand time can be set in (dEnn SEt) menu.

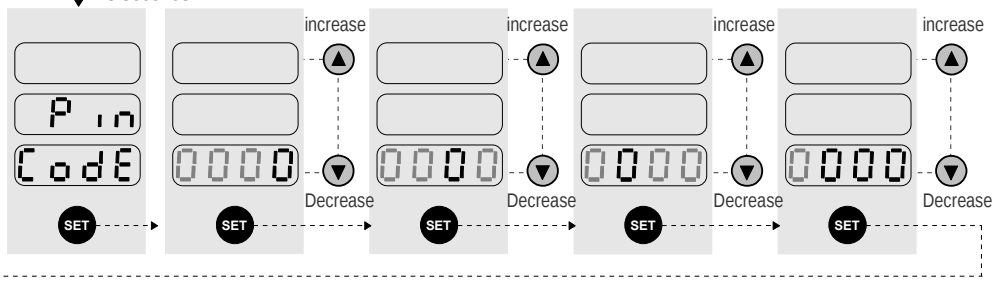


Parameters

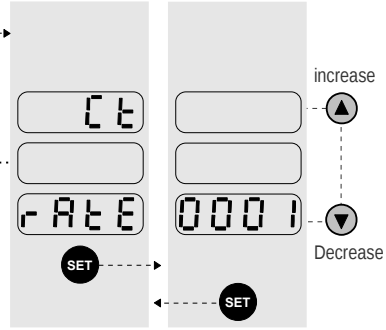
If the password is active, SET button is pressed for 3 seconds, the parameter menu can be accessed only after entering 4-digit password. Temporary password is "0000". if password is not active, you can enter to the parameter menu without entering password. First parameter is current transformer ratio. After pressing the SET key, value is increased or decreased by using the arrow keys. By pressing the SET button, the new value will be saved.

SET Press for 3 seconds

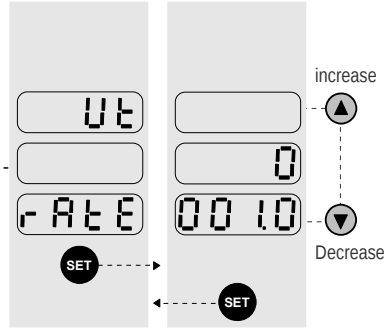
PIN (Password)
Factory setting for the password is "0000" '. To the desired number is reached by using the arrow keys for each a digit. Confirmed by pressing the SET key.



Ct :Current Transformer Ratio (1.....5000)
Current transformer ratio value is entered.
Example: For 500 / 5A is entered 100. (500/5A=100)



Ut :Voltage Transformer Ratio (1.....4000)
Voltage transformer ratio value is entered.
Example: For 34500 /100V is entered 345. (34500/100V=345)

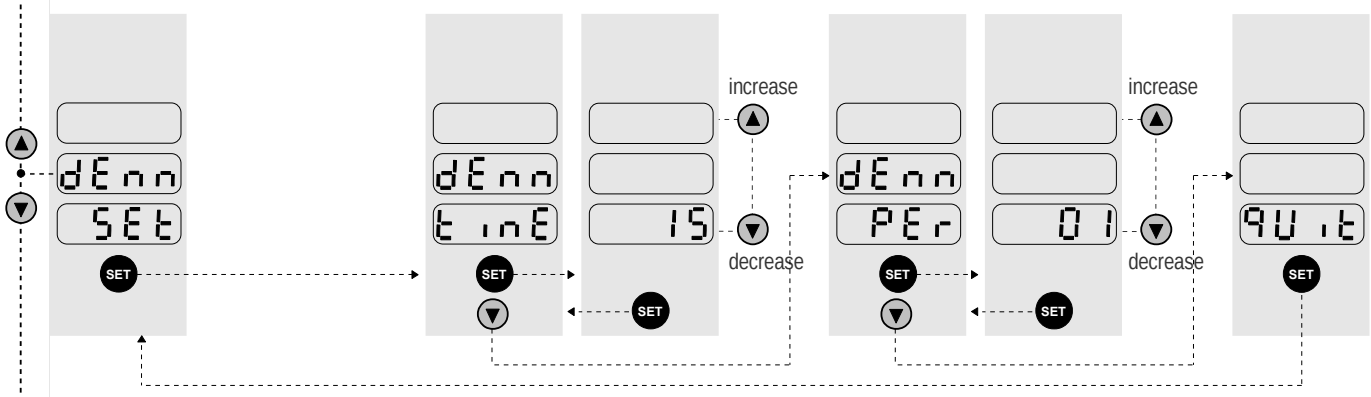


PARAMETERS

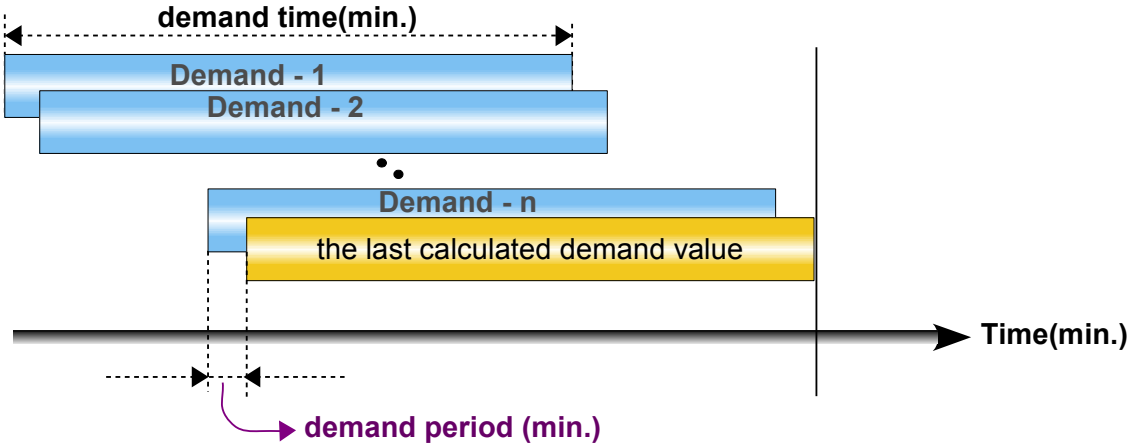
dEnn SEt : Demand SET
There are two parameters.
These are shown in the graph below.

dEnn tınE :Demand Time
(demand period +1) ..... (60 minutes)
Refers to the computation time.

dEnn PEr :Demand Period (1minute) ....(demand time - 1)
Refers to the time between two calculations.



Example: if , demand time= 15 minutes and demand period= 3 minutes ; Every 3 minutes, demand value is re-calculated for the last 15 minutes.

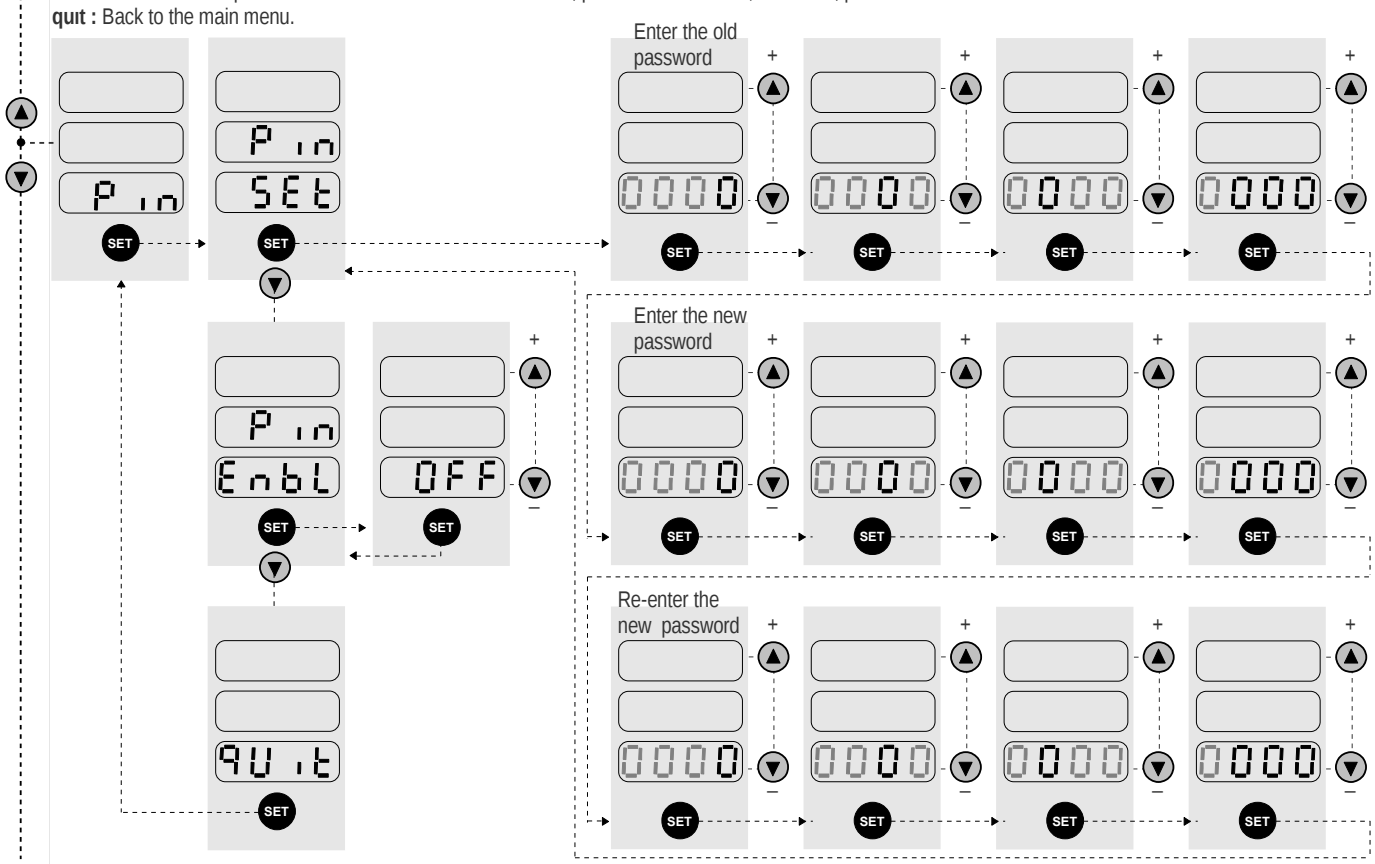


PIN (Password) : In this section, the password can be changed. Also password can be enabled or disabled.

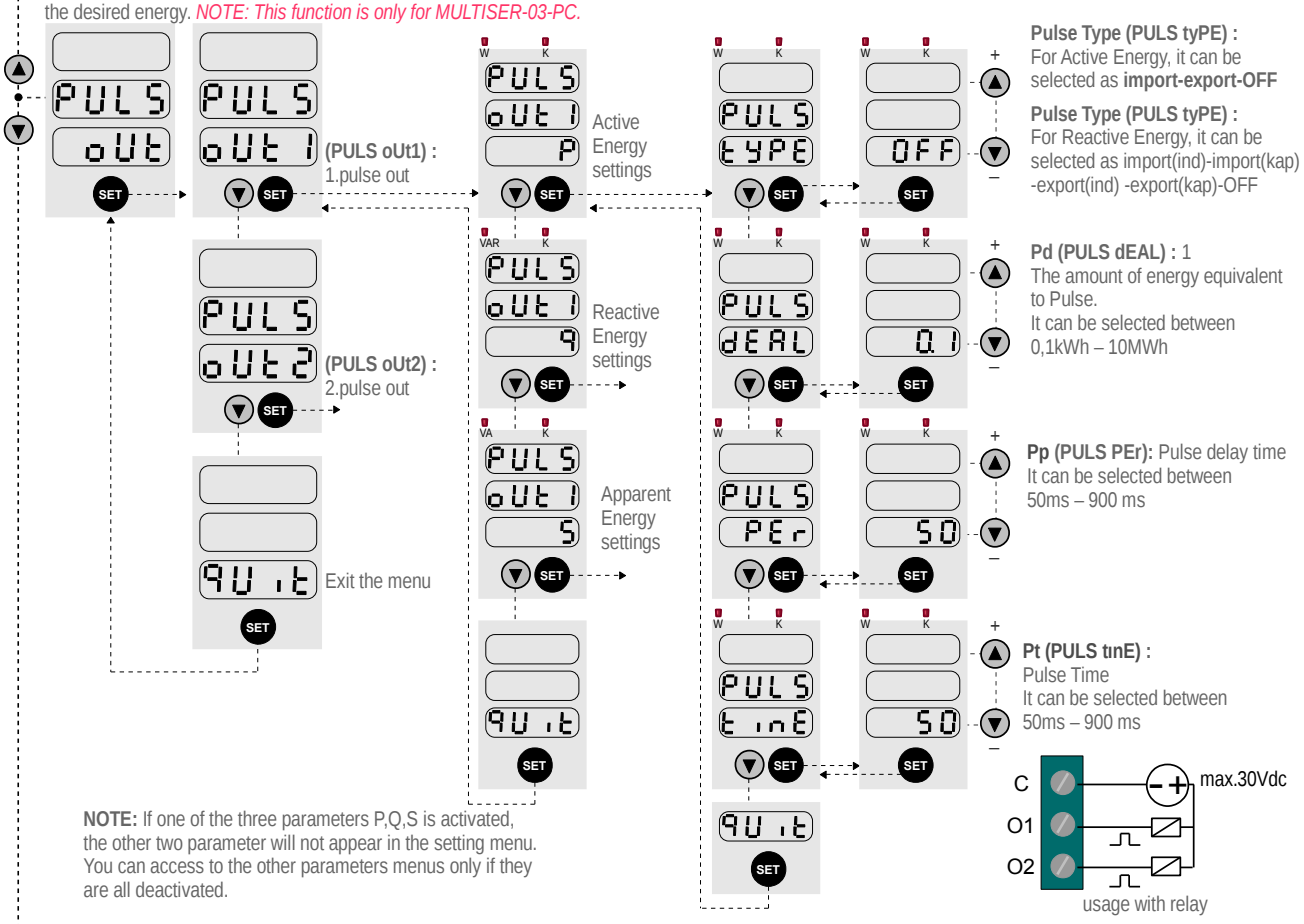
Pın SEt : Default value for the password is "0000". First of all, the old password (PIN OLD) must be entered correctly. If the old password is correct, the user can enter the new password (**Pın nEU**). You must enter the new password again (**Pın rEP**). If both passwords are the same, "NEU Pin Suite" message appears on the screen and a new password will be stored.

Pın EnbL : Password protection is enabled or disabled. **Pın On** ; password is enabled, **Pın OFF** ; password is disabled.

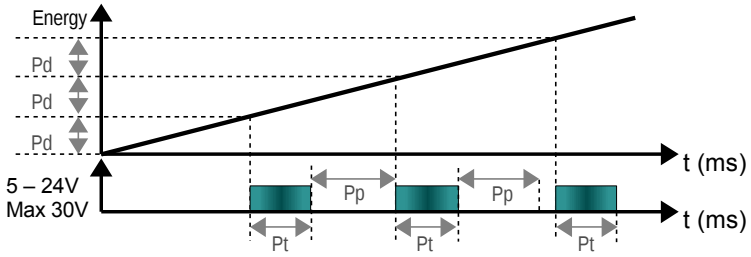
quıt : Back to the main menu.



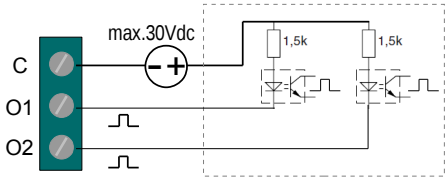
PULS oUt : The device has two digital pulse output. Menus and functions are the same for the two outputs.Outputs can be set differently according to the type of the desired energy. *NOTE: This function is only for MULTISER-03-PC.*



NOTE: If one of the three parameters P,Q,S is activated, the other two parameter will not appear in the setting menu. You can access to the other parameters menus only if they are all deactivated.

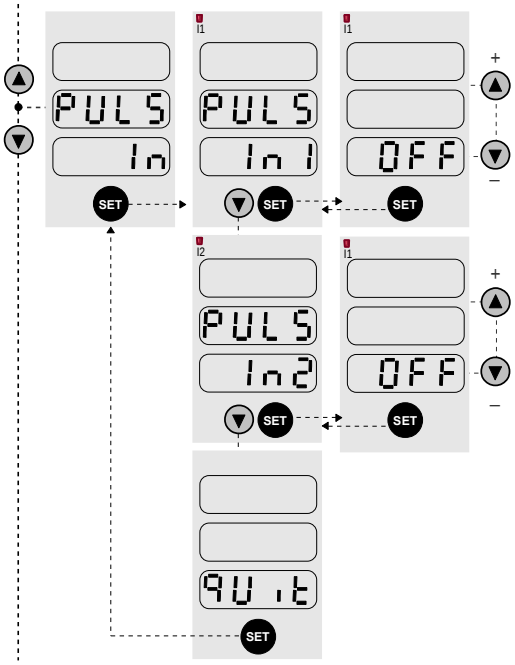


Connection to another device as insulated



when amount of each energy (Pd) occurs , a pulse is generated from output, during time of (Pt). And then, output stays as 0V ,during time of (Pp)

PULS In : The device has two digital inputs. Menus and functions are the same for the two outputs.

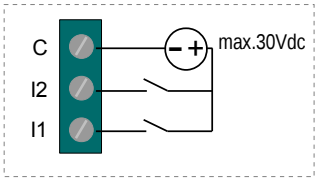


NOTE: This function is only for MULTISER-03-PC.

For example, it can understand position of the circuit breaker.

There is an input at i1.

There is not an input at i1.

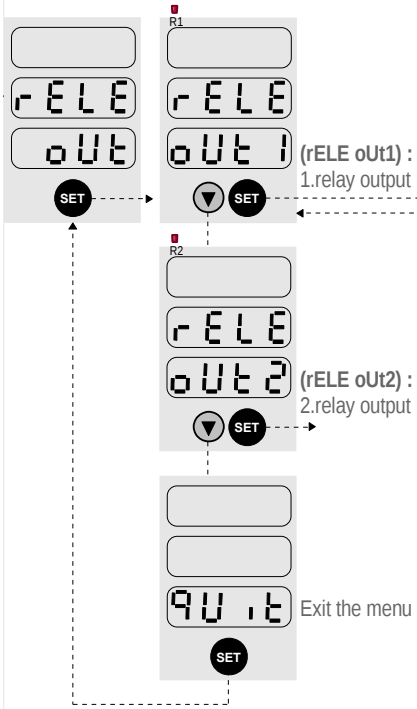


PARAMETERS

PARAMETERS

rELE oUt : The device has two digital inputs. Menus and functions are the same for the two outputs.

NOTE: This function is only for MULTISER-03-PC and MULTISER-02-PC



Relay contact position
no : Normaly open
nc : Normaly closed

Permission to Access
on : enabled
oFF : disabled

NOTE: If remote Access Permission (ten) is made, can not be accessed to the other parameters. The pre-set parameters are disabled. In this case, the relay can be accessed only via remote access (if device has RS485 port).

Over-Voltage Adjustment:
SEt VAL : Set value. 110V – 260V
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 10 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Under-Voltage Adjustment:
SEt VAL : Set value. 80V – 210V
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 10 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Voltage Unbalance Adjustment:
SEt VAL : Set value. 1 – 50 %
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 30 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Over-Current Adjustment:
SEt VAL : Set value. (Current transformer ratio) x (0,1 – 5) A
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 50 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Under-Current Adjustment:
SEt VAL : Set value. (Current transformer ratio) x (0,1 – 5) A
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 50 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Current Unbalance Adjustment:
SEt VAL : Set valuei. 1 – 50 %
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 30 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Over-Frequency Adjustment:
SEt VAL : Set value. 50,0 – 75,0 Hz
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 20 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Under-Frequency Adjustment:
SEt VAL : Set value. 40,0 – 60,0 Hz
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 20 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Over THD-V Adjustment:
SEt VAL : Set value. 1 – 99 %
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 50 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Over THD-I Adjustment:
SEt VAL : Set value. 1 – 99 %
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 50 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Over HD-V Adjustment:
SEt VAL : Set value. 1 – 99 %
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 50 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Over HD-I Adjustment:
SEt VAL : Set value. 1 – 99 %
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 50 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Over-Neutral Current Adjustment:
SEt VAL : Set value. (Current transformer ratio) x (0,1 – 5) A
d – t dELy : Delay time. 1 – 300 s
r – t rEt tnE : Return time from fault. 1 – 300 s
hYS : Hysteresis value. 1 – 50 %
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Phase Sequence Protection:
d – t dELy : Delay time. 0 – 10 s
r – t rEt tnE : Return time from fault. 0 – 10 s
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Phase Failure Protection:
d – t dELy : Delay time. 0 – 10 s
r – t rEt tnE : Return time from fault. 0 – 10 s
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

Connection Failure:
d – t dELy : Delay time. 0 – 10 s
r – t rEt tnE : Return time from fault. 0 – 10 s
EnbL : Enable. If enable is on, relay is enabled.If enable is off, relay is disabled

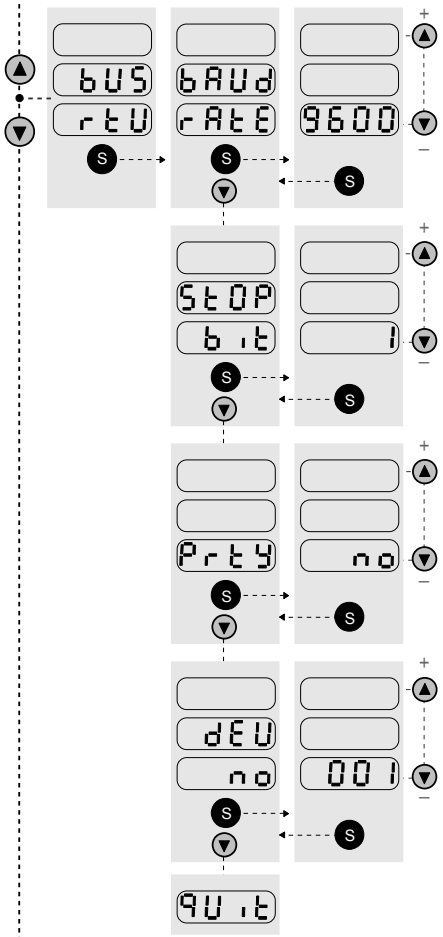
Exit the menu

PARAMETERS

PARAMETERS

bUS rtU : Modbus rtu adjustments.

NOTE: This function is not for MULTISER-01



Baud rate: 2400,4800,9600,19200,28800,38400,57600,115200
Stop Bits : (0.5) , (1) , (1.5) , (2)
Parity : no , even , odd
Cihaz No : 001 255

MODBUS – RTU

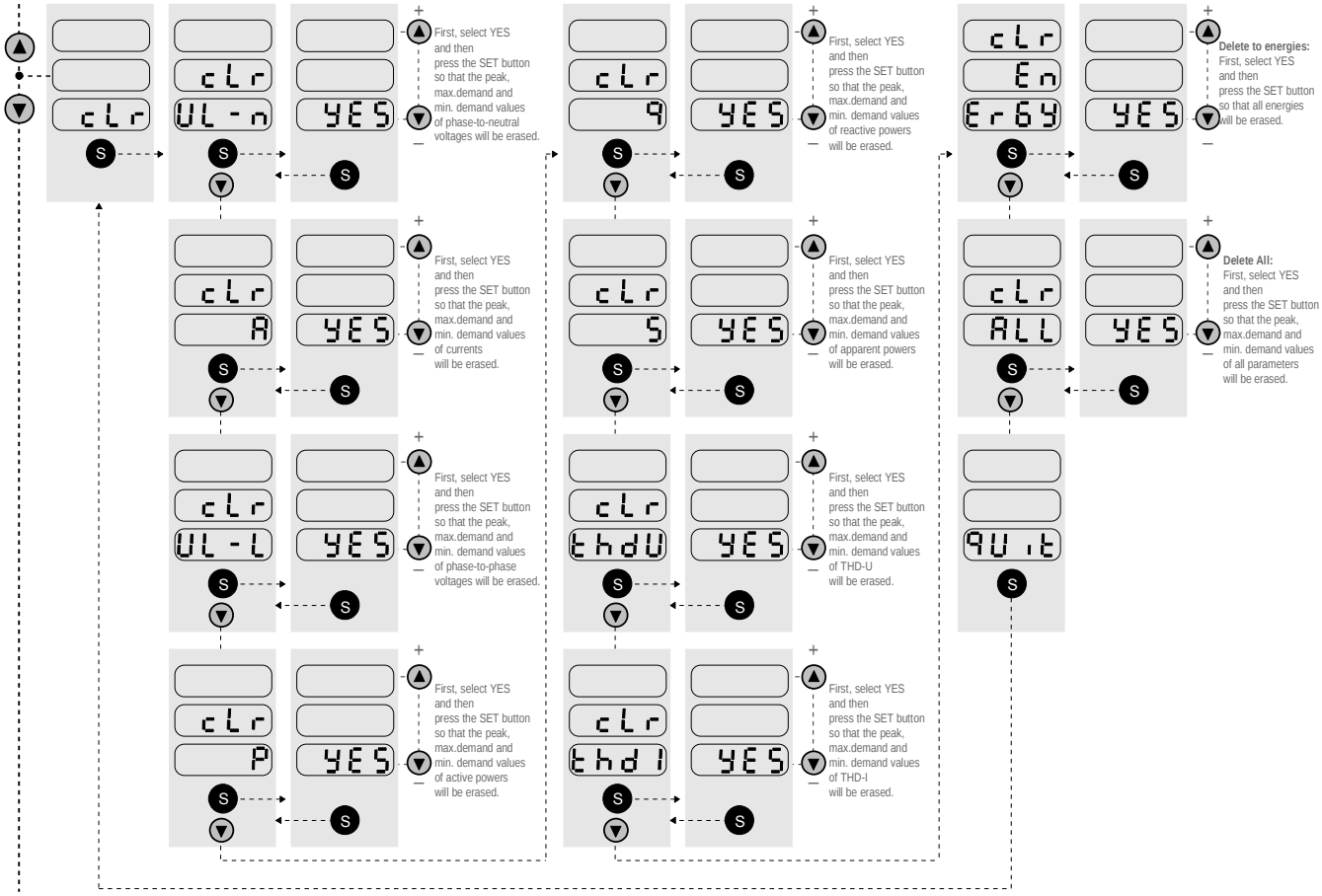
ADRESS 8 BIT	FUNCTION 8 BIT	DATA 8 BIT	CRCL 8 BIT	CRCH 8 BIT	T Delay time for 3,5 character

The maximum length of this package is 12 Byte.

MODBUS – RTU Functions

03H	READING SINGLE REGISTER
06H	WRITING SINGLE REGISTER
10H	WRITING MULTIPLE REGISTER

cLr : Demands, peak values, and accumulated energies can be erased in this section.The parameters which indicated by the LEDs at the top of the device, will be erased.

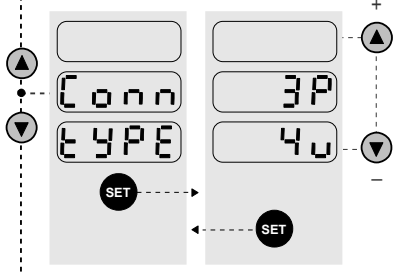


PARAMETERS

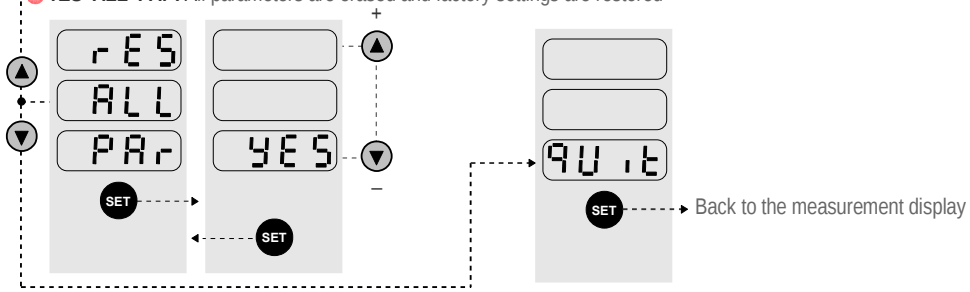
PARAMETERS

Conn tyPE : Selection of connection type.

3P 4u : 3 phase , 4 wire (star)
3P 3u : 3 phase , 3 wire (wye), without neutral



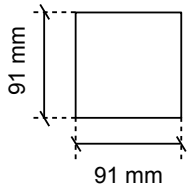
rES ALL PAr : All parameters are erased and factory settings are restored

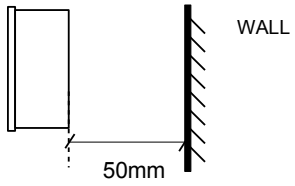


Installation Instructions

1- A space with a dimension of 92mm * 92mm shall be emptied on the panel where the device will be mounted.
2- Before assembly of the device, remove panel fixing apparatuses.
3- Place the device from front into the window opened in the panel as flush.
4- -Fix the device on to the panel by using fixing apparatuses from back part.
Make the assembly in a manner to assure 50 cms space between the device and the wall to enable good ventilation of the device.

PANEL SPACING DIMENSIONS





Technical Specifications

Operating Voltage (Un)	: (Phase-Neutral) 230Vac
Operating Range	: (0,8-1,1) x Un
Operating Frequency	: 50/60 Hz
Supply Power Consumption	: < 6VA
Power Consumption of Measurement Inputs:	: < 1VA
Vin	: 1 – 300 Vac (L-N)
	: 2 – 600 Vac (L-L)
Iin	: (as the secondary current of the current transformer) 0,01 - 6 Amp AC
Measurement Class	: CAT III
Voltage Transformer Ratio:	: 1 4000
Current Transformer Ratio	: 1 ..... 5000 (25000/5A)
Connection Type	: 3P&4W , 3P&3W , ARON
Demand Time	: 1 – 600 min
Display range	: 1,0V - 400,0 kV
	: 0,001A ..... 25000 A
	: 0 – 999,9 M (W,VAR,VA)
	: 0 – 999,9 k (W,VAR,VA)
	: 0 – 999.999.999,999 (GWh,GVARh,GVAh)

accuracy

Voltage	: 0,5 class
Current	: 0,5 class
Active Power	: 1 class
Reactive Power	: 2 class
Apparent Power	: 1 class

Relay Outputs (2 pcs)	: 2 NO and max.3A/240 Vac

Pulse Outputs (2 pcs)

Operating Voltage	: 5 – 24Vdc max. 30Vdc
Operating Current	: max 50 mA
Min. Switching Time	: 100 ms

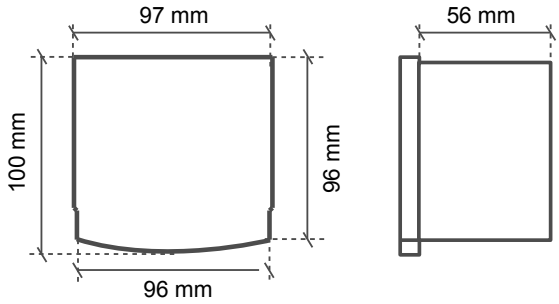
Digital Inputs (2 pcs)

Operating Voltage	: 5 – 24Vdc max. 30Vdc

RS485

Baud rate	: 2400,4800,9600,19200,28800,38400,57600,115200
Stop Bits	: (0.5) , (1) , (1.5) , (2)
Parity	: no , even , odd
Device No	: 1 255

Device Protection Class	: IP 20
Terminal protection class	: IP 00
Ambient temperature	: - 5 °C .... + 50 °C
Installation Type	: to panel cover from front
Dimensions	: 96x96x56 mm



NOTE: Operating Voltage (Un): ask price and delivery time for 85-256Vac/dc

Factory Settings

	Current Transformer(Primary) Value	: 5 / 5 A
	Voltage Transformer Ratio	: 1
	Password	: if not changed by user (0000) NOTE 1
	Password use	: Off (disabled)
	Connection Type	: 3P&4W
MODBUS RTU	Port Settings (Baud Rate)	: 9600
	Port Settings (Stop Bits)	: 1
	Port Settings (Parity)	: No
	Port Settings (Device No)	: 1
	Demand Time	: 15 minutes
	Demand Interval	: 3 min
1. Pulse ouput	Pulse Type for 1.Pulse Output	: OFF
	Pulse Value for 1. Pulse Output (Pd)	: 1 KWh
	Pulse Duration for 1.Pulse Output (Pt)	: 100 ms
	Pulse OFF Time for 1.Pulse output (Pp)	: 200 ms
2. Pulse output	Pulse Type for 2.Pulse Output	: OFF
	Pulse Value for 2. Pulse Output (Pd)	: 1 KVARh
	Pulse Duration for 2.Pulse Output (Pt)	: 100 ms
	Pulse OFF Time for 2.Pulse output (Pp)	: 200 ms
	1.Digital Input	: Alarm Input
	2.Digital Input	: Alarm Input
	Contact Position	: N.O Normally Open
	Remote Access Permit	: off
1. Relay output	Over Voltage	: 255V Relay OFF
	Under Voltage	: 185V Relay OFF
	Voltage Unbalance	: 10% Relay OFF
	Over Current	: 5A Relay OFF
	Under Current	: 1A Relay OFF
	Current Unbalance	: 50% Relay OFF
	Over Frequency	: 53Hz Relay OFF
	Under Frequency	: 48Hz Relay OFF
	Over THD-V	: 6% Relay OFF
	Over THD-I	: 15% Relay OFF
	Over HD-V	: 6% Relay OFF
	Over HD-I	: 15% Relay OFF
	Over Neutral Current	: 3A Relay OFF
	Phase Sequence Failure	: Relay OFF
	Phase Failure	: Relay OFF
	Connection Failure	: Relay OFF
1. Relay output	Phase Failure	: Relay OFF
	Connection Failure	: Relay OFF
	Contact Position	: N.O Normally Open
	Remote Access Permit	: off
2. Relay output	Over Voltage	: 255V Relay OFF
	Under Voltage	: 185V Relay OFF
	Voltage Unbalance	: 10% Relay OFF
	Over Current	: 5A Relay OFF
	Under Current	: 1A Relay OFF
	Current Unbalance	: 50% Relay OFF
	Over Frequency	: 53Hz Relay OFF
	Under Frequency	: 48Hz Relay OFF
	Over THD-V	: 6% Relay OFF
	Over THD-I	: 15% Relay OFF
	Over HD-V	: 6% Relay OFF
	Over HD-I	: 15% Relay OFF
	Over Neutral Current	: 3A Relay OFF
	Phase Sequence Failure	: Relay OFF
	Phase Failure	: Relay OFF
	Connection Failure	: Relay OFF

Note 1 : The password is primarily defined as 0000. However the password will not change even in the event that factory values are restored after having amended the password. The latest password entered by the user is valid.

Note 2 : When factory settings are restored, energies are set to zero.

Formulas

RMS Voltage $V_{RMS} = \sqrt{\frac{1}{N}\sum_{i=0}^{N} V_i^2}$

RMS Current $I_{RMS} = \sqrt{\frac{1}{N}\sum_{i=0}^{N} I_i^2}$

Active Power $P = \frac{1}{N}\sum_{i=0}^{N} P_i$

Reactive Power $Q = \frac{1}{N}\sum_{i=0}^{N} Q_i$

Apparent Power $S = \sqrt{P^2 + Q^2}$

Power Factor $PF = \frac{P}{S}$

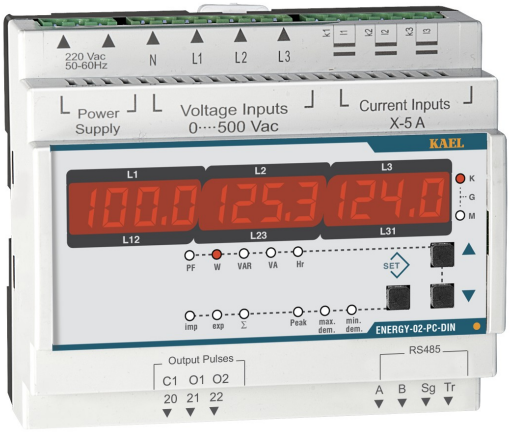
$$V_{THD}\ \% = \frac{\sqrt{\sum_{i=2}^{N} V_i^2}}{V_1} \times 100$$

$$I_{THD}\ \% = \frac{\sqrt{\sum_{i=2}^{N} I_i^2}}{I_1} \times 100$$

ENERGY 02-96
POWER 01-96

ENERGY 02-DIN
POWER 01-DIN

ENERGY and POWER



TÜV SÜD GOST-R CE **ISO 9001:2008**

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KAEL Mühendislik Elektronik Tic. ve San. Ltd.Şti.

PARAMETERS:	ENERGY-02	POWER-01
Ct : current transformer ratio (1...5000)	■	■
Ut : voltage transformer ratio (1...4000)	■	■
Denn Set : Demand SET	■	■
PIN: (Pasword)	■	■
PULS oUt : Pulse out	■	
bUS rtU : Settings of Modbus RTU	■	
CLr : clear	■	■
Coon tyPE : connection type	■	■
rES ALL PAr : reset all values	■	■

MODEL

	With RS485 MODBUS RTU VL1,VL2,VL3 VL12,VL23,VL13 IL1,IL2,IL3,I-Neutral,Hz P1,P2,P3,Q1,Q2,Q3,S1,S2,S3 CosΦ1,CosΦ2,CosΦ3 PFD1,PFD2,PFD3,ΣPF ΣP,ΣQi,ΣQc,ΣQ,ΣS imp-exp ΣkWh imp-exp ΣkVARh(ind) imp-exp ΣkVARh(cap) ΣkVAh 3 – 31. harmonics for currents 3 – 31. harmonics for voltages	■ Power Factor PF1,PF2,PF3	■ W Active Power	■ VAR Reactive Power	■ VA Apparent Power	■ ΣkWh Active Energy	■ ΣkVArh, Reactive Energy	■ Peak	■ Min,Max demand	■ 2 Pulse out for Energy	■ RS-485 MODBUS-RTU	■ 3P&4W , 3P&3W , ARON connection	■ Current and Voltage Transformer Ratio	■ Password	■ LED display	■ 96 x 96	■ DIN
ENERGY-02-96	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
ENERGY-02-DIN	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■
POWER-01-96		■	■	■			■	■			■		■	■	■	
POWER-01-DIN		■	■	■			■	■			■		■	■		■

Introduction

The device was designed to measure, report and analyse the electrical magnitudes in the 3-phase electric network and both design and software were produced by KAEL engineers. The state-of-the-art technologies were inserted in this device and both menus which facilitate the use of the user and the required features were included.

All the information and warnings you need to know concerning the device were described in the user operation manual. Please read this manual carefully before engaging with the device. Please do not take any action before consulting with our company for any matters not clearly understood.

Tel: +90 232 877 14 84 (pbx) Fax: +90 232 877 14 49
Factory: Atatürk Mh. 78. Sok. No:10 Ulucak Köyü Kemalpaşa İzmir- TURKIYE

WARNINGS

1- The device shall be engaged by competent and licensed persons in conformity with the instructions set forth in the operation manual. In case required, controls shall be carried out by such persons also.
2- Do not open the inside of the device or cause to be opened. There are no parts inside the device which the user or anyone else may intervene.
3- Use the device according to assembly instructions
4- Before making electrical connection to the terminals of the device, make sure there is no electric power on the cables and terminals. The switchboard shall not have electric power on.
5- The fuses used in the device are of 1A FF type.
6- Make sure to fix the device on the switchboard firmly without swings with the apparatus given with the device.
7- Do not touch the keys on the front panel of the device with any substance other than your finger.
8- Wipe the device only with dry cloths after making sure the electric energy of the device is cut-off. Water or chemicals used for cleaning may cause damage to the device.
9- Before activating (energizing) your device please make sure that the terminal connections are made according to the connection scheme and without causing any contact problems (loose connection or contact of multiple copper cables).
10. The above measurements and warnings are for your safety. Kael Elektronik Ltd Şti or the dealer may not be held liable for any inconveniences when those warnings are not observed.

Features

- Easy use with menu
- Improved dynamic software
- Ability to enter current and voltage transformer rates
- True RMS
- Voltage, current and harmonic protection
- Password protection
- 3P&4W, 3P&3W, ARON Connectionı

Measurements

- Active Power (ΣP)
- Inductive Reactive Power ΣQ(ind)
- Capacitive Reactive Power ΣQ(cap)
- Apparent Power (ΣS)
- Active Energy (ΣkWh)
- Inductive Reactive Energy (ΣkVARh(ind))
- Capacitive Reactive Energy (ΣkVARh(cap))
- Peak and Demands

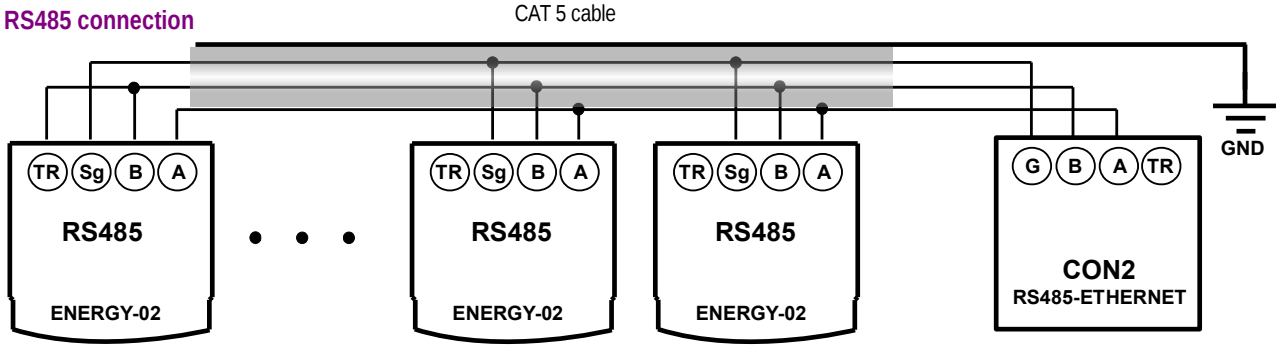
Outputs

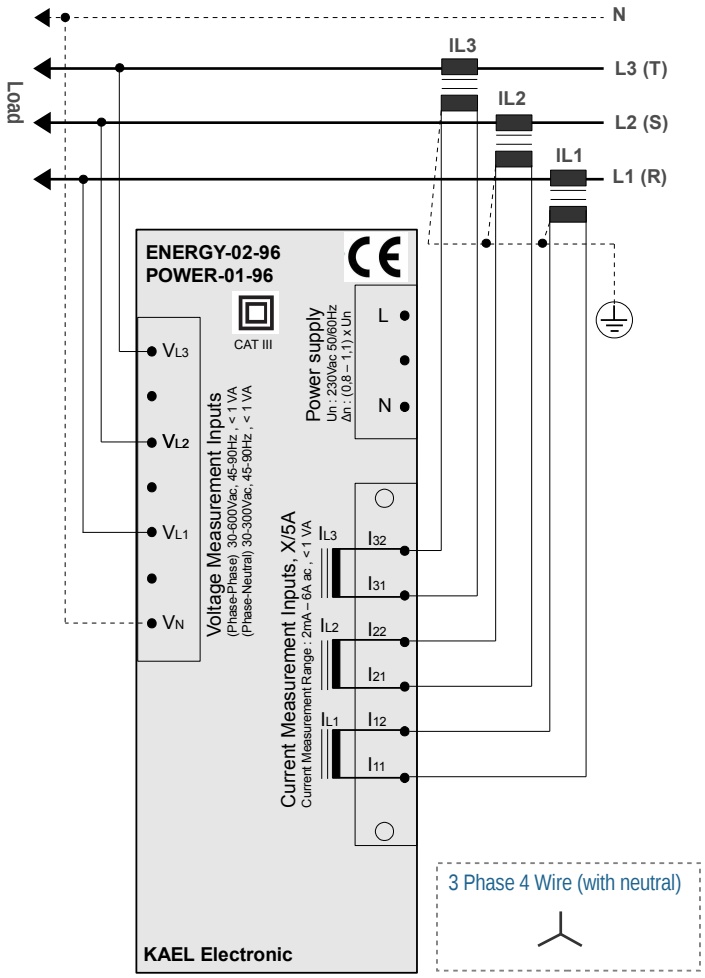
- Pulse Output (2pcs)
- RS-485 MODBUS-RTU

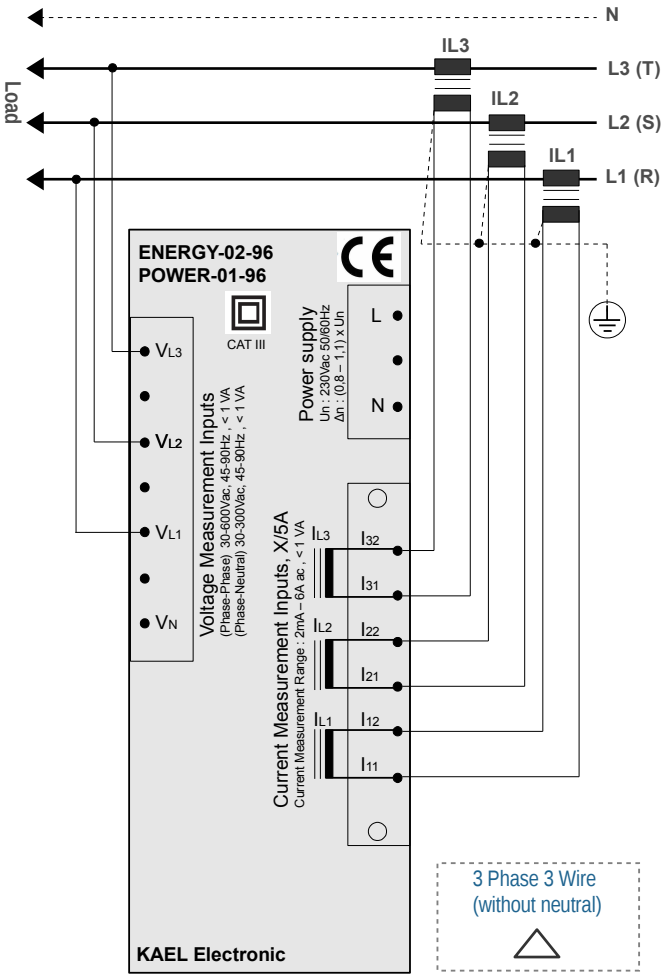
Making the Connections

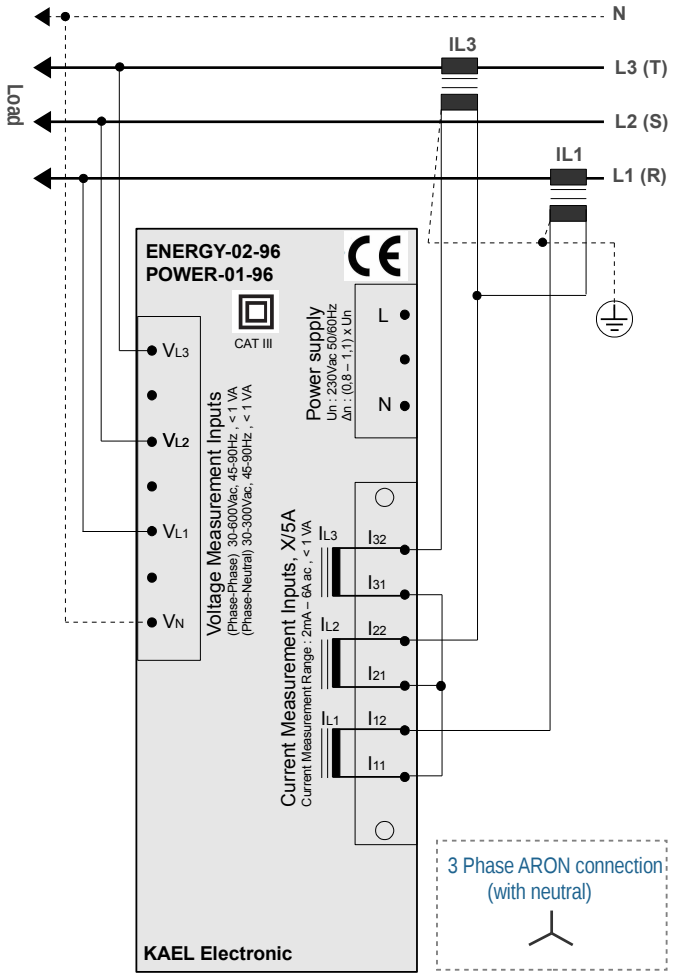
- The connections of the system must be made when it is out of power.
- The connections of the device shall be connected as shown in the connection scheme.
- The current and voltage connections shall be connected in a manner that they are placed on the same phase same current transformer and with the same direction. Connection scheme must be observed.
- The value of the current transformer chosen shall not be less than the real load value and X/5 amperes. Moreover, it is recommended to chose class 0,5.
- Fuses to be used shall be FF type. Fuses to be used shall be chosen according to given current values.
- RS485 connection shall be made.
- Do not supply power to the device before all the connections are checked by means of a measurement apparatus.
- The terminals for currents and voltage are suitable for cables with 2,5mm2 cross- section.
- Pulse outputs, Inputs and RS485 terminals are suitable to max. 1,5 mm2 cables
- CAT5 (category 5) cables are recommended for RS485 connection

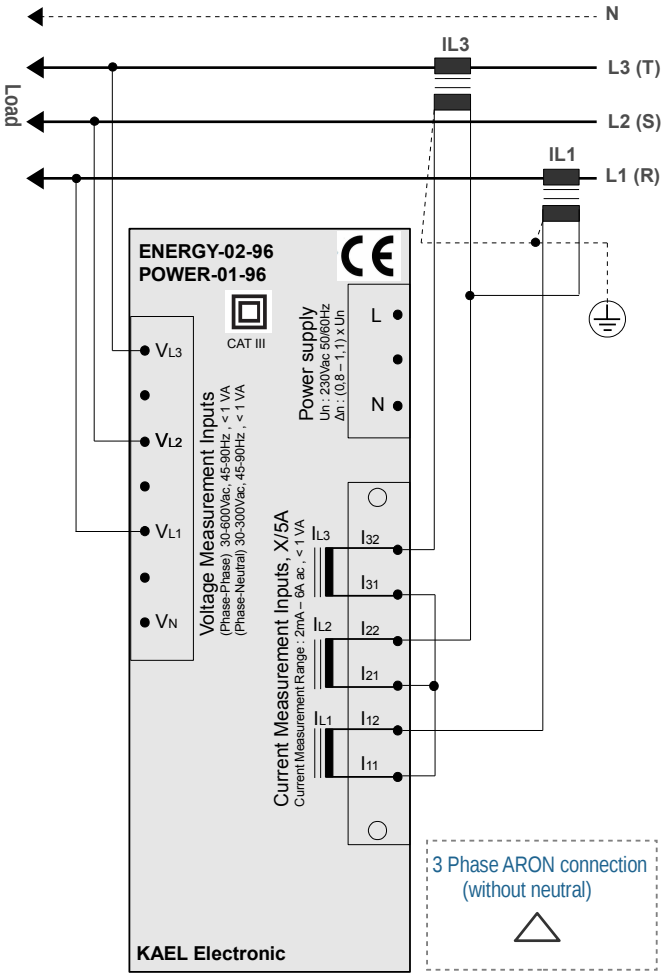
RS485 connection

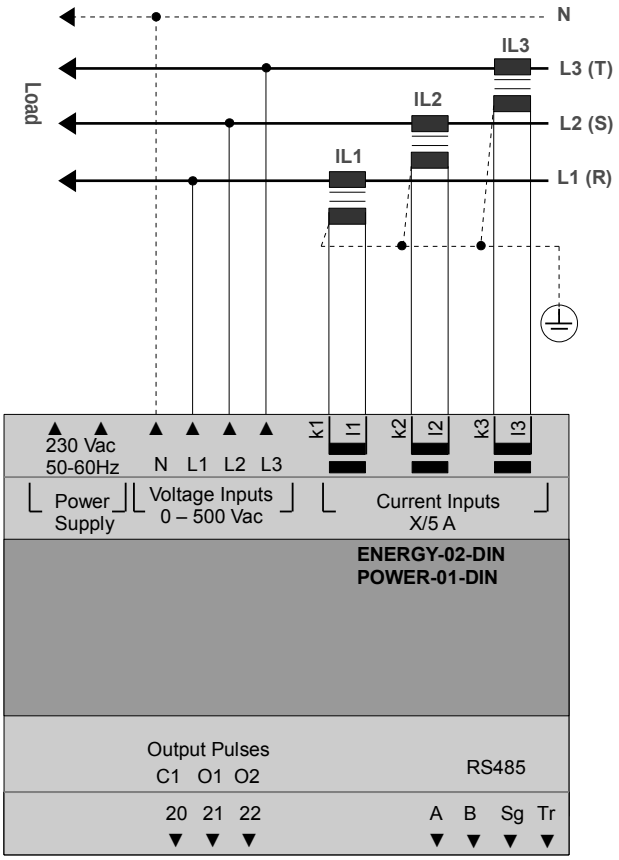



N
IL3
L3 (T)
IL2
L2 (S)
IL1
L1 (R)
Load
ENERGY-02-96
POWER-01-96
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0,8 – 1,1) x Un
L
N
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
VL3
VL2
VL1
VN
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
IL2
IL1
I32
I31
I22
I21
I12
I11
KAEL Electronic
3 Phase 4 Wire (with neutral)

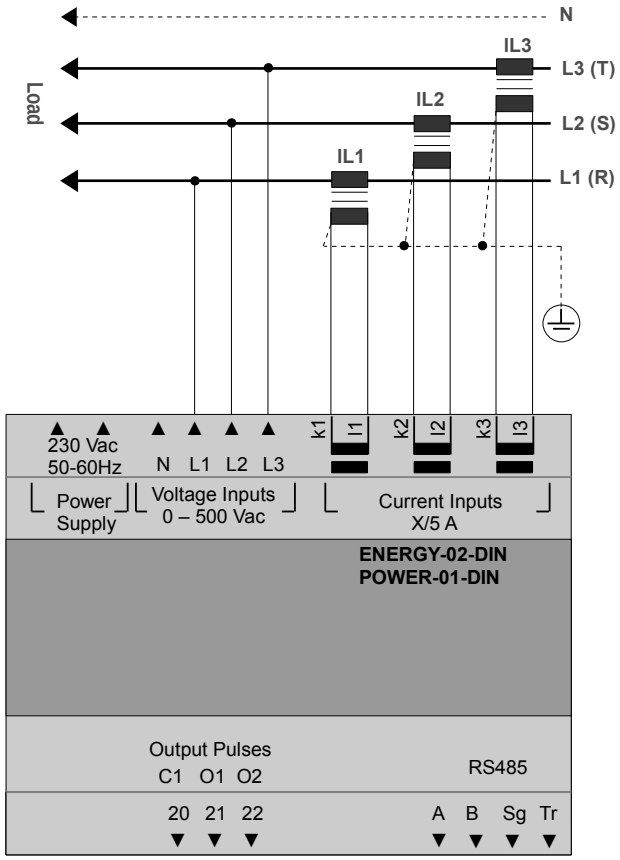

N
IL3
L3 (T)
IL2
L2 (S)
IL1
L1 (R)
Load
ENERGY-02-96
POWER-01-96
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0,8 – 1,1) x Un
L
N
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
VL3
VL2
VL1
VN
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
IL2
IL1
I32
I31
I22
I21
I12
I11
KAEL Electronic
3 Phase 3 Wire
(without neutral)


N
IL3
L3 (T)
L2 (S)
IL1
L1 (R)
Load
ENERGY-02-96
POWER-01-96
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0,8 – 1,1) x Un
L
N
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
VL3
VL2
VL1
VN
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
IL2
IL1
I32
I31
I22
I21
I12
I11
KAEL Electronic
3 Phase ARON connection
(with neutral)

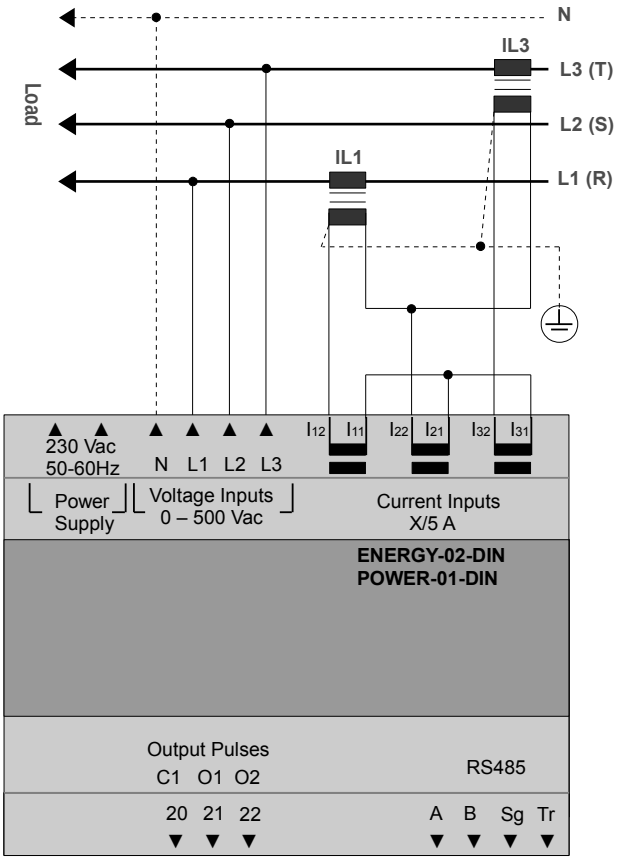

N
IL3
L3 (T)
L2 (S)
IL1
L1 (R)
Load
ENERGY-02-96
POWER-01-96
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0,8 – 1,1) x Un
L
N
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
VL3
VL2
VL1
VN
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
IL2
IL1
I32
I31
I22
I21
I12
I11
KAEL Electronic
3 Phase ARON connection
(without neutral)



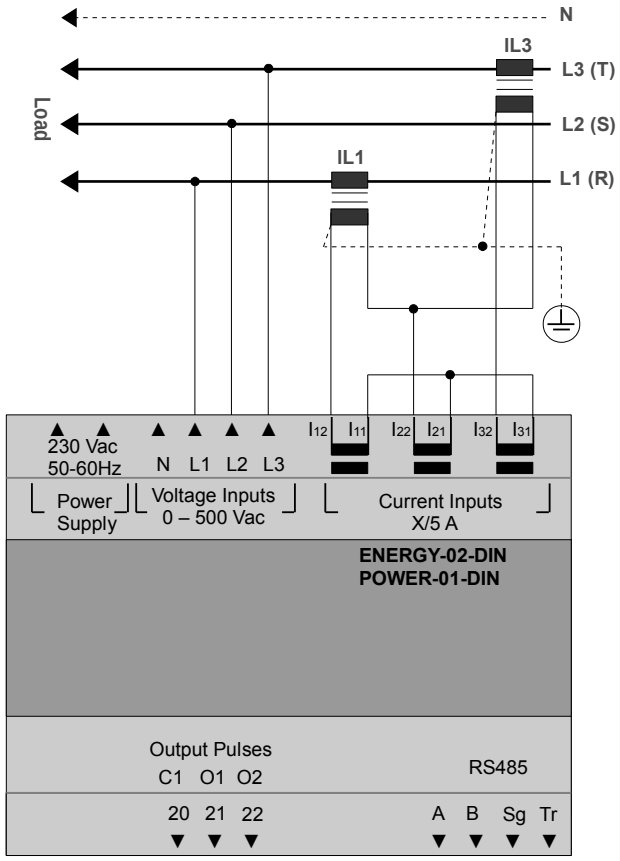
3 Phase 4 Wire (with neutral)



3 Phase 3 Wire (without neutral)

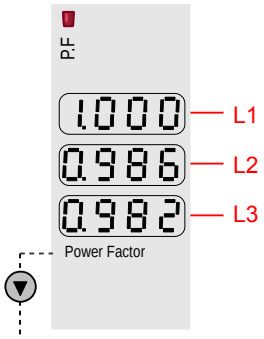


3 Phase ARON connection (with neutral)



3 Phase ARON connection (without neutral)

Power Factor (P.F)



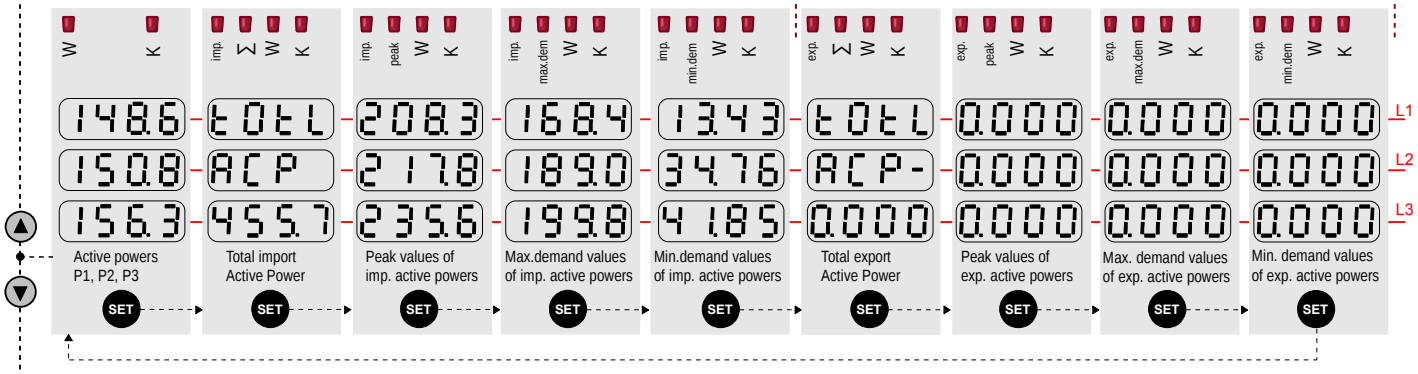
MEASUREMENTS:

For ENERGY-02 (P.F, W, VAr, VA, ΣW, ΣVAR, ΣVA, ΣWh, ΣVArh, ΣVAh)
For POWER-01 (P.F, W, VAr, VA, ΣW, ΣVAR, ΣVA)
The above parameters can be reached step by step using arrow keys. Related leds lights up and displays the corresponding parameter value which is displayed at the same time.

Active Power (P1, P2, P3, ∑P)

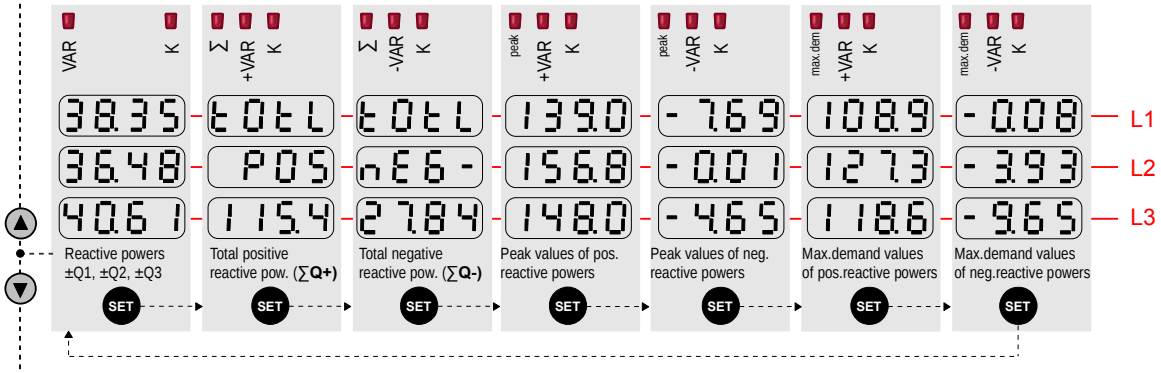
Active powers for each phases, total active power , their peak and demand values can be found in this menu. Demand and peak values are cleared in (cLr P) menu . Also setting of the demand time can be set in (dEnn SEt) menu.

NOT: POWER-01 do not measure the export powers.



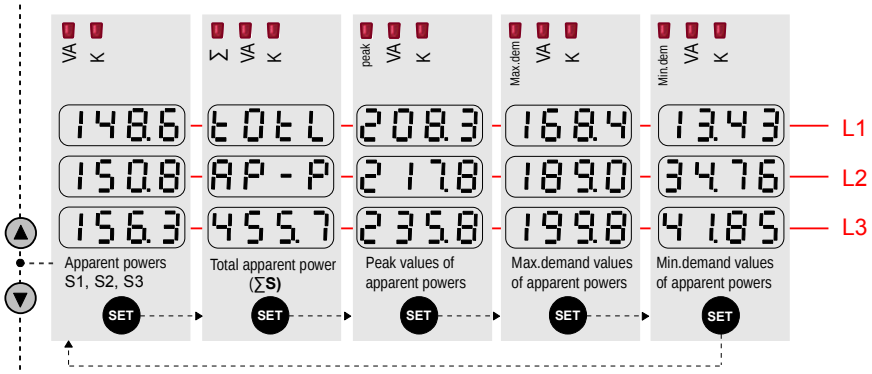
Reactive Power (+Q1, -Q1, +Q2, -Q2, +Q3, -Q3, ∑Q+, ∑Q-)

Reactive powers for each phases, total positive and negative reactive power , their peak and demand values can be found in this menu. Demand and peak values are cleared in (cLr q) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



Apparent Power (S1,S2,S3, ∑S)

Apparent powers for each phases, total apparent power , their peak and demand values can be found in this menu. Demand and peak values are cleared in (cLr S) menu . Also setting of the demand time can be set in (dEnn SEt) menu.

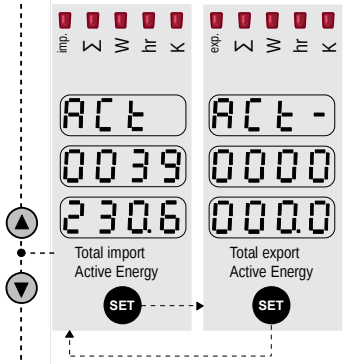


MEASUREMENTS

Active Energy (KWhr,MWhr,GWhr)

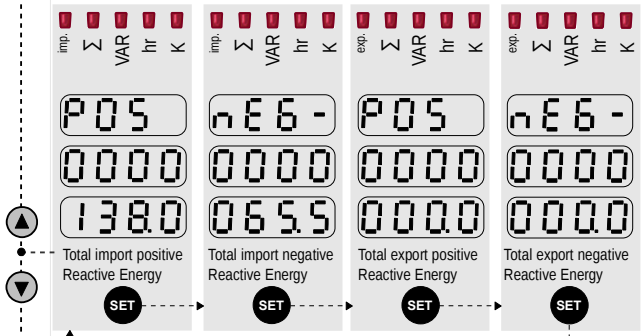
Total import and export active energy can be monitored.
Energies can be deleted in (CLR Energy) menu.

NOT: POWER-01 do not measure to the energies.



Reactive Energy (KVARhr,MVARhr,GVARhr)

Total import/export positive and negative energy can be monitored .
Energies can be deleted in (CLR Energy) menu.



Apparent Energy (KVAhr)

Apparent Energy can be deleted in
(CLR Energy) menu.

PARAMETERS

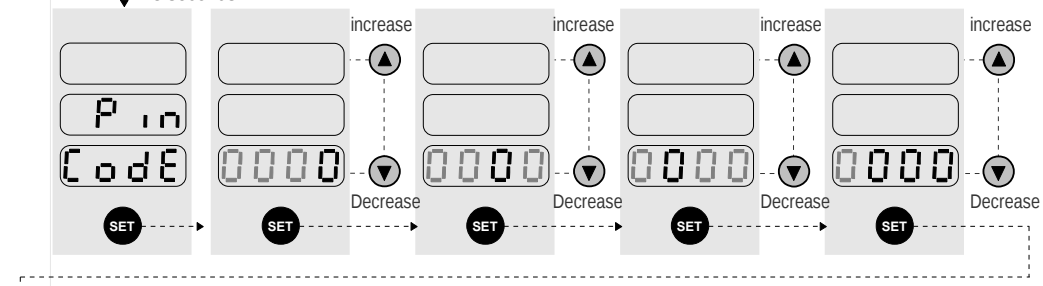
Parameters

If the password is active, SET button is pressed for 3 seconds, the parameter menu can be accessed only after entering 4-digit password. Temporary password is "0000". if password is not active, you can enter to the parameter menu without entering password. First parameter is current transformer ratio. After pressing the SET key, value is increased or decreased by using the arrow keys. By pressing the SET button, the new value will be saved.

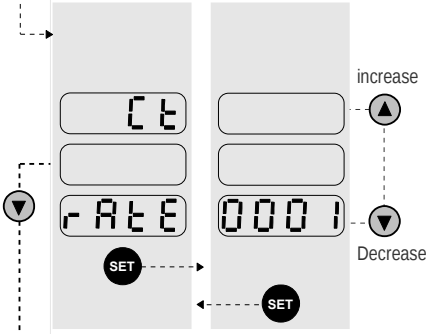
SET Press for 3 seconds

PIN (Password)

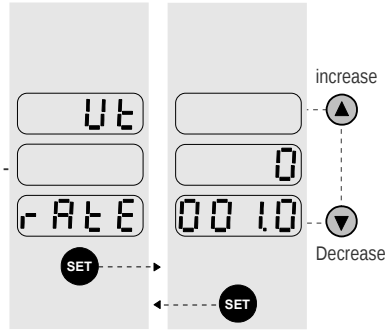
Factory setting for the password is "0000" '. To the desired number is reached by using the arrow keys for each a digit. Confirmed by pressing the SET key.



Ct :Current Transformer Ratio (1.....5000)
Current transformer ratio value is entered.
Example: For 500 / 5A is entered 100. (500/5A=100)



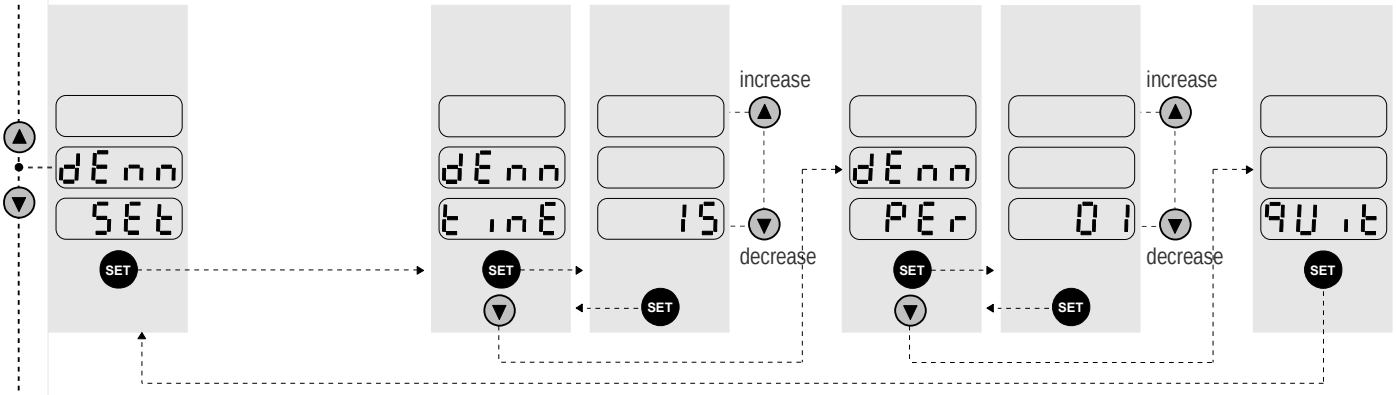
Ut :Voltage Transformer Ratio (1.....4000)
Voltage transformer ratio value is entered.
Example: For 34500 /100V is entered 345. (34500/100V=345)



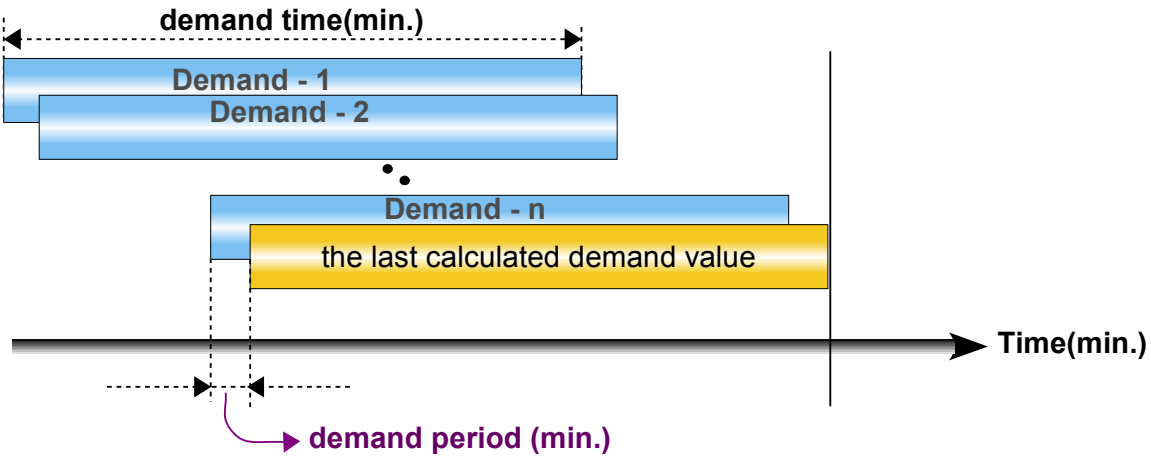
dEnn SEt : Demand SET
There are two parameters.
These are shown in the graph below.

dEnn tınE :Demand Time
(demand period +1) ..... (60 minutes)
Refers to the computation time.

dEnn PEr :Demand Period (1minute) ....(demand time - 1)
Refers to the time between two calculations.



Example: if , demand time= 15 minutes and demand period= 3 minutes ; Every 3 minutes, demand value is re-calculated for the last 15 minutes.

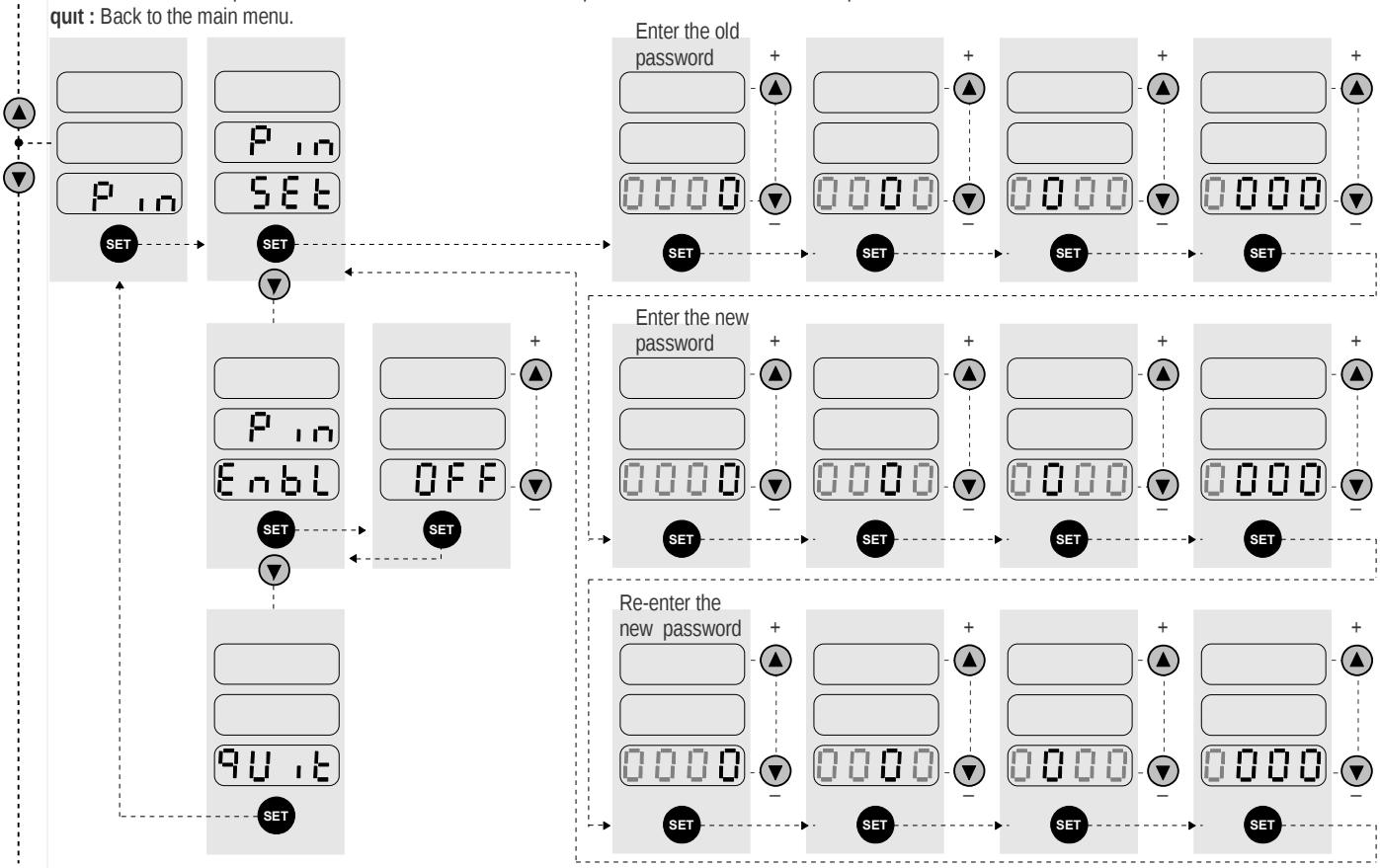


PIN (Password) : In this section, the password can be changed. Also password can be enabled or disabled.

Pın SEt : Default value for the password is "0000". First of all, the old password (PIN OLD) must be entered correctly. If the old password is correct, the user can enter the new password (**Pın nEU**). You must enter the new password again (**Pın rEP**). If both passwords are the same, "NEU Pin Suite" message appears on the screen and a new password will be stored.

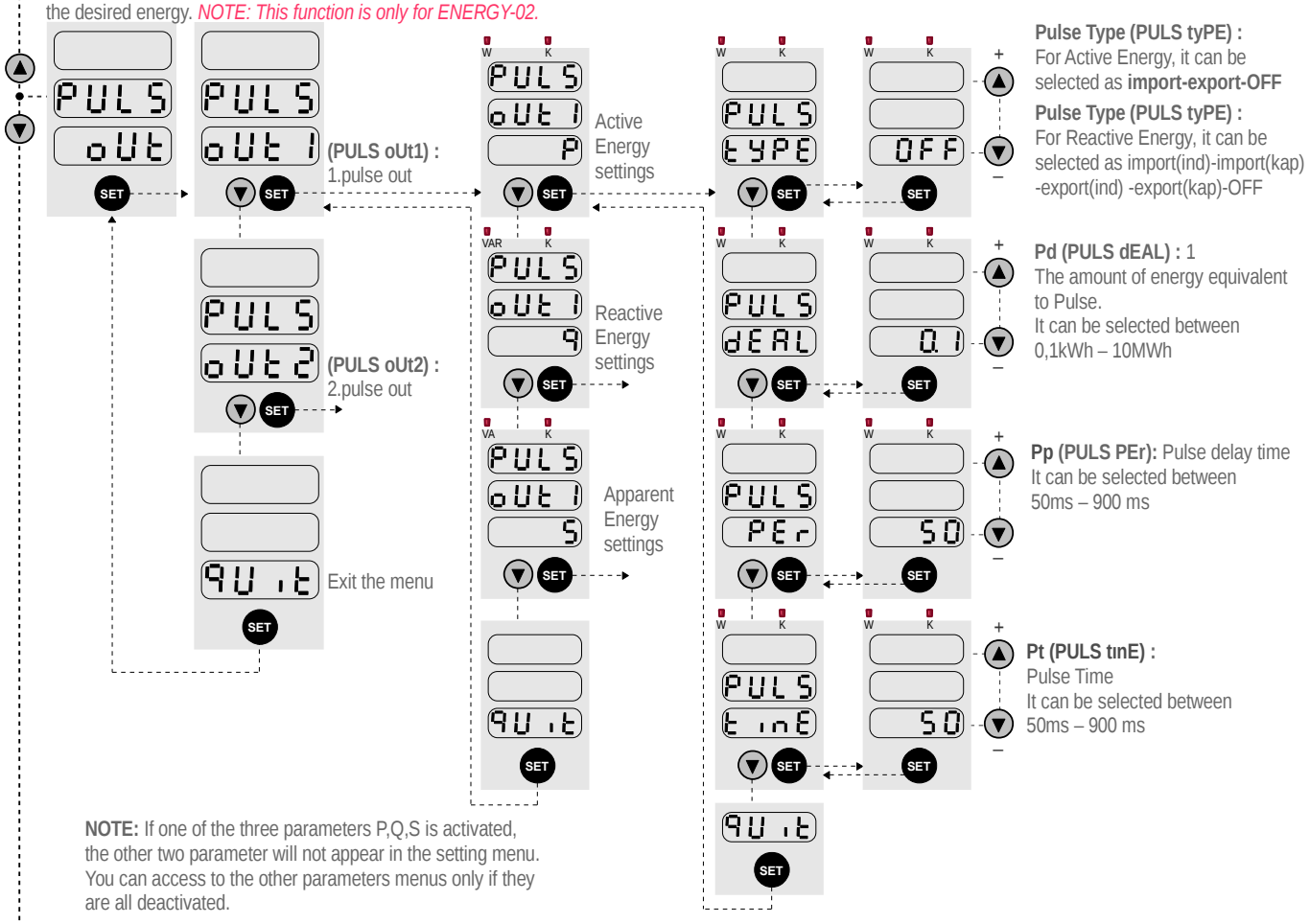
Pın EnbL : Password protection is enabled or disabled. **Pın On** ; password is enabled, **Pın OFF** ; password is disabled.

quıt : Back to the main menu.

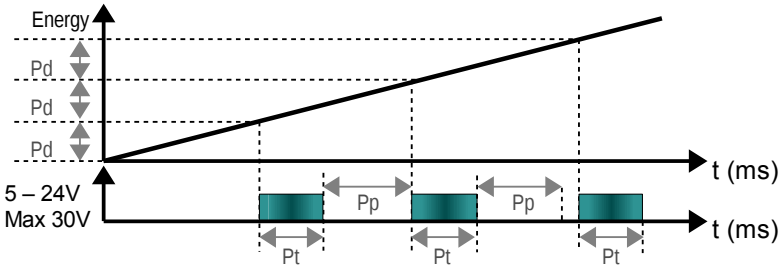


PARAMETERS

PULS oUt : The device has two digital pulse output. Menus and functions are the same for the two outputs.Outputs can be set differently according to the type of the desired energy. *NOTE: This function is only for ENERGY-02.*

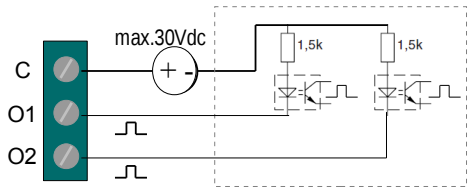


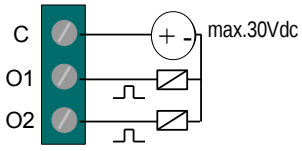
NOTE: If one of the three parameters P,Q,S is activated, the other two parameter will not appear in the setting menu. You can access to the other parameters menus only if they are all deactivated.



when amount of each energy (Pd) occurs , a pulse is generated from output, during time of (Pt). And then, output stays as 0V ,during time of (Pp)

Connection to another device as insulated



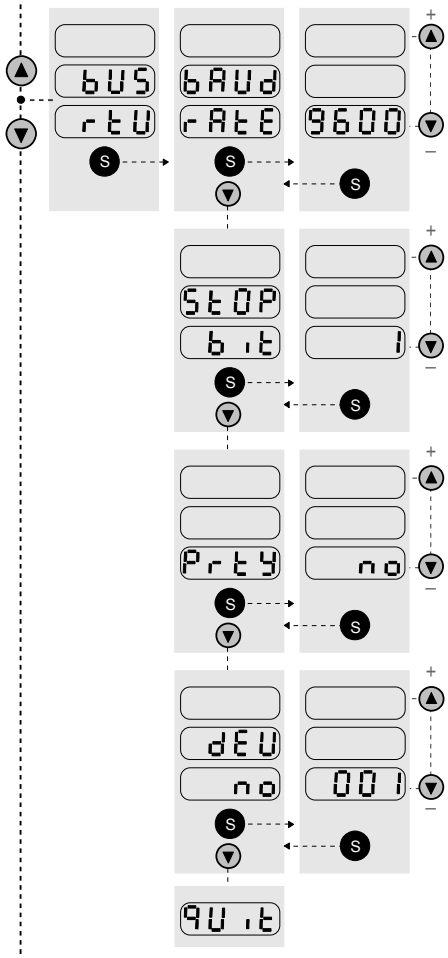


usage with relay

PARAMETERS

bUS rtU : Modbus rtu adjustments.

NOTE: This function is only for ENERGY-02.



Parity : no , even , odd
Cihaz No : 001 255

MODBUS – RTU

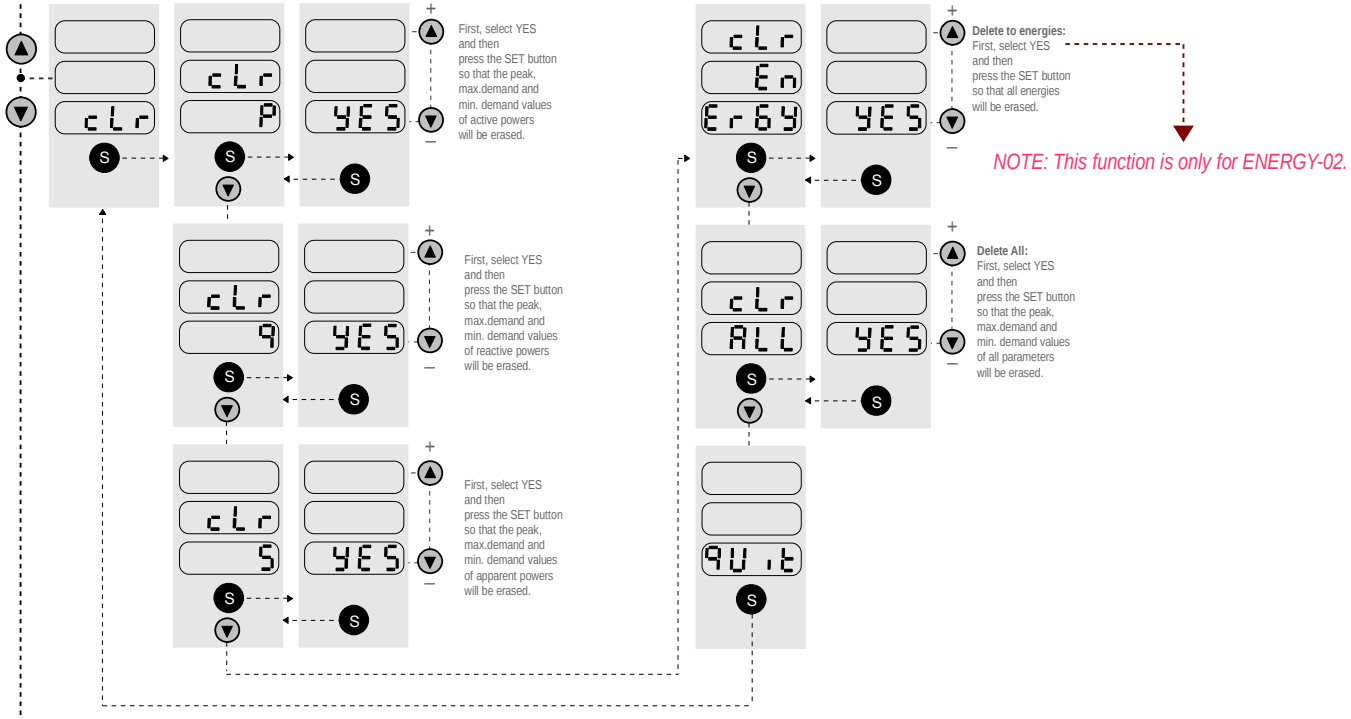
ADRESS 8 BIT	FUNCTION 8 BIT	DATA 8 BIT	CRCL 8 BIT	CRCH 8 BIT	T Delay time for 3,5 character

The maximum length of this package is 12 Byte.

MODBUS – RTU Functions

03H	READING SINGLE REGISTER
06H	WRITING SINGLE REGISTER
10H	WRITING MULTIPLE REGISTER

cLr : Demands, peak values, and accumulated energies can be erased in this section.The parameters which indicated by the LEDs at the top of the device, will be erased.



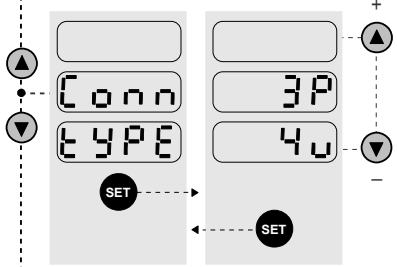
NOTE: This function is only for ENERGY-02.

PARAMETERS

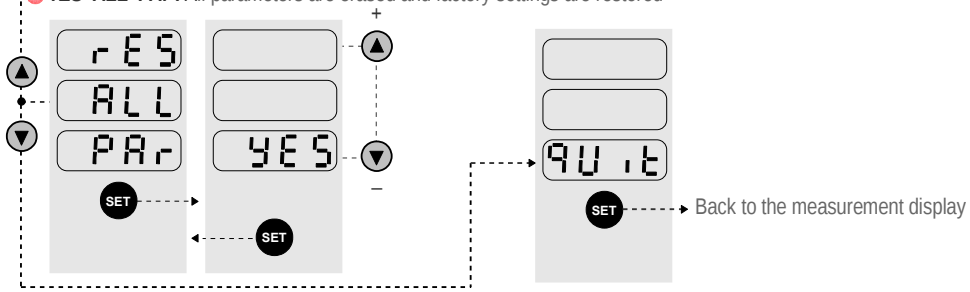
PARAMETERS

Conn tyPE : Selection of connection type.

3P 4u : 3 phase , 4 wire (star)
3P 3u : 3 phase , 3 wire (wye), without neutral



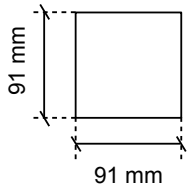
rES ALL PAr : All parameters are erased and factory settings are restored

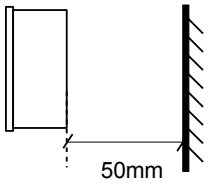


Installation Instructions

1- A space with a dimension of 92mm * 92mm shall be emptied on the panel where the device will be mounted.
2- Before assembly of the device, remove panel fixing apparatuses.
3- Place the device from front into the window opened in the panel as flush.
4- -Fix the device on to the panel by using fixing apparatuses from back part.
Make the assembly in a manner to assure 50 cms space between the device and the wall to enable good ventilation of the device.

PANEL SPACING DIMENSIONS





Technical Specifications

Operating Voltage (Un)	: (Phase-Neutral) 230Vac
Operating Range	: (0,8-1,1) x Un
Operating Frequency	: 50/60 Hz
Supply Power Consumption	: < 6VA
Power Consumption of Measurement Inputs:	: < 1VA
Vin	: 1 – 300 Vac (L-N)
	: 2 – 600 Vac (L-L)
Iin	: (as the secondary current of the current transformer) 0,01 - 6 Amp AC
Measurement Class	: CAT III
Voltage Transformer Ratio:	: 1 4000
Current Transformer Ratio	: 1 ..... 5000 (25000/5A)
Connection Type	: 3P&4W , 3P&3W , ARON
Demand Time	: 1 – 600 min
Display range	: 1,0V - 400,0 kV
	: 0,001A ..... 25000 A
	: 0 – 999,9 M (W,VAR,VA)
	: 0 – 999,9 k (W,VAR,VA)
	: 0 – 999.999.999,999 (GWh,GVARh,GVAh)

accuracy

Active Power	: 1 class
Reactive Power	: 2 class
Apparent Power	: 1 class

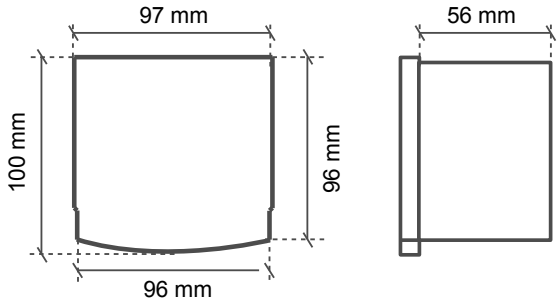
Pulse Outputs (2 pcs)

Operating Voltage	: 5 – 24Vdc max. 30Vdc
Operating Current	: max 50 mA
Min. Switching Time	: 100 ms

RS485

Baud rate	: 2400,4800,9600,19200,28800,38400,57600,115200
Stop Bits	: (0.5) , (1) , (1.5) , (2)
Parity	: no , even , odd
Device No	: 1 255

Device Protection Class	: IP 20
Terminal protection class	: IP 00
Ambient temperature	: - 5 °C .... + 50 °C
Installation Type	: to panel cover from front
Dimensions	: 96x96x56 mm



NOTE: Operating Voltage (Un): ask price and delivery time for 85-256Vac/dc

Factory Settings

	Current Transformer(Primary) Value	: 5 / 5 A
	Voltage Transformer Ratio	: 1
	Password	: if not changed by user (0000) NOTE 1
	Password use	: Off (disabled)
	Connection Type	: 3P&4W
MODBUS RTU	Port Settings (Baud Rate)	: 9600
MODBUS RTU	Port Settings (Stop Bits)	: 1
MODBUS RTU	Port Settings (Parity)	: No
MODBUS RTU	Port Settings (Device No)	: 1
	Demand Time	: 15 minutes
	Demand Interval	: 3 min
1. Pulse ouputt	Pulse Type for 1.Pulse Output	: OFF
1. Pulse ouputt	Pulse Value for 1. Pulse Output (Pd)	: 1 KWh
1. Pulse ouputt	Pulse Duration for 1.Pulse Output (Pt)	: 100 ms
1. Pulse ouputt	Pulse OFF Time for 1.Pulse output (Pp)	: 200 ms
2. Pulse output	Pulse Type for 2.Pulse Output	: OFF
2. Pulse output	Pulse Value for 2. Pulse Output (Pd)	: 1 KVARh
2. Pulse output	Pulse Duration for 2.Pulse Output (Pt)	: 100 ms
2. Pulse output	Pulse OFF Time for 2.Pulse output (Pp)	: 200 ms

Note 1 : The password is primarily defined as 0000. However the password will not change even in the event that factory values are restored after having amended the password. The latest password entered by the user is valid.

Note 2 : When factory settings are restored, energies are set to zero.

Formulas

Active Power	$P = \frac{1}{N} \sum_{i=0}^{N} P_i$
Reactive Power	$Q = \frac{1}{N} \sum_{i=0}^{N} Q_i$
Apparent Power	$S = \sqrt{P^2 + Q^2}$
Power Factor	$PF = \frac{P}{S}$

MULTIMET 01-PC-96 01-96 02-R-96 02-96

MULTIMET 01-PC-DIN 01-DIN 02-R-DIN 02-DIN

MULTIMETERS

TÜV SÜD GOST-R CE ISO 9001:2008

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KAEL Mühendislik Elektronik Tic. ve San. Ltd.Şti.

PARAMETERS:	MULTIMET-01	MULTIMET-01-PC-R	MULTIMET-02	MULTIMET-02-R
Ct : current transformer ratio (1...5000)	■	■	■	■
Ut : voltage transformer ratio (1...4000)	■	■	■	■
Denn Set : Demand SET	■	■	■	■
PIN: (Pasword)	■	■	■	■
rELE oUt : Settings of Relay outputs		■		■
bUS rtU : Settings of Modbus RTU		■		
CLr : clear	■	■	■	■
Coon tyPE : connection type	■	■	■	■
rES ALL PAr : reset all values	■	■	■	■

MODEL

	With RS485 MODBUS RTU VL1,VL2,VL3 VL12,VL23,VL13 IL1,IL2,IL3 I-Neutral, Hz P1,P2,P3, Q1,Q2,Q3, S1,S2,S3 CosΦ1,CosΦ2,CosΦ3 PFD1,PFD2,PFD3, ΣPF ΣP,ΣQi,ΣQc,,ΣS	■ Voltages(phase-neutral)VL1N,VL2N,VL3N	■ Voltages(phase-phase) VL12,VL23,VL13	■ Currents I1,I2,I3	■ Frequency	Neutral Current	■ Power Factors PF1,PF2,PF3	■ Powers W,VAR,VA	■ Peak	■ Min,Max demand	■ Voltage, Current, Frequency protections	■ Phase Sequence Protection	■ 2 Relay outputs	■ RS-485 MODBUS-RTU	■ 3P&4W , 3P&3W , ARON connections	■ Voltage transformer ratio	■ Current transformer ratio	■ Password	■ LED display	■ 96 x 96	■ DIN
MULTIMET-01-96		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
MULTIMET-01-DIN		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■
MULTIMET-01-PC-96		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
MULTIMET-01-PC-DIN		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■
MULTIMET-02-96		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
MULTIMET-02-DIN		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■
MULTIMET-02-R-96		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
MULTIMET-02-R-DIN		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■

Introduction

The device was designed to measure, report and analyse the electrical magnitudes in the 3-phase electric network and both design and software were produced by KAEL engineers. The state-of-the-art technologies were inserted in this device and both menus which facilitate the use of the user and the required features were included.

All the information and warnings you need to know concerning the device were described in the user operation manual. Please read this manual carefully before engaging with the device. Please do not take any action before consulting with our company for any matters not clearly understood.

Tel: +90 232 877 14 84 (pbx) Fax: +90 232 877 14 49
Factory: Atatürk Mh. 78. Sok. No:10 Ulucak Köyü Kemalpaşa İzmir- TURKIYE

WARNINGS

1- The device shall be engaged by competent and licensed persons in conformity with the instructions set forth in the operation manual. In case required, controls shall be carried out by such persons also.
2- Do not open the inside of the device or cause to be opened. There are no parts inside the device which the user or anyone else may intervene.
3- Use the device according to assembly instructions
4- Before making electrical connection to the terminals of the device, make sure there is no electric power on the cables and terminals. The switchboard shall not have electric power on.
5- The fuses used in the device are of 1A FF type.
6- Make sure to fix the device on the switchboard firmly without swings with the apparatus given with the device.
7- Do not touch the keys on the front panel of the device with any substance other than your finger.
8- Wipe the device only with dry cloths after making sure the electric energy of the device is cut-off. Water or chemicals used for cleaning may cause damage to the device.
9- Before activating (energizing) your device please make sure that the terminal connections are made according to the connection scheme and without causing any contact problems (loose connection or contact of multiple copper cables).
10. The above measurements and warnings are for your safety. Kael Elektronik Ltd Şti or the dealer may not be held liable for any inconveniences when those warnings are not observed.

Features

- Easy use with menu
- Improved dynamic software
- Ability to enter current and voltage transformer rates
- True RMS
- Voltage, current and frequency protection
- Phase Sequence Protection
- Multiple alarms
- Password
- 3P&4W, 3P&3W, ARON Connectionı

Measurements

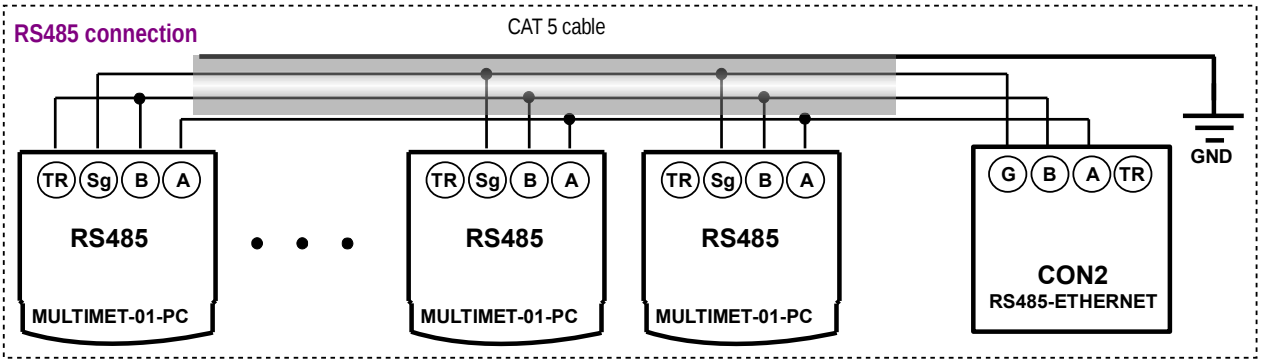
- Voltage (V1N, V2N, V3N , V12, V23, V13)
- Current (I1, I2, I3,)
- Power Factor (PF1, PF2, PF3)
- Frequency (Hz)
- Active Power (ΣP)
- Inductive Reactive Power Q(ind)
- Capacitive Reactive Power Q(cap)
- Apparent Power (ΣS)
- Neutral Current (I(N))
- Peak and Demands

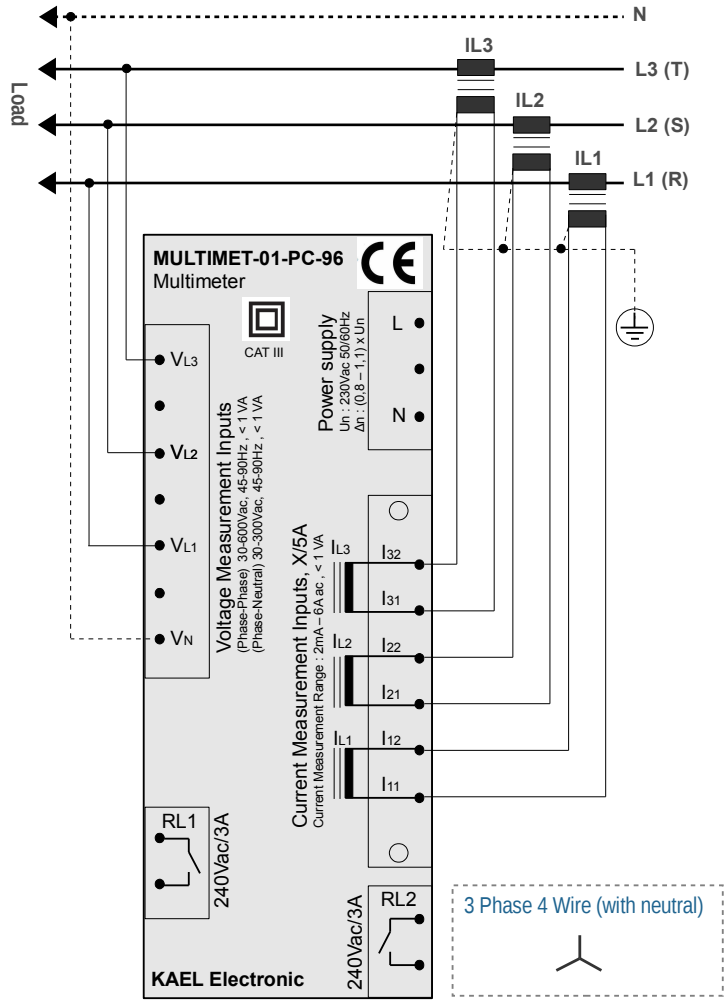
Outputs

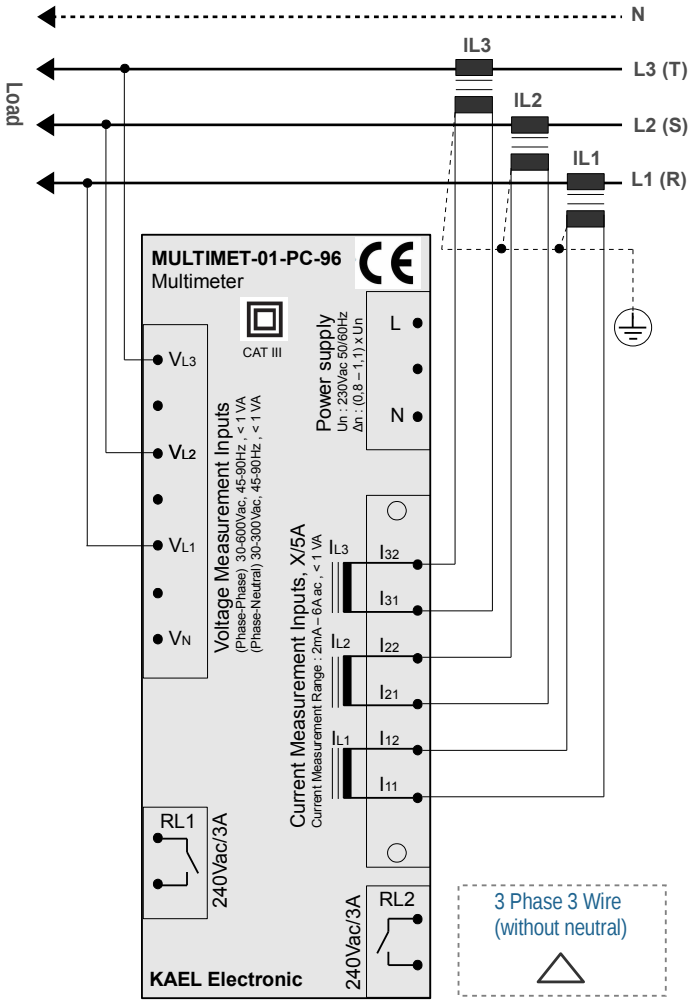
- Relay Output (2pcs)
- RS-485 MODBUS-RTU

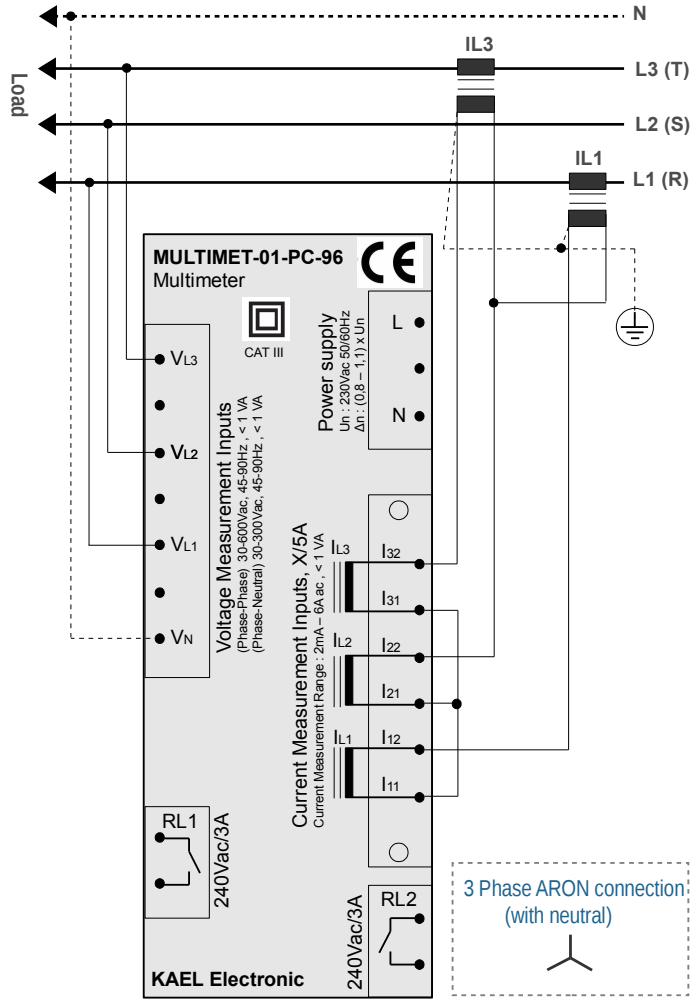
Making the Connections

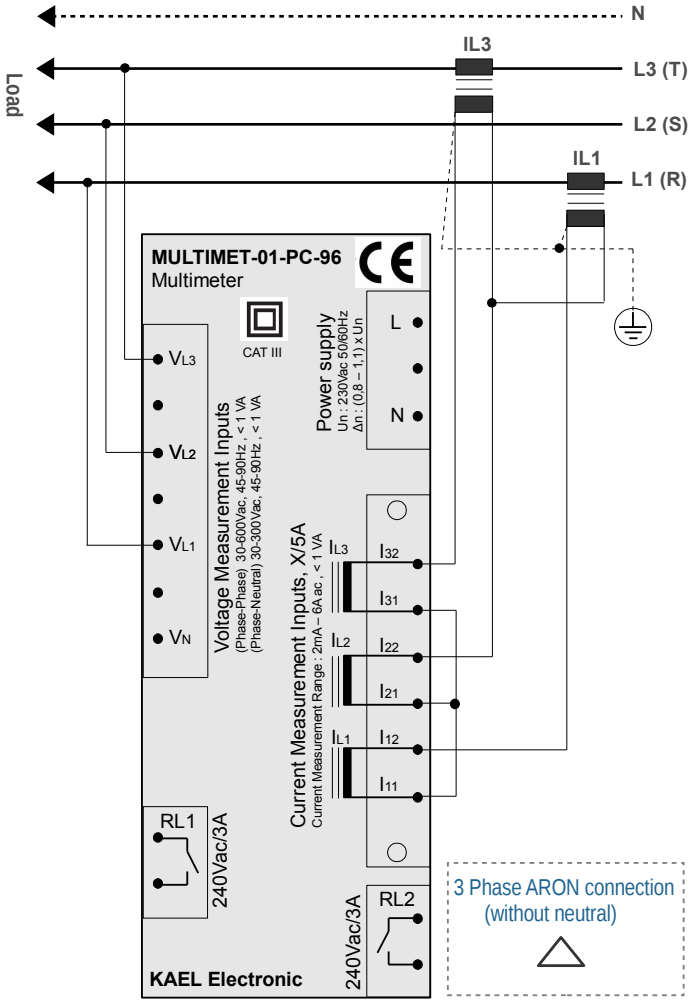
RS485 connection

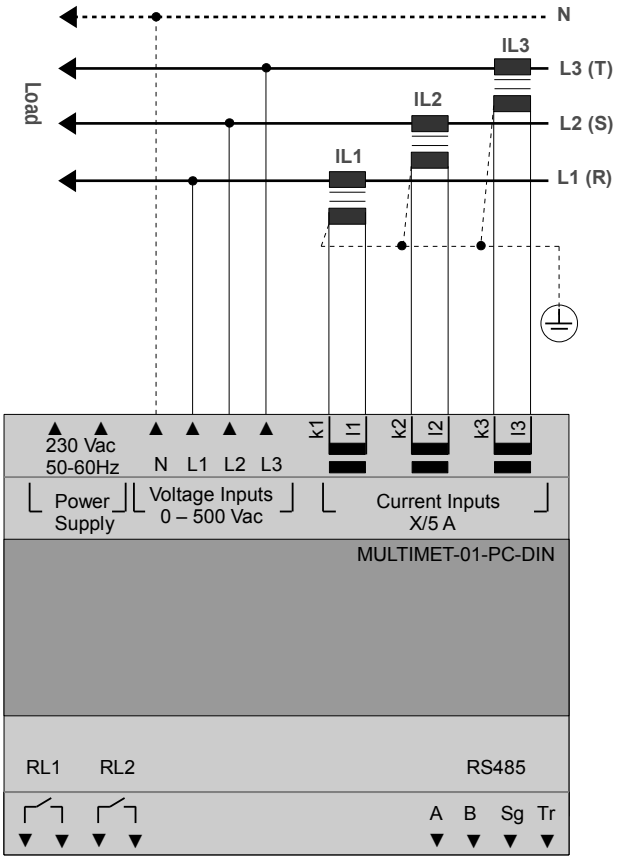



N
IL3
L3 (T)
IL2
L2 (S)
IL1
L1 (R)
Load
MULTIMET-01-PC-96
Multimeter
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0,8 – 1,1) x Un
L
N
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
VL3
VL2
VL1
VN
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
IL2
IL1
I32
I31
I22
I21
I12
I11
RL1
240Vac/3A
RL2
240Vac/3A
KAEL Electronic
3 Phase 4 Wire (with neutral)

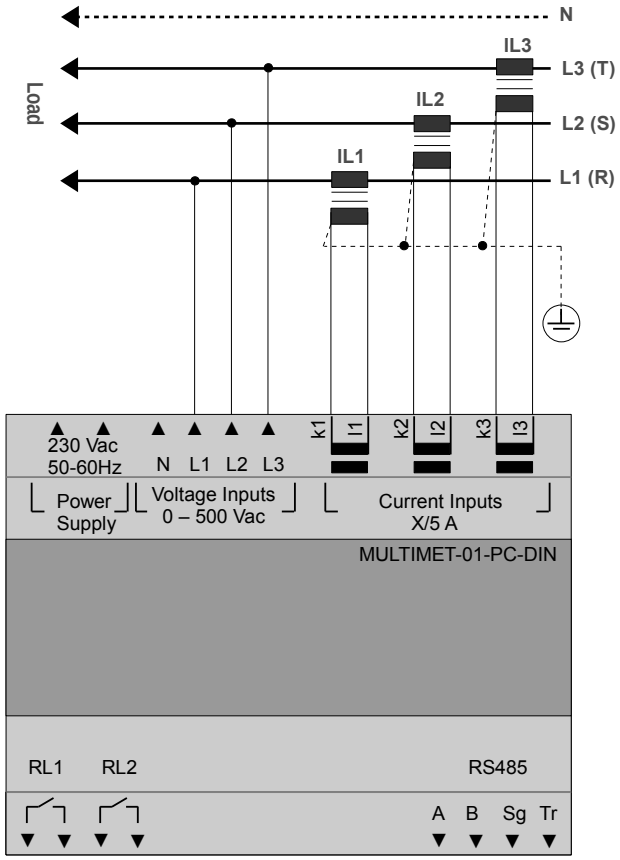

N
IL3
L3 (T)
IL2
L2 (S)
IL1
L1 (R)
Load
MULTIMET-01-PC-96
Multimeter
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0,8 – 1,1) x Un
L
N
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
VL3
VL2
VL1
VN
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
IL2
IL1
I32
I31
I22
I21
I12
I11
RL1
240Vac/3A
RL2
240Vac/3A
KAEL Electronic
3 Phase 3 Wire
(without neutral)


N
IL3
L3 (T)
L2 (S)
IL1
L1 (R)
Load
MULTIMET-01-PC-96
Multimeter
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0,8 – 1,1) x Un
L
N
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
VL3
VL2
VL1
VN
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
IL2
IL1
I32
I31
I22
I21
I12
I11
RL1
240Vac/3A
RL2
240Vac/3A
KAEL Electronic
3 Phase ARON connection
(with neutral)

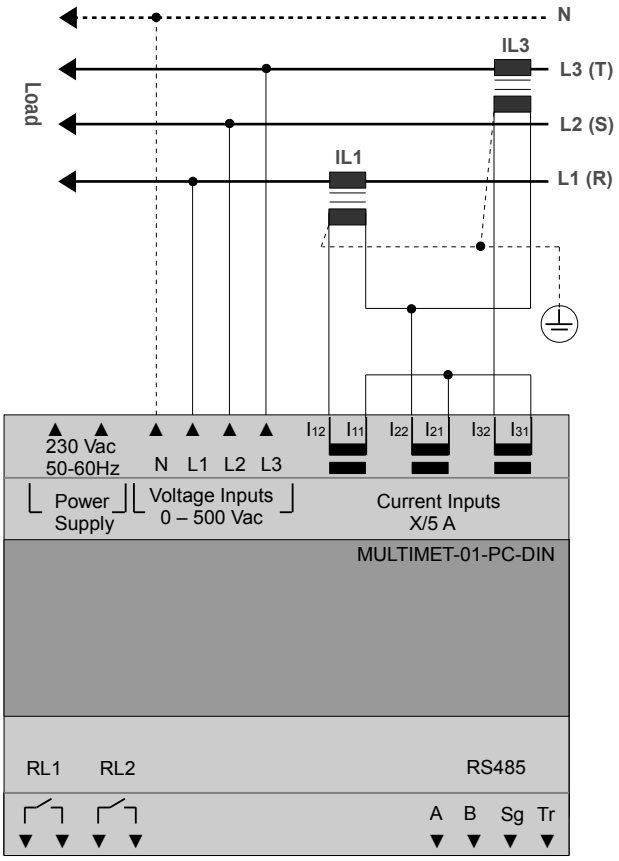

N
IL3
L3 (T)
L2 (S)
IL1
L1 (R)
Load
MULTIMET-01-PC-96
Multimeter
CAT III
Power supply
Un : 230Vac 50/60Hz
Δn : (0,8 – 1,1) x Un
L
N
Voltage Measurement Inputs
(Phase-Phase) 30-600Vac, 45-90Hz , < 1 VA
(Phase-Neutral) 30-300Vac, 45-90Hz , < 1 VA
VL3
VL2
VL1
VN
Current Measurement Inputs, X/5A
Current Measurement Range : 2mA – 6A ac , < 1 VA
IL3
IL2
IL1
I32
I31
I22
I21
I12
I11
RL1
240Vac/3A
RL2
240Vac/3A
KAEL Electronic
3 Phase ARON connection
(without neutral)



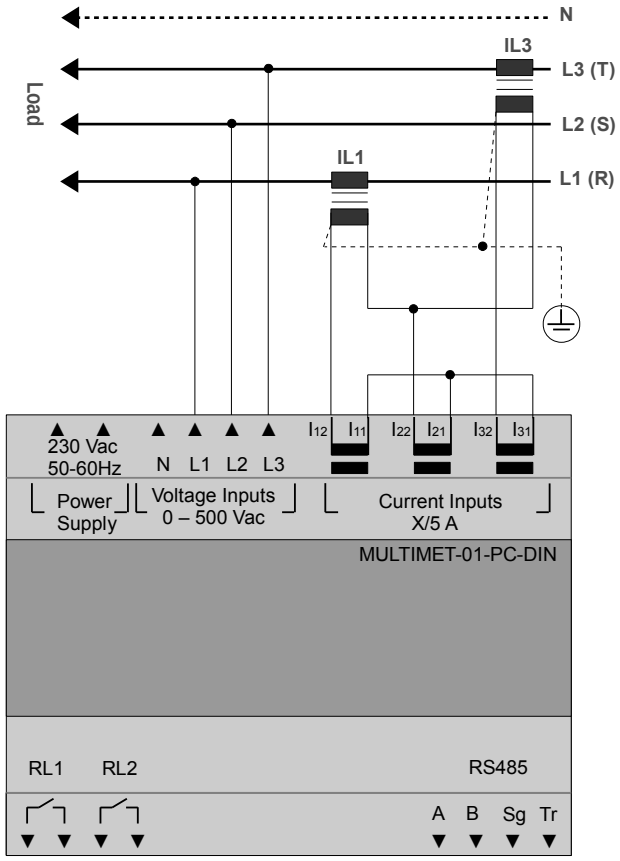
3 Phase 4 Wire (with neutral)



3 Phase 3 Wire (without neutral)



3 Phase ARON connection (with neutral)



3 Phase ARON connection (without neutral)

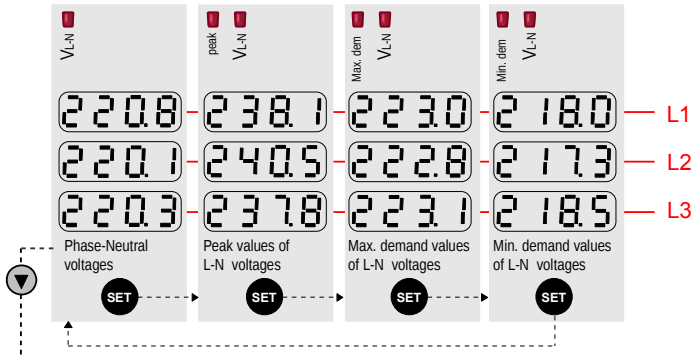
MEASUREMENTS

MULTIMET-01 ve MULTIMET-01-PC için (VL-N, VL-L, A, I-Neutral, Hz, CosΦ, W, VAr, VA)
MULTIMET-02 ve MULTIMET-02-R için (VL-N, VL-L, A, I-Neutral, Hz, CosΦ)

The above parameters can be reached step by step using arrow keys. Related leds lights up and displays the corresponding parameter value which is displayed at the same time.

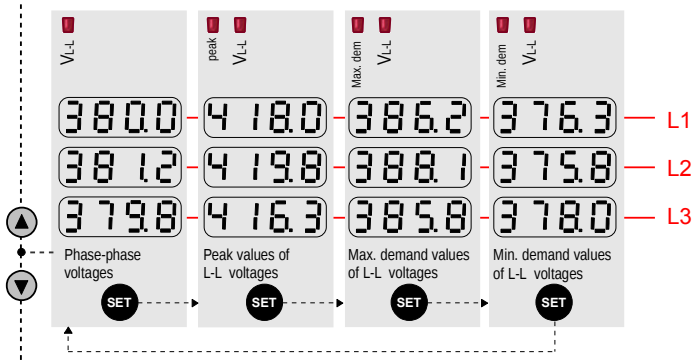
Voltages of phase to neutral (VL-N)

Phase-to-neutral voltages , their peak and demand values can be found in this menu. Demand and peak values are cleared in (cLr UL-n) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



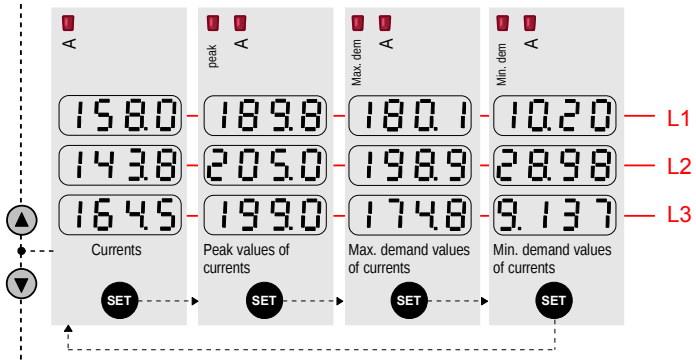
Voltages of phase to phase (VL-L)

Phase-to-phase voltages , their peak and demand values can be found in this menu. Demand and peak values are cleared in (cLr UL-L) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



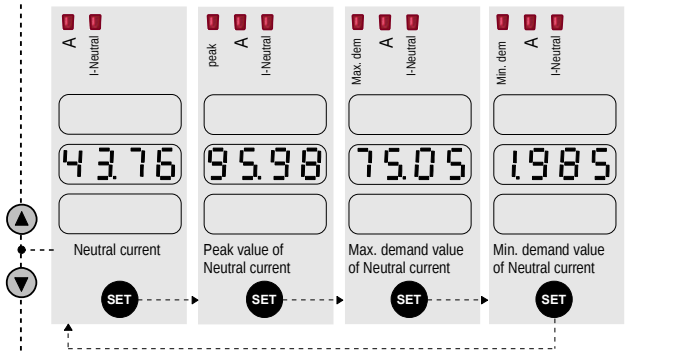
Currents (I1, I2, I3)

Phase currents , their peak and demand values can be found in this menu. Demand and peak values are cleared in (cLr A) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



Neutral Current (I-Neutral)

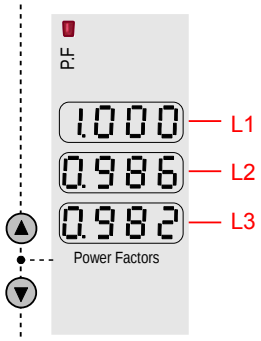
Neutral current , its peak and demand values can be found in this menu. Demand and peak values are cleared in (cLr A) menu . Also setting of the demand time can be set in (dEnn SEt) menu.



MEASUREMENTS

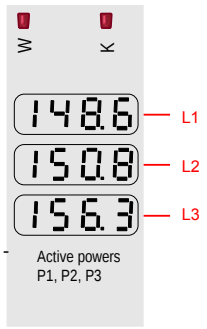
Frequency (Hz)

Power Factor (P.F)



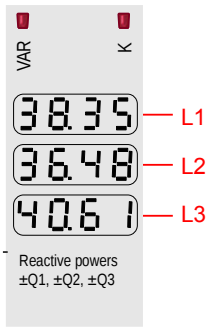
Active Power (P1, P2, P3)

Active powers for each phases can be found in this menu.



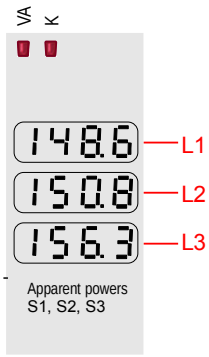
Reactive Power (±Q1, ±Q2, ±Q3)

Reactive powers for each phases can be found in this menu.



Apparent Power (S1,S2,S3)

Apparent powers for each phases can be found in this menu.



NOTE: MULTIMET-02-R and MULTIMET-02 do not measure powers.

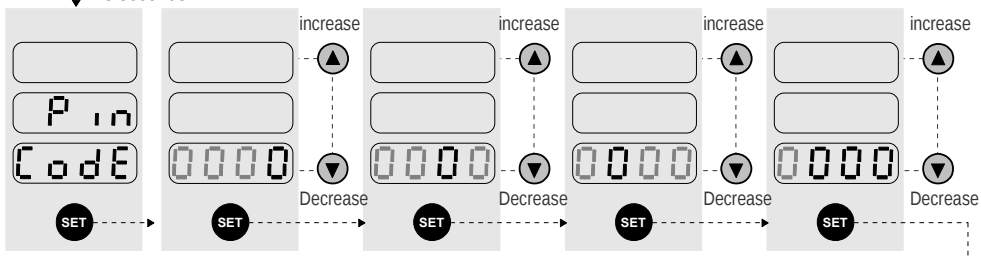
Parameters

If the password is active, SET button is pressed for 3 seconds, the parameter menu can be accessed only after entering 4-digit password. Temporary password is "0000". if password is not active, you can enter to the parameter menu without entering password. First parameter is current transformer ratio. After pressing the SET key, value is increased or decreased by using the arrow keys. By pressing the SET button, the new value will be saved.

SET Press for 3 seconds

PIN (Password)

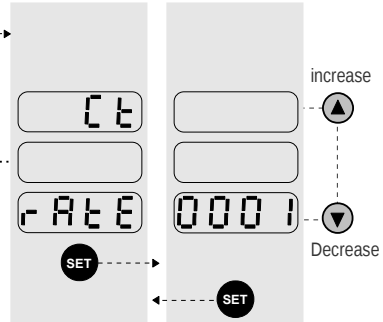
Factory setting for the password is "0000" '. To the desired number is reached by using the arrow keys for each a digit. Confirmed by pressing the SET key.



Ct :Current Transformer Ratio (1.....5000)

Current transformer ratio value is entered.

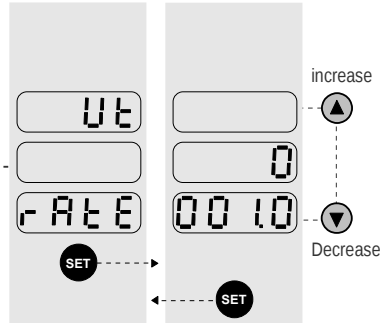
Example: For 500 / 5A is entered 100. (500/5A=100)



Ut :Voltage Transformer Ratio (1.....4000)

Voltage transformer ratio value is entered.

Example: For 34500 /100V is entered 345. (34500/100V=345)

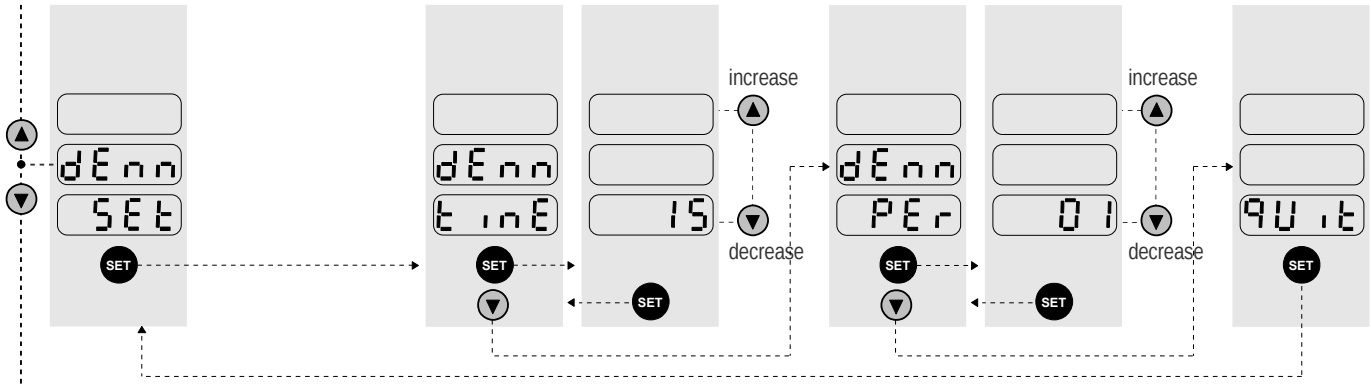


PARAMETERS

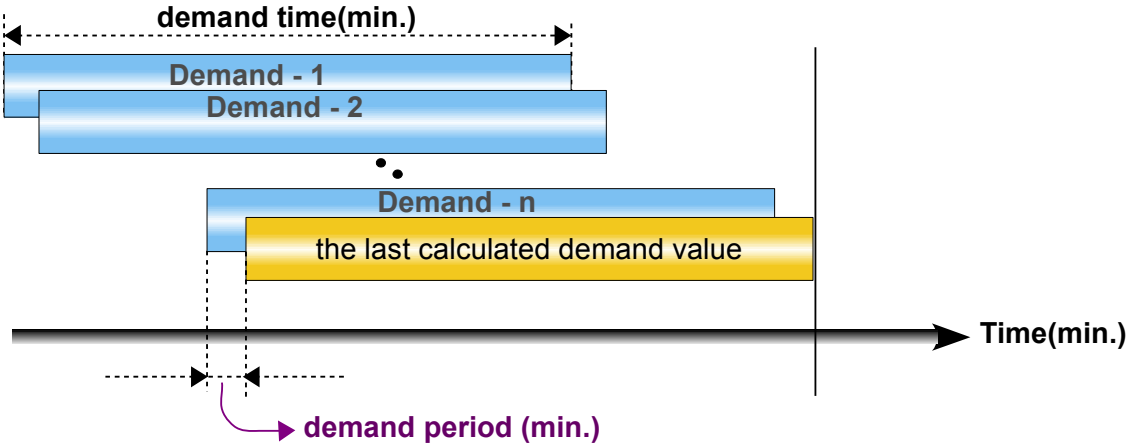
dEnn SEt : Demand SET
There are two parameters.
These are shown in the graph below.

dEnn tınE :Demand Time
(demand period +1) ..... (60 minutes)
Refers to the computation time.

dEnn PEr :Demand Period (1minute) ....(demand time - 1)
Refers to the time between two calculations.



Example: if , demand time= 15 minutes and demand period= 3 minutes ; Every 3 minutes, demand value is re-calculated for the last 15 minutes.

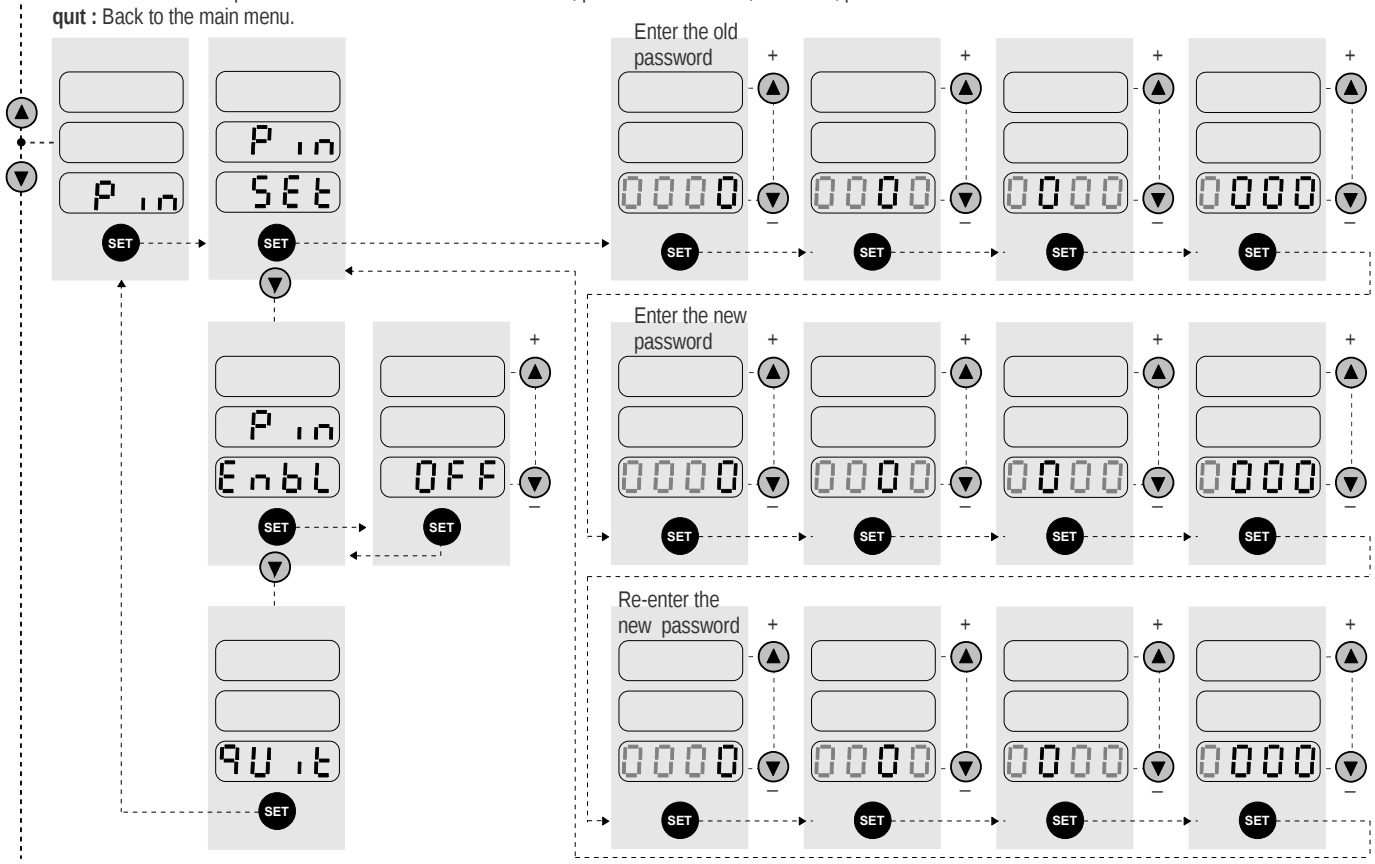


PIN (Password) : In this section, the password can be changed. Also password can be enabled or disabled.

Pın SEt : Default value for the password is "0000". First of all, the old password (PIN OLD) must be entered correctly. If the old password is correct, the user can enter the new password (**Pın nEU**). You must enter the new password again (**Pın rEP**). If both passwords are the same, "NEU Pin Suite" message appears on the screen and a new password will be stored.

Pın EnbL : Password protection is enabled or disabled. **Pın On** ; password is enabled, **Pın OFF** ; password is disabled.

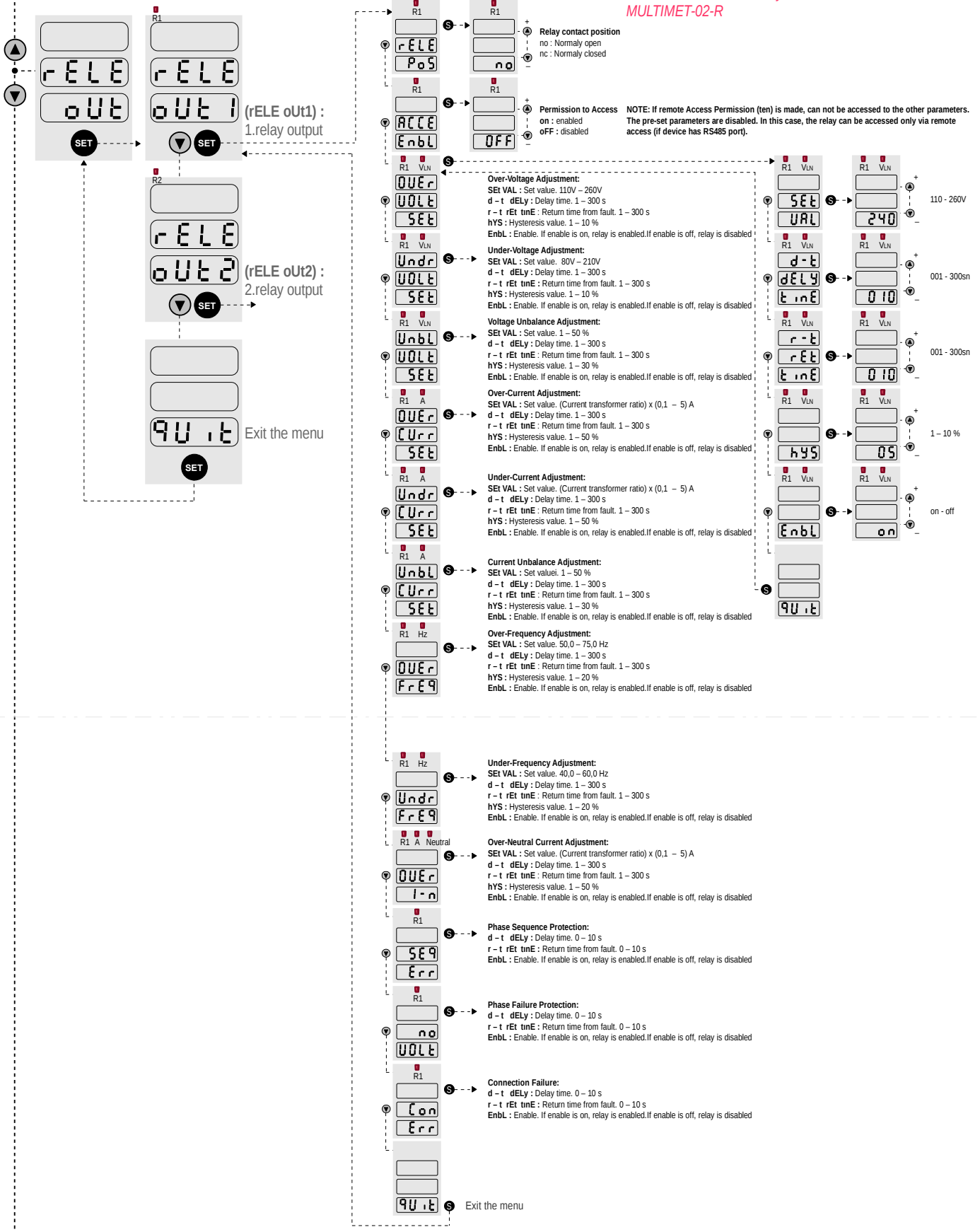
quıt : Back to the main menu.



PARAMETERS

rELE oUt : The device has two digital inputs. Menus and functions are the same for the two outputs.

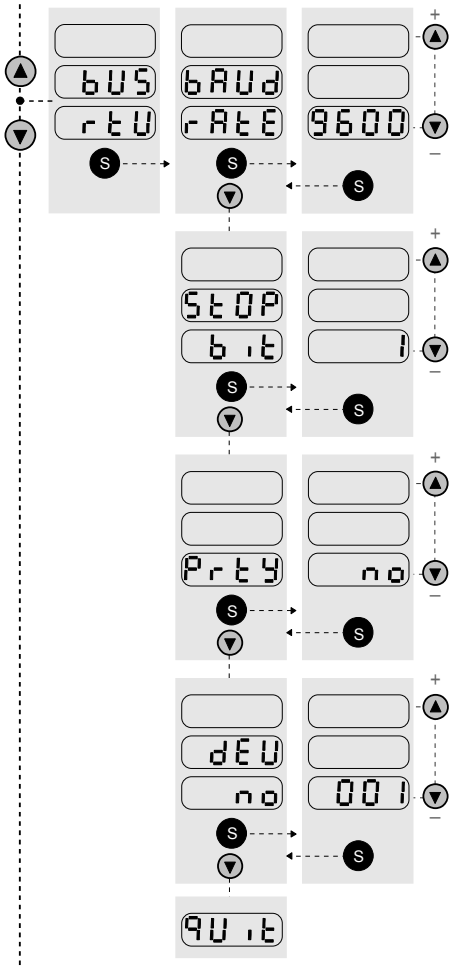
NOTE: This function is only for MULTIMET-01-PC and MULTIMET-02-R



PARAMETERS

bUS rtU : Modbus rtu adjustments.

NOTE: This function is only for MULTIMET-01-PC



Baud rate: 2400,4800,9600,19200,28800,38400,57600,115200
Stop Bits : (0.5) , (1) , (1.5) , (2)
Parity : no , even , odd
Cihaz No : 001 255

MODBUS – RTU

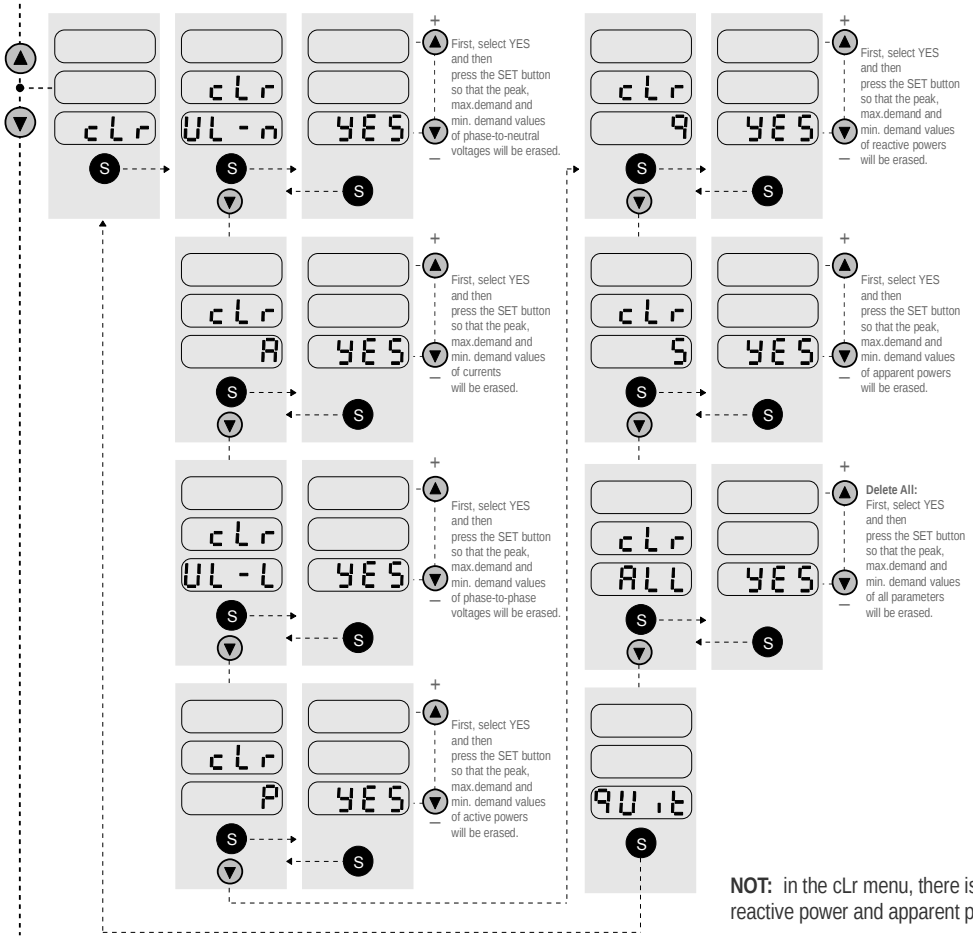
ADRESS 8 BIT	FUNCTION 8 BIT	DATA 8 BIT	CRCL 8 BIT	CRCH 8 BIT	T Delay time for 3,5 character

The maximum length of this package is 12 Byte.

MODBUS – RTU Functions

03H	READING SINGLE REGISTER
06H	WRITING SINGLE REGISTER
10H	WRITING MULTIPLE REGISTER

cLr : Demands, peak values, and accumulated energies can be erased in this section.The parameters which indicated by the LEDs at the top of the device, will be erased.



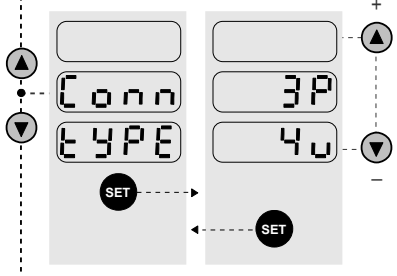
NOT: in the cLr menu, there is no delete section for active power, reactive power and apparent power in for MULTIMET-02-R and MULTIMET-02.

PARAMETERS

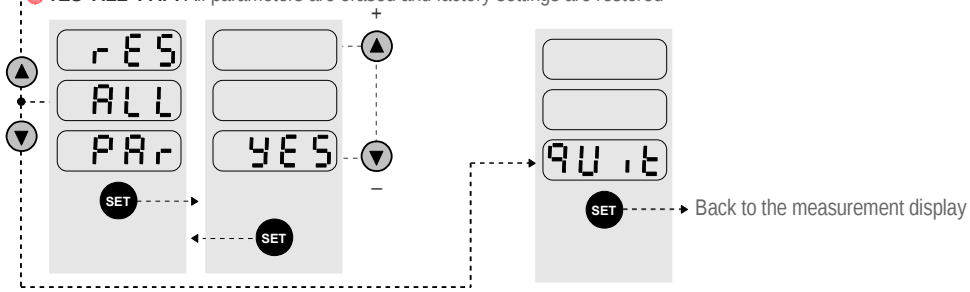
PARAMETERS

Conn tyPE : Selection of connection type.

3P 4u : 3 phase , 4 wire (star)
3P 3u : 3 phase , 3 wire (wye), without neutral



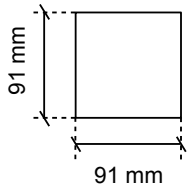
rES ALL PAr : All parameters are erased and factory settings are restored

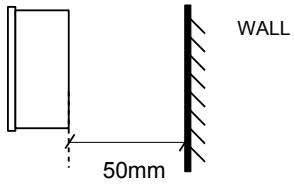


Installation Instructions

1- A space with a dimension of 92mm * 92mm shall be emptied on the panel where the device will be mounted.
2- Before assembly of the device, remove panel fixing apparatuses.
3- Place the device from front into the window opened in the panel as flush.
4- -Fix the device on to the panel by using fixing apparatuses from back part.
Make the assembly in a manner to assure 50 cms space between the device and the wall to enable good ventilation of the device.

PANEL SPACING DIMENSIONS





Technical Specifications

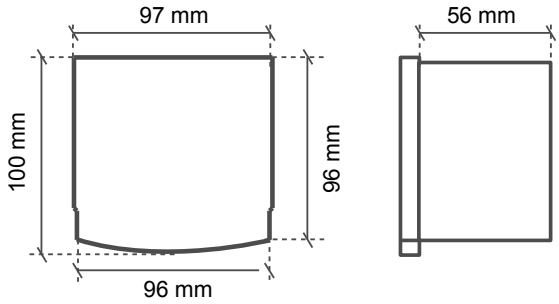
Operating Voltage (Un)	: (Phase-Neutral) 230Vac
Operating Range	: (0,8-1,1) x Un
Operating Frequency	: 50/60 Hz
Supply Power Consumption	: < 6VA
Power Consumption of Measurement Inputs:	: < 1VA
Vin	: 1 – 300 Vac (L-N)
	: 2 – 600 Vac (L-L)
Iin	: (as the secondary current of the current transformer) 0,01 - 6 Amp AC
Measurement Class	: CAT III
Voltage Transformer Ratio:	: 1 4000
Current Transformer Ratio	: 1 ..... 5000 (25000/5A)
Connection Type	: 3P&4W , 3P&3W , ARON
Demand Time	: 1 – 600 min
Display range	: 1,0V - 400,0 kV
	: 0,001A ..... 25000 A
	: 0 – 999,9 M (W,VAR,VA)
	: 0 – 999,9 k (W,VAR,VA)

accuracy

Voltage	: 0,5 class
Current	: 0,5 class
Active Power	: 1 class
Reactive Power	: 2 class
Apparent Power	: 1 class
Relay Outputs (2 pcs)	: 2 NO and max.3A/240 Vac

RS485

Baud rate	: 2400,4800,9600,19200,28800,38400,57600,115200
Stop Bits	: (0.5) , (1) , (1.5) , (2)
Parity	: no , even , odd
Device No	: 1 255
Device Protection Class	: IP 20
Terminal protection class	: IP 00
Ambient temperature	: - 5 °C .... + 50 °C
Installation Type	: to panel cover from front
Dimensions	: 96x96x56 mm



NOTE: Operating Voltage (Un): ask price and delivery time for 85-256Vac/dc

Factory Settings

MODBUS RTU

Current Transformer(Primary) Value	: 5 / 5 A
Voltage Transformer Ratio	: 1
Password	: if not changed by user (0000) NOTE 1
Password use	: Off (disabled)
Connection Type	: 3P&4W
Port Settings (Baud Rate)	: 9600
Port Settings (Stop Bits)	: 1
Port Settings (Parity)	: No
Port Settings (Device No)	: 1
Demand Time	: 15 minutes
Demand Interval	: 3 min

1. Relay output

Contact Position	: N.O Normally Open
Remote Access Permit	: off
Over Voltage	: 255V Relay OFF
Under Voltage	: 185V Relay OFF
Voltage Unbalance	: 10% Relay OFF
Over Current	: 5A Relay OFF
Under Current	: 1A Relay OFF
Current Unbalance	: 50% Relay OFF
Over Frequency	: 53Hz Relay OFF
Under Frequency	: 48Hz Relay OFF
Over THD-V	: 6% Relay OFF
Over THD-I	: 15% Relay OFF
Over HD-V	: 6% Relay OFF
Over HD-I	: 15% Relay OFF
Over Neutral Current	: 3A Relay OFF
Phase Sequence Failure	: Relay OFF
Phase Failure	: Relay OFF
Connection Failure	: Relay OFF

2. Relay output

Contact Position	: N.O Normally Open
Remote Access Permit	: off
Over Voltage	: 255V Relay OFF
Under Voltage	: 185V Relay OFF
Voltage Unbalance	: 10% Relay OFF
Over Current	: 5A Relay OFF
Under Current	: 1A Relay OFF
Current Unbalance	: 50% Relay OFF
Over Frequency	: 53Hz Relay OFF
Under Frequency	: 48Hz Relay OFF
Over THD-V	: 6% Relay OFF
Over THD-I	: 15% Relay OFF
Over HD-V	: 6% Relay OFF
Over HD-I	: 15% Relay OFF
Over Neutral Current	: 3A Relay OFF
Phase Sequence Failure	: Relay OFF
Phase Failure	: Relay OFF
Connection Failure	: Relay OFF

Note 1 : The password is primarily defined as 0000. However the password will not change even in the event that factory values are restored after having amended the password. The latest password entered by the user is valid.

Formulas

RMS Voltage	$V_{RMS} = \sqrt{\frac{1}{N}\sum_{i=0}^{N} V_i^2}$
RMS Current	$I_{RMS} = \sqrt{\frac{1}{N}\sum_{i=0}^{N} I_i^2}$
Active Power	$P = \frac{1}{N}\sum_{i=0}^{N} P_i$
Reactive Power	$Q = \frac{1}{N}\sum_{i=0}^{N} Q_i$
Apparent Power	$S = \sqrt{P^2 + Q^2}$
Power Factor	$PF = \frac{P}{S}$

MULTIMET-03-96

Multimeter

A	IL1, IL2, IL3
V	VL1N, VL2N, VL3N VL12, VL13,VL23
Hz	
TRUE RMS	
Reduced Price	

SPECIFICATIONS

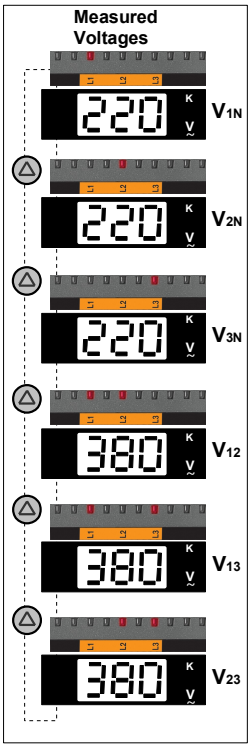
-Microprocessor based
-Measurement of 3 phase electrical quantities (VL-N, A, VL-L, Hz)
-Setting of current and voltage transformer ratios
-Easy Access to menu
-Reduces both number of measurement equipment used in the panel and connection time.
-Lower Electrical panel costs.

General

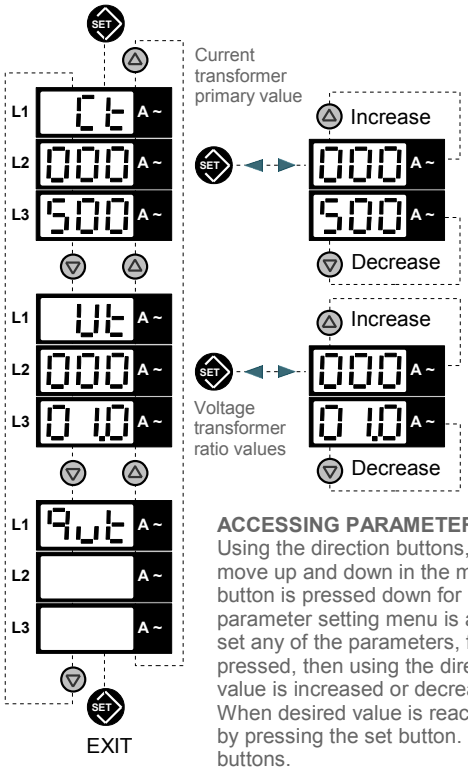
Multimet gives the ability of tracking electrical parameters for 3 phase systems such as, phase currents, phase-neutral & phase-phase voltages, frequency .Current and voltage transformer ratios can be set by the user.

Using the directions buttons, desired parameters can be accessed easily .

On the other hand, its displays make it possible to track values from long distance.



Enter Pressing for 3 seconds



ACCESSING PARAMETERS:
Using the direction buttons, it is possible to move up and down in the menu. When set button is pressed down for 3 seconds, parameter setting menu is accessed and to set any of the parameters, first set button is pressed, then using the directions buttons, value is increased or decreased.
When desired value is reached, it is stored by pressing the set button. Using the direction buttons.

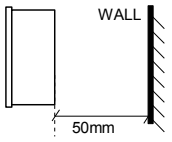
Ct: Current transformer value : (5...10000)
The current tranformer's primary value should be entered. For example if 500/5A cuurent is used then 500 must be entered.
Ut: Voltage transformer value : (1...1000)
If no voltage transformer is used, this parameter must be left as 1.

TECHNICAL DATA :

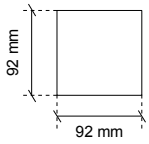
Rated Voltage (Un)	: 230 VAC
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50/60 Hz
Supply Power Consumption	: < 6 VA
Measurement Power Consumption	: < 1 VA
Voltage Measurement Range	: (Phase-Neutral) 30-300 VAC, 45-90 Hz (Phase-Phase) 30-600 VAC, 45-90 Hz
Current Measurement Range	: (Secondary current)50mA – 6 Amp.ac
Minimum Measurement Values	: 50 mA, 30V
Measurement Sensitivity	: %1±1 dijit
Voltage Transformer Ratio	: 1 1000
Current Transformer Ratio	: 5/5 ..... 10000/5 A
Dev ice Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 96x96x56 mm

Installation

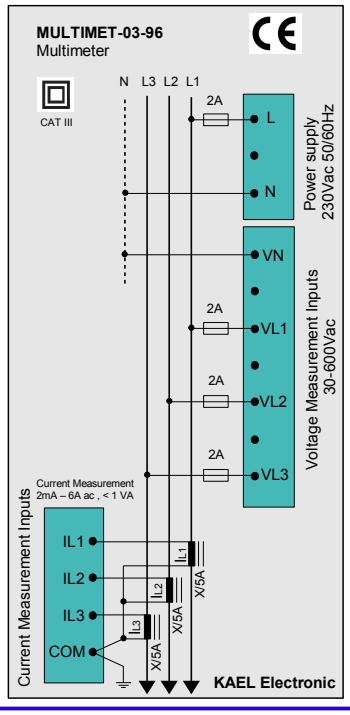
1- An outlet in square form by 92 mm x 92 mm will be made on the panel where the assembly of the device will be made.
2- Prior to the assembly of the device, remove the apparatus of the panel.
3- Insert the device from the front window drilled at the panel.
4- Fix the device to the panel by using panel holding apparatus at the back of the device.



PANEL OUTLET MEASUREMENT



Connection



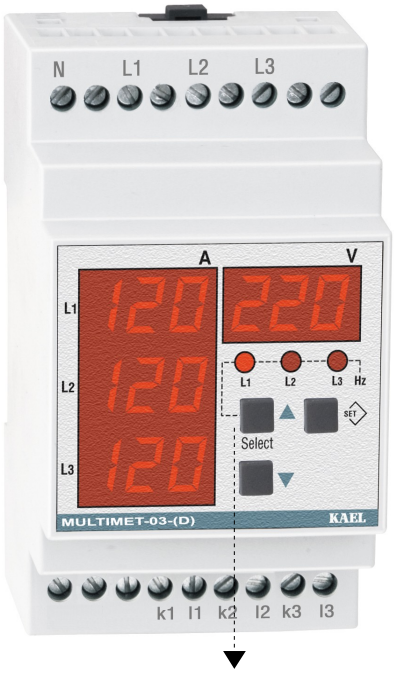
MULTIMET-03-(D)

KAEL ISO 9001:2008 www.kael.com.tr ®

MULTIMETER

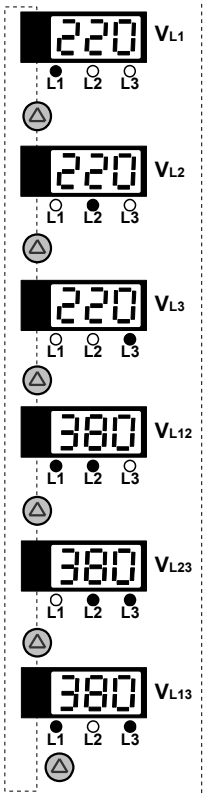
V_{L1}, V_{L2}, V_{L3}
$V_{L12}, V_{L23}, V_{L13}$
I_{L1}, I_{L2}, I_{L3}
Hz

TRUE RMS

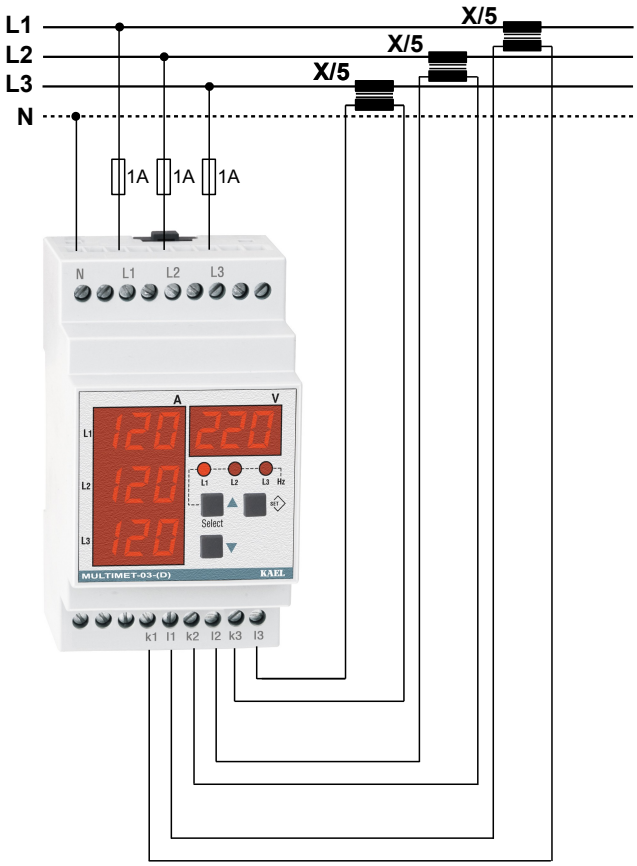


Select Button : (Up direction) when pressing continuously, screen displays frequency of system. When button release device continue to show voltage.

Display Functions:



Connection :



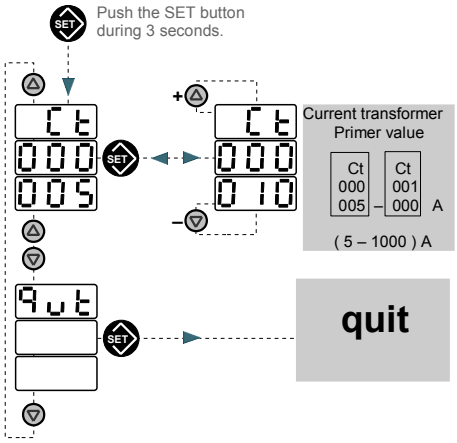
SPECIFICATIONS

-Microprocessor based
-Measurement of 3 phase electrical quantities (VL-N, A, VL-L, Hz)
-Setting of current and voltage transformer ratios
-Easy Access to menu
-Reduces both number of measurement equipment used in the panel and connection time.
-Lower Electrical panel costs.

General

Multimet-03-(D) gives the ability of tracking electrical parameters for 3 phase systems such as, phase currents, phase-neutral & phase-phase voltages, frequency. Current transformer ratio can be set by the user. Using the directions buttons, desired parameters can be accessed easily.

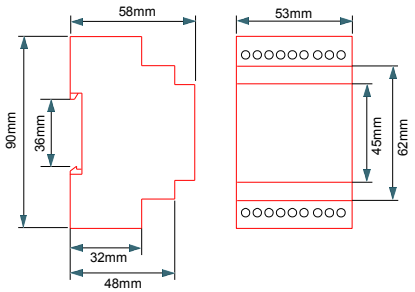
ACCESSING PARAMETER MENU:



IMPORTANT: L1 - N is device supply inputs. Thus,the applied L1 – N voltage must be rated voltage of system .
The measured frequency also must the frequency of the system.

TECHNICAL INFORMATION:

Rated Voltage (Un)	: 230Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Current Transformer Ratio	: X / 5A
Current Measurement Range	: (for seconder current) 0,05 - 6 Amp AC
Voltage Measurement Range	: (Phase-Phase)10 - 500 Vac, 45 - 65Hz
	: (Phase-Neutral)10 - 300 Vac, 45 - 65Hz
	For power supply(L1 - N) 176V – 242V
Voltage Measurement Power Consumption	: <1VA (for one phase)
Measurement Sensitivity	: %1±1 digit
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To connection rail in electrical panel
Dimension	:



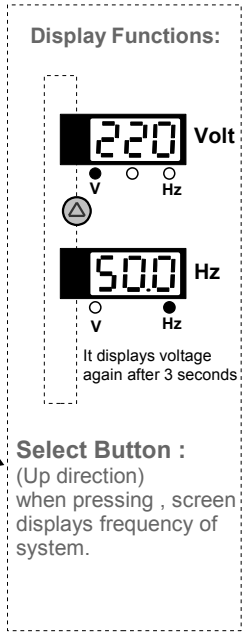
MULTIMET-04-(D)

KAEL ISO 9001:2008 www.kael.com.tr ®

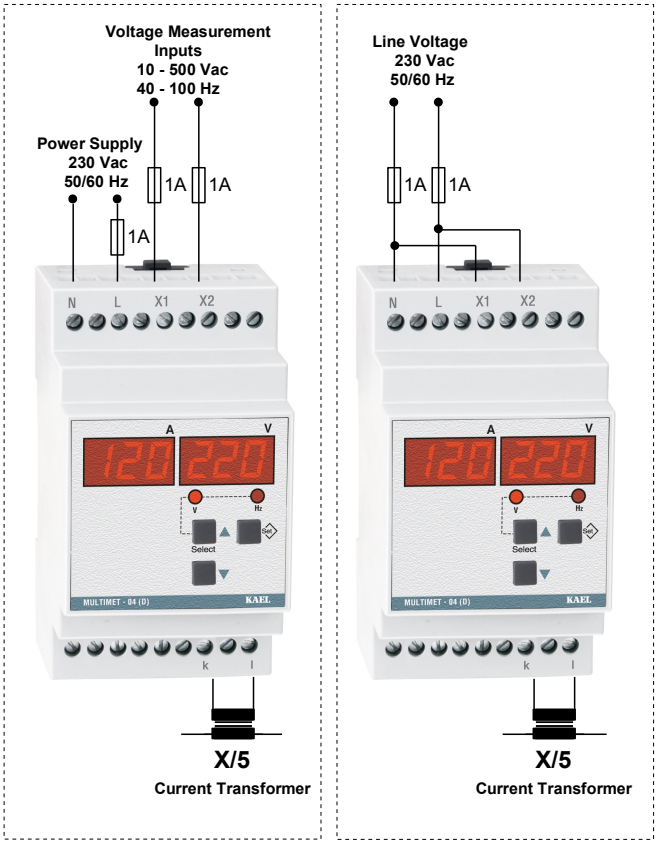
VOLTMETER & AMMETER & FREQUENCYMETER
(1 Phase)

V (Voltage)
I (Current)
Hz (Frequencymeter)

TRUE RMS



Connection :



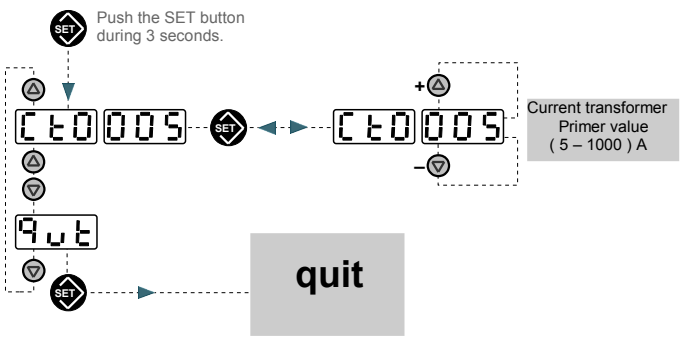
SPECIFICATIONS

- Microprocessor based
- Measurement of 1 phase electrical quantities (V, A, Hz)
- Setting of current transformer ratio
- Easy Access to menu
- Reduces both number of measurement equipment used in the panel and connection time.
- Lower Electrical panel costs.

General

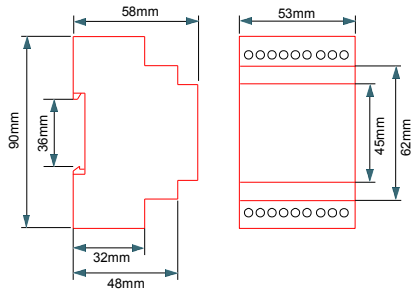
Multimet-04-(D) gives the ability of tracking electrical parameters for 1 phase systems such as, current, voltages, frequency. Current transformer ratio can be set by the user.
Using the up direction button, frequency can be displayed easily.

ACCESSING PARAMETER MENU:



TECHNICAL INFORMATION:

Rated Voltage (Un)	: 230Vac (L-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Current Transformer Ratio	: X / 5A
Current Measurement Range	: (for seconder current) 0,05 - 6 Amp AC
Voltage Measurement Range	: 10 - 500 Vac, 40 - 100Hz
Measurement Sensitivity	: %1±1 digit
Contact Current	: Max. 3A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To connection rail in electrical panel
Dimension	:



IMPORTANT: L - N is device supply inputs. Thus,the applied L – N voltage must be rated voltage of system .
The measured frequency also must the frequency of the system.

ASTRO-01 / ASTRO-03
ASTRO-11 / ASTRO-13

Astronomical Time Relay

KAEL ASTRO Software

ASTRO-11 / ASTRO-13

CON-03

ASTRO-01 / ASTRO-03

- User replaceable battery
- 2 Relay Output (8A) (ASTRO-01 & ASTRO-03)
- 2 Relay Output (16A) (ASTRO-11 & ASTRO-13)
- No Backlight ; ASTRO-01 & ASTRO-03
- Backlight ; ASTRO-11 & ASTRO-13
- Easy to use with English menu
- Real time clock and calender
- 24 programs for ASTRO-01 / ASTRO-11
- 100 programs for ASTRO-03 / ASTRO-13
- Astronomical and/or time switching function
- Automatic or manual summer/winter time option
- ON/OFF switching times
- Easy to program with PC Software
- Optical loading the programs with CON-3 Device
- Graphical simulation program for both outputs
- Automatic sunrise/sunset calculation using coordinates and time
- Offset for adjustable programming of sunrise/sunset times
- Quiet mode
- 2 Manual modes
- PIN code protection

Area of Usage:

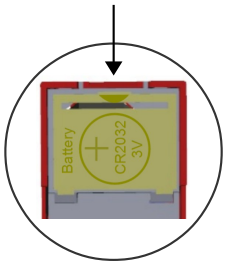
- Park, garden and farm irrigation
- Street, park, garden illuminations
- ATM ,store window, billboard illuminations

General:

ASTRO is a digital time switch that calculates the sunset and sunrise times by using coordinates and real time clock. It operates according to the program setting and it has no need for a photocell sensor. Device could be used as astronomical or digital time switch.
ASTRO has two reserves to protect the real time clock and calender against power outage.
For long term reserve there is CR2032 battery. If the device is powered, battery life is approx. 5 years. When the battery life is expired,the user is able to replace the battery easily.
Super capacitor is used for short time power failures. It supplies the device for 3-7 hours. In this case battery is not used, so battery level is conserved.

NOTE1: Before commissioning the device, please insert the battery into the battery compartment .
NOTE2: If the device is not powered, ASTRO automatically enters power save mode to conserve the battery life. When the device is in this mode LCD screen is turned off. The screen would turn on when pressing any button and so the user would be able to change the settings and programming the device manually. After 15 seconds of inactivity, the screen would be turned off again.
NOTE3: For programming with CON-3, the device must be auxiliary supplied.

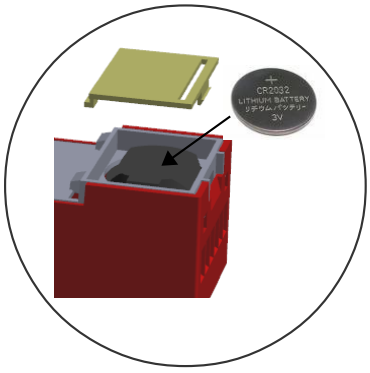
Push in this direction and remove the battery cover



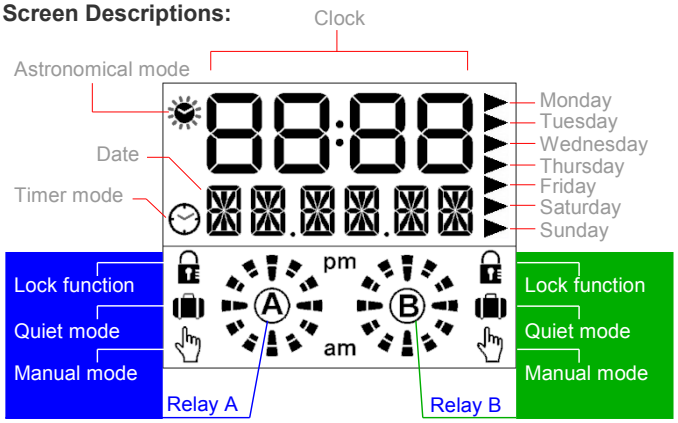
Insert the battery with the positive(+) side facing up as shown in the figure.

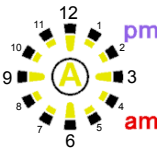
Make sure the battery is seated correctly in the battery slot.

Replace the battery cover.



Screen Descriptions:





Clock faces represent output states of the relay contacts during current day.
Before midday, am icon appears.
After midday, pm icon appears.
There are two clock faces, on the left for Relay A and on the right for Relay B.

Warnings:

- The connection of device must be done by authorized technical service staff according to the wiring diagram.
- Before making the connections to device's terminals, please be sure that there is no voltage across the cables or terminals. Also be sure that the panel is de-energized.
- Before cleaning the device, please be sure that it is de-energized and use only dry tissue-paper to clean it. Water or any other chemicals used for cleaning may harm the device
- Before commissioning the device, please be sure that the terminal connections are made exactly
the same as in the connection diagram
- To protect the device, please mount it on DIN rail in a panel.
- Contact your authorized dealer, if a problem occurs with your device.

Following the precautions is to prevent the users from physically and spiritual damage. The manufacturer is not responsible for any injuries or damages due to violation of the warnings.

Button Functions:

ASTRO is an easy to use device with 3 buttons.

▼ : Press to move between menus or decrease the related parameter.
▲ : Press to move between menus or increase the related parameter.
SET : Press to go into the menu or save the related parameter.

MANUAL MODE

Manual mode is used for setting or testing the desired relay output, or deactivating the program operation. This mode could be activated for both of the relays separately. If output A is locked it can't be switched to manual mode for output A, but it can be switched for output B.
For blocking the activation of manual mode, the related output should be locked. Lock function is described on page 7.
There are two different manual modes.

1-TEMPORARY MODE : When the subsequent program steps in, temporary manual mode would be deactivated.

Temporary manual mode for Relay A :

Push ▼ button until the flashing hand icon appears on the left of the screen.
Throughout the manual mode, for changing Relay **A** output, it is necessary to push and release ▼ button.
In this mode, if the subsequent program for Relay **A** changes the output, manual mode would be deactivated automatically and ASTRO operates the program. Otherwise manual mode would continue to be active for Relay **A**.
To deactivate this mode for Relay **A** as an option, push ▼ button until the flashing hand icon disappears.

Temporary manual mode for Relay B :

Push ▲ button until the flashing hand icon appears on the right of the screen.
Throughout the manual mode, for changing Relay **B** output, it is necessary to push and release ▲ button.
In this mode, if the subsequent program for Relay **B** changes the output, manual mode would be deactivated automatically and ASTRO operates the program. Otherwise manual mode would continue to be active for Relay **B**.
To deactivate this mode for Relay **B** as an option, push ▲ button until the flashing hand icon disappears.

2- PERMANENT MODE : It is only possible to deactivate permanent mode as manually.

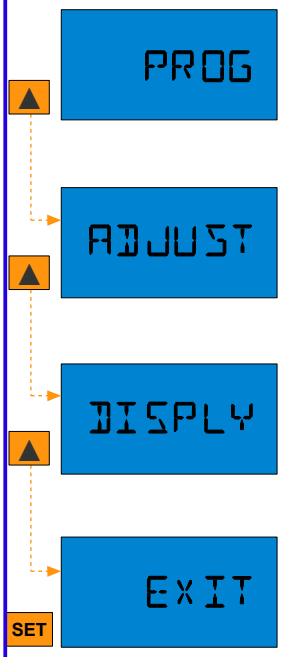
Permanent manual mode for Relay A:

Push ▼ and **SET** buttons at the same time until the hand icon appears on the left of the screen.
Permanent manual mode is not deactivated automatically. The only way to deactivate this mode is manually.
Throughout the manual mode, for changing Relay **A** output, it is necessary to push and release ▼ button.
To deactivate this mode for Relay **A**, push ▼ button until the hand icon disappears.

Permanent manual mode for Relay B:

Push ▲ and **SET** buttons at the same time until the hand icon appears on the right of the screen.
Permanent manual mode is not deactivated automatically. The only way to deactivate this mode is manually.
Throughout the manual mode, for changing Relay **B** output, it is necessary to push and release ▲ button.
To deactivate this mode for Relay **B**, push ▲ button until the hand icon disappears.

MENUS:
Press SET button on the main screen to access the menus. If the lock function is deactivated, PROG menu appears on the screen. Use the direction buttons to see ADJUST,DISPLY and EXIT



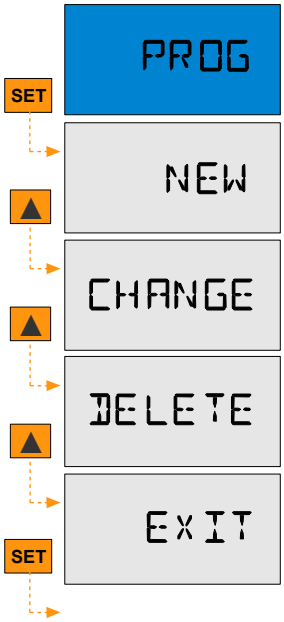
PROGRAM:

All program settings could be done. Creating new program, changing or deleting an existing program.

ADJUST:

Device settings could be done.

DISPLAY :
In this menu, program and device settings could be monitored without making changes. Use the direction buttons to see information about sunrise, sunset, programs, memory status, season (summer-winter), latitude, longitude,quiet mode status.

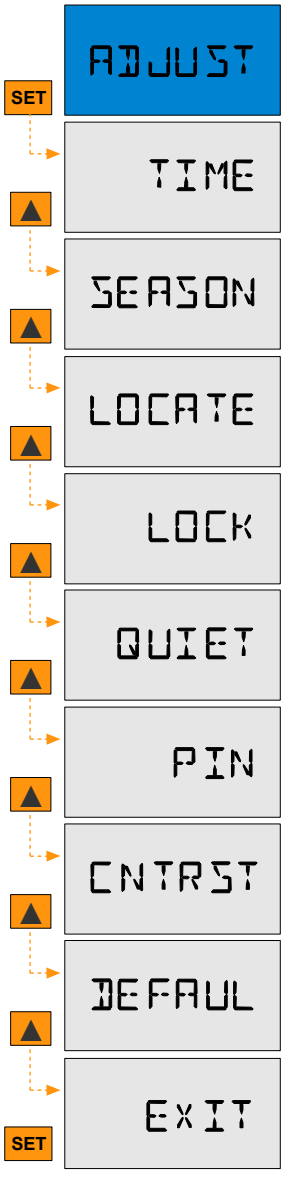


PROGRAM MENU:
Press SET button on PROG screen to access the Program Menu. Use the direction buttons to see NEW,CHANGE,DELETE and EXIT menus.

NEW : New programs are created.

CHANGE : Existing programs could be changed.

DELETE : Existing programs could be deleted. It is possible to delete all of them or the selected one.



ADJUST MENU:
In this menu, device settings could be done.

Real Time Clock and Calender could be set in TIME menu

In this menu, daylight saving time settings could be done. If AUTO is chosen, device determines beginning dates of the summer and winter automatically.

Coordinates and time zone settings of the location could be done in this menu.

Lock function could be activated to prevent unauthorized persons from using the device. This mode could be activated for both of the relays separately.

Quiet mode could be activated to stop the program operation for a certain period.

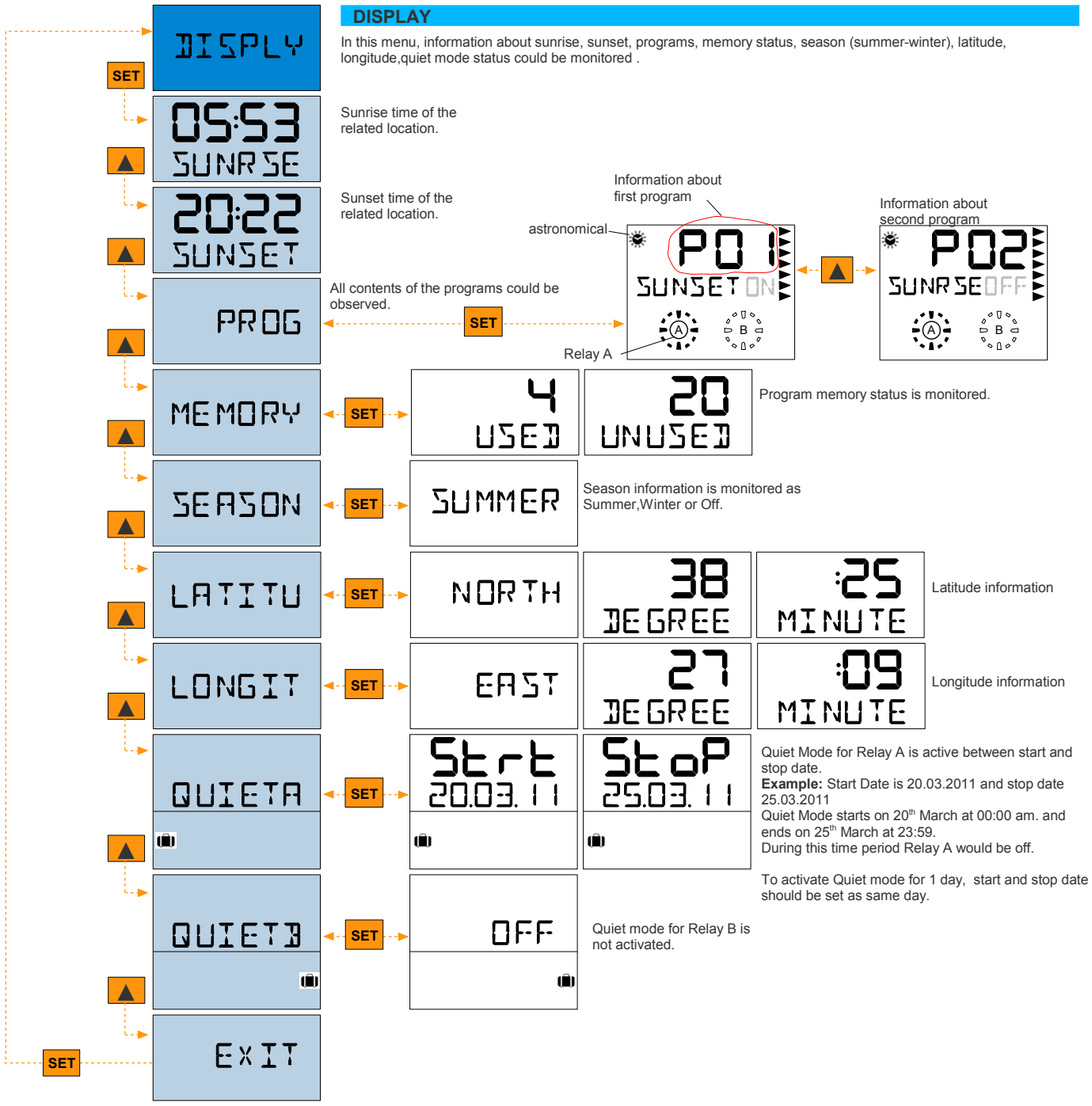
In this menu, PIN code could be changed. PIN code is a 4 digit number.

Display contrast value could be set between 1 and 7.

All device settings except time and date are set to default.

DISPLAY

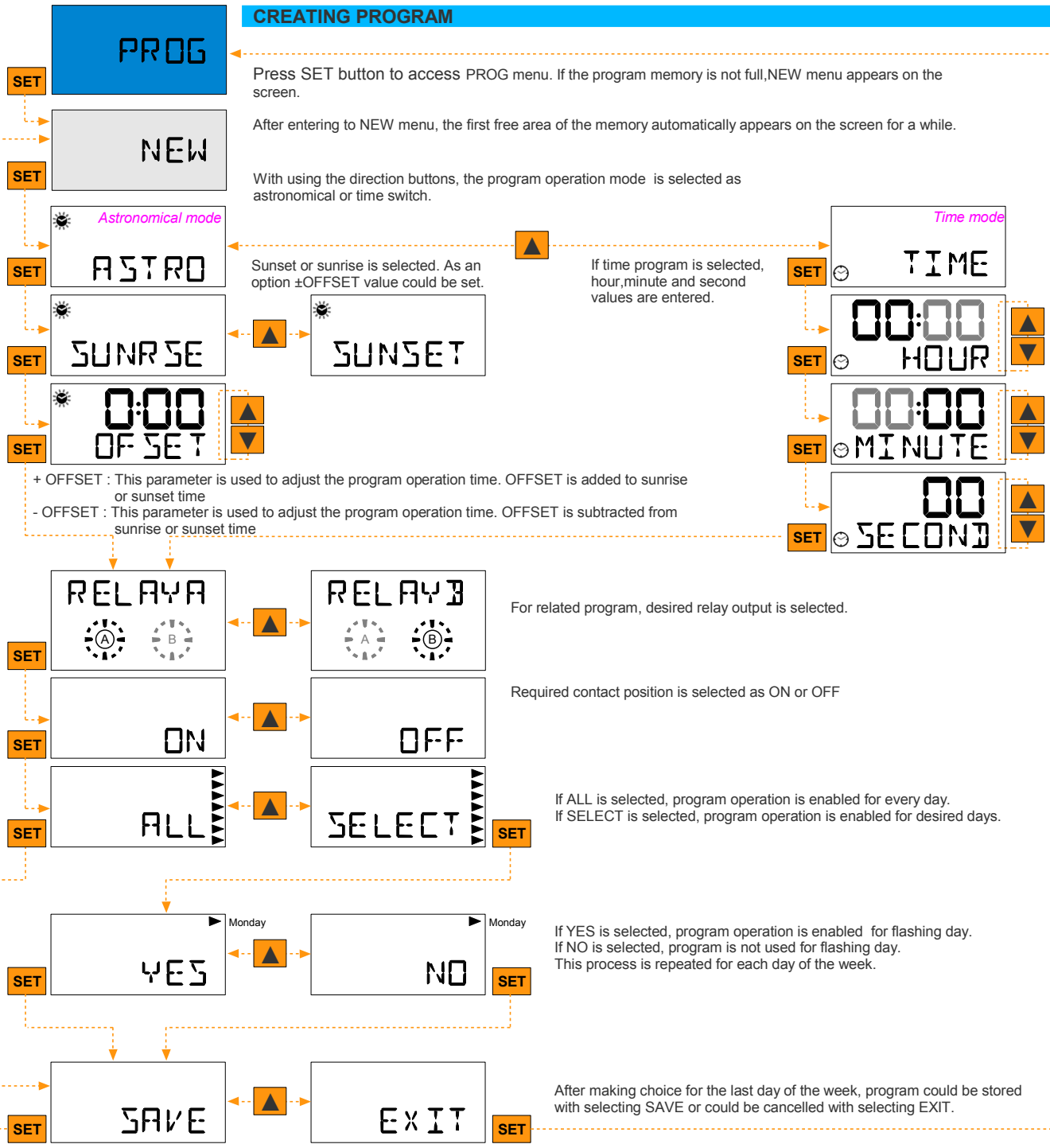
In this menu, information about sunrise, sunset, programs, memory status, season (summer-winter), latitude, longitude,quiet mode status could be monitored .



ABBREVIATIONS

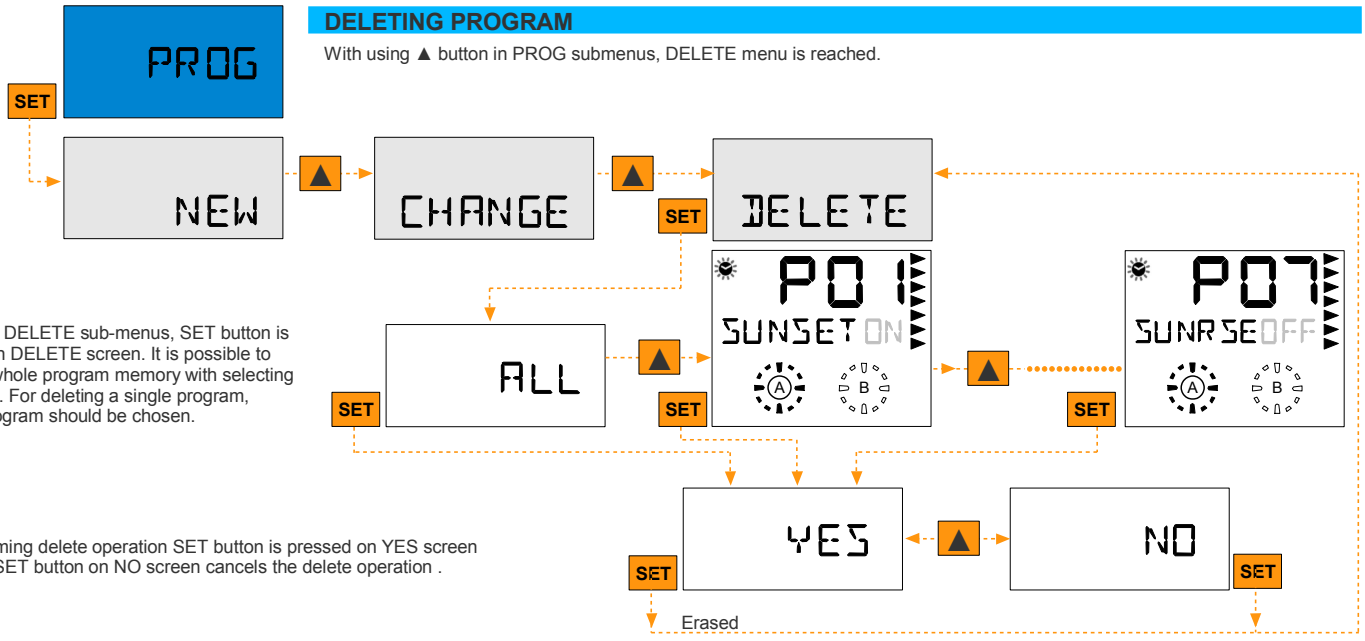
ADJUST	adjust
ALL	entire week
ASTRO	astronomical mode
AUTO	automatic
CHANGE	change
CNTRST	contrast
CON-03	data is coming from CON-3 device
COORD	coordinates
CUSTOM	custom
DAY	day
DEFAUL	factory defaults
DEGREE	degree
DELETD	deleted
DELETE	delete
DISPLY	display
EAST	east
ERR1	CON3 communication error
ERR2	PIN code error
ERR3	Parameter values are out of max-min.
ERR4	CON-3 has no data
ERR5	Program overload error
EXIT	exit
HOUR	hour
IR OK	data communication is successful
LATITU	latitude
LOCATE	locate
LOCK	lock
LOCKA	lock function for relay A
LOCKB	lock function for relay B
LONGIT	longitude
MANUAL	manual
MINUTE	minute
MONTH	month
NEW	new
NO	no
NORTH	north
OFF	off
OFF	relay is off
OFSET	offset
OK	okay
OLD	old
ON	on
ON	relay is on
P1 OK	program1 is saved.
PIN	pin code
PROG	program
QUIET	quiet mode
QUIETA	quiet mode for relay A
QUIETB	quiet mode for relay B
RELAYA	relay A
RELAYB	relay B
REPEAT	repeat
S-DAY	summer beginning(day)
S-HOUR	summer beginning(hour)
S-MIN	summer beginning(minute)
S-MON	summer beginning(month)
S-WEEK	summer beginning(week)
SAVE	save
SEARCH	data signal is not coming from CON-3
SEASON	season
SECOND	second
SELECT	select the day
SOUTH	south
STOP-D	end of quiet mode(day)
STOP-M	end of quiet mode(month)
STOP-Y	end of quiet mode(year)
STRT-D	start of quiet mode(day)
STRT-M	start of quiet mode(month)
STRT-Y	start of quiet mode(year)
SUMMER	summer
SUNRSE	sunrise
SUNSET	sunset
T-ZONE	time zone
TIME	time
UNUSED	unused
USED	used
UTC	coordinated universal time
W-DAY	winter beginning(day)
W-HOUR	winter beginning(hour)
W-MIN	winter beginning(minute)
W-MON	winter beginning(month)
W-WEEK	winter beginning(week)
WEST	west
WINTER	winter
WRONG	wrong
YEAR	year
YES	yes

CREATING PROGRAM



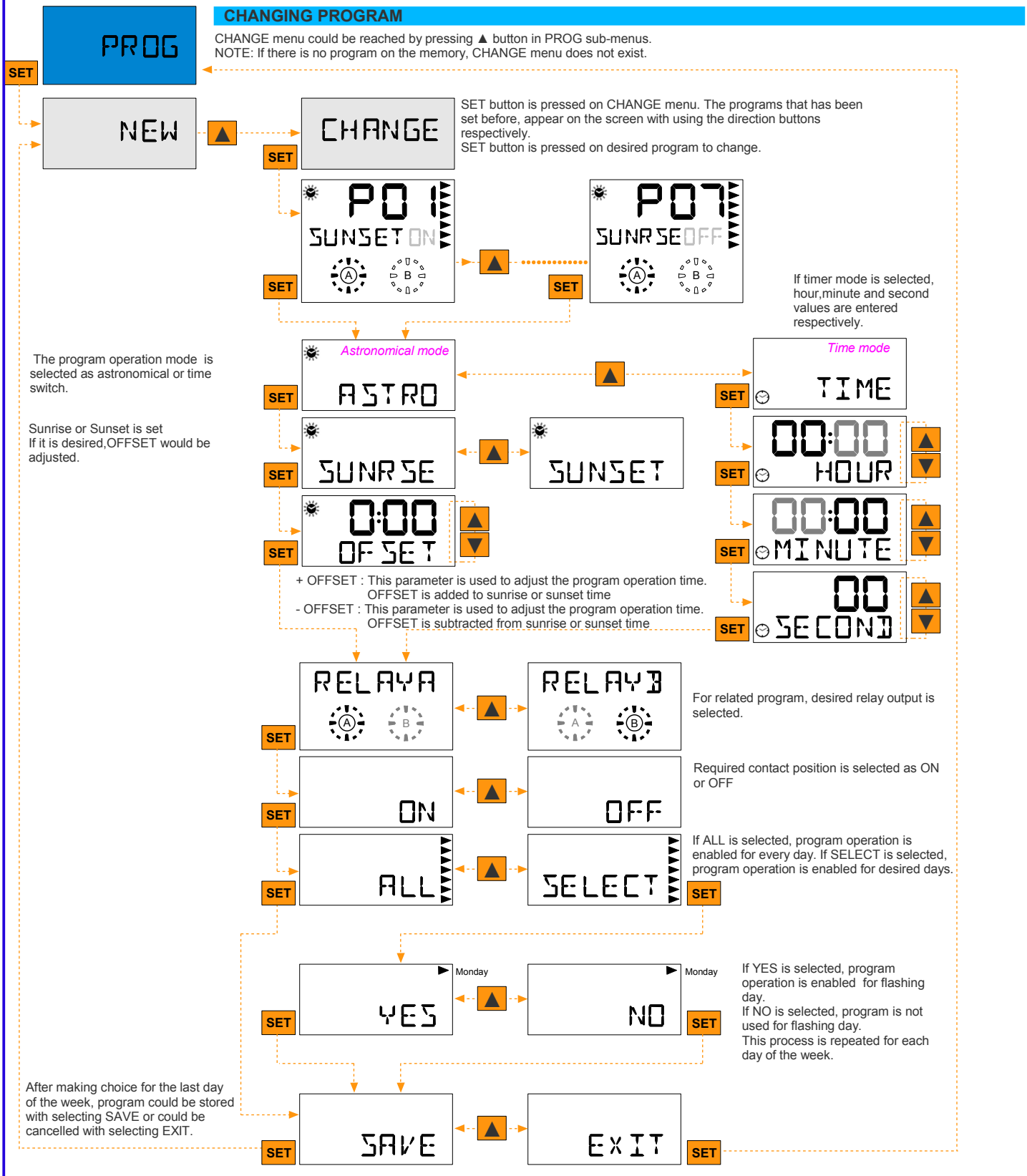
DELETING PROGRAM

With using ▲ button in PROG submenus, DELETE menu is reached.



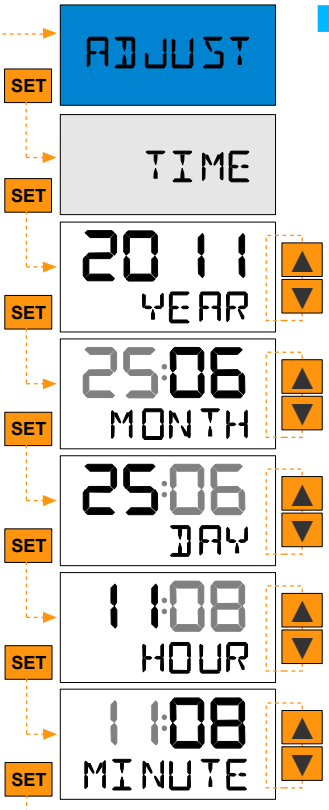
CHANGING PROGRAM

CHANGE menu could be reached by pressing ▲ button in PROG sub-menus.
NOTE: If there is no program on the memory, CHANGE menu does not exist.



TIME AND DATE

In ADJUST sub-menus could be accessed TIME menu.



With using ▼▲ buttons, year value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

With using ▼▲ buttons, month value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

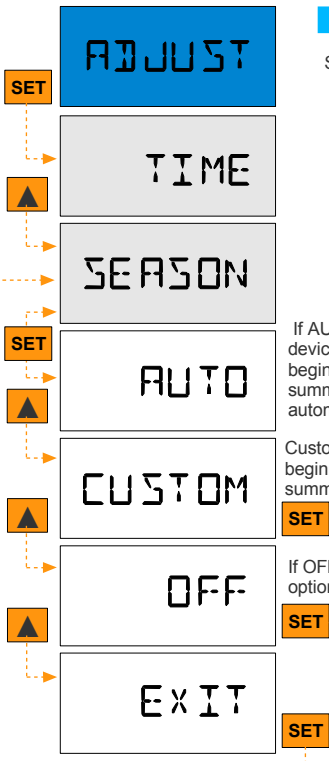
With using ▼▲ buttons, day value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

With using ▼▲ buttons, hour value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

With using ▼▲ buttons, minute value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

SEASON

SEASON menu could be reached by pressing ▲ button in ADJUST sub-menus.



If AUTO is chosen, device determines beginning dates of the summer and winter automatically

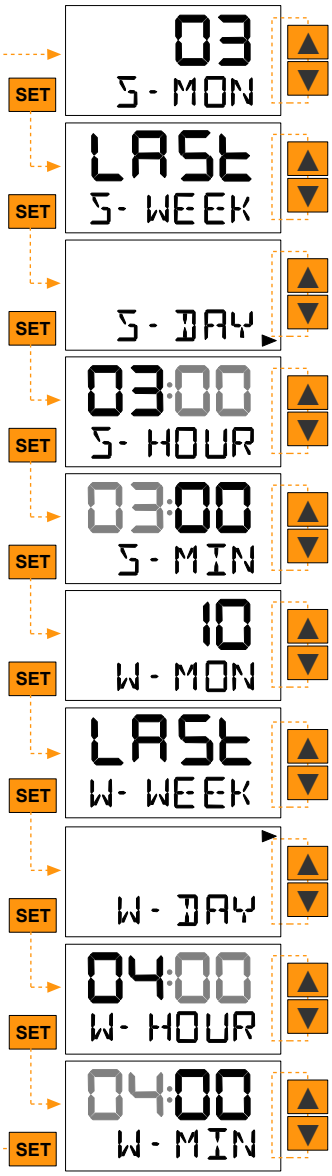
Custom dates for beginning of the summer and winter

SET

If OFF chosen, daylight saving option is disabled.

SET

SET



First parameter of custom season setting is beginning month for the summer season. With using ▼▲ buttons, month value is increased or decreased. When desired value is reached, it is stored by pressing SET button

Second parameter is beginning week for the summer in chosen month. With using ▼▲ buttons week value is set as 1,2,3,4 or last.

Third parameter is beginning day for the summer. With using ▼▲ buttons day is set.

Fourth parameter is beginning hour for the summer. With using ▼▲ buttons hour value is set.

Fifth parameter is beginning minutes for the summer. With using ▼▲ buttons minute value is set.

Sixth parameter is beginning month for the winter season. With using ▼▲ buttons, month value is increased or decreased. When desired value is reached, it is stored by pressing SET button

Seventh parameter is beginning week for the winter in chosen month. With using ▼▲ buttons week value is set as 1,2,3,4 or last.

Eighth parameter is beginning day for the wınter. With using ▼▲ buttons day is set.

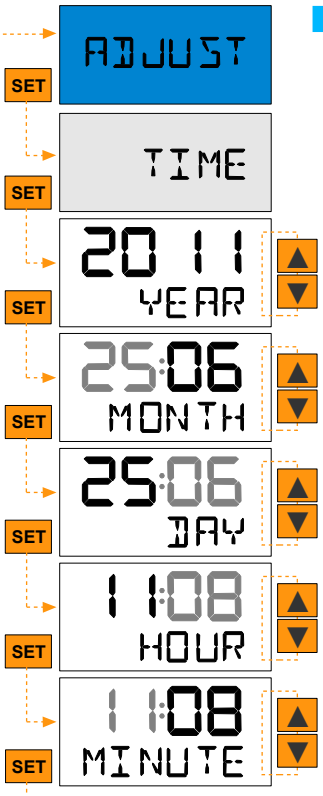
Ninth parameter is beginning hour for the winter. With using ▼▲ buttons hour value is set.

Tenth parameter is beginning minutes for the winter. With using ▼▲ buttons minute value is set.

NOTE:
Auto Season mode
winter→summer change: last Sunday in March 03:00:00
(Clocks are adjusted forward one hour)
summer→winter change: last Sunday in October 04:00:00
(Clocks are adjusted backward one hour)

TIME AND DATE

In ADJUST sub-menus could be accessed TIME menu.



With using ▼▲ buttons, year value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

With using ▼▲ buttons, month value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

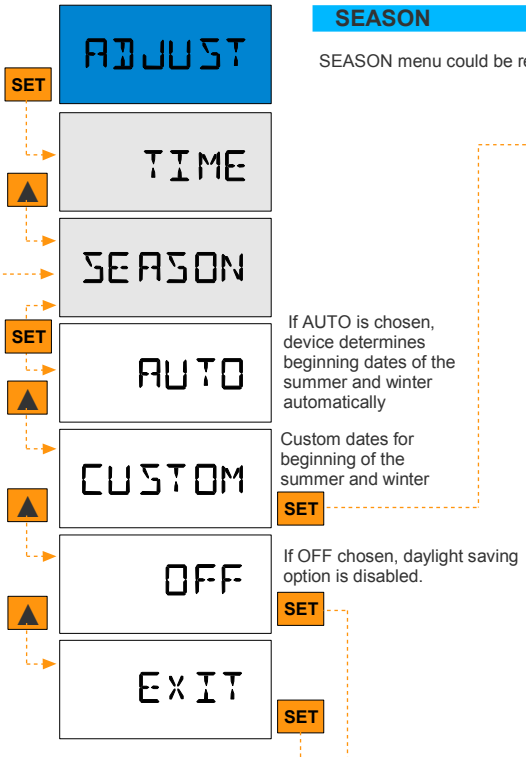
With using ▼▲ buttons, day value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

With using ▼▲ buttons, hour value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

With using ▼▲ buttons, minute value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

SEASON

SEASON menu could be reached by pressing ▲ button in ADJUST sub-menus.



If AUTO is chosen, device determines beginning dates of the summer and winter automatically

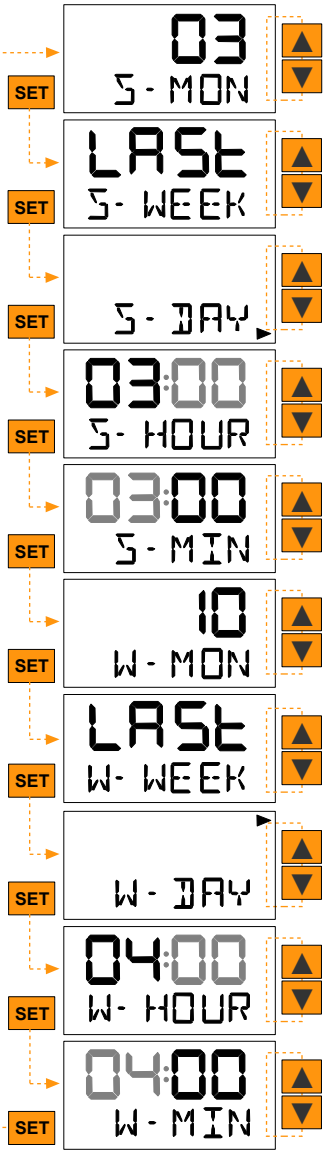
Custom dates for beginning of the summer and winter

SET

If OFF chosen, daylight saving option is disabled.

SET

SET



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Third parameter is beginning day for the summer. With using ▼▲ buttons day is set.

Fourth parameter is beginning hour for the summer. With using ▼▲ buttons hour value is set.

Fifth parameter is beginning minutes for the summer. With using ▼▲ buttons minute value is set.

Sixth parameter is beginning month for the winter season. With using ▼▲ buttons, month value is increased or decreased. When desired value is reached, it is stored by pressing SET button

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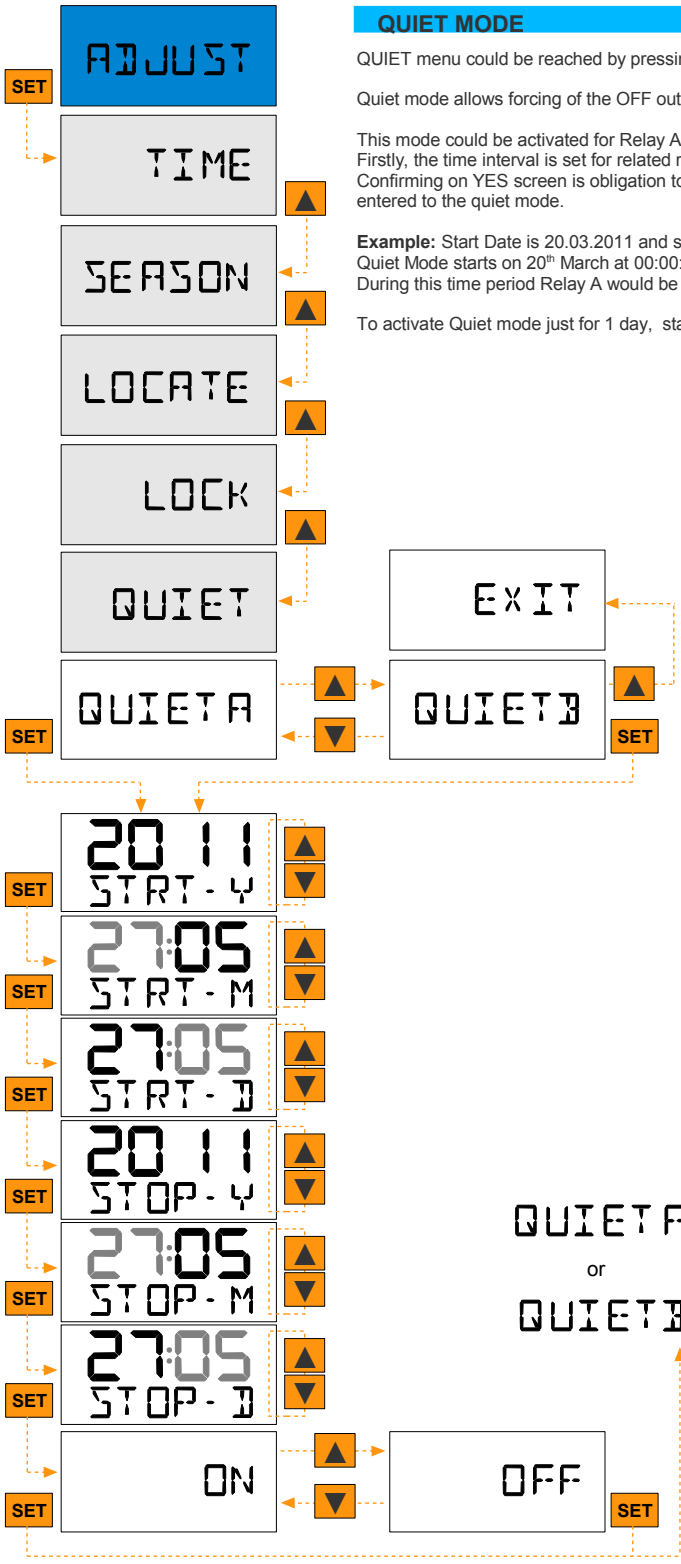
Eighth parameter is beginning day for the wınter. With using ▼▲ buttons day is set.

Ninth parameter is beginning hour for the winter. With using ▼▲ buttons hour value is set.

Tenth parameter is beginning minutes for the winter. With using ▼▲ buttons minute value is set.

NOTE:
Auto Season mode
winter→summer change: last Sunday in March 03:00:00
(Clocks are adjusted forward one hour)
summer→winter change: last Sunday in October 04:00:00
(Clocks are adjusted backward one hour)



QUIET MODE

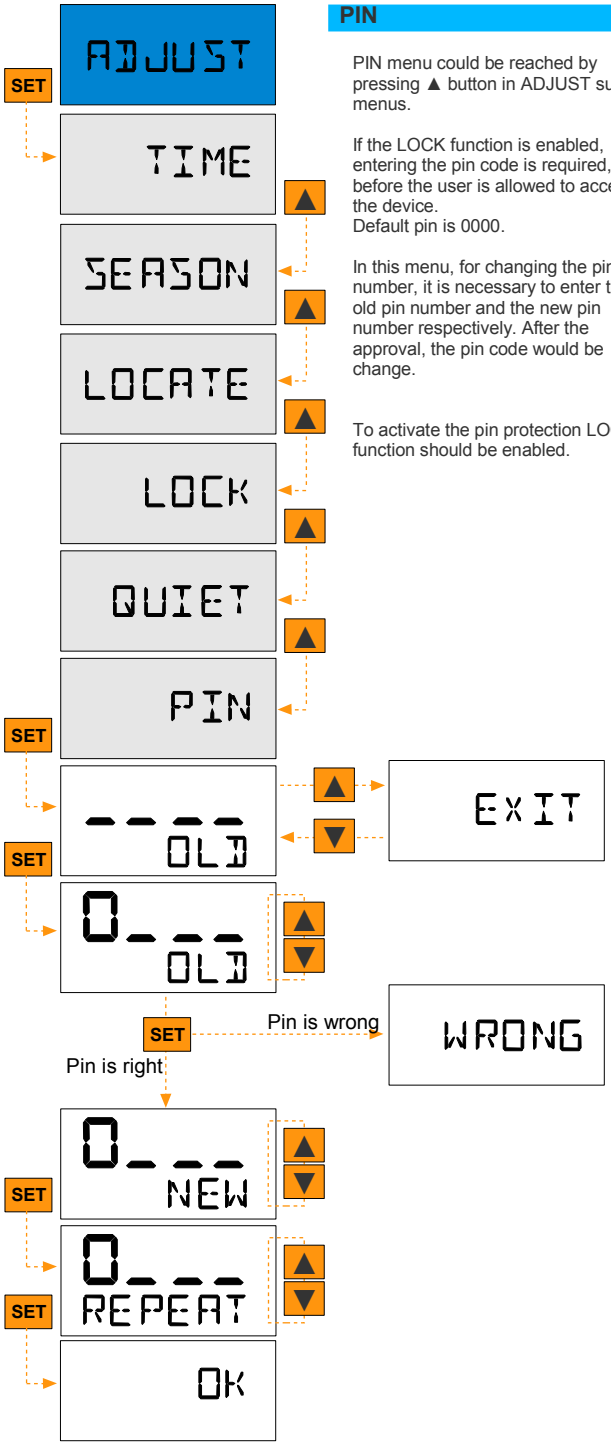
QUIET menu could be reached by pressing ▲ button in ADJUST sub-menus.

Quiet mode allows forcing of the OFF output for a time period.

This mode could be activated for Relay A and/or Relay B.
Firstly, the time interval is set for related relay.
Confirming on YES screen is obligation to activate this mode. If the time period is set but not confirmed, related relay would not be entered to the quiet mode.

Example: Start Date is 20.03.2011 and stop date 25.03.2011
Quiet Mode starts on 20th March at 00:00:00 am. and ends on 25th March at 23:59:59.
During this time period Relay A would be off.

To activate Quiet mode just for 1 day, start and stop date should be set as same day.



PIN

PIN menu could be reached by pressing ▲ button in ADJUST sub-menus.

If the LOCK function is enabled, entering the pin code is required, before the user is allowed to access the device.
Default pin is 0000.

In this menu, for changing the pin number, it is necessary to enter the old pin number and the new pin number respectively. After the approval, the pin code would be change.

To activate the pin protection LOCK function should be enabled.

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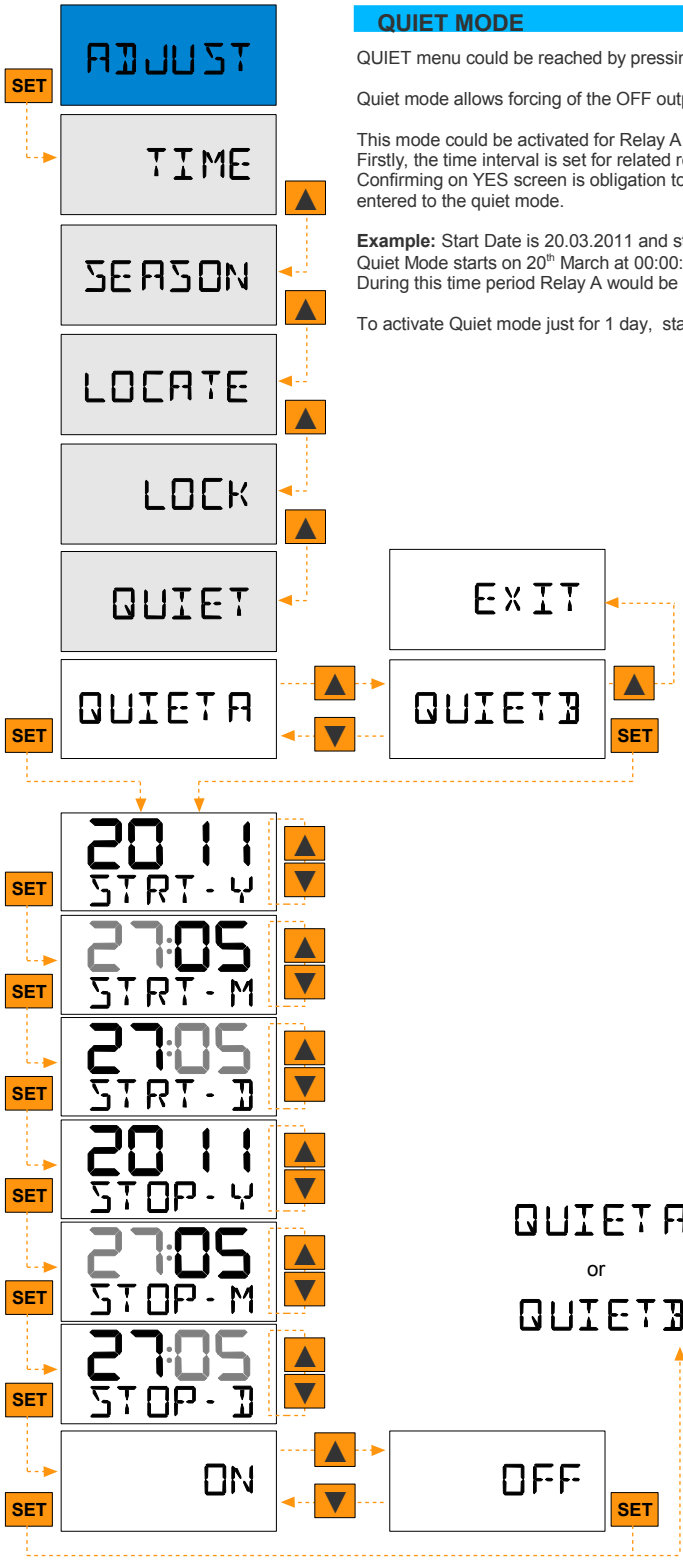

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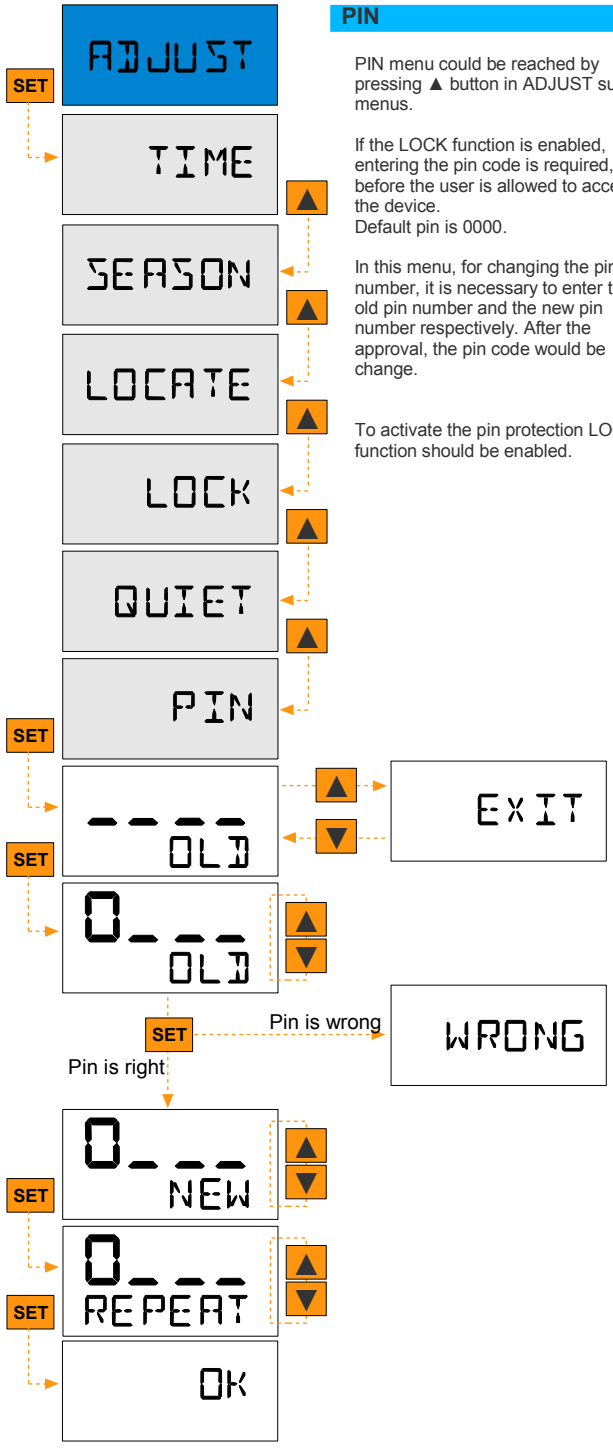


ASTRO-05 and ASTRO-15

Astronomical & Prayer Time Switch

KAEL ASTRO Software

CON-03

ASTRO-11 / ASTRO-13

ASTRO-01 / ASTRO-03

- User replaceable battery
- 2 Relay Output (8A) ; ASTRO-05
- 2 Relay Output (16A) ; ASTRO-15
- No Backlight ; ASTRO-05
- **Backlight ; ASTRO-15**
- Easy to use with English menu
- Real time clock and calender
- 56 programs
- Prayer, astronomical or/and time switching function
- Preset and adjustable Fajr and Isha twilight angles
- Automatic or manual summer/winter time option
- ON/OFF switching times
- Easy to program with PC Software
- Optical loading the programs with CON-3 Device
- Graphical simulation program for both outputs
- Automatic sunrise/sunset calculation using coordinates and time
- Offset for adjustable programming of sunrise/sunset times
- Quiet mode
- 2 Manual modes
- PIN code protection

Area of Usage:

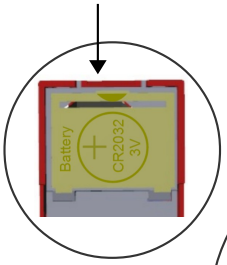
- Heating systems in mosques according the prayer times
- Park, garden and farm irrigation
- Street, park, garden illuminations
- ATM ,store window, billboard illuminations

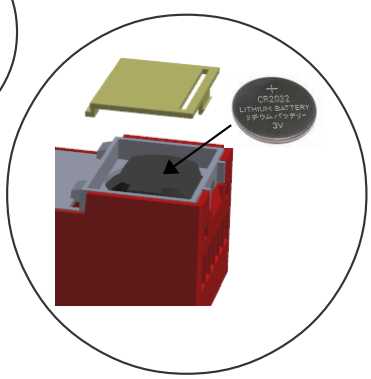
General:

ASTRO is a digital time switch that calculates the sunset,sunrise and prayer times by using coordinates and real time clock. It operates according to the program setting and it has no need for a photocell sensor. Device could be used as astronomical, prayer or digital time switch.
ASTRO has two reserves to protect the real time clock and calender against power outage.
For long term reserve there is CR2032 battery. If the device is powered, battery life is approx. 5 years. When the battery life is expired,the user is able to replace the battery easily.
Super capacitor is used for short time power failures. It supplies the device for 3-7 hours. In this case battery is not used, so battery level is conserved.

NOTE1: Before commissioning the device, please insert the battery into the battery compartment .
NOTE2: If the device is not powered, ASTRO automatically enters power save mode to conserve the battery life. When the device is in this mode LCD screen is turned off. The screen would turn on when pressing any button and so the user would be able to change the settings and programming the device manually. After 15 seconds of inactivity, the screen would be turned off again.
NOTE3: For programming with CON-3, the device must be auxiliary supplied.

Push in this direction and remove the battery cover



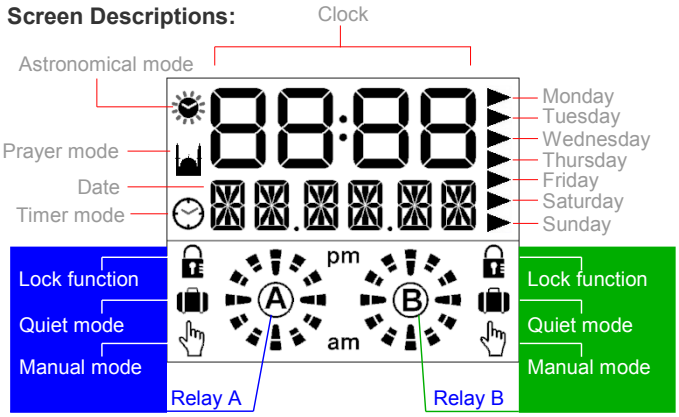


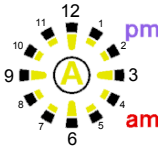
Insert the battery with the positive(+) side facing up as shown in the figure.

Make sure the battery is seated correctly in the battery slot.

Replace the battery cover.

Screen Descriptions:





Clock faces represent output states of the relay contacts during current day.
Before midday, am icon appears.
After midday, pm icon appears.
There are two clock faces, on the left for Relay A and on the right for Relay B.

Warnings:

- The connection of device must be done by authorized technical service staff according to the wiring diagram.
- Before making the connections to device's terminals, please be sure that there is no voltage across the cables or terminals. Also be sure that the panel is de-energized.
- Before cleaning the device, please be sure that it is de-energized and use only dry tissue-paper to clean it. Water or any other chemicals used for cleaning may harm the device
- Before commissioning the device, please be sure that the terminal connections are made exactly the same as in the connection diagram
- To protect the device, please mount it on DIN rail in a panel.
- Contact your authorized dealer, if a problem occurs with your device.

Following the precautions is to prevent the users from physically and spiritual damage. The manufacturer is not responsible for any injuries or damages due to violation of the warnings.

Button Functions:

ASTRO is an easy to use device with 3 buttons.

- ▼ : Press to move between menus or decrease the related parameter.
- ▲ : Press to move between menus or increase the related parameter.
- **SET** : Press to go into the menu or save the related parameter.

MANUAL MODE

Manual mode is used for setting or testing the desired relay output, or deactivating the program operation. This mode could be activated for both of the relays separately. If output A is locked it can't be switched to manual mode for output A, but it can be switched for output B.
For blocking the activation of manual mode, the related output should be locked. Lock function is described on page 7.
There are two different manual modes.
1-TEMPORARY MODE : When the subsequent program steps in, temporary manual mode would be deactivated.

Temporary manual mode for Relay A :

Push ▼ button until the flashing hand icon appears on the left of the screen.
Throughout the manual mode, for changing Relay **A** output, it is necessary to push and release ▼ button.
In this mode, if the subsequent program for Relay **A** changes the output, manual mode would be deactivated automatically and ASTRO operates the program. Otherwise manual mode would continue to be active for Relay **A**.
To deactivate this mode for Relay **A** as an option, push ▼ button until the flashing hand icon disappears.

Temporary manual mode for Relay B :

Push ▲ button until the flashing hand icon appears on the right of the screen.
Throughout the manual mode, for changing Relay **B** output, it is necessary to push and release ▲ button.
In this mode, if the subsequent program for Relay **B** changes the output, manual mode would be deactivated automatically and ASTRO operates the program. Otherwise manual mode would continue to be active for Relay **B**.
To deactivate this mode for Relay **B** as an option, push ▲ button until the flashing hand icon disappears.

2- PERMANENT MODE : It is only possible to deactivate permanent mode as manually.

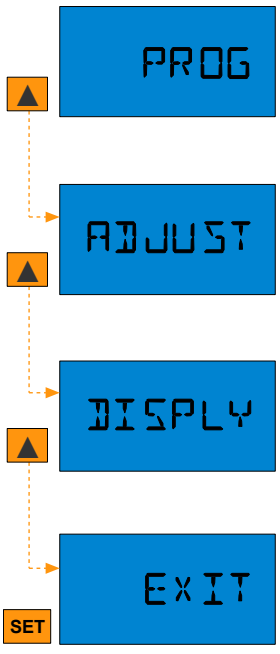
Permanent manual mode for Relay A:

Push ▼ and **SET** buttons at the same time until the hand icon appears on the left of the screen.
Permanent manual mode is not deactivated automatically. The only way to deactivate this mode is manually.
Throughout the manual mode, for changing Relay **A** output, it is necessary to push and release ▼ button.
To deactivate this mode for Relay **A**, push ▼ button until the hand icon disappears.

Permanent manual mode for Relay B:

Push ▲ and **SET** buttons at the same time until the hand icon appears on the right of the screen.
Permanent manual mode is not deactivated automatically. The only way to deactivate this mode is manually.
Throughout the manual mode, for changing Relay **B** output, it is necessary to push and release ▲ button.
To deactivate this mode for Relay **B**, push ▲ button until the hand icon disappears.

MENUS:
Press SET button on the main screen to access the menus. If the lock function is deactivated, PROG menu appears on the screen. Use the direction buttons to see ADJUST,DISPLY and EXIT



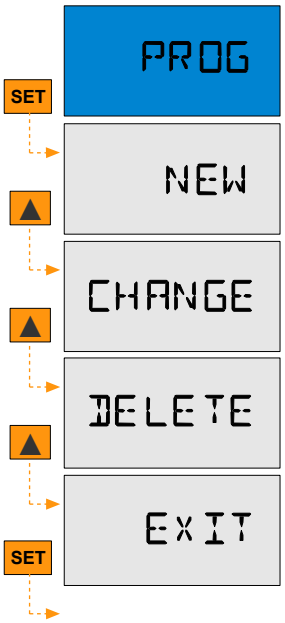
PROGRAM:

All program settings could be done. Creating new program, changing or deleting an existing program.

ADJUST:

Device settings could be done.

DISPLAY :
In this menu, program and device settings could be monitored without making changes. Use the direction buttons to see information about sunrise, sunset, prayer times, programs, memory status, season (summer-winter), latitude, longitude,quiet mode status.

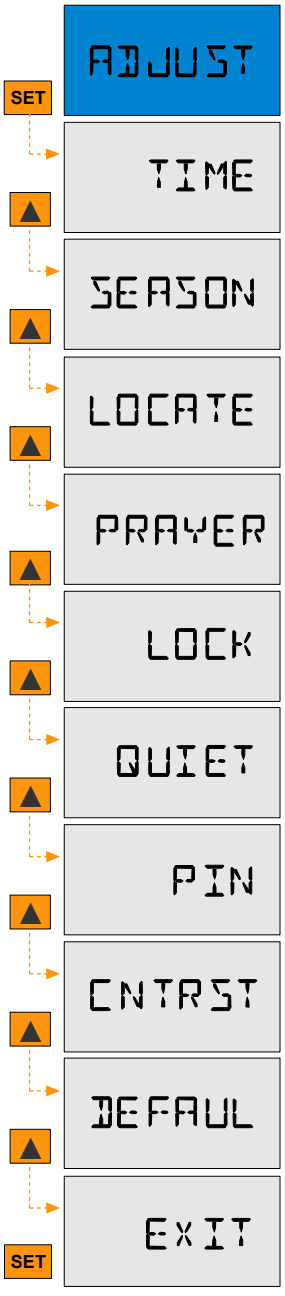


PROGRAM MENU:
Press SET button on PROG screen to access the Program Menu. Use the direction buttons to see NEW,CHANGE,DELETE and EXIT menus.

NEW : New programs are created.

CHANGE : Existing programs could be changed.

DELETE : Existing programs could be deleted. It is possible to delete all of them or the selected one.



ADJUST MENU:
In this menu, device settings could be done.

Real Time Clock and Calender could be set in TIME menu

In this menu, daylight saving time settings could be done. If AUTO is chosen, device determines beginning dates of the summer and winter automatically.

Coordinates and time zone settings of the location could be done in this menu.

Prayer times calculation method could be set in this menu.

Lock function could be activated to prevent unauthorized persons from using the device. This mode could be activated for both of the relays separately.

Quiet mode could be activated to stop the program operation for a certain period.

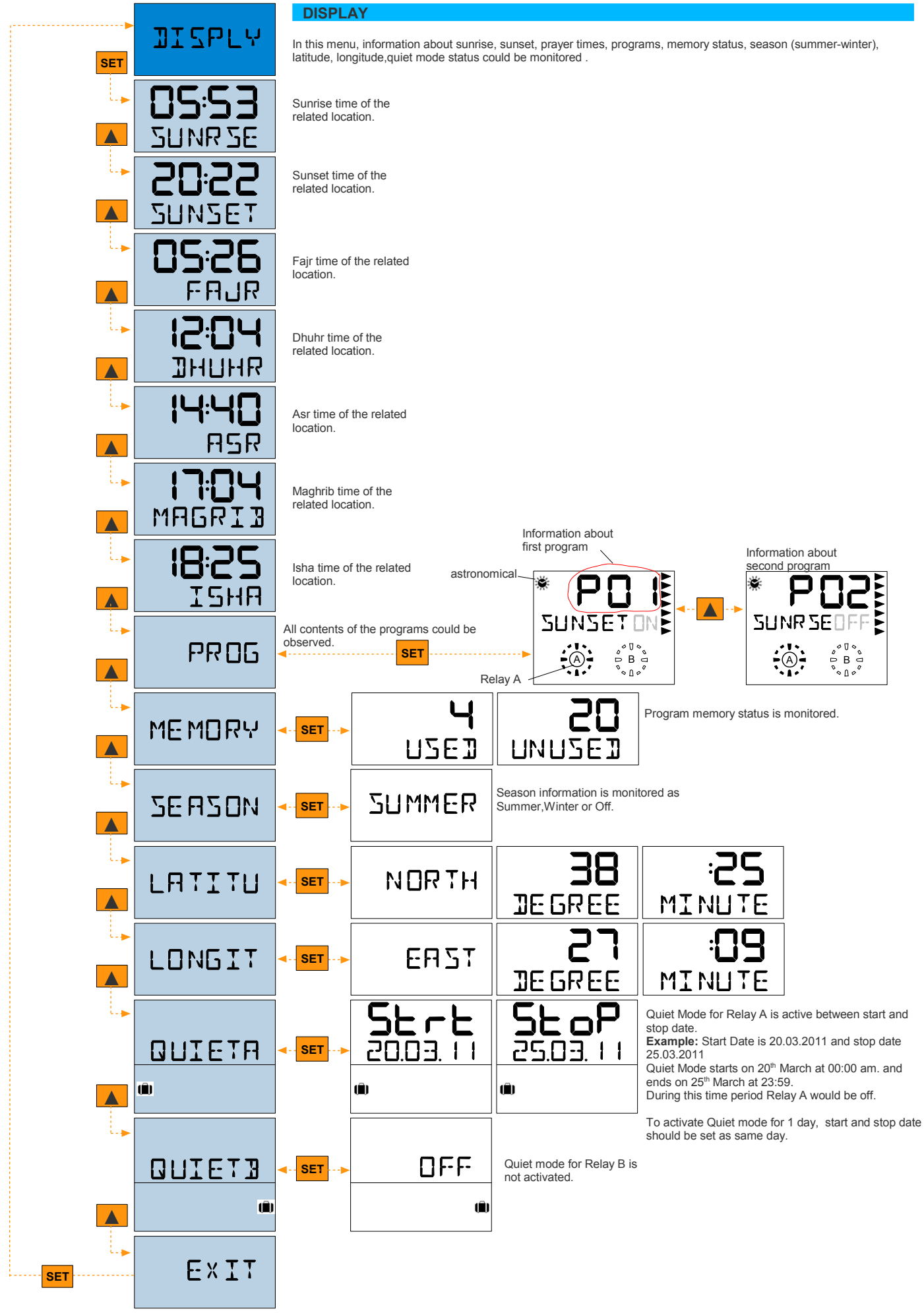
In this menu, PIN code could be changed. PIN code is a 4 digit number.

Display contrast value could be set between 1 and 7.

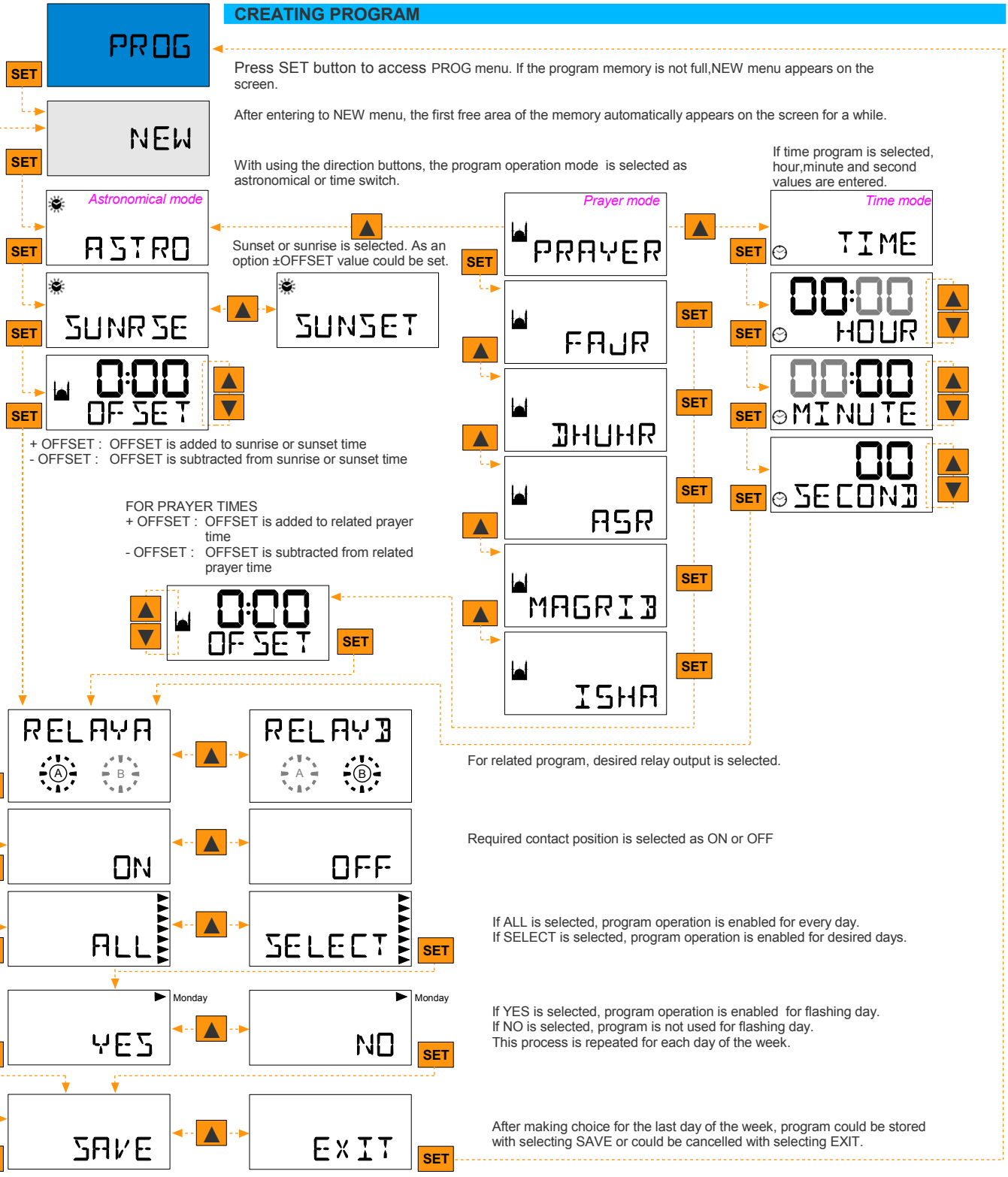
All device settings except time and date are set to default.

DISPLAY

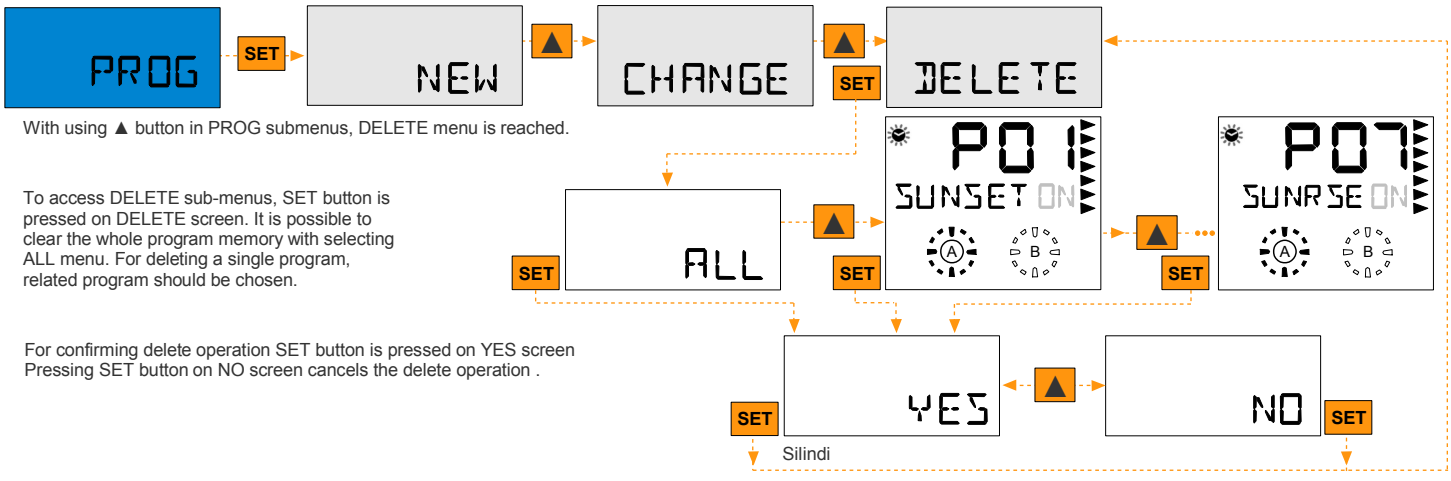
In this menu, information about sunrise, sunset, prayer times, programs, memory status, season (summer-winter), latitude, longitude,quiet mode status could be monitored .



CREATING PROGRAM

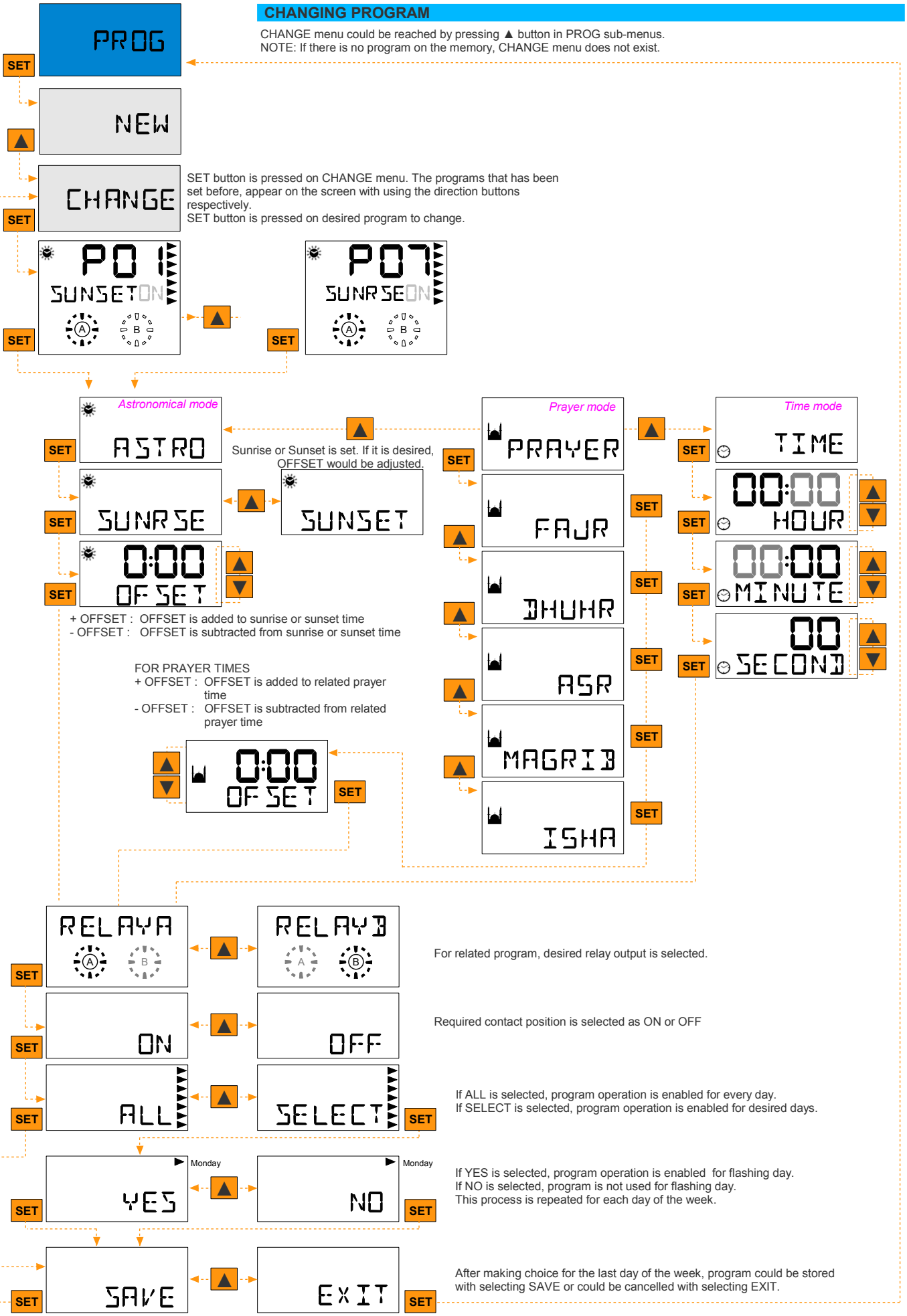


DELETING PROGRAM



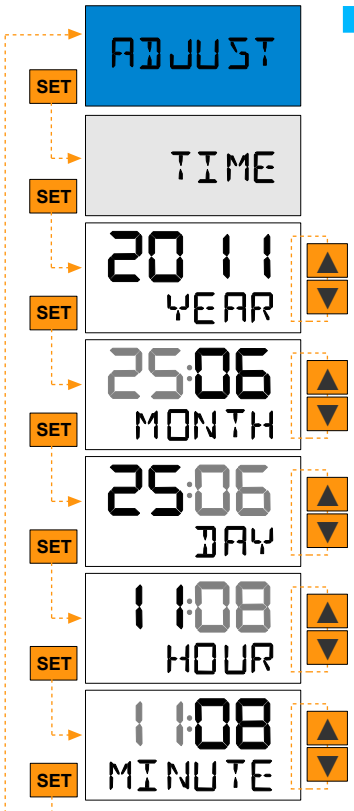
CHANGING PROGRAM

CHANGE menu could be reached by pressing ▲ button in PROG sub-menus.
NOTE: If there is no program on the memory, CHANGE menu does not exist.



TIME AND DATE

In ADJUST sub-menus could be accessed TIME menu.



With using ▼▲ buttons, year value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

With using ▼▲ buttons, month value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

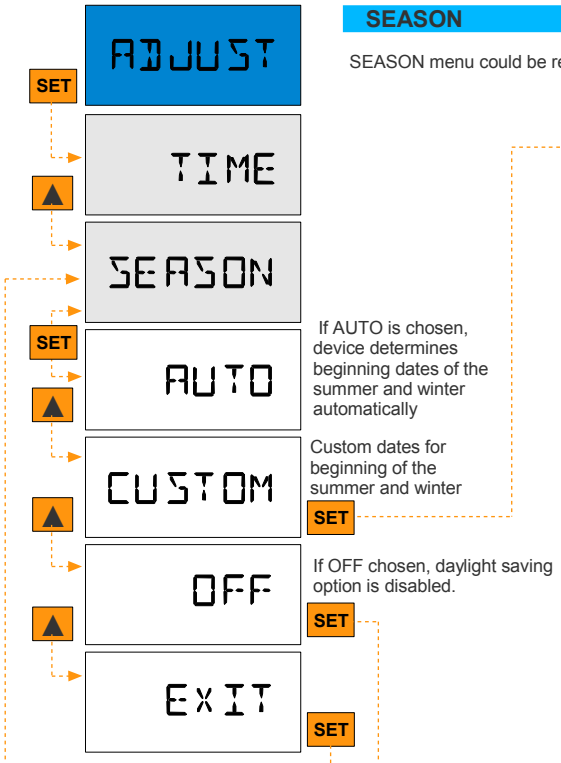
With using ▼▲ buttons, day value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

With using ▼▲ buttons, hour value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

With using ▼▲ buttons, minute value is increased or decreased.
When desired value is reached, it is stored by pressing SET button.

SEASON

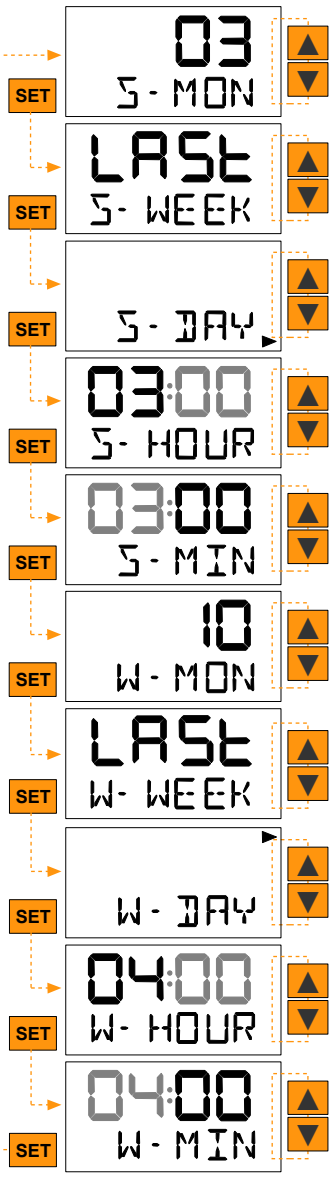
SEASON menu could be reached by pressing ▲ button in ADJUST sub-menus.



If AUTO is chosen, device determines beginning dates of the summer and winter automatically

Custom dates for beginning of the summer and winter

If OFF chosen, daylight saving option is disabled.



First parameter of custom season setting is beginning month for the summer season. With using ▼▲ buttons, month value is increased or decreased. When desired value is reached, it is stored by pressing SET button

Second parameter is beginning week for the summer in chosen month. With using ▼▲ buttons week value is set as 1,2,3,4 or last.

Third parameter is beginning day for the summer. With using ▼▲ buttons day is set.

Fourth parameter is beginning hour for the summer. With using ▼▲ buttons hour value is set.

Fifth parameter is beginning minutes for the summer. With using ▼▲ buttons minute value is set.

Sixth parameter is beginning month for the winter season. With using ▼▲ buttons, month value is increased or decreased. When desired value is reached, it is stored by pressing SET button

Seventh parameter is beginning week for the winter in chosen month. With using ▼▲ buttons week value is set as 1,2,3,4 or last.

Eighth parameter is beginning day for the winter. With using ▼▲ buttons day is set.

Ninth parameter is beginning hour for the winter. With using ▼▲ buttons hour value is set.

Tenth parameter is beginning minutes for the winter. With using ▼▲ buttons minute value is set.

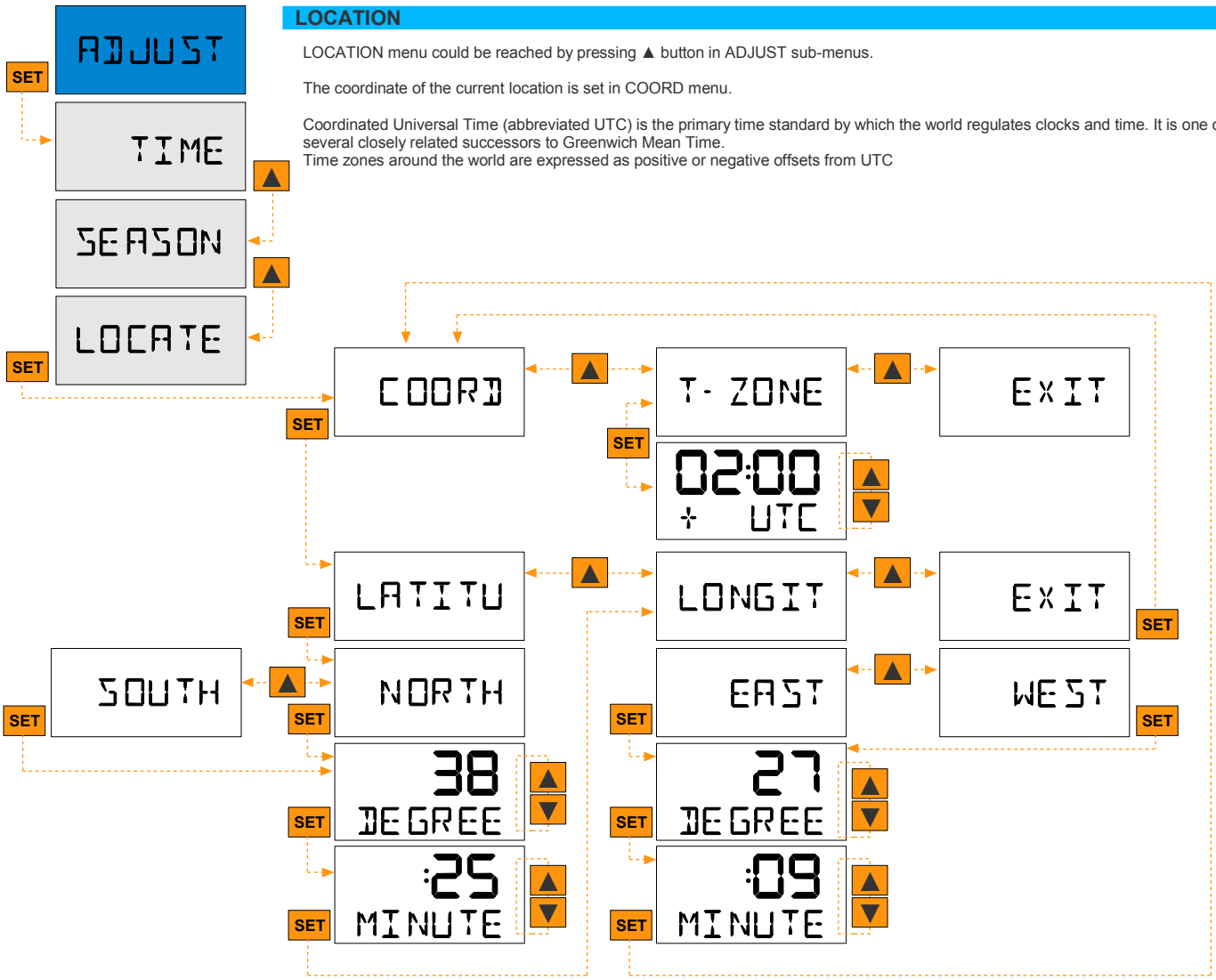
NOTE:
Auto Season mode
winter→summer change: last Sunday in March 03:00:00
(Clocks are adjusted forward one hour)
summer→winter change: last Sunday in October 04:00:00
(Clocks are adjusted backward one hour)

LOCATION

LOCATION menu could be reached by pressing ▲ button in ADJUST sub-menus.

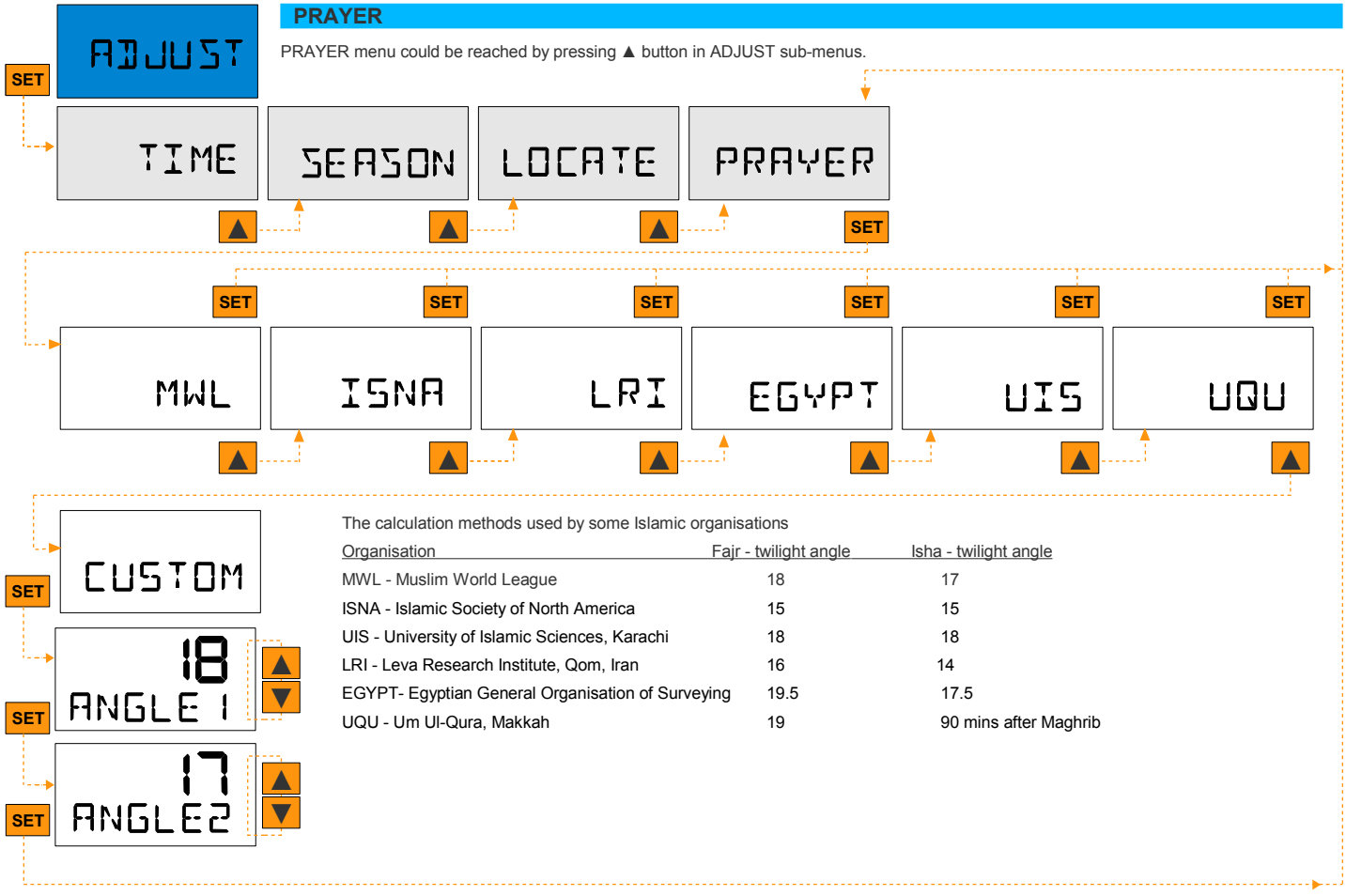
The coordinate of the current location is set in COORD menu.

Coordinated Universal Time (abbreviated UTC) is the primary time standard by which the world regulates clocks and time. It is one of several closely related successors to Greenwich Mean Time.
Time zones around the world are expressed as positive or negative offsets from UTC



PRAYER

PRAYER menu could be reached by pressing ▲ button in ADJUST sub-menus.

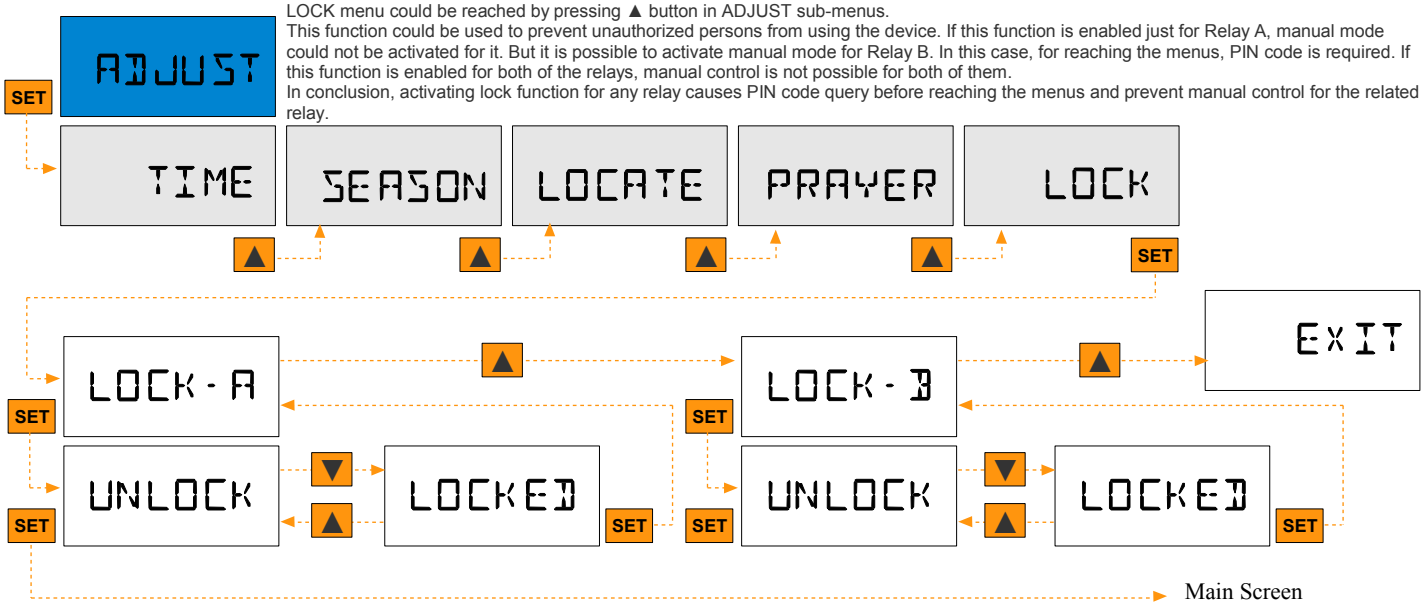


The calculation methods used by some Islamic organisations

Organisation	Fajr - twilight angle	Isha - twilight angle
MWL - Muslim World League	18	17
ISNA - Islamic Society of North America	15	15
UIS - University of Islamic Sciences, Karachi	18	18
LRI - Leva Research Institute, Qom, Iran	16	14
EGYPT- Egyptian General Organisation of Surveying	19.5	17.5
UQU - Um Ul-Qura, Makkah	19	90 mins after Maghrib

LOCK FUNCTION

LOCK menu could be reached by pressing ▲ button in ADJUST sub-menus.
This function could be used to prevent unauthorized persons from using the device. If this function is enabled just for Relay A, manual mode could not be activated for it. But it is possible to activate manual mode for Relay B. In this case, for reaching the menus, PIN code is required. If this function is enabled for both of the relays, manual control is not possible for both of them.
In conclusion, activating lock function for any relay causes PIN code query before reaching the menus and prevent manual control for the related relay.

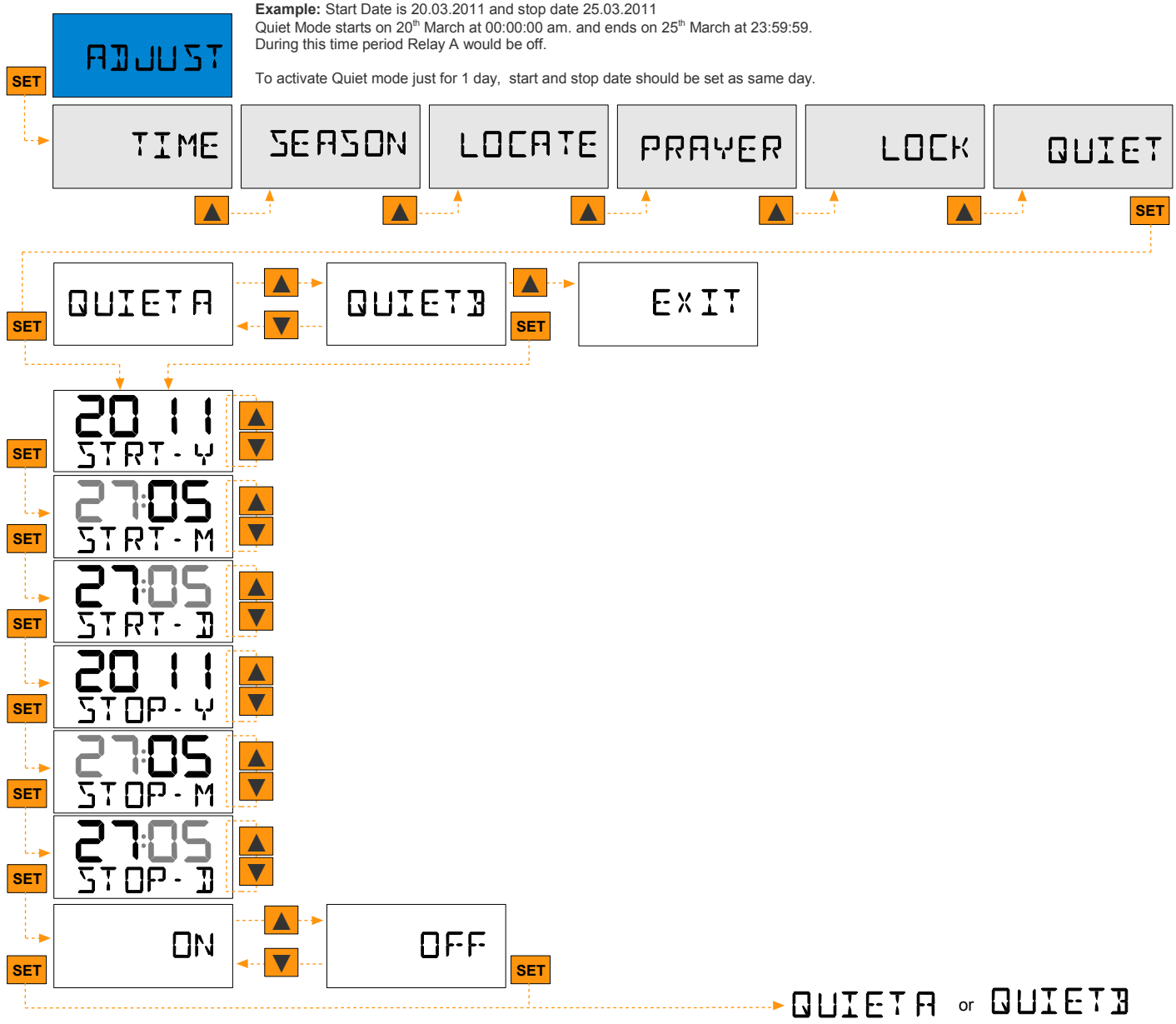


QUIET MODE

QUIET menu could be reached by pressing ▲ button in ADJUST sub-menus.
Quiet mode allows forcing of the OFF output for a time period. This mode could be activated for Relay A and/or Relay B.
Firstly, the time interval is set for related relay. Confirming on YES screen is obligation to activate this mode. If the time period is set but not confirmed, related relay would not be entered to the quiet mode.

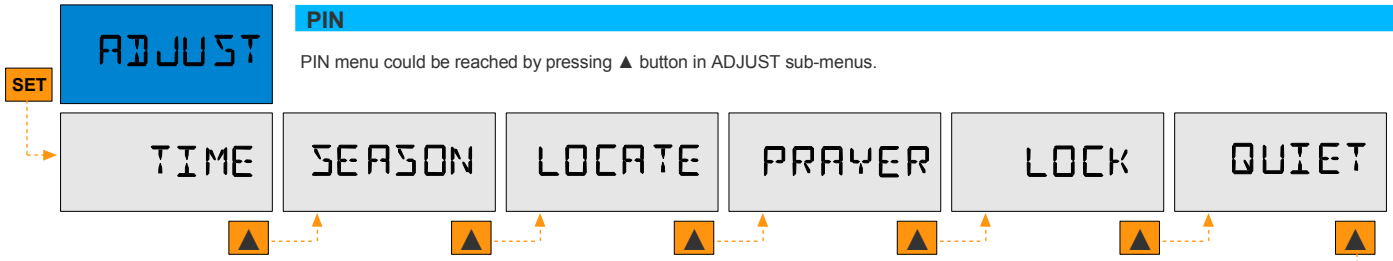
Example: Start Date is 20.03.2011 and stop date 25.03.2011
Quiet Mode starts on 20th March at 00:00:00 am. and ends on 25th March at 23:59:59.
During this time period Relay A would be off.

To activate Quiet mode just for 1 day, start and stop date should be set as same day.



PIN

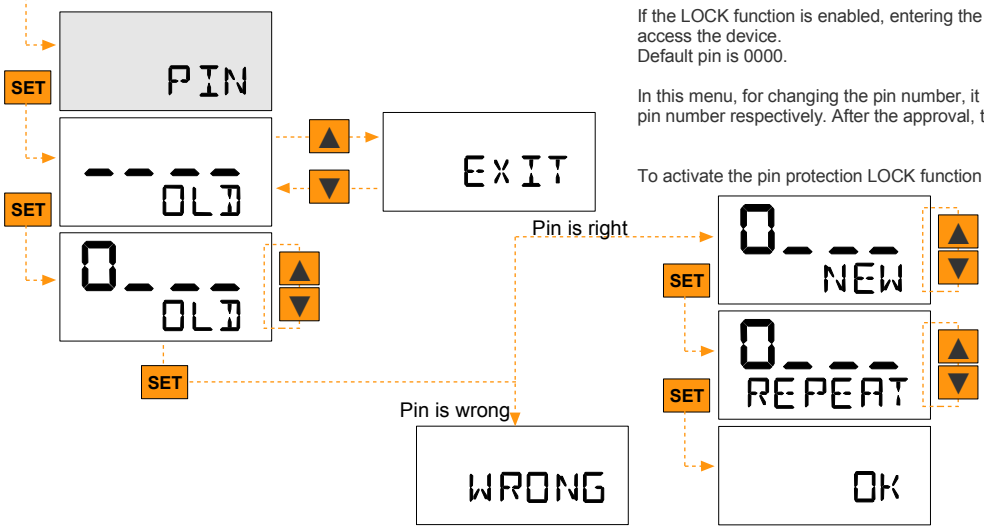
PIN menu could be reached by pressing ▲ button in ADJUST sub-menus.



If the LOCK function is enabled, entering the pin code is required, before the user is allowed to access the device.
Default pin is 0000.

In this menu, for changing the pin number, it is necessary to enter the old pin number and the new pin number respectively. After the approval, the pin code would be change.

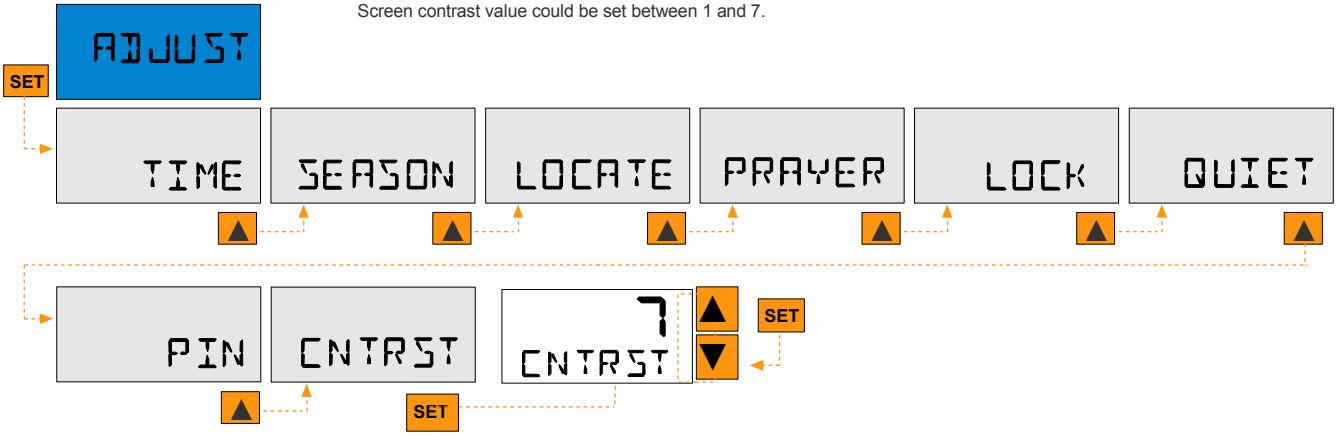
To activate the pin protection LOCK function should be enabled.



CONTRAST

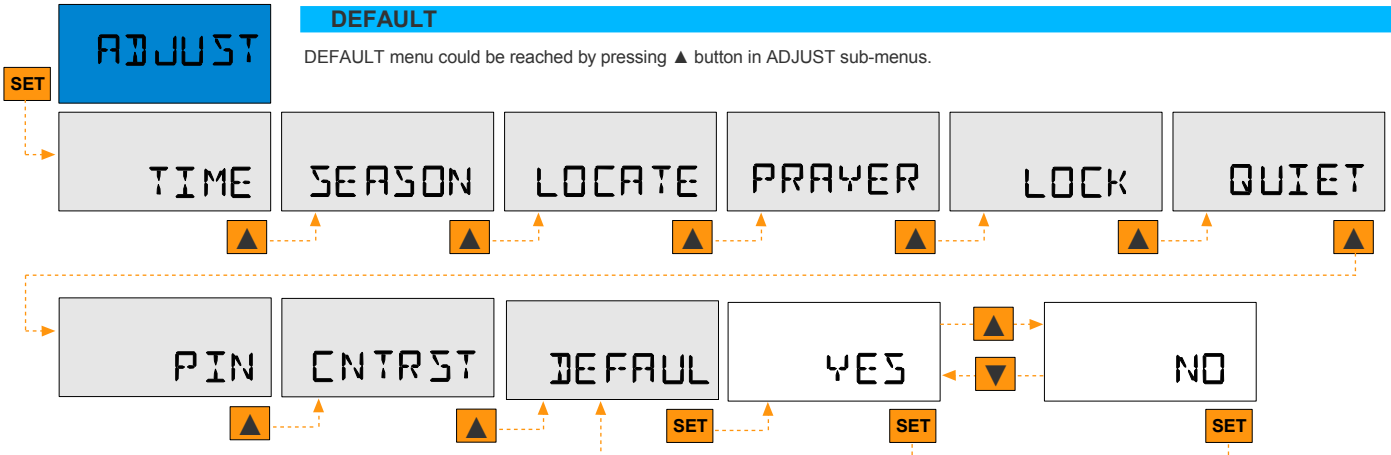
CONTRAST menu could be reached by pressing ▲ button in ADJUST sub-menus.

Screen contrast value could be set between 1 and 7.



DEFAULT

DEFAULT menu could be reached by pressing ▲ button in ADJUST sub-menus.



By restoring an ASTRO to factory defaults, following settings are installed.
Programs : 24 preset programs
Lock A-B : Off
Quiet A-B : Off
Manual A-B : Off
Season : Auto
Contrast : 7

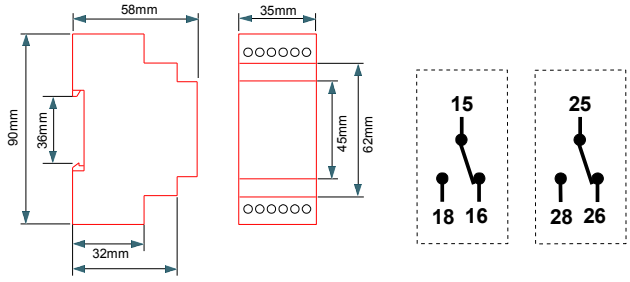
NOTE:Reset an ASTRO to factory defaults does not change the pin code and the real time.

ABBREVIATIONS

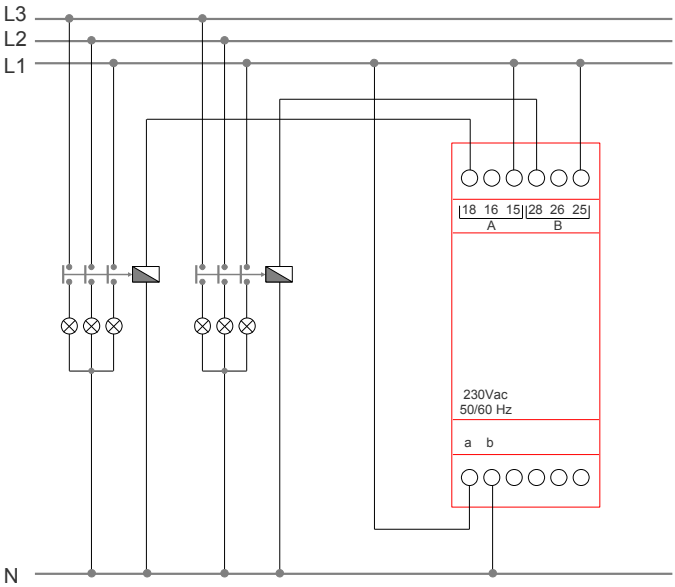
ADJUST	adjust
ALL	entire week
ANGLE1	Fajr twilight angle
ANGLE2	Isha Twilight angle
ASR	Asr
ASTRO	astronomical mode
AUTO	automatic
CHANGE	change
CNTRST	contrast
CON-03	data is coming from CON-3 device
COORD	coordinates
CUSTOM	custom
DAY	day
DEFAUL	factory defaults
DEGREE	degree
DELETD	deleted
DELETE	delete
DISPLY	display
DHUHR	Dhuhr
EAST	east
EGYPT	Egyptian General Organisation of Surveying
ERR1	CON3 communication error
ERR2	PIN code error
ERR3	Parameter values are out of max-min.
ERR4	CON-3 has no data
ERR5	Program overload error
EXIT	exit
FAJR	Fajr
HOUR	hour
IR OK	data communication is Successful
ISHA	Isha
ISNA	Islamic Society of North America
LATITU	latitude
LOCATE	locate
LOCK	lock
LOCKA	lock function for relay A
LOCKB	lock function for relay B
LONGIT	longitude
LRI	Leva Research Institute
MANUAL	manual
MAGRIB	Maghrib
MINUTE	minute
MONTH	month
MWL	Muslim World League
NEW	new
NO	no
NORTH	north
OFF	off
OFF	relay is off
OFSET	offset
OK	okay
OLD	old
ON	on
ON	relay is on
P1 OK	program1 is saved.
PIN	pin code
PRAYER	prayer
PROG	program
QUIET	quiet mode
QUIETA	quiet mode for relay A
QUIETB	quiet mode for relay B
RELAYA	relay A
RELAYB	relay B
REPEAT	repeat
S-DAY	summer beginning(day)
S-HOUR	summer beginning(hour)
S-MIN	summer beginning(minute)
S-MON	summer beginning(month)
S-WEEK	summer beginning(week)
SAVE	save
SEARCH	data signal is not coming from CON-3
SEASON	season
SECOND	second
SELECT	select the day
SOUTH	south
STOP-D	end of quiet mode(day)
STOP-M	end of quiet mode(month)
STOP-Y	end of quiet mode(year)
STRT-D	start of quiet mode(day)
STRT-M	start of quiet mode(month)
STRT-Y	start of quiet mode(year)
SUMMER	summer
SUNRSE	sunrise
SUNSET	sunset
T-ZONE	time zone
TIME	time
UIS	University of Islamic Sciences
UNUSED	unused
USED	used
UTC	coordinated universal time
UQU	Umm al-Qura
W-DAY	winter beginning(day)
W-HOUR	winter beginning(hour)
W-MIN	winter beginning(minute)
W-MON	winter beginning(month)
W-WEEK	winter beginning(week)
WEST	west
WINTER	winter
WRONG	wrong
YEAR	year
YES	yes

TECHNICAL DATA

Rated Voltage (Un)	: 230Vac
Operation Range	: Un x (0,85 – 1,10)
Contact Current(15-18)(25-28)	: max. 8 A / 250Vac (N.O) ; ASTRO-05
Contact Current(15-18)(25-28)	: max. 16 A / 250Vac (N.O) ; ASTRO-15
Supply Power Consumption	: < 3VA
Clock Precision	: ± 1 sec/day
Programming Resolution	: 1 sec
Number of Programs	: 56 programs
Memory	: EEPROM
Battery	: CR2032 (Replacable)
Battery Life	: 5 year (not inserted in device)
Additional Reserv Time	: 3 - 7 hour
Screen	: LCD
Language	: English
Programming with InfraRed	: Yes
Mounting	: To connection rail in electrical panel
Storage Temperature	: -10 ºC ..... +70 ºC
Ambient Temperature	: 0 ºC ..... +50 ºC
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Dimensions	: 2 x DIN modules



CONNECTION



DAM – A - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

► With Demand

Technical Data

Operational Voltage (Un)	: 230Vac
Operating range	: (0,8-1,1) x Un
Frequency	: 50/60 Hz
Power Consumption	: < 4VA
Measurement Sensitivity	: %1 +1 digit
Current Transformer Ratio	: 5/5.....10000/5 A
Display	: 4 Digits Led Display
Protection Class	: IP 20
Terminal Protection Class	: IP 00
Operation Temperature	: - 5 °C .... + 50 °C
Operation Humidity	: %15 ..... %95 (without consensation)
Installation	: to the panel tap
Dimensions	:72x72x80 mm

General Informations

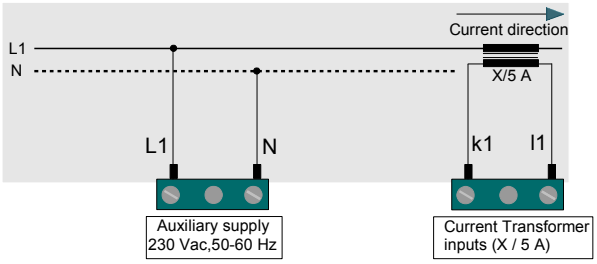
The device can be used in electrical panels, laboratories and test devices. With the assistance of a current transformer, it measures the AC current passing through the system in terms of Amper unite. After energizing the device, "dA -A " message appears on it's screen for 2 seconds and then it starts to show the current value

■ The current transformer ratio can be adjusted between 5/5 and 10000/5 using the touch buttons on the front panel of the device.

■ Stores the maximum demand value and the peak value on its memory and keeps these values even if the energy supply goes off.

■ When the measured value of the seconder current reaches 5,1 A, " OvEr" message starts to flash on the screen to warn the user that the value of the current exceeded the limit values.

Connection Scheme:



Button Functions:

Using the direction buttons, it is possible to go through the nemu up and down. "SEt" message will appear on the screen if the set button pressed. To set one of the parameters set button must be pressed again inorder to enter that menu. The first parameter that can be set in the set menu is transformer's primer current value, that would flash on the screen with the message " CtrF" while setting. Pressing the set button and the direction buttons can increase and decrease this value " between 5 and 10000". after reaching the required value set button should be pressed to store this value on the device. After that pressing the down button leads to the demand time setting with dd-t flashing on the screen.

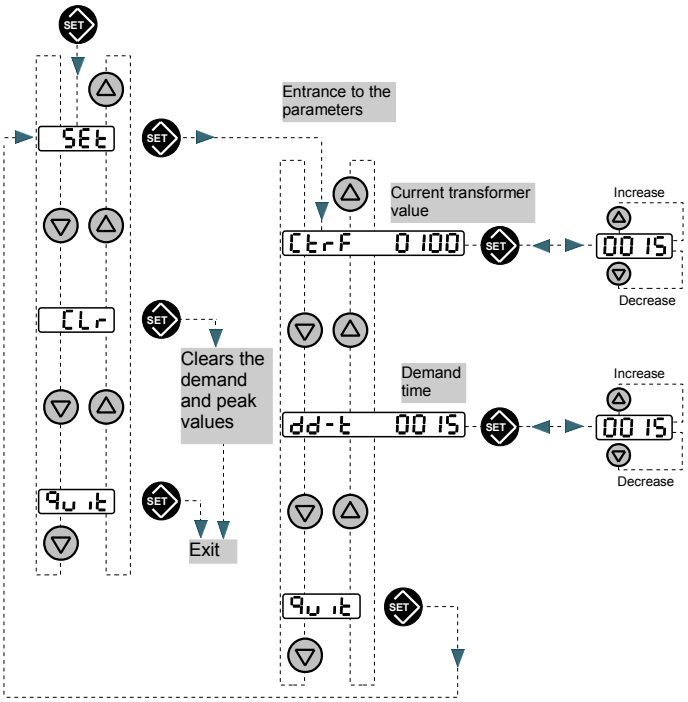
To make an adjustment, set button must be pushed. With the direction buttons the value can be adjusted "between 10 and 60 minutes". After reaching the required value pressing set button would store this value. Next what would appear in the SEt menu pressing the down direction button is qUit. Pressing the set button would exit the set menu.

The next menu after set menu is Clr, " can be reached by pressing down button". To clear the maximum demand and the peak value set button must be pressed. After the Clr menu qUit show appear. Pressing set there would return the screen to the measurement screen.

<u>While in measurement screen, pressing the up direction button shows the maximum peak current value occurred since the last operation done, pressing the down direction button shows the maximum demand occurred since last Clr operation done.</u>

Warning !!!

- The message Err1 or Err2 on the screen means that the device has got a failure
- Can not be used without current transformer, a current that is higher that 5 A passing through the measurement inputs may damage the device.
- To clean the device use dry dust cloth after de-energizing the device



DAM – A - 48

DIGITAL UNIVERSAL AMMETER

TRUE RMS

with Demand

Technical Data

Operational Voltage (Un)	: 230Vac
Operating range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Power Consumption	: < 4VA
Measurement Sensitivity	: %1 +1 digit
Current Transformer Ratio	: 5/5.....10000/5 A
Display	: 4 Digits Led Display
Protection Class	: IP 20
Terminal Protection Class	: IP 00
Operation Temperature	: - 5 °C .... + 50 °C
Operation Humidity	: %15 ..... %95 (without consensation)
Installation	: to the panel tap
Dimensions	: 48x96x50 mm)

General Informations

The device can be used in electrical panels, laboratories and test devices. With the assistance of a current transformer, it measures the AC current passing through the system in terms of Amper unite.

■ The current transformer ratio can be adjusted between 5/5 and 10000/5 using the touch buttons on the front panel of the device.

■ Stores the maximum demand value and the peak value on its memory and keeps these values even if the energy supply goes off.

Button Functions:

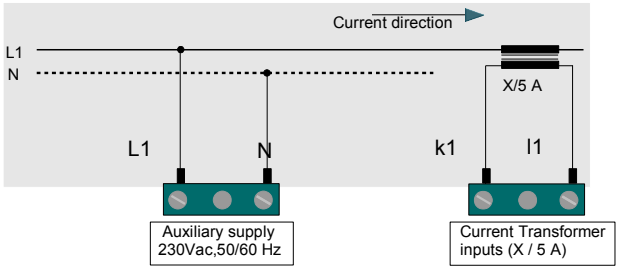
Using the direction buttons, it is possible to go through the nemu up and down. “SEt” message will appear on the screen if the set button pressed. To set one of the parameters set button must be pressed again inorder to enter that menu. The first parameter that can be set in the set menu is transformer's primer current value, that would flash on the screen with the message “ CtrF” while setting. Pressing the set button and the direction buttons can increase and decrease this value “ between 5 and 10000”. after reaching the required value set button should be pressed to store this value on the device. After that pressing the down button leads to the demand time setting with dd-t flashing on the screen.

To make an adjustment, set button must be pushed. With the direction buttons the value can be adjusted “between 10 and 60 minutes”. After reaching the required value pressing set button would store this value. Next what would appear in the SEt menu pressing the down direction button is qUit. Pressing the set button would exit the set menu.

The next menu after set menu is Clr, “ can be reached by pressing down button”. To clear the maximum demand and the peak value set button must be pressed. After the Clr menu qUit show appear. Pressing set there would return the screen to the measurement screen.

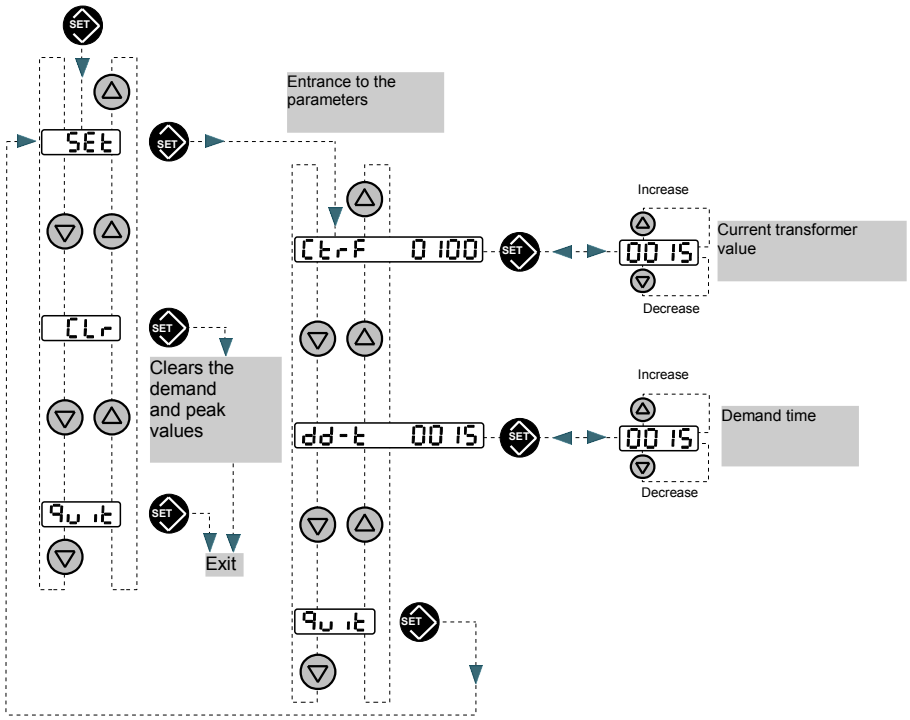
While in measurement screen, pressing the up direction button shows the maximum peak current value occurred since the last operation done, pressing the down direction button shows the maximum demand occurred since last Clr operation done.

Connection Scheme:



Warning !!!

- The message Err1 or Err2 on the screen means that the device has got a failure
- Can not be used without current transformer, a current that is higher that 5 A passing through the measurement inputs may damage the device.
- To clean the device use dry dustcloth after de-energizing the device



DAM – B - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

► With Demand
► Over Current Adjustment

General Informations
The device can be used in electrical panels, laboratories and test devices. With the assistance of a current transformer, it measures the AC current passing through the system in terms of Amper unite. If the current exceeds the adjusted current then then alarm led starts to blink and after the the adjusted time delay it changes the outputs possition.
When the current exceeds the adjusted over current value the device starts to count for the adjusted delay time and after that it opens its output contacts.
After energizing the device, "dA -b " message appears on it's screen for 2 seconds and then it starts to show the current value.
■ The current transformer ratio can be adjusted between 5/5 and 10000/5 using the touch buttons on the front panel of the device.
■ Stores the maximum demand value and the peak value on its memory and keeps these values even if the energy supply goes off.
■ When the measured value of the seconder current reaches 5,1 A, " OvEr" message starts to flash on the screen to warn the user that the value of the current exceeded the limit values.

Fast Buttons:
While in measurement screen, pressing up button shows the peak value

Pressing down button shows the maximum demand value

Main Menu :
Pressing on the set button leads to the main menu. The menu contains **OP**, **CLr**, **SEt** and **qult** in order.

► **OP:** Shows the opening counter " that occures when the adjusted over current values being exceeded.

► **Clr:** Peak and maximum demand values can be cleared in this menu. To enter this menu, set button must be pressed. **cALL**, **c-OP**, **c-dp** and **qult** submenus are included within this menu.

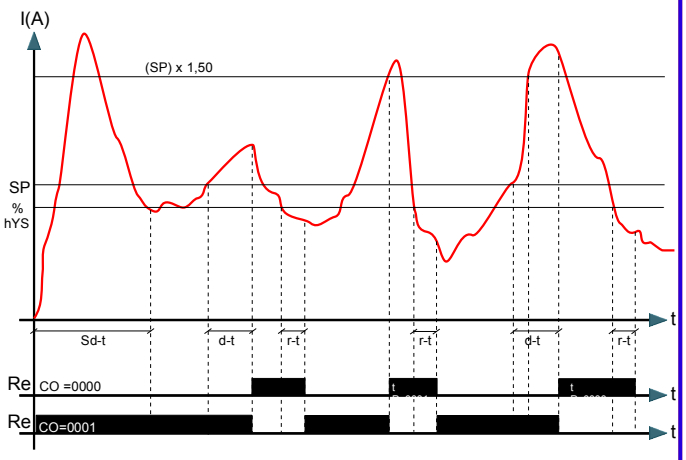
- ► **cALL :** It is used to clear all peak, maximum demand and opening counter values by pressing the set button.
- ► **c-OP :** It is used only to clear the opening counter value.
- ► **c-dp :** It is used only to clear the peak and the maximum demand values.
- ► **qult :** To exit the submenus and return back to the main menu.

► **Set :** The menu that parameters can be adjusted in. to enter this menu set button must be pressed. **ctrF**, **SP**, **hYS**, **d-t**, **Sd-t**, **r-t**, **dd-t**, **CO**, **LtCh**, **tP**, and **qult** submenus are included within this menu. These parameters will flash on the screen. In order to change any of them set button must be pressed, then the screen will stop flashing and using the direction buttons the new value can be applied. Pressing the set button again would store this value.

- ► **ctrF :** **Current transformer ratio.** It can be set between 5 and 10000. Inorder to set the value, set button must be pressed then using the direction button the aimed value can be set. Pressing set again would store the new value.
- ► **SP :** **Over current value set menu.** It can be set between the maximum current allowed for the current transformer and %10 of the that value. For example for 500/5A transformer, it can be set between 50 and 500A.
- ► **hYS :** **The percentage Hysteresis value.** It can be adjusted between 0,03 and 0,50. When the current exceeds the adjusted over current value then an opening occures. In order to close the output contact again, the current must go below the adjusted over current value multiplied by the %hYS, otherwise it will keep the output open.
- ► **d-t :** **Delay time.** It can be adjusted between 1 and 30 seconds. The opening of current exceeding adjusted current limit occures after this delay.
- ► **Sd-t :** Start delay time. It can be set btween 0 and 60 seconds. It is used to prevent any unwanted opening while current is starting from 0 " especially for motors that need high current for start up". In this period opening wouldn't occure even if the current exceeds the adjusted over current value. If this value is set to "0000" the the device will wait for the delay time d-t and then opens its output.
- ► **r-t :** **Return time.** The time required to turn back from an alarm situation. The device waits for that period after the current returns below the adjusted value. It can be set between 2 and 10 seconds.
- ► **dd-t :** **Demand time.** The time interval in which the demand value is calculated. It can be adjusted between 10 to 60 minutes
- ► **CO :** The menu to adjust the output contact position.
  - ■ if the value is set to 0000 then the output in normal situation is closed contact and is alarm situation is open contact.
  - ■ if the value is set to 0001 then the output in normal situation is open contact and is alarm situation is closed contact.
- ► **LtCh :** **Latch function.** The place to choose wether the device will go out of an alarm manually or automatically
  - ■ if the value is set to 0000 then the latch function is off and the device will go out of the alarm automatically
  - ■ if the value is set to 0001 then the latch function is on and the device wouldn't go out of the alarm unless the user presses the set button until the alarm led turns off. If pressed, then device then will go out of the alarm after the delay time r-t.
- ► **tP :** Sudden opening function. If the current goes over %150 of the adjusted over current value the the device will open its output without any delay.
  - ■ if 0000 then the function is disabled .
  - ■ if 0001 then the function is enabled. (not active while start delay time (Sd-t)).
- ► **quit :** Pressing set leads to the main menu.

► **quit :** Pressing set leads to the measurement screen.

Button Functions :
To enter the menu set button must be pressed. Within the menu, the parameters can e reached using the direction buttons. To inter the desired menu set button must be pushed again. This parameters can be adjusted using the direction buttons, pressing the set button again stores the new parameters.



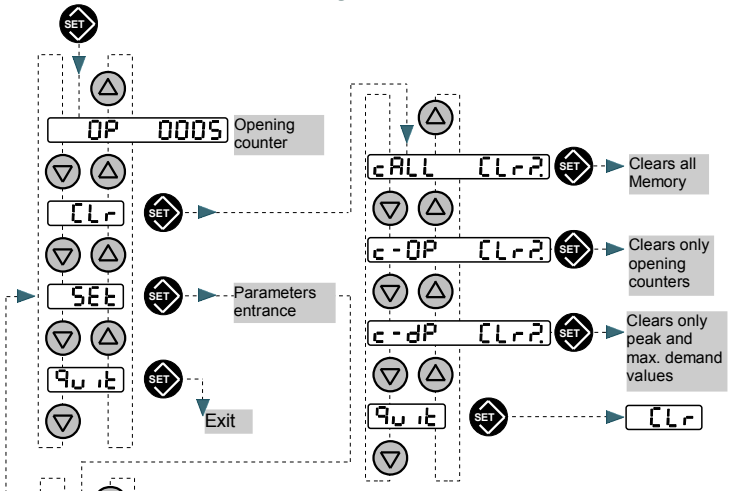
Technical Data

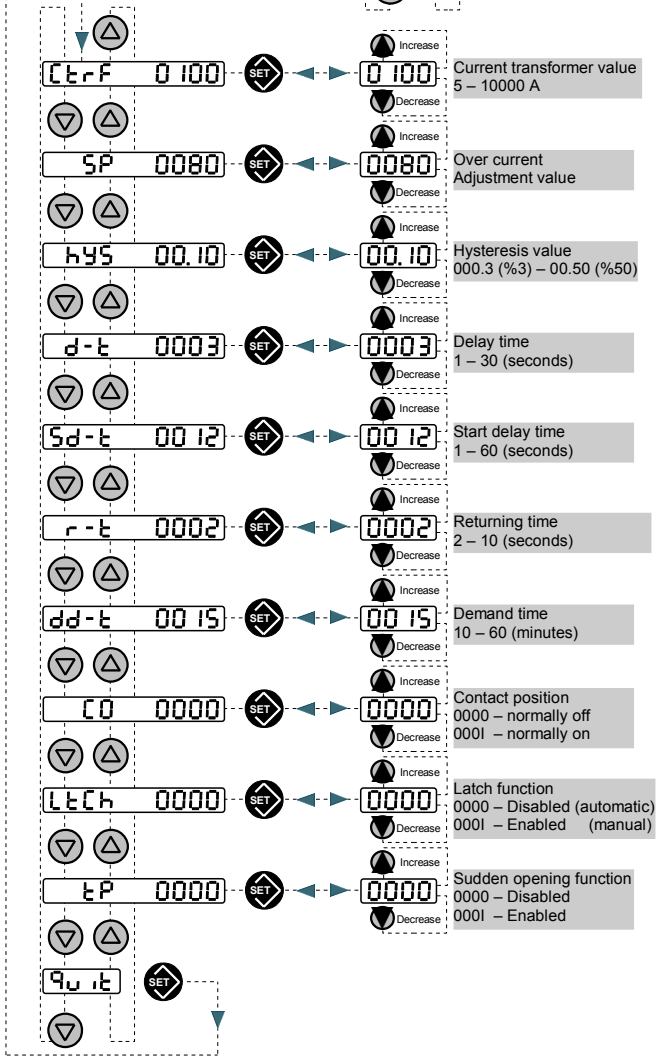
Operational Voltage (Un)	: 230Vac
Operating range	: (0,8-1,1) x Un
Frequency	: 50/60 Hz
Power Consumption	: < 4VA
Measurement Sensitivity	: %1 +1 digit
Current Transformer Ratio	: 5/5.....10000/5 A
Display	: 4 Digits Led Display
Contact Current	: Max. 3A / 240Vac
Protection Class	: IP 20
Terminal Protection Class	: IP 00
Operating Temperature	: - 5 °C .... + 50 °C
Operating Humidity	: %15 ..... %95 (without condensation)
Installation	: to the panel tap
Dimentions	: 72x72x80 mm

DAM – B - 72

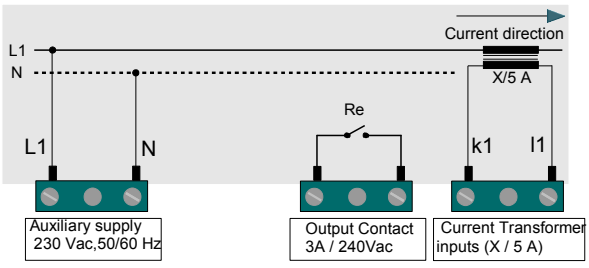
DIGITAL UNIVERSAL AMPERMETER (True RMS)

- ► With Demand
- ► Over Current Adjustment





Connection Scheme:



Warning !!!

- The message Err1 or Err2 on the screen means that the device has got a failure
- Can not be used without current transformer, a current that is higher that 5 A passing through the measurement inputs may damage the device.
- To clean the device use dry Dust cloth after de-energizing the device

DAM – C - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

► With Demand
► Over & Under Current Adjustment

General Informations

The device can be used in electrical panels, laboratories and test devices. With the assistance of a current transformer, it measures the AC current passing through the system in terms of Amper unite. When the current exceeds the adjusted over current or goes below the adjusted under current values the device starts to count for the adjusted delay time and after that it changes Re1 or Re2 outputs contact possition. After energizing the device, "dA -c " message appears on it's screen for 2 seconds and then it starts to show the current value.

■ The current transformer ratio can be adjusted between 5/5 and 10000/5 using the touch buttons on the front panel of the device.

■ Stores the maximum demand value and the peak value on its memory and keeps these values even if the energy supply goes off.

■ When the measured value of the seconder current reaches 5,1 A, " OvEr" message starts to flash on the screen to warn the user that the value of the current exceeded the limit values

Fast Buttons:

While in measurement screen, pressing up button shows the peak value

Pressing down button shows the maximum demand value

Main Menu :

Pressing on the set button leads to the main menu. The menu contains **o-OP**, **u-OP**, **CLr**, **SEt** and **qult** in order.

► **OP :** Shows the opening counter " that occures when the adjusted over current values being exceeded

► **CLr :** Peak and maximum demand values can be cleared in this menu. To enter this menu, set button must be pressed. **cALL**, **c-OP**, **c-dp** and **qult** submenus are included within this menu.

- ► **cALL :** It is used to clear all peak, maximum demand and opening counter values by pressing the set button.
- ► **c-OP :** It is used only to clear the opening counter value.
- ► **c-dp :** It is used only to clear the peak and the maximum demand values.
- ► **qult :** To exit the submenus and return back to the main menu.

► **Set :** The menu that parameters can be adjusted in. to enter this menu set button must be pressed. **CtrF**, **o-SP**, **u-SP, hYS**, **od-t**, **ud-t**, **Sd-t**, **r-t**, **dd-t**, **o-CO**, **u-CO**, **LtCh**, **tP**, and **qult** submenus are included within this menu. These parameters will flash on the screen. In order to change any of them set button must be pressed, then the screen will stop flashing and using the direction buttons the new value can be applied. Pressing the set button again would store this value.

► **ctrF : Current transformer ratio.** It can be set between 5 and 10000. In order to set the value, set button must be pressed then using the direction button the aimed value can be set. Pressing set again would store the new value.

► **o-SP : Over current value set menu.** It can be set between the maximum current allowed for the current transformer and %10 of the that value. For example for 500/5A transformer, it can be set between 50 and 500A.

► **u-SP : Under current value set menu.** It can be set between the maximum current allowed for the current transformer and %10 of the that value.

► **hYS : The percentage Hysteresis value.** It can be adjusted between 0,03 and 0,50. When the current exceeds the adjusted over current value then an opening occures. Inorder to close the output contact again, the current must go below the adjusted over current value multiplied by the %hYS, otherwise it will keep the output open.

► **od-t : Delay time for over current alarm.** It can be adjusted between 1 and 30 seconds. The opening of current exceeding adjusted current limit occures after this delay.

► **ud-t : Delay time for under current alarm.** It can be adjusted between 1 and 30 seconds. The opening of current exceeding adjusted current limit occures after this delay.

► **Sd-t : Start delay time.** It can be set btween 0 and 60 seconds. It is used to prevent any unwanted opening while current is starting from 0 " especially for motors that need high current for start up". In this period opening wouldn't occure even if the current exceeds the adjusted over current value. If this value is set to "0000" the device will wait for the delay time d-t and then opens its output.

► **r-t : Return time.** The time required to turn back from an alarm situation. The device waits for that period after the current returns below the adjusted value. It can be set between 2 and 10 seconds.

► **dd-t : Demand time.** The time interval in which the demand value is calculated. It can be adjusted between 10 to 60 minutes

► **o-CO :** The menu to adjust the over current output contact possition.
- ■ if the value is set to 0000 then the output in normal situation is closed contact and in over current alarm situation is open contact.
- ■ if the value is set to 0001 then the output in normal situation is open contact and in over current alarm situation is closed contact.

► **u-CO :** The menu to adjust the under current output contact possition.
- ■ if the value is set to 0000 then the output in normal situation is closed contact and in under current alarm situation is open contact.
- ■ if the value is set to 0001 then the output in normal situation is open contact and in over current alarm situation is closed contact.

► **LtCh : Latch function.** The place to choose wether the device will go out of an alarm manually or automatically
- ■ if the value is set to 0000 then the latch function is off and the device will go out of the alarm automatically
- ■ if the value is set to 0001 then the latch function is on and the device wouldn't go out of the alarm unless the user presses the set button until the alarm led turns off. If pressed, then device then will go out of the alarm after the delay time r-t.

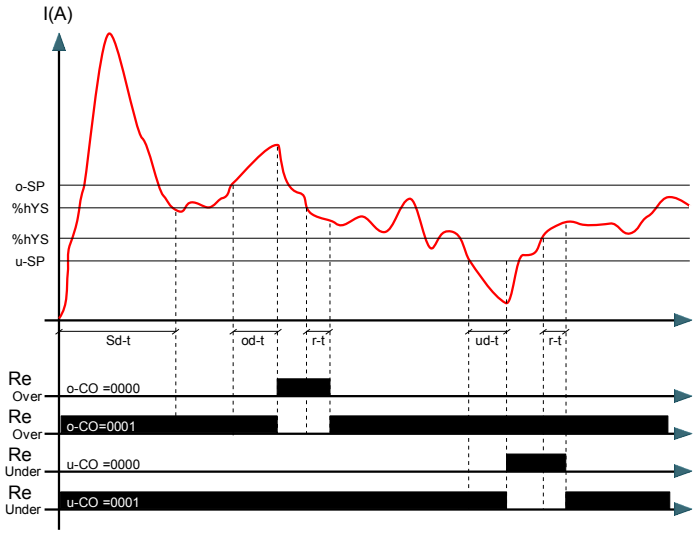
► **tP :** Sudden opening function. If the current goes over %150 of the adjusted over current value the the device will open its output without any delay.
- ■ if 0000 then the function is disabled .
- ■ if 0001 then the function is enabled. (not active while start delay time (Sd-t)).

► **quit :** Pressing set leads to the main menu.

► **quit :** Pressing set leads to the measurement screen.

Button Functions :

To enter the menu set button must be pressed. Within the menu, the parameters can e reached using the direction buttons. To inter the desired menu set button must be pushed again. This parameters can be adjusted using the direction buttons, pressing the set button again stores the new parameters.



Technical Data

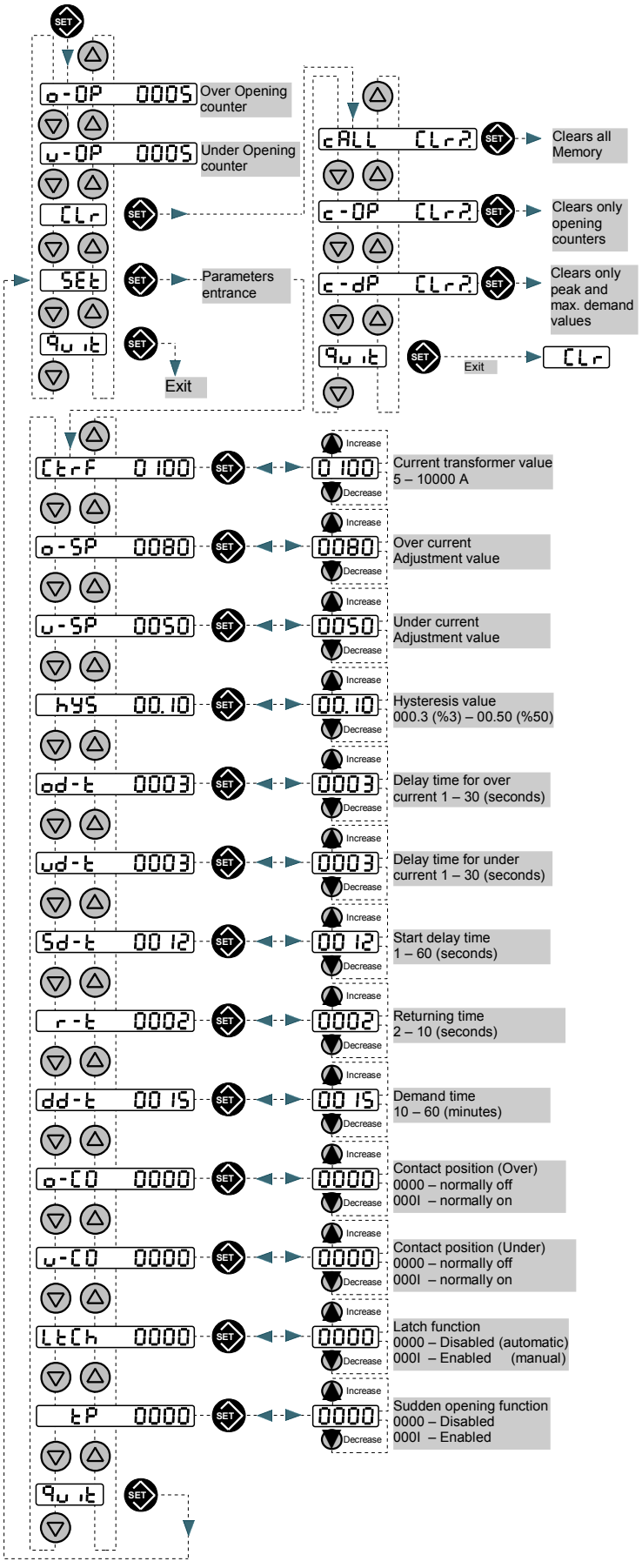
Operational Voltage (Un)	: 230Vac
Operating range	: (0,8-1,1) x Un
Frequency	: 50/60 Hz
Power Consumption	: < 4VA
Measurement Sensitivity	: %1 +1 digit
Current Transformer Ratio	: 5/5.....10000/5 A
Display	: 4 Digits Led Display
Contact Current	: Max. 3A / 240Vac
Protection Class	: IP 20
Terminal Protection Class	: IP 00
Operating Temperature	: - 5 °C .... + 50 °C
Operating Humidity	: %15 ..... %95 (without condensation)
Installation	: to the panel tap
Dimentions	: 72x72x80 mm

DAM – C - 72

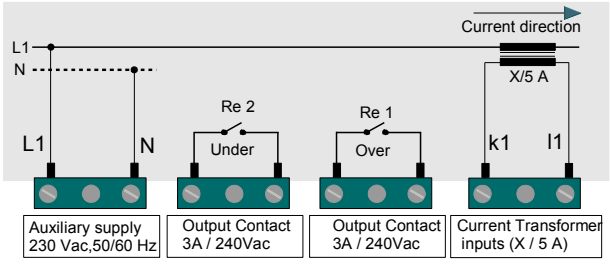
DIGITAL UNIVERSAL AMPERMETER (True RMS)

► With Demand

► Over & Under Current Adjustment



Connection Scheme:



Warning !!!

- The message Err1 or Err2 on the screen means that the device has got a failure
- Can not be used without current transformer, a current that is higher that 5 A passing through the measurement inputs may damage the device.
- Clean the device using dry dust cloth after de-energizing the device
- o-SP and u-SP must be set as shown in the graphic below without having any intersection , otherwise Error message will show on the screen.

DAM – D - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

► 2 Over Current Set

General Informations

The device can be used in electrical panels, laboratories and test devices. With the assistance of a current transformer, it measures the AC current passing through the system in terms of Amper unite. Two over current set (SP1, SP2) with a different output contact for each.The first set value is SP2, the higher one is SP1. When the current exceeds the adjusted first over current value (SP2) then the alarm1 led will start to blink and after the set delay time, the device would change the possition of the Re2 output contact.
If the current exceeds the higher over current value the device opens its 1st output too. The current is called normal if it is below these two limits. After energizing the device, "dA -d " message appears on it's screen for 2 seconds and then it starts to show the current value.Even when the power supply is off, the stored values will not be deleted.
■ When the measured value of the seconder current reaches 5,1 A, " OvEr" message starts to flash on the screen to warn the user that the value of the current exceeded the limit values.

Fast Buttons:

While in measurement screen, pressing up button shows SP1

Pressing down button shows SP2

Parameter entrance :

It can be reached pressing the set button.

Set : The menu that parameters can be adjusted in. to enter this menu set button must be pressed. **CtrF**, **SP1**,**d-t1, SP2**, **d-t2, hYS**, **Sd-t**, **r-t**, **CO**, **LtCh**, **cut**, and **quit** submenusare included within this menu. These parameters will flash on the screen. In order to change any of them set button must be pressed, then the screen will stop flashing and using the direction buttons the new value can be applied. Pressing the set button again would store this value.

► **ctrF : Current transformer ratio.** It can be set between 5 and 10000. Inorder to set the value, set button must be pressed then using the direction button the aimed value can be set. Pressing set again would store the new value.

► **SP1 : Higher over current value set menu.** It can be set between the maximum current allowed for the current transformer and %10 of the that value. For example for 500/5A transformer, it can be set between 50 and 500A.

► **d-t1 : Delay time for the higher over current alarm(SP1).** It can be adjusted between 1 and 30 seconds. The opening of current exceeding adjusted current limit occures after **d-t1** delay.

► **SP2 : First over current value set menu.** It can be set between the maximum current allowed for the current transformer and %10 of the that value. For example for 500/5A transformer, it can be set between 50 and 500A.

► **d-t2 : Delay time for the first over current alarm(SP1).** It can be adjusted between 1 and 30 seconds. The opening of current exceeding adjusted current limit occures after **d-t2** delay.

► **hYS : The percentage Hysteresis value.** It can be adjusted between 0,03 and 0,50. When the current exceeds the adjusted over current value then an opening occures. Inorder to close the output contact again, the current must go below the adjusted over current value multiplied by the %hYS, otherwise it will keep the output open.

► **Sd-t : Start delay time.** It can be set btween 0 and 60 seconds. It is used to prevent any unwanted opening while current is starting from 0 " especially for motors that need high current for start up". In this period opening wouldn't occure even if the current exceeds the adjusted over current value.
If this value is set to "0000" the the device will wait for the delay time **d-t1** and then opens its output.

► **r-t : Return time.** The time required to turn back from an alarm situation. The device waits for that period after the current returns below the adjusted value. It can be set between 2 and 10 seconds.

► **CO : The menu to adjust the output contact possition.**
- ■ if the value is set to 0000 then the output in normal situation is closed contact and is alarm situation is open contact.
- ■ if the value is set to 0001 then the output in normal situation is open contact and is alarm situation is closed contact.

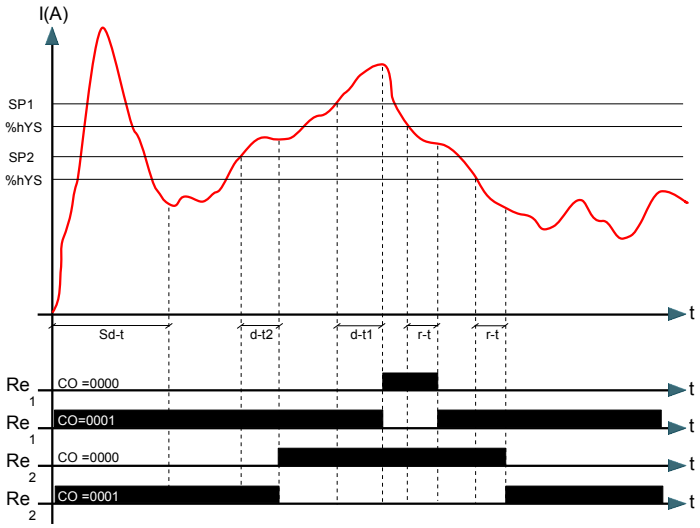
► **LtCh : Latch function.** The place to choose wether the device will go out of an alarm manually or automatically
- ■ if the value is set to 0000 then the latch function is off and the device will go out of the alarm automatically
- ■ if the value is set to 0001 then the latch function is on and the device wouldn't go out of the alarm unless the user presses the set button until the alarm led turns off. If pressed, then device then will go out of the alarm after the delay time r-t.

► **cut : Sudden opening function**. If the current goes over %150 of the adjusted over current value the the device will open its output without any delay.
- ■ if 0000 then the function is disabled .
- ■ if 0001 then the function is enabled. (not active while start delay time (Sd-t)).

► **quit :** Pressing set leads to the measurement screen.

Button Functions :

To enter the menu set button must be pressed. Within the menu, the parameters can e reached using the direction buttons. To inter the desired menu set button must be pushed again. This parameters can be adjusted using the direction buttons, pressing the set button again stores the new parameters.



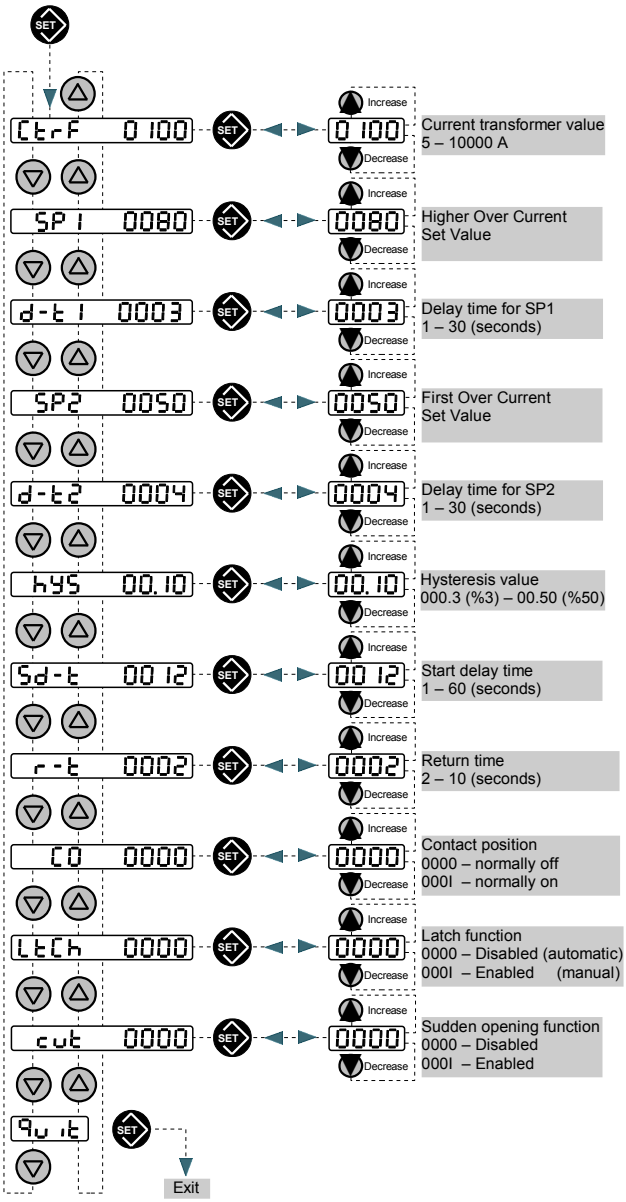
Technical Data

Operational Voltage (Un)	: 220Vac
Operating range	: (0,8-1,1) x Un
Frequency	: 50/60 Hz
Power Consumption	: < 4VA
Measurement Sensitivity	: %1 +1 digit
Current Transformer Ratio	: 5/5.....10000/5 A
Display	: 4 Digits Led Display
Contact Current	: Max. 3A / 240Vac
Protection Class	: IP 20
Terminal Protection Class	: IP 00
Operating Temperature	: - 5 °C .... + 50 °C
Operating Humidity	: %15 ..... %95 (without condensation)
Installation	: to the panel tap
Dimentions	: 72x72x80 mm

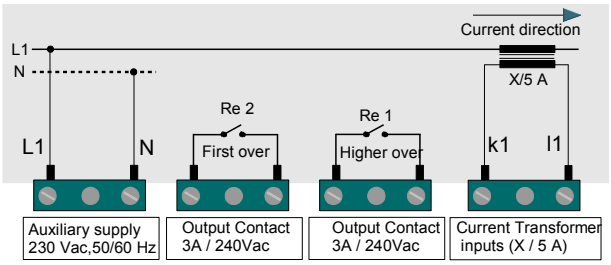
DAM – D - 72

DIGITAL UNIVERSAL AMPERMETER (True RMS)

► 2 Over Current Set



Connection Scheme:



Warning !!!

- The message Err1 or Err2 on the screen means that the device has got a failure
- Can not be used without current transformer, a current that is higher that 5 A passing through the measurement inputs may damage the device.
- To clean the device use dry dustcloth after de-energizing the device

DV – 72 - 01

DIGITAL VOLTMETER & FREQUENCYMETER

► True RMS

General Informations

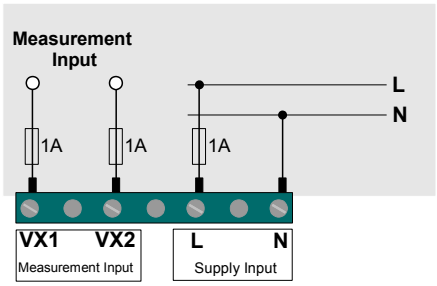
The device measures the RMS value of the AC voltage and the frequency.
It shows the voltage on the upper display and the frequency value on the bottom display simultaneously.
Voltage can be measured within the range of 10-500 V.
Frequency can be measured with in the range of 40-100 Hz

Installation Instructions:

- Read the user instructions and cautions before installation.
- Be sure that the panel you are installing in is not energized.
- The device is designed to be installed to the front panel tap, use the small fixing apparatus to stabilize the device to the front panel tap.
- Do not under any case open the front panel of the device.
- Open the Terminals at the back side of the device after you are sure that no energy is connected to the panel. Connect the device as shown in the connection scheme.
- Be sure that the terminals are connected tight to the device.
- Use a switch between the energy network and the device's supply and measurement inputs in order to switch off the device if required.
  Use 1A FF fuse between switchs and all inputs.

DV-72-01

Connection Scheme :



Technical Data

Rated Voltage (Un)	: 230 VAC
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50/60 Hz
Supply Power Consumption	: < 4 VA
Measurement input	: 10 – 500 Vac
Measurement Frequency	: 40 / 100 Hz
Measurement Power Consumption	: <1VA
Measurement Sensitivity	: 1% ± digit
Display	: Two lines of 3 Digits LED display
Device Protection Class	: IP20
Connector Protection Class	: IP00
Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 72x72x80 mm

Dimensions For Hole On The Panel : 68 x 68 mm

Warning !!!

- The message Er1 or Er2 on the screen means that the device has got a failure
- Clean the device using dry dust cloth after de-energizing the device
- Please read and follow the instructions mentioned in this user manual.

DV – 72 - 03

DIGITAL TRIPHASE VOLTMETER & FREQUENCYMETER

► True RMS

General Informations

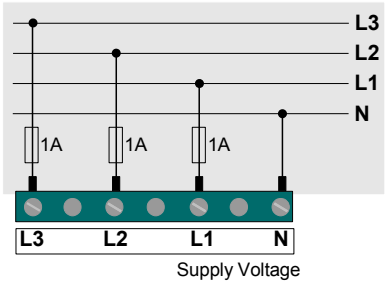
In triphase systems, the device measures the RMS value of the AC voltage and the frequency.
It shows the voltage on the upper display and the frequency value on the buttom display simultaneously.
Using the button on the device phase – neutral and phase – phase voltage scan be seen.
Voltage can be measured within the range of 10-500 V.
NOTE : L1_N is the device's supply input. For that reason the voltage applied to L1 _N should be the rated voltage in the system. Frquency measurement must be within the rate frquency ranges.

Installation Instructions:

- Read the user instructions and cautions before installation.
- Be sure that the panel you are installing in is not energized.
- The device is designed to be installed to the front panel tap, use the small fixing apparatus to stabilize the device to the front panel tap.
- Do not under any case open the front panel of the device.
- Open the Terminals at the back side of the device after you are sure that no energy is connected to the panel. Connect the device as shown in the connection scheme.
- Be sure that the terminals are connected tight to the device.
- Use a switch between the energy network and the device's supply and measurement inputs in order to switch off the device if required.
  Use 1A FF fuse between switchs and all inputs.

DV-72-03

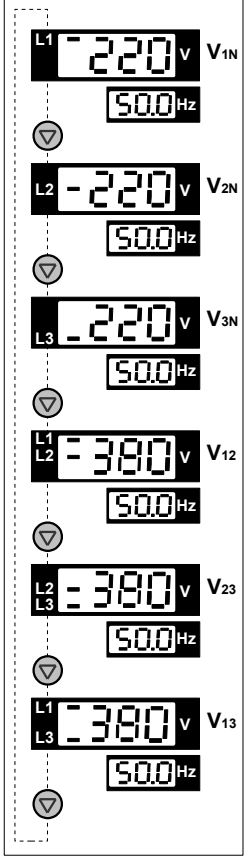
Connection Scheme :



Technical Data

Rated Voltage (Un)	: 230 VAC (L1-N)
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4 VA
Measurement input	: 10 – 500 Vac
Measurement Frequency	: 40 / 100 Hz
Measurement Power Consumption	: <1VA (for each phase)
Measurement Sensitivity	: 1% ± digit
Display	: Two lines of 3 Digits LED display
Device Protection Class	: IP20
Connector Protection Class	: IP00
Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 72x72x80 mm

Display Functions



Dimensions For Hole On The Panel : 68 x 68 mm

Warning !!!

- The message Er1 or Er2 on the screen means that the device has got a failure
- Clean the device using dry dust cloth after de-energizing the device
- Please read and follow the instructions mentioned in this user manual.

DV – 72 - 01C

DIGITAL VOLTAGE & FREQUENCY MONITORING DEVICE

► True RMS

General Informations

The device measures the True RMS value of the voltage and frequency in mono phase systems accurately.
It is possible to observe the voltage value in the upper screen and the frequency value in the buttom screen simultaneously.
The device contains many protections as followes:

- Over Voltage protection.
- Under voltage protection:
- Over frequency protection.
- Under frequency protection.

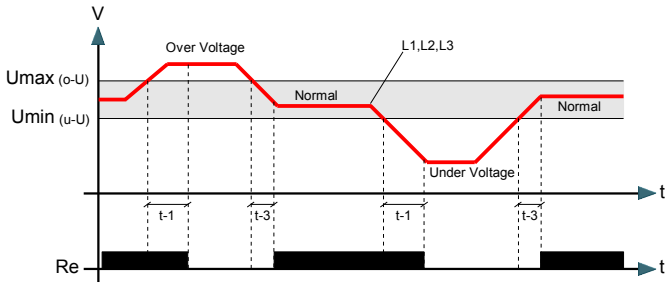
As the device is beeing installed it closes its output contact if the voltage and frequency values are within the adjusted ranges. In case of any previous mentioned faults the the device opens its output contact at the end ofdelay adjusted by user. When the values return withiin the adjusted ranges the device closes its output contacts at the end of an adjusted delay.

Over&Under Voltage : (o-U) (u-U)

Over voltage (o-U), it can be adjusted between Umax= (230 – 290 V).
Under voltage (u-U), it can be adjusted between Umin=(150 – 210 V).

- If the voltage drops below the adjusted under voltage limit then **u-U** shows on the screen and the device closes it output contact after t-1 delay.
- If the voltage exceeds the adjusted over voltage limit then **o-U** shows on the screen and the device closes it output contact after t-1 delay.

The hysteresis value is 6V.



Locking Property :

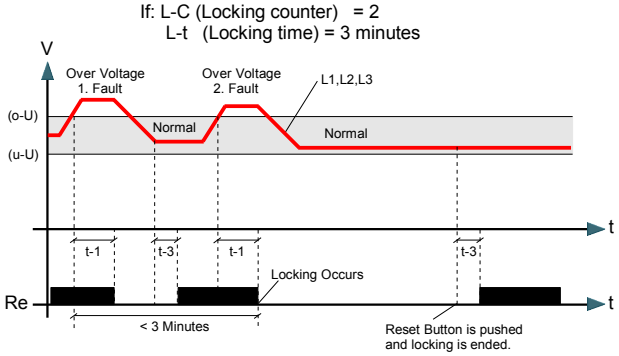
It can be controlled by two parameters; Locking Time and Locking Counter.
If the number of openning reaches the adjusted locking counter within the adjusted locking time then the device opens its output contact and locks its functions until the user pressed **Reset** button. If the locking counter is adjusted to **oto** then this function is inactive and the device never locks itself

L-t : Locking Time (001 – 060 minutes)

It is well known the the frequentely occuring faults may damage the system. For that the device locks itself when the number of faults reaches the adjusted locking number within this locking time. This way the sistem is protected and the user has the chance to investigate the problem.

L-C : Locking Counter (oto , 001 – 010)

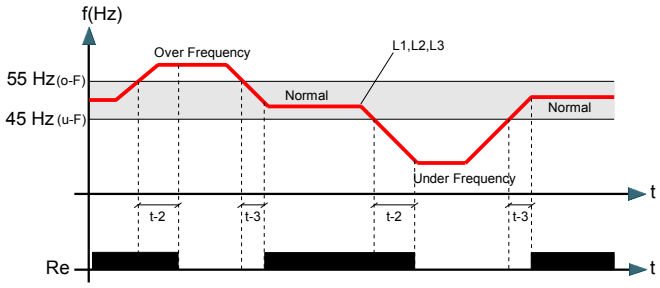
The number of the faults allowed within the period L-t. If the number of the faults exceeds this adjusted counter value then the device locks itself. The user must press Reset button agter the fault passes in order to unlock the device. If L-C is set to **oto** then this property is inactive.



Over and/or Under Frequency Protection : (40 – 70 Hz)

Under frequency can be adjusted be tween (u-F) = 40 Hz .....[(o-F)-0,4]
Over frequency can be adjusted between (o-F) = [(u-F) + 0,4]..... 70 Hz.
It is possible to activate one or two of these protections or deactivate them both.

- If o-F = 55 Hz and u-F = oFF then the device protects from over frequency (if the frequency exceeds 55hz then the device shows **o-F** on the buttom screen and opens its output contact at the end of t-2 delay).
- If o-F = oFF and u-F = 45 Hz then the device protects from under frequency (if frequency drops below 45Hz then the device shows **u-F** on the buttom screen and opens its output contact at the end of t-2 delay).
- If o-F = oFF and u-F = oFF then the frequency protection is disabled.



Parameters :

The menu where protection functions are adjusted. To enter this menu press set button until set is shown on the nuttom screen. Parameters are as follow:

► **o-U : Over Voltage Adjustment** (230 V – 290 V)
If the phase – phase voltage exceeds the adjusted value then the device opens it output contacts at the end of t – 1 delay.

► **u-U : Under Voltage Adjustment** (150 V – 210 V)
If the phase – phase voltage drops below the adjusted value then the device opens it output contacts at the end of t – 1 delay.

► **t-1 : Openning Delay (Voltage)** (00,1 – 99,9 seconds)
If any of voltage faults occurs, and if it lasts for t-1 period then the device opens its output contact.

► **t-2 : Openning Delay (Frequency)**(00,1 – 99,9 seconds)
If any of freuqency faults occurs, and if it lasts for t-2 period then the device opens its output contact.

► **t-3 : Returning Delay (Voltage and Frequency)**(00,1 – 99,9 seconds)
To close the output contact after openning because of both voltage and frequency faults, the values should return to the normal ranges and after t-3 delay the device closes its output contact.

► **L-t : Locking Time** (001 – 060 minutes)
The device locks itself when the number of faults reaches the adjusted locking number within this locking time. This way the sistem is protected and the user has the chance to investigate the problem.

► **L-C : Locking Counter** (oto , 001 – 010)
The number of the faults allowed within the period L-t. If the number of the faults exceeds this adjusted counter value then the device locks itself. The user must press Reset button agter the fault passes in order to unlock the device. If L-C is set to **oto** then this property is inactive.

► **o-F : Over Frequency Adjustment**
It can be set between (o-F) = [(u-F) + 0,4]..... 70 Hz.
If it is set to o-F = oFF then this protection is disabled.

► **u-F : Under Frequency Adjustment**
It can be set between (u-F) = 40 Hz .....[(o-F) – 0,4] .
If it is set to u-F = oFF then this protection is disabled.

► **qut : Quit**
If Set button is pressed there then the device goes back to the measurement screen.

TECHNICAL DATA:

Rated Voltage (Un)	: 220Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Pow er Consumption	: < 4VA
Measurement Pow er Consumption	: <1VA
Voltage Measurement	: 10 – 500 Vac
Frequency Measurement	: 40 / 100 Hz
Measurement Sensitivity	: %1±1 digit
Measurement Catagory	: CAT III
Display	: 3 Digit x 2 line LED
Contact Current	: Max. 5A / 240Vac
Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Humidity	: %15 ..... %95 (w ithout condensation)
Connection Type	: To front panel tap
Dimensions	: 72x72x80 mm

DV – 72 - 01C

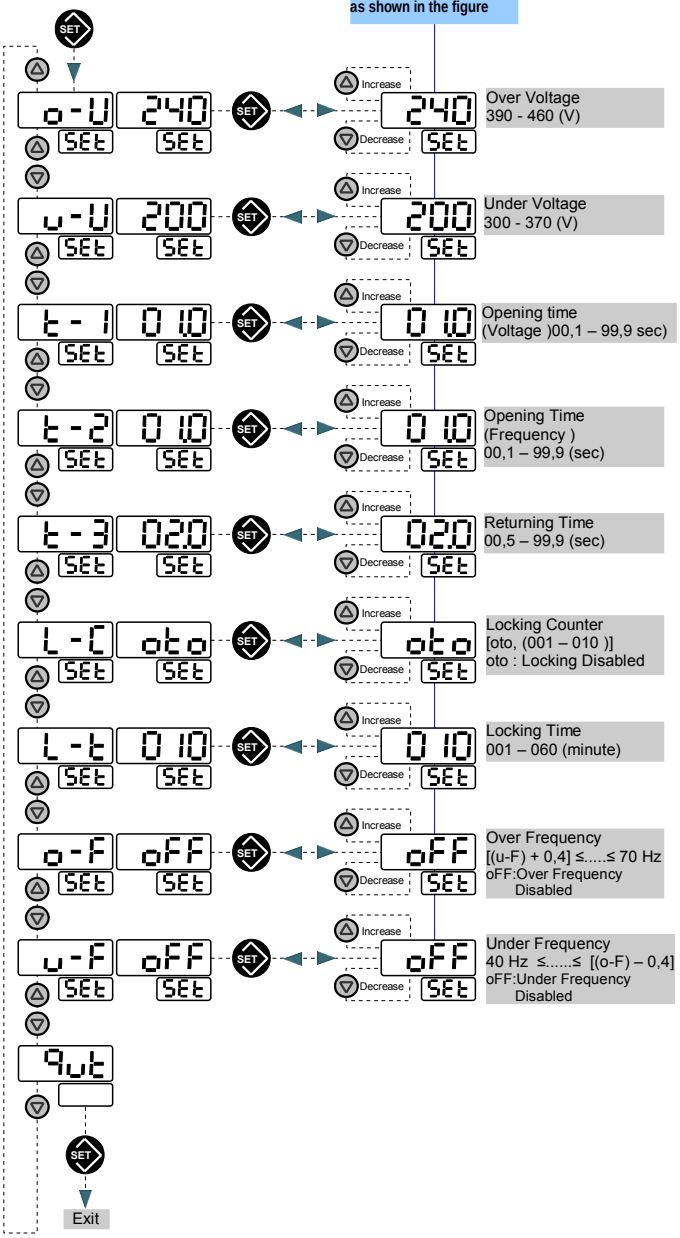
DIGITAL VOLTAGE & FREQUENCY MONITORING DEVICE

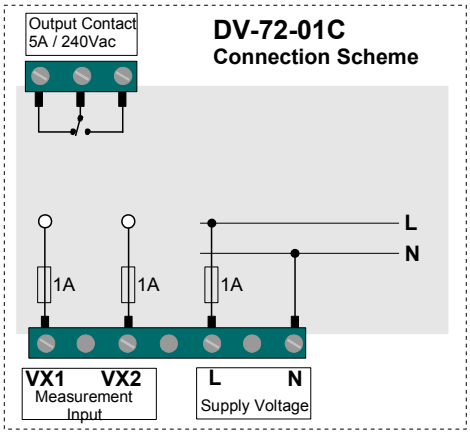
► True RMS

Accessing Parameter Menu

Press Set until Set is shown on the button screen.

Factory Default values are as shown in the figure





Dimension of hole on the panel : 68 x 68 mm

Warning !!!
- The message Er1 or Er2 on the screen means that the device has got a failure
- Clean the device using dry dust cloth after de-energizing the device
- Read and understand the instruction on this manual and attached label.

DV – 72 - 03C

DIGITAL VOLTAGE & FREQUENCY MONITORING DEVICE

- ► True RMS
- ► Triphase controlled

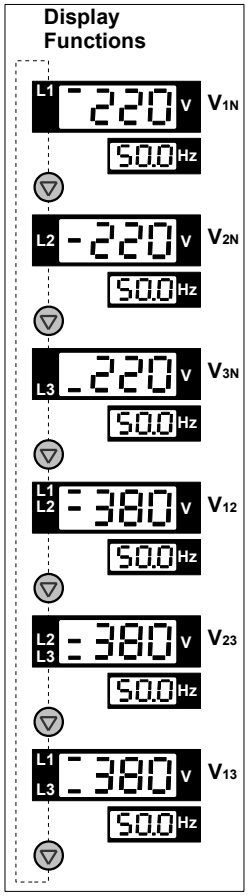
General

The device measures the True RMS value of the voltage and frequency in tri-phase systems accurately. It is possible to observe the voltage value in the upper screen and the frequency value in the buttom screen simultaneously. Using the buttons, phase – nuetral and phase – phase voltages can be observed as shown in the figure in the right side.
The device contains many protections as follwes:

- ■ Phase failure.
- ■ Phase sequence.
- ■ Over Voltage protection.
- ■ Under voltage protection:
- ■ Unbalanced voltage protection.
- ■ Over frequency protection.
- ■ Under frequency protection.

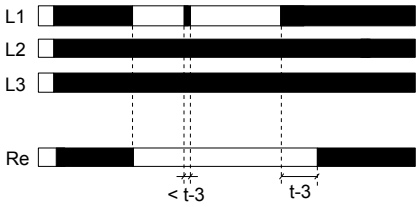
As the device is beeing installed it closes its output contact if the voltage and frequency values are within the adjusted ranges and phase sequence is correct. In case of any previous mentioned faults (except of phase failure where openning is sudden) the the device opens its output contact at the end of delay adjusted by user. When the values return withiin the adjusted ranges the device closes its output contacts at the end of an adjusted delay.
Note: L1-N is the device's power supply inputs. Thus, the applied voltage must be the rated voltage of the system. The measured frequency also must the frequency of the system.

Display Functions



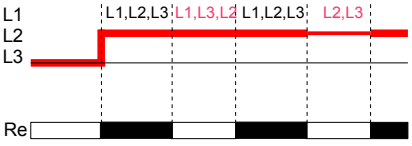
Phase Failure: (u-U)

When at least on of the three phases L1,L2,L3 is missing **u-U** is shown on the bottom screen and the device opens its output contact immediately.



Phase Sequence: (Seq)

In case of wrong phase sequence, **Seq** is shown on the bottom screen and the device does not close its output contact. If the the sequence is corrected the device closes its output contacts

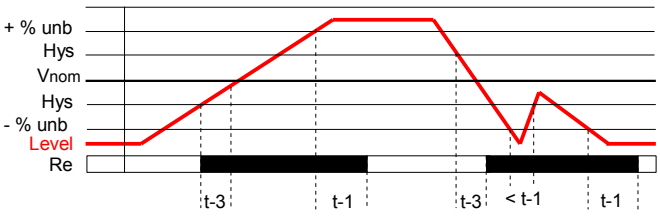


Unbalanced Voltage: (unb)

The phase – phase voltage unbalance limit can be adjusted between (%5 - %20). When it exceeds the adjusted limit **unb** is shown on the bottom screen and the device opens its output contact at the end of t – 1 delay.
It is needed for the device to close its output contact again that the voltage unbalance drops below the hysteresis percentage (%20). Thus, the device closes its output contact at the end of t – 2 delay.
Example: In tri-phase system where phase – phase voltage is 380 V.
The voltage unbalance limit is adjusted to %15. then the opening occurs at: (380-(380 x 0,15) = 323 V. In order to close the output contact again the voltage should reach 323 + (380 x %15 x %20) = 334 V.

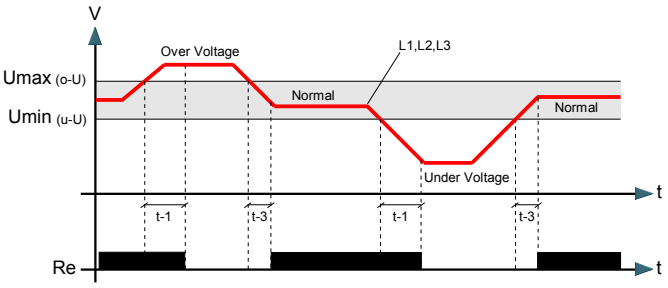
$$\%\ unb = \frac{(V_{max} - V_{min})}{380} \times 100$$

$$Hys = 380 \times (\%\ Asm) \times (\%\ 20)$$



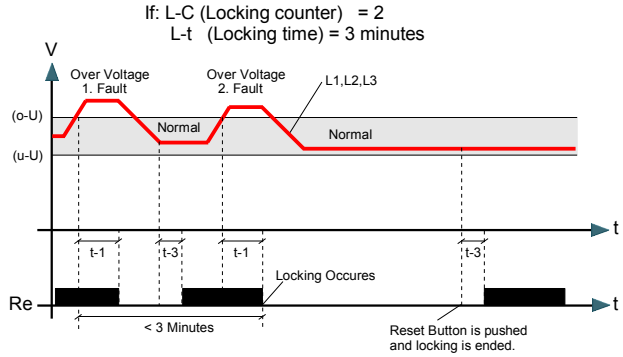
Over&Under Voltage : (o-U) (u-U)

Over voltage (o-U), it can ve adjusted between Umax= (390 – 460 V).
Under voltage (u-U), it can ve adjusted between Umin=(300 – 370 V).
Mentioned values are phase – phase voltages. If the voltage drops below the adjusted under voltage limit then **u-U** shows on the screen and the device closes it output contact after t-1 delay.
If the voltage exceeds the adjusted over voltage limit then **o-U** shows on the screen and the device closes it output contact after t-1 delay.
The hysteresis value is 6V.



Locking Property :

It can be controlled by two parameters; Locking Time and Locking Counter.
If the number of openning reaches the adjusted locking counter within the adjusted locking time then the device opens its output contact and locks its functions until the user pressed **Reset** button. If the locking counter is adjusted to **oto** then this function is inactive and the device never locks itself
L-t : Locking Time (001 – 060 minutes)
It is well known the the frequentely occuring faults may damage the system. For that the device locks itself when the number of faults reaches the adjusted locking number within this locking time. This way the sistem is protected and the user has the chance to investigate the problem.
L-C : Locking Counter (oto , 001 – 010)
The number of the faults allowed within the period L-t. If the number of the faults exceeds this adjusted counter value then the device locks itself. The user must press Reset button agter the fault passes in order to unlock the device. If L-C is set to **oto** then this property is inactive.



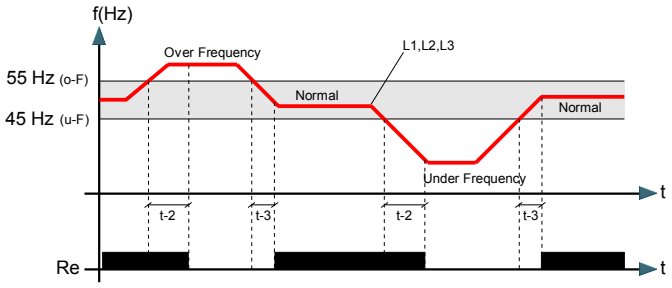
DV – 72 - 03C

DIGITAL VOLTAGE & FREQUENCY MONITORING DEVICE

- ► True RMS
- ► Triphase controlled

Over and/or Under Frequency Protection : (40 – 70 Hz)

Under frequency can be adjusted be tween (u-F) = 40 Hz .....[(o-F)-0,4]
Over frequency can be adjusted between (o-F) = [(u-F) + 0,4]..... 70 Hz.
It is possible to activate one or two of these protections or deactivate them both.
■ If o-F = 55 Hz and u-F = oFF then the device protects from over frequency (if the frequency exceeds 55hz then the device shows **o-F** on the bottom screen and opens its output contact at the end of t-2 delay).
■ If o-F = oFF and u-F = 45 Hz then the device protects from under frequency (if frequency drops below 45Hz then the device shows **u-F** on the bottom screen and opens its output contact at the end of t-2 delay).
If o-F = oFF and u-F = oFF then the frequency protection is disabled.



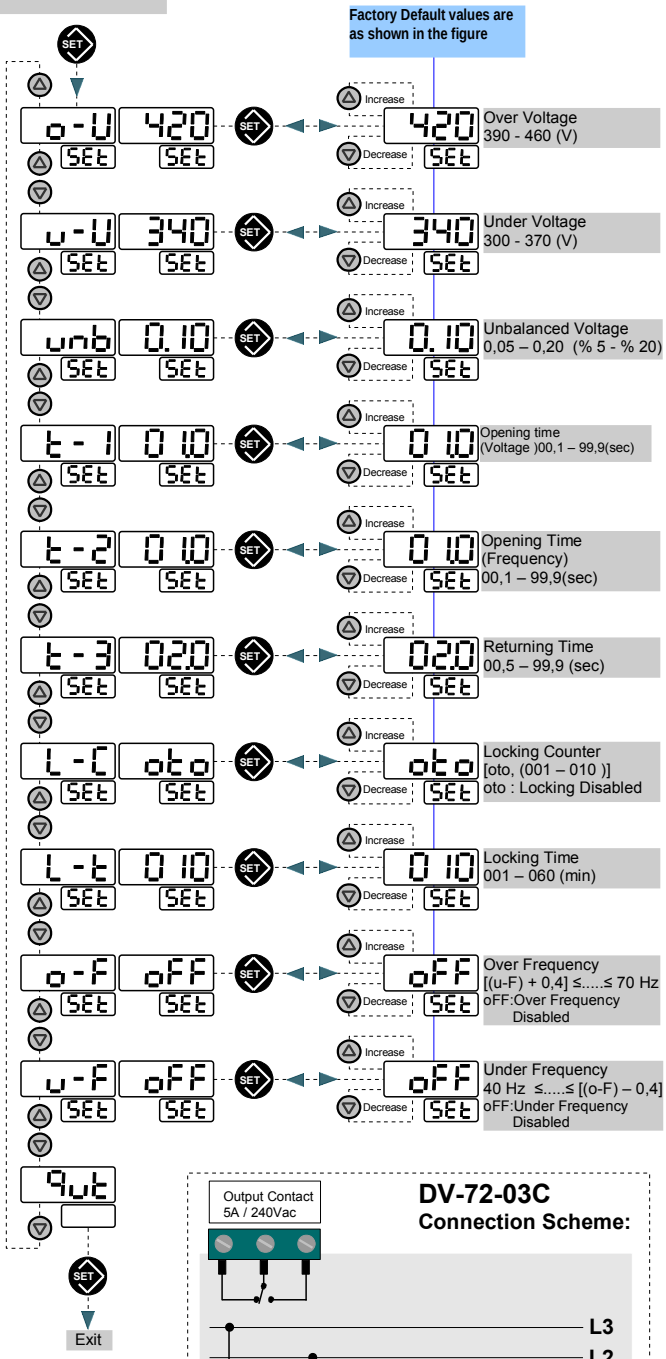
Parameters :
The menu where protection functions are adjusted. To enter this menu press set button until set is shown on the bottom screen. Parameters are as follow:

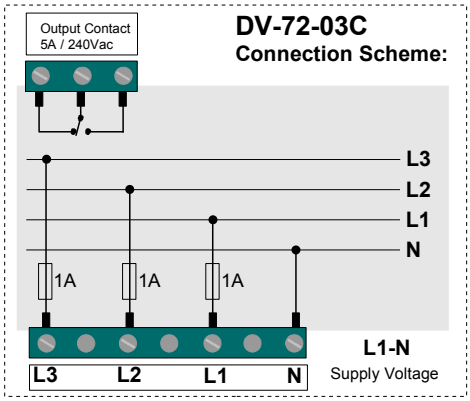
- ► **o-U : Over Voltage Adjustment** (390 V – 460 V)
  If the phase – phase voltage exceeds the adjusted value then the device opens it output contacts at the end of t – 1 delay.
- ► **u-U : Under Voltage Adjustment** (300 V – 370 V)
  If the phase – phase voltage drops below the adjusted value then the device opens it output contacts at the end of t – 1 delay.
- ► **unb : Voltage Unbalance Adjustment** (0,05 – 0,20)%5 - 20
  Unbalance between the phase – phase voltages, when the unbalance exceeds the adjusted value then the device opens it output contacts at the end of t – 1 delay.
- ► **t-1 : Opening Delay (Voltage)** (00,1 – 99,9 seconds)
  If any of voltage faults occurs, and if it lasts for t-1 period then the device opens its output contact.
- ► **t-2 : Opening Delay (Frequency)**(00,1 – 99,9 seconds)
  If any of frequency faults occurs, and if it lasts for t-2 period then the device opens its output contact.
- ► **t-3 : Returning Delay (Voltage and Frequency)**(00,1 – 99,9 seconds)
  To close the output contact after opening because of both voltage and frequency faults, the values should return to the normal ranges and after t-3 delay the device closes its output contact.
- ► **L-t : Locking Time** (001 – 060 minutes)
  The device locks itself when the number of faults reaches the adjusted locking number within this locking time. This way the system is protected and the user has the chance to investigate the problem.
- ► **L-C : Locking Counter** (oto , 001 – 010)
  The number of the faults allowed within the period L-t. If the number of the faults exceeds this adjusted counter value then the device locks itself. The user must press Reset button after the fault passes in order to unlock the device. If L-C is set to **oto** then this property is inactive.
- ► **o-F : Over Frequency Adjustment**
  It can be set between (o-F) = [(u-F) + 0,4]..... 70 Hz.
  If it is set to o-F = oFF then this protection is disabled.
- ► **u-F : Under Frequency Adjustment**
  It can be set between (u-F) = 40 Hz .....[(o-F) – 0,4] .
  If it is set to u-F = oFF then this protection is disabled.
- ► **qut : Quit**
  If Set button is pressed there then the device goes back to the measurement screen.

Warning !!!
■ The message Er1 or Er2 on the screen means that the device has got a failure
■ Clean the device using dry dust cloth after de-energizing the device
■ Read and understand the instruction on this manual and attached label.

Accessing Parameter Menu

Press Set until Set is shown on the button screen.



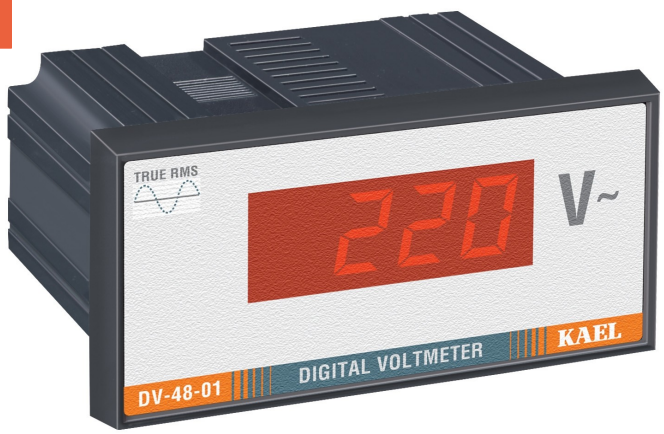


TECHNICAL DATA:

Rated Voltage (Un)	: 230Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Pow er Consumption	: < 4VA
Voltage Measurement	: 10 – 500 Vac
Frequency Measurement	: 40 / 100 Hz
Measurement Pow er Consumption	: <1VA
Measurement Sensitivity	: %1±1 digit
Measurement Catagory	: CAT III
Display	: 3 Digit x 2 line LED
Contact Current	: Max. 5A / 240Vac
Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Humidity	: %15 ..... %95 (without condensation)
Connection Type	: To front panel tap
Dimensions	: 72x72x80 mm

DV – 48 - 01
DIGITAL VOLTMETER

TRUE RMS



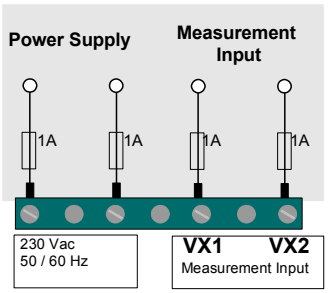
General Informations

The device measures the RMS value of the AC voltage.
Voltage can be measured within the range of 10-500 V.

Installation Instructions:

- Read the user instructions and cautions before installation.
- Be sure that the panel you are installing in is not energized.
- The device is designed to be installed to the front panel tap, use the small fixing apparatus to stabilize the device to the front panel tap.
- Do not under any case open the front panel of the device.
- Open the Terminals at the back side of the device after you are sure that no energy is connected to the panel. Connect the device as shown in the connection scheme.
- Be sure that the terminals are connected tight to the device.
- Use a switch between the energy network and the device's supply and measurement inputs in order to switch off the device if required. Use 1A FF fuse between switchs and all inputs.

DV- 48- 01
Connection Scheme :



Technical Data

Rated Voltage (Un)	: 230 VAC
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4 VA
Measurement input	: 10 – 500 Vac
Measurement Power Consumption	: <1VA
Measurement Sensitivity	: 1% ± digit
Display	: 3 Digits LED display
Device Protection Class	: IP20
Connector Protection Class	: IP00
Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 48x96x50 mm

Warning !!!
- The message Er1 or Er2 on the screen means that the device has got a failure
- Clean the device using dry dustcloth after de-energizing the device
- Please read and follow the instructions mentioned in this user manual.

DV – 48 - 03
DIGITAL TRIPHASE VOLTMETER

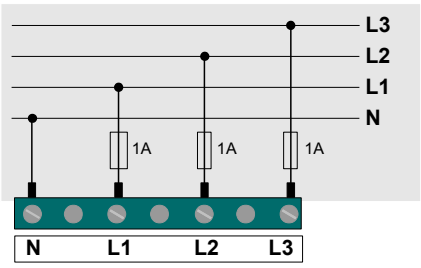
TRUE RMS

General Informations
In triphase systems, the device measures the RMS value of the AC voltage. Using the button on the device phase – neutral and phase – phase voltage scan be seen. Voltage can be measured within the range of 10-500 V.

NOTE : L1_N is the device's supply input. For that reason the voltage applied to L1 _N should be the rated voltage in the system.

Installation Instructions:
- Read the user instructions and cautions before installation.
- Be sure that the panel you are installing in is not energized.
- The device is designed to be installed to the front panel tap, use the small fixing apparatus to stabilize the device to the front panel tap.
- Do not under any case open the front panel of the device.
- Open the Terminals at the back side of the device after you are sure that no energy is connected to the panel. Connect the device as shown in the connection scheme.
- Be sure that the terminals are connected tight to the device.
- Use a switch between the energy network and the device's supply and measurement inputs in order to switch off the device if required. Use 1A FF fuse between switchs and all inputs.

DV-48-03
Connection Scheme :

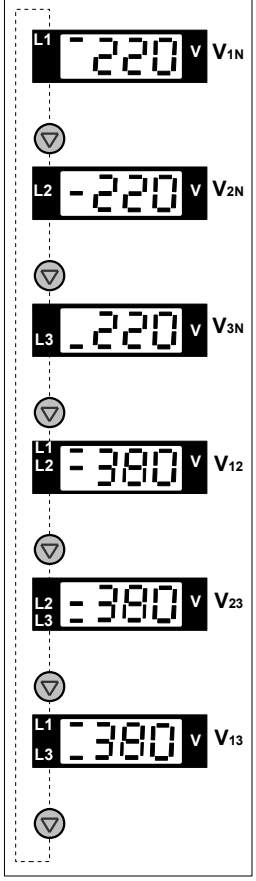


Supply Voltage

Technical Data

Rated Voltage (Un)	: 230 VAC (L1-N)
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4 VA
Measurement input	: 10 – 500 Vac
Measurement Power Consumption	: <1VA (for each phase)
Measurement Sensitivity	: 1% ± digit
Display	: 3 Digits LED display
Device Protection Class	: IP20
Connector Protection Class	: IP00
Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 48x96x50 mm

Display Functions



Warning !!!
- The message Er1 or Er2 on the screen means that the device has got a failure
- Clean the device using dry dustcloth after de-energizing the device
- Please read and follow the instructions mentioned in this user manual.

DV – 96 - 03
DIGITAL TRIPHASE VOLTMETER

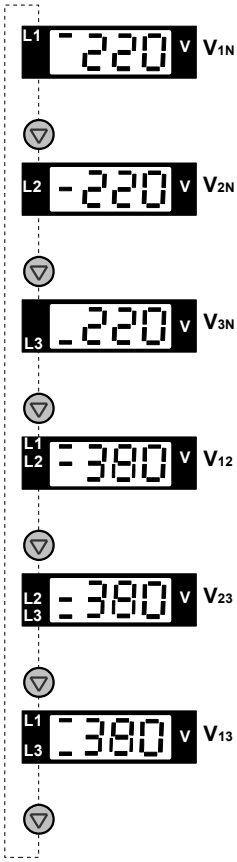
TRUE RMS

General Informations
In triphase systems, the device measures the RMS value of the AC voltage. Using the button on the device phase – neutral and phase – phase voltage scan be seen. Voltage can be measured within the range of 10-500 V.

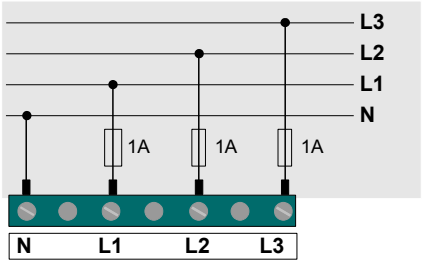
NOTE : L1_N is the device's supply input. For that reason the voltage applied to L1 _N should be the rated voltage in the system.

Installation Instructions:
- Read the user instructions and cautions before installation.
- Be sure that the panel you are installing in is not energized.
- The device is designed to be installed to the front panel tap, use the small fixing apparatus to stabilize the device to the front panel tap.
- Do not under any case open the front panel of the device.
- Open the Terminals at the back side of the device after you are sure that no energy is connected to the panel. Connect the device as shown in the connection scheme.
- Be sure that the terminals are connected tight to the device.
- Use a switch between the energy network and the device's supply and measurement inputs in order to switch off the device if required.
  Use 1A FF fuse between switchs and all inputs.

Display Functions



DV-96-03
Connection Scheme :



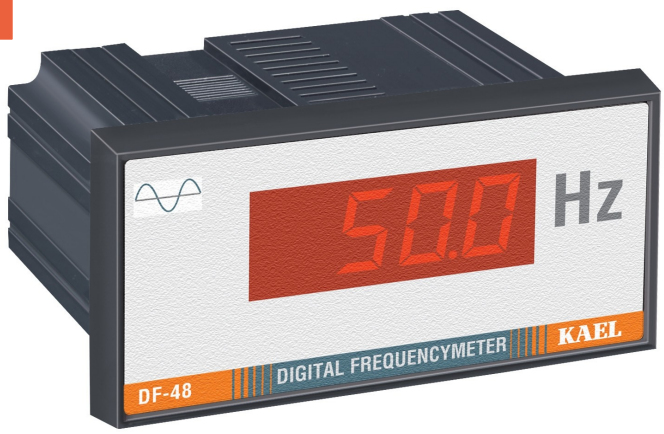
Supply Voltage

Technical Data

Rated Voltage (Un)	: 230 VAC (L1-N)
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4 VA
Measurement input	: 10 – 500 Vac
Measurement Power Consumption	: <1VA (for each phase)
Measurement Sensitivity	: 1% ± digit
Display	: 3 Digits LED display
Device Protection Class	: IP20
Connector Protection Class	: IP00
Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 96x96x80 mm

DF – 48
DIGITAL FREQUENCYMETER

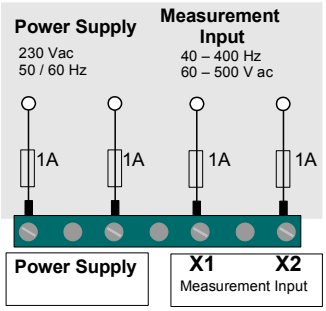
40 – 400 Hz



Installation Instructions:

- Read the user instructions and cautions before installation.
- Be sure that the panel you are installing in is not energized.
- The device is designed to be installed to the front panel tap, use the small fixing apparatus to stabilize the device to the front panel tap.
- Do not under any case open the front panel of the device.
- Open the Terminals at the back side of the device after you are sure that no energy is connected to the panel. Connect the device as shown in the connection scheme.
- Be sure that the terminals are connected tight to the device.
- Use a switch between the energy network and the device's supply and measurement inputs in order to switch off the device if required. Use 1A FF fuse between switchs and all inputs.

DF- 48
Connection Scheme :



Technical Data

Rated Voltage (Un)	: 230 VAC
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4 VA
Measurement input (X1 - X2)	: 60 – 500 Vac 40 – 400 Hz
Measurement Power Consumption	: <1VA
Measurement Sensitivity	: 1% ± digit
Display	: 3 Digits LED display
Device Protection Class	: IP20
Connector Protection Class	: IP00
Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 48x96x50 mm

Warning !!!

- The message Er1 or Er2 on the screen means that the device has got a failure
- Clean the device using dry dustcloth after de-energizing the device
- Please read and follow the instructions mentioned in this user manual.

DF – 96
DIGITAL FREQUENCYMETER

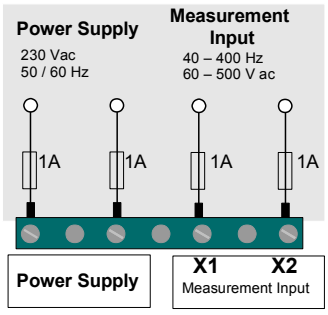
40 – 400 Hz

KAEL ISO 9001:2008 www.kael.com.tr ®

Installation Instructions:

- Read the user instructions and cautions before installation.
- Be sure that the panel you are installing in is not energized.
- The device is designed to be installed to the front panel tap, use the small fixing apparatus to stabilize the device to the front panel tap.
- Do not under any case open the front panel of the device.
- Open the Terminals at the back side of the device after you are sure that no energy is connected to the panel. Connect the device as shown in the connection scheme.
- Be sure that the terminals are connected tight to the device.
- Use a switch between the energy network and the device's supply and measurement inputs in order to switch off the device if required. Use 1A FF fuse between switchs and all inputs.

DF- 96
Connection Scheme :



Technical Data

Rated Voltage (Un)	: 230 VAC
Operating Range	: (0.8 – 1.1)xUn
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4 VA
Measurement input (X1 - X2)	: 60 – 500 Vac 40 – 400 Hz
Measurement Power Consumption	: <1VA
Measurement Sensitivity	: 1% ± digit
Display	: 3 Digits LED display
Device Protection Class	: IP20
Connector Protection Class	: IP00
Temperature	: -5°C....+50°C
Humidity	: 15% ..... 95% (without condensation)
Connection Type	: To front panel tap
Dimensions	: 96x96x80 mm

Warning !!!

- The message Er1 or Er2 on the screen means that the device has got a failure
- Clean the device using dry dustcloth after de-energizing the device
- Please read and follow the instructions mentioned in this user manual.

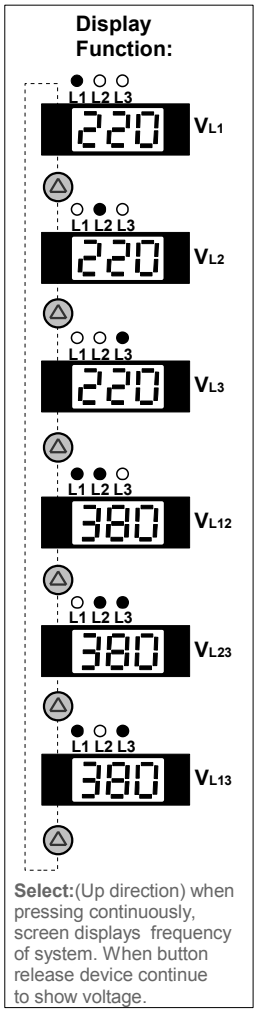
KAEL ISO 9001:2008 www.kael.com.tr ®

DV-03 (D)

Triphase Voltmeter & Frequencymeter

V_{L1}, V_{L2}, V_{L3}
$V_{L12}, V_{L23}, V_{L13}$, Hz

TRUE RMS



Select:(Up direction) when pressing continuously, screen displays frequency of system. When button release device continue to show voltage.

General

In three phase systems, it measures RMS values of AC voltages and system frequency sensitively. Using up direction button (Select) phase-neutral voltages and phase-phase voltages monitor sequentially

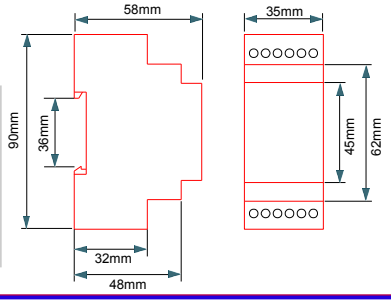
IMPORTANT: L1 - N is device supply inputs.
Thus,the applied L1 – N voltage must be rated voltage of system .
The measured frequency also must the frequency of the system.

TECHNICAL INFORMATION:

Rated Voltage (Un)	: 230Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Voltage Measurement (Phase-Phase)	: 10 – 500 VAC (40 – 100 Hz) (For L1-N 176V - 242V)
Voltage Measurement Power Consumption	: <1VA (for one phase)
Measurement Sensitivity	: %1±1 digit
Display	: 3 Digit LED
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To connection rail in electrical panel
Dimension	:

ATTANTION !!!

- Clean the device using dry dust cloth after turned off device.
- Read and follow the instruction on this manual and attached label.

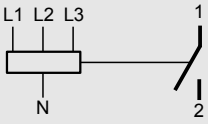


ke – FKR1

PHASE FAILURE DEVICE

► Phase Failure

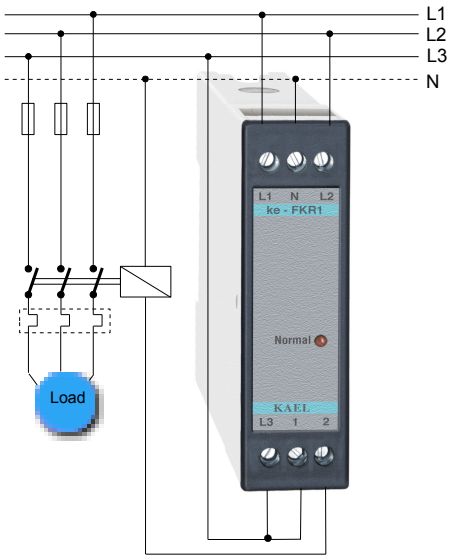
L1,L2,L3 : 3 x 400 V ac
L1,N : 230 V ac



► **Operating Principle:**

If all R, S, T phase voltages are balanced and there is no missing phase; normal LED turns on and the relay energizes its contact.
If phase-neutral voltage unbalance value exceeds ± 20 %, normal LED turns off and relay de-energizes its contact.
When the unbalance returns to normal boundary, normal LED turns on and the relay energizes its contact again.

Simple Connection :



Application Areas:

- Protection of electrical motors
- Protection of 3 phase systems

TECHNICAL DATA:

Rated Voltage	: 3 Phase and 1 Neutral 230 VAC
Operating Range	: (0.8 – 1.2)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Asymmetry Adj.	: Phase to Neutral 20% constant
Output Contacts (1-2)	: Normally Open Contact
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm

ke–FKR1T

PHASE PROTECTION RELAY

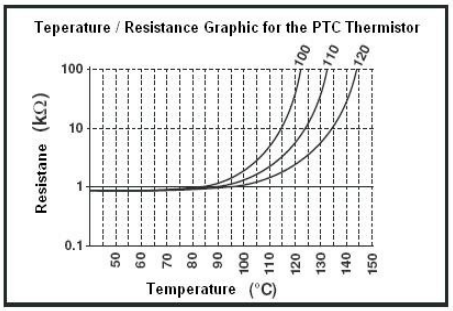
- ► Phase Failure
- ► PTC Protection

PHASE PROTECTION RELAY

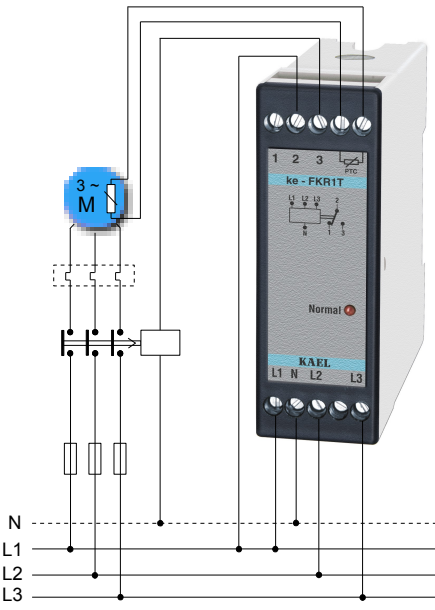
Operating Principle:

If all R, S, T phase voltages are balanced and there is no missing phase; normal LED turns on and the relay energizes its contact.
If phase-neutral voltage unbalance value exceeds ± 20 %, normal LED turns off and relay de-energizes its contact.
When the unbalance returns to normal boundary, normal LED turns on and the relay energizes its contact again.

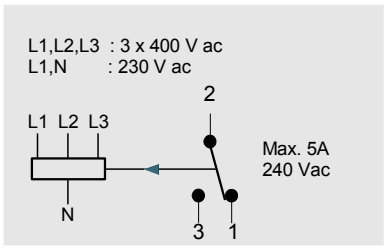
► **PTC Protection:**
If you have a device with PTC protection capability.
If you do not want to use this property, simply short circuit the PTC connections.



Simple Connection :

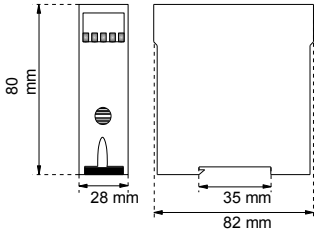


PTC inputs
if not used then
short cut them



TECHNICAL DATA:

Rated Voltage	: 3 Phase and 1 Neutral 230 VAC
Operating Range	: (0,8-1,2) x Un (Un nominal voltage)
Frequency	: 50/60 Hz
Energizing and de-energizing difference	: ± %3
Contact Current	: max. 5A/240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Operating Temperature	: -5 °C.....+50 °C
Connection Type	: To connection rail in electrical panel
Dimensions	: 28x82x80 mm



FKR1-DIN
PHASE FAILURE DEVICE

► **Operating Principle:**

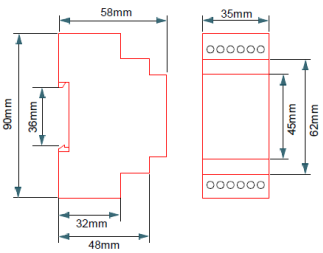
If all L1, L2, L3 phase voltages are balanced and there is no missing phase; normal LED turns on and the relay energizes its contact.
If phase-neutral voltage unbalance value exceeds + 20 %, normal LED turns off and relay de-energizes its contact.
When the unbalance returns to normal boundary, normal LED turns on and the relay energizes its contact again.

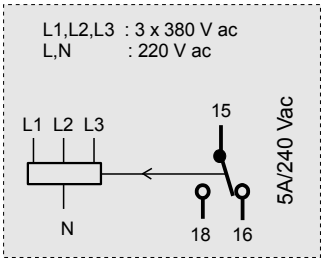
Application Areas:

- Protection of electrical motors
- Protection of 3 phase systems

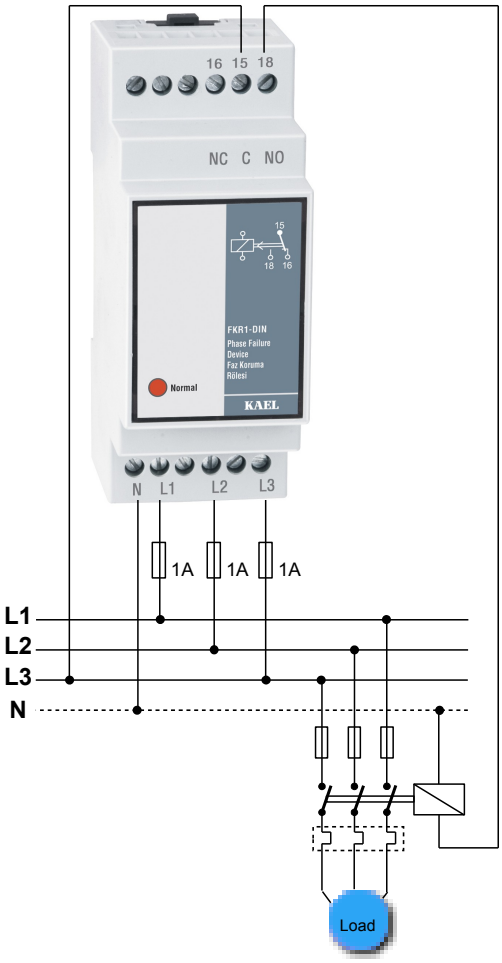
TECHNICAL DATA:

Rated Voltage	: 3 Phase and 1 Neutral, 230 VAC
Operating Range	: (0.8 – 1.2)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Asymmetry Adj.	: Phase to Neutral 20% constant
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 35x90x58 mm





Connection Scheme



FKR1T-DIN

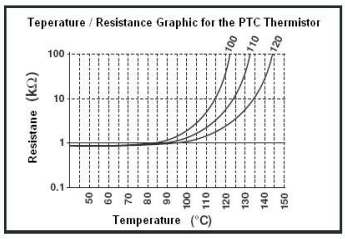
PHASE FAILURE DEVICE

Application Area:

■ Protection of electrical motors

► Operating Principle:

If all L1, L2, L3 phase voltages are balanced and there is no missing phase; normal LED turns on and the relay energizes its contact. If phase-neutral voltage unbalance value exceeds + 20 %, normal LED turns off and relay de-energizes its contact. When the unbalance returns to normal boundary, normal LED turns on and the relay energizes its contact again.

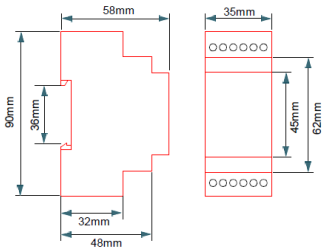


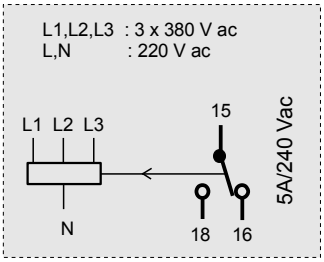
PTC Protection:

If you do not want to use PTC protection, simply short circuit the PTC connections.

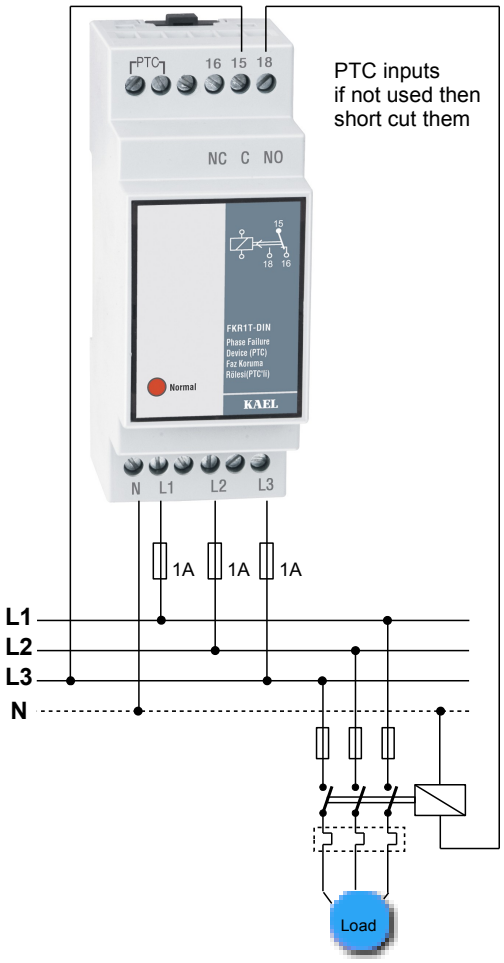
TECHNICAL DATA:

Rated Voltage	: 3 Phase and 1 Neutral, 230VAC
Operating Range	: (0.8 – 1.2)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Asymmetry Adj.	: Phase to Neutral 20% constant
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 35x90x58 mm





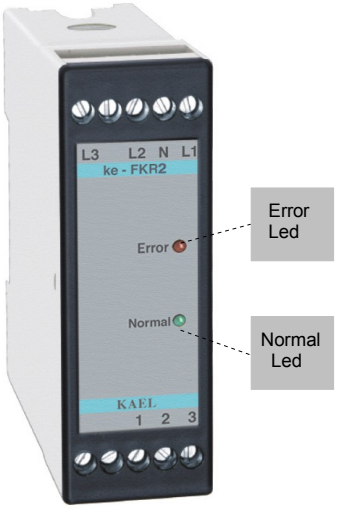
Connection Scheme



ke – FKR2

PHASE FAILURE and PHASE SEQUENCE DEVICE

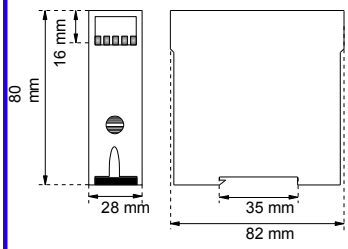
- ► Constant Voltage Asymmetry (Phase – Neutral 40%)
- ► Phase Sequence
- ► Phase Failure



Application Areas:
- ■ Protection of electrical motors
- ■ Protection of 3 phase systems

TECHNICAL DATA:

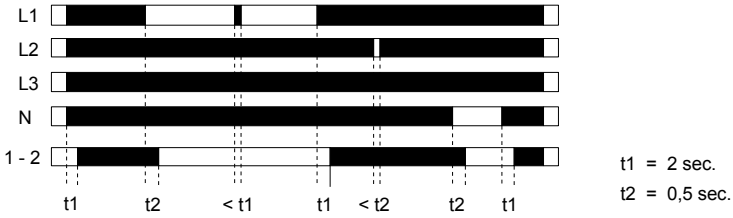
Rated Voltage	: 3 Phase and 1 Neutral 230 VAC
Operating Range	: (0.8 – 1.2)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Asymmetry Adj.	: Phase to Neutral 40% constant
Output Contacts (1-2)	: Normally Open Contact
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 28x82x80 mm



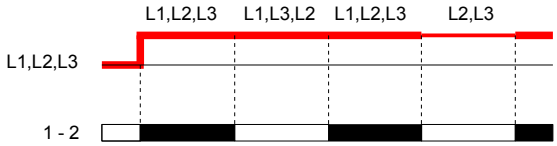
General:

In three phase systems, when phase sequence is correct and there is no asymmetry between phases, ***normal*** LED is turned on and relay contact is energised. Protection functions of ke-FKR2 are given below.

► **Phase Failure:**
In case of absence of at least one phase, relay immediately de-energizes its contact and ***Error*** LED is turned on.



► **Phase Sequence:**
In case of wrong phase order, ***Error*** LED is turned on and relay does not energize its contact. If phase order is corrected, ***Error*** LED is turned off and relay energizes its contact.

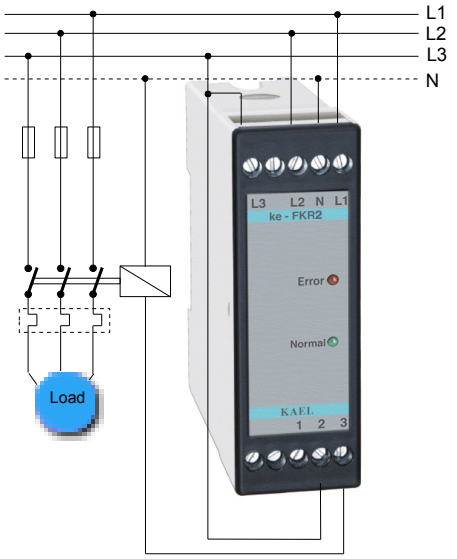


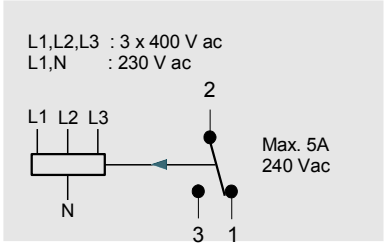
► **Voltage Asymmetry :**
Phase to neutral asymmetry is fixed 40%. If asymmetry exceeds this value, ***Error*** LED is turned on and relay contact is de-energized.
To return normal state, voltage asymmetry value must be under 15% (hysteresis).

$$\text{Asym } \% = \frac{(V_{max} - V_{min})}{230} \times 100$$

Hys = 15 %

Simple Connection :





FKR2-DIN

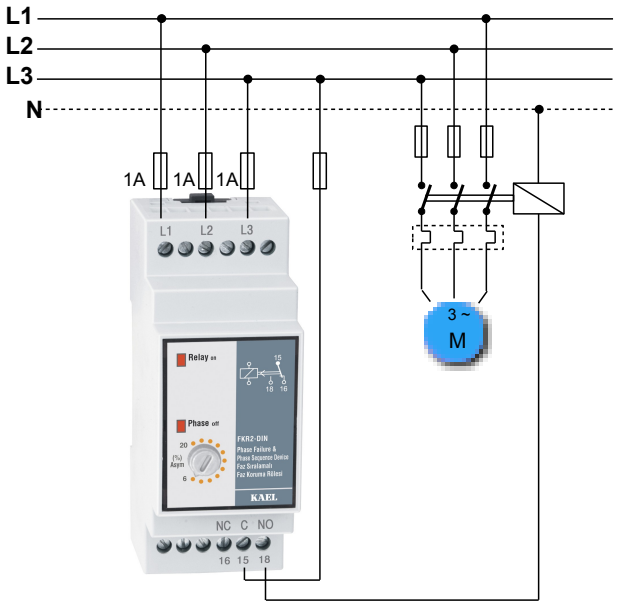
Made in TURKEY

PHASE FAILURE and SEQUENCE MONITORING DEVICE (without Neutral)

In three phase systems, when all phases are in correct order and phases are balanced, Normal LED turns on and the relay is energized.

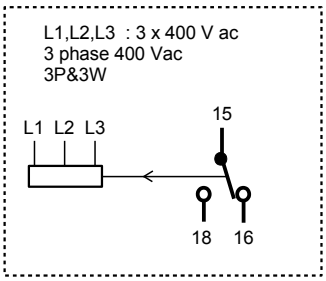
Missing Phase : When at least one of phases L1, L2, L3 is missing, phase off LED turns on and relay de-energizes its contact.
Phase Sequence : If the phase sequence is correct, Relay On LED turns on and relay energizes its contact. If phase order is changed, Phase Off LED turns on and relay de-energizes its contact.
Phase Voltage Unbalance : Phase-phase voltage unbalance is adjusted using the knob located on the front panel of the device. If phase unbalance exceeds the adjusted limit, Phase Off LED turns on, relay de-energises its contact .
Voltage Asymmetry Adjustment (Phase Unbalance)(asym.%)
Phase to phase asymmetry is adjusted using the adjustment knob in the range of ±%6 .... ±%20

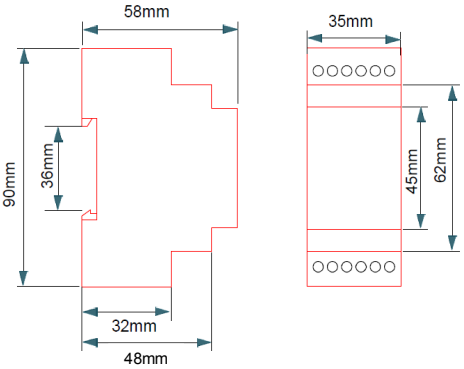
Connection Scheme



Technical Data:

Rated Voltage, Un	: 3 Phases (3 x 400Vac)
Operating Range	: (0,8-1,1) x Un (Un nominal voltage)
Frequency	: 50
Energizing and de-energizing difference	: +%3
(15-16)	: Normally Closed Contact
(15-18)	: Normally Open Contact
Contact Current	: max. 5A/250 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5 °C.....+50 °C
Humidity	: %15.....%95 (without condensation)
Connection Type	: Perpendicular to inner panel or to connection rail
Dimensions	: 58 x 90 x 35

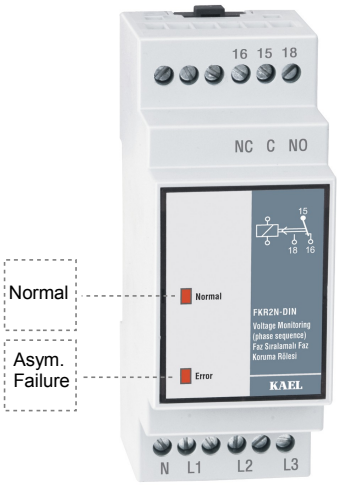




FKR2N-DIN

PHASE FAILURE and PHASE SEQUENCE DEVICE

► Constant Voltage Asymmetry (Phase – Neutral 40%))

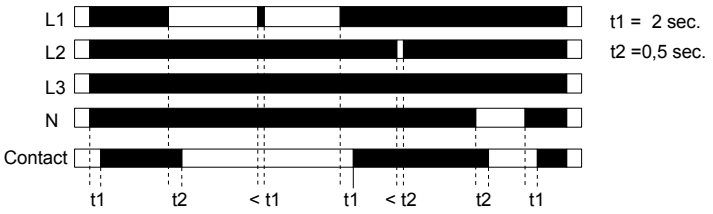


General:

In three phase systems, when phase sequence is correct and there is no asymmetry between phases, ***normal*** LED is turned on and relay contact is energised. Protection functions of FKR2N-DIN are given below.

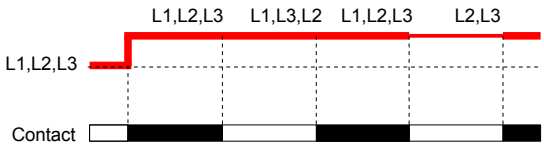
Phase Failure:

In case of absence of at least one phase, relay immediately de-energises its contact and ***E2*** LED is turned on.



Phase Sequence:

In case of wrong phase order, both of ***E1*** and ***E2*** LEDs are turned on at the same time and relay does not energise its contact. If phase order is corrected, both of ***E1*** and ***E2*** LEDs are turned off and relay energises its contact.

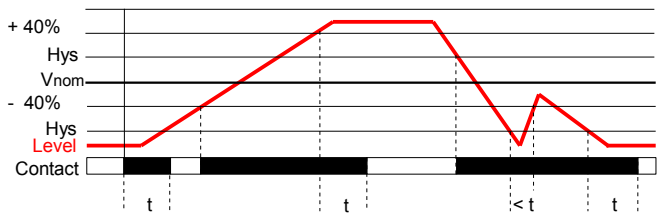


Voltage Asymmetry: (asym.%) (fixed 40% for phase-neutral)

Phase to neutral asymmetry is fixed 40%. If asymmetry exceeds this value, ***Error*** LED is turned on and relay contact is de-energized. To return normal state, voltage asymmetry value must be under 15% (hysteresis).

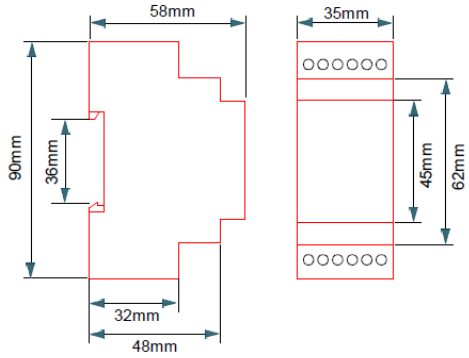
$$\%\ Asm = \frac{(V_{max} - V_{min})}{230} \times 100$$

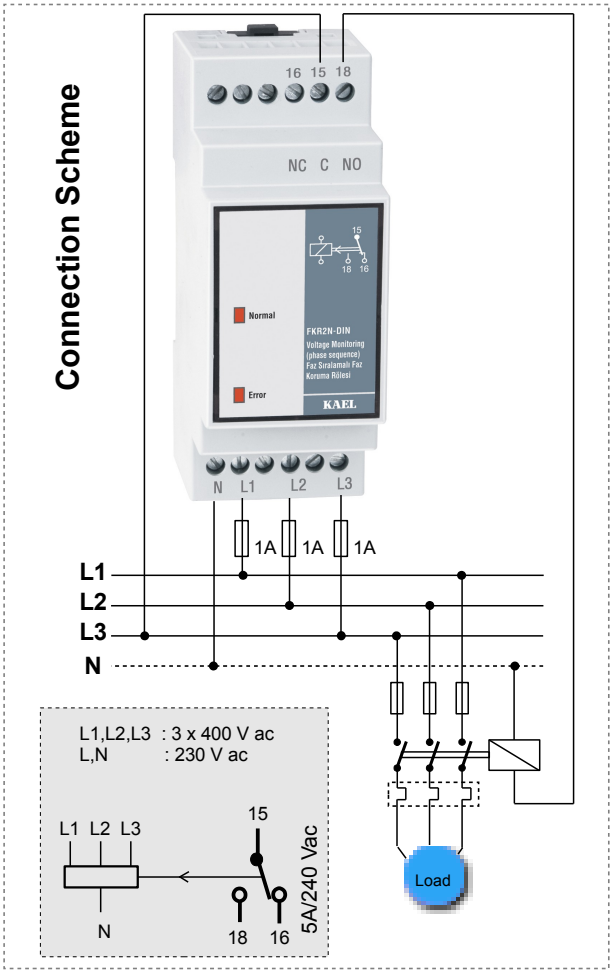
Hys = (15%)



TECHNICAL DATA:

Rated Voltage	: 3 Phase and 1 Neutral (VL-N; 230 Vac and VL-L; 400Vac)
Operating Range	: (0,8 – 1,2) x Un (Un nominal voltage)
Frequency	: 50/60 Hz.
Contact current	: Max.5 A / 240 Vac
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class:	IP00
Ambient Temperature	: - 5 °C....+ 50 °C
Connection Type	: To connection rail in electrical panel
Dimensions	: 35x90x58 mm

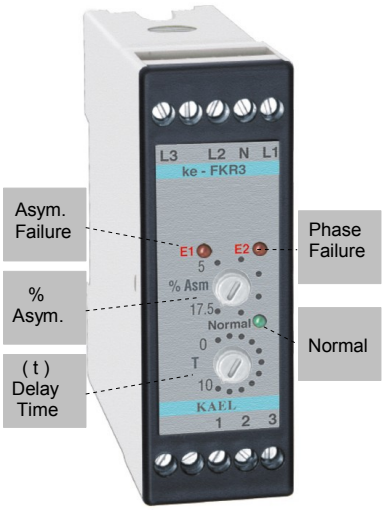




ke – FKR3

PHASE FAILURE and PHASE SEQUENCE DEVICE

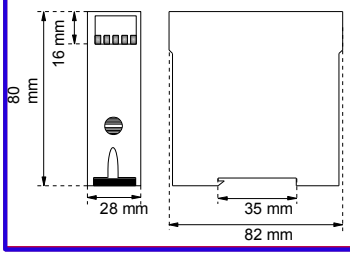
- ► Asymmetry % Adjustment
- ► Phase Sequence
- ► Phase Failure
- ► Delay Time Adjustment



Application Areas:
- ■ Protection of electrical motors
- ■ Protection of 3 phase systems

TECHNICAL DATA:

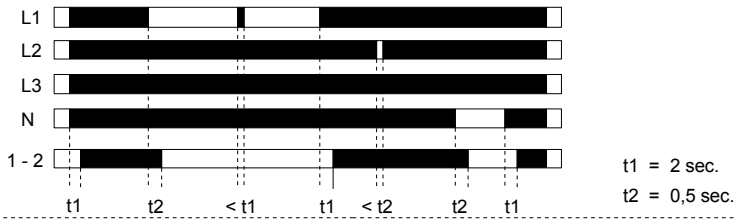
Rated Voltage	: 3 Phase and 1 Neutral 230 VAC
Operating Range	: (0.8 – 1.2)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Asymmetry Adj.	: Phase to phase 5 - 17,5%
Delay Time Adj.	: 1 – 10 sec.
Output Contacts (1-2)	: Normally Open Contact
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 28x82x80 mm



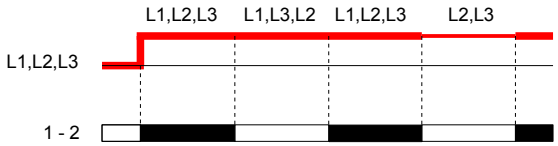
General:

In three phase systems, when phase sequence is correct and there is no asymmetry between phases, ***normal*** LED is turned on and relay contact is energised. Protection functions of ke-FKR3 are given below.

► **Phase Failure:**
In case of absence of at least one phase, relay immediately de-energises its contact and ***E2*** LED is turned on.



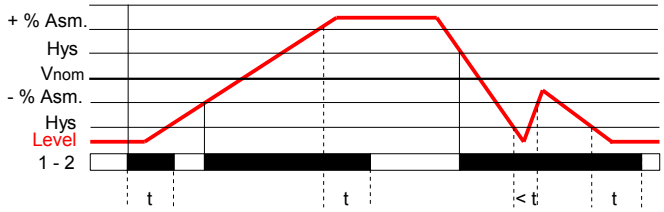
► **Phase Sequence:**
In case of wrong phase order, both of ***E1*** and ***E2*** LEDs are turned on at the same time and relay does not energise its contact. If phase order is corrected, both of ***E1*** and ***E2*** LEDs are turned off and relay energises its contact.



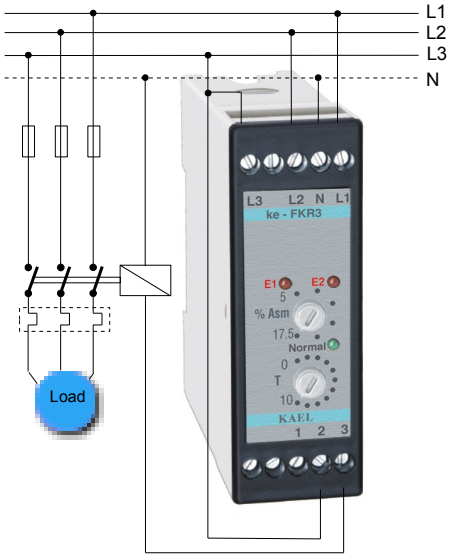
► **Voltage Asymmetry (asym. %) (5-17.5 %) :**
Phase to phase asymmetry is adjusted using the adjustment knob in the range of (5-17.5%). If asymmetry exceeds adjusted value, LED ***E1*** starts to flash and at the end of delay time (1-10s) ***E1*** LED is turned on continuously and relay contact is de-energised.
To return normal state, voltage asymmetry value must be under 20% of adjusted value (hysteresis). If phase – phase asymmetry value returns to normal region in a shorter time then adjusted delay time, relay does not de-energise its contact and LED ***E1*** stops flashing.
Example: Let's say that asymmetry value is set to 15% for a 3 x 380VAC. In this case, relay contact is de-energised at (380-(380x0.15))=323 V.
Re-energising the contact is performed at 323+(380x15%x20%)= 334V. (20% is the hysteresis).

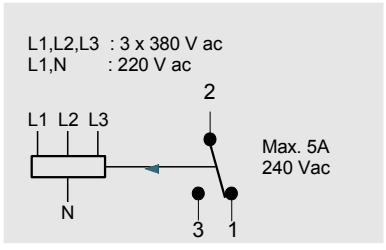
$$\text{Asym } \% = \frac{(V_{max} - V_{min})}{380} \times 100$$

Hys = 380 x (Asym %) x (20 %)



Simple Connection :





FKR3-DIN FKR3T-DIN

PHASE FAILURE and SEQUENCE MONITORING DEVICE

In three phase systems, when all phases are in correct order and phases are balanced, Normal LED turns on and the relay is energized.

Missing Phase : When at least one of phases L1, L2, L3 is missing, phase off LED turns on and at the end of delay time (1-10s) relay de-energizes its contact.

Phase Sequence : If the phase sequence is correct, Relay On LED turns on and relay energizes its contact. If phase order is changed, Phase Off LED turns on and at the end of delay time (1-10s) relay de-energizes its contact.

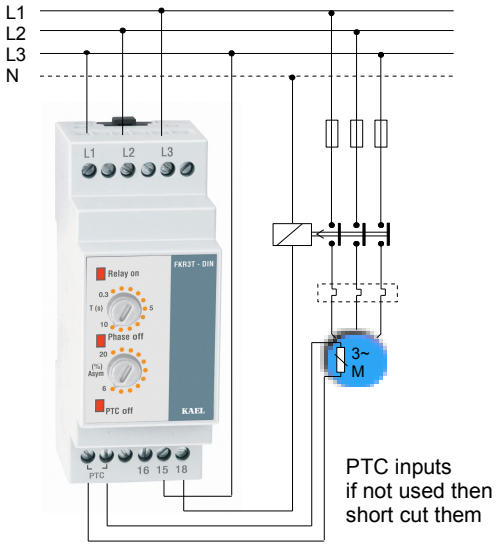
Phase Voltage Unbalance : Phase-phase voltage unbalance is adjusted using the knob located on the front panel of the device. If phase unbalance exceeds the adjusted limit, Phase Off LED turns on, at the end of delay time (1-10s) relay de-energises its contact .

Voltage Asymmetry Adjustment (Phase Unbalance)(asym.%)

Phase to phase asymmetry is adjusted using the adjustment knob in the range of ±%6 .... ±%20

PTC Protection : If you have a device with PTC protection capability (FKR3T-DIN), additional properties are equal with Thermistor Relay (TKR). If you do not want to use this property, simply short circuit the PTC connections.

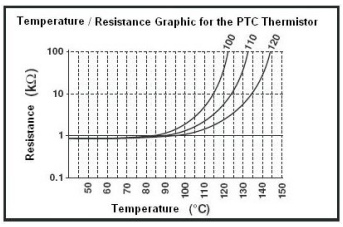
Connection Scheme

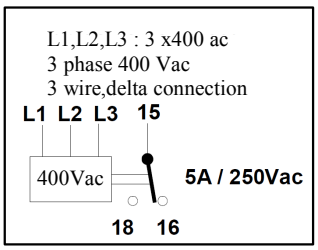


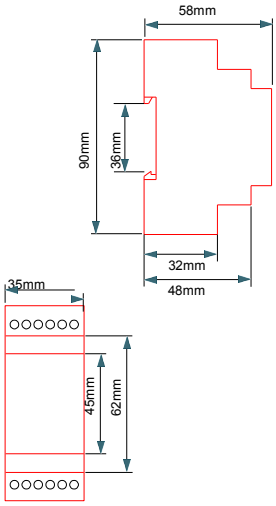
Delay time adjusment : 1 - 10 seconds

Technical Data:

Rated Voltage, Un	: 3 Phases (3 x 400Vac)
Operating Range	: (0,8-1,1) x Un (Un nominal voltage)
Frequency	: 50 Hz
Energizing and de-energizing difference	: +% 3
(15-16)	: Normally Closed Contact
(15-18)	: Normally Open Contact
Contact Current	: max. 5A/240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5 °C.....+50 °C
Humidity	: %15.....%95 (without condensation)
Connection Type	: Perpendicular to inner panel or to connection rail
Dimensions	: 58 x 90 x 35



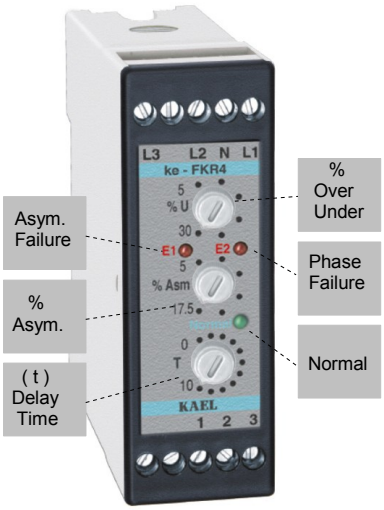




ke – FKR4

PHASE FAILURE and PHASE SEQUENCE DEVICE

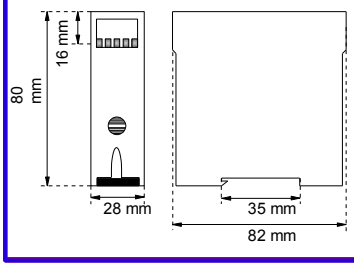
- ► Asymmetry % Adjustment
- ► Phase Sequence
- ► Over&Under Voltage % Adjustment
- ► Phase Failure
- ► Delay Time Adjustment



Application Areas:
-Protection of electrical motors
-Protection of 3 phase systems

TECHNICAL DATA:

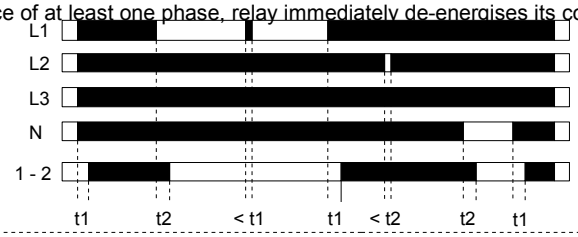
Rated Voltage	: 3 Phase and 1 Neutral 230 VAC
Operating Range	: (0.8 – 1.2)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Asymmetry Adj.	: Phase to phase 5 - 17,5%
Over-Under Adj.	: Phase to Neutral 5 – 30%
Delay Time Adj.	: 1 – 10 sec.
Output Contacts (1-2)	: Normally Open Contact
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 28x82x80 mm



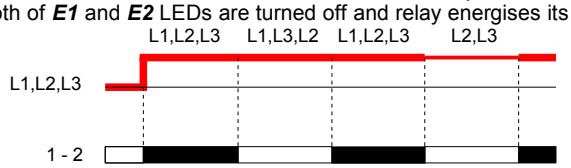
General:

In three phase systems, when phase sequence is correct and there is no asymmetry between phases, ***normal*** LED is turned on and relay contact is energised. Protection functions of ke-FKR4 are given below.

► **Phase Failure:**
In case of absence of at least one phase, relay immediately de-energises its contact and ***E2*** LED is turned on.



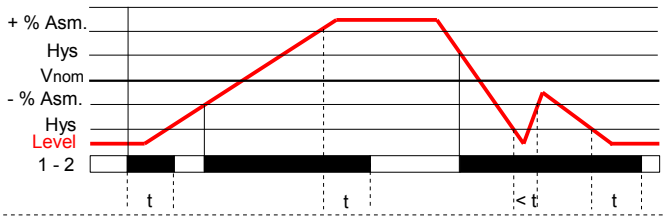
► **Phase Sequence:**
In case of wrong phase order, both of ***E1*** and ***E2*** LEDs are turned on at the same time and relay does not energise its contact. If phase order is corrected, both of ***E1*** and ***E2*** LEDs are turned off and relay energises its contact.



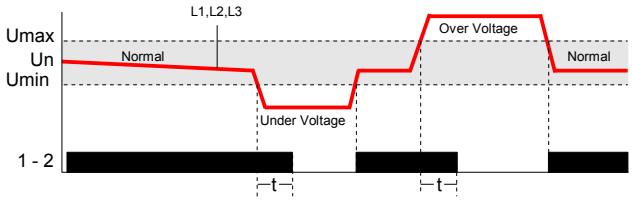
► **Voltage Asymmetry (asym. %) (5-17.5 %) :**
Phase to phase asymmetry is adjusted using the adjustment knob in the range of (5-17.5%). If asymmetry exceeds adjusted value, LED ***E1*** starts to flash and at the end of delay time (1-10s) ***E1*** LED is turned on continuously and relay contact is de-energised.
To return normal state, voltage asymmetry value must be under 20% of adjusted value (hysteresis). If phase – phase asymmetry value returns to normal region in a shorter time then adjusted delay time, relay does not de-energise its contact and LED ***E1*** stops flashing.
Example: Let's say that asymmetry value is set to 15% for a 3 x 380VAC. In this case, relay contact is de-energised at (380-(380x0.15))=323 V.
Re-energising the contact is performed at 323+(380x15%x20%)= 334V. (20% is the hysteresis).

$$\text{Asym } \% = \frac{(V_{max} - V_{min})}{380} \times 100$$

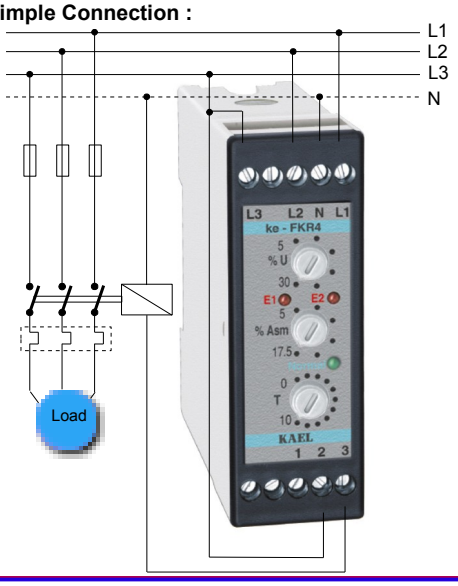
Hys = 380 x (Asym %) x (20 %)

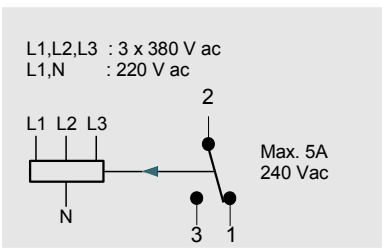


► **Voltage Adjustment Range: ± (0,5 - 0,30)**
Under Voltage Umin=(0.70-0.95)xUn and Over Voltage Umax=(1.05-1.30)xUn.
As long as the voltage values do not exceed adjusted values, ***normal*** LED is kept on and relay contact is energized. Hysteresis is 15%. LED ***E2*** indicates that the adjusted voltage range is exceeded. There is only one adjustment knob for both over and under voltage values.



Simple Connection :





ke-FKR4 (D)

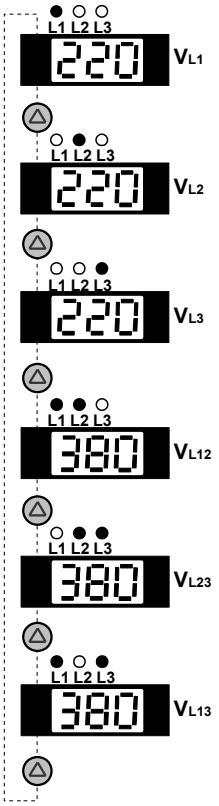
Digital Phase Failure and Phase Sequence Device

- V_{L1}, V_{L2}, V_{L3} $V_{L12}, V_{L23}, V_{L13}$
- Phase Sequence Control
- Over Voltage Protection
- Under Voltage Protection
- Unbalanced Voltage Protection
- Over Frequency Protection
- Under Frequency Protection
- Latch Function
- TRUE RMS

General
In three phase systems, it measures RMS values of AC voltages and system frequency sensitively. Using up direction button (Select) phase-neutral voltages and phase-phase voltages monitor sequentially ke-FKR4(D) has many features.
Those are;
- Phase Failure
- Phase Sequence
- Over Voltage Protection
- Under Voltage Protection
- Voltage Unbalance (asymmetry) Protection
- Over Frequency Protection
- Under Frequency Protection

When device is turn on if its adjusted voltages and frequency in its interval and if phase sequence is correct relay switch on. If any of error occurred (except phase failure and phase sequence) at the end of adjusted time relay switch off its contact. When system return normal values, at the end of time out relay switch on.

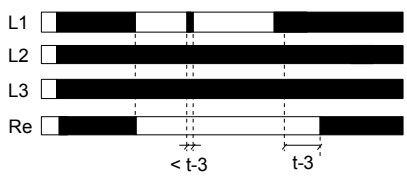
Display Function:



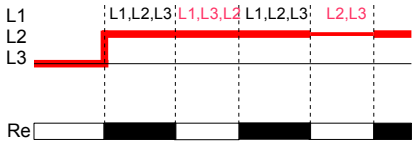
Select:(Up direction) when pressing continuously, screen displays frequency of system. When button release device continue to show voltage.

IMPORTANT: L1 - N is device supply inputs. Thus,the applied L1 – N voltage must be rated voltage of system .
The measured frequency also must the frequency of the system.

Phase Failure: (u-U)
Before starting system , it controls phase absence then if all phases exits Normal LED turn on and relay contact switch on. In case of missing of any L1,L2,L3 phases , Normal LED turn off and relay switch off its contact .In this case when pressing Reset button, u-U warn appears on display.



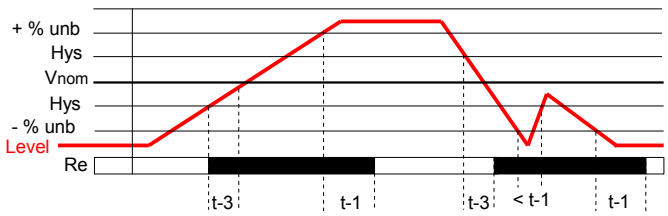
Phase Sequetion: (Seq)
In case of wrong phase order , Normal LED turned off and relay contact is not switch on. In this case if Reset button pushes **seq** warn displayed. If phase order is corrected , Normal LED turned on and out relay switch on.



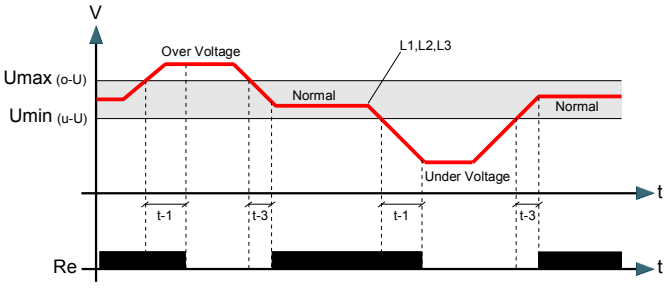
Voltage Unbalanced: (unb)
The phase-phase voltage unbalance limit can be adjusted between(%5-%20) . When it exceeds the adjusted limit , the device switched off its out contact at the end of t-1 delay. In this case when pushing Reset button **unb** warn appear on the screen. For the returning normal state, asymmetry values should under % 20 (hysteresis value). In this case at the end of t3 time Normal LED turned on and output contact switch on. If the phase-phase voltage unbalance, return adjusted value shorter than t-1 time, output relay does not release its contact. Hysteresis is %20.
.
Example: Let's say that asymmetry value is set to 15% for a 3 x 380VAC.
In this case, relay contact switch off at (380-(380x0.15))=323 V.
Switch on the contact is performed at 323+(380x15%x20%)= 334V.
(20% is the hysteresis).

$$\%\ un\ b = \frac{(V_{max} - V_{min})}{380} \times 100$$

$$Hys = 380 \times (\%\ Asm) \times (\%\ 20)$$



Over and Under Voltage : (o-U),(u-U)
Under voltage (u-U) it can adjusted between Umin= (300 – 370 V).
Over voltage (o-U) it can adjusted between Umax=(390 – 460 V).
If the voltage drops below the adjusted under voltage limit, when **u-U shows** on the screen and device switch off its output contact end of the t-1 time Normal LED turned on .In this case when pushing Reset button **u-U** warn appear on its screen.
If the voltage exceed the adjusted over voltage limit, Normal LED turned off and output relay switch off. In this case when pushing Reset button **o-U warn** appers **on** its screen.

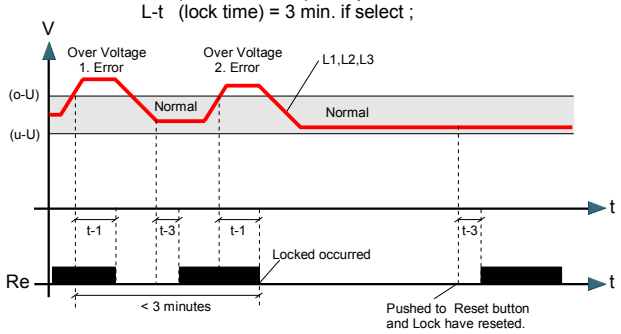


LOCKING FUNCTION : (LATCH)
It can be controlled by two parameters. Locking time and Locking counter. If the number of opening reaches the adjusted locking counter withing the adjusted locking time then device switch off its contact and locks its functions until the user pressed **Reset** button.
If the locking counter is adjusted to **oto** then this function is disable and device never locks itself.

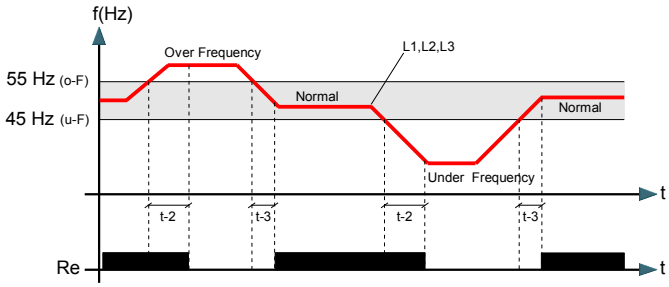
L-t : Locking Time (001 – 060 min.)
It is well know the frequently occurring faults may damage system. For that the device when number of faults reaches the adjusted locking number within this locking time. This way the system is protected and user has chance to investigate the problem.

L-C : Locking Counter (oto , 001 – 010 piece)
The number of faults allowed within the period L-t. If number of faults exceeds this adjusted counter value device locks itself. User must press Reset button then the fault passes in order to unlock the device.
If **L- C** is set to **oto** then this property is disabled.

L-C (number of lock) = 2 piece
L-t (lock time) = 3 min. if select ;



Over and/or Under Frequency Protection : (40 – 70 Hz)
Under Frequency be able to set between (u-F) = 40 Hz .....[(o-F) - 0,4]
Over Frequency be able to set between (o-F) = [(u-F) + 0,4]..... 70 Hz
If required , it can be set only under frequency or only over frequency protection as well as both of protection can be disabled.
If o-F = 55 Hz and u-F = oFF set, device works as over frequency protector only. (if system frequency above 55 Hz, under screen displays **o-F** warning and end of time t-2 relay switch off its output contact)
if o-F = oFF and u-F = 45 Hz set , device works as under frequency protector only . (if system frequency below 45 Hz, under screen displays **u-F** warning and end of time t-2 relay switch off its out contact.)
if o-F = oFF and u-F = oFF set, frequency protection is disabled.



Parameters :

Device protection function can be set this portion .In this portion entering pushing SET button until appears **o-U**.

First parameter ;
o-U : Over Voltage Setting (between 390 V – 460 V can be set)
Between phase-phase voltages ,in case of over adjusted values, device end of the time t-1 output relay switch off its contact .

u-U : Under Voltages Setting (between 300 V – 370 V can be set)
Between phase-phase voltages ,in case of under adjusted values, device end of the time t-1 output relay switch off its contact .

unb : Unbalanced Voltage (asymmetry) Setting (0,05 – 0,20)%5 – 20
Between phase-phase voltages ,in case of under adjusted % value,device end of the time t-1 output relay switch off its contact .

t-1 :On Delay Time (Voltages) (00,1 – 99,9 sec)
When occurred over voltage , under voltage and unbalanced voltage, if error stretch t-1 time ,device out relay switch off.

t-2 : On Delay Time (Frequency)(00,1 – 99,9 sec)
When over and under frequency occurred, if error stretch t-2 time, device output relay switch off.

t-3 : Returning Delay (Voltage and Frequency)(00,1 – 99,9 min)
To close the output contact after opening because of both voltage and frequency faults ,the values should return to the normal ranges and after t-3 delay, the device switch on its output contact.

L-C : Locking Counter (oto , 001 – 010 piece)
The number of the faults allowed within the period (L-t). If the number of faults exceeds this adjusted counter value then the device locks itself.
The user must press Reset button after the device locks itself.
If L-C is set to **oto** then this property is disable.

L-t : Locking Time (001 – 060 min.)
The device locks itself when the number of faults reaches the adjusted locking number within this locking time. This way the system is protected and the user has the chance to nvestigate the problem.

o-F : Over Frequency Adjustment
It can be set between (o-F) = [(u-F) + 0,4]..... 70 Hz.
If it is set to o-F = oFF then this protection is disabled.

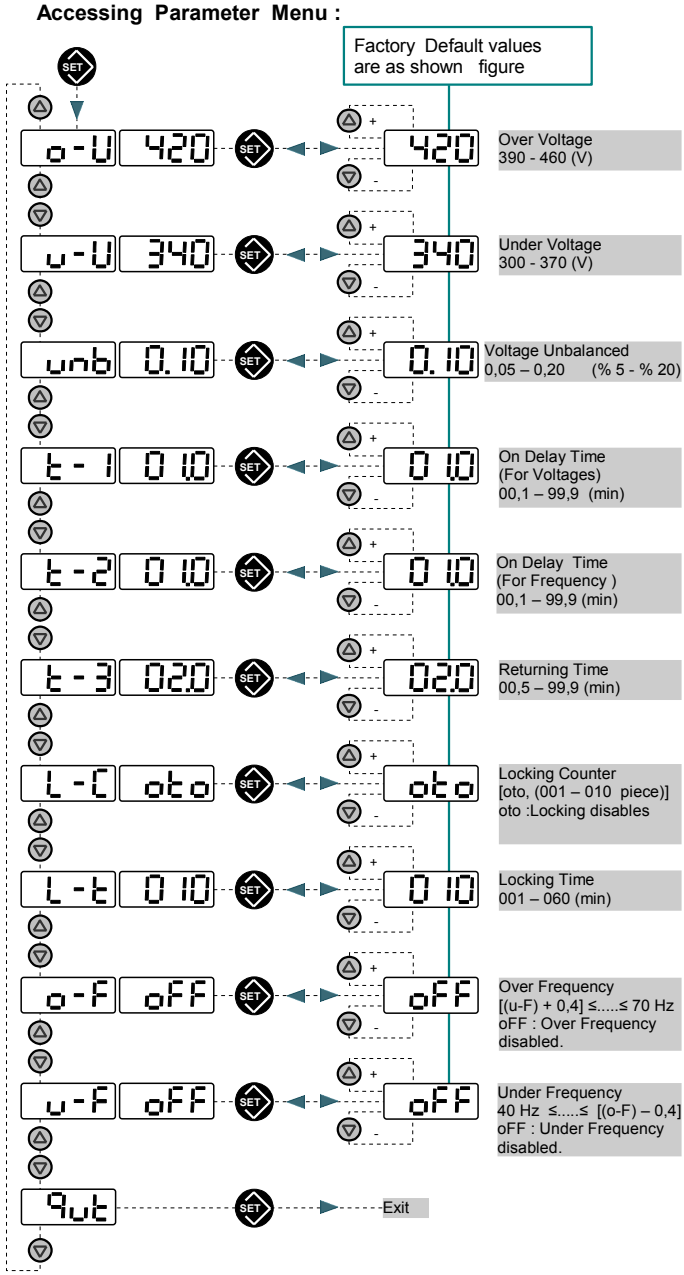
u-F : Under Frequency Adjustment
it can be set between (u-F) = 40 Hz .....[(o-F) - 0,4].
If it is set to u-F = oFF then this protection is disabled.

qut : Quit
If Set button is pressed there then the device goes back the measurement screen.

Installation Instruction :
- Read the user instructions and caution before installation
- Be sure that the panel you are installing in when power off.
- The device designed to be installed to the rail where the installation tap into the panel,
- Do not under case open the front of device.
- You should open the Terminals at the back side of the device after you must be sure that there is no power in the panel.
  Connect the device as shown in the connection scheme.
- Be sure that the terminals are connected tightly to the device.
- Use a power switch between the network line and the device's supply. Moreover you should connect the 1A rapid fuse before measurement inputs for device protection.
- If you are having any problem you can contact to KAEL Electronics Co. where you can reach address given below.

Atatürk mah.78 sok.No:10 Büyükalan Mevkii,Ulucak-Kemalpaşa-İZMİR
TÜRKİYE Tel: 90 - 232 – 8771484 pbx

Accessing Parameter Menu :



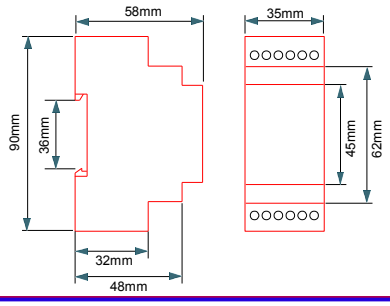
Connection Scheme

Select: (up direction) when pushing continuously ,it shows systems frequency its screen. When release button , it is continue to display voltage.

Reset:
If pushing Reset button while system has any error, device shows alarm codes. If error case although disappeared , then device is not return to normal , latch-function occurred and it makes locked device .
After checking error in system then restart device with pushing reset button.

TECHNICAL INFORMATION:

Rated Voltage (Un)	: 230Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Voltage Measurement (Phase-Phase)	: 10 – 500 VAC (For L1-N 176V - 242V)
Voltage Measurement Power Consumption	: <1VA (for one phase)
Measurement Sensitivity	: %1±1 digit
Display	: 3 Digit LED
Contact Current	: Max. 5A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To connection rail in electrical panel
Dimension	:



ATTANTION !!!
- The messages Err1 and Err2 on the screen means that device is failure.
- Clean the device using dry dust cloth after turned off device.
- Read and follow the instruction on this manual and attached label.

DP01-72

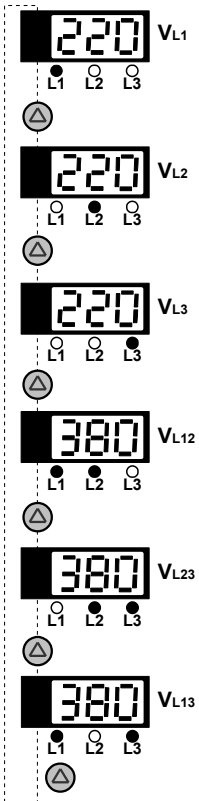
Digital Protector
Voltage – Current
and
Frequency control

AREAS OF OPERATION:

- In-Elevator motors protection
- On-pump and electric motor
- Resistance in oven with

- V_{L1}, V_{L2}, V_{L3}
- $V_{L12}, V_{L23}, V_{L13}$
- I_{L1}, I_{L2}, I_{L3}
- Hz
- Phase Sequence Control
- Over Voltage Protection
- Under Voltage Protection
- Unbalanced Voltage Protection
- Over Current Protection
- Under Current Protection
- Unbalanced Current Protection
- Over Frequency Protection
- Under Frequency Protection
- Latch Function
- TRUE RMS

Display Functions:



Special Buttons:

Select: (Up direction) when pressing continuously, screen displays frequency of system. When button release device continue to show voltage.

Reset:
If error case although disappeared then device is not return to normal, latch-function occurred and it makes locked device.
Or Lock-function (only for currents) may be occured.
After checking error in system then restart device with pushing reset button.

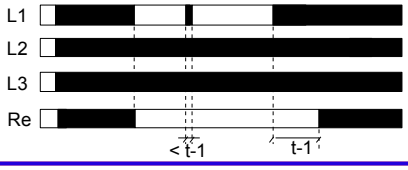
General:
In three phase systems, it measures RMS values of AC voltages, currents and system frequency sensitively. Using up direction button (Select) phase-neutral voltages and phase-phase voltages monitor sequentially.
DP01-72 has many features.
Those are;

- Phase Failure	**(seq)**
- Phase Sequence	**(seq)**
- Over Voltage Protection	**(o - U)**
- Under Voltage Protection	**(u - U)**
- Voltage Unbalance (asymmetry) Protection	**(unb)**
- Over Current Protection	**(o - C)**
- Under Current Protection	**(u - C)**
- Current Unbalance (asymmetry) Protection	**(ubC)**
- Over Frequency Protection	**(o - F)**
- Under Frequency Protection	**(u - F)**

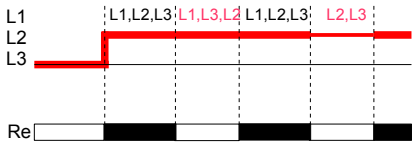
When device is turn on if its adjusted voltages and frequency in its interval and if phase sequence is correct relay switch on.
If any of error occurred (except phase failure and phase sequence) at the end of adjusted time relay switch off its contact. When system return normal values, at the end of time out relay switch on.

IMPORTANT: L1 - N is device supply inputs. Thus,the applied L1 – N voltage must be rated voltage of system . Otherwise normal led makes flash and the device switched off its output contact.
The measured frequency also must the frequency of the system.

Phase Failure: (u-U)
Before starting system , it controls phase absence then if all phases exits Normal LED turn on and relay contact switch on. In case of missing of any L1,L2,L3 phases , Normal LED turn off and relay switch off its contact .In this case **u-U** warn appears on display.



Phase Sequetion: (Seq)
In case of wrong phase order , Normal LED turned off and relay contact is not switch on. In this case **seq** warn appears on the screen. If phase order is corrected , Normal LED turned on and out relay switch on.

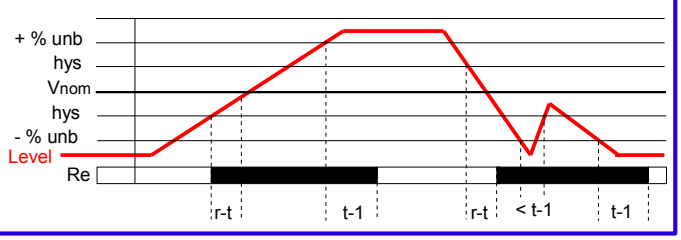


Voltage Unbalanced: (unb)
The phase-phase voltage unbalance limit can be adjusted between(5% - 20%) . When it exceeds the adjusted limit , the device switched off its out contact at the end of t-1 delay. In this case **unb** warn appears on the screen. For the returning normal state, asymmetry values should under 20% (hysteresis value). In this case at the end of t3 time Normal LED turned on and output contact switch on. If the phase-phase voltage unbalance, return adjusted value shorter than t-1 time, output relay does not release its contact.
Hysteresis is 20 %.
unb = 000(oFF) protection is disable .

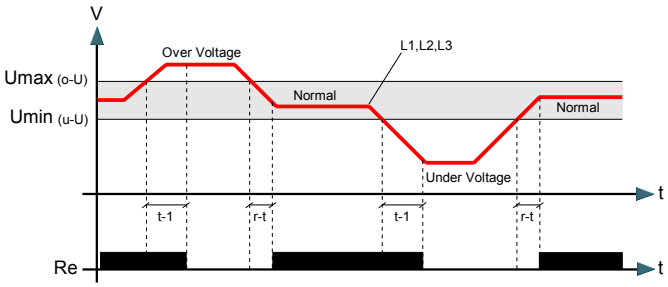
Example: Let's say that asymmetry value is set to %15 for a 3 x 380VAC.
In this case, relay contact switch off at (380-(380x0.15))=323 V.
Switch on the contact is performed at 323+(380x%15x%20)= 334V.
(%20 is the hysteresis).

$$\%\ unb = \frac{(V_{max} - V_{min})}{380} \times 100$$

$$Hys = 380 \times (\%\ Asm) \times (\%\ 20)$$

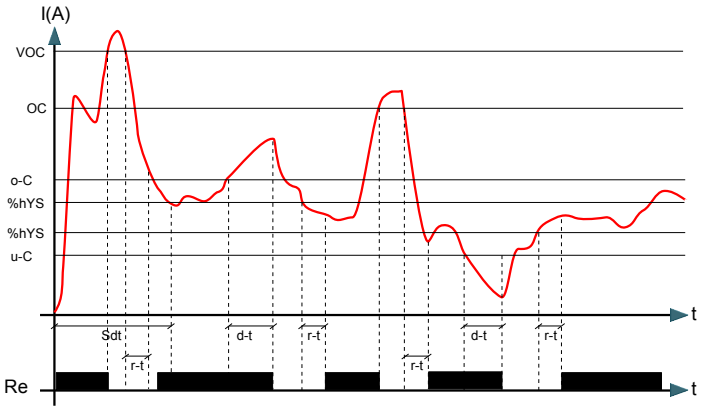


Over and Under Voltage : (o-U),(u-U)
Under voltage (u-U) it can adjusted between Umin= (300 – 370 V).
Over voltage (o-U) it can adjusted between Umax=(390 – 460 V).
If the voltage drops below the adjusted under voltage limit, when **u-U** shows on the screen and device switch off its output contact end of the t-1 time Normal LED turned on .In this case **u-U** warn appears on the screen.
If the voltage exceed the adjusted over voltage limit, Normal LED turned off and output relay switch off. In this case **o-U** warn appers on its screen.
Hysteresis is 6 V.



Over and Under Current : (o-C),(u-C)
Under Current (u-C)
Over Current (o-C)
When the current of the protected system goes below the adjusted value it switches off its output contact after **d-t** delay.
Normal LED turn off and relay switch off its contact .In this case **u-C** warn appears on display.
When any current passing through any phase of the protected system exceeds the adjusted value the device switches off its output contacts after a proper time (**d-t**).Normal LED turn off and relay switch off its contact .In this case **o-C** warn appears on display.

NOTE: *Under current protection set value with its hysteresis must not overlap with over current protection set value with its hysteresis or, the under current protection set value must not be higher than the over current protection set value.*

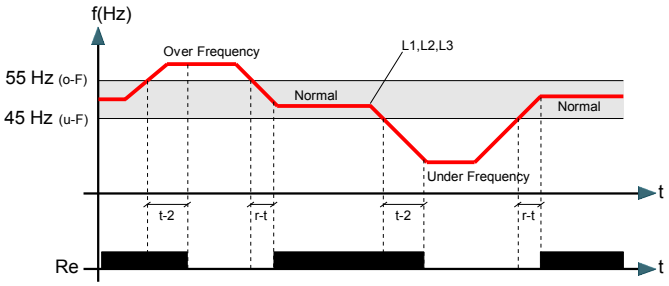


Start delay time: Sd-t
It can be set between 1 and 60 seconds.It is used to prevent the switch off from occurance because of the motor's inrush current.
This function can be disable if Sd-t value = 000 (oFF)
Return Time : r-t
it shows the delay time that device will wait to switch on its output relay when failure ends after a switch off. It can be set between 0,5 and 99,9 seconds.
Very Over Current Coefficient : VOC (Current Very Sudden Switch Off Protection)
It can be set by the user between 2,1 and 6.
When the current value exceeds the adjusted value within the start delay time, the device switches off, its output contact immediately.
Very Over Current value = (o – C) x (VOC)
This function can be disable if VOC = 000 (oFF)
Over Current Coefficient : OC (Current Sudden Switch Off Protection)
It can be set by the user between 1,1 and 2.
When the current value exceeds the adjusted value without the start delay time, the device switches off, its output contact immediately.
Over Current value = (o – C) x (OC)
This function can be disable if OC = 000 (oFF)

2.6 Asymmetric Current Protection:
It can be set by the user between 5% and 40%. It controls the asymmetric that may occur in the current of the three phases. That may occur when one of the phases' voltage is low and the other one is high. That may cause asymmetric current in the motor's bobbin. This way the motor's bobbin is protected. Furthermore it protects the motor from missing phase or a possible unplugged or cut wiring.
If the unbalance between the phases' current exceeds the adjusted value the switch off occurs after t-1 delay.
If the current unbalance exceed the adjusted value, Normal LED turned off and output relay switch off. In this case **ubC** warn appears on its screen.
This function can be disable if **ubC** value = 000 (oFF)

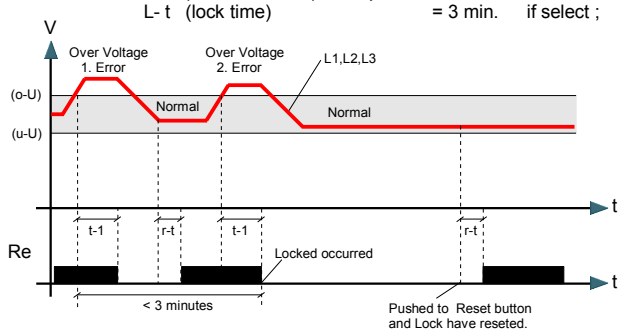
Over and/or Under Frequency Protection : (40 – 70 Hz)
Under Frequency be able to set between**(u-F)** = 40 Hz ...[(o-F) -0,4]
Over Frequency be able to set between **(o-F)** =[(u-F) + 0,4]...70 Hz
If required , it can be set only under frequency or only over frequency protection as well as both of protection can be disabled.

- If o-F = 55 Hz and u-F = oFF set, device works as over frequency protector only. (if system frequency above 55 Hz, under screen displays **o-F** warning and end of time t-2 relay switch off its output contact)
- if o-F = oFF and u-F = 45 Hz set , device works as under frequency protector only . (if system frequency below 45 Hz, under screen displays **u-F** warning and end of time **t-2** relay switch off its out contact.)
- if o-F = oFF and u-F = oFF set, frequency protection is disabled.

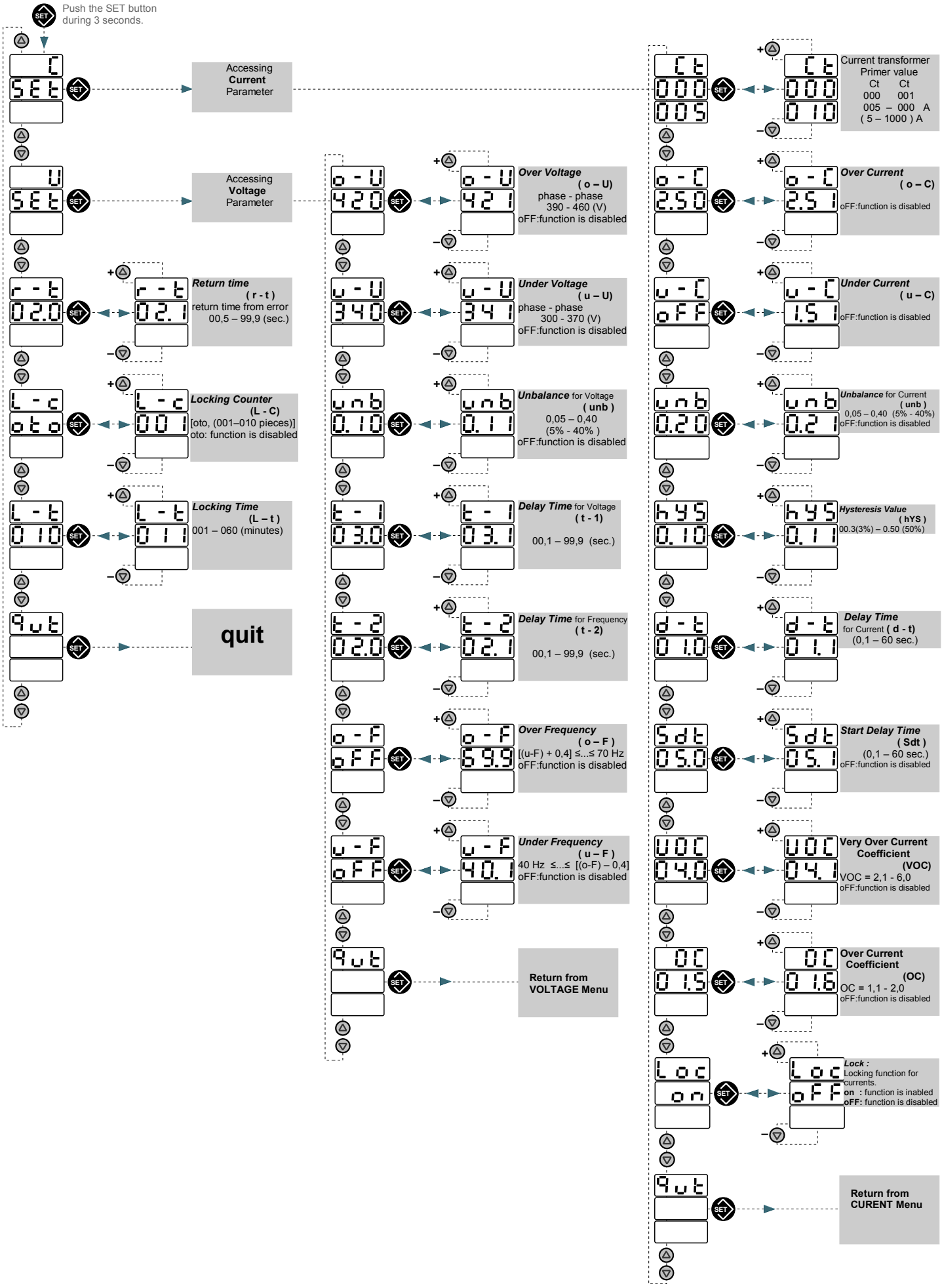


LOCKING FUNCTION :
It can be controlled by two parameters. Locking time and Locking counter. If the number of opening reaches the adjusted locking counter withing the adjusted locking time then device switch off its contact and locks its functions until the user pressed **Reset** button.
If the locking counter is adjusted to **oto** then this function is disable and device never locks itself.
L-t : Locking Time (001 – 060 min.)
It is well know the frequently occurring faults may damage system. For that the device when number of faults reaches the adjusted locking number within this locking time. This way the system is protected and user has chance to investigate the problem.
L-C : Locking Counter (oto , 001 – 010 piece)
The number of faults allowed within the period L-t. If number of faults exceeds this adjusted counter value device locks itself.
In this case (**- - -**) warn appears on its screen. User must press Reset button then the fault passes in order to unlock the device.
If **L- C** is set to **oto** then this property is disabled.

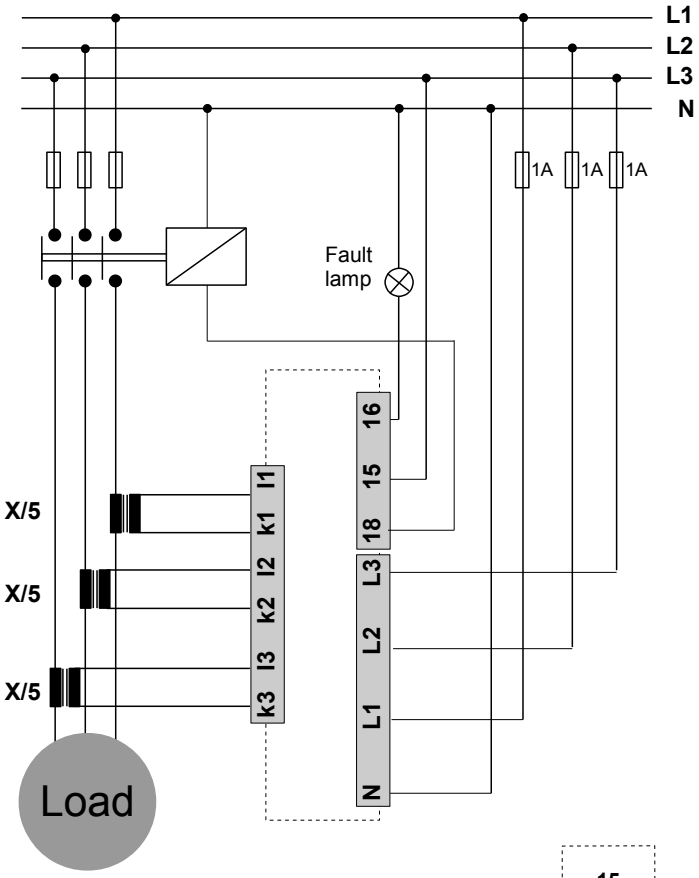
L- C (number of lock) = 2 piece
L- t (lock time) = 3 min. if select ;

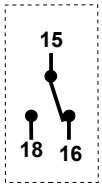


ACCESSING PARAMETER MENU:



Connection :





3 A / 240Vac

TECHNICAL INFORMATION:

Rated Voltage (Un)	: 230Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Current Transformer Ratio	: X / 5A
Current Measurement Range	: (for seconder current) 0,05 - 6 Amp AC
Voltage Measurement Range	: (Phase-Phase)10 - 500 Vac, 45 - 65Hz
	: (Phase-Neutral)10 - 300 Vac, 45 - 65Hz
	For power supply(L1 - N) 176V – 242V
Voltage Measurement Power Consumption	: <1VA (for one phase)
Measurement Sensitivity	: %1±1 digit
Contact Current	: Max. 3A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To front panel tap
Dimensions	: 72x72x80 mm :

ATTENTION !!!

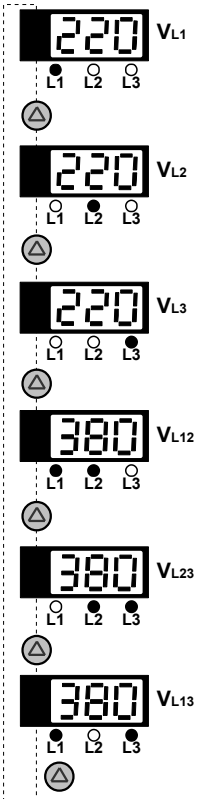
- Clean the device using dry dust cloth after turned off device.
- Read and follow the instruction on this manual and attached label.

ke-DP01

Digital Protector
Voltage – Current
and
Frequency control

- V_{L1}, V_{L2}, V_{L3}
- $V_{L12}, V_{L23}, V_{L13}$
- I_{L1}, I_{L2}, I_{L3}
- Hz
- Phase Sequence Control
- Over Voltage Protection
- Under Voltage Protection
- Unbalanced Voltage Protection
- Over Current Protection
- Under Current Protection
- Unbalanced Current Protection
- Over Frequency Protection
- Under Frequency Protection
- Latch Function
- TRUE RMS

Display Functions:



Special Buttons:

Select: (Up direction) when pressing continuously, screen displays frequency of system. When button release device continue to show voltage.

Reset:
If error case although disappeared then device is not return to normal, latch-function occurred and it makes locked device.
Or Lock-function (only for currents) may be occured.
After checking error in system then restart device with pushing reset button.

AREAS OF OPERATION:

- In-Elevator motors protection
- On-pump and electric motor
- Resistance in oven with

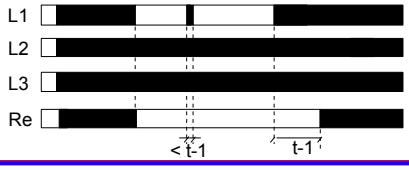
General:
In three phase systems, it measures RMS values of AC voltages, currents and system frequency sensitively. Using up direction button (Select) phase-neutral voltages and phase-phase voltages monitor sequentially.
ke-DP01 has many features.
Those are;

- Phase Failure	**(seq)**
- Phase Sequence	**(seq)**
- Over Voltage Protection	**(o - U)**
- Under Voltage Protection	**(u - U)**
- Voltage Unbalance (asymmetry) Protection	**(unb)**
- Over Current Protection	**(o - C)**
- Under Current Protection	**(u - C)**
- Current Unbalance (asymmetry) Protection	**(ubC)**
- Over Frequency Protection	**(o - F)**
- Under Frequency Protection	**(u - F)**

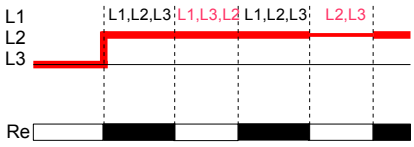
When device is turn on if its adjusted voltages and frequency in its interval and if phase sequence is correct relay switch on.
If any of error occurred (except phase failure and phase sequence) at the end of adjusted time relay switch off its contact. When system return normal values, at the end of time out relay switch on.

IMPORTANT: L1 - N is device supply inputs. Thus,the applied L1 – N voltage must be rated voltage of system . Otherwise normal led makes flash and the device switched off its output contact.
The measured frequency also must the frequency of the system.

Phase Failure: (u-U)
Before starting system , it controls phase absence then if all phases exits Normal LED turn on and relay contact switch on. In case of missing of any L1,L2,L3 phases , Normal LED turn off and relay switch off its contact .In this case **u-U** warn appears on display.



Phase Sequetion: (Seq)
In case of wrong phase order , Normal LED turned off and relay contact is not switch on. In this case **seq** warn appears on the screen. If phase order is corrected , Normal LED turned on and out relay switch on.

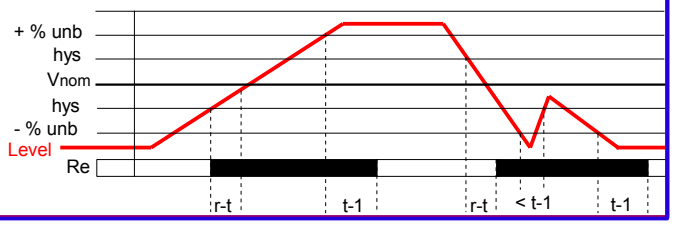


Voltage Unbalanced: (unb)
The phase-phase voltage unbalance limit can be adjusted between(5% - 20%) . When it exceeds the adjusted limit , the device switched off its out contact at the end of t-1 delay. In this case **unb** warn appears on the screen. For the returning normal state, asymmetry values should under 20% (hysteresis value). In this case at the end of t3 time Normal LED turned on and output contact switch on. If the phase-phase voltage unbalance, return adjusted value shorter than t-1 time, output relay does not release its contact.
Hysteresis is 20 %.
unb = 000(oFF) protection is disable .

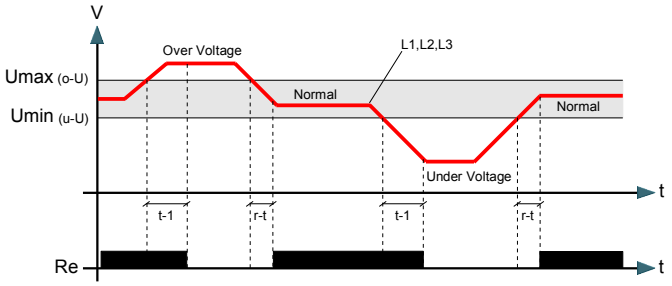
Example: Let's say that asymmetry value is set to %15 for a 3 x 380VAC.
In this case, relay contact switch off at (380-(380x0.15))=323 V.
Switch on the contact is performed at 323+(380x%15x%20)= 334V.
(%20 is the hysteresis).

$$\%\ unb = \frac{(V_{max} - V_{min})}{380} \times 100$$

$$Hys = 380 \times (\%\ Asm) \times (\%\ 20)$$

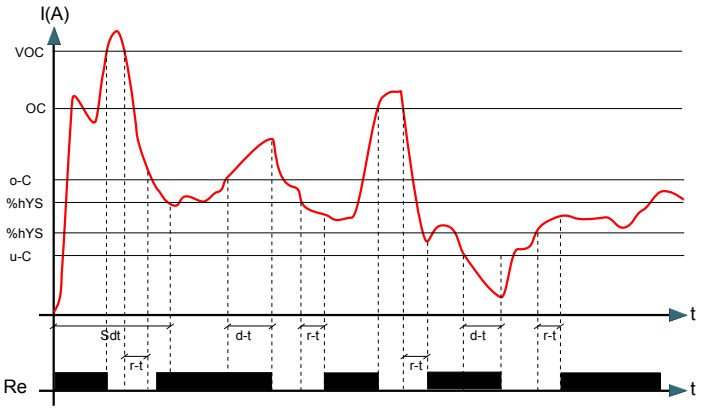


Over and Under Voltage : (o-U),(u-U)
Under voltage (u-U) it can adjusted between Umin= (300 – 370 V).
Over voltage (o-U) it can adjusted between Umax=(390 – 460 V).
If the voltage drops below the adjusted under voltage limit, when **u-U** shows on the screen and device switch off its output contact end of the t-1 time Normal LED turned on .In this case **u-U** warn appears on the screen.
If the voltage exceed the adjusted over voltage limit, Normal LED turned off and output relay switch off. In this case **o-U** warn appers on its screen.
Hysteresis is 6 V.



Over and Under Current : (o-C),(u-C)
Under Current (u-C)
Over Current (o-C)
When the current of the protected system goes below the adjusted value it switches off its output contact after **d-t** delay.
Normal LED turn off and relay switch off its contact .In this case **u-C** warn appears on display.
When any current passing through any phase of the protected system exceeds the adjusted value the device switches off its output contacts after a proper time (**d-t**).Normal LED turn off and relay switch off its contact .In this case **o-C** warn appears on display.

NOTE: *Under current protection set value with its hysteresis must not overlap with over current protection set value with its hysteresis or, the under current protection set value must not be higher than the over current protection set value.*

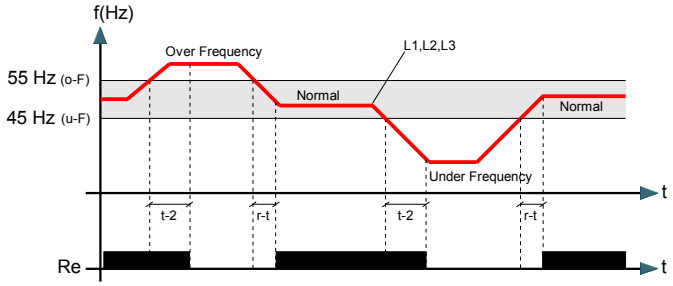


Start delay time: Sd-t
It can be set between 1 and 60 seconds.It is used to prevent the switch off from occurance because of the motor's inrush current.
This function can be disable if Sd-t value = 000 (oFF)
Return Time : r-t
it shows the delay time that device will wait to switch on its output relay when failure ends after a switch off. It can be set between 0,5 and 99,9 seconds.
Very Over Current Coefficient : VOC (Current Very Sudden Switch Off Protection)
It can be set by the user between 2,1 and 6.
When the current value exceeds the adjusted value within the start delay time, the device switches off, its output contact immediately.
Very Over Current value = (o – C) x (VOC)
This function can be disable if VOC = 000 (oFF)
Over Current Coefficient : OC (Current Sudden Switch Off Protection)
It can be set by the user between 1,1 and 2.
When the current value exceeds the adjusted value without the start delay time, the device switches off, its output contact immediately.
Over Current value = (o – C) x (OC)
This function can be disable if OC = 000 (oFF)

2.6 Asymmetric Current Protection:
It can be set by the user between 5% and 40%. It controls the asymmetric that may occur in the current of the three phases. That may occur when one of the phases' voltage is low and the other one is high. That may cause asymmetric current in the motor's bobbin. This way the motor's bobbin is protected. Furthermore it protects the motor from missing phase or a possible unplugged or cut wiring.
If the unbalance between the phases' current exceeds the adjusted value the switch off occurs after t-1 delay.
If the current unbalance exceed the adjusted value, Normal LED turned off and output relay switch off. In this case **ubC** warn appears on its screen.
This function can be disable if **ubC** value = 000 (oFF)

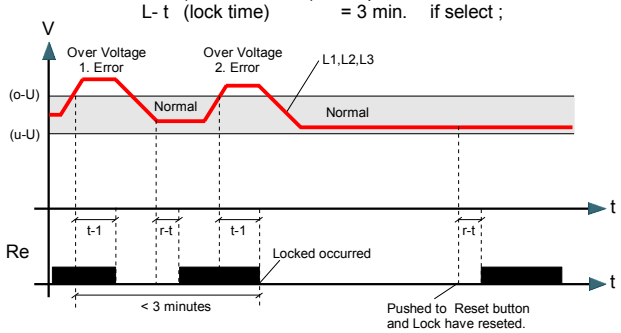
Over and/or Under Frequency Protection : (40 – 70 Hz)
Under Frequency be able to set between**(u-F)** = 40 Hz ...[(o-F) -0,4]
Over Frequency be able to set between **(o-F)** =[(u-F) + 0,4]...70 Hz
If required , it can be set only under frequency or only over frequency protection as well as both of protection can be disabled.

- If o-F = 55 Hz and u-F = oFF set, device works as over frequency protector only. (if system frequency above 55 Hz, under screen displays **o-F** warning and end of time t-2 relay switch off its output contact)
- if o-F = oFF and u-F = 45 Hz set , device works as under frequency protector only . (if system frequency below 45 Hz, under screen displays **u-F** warning and end of time **t-2** relay switch off its out contact.)
- if o-F = oFF and u-F = oFF set, frequency protection is disabled.

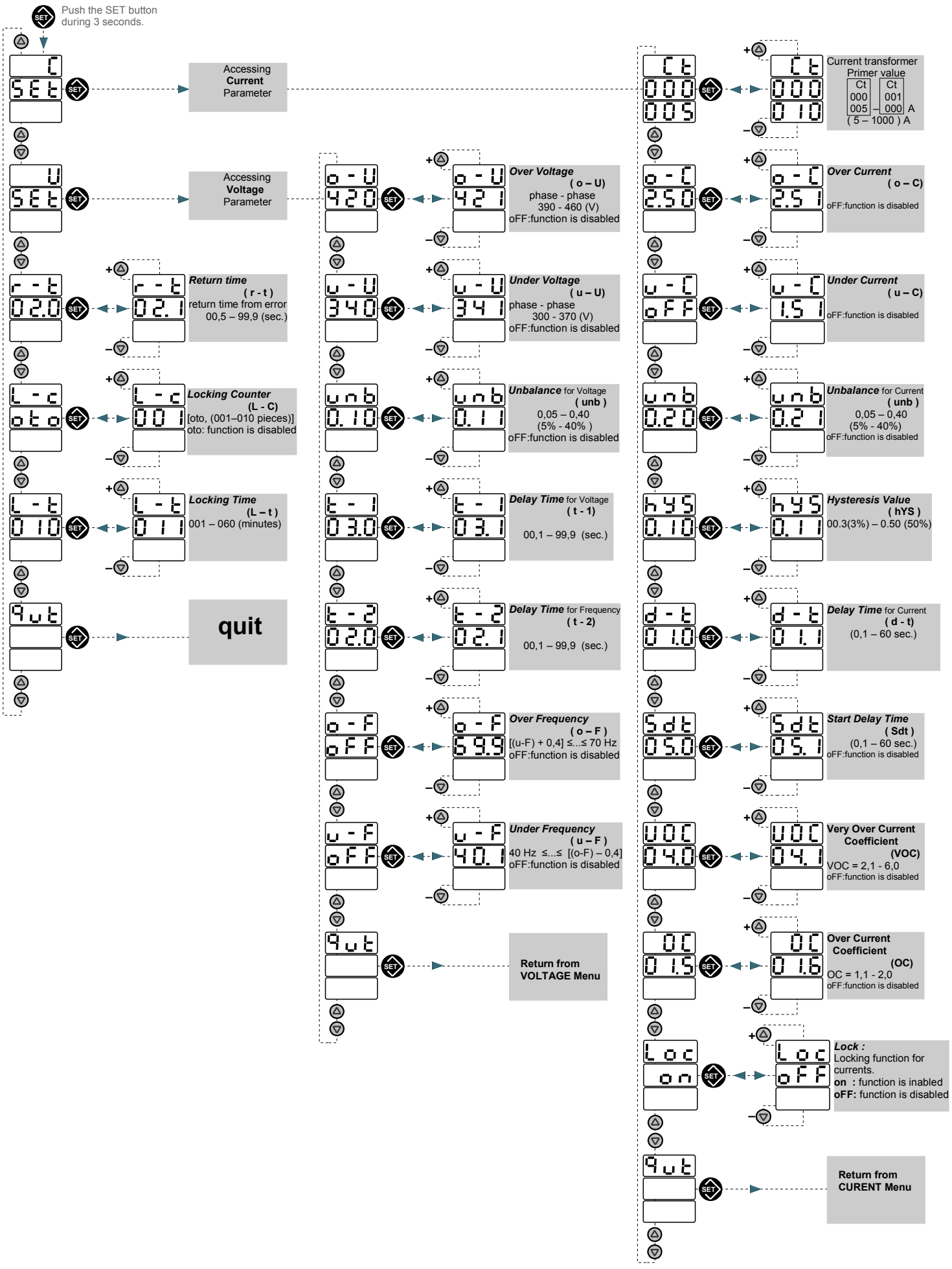


LOCKING FUNCTION :
It can be controlled by two parameters. Locking time and Locking counter. If the number of opening reaches the adjusted locking counter withing the adjusted locking time then device switch off its contact and locks its functions until the user pressed **Reset** button.
If the locking counter is adjusted to **oto** then this function is disable and device never locks itself.
L-t : Locking Time (001 – 060 min.)
It is well know the frequently occurring faults may damage system. For that the device when number of faults reaches the adjusted locking number within this locking time. This way the system is protected and user has chance to investigate the problem.
L-C : Locking Counter (oto , 001 – 010 piece)
The number of faults allowed within the period L-t. If number of faults exceeds this adjusted counter value device locks itself.
In this case (**- - -**) warn appears on its screen. User must press Reset button then the fault passes in order to unlock the device.
If **L- C** is set to **oto** then this property is disabled.

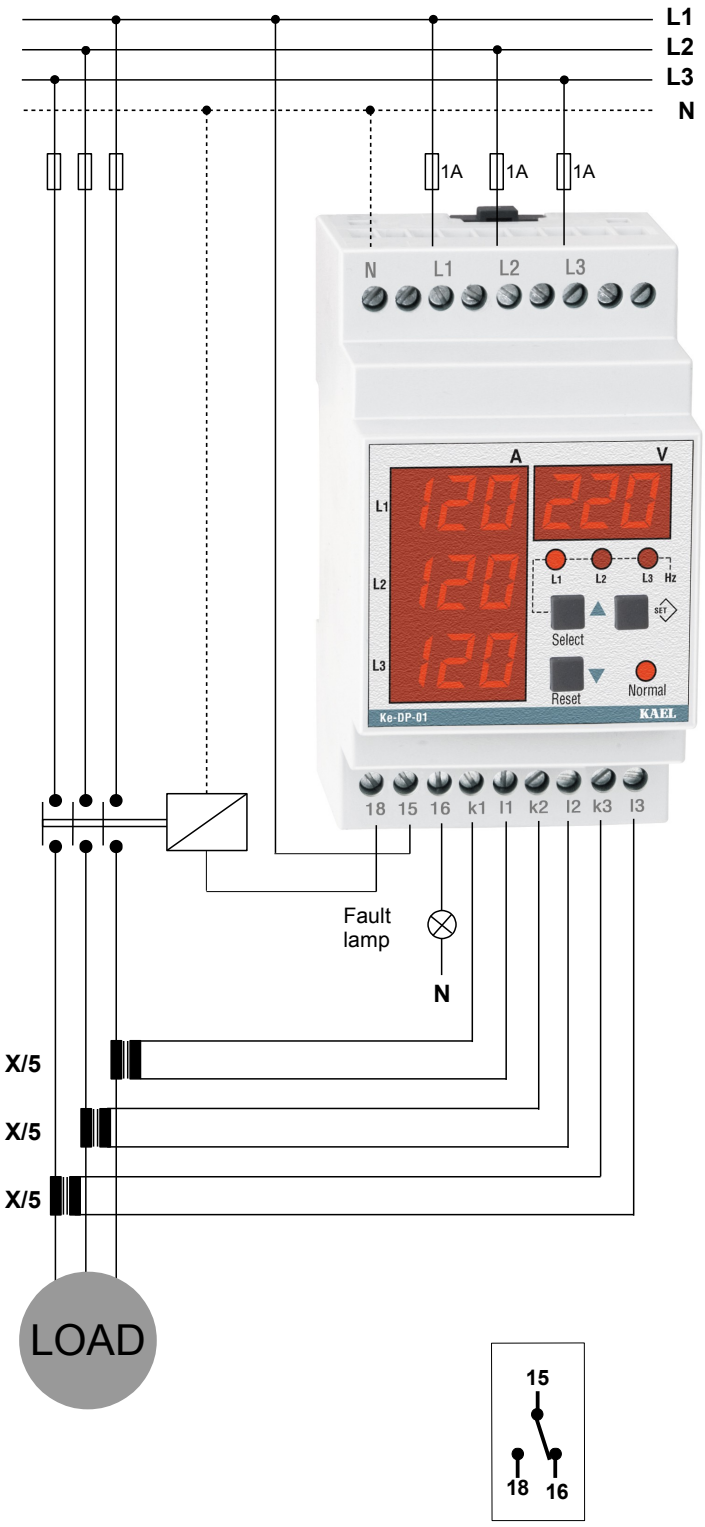
L- C (number of lock) = 2 piece
L- t (lock time) = 3 min. if select ;



ACCESSING PARAMETER MENU:

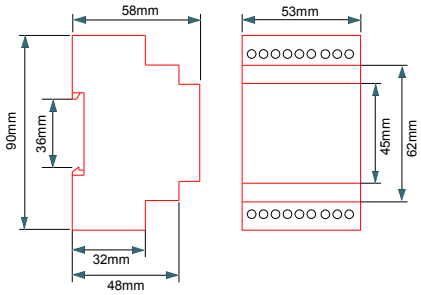


Connection :



TECHNICAL INFORMATION:

Rated Voltage (Un)	: 230Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Current Transformer Ratio	: X / 5A
Current Measurement Range	: (for seconder current) 0,05 - 6 Amp AC
Voltage Measurement Range	: (Phase-Phase)10 - 500 Vac, 45 - 65Hz
	: (Phase-Neutral)10 - 300 Vac, 45 - 65Hz
	For power supply(L1 - N) 176V – 242V
Voltage Measurement Power Consumption	: <1VA (for one phase)
Measurement Sensitivity	: %1±1 digit
Contact Current	: Max. 3A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To connection rail in electrical panel
Dimension	:



ATTENTION !!!

- Clean the device using dry dust cloth after turned off device.
- Read and follow the instruction on this manual and attached label.

ke-DP01-100A

Digital Protector
Voltage – Current
and
Frequency control
0 -100A

- V_{L1}, V_{L2}, V_{L3}
- $V_{L12}, V_{L23}, V_{L13}$
- I_{L1}, I_{L2}, I_{L3}
- Hz
- Phase Sequence Control
- Over Voltage Protection
- Under Voltage Protection
- Unbalanced Voltage Protection
- Over Current Protection
- Under Current Protection
- Unbalanced Current Protection
- Over Frequency Protection
- Under Frequency Protection
- Latch Function
- TRUE RMS

AREAS OF OPERATION:

- In-Elevator motors protection
- on submersible pump and electric motors protection
- Resistance in oven with

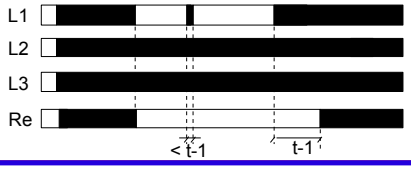
General:
In three phase systems, it measures RMS values of AC voltages, currents and system frequency sensitively. Using up direction button (Select) phase-neutral voltages and phase-phase voltages monitor sequentially.
ke-DP01 has many features.
Those are;

- Phase Failure	**(seq)**
- Phase Sequence	**(seq)**
- Over Voltage Protection	**(o - U)**
- Under Voltage Protection	**(u - U)**
- Voltage Unbalance (asymmetry) Protection	**(unb)**
- Over Current Protection	**(o - C)**
- Under Current Protection	**(u - C)**
- Current Unbalance (asymmetry) Protection	**(ubC)**
- Over Frequency Protection	**(o - F)**
- Under Frequency Protection	**(u - F)**

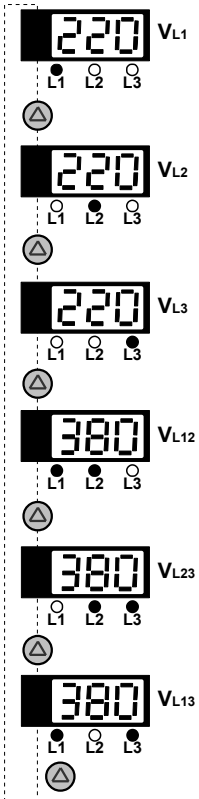
When device is turn on if its adjusted voltages and frequency in its interval and if phase sequence is correct relay switch on.
If any of error occurred (except phase failure and phase sequence) at the end of adjusted time relay switch off its contact. When system return normal values, at the end of time out relay switch on.

IMPORTANT: L1 - N is device supply inputs. Thus,the applied L1 – N voltage must be rated voltage of system . Otherwise normal led makes flash and the device switched off its output contact.
The measured frequency also must the frequency of the system.

Phase Failure: (u-U)
Before starting system , it controls phase absence then if all phases exits Normal LED turn on and relay contact switch on. In case of missing of any L1,L2,L3 phases , Normal LED turn off and relay switch off its contact .In this case **u-U** warn appears on display.



Display Functions:

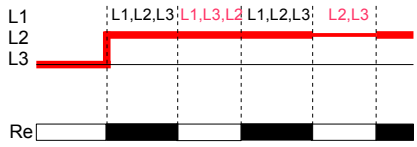


Special Buttons:

Select: (Up direction) when pressing continuously, screen displays frequency of system. When button release device continue to show voltage.

Reset:
If error case although disappeared then device is not return to normal, latch-function occurred and it makes locked device.
Or Lock-function (only for currents) may be occured.
After checking error in system then restart device with pushing reset button.

Phase Sequetion: (Seq)
In case of wrong phase order , Normal LED turned off and relay contact is not switch on. In this case **seq** warn appears on the screen. If phase order is corrected , Normal LED turned on and out relay switch on.

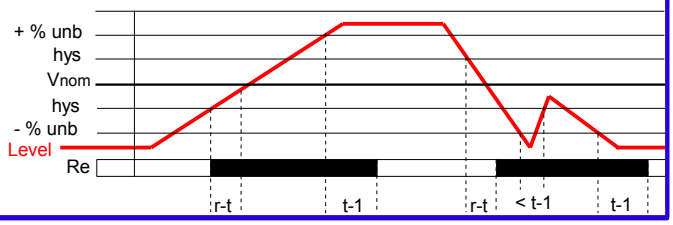


Voltage Unbalanced: (unb)
The phase-phase voltage unbalance limit can be adjusted between(5% - 20%) . When it exceeds the adjusted limit , the device switched off its out contact at the end of t-1 delay. In this case **unb** warn appears on the screen. For the returning normal state, asymmetry values should under 20% (hysteresis value). In this case at the end of t3 time Normal LED turned on and output contact switch on. If the phase-phase voltage unbalance, return adjusted value shorter than t-1 time, output relay does not release its contact.
Hysteresis is 20 %.
unb = 000(oFF) protection is disable .

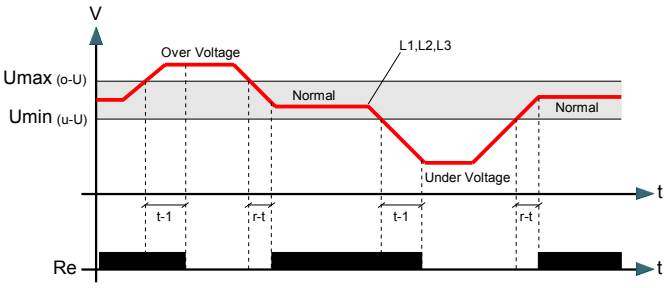
Example: Let's say that asymmetry value is set to %15 for a 3 x 380VAC.
In this case, relay contact switch off at (380-(380x0.15))=323 V.
Switch on the contact is performed at 323+(380x%15x%20)= 334V.
(%20 is the hysteresis).

$$\%\ unb = \frac{(V_{max} - V_{min})}{380} \times 100$$

$$Hys = 380 \times (\%\ Asm) \times (\%\ 20)$$

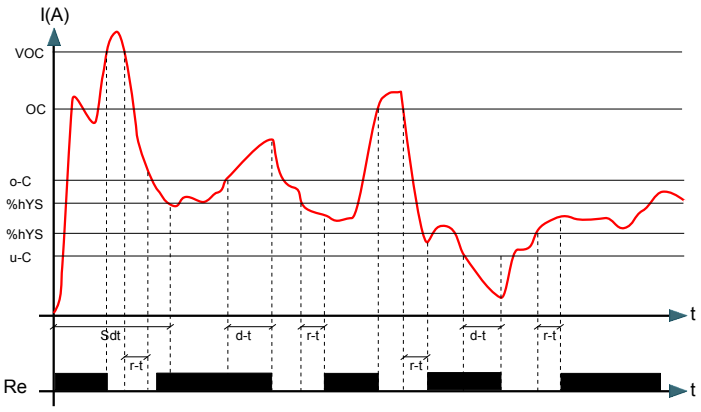


Over and Under Voltage : (o-U),(u-U)
Under voltage (u-U) it can adjusted between Umin= (300 – 370 V).
Over voltage (o-U) it can adjusted between Umax=(390 – 460 V).
If the voltage drops below the adjusted under voltage limit, when **u-U** shows on the screen and device switch off its output contact end of the t-1 time Normal LED turned on .In this case **u-U** warn appears on the screen.
If the voltage exceed the adjusted over voltage limit, Normal LED turned off and output relay switch off. In this case **o-U** warn appers on its screen.
Hysteresis is 6 V.



Over and Under Current : (o-C),(u-C)
Under Current (u-C)
Over Current (o-C)
When the current of the protected system goes below the adjusted value it switches off its output contact after **d-t** delay.
Normal LED turn off and relay switch off its contact .In this case **u-C** warn appears on display.
When any current passing through any phase of the protected system exceeds the adjusted value the device switches off its output contacts after a proper time (**d-t**).Normal LED turn off and relay switch off its contact .In this case **o-C** warn appears on display.

NOTE: *Under current protection set value with its hysteresis must not overlap with over current protection set value with its hysteresis or, the under current protection set value must not be higher than the over current protection set value.*

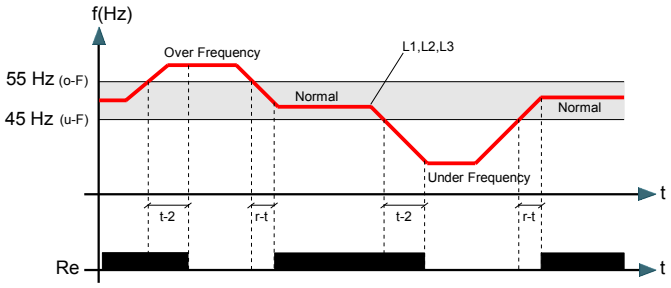


Start delay time: Sd-t
It can be set between 1 and 60 seconds.It is used to prevent the switch off from occurance because of the motor's inrush current.
This function can be disable if Sd-t value = 000 (oFF)
Return Time : r-t
it shows the delay time that device will wait to switch on its output relay when failure ends after a switch off. It can be set between 0,5 and 99,9 seconds.
Very Over Current Coefficient : VOC (Current Very Sudden Switch Off Protection)
It can be set by the user between 2,1 and 6.
When the current value exceeds the adjusted value within the start delay time, the device switches off, its output contact immediately.
Very Over Current value = (o – C) x (VOC)
This function can be disable if VOC = 000 (oFF)
Over Current Coefficient : OC (Current Sudden Switch Off Protection)
It can be set by the user between 1,1 and 2.
When the current value exceeds the adjusted value without the start delay time, the device switches off, its output contact immediately.
Over Current value = (o – C) x (OC)
This function can be disable if OC = 000 (oFF)

2.6 Asymmetric Current Protection:
It can be set by the user between 5% and 40%. It controls the asymmetric that may occur in the current of the three phases. That may occur when one of the phases' voltage is low and the other one is high. That may cause asymmetric current in the motor's bobbin. This way the motor's bobbin is protected. Furthermore it protects the motor from missing phase or a possible unplugged or cut wiring.
If the unbalance between the phases' current exceeds the adjusted value the switch off occurs after t-1 delay.
If the current unbalance exceed the adjusted value, Normal LED turned off and output relay switch off. In this case **ubC** warn appears on its screen.
This function can be disable if **ubC** value = 000 (oFF)

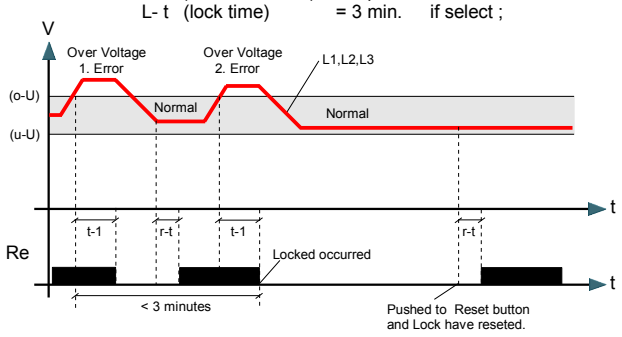
Over and/or Under Frequency Protection : (40 – 70 Hz)
Under Frequency be able to set between**(u-F)** = 40 Hz ...[(o-F) -0,4]
Over Frequency be able to set between **(o-F)** =[(u-F) + 0,4]...70 Hz
If required , it can be set only under frequency or only over frequency protection as well as both of protection can be disabled.

- If o-F = 55 Hz and u-F = oFF set, device works as over frequency protector only. (if system frequency above 55 Hz, under screen displays **o-F** warning and end of time t-2 relay switch off its output contact)
- if o-F = oFF and u-F = 45 Hz set , device works as under frequency protector only . (if system frequency below 45 Hz, under screen displays **u-F** warning and end of time **t-2** relay switch off its out contact.)
- if o-F = oFF and u-F = oFF set, frequency protection is disabled.

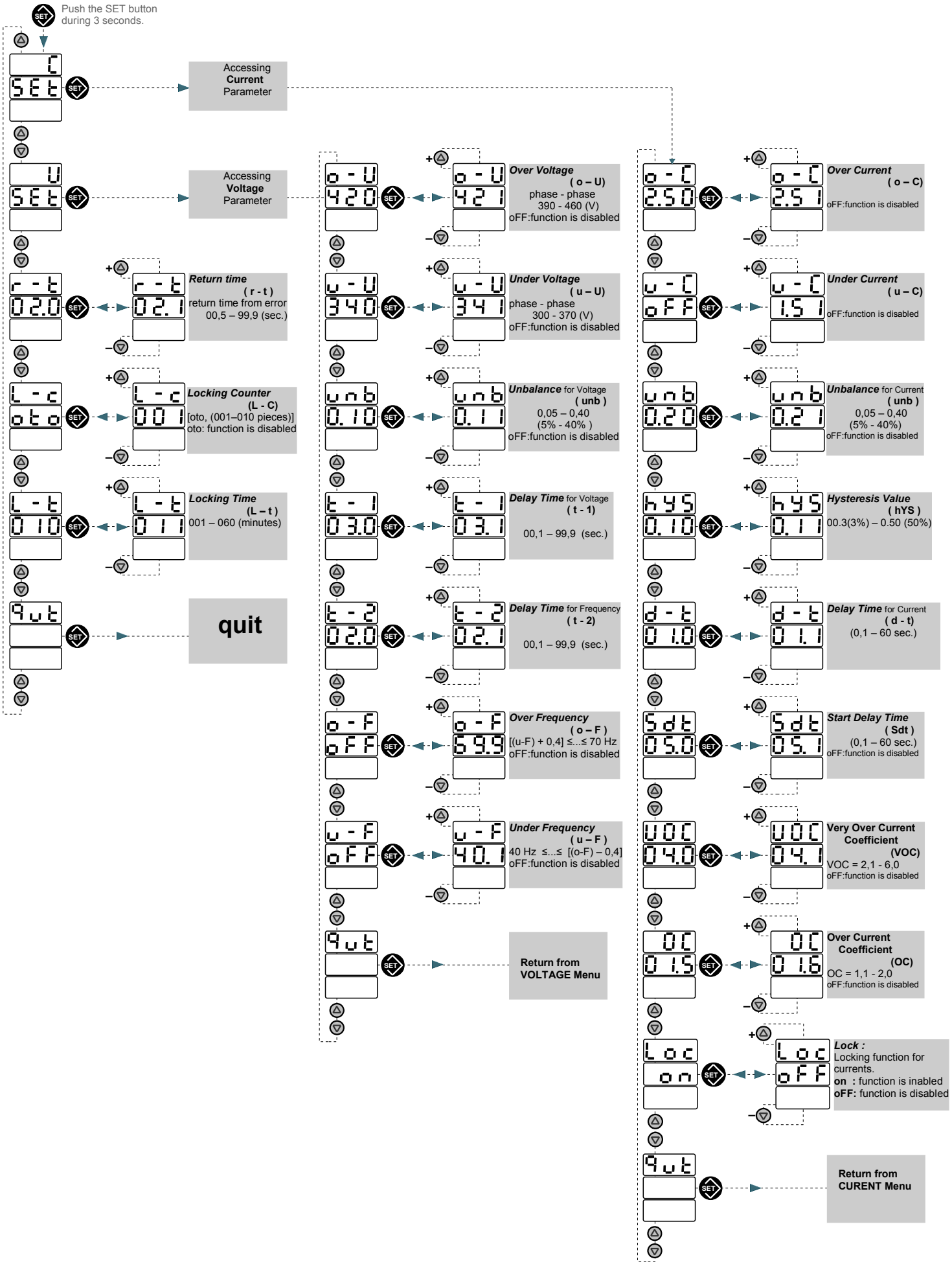


LOCKING FUNCTION :
It can be controlled by two parameters. Locking time and Locking counter. If the number of opening reaches the adjusted locking counter withing the adjusted locking time then device switch off its contact and locks its functions until the user pressed **Reset** button.
If the locking counter is adjusted to **oto** then this function is disable and device never locks itself.
L-t : Locking Time (001 – 060 min.)
It is well know the frequently occurring faults may damage system. For that the device when number of faults reaches the adjusted locking number within this locking time. This way the system is protected and user has chance to investigate the problem.
L-C : Locking Counter (oto , 001 – 010 piece)
The number of faults allowed within the period L-t. If number of faults exceeds this adjusted counter value device locks itself.
In this case (- - -) warn appears on its screen. User must press Reset button then the fault passes in order to unlock the device.
If **L- C** is set to **oto** then this property is disabled.

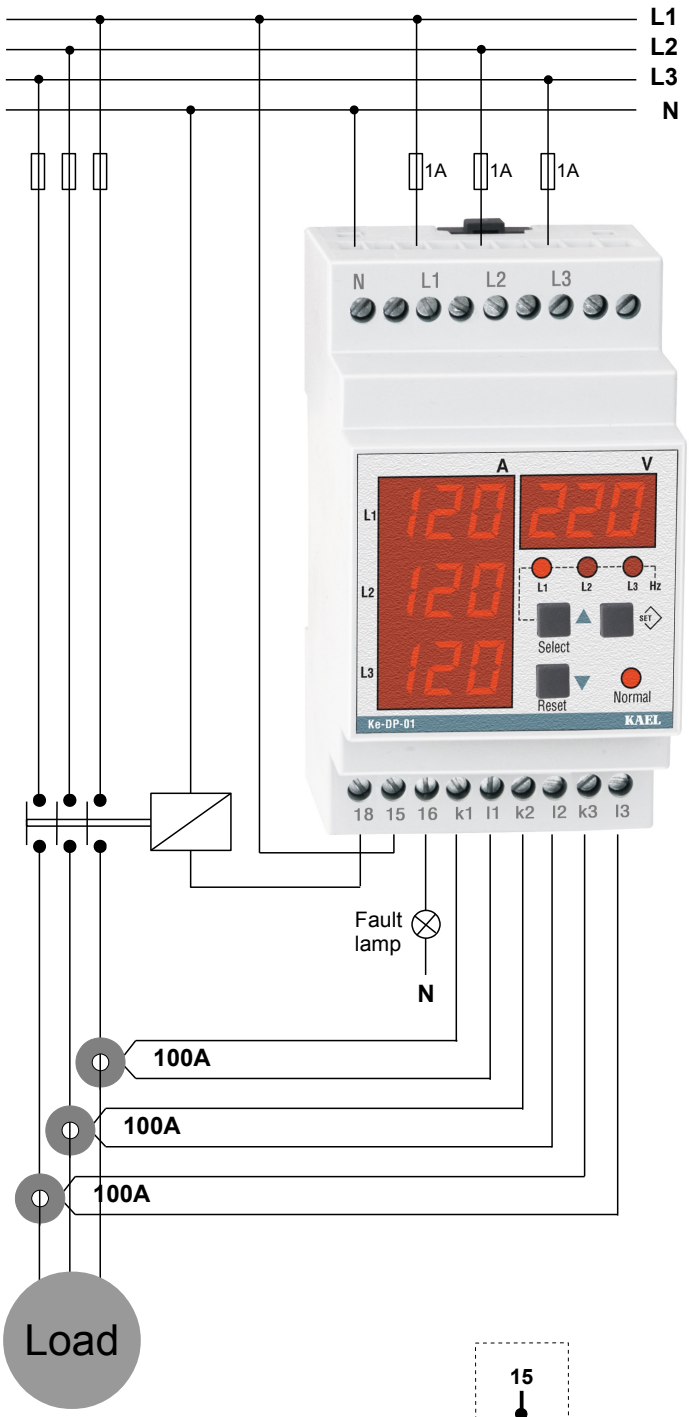
L- C (number of lock) = 2 piece
L- t (lock time) = 3 min. if select ;

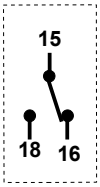


ACCESSING PARAMETER MENU:



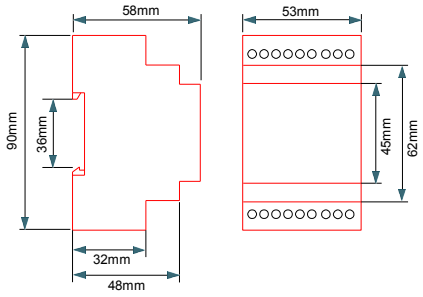
Connection :





TECHNICAL INFORMATION:

Rated Voltage (Un)	: 230Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Current Transformer Ratio	: X / 5A
Current Measurement Range	: 0 - 100 Amp AC
Voltage Measurement Range	: (Phase-Phase)10 - 500 Vac, 45 - 65Hz
	: (Phase-Neutral)10 - 300 Vac, 45 - 65Hz
	For power supply(L1 - N) 176V – 242V
Voltage Measurement Power Consumption	: <1VA (for one phase)
Measurement Sensitivity	: %1±1 digit
Contact Current	: Max. 3A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To connection rail in electrical panel
Dimension	:



ATTENTION !!!

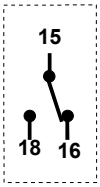
- Clean the device using dry dust cloth after turned off device.
- Read and follow the instruction on this manual and attached label.

ke-DP02

Digital Protector
One phase
Voltage – Current
and
Frequency control

Voltage (V)
Current (A)
Frequency (Hz)

- Over Voltage Protection
- Under Voltage Protection
- Over Current Protection
- Under Current Protection
- Over Frequency Protection
- Under Frequency Protection
- Latch Function
- **TRUE RMS**



General:
In one phase systems, it measures RMS values of AC voltage, current and system frequency sensitively.
ke-DP02 has many features.
Those are;

- Over Voltage Protection	**(o - U)**
- Under Voltage Protection	**(u - U)**
- Over Current Protection	**(o - C)**
- Under Current Protection	**(u - C)**
- Over Frequency Protection	**(o - F)**
- Under Frequency Protection	**(u - F)**

When device is turn on if its adjusted voltage and frequency in its interval relay switch on.
If any of error occurred at the end of adjusted time relay switch off its contact. When system return normal values, at the end of time out relay switch on.

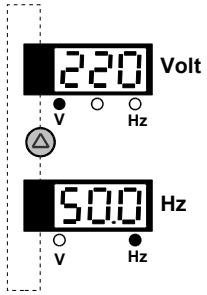
IMPORTANT: L - N is device supply inputs. Thus,the applied L – N voltage must be rated voltage of system . Otherwise normal led makes flash and the device switched off its output contact.
The measured frequency also must the frequency of the system.

Special Buttons:

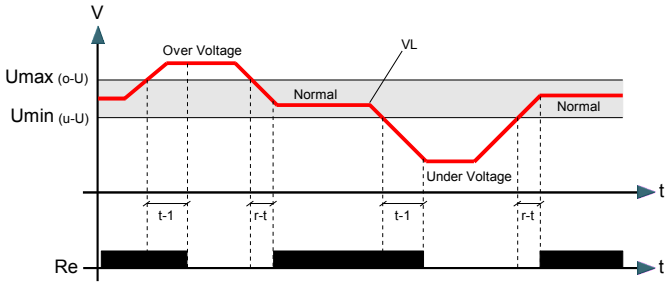
Select: (Up direction) when pressing continuously, screen displays frequency of system. When button release device continue to show voltage.

Reset:
If error case although disappeared then device is not return to normal, latch-function occurred and it makes locked device.
Or Lock-function (only for currents) may be occured.
After checking error in system then restart device with pushing reset button.

Display Functions

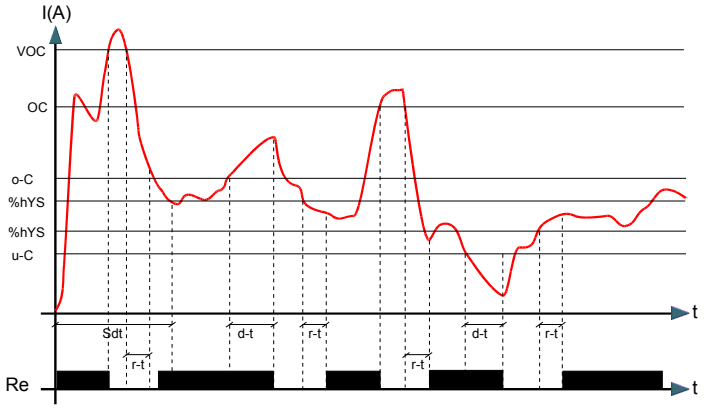


Over and Under Voltage : (o-U),(u-U)
Under voltage (u-U) it can adjusted between Umin= (180 – 225 V).
Over voltage (o-U) it can adjusted between Umax=(235 –275 V).
If the voltage drops below the adjusted under voltage limit, when **u-U** shows on the screen and device switch off its output contact end of the t-1 time Normal LED turned on .In this case **u-U** warn appears on the screen.
If the voltage exceed the adjusted over voltage limit, Normal LED turned off and output relay switch off. In this case **o-U** warn appers on its screen.
Hysteresis is 6 V.



Over and Under Current : (o-C),(u-C)
Under Current (u-C)
Over Current (o-C)
When the current of the protected system goes below the adjusted value it switches off its output contact after **d-t** delay.
Normal LED turn off and relay switch off its contact .In this case **u-C** warn appears on display.
When current passing through phase of the protected system exceeds the adjusted value the device switches off its output contacts after a proper time (**d-t**).Normal LED turn off and relay switch off its contact .In this case **o-C** warn appears on display.

NOTE: *Under current protection set value with its hysteresis must not overlap with over current protection set value with its hysteresis or, the under current protection set value must not be higher than the over current protection set value.*



Start delay time: Sd-t
It can be set between 1 and 60 seconds.It is used to prevent the switch off from occurance because of the motor's inrush current.
This function can be disable if Sd-t value = 000 (oFF)

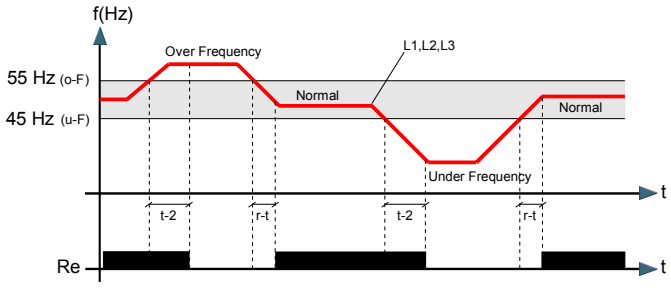
Return Time : r-t
it shows the delay time that device will wait to switch on its output relay when failure ends after a switch off. It can be set between 0,5 and 99,9 seconds.

Very Over Current Coefficient : VOC (Current Very Sudden Switch Off Protection)
It can be set by the user between 2,1 and 6.
When the current value exceeds the adjusted value within the start delay time, the device switches off, its output contact immediately.
Very Over Current value = (o – C) x (VOC)
This function can be disable if VOC = 000 (oFF)

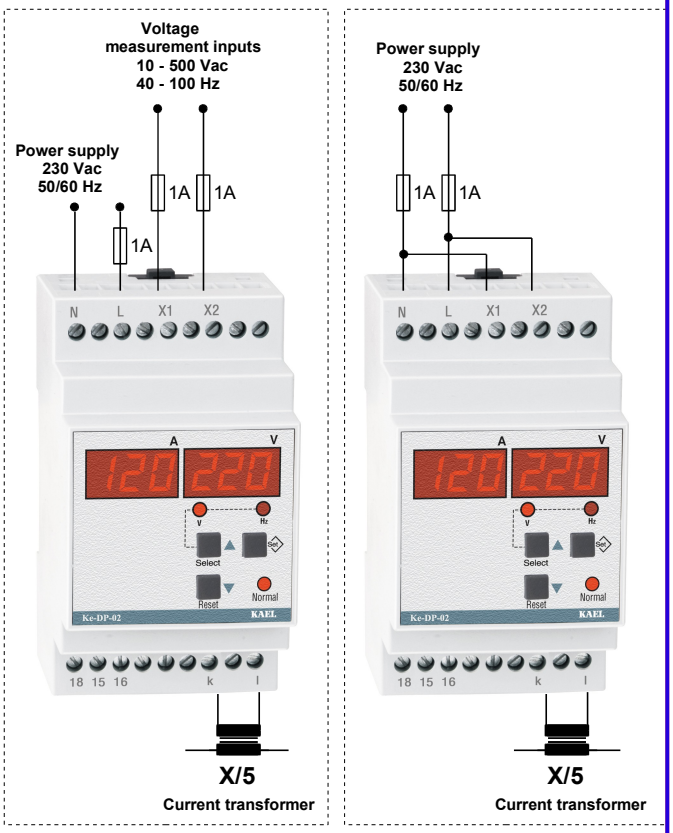
Over Current Coefficient : OC (Current Sudden Switch Off Protection)
It can be set by the user between 1,1 and 2.
When the current value exceeds the adjusted value without the start delay time, the device switches off, its output contact immediately.
Over Current value = (o – C) x (OC)
This function can be disable if OC = 000 (oFF)

Over and/or Under Frequency Protection : (40 – 70 Hz)
Under Frequency be able to set between**(u-F)** = 40 Hz ...[(o-F) -0,4]
Over Frequency be able to set between **(o-F)** =[(u-F) + 0,4]...70 Hz
If required , it can be set only under frequency or only over frequency protection as well as both of protection can be disabled.

- If o-F = 55 Hz and u-F = oFF set, device works as over frequency protector only. (if system frequency above 55 Hz, under screen displays **o-F** warning and end of time t-2 relay switch off its output contact)
- if o-F = oFF and u-F = 45 Hz set , device works as under frequency protector only . (if system frequency below 45 Hz, under screen displays **u-F** warning and end of time **t-2** relay switch off its out contact.)
- if o-F = oFF and u-F = oFF set, frequency protection is disabled.



Connection :



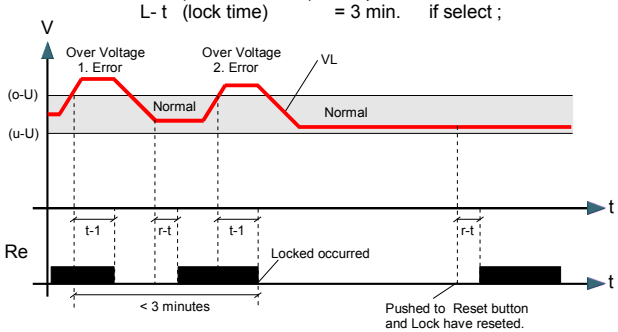
LOCKING FUNCTION :

It can be controlled by two parameters. Locking time and Locking counter. If the number of opening reaches the adjusted locking counter withing the adjusted locking time then device switch off its contact and locks its functions until the user pressed **Reset** button.
If the locking counter is adjusted to **oto** then this function is disable and device never locks itself.

L-t : Locking Time (001 – 060 min.)
It is well know the frequently occurring faults may damage system. For that the device when number of faults reaches the adjusted locking number within this locking time. This way the system is protected and user has chance to investigate the problem.

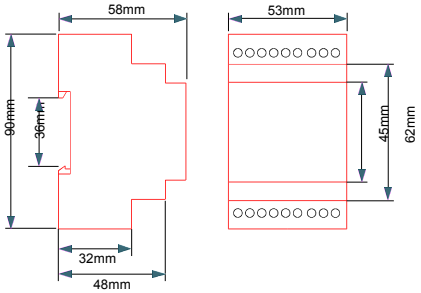
L-C : Locking Counter (oto , 001 – 010 piece)
The number of faults allowed within the period L-t. If number of faults exceeds this adjusted counter value device locks itself. In this case (**- - -**) warn appears on its screen. User must press Reset button then the fault passes in order to unlock the device. If **L- C** is set to **oto** then this property is disabled.

L- C (number of lock) = 2 piece
L- t (lock time) = 3 min. if select ;



TECHNICAL INFORMATION:

Rated Voltage (Un)	: 230Vac (L-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Current Transformer Ratio	: X / 5A
Current Measurement Range	: (for seconder current) 0,05 - 6 Amp AC
Voltage Measurement Range (X1, X2)	: 10 - 500 Vac, 40 - 100Hz
Voltage Measurement Power Consumption	: <1VA (for one phase)
Measurement Sensitivity	: %1±1 digit
Contact Current	: Max. 3A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To connection rail in electrical panel
Dimension	:

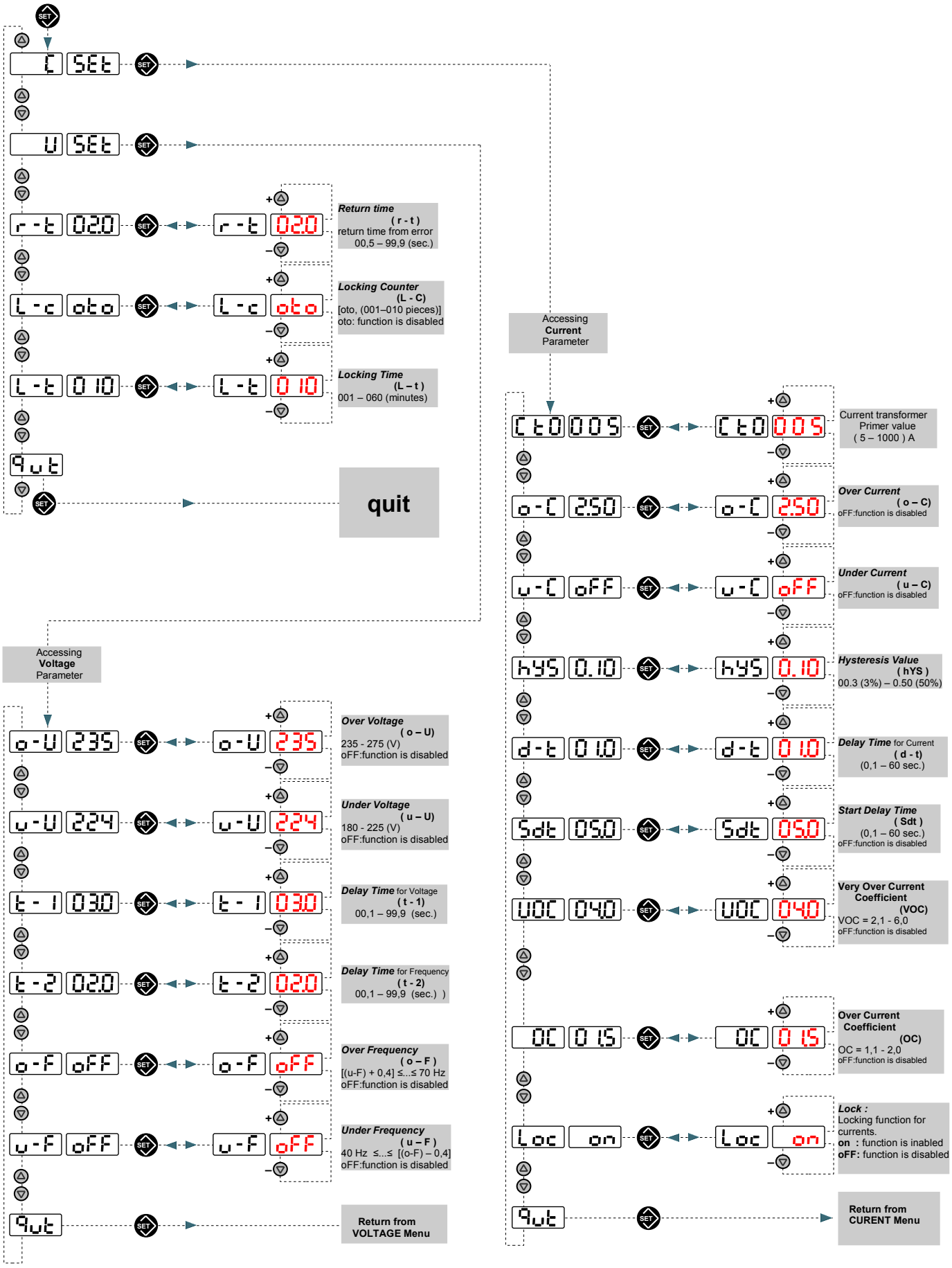


ATTENTION !!!

- Clean the device using dry dust cloth after turned off device.
- Read and follow the instruction on this manual and attached label.

ACCESSING PARAMETER MENU:

Push the SET button during 3 seconds.

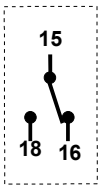


Ke-DP02 – 100 A

Digital Protector
One phase
Voltage – Current
and
Frequency control

Voltage (V)
Current (A)
Frequency (Hz)

- Over Voltage Protection
- Under Voltage Protection
- Over Current Protection
- Under Current Protection
- Over Frequency Protection
- Under Frequency Protection
- Latch Function
- **TRUE RMS**



General:
In one phase systems, it measures RMS values of AC voltage, current and system frequency sensitively.
ke-DP01 has many features.
Those are;

- Over Voltage Protection	**(o - U)**
- Under Voltage Protection	**(u - U)**
- Over Current Protection	**(o - C)**
- Under Current Protection	**(u - C)**
- Over Frequency Protection	**(o - F)**
- Under Frequency Protection	**(u - F)**

When device is turn on if its adjusted voltage and frequency in its interval relay switch on.
If any of error occurred at the end of adjusted time relay switch off its contact. When system return normal values, at the end of time out relay switch on.

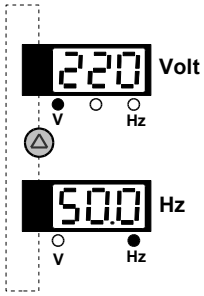
IMPORTANT: L - N is device supply inputs. Thus,the applied L – N voltage must be rated voltage of system . Otherwise normal led makes flash and the device switched off its output contact.
The measured frequency also must the frequency of the system.

Special Buttons:

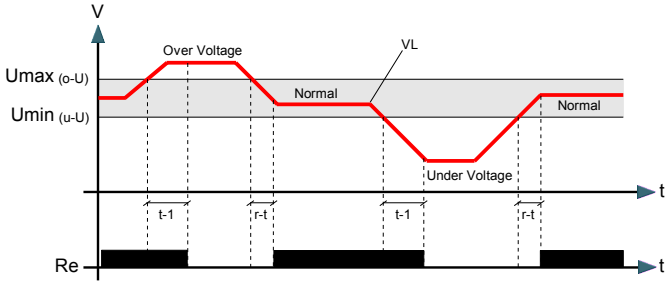
Select: (Up direction) when pressing continuously, screen displays frequency of system. When button release device continue to show voltage.

Reset:
If error case although disappeared then device is not return to normal, latch-function occurred and it makes locked device.
Or Lock-function (only for currents) may be occured.
After checking error in system then restart device with pushing reset button.

Display Functions

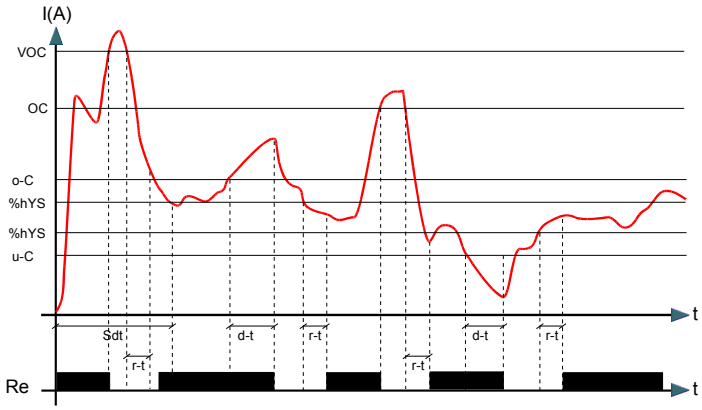


Over and Under Voltage : (o-U),(u-U)
Under voltage (u-U) it can adjusted between Umin= (180 – 225 V).
Over voltage (o-U) it can adjusted between Umax=(235 –275 V).
If the voltage drops below the adjusted under voltage limit, when **u-U** shows on the screen and device switch off its output contact end of the t-1 time Normal LED turned on .In this case **u-U** warn appears on the screen.
If the voltage exceed the adjusted over voltage limit, Normal LED turned off and output relay switch off. In this case **o-U** warn appers on its screen.
Hysteresis is 6 V.



Over and Under Current : (o-C),(u-C)
Under Current (u-C)
Over Current (o-C)
When the current of the protected system goes below the adjusted value it switches off its output contact after **d-t** delay.
Normal LED turn off and relay switch off its contact .In this case **u-C** warn appears on display.
When current passing through phase of the protected system exceeds the adjusted value the device switches off its output contacts after a proper time (**d-t**).Normal LED turn off and relay switch off its contact .In this case **o-C** warn appears on display.

NOTE: *Under current protection set value with its hysteresis must not overlap with over current protection set value with its hysteresis or, the under current protection set value must not be higher than the over current protection set value.*



Start delay time: Sd-t
It can be set between 1 and 60 seconds.It is used to prevent the switch off from occurance because of the motor's inrush current.
This function can be disable if Sd-t value = 000 (oFF)

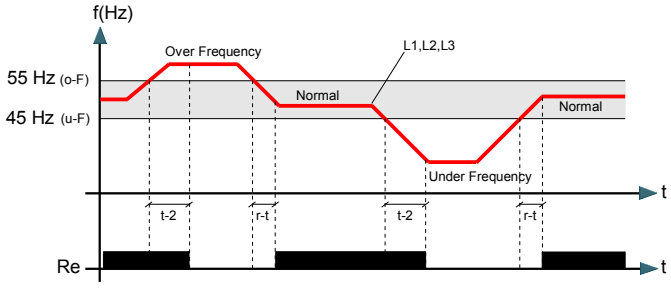
Return Time : r-t
it shows the delay time that device will wait to switch on its output relay when failure ends after a switch off. It can be set between 0,5 and 99,9 seconds.

Very Over Current Coefficient : VOC (Current Very Sudden Switch Off Protection)
It can be set by the user between 2,1 and 6.
When the current value exceeds the adjusted value within the start delay time, the device switches off, its output contact immediately.
Very Over Current value = (o – C) x (VOC)
This function can be disable if VOC = 000 (oFF)

Over Current Coefficient : OC (Current Sudden Switch Off Protection)
It can be set by the user between 1,1 and 2.
When the current value exceeds the adjusted value without the start delay time, the device switches off, its output contact immediately.
Over Current value = (o – C) x (OC)
This function can be disable if OC = 000 (oFF)

Over and/or Under Frequency Protection : (40 – 70 Hz)
Under Frequency be able to set between**(u-F)** = 40 Hz ...[(o-F) -0,4]
Over Frequency be able to set between **(o-F)** =[(u-F) + 0,4]...70 Hz
If required , it can be set only under frequency or only over frequency protection as well as both of protection can be disabled.

- If o-F = 55 Hz and u-F = oFF set, device works as over frequency protector only. (if system frequency above 55 Hz, under screen displays **o-F** warning and end of time t-2 relay switch off its output contact)
- if o-F = oFF and u-F = 45 Hz set , device works as under frequency protector only . (if system frequency below 45 Hz, under screen displays **u-F** warning and end of time **t-2** relay switch off its out contact.)
- if o-F = oFF and u-F = oFF set, frequency protection is disabled.



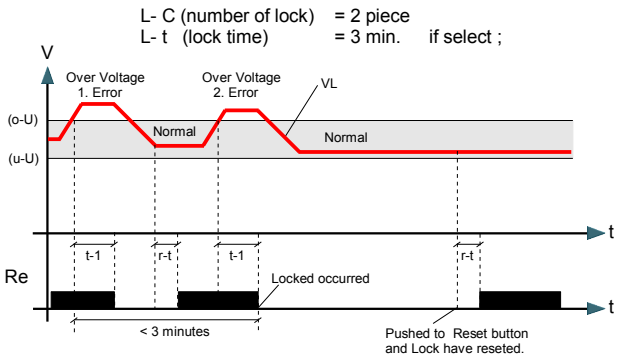
Connection :

LOCKING FUNCTION :

It can be controlled by two parameters. Locking time and Locking counter. If the number of opening reaches the adjusted locking counter withing the adjusted locking time then device switch off its contact and locks its functions until the user pressed **Reset** button.
If the locking counter is adjusted to **oto** then this function is disable and device never locks itself.

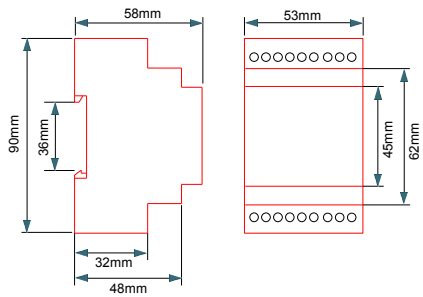
L-t : Locking Time (001 – 060 min.)
It is well know the frequently occurring faults may damage system. For that the device when number of faults reaches the adjusted locking number within this locking time. This way the system is protected and user has chance to investigate the problem.

L-C : Locking Counter (oto , 001 – 010 piece)
The number of faults allowed within the period L-t. If number of faults exceeds this adjusted counter value device locks itself. In this case (**- - -**) warn appears on its screen. User must press Reset button then the fault passes in order to unlock the device.
If **L- C** is set to **oto** then this property is disabled.



TECHNICAL INFORMATION:

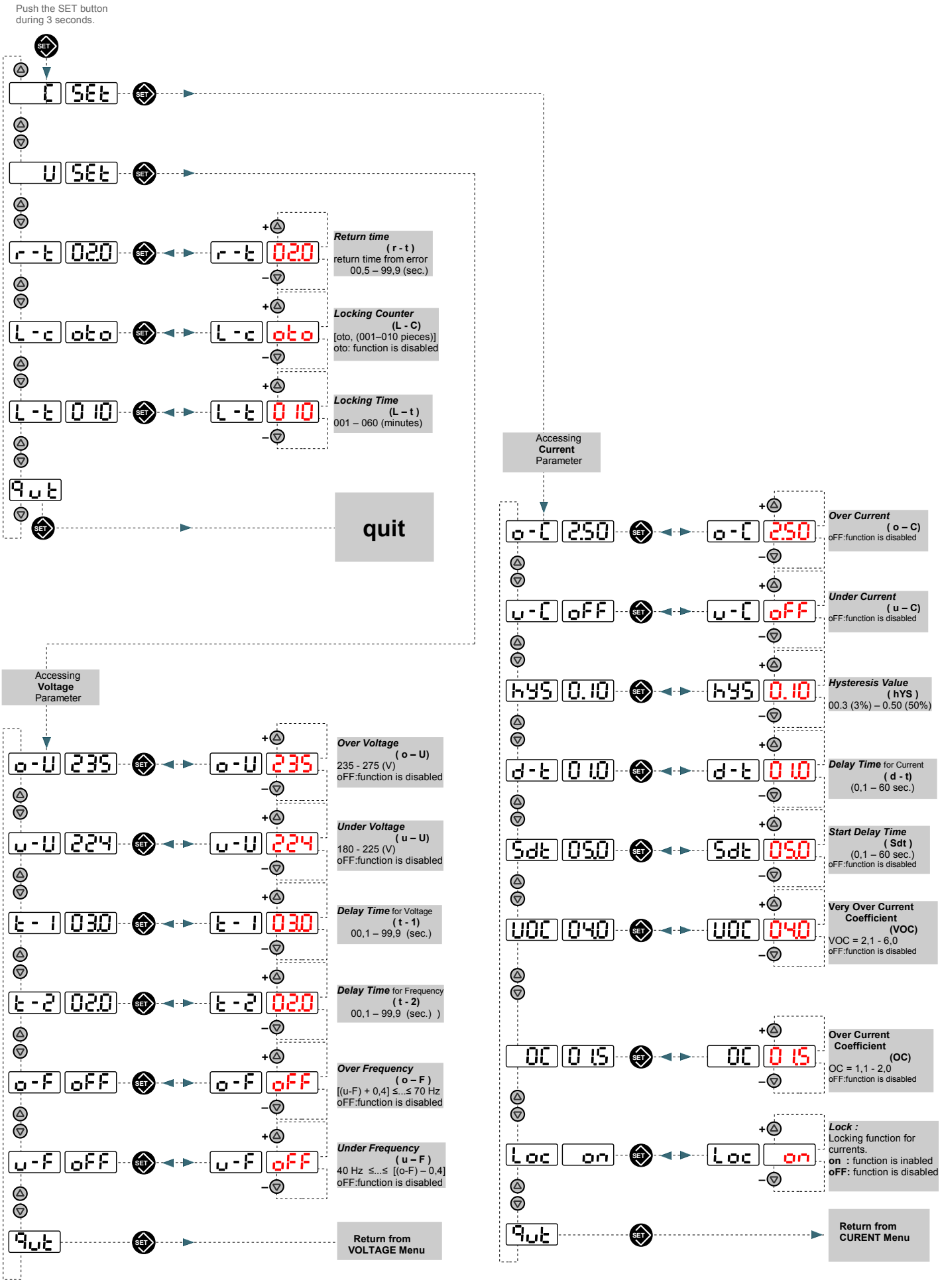
Rated Voltage (Un)	: 230Vac (L-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Current Transformer Ratio	: X / 5A
Current Measurement Range	: 0 -100 Amp AC
Voltage Measurement Range (X1, X2)	: 10 - 500 Vac, 40 - 100Hz
Voltage Measurement Power Consumption	: <1VA (for one phase)
Measurement Sensitivity	: %1±1 digit
Contact Current	: Max. 3A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To connection rail in electrical panel
Dimension	:



ATTENTION !!!

- Clean the device using dry dust cloth after turned off device.
- Read and follow the instruction on this manual and attached label.

ACCESSING PARAMETER MENU:



KAEL ISO 9001:2008 www.kael.com.tr

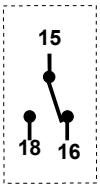
DP02-72

Digital Protector

One phase
Voltage – Current
and
Frequency control

Voltage (V)
Current (A)
Frequency (Hz)

- Over Voltage Protection
- Under Voltage Protection
- Over Current Protection
- Under Current Protection
- Over Frequency Protection
- Under Frequency Protection
- Latch Function
- **TRUE RMS**



General:
In one phase systems, it measures RMS values of AC voltage, current and system frequency sensitively.
DP02-72 has many features.
Those are;

- Over Voltage Protection	**(o - U)**
- Under Voltage Protection	**(u - U)**
- Over Current Protection	**(o - C)**
- Under Current Protection	**(u - C)**
- Over Frequency Protection	**(o - F)**
- Under Frequency Protection	**(u - F)**

When device is turn on if its adjusted voltage and frequency in its interval relay switch on.
If any of error occurred at the end of adjusted time relay switch off its contact. When system return normal values, at the end of time out relay switch on.

⚠

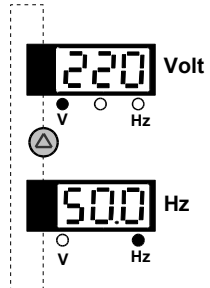
IMPORTANT: L - N is device supply inputs. Thus,the applied L – N voltage must be rated voltage of system . Otherwise normal led makes flash and the device switched off its output contact.
The measured frequency also must the frequency of the system.

Special Buttons:

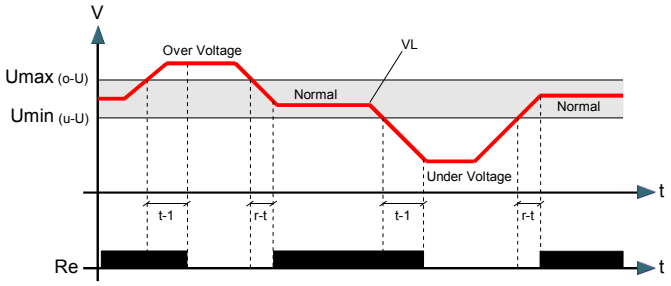
Select: (Up direction) when pressing continuously, screen displays frequency of system. When button release device continue to show voltage.

Reset:
If error case although disappeared then device is not return to normal, latch-function occurred and it makes locked device.
Or Lock-function (only for currents) may be occured.
After checking error in system then restart device with pushing reset button.

Display Functions

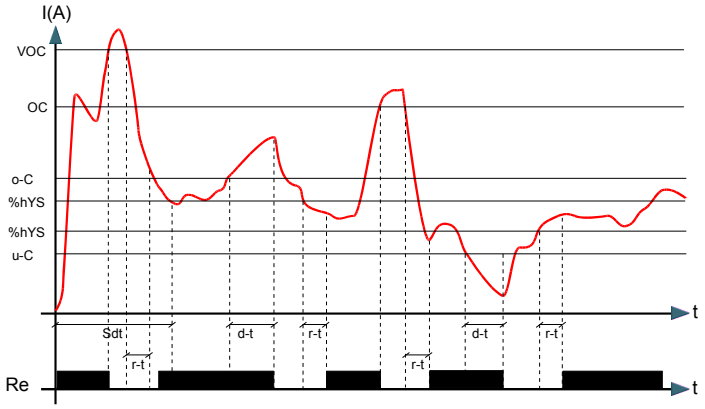


Over and Under Voltage : (o-U),(u-U)
Under voltage (u-U) it can adjusted between Umin= (180 – 225 V).
Over voltage (o-U) it can adjusted between Umax=(235 –275 V).
If the voltage drops below the adjusted under voltage limit, when **u-U** shows on the screen and device switch off its output contact end of the t-1 time Normal LED turned on .In this case **u-U** warn appears on the screen.
If the voltage exceed the adjusted over voltage limit, Normal LED turned off and output relay switch off. In this case **o-U** warn appers on its screen.
Hysteresis is 6 V.



Over and Under Current : (o-C),(u-C)
Under Current (u-C)
Over Current (o-C)
When the current of the protected system goes below the adjusted value it switches off its output contact after **d-t** delay.
Normal LED turn off and relay switch off its contact .In this case **u-C** warn appears on display.
When current passing through phase of the protected system exceeds the adjusted value the device switches off its output contacts after a proper time (**d-t**).Normal LED turn off and relay switch off its contact .In this case **o-C** warn appears on display.

NOTE: *Under current protection set value with its hysteresis must not overlap with over current protection set value with its hysteresis or, the under current protection set value must not be higher than the over current protection set value.*



Start delay time: Sd-t
It can be set between 1 and 60 seconds.It is used to prevent the switch off from occurance because of the motor's inrush current.
This function can be disable if Sd-t value = 000 (oFF)

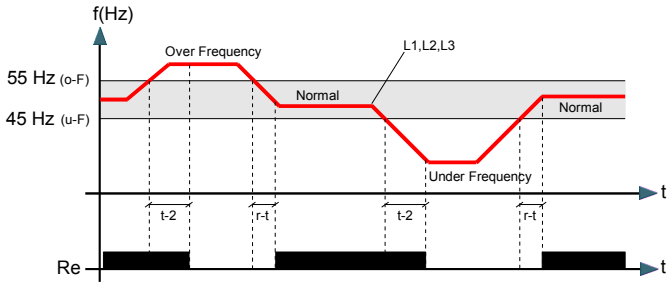
Return Time : r-t
it shows the delay time that device will wait to switch on its output relay when failure ends after a switch off. It can be set between 0,5 and 99,9 seconds.

Very Over Current Coefficient : VOC (Current Very Sudden Switch Off Protection)
It can be set by the user between 2,1 and 6.
When the current value exceeds the adjusted value within the start delay time, the device switches off, its output contact immediately.
Very Over Current value = (o – C) x (VOC)
This function can be disable if VOC = 000 (oFF)

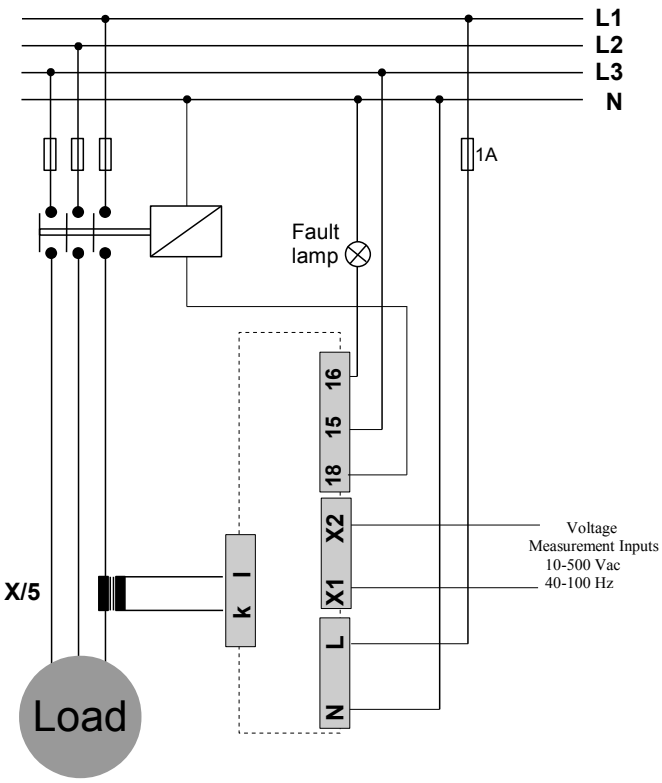
Over Current Coefficient : OC (Current Sudden Switch Off Protection)
It can be set by the user between 1,1 and 2.
When the current value exceeds the adjusted value without the start delay time, the device switches off, its output contact immediately.
Over Current value = (o – C) x (OC)
This function can be disable if OC = 000 (oFF)

Over and/or Under Frequency Protection : (40 – 70 Hz)
Under Frequency be able to set between**(u-F)** = 40 Hz ...[(o-F) -0,4]
Over Frequency be able to set between **(o-F)** =[(u-F) + 0,4]...70 Hz
If required , it can be set only under frequency or only over frequency protection as well as both of protection can be disabled.

- If o-F = 55 Hz and u-F = oFF set, device works as over frequency protector only. (if system frequency above 55 Hz, under screen displays **o-F** warning and end of time t-2 relay switch off its output contact)
- if o-F = oFF and u-F = 45 Hz set , device works as under frequency protector only . (if system frequency below 45 Hz, under screen displays **u-F** warning and end of time **t-2** relay switch off its out contact.)
- if o-F = oFF and u-F = oFF set, frequency protection is disabled.



Connection :



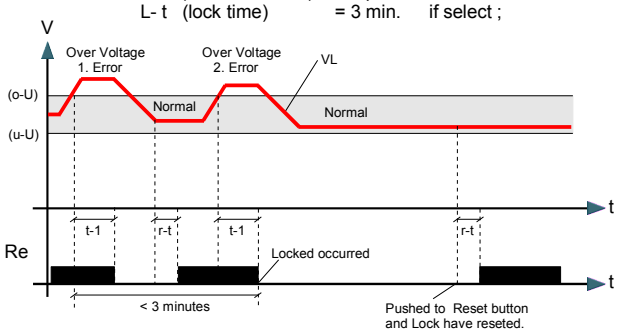
LOCKING FUNCTION :

It can be controlled by two parameters. Locking time and Locking counter. If the number of opening reaches the adjusted locking counter withing the adjusted locking time then device switch off its contact and locks its functions until the user pressed **Reset** button.
If the locking counter is adjusted to **oto** then this function is disable and device never locks itself.

L-t : Locking Time (001 – 060 min.)
It is well know the frequently occurring faults may damage system. For that the device when number of faults reaches the adjusted locking number within this locking time. This way the system is protected and user has chance to investigate the problem.

L-C : Locking Counter (oto , 001 – 010 piece)
The number of faults allowed within the period L-t. If number of faults exceeds this adjusted counter value device locks itself.
In this case (**- - -**) warn appears on its screen. User must press Reset button then the fault passes in order to unlock the device.
If **L- C** is set to **oto** then this property is disabled.

L- C (number of lock) = 2 piece
L- t (lock time) = 3 min. if select ;



TECHNICAL INFORMATION:

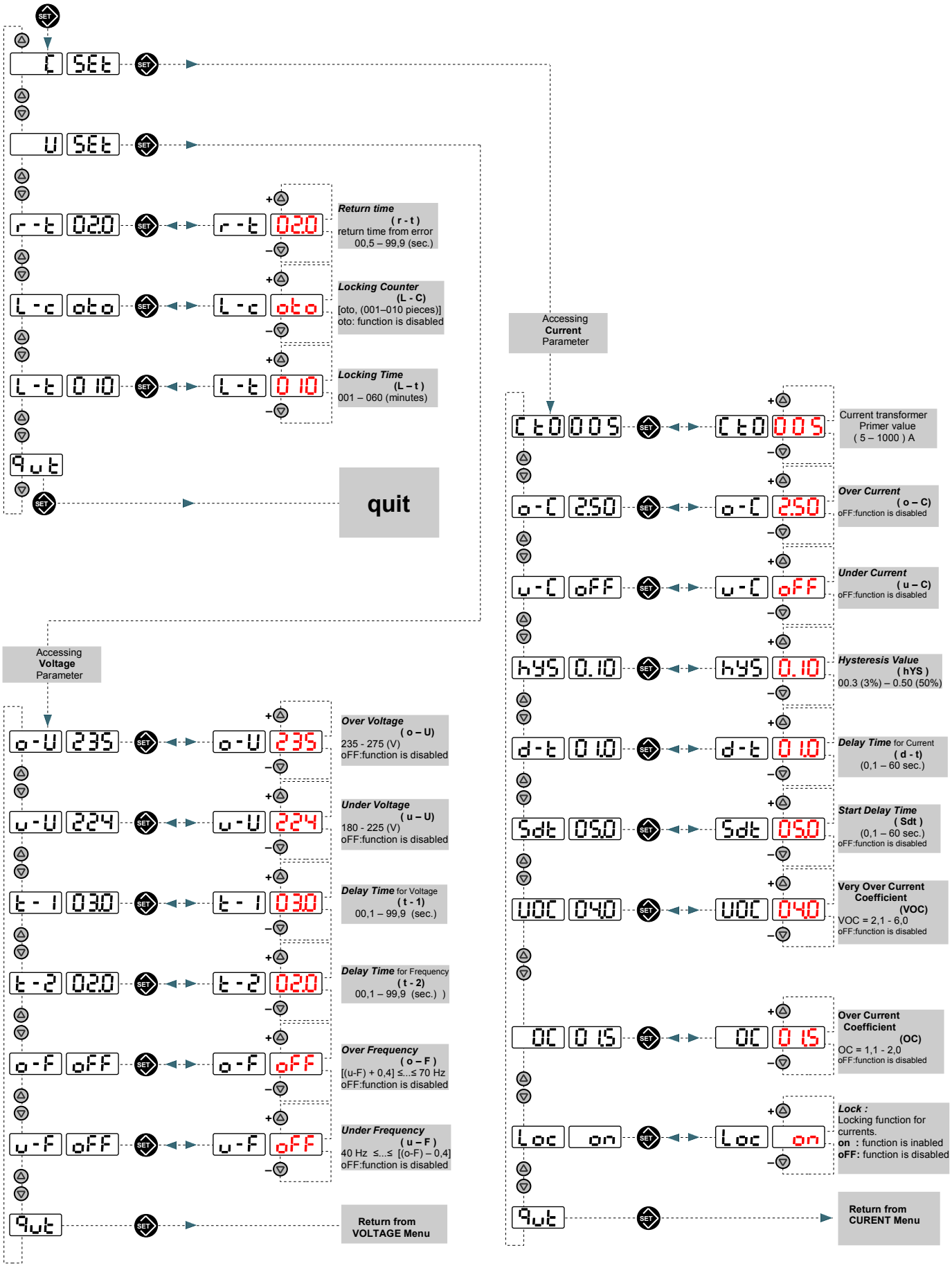
Rated Voltage (Un)	: 230Vac (L-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Current Transformer Ratio	: X / 5A
Current Measurement Range	: (for seconder current) 0,05 - 6 Amp AC
Voltage Measurement Range (X1, X2)	: 10 - 500 Vac, 40 - 100Hz
Voltage Measurement Power Consumption	: <1VA (for one phase)
Measurement Sensitivity	: %1±1 digit
Contact Current	: Max. 3A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To front panel tap
Dimensions	: 72x72x80 mm

ATTENTION !!!

- Clean the device using dry dust cloth after turned off device.
- Read and follow the instruction on this manual and attached label.

ACCESSING PARAMETER MENU:

Push the SET button during 3 seconds.



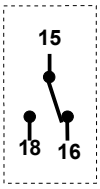
DP02-72-100A

Digital Protector

One phase
Voltage – Current
and
Frequency control

Voltage (V)
Current (A)
Frequency (Hz)

- Over Voltage Protection
- Under Voltage Protection
- Over Current Protection
- Under Current Protection
- Over Frequency Protection
- Under Frequency Protection
- Latch Function
- **TRUE RMS**



General:
In one phase systems, it measures RMS values of AC voltage, current and system frequency sensitively.
DP02-72-100A has many features.
Those are;

- Over Voltage Protection	**(o - U)**
- Under Voltage Protection	**(u - U)**
- Over Current Protection	**(o - C)**
- Under Current Protection	**(u - C)**
- Over Frequency Protection	**(o - F)**
- Under Frequency Protection	**(u - F)**

When device is turn on if its adjusted voltage and frequency in its interval relay switch on.
If any of error occurred at the end of adjusted time relay switch off its contact. When system return normal values, at the end of time out relay switch on.

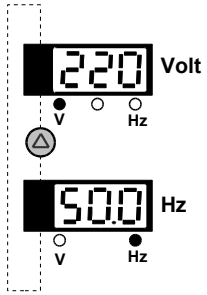
IMPORTANT: L - N is device supply inputs. Thus,the applied L – N voltage must be rated voltage of system . Otherwise normal led makes flash and the device switched off its output contact.
The measured frequency also must the frequency of the system.

Special Buttons:

Select: (Up direction) when pressing continuously, screen displays frequency of system. When button release device continue to show voltage.

Reset:
If error case although disappeared then device is not return to normal, latch-function occurred and it makes locked device.
Or Lock-function (only for currents) may be occured.
After checking error in system then restart device with pushing reset button.

Display Functions



Over and Under Voltage : (o-U),(u-U)
Under voltage (u-U) it can adjusted between Umin= (180 – 225 V).
Over voltage (o-U) it can adjusted between Umax=(235 –275 V).
If the voltage drops below the adjusted under voltage limit, when **u-U** shows on the screen and device switch off its output contact end of the t-1 time Normal LED turned on .In this case **u-U** warn appears on the screen.
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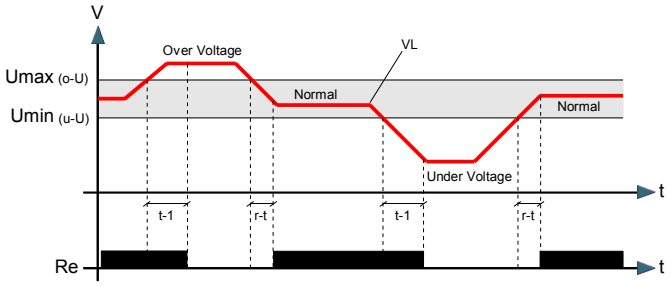
Hysteresis is 6 V.



Over and Under Current : (o-C),(u-C)
Under Current (u-C)
Over Current (o-C)
When the current of the protected system goes below the adjusted value it switches off its output contact after **d-t** delay.
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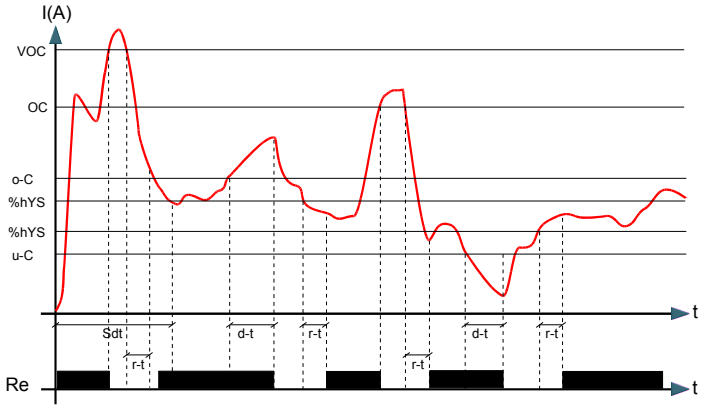
When current passing through phase of the protected system exceeds the adjusted value the device switches off its output contacts after a proper time (**d-t**).Normal LED turn off and relay switch off its contact .In this case **o-C** warn appears on display.

NOTE: *Under current protection set value with its hysteresis must not overlap with over current protection set value with its hysteresis or, the under current protection set value must not be higher than the over current protection set value.*



Start delay time: Sd-t
It can be set between 1 and 60 seconds.It is used to prevent the switch off from occurance because of the motor's inrush current.
This function can be disable if Sd-t value = 000 (oFF)

Return Time : r-t
it shows the delay time that device will wait to switch on its output relay when failure ends after a switch off. It can be set between 0,5 and 99,9 seconds.

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It can be set by the user between 1,1 and 2.
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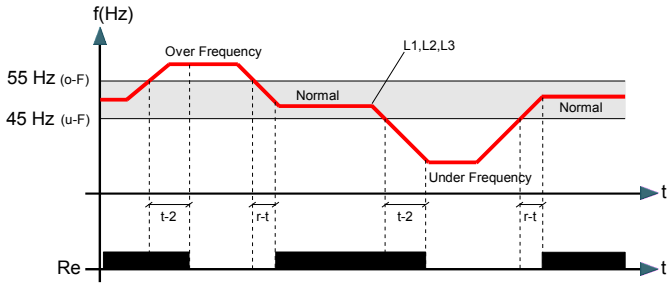
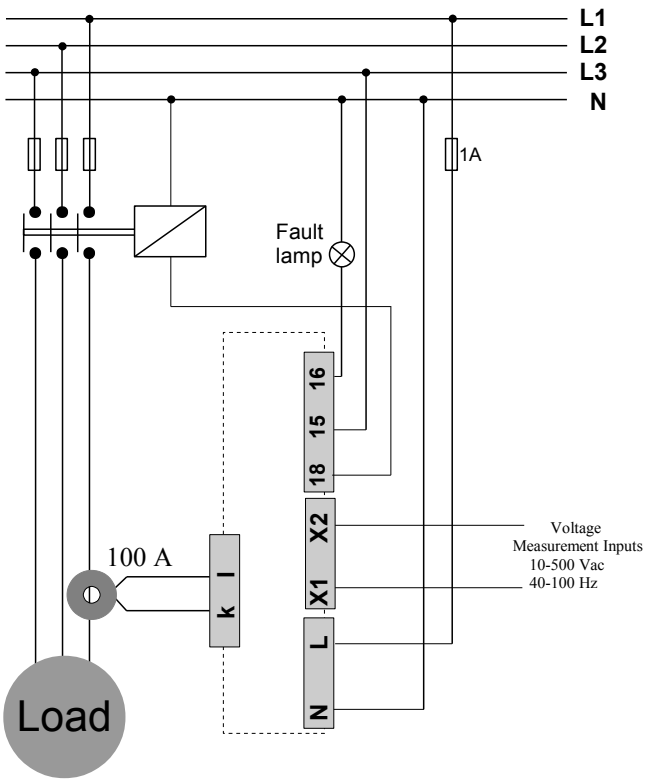


Connection :



LOCKING FUNCTION :

It can be controlled by two parameters. Locking time and Locking counter. If the number of opening reaches the adjusted locking counter withing the adjusted locking time then device switch off its contact and locks its functions until the user pressed **Reset** button.
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L- C (number of lock) = 2 piece
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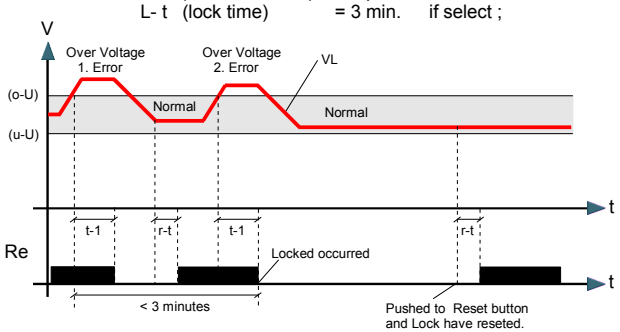


TECHNICAL INFORMATION:

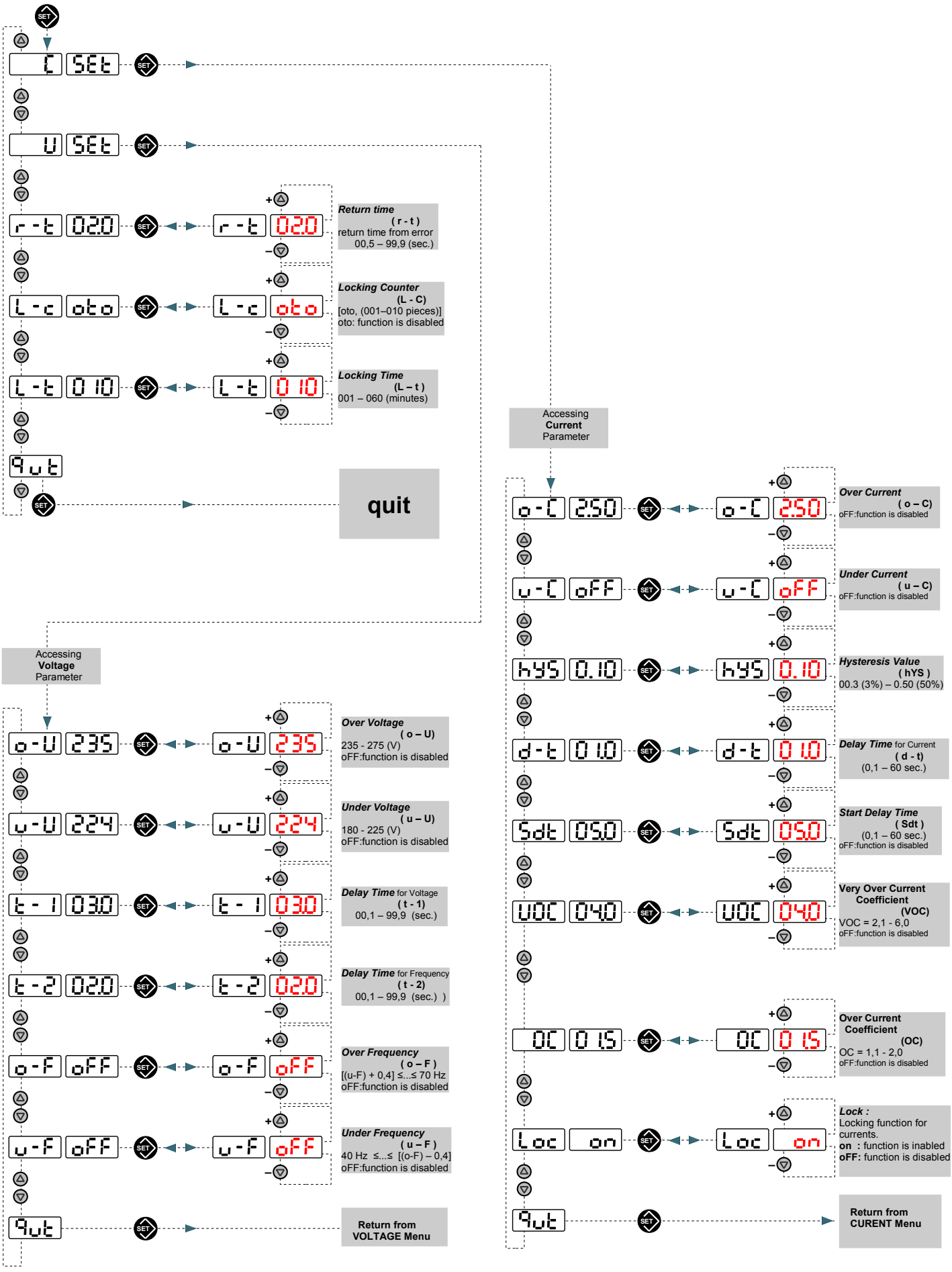
Rated Voltage (Un)	: 230Vac (L-N)
Operating Range	: (0,8-1,1) x Un
Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Current Measurement Range	: 0-100 Amp Ac
Voltage Measurement Range	: 10 - 500 Vac, 40 - 100Hz (X1, X2)
Voltage Measurement Power Consumption	: <1VA (for one phase)
Measurement Sensitivity	: %1±1 digit
Contact Current	: Max. 3A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To front panel tap
Dimensions	: 72x72x80 mm

ATTENTION !!!

- Clean the device using dry dust cloth after turned off device.
- Read and follow the instruction on this manual and attached label.

ACCESSING PARAMETER MENU:

Push the SET button during 3 seconds.

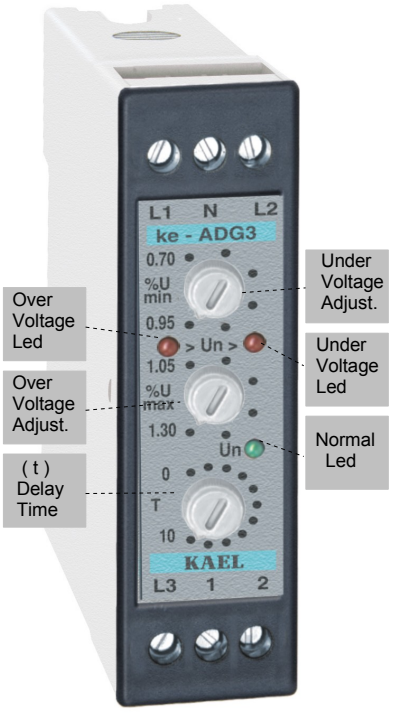


ke – ADG

OVER and UNDER VOLTAGE CONTROL RELAY

- ► Over & Under Voltage % Adjustment
- ► Phase Failure
- ► Phase Sequence
- ► Delay Time Adjustment

PRODUCTION CODE	VOLTAGE ADJUSTMENT INTERVAL (%)		TIME DELAY INTERVAL		SUDDEN OPENING <0,65xUn >1,35xUn	PHASE SEQUENCE CONTROL	TRI PHASE	MONO PHASE	USAGE FIELDS	DIMENSIONS
	Under Voltage % (<Un)	Over Voltage % (>Un)	Time Delay	Function						
ke-ADG31	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 s.	Off Delay	•		•		Command, control or compensation systems, electrical motors, condensers	23x82x80 mm
ke-ADG33	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 s.	Off Delay	•	•	•			
ke-ADG35	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 min.	On Delay	•		•		Air conditioners and compressors	
ke-ADG37	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 min.	On Delay	•	•	•			
ke-ADG11	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 s.	Off Delay	•			•	Command, control systems	
ke-ADG15	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 min.	On Delay	•			•	Air conditioners.	

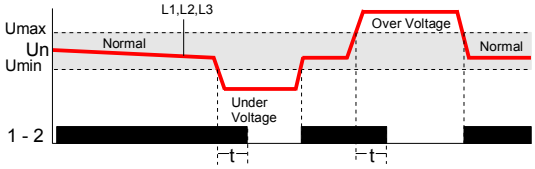


General:
Microprocessor controlled. Three or single phase relay is used in systems exposed to over or under voltage, such as command, control or compensation systems and protects devices such as condensers, motors, air conditioners and compressors.
It is divided into sub-categories depending on the voltage adjustment range, phase sequencing control, on or off start modes.

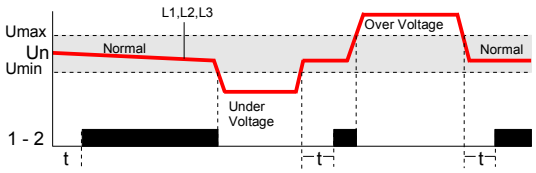
► **Phase Sequencing Control :** For the models with phase sequencing control, when device is energized, if the phase sequence is wrong, over (>Un) and under (<Un) LEDS are turned on together and phase sequence error is indicated. Meanwhile, Normal LED (Un) is turned off and relay contact is open circuit. In case of phase sequence is correct and phase voltages are in adjusted percentage range, the delay time for turning the Normal LED on and energizing the relay depends on the Off Delay or On Delay type of device. For further information please refer to graph 1 & 2 and Delay Time Modes section of this manual.

► **Delay Time Modes :** There are two types, one is Off-Delay and the other is On-Delay.

■ **Off Delay :** (refer graph 1)
If phase voltages are in the adjusted percentage range, normal LED turns on and relay contact is energized. When adjusted over or under voltage limit is exceeded 1-10 sec delay time is started. During this time interval, appropriate error LED is also on together with Normal LED and at the end of delay time, Normal LED is turned on and relay contact is de-energized. When the error condition is disappeared, Normal LED is turned on and relay contact is re-energized.



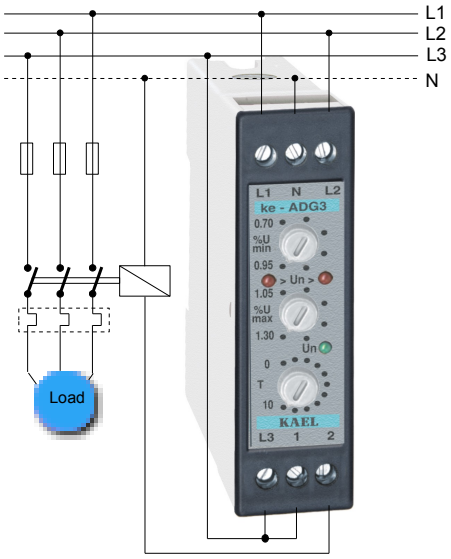
■ **On Delay :** If phase voltages are in the adjusted percentage range, adjusted delay time, 1-10 min, is counted and at the end of delay time Normal LED is turned on and relay contact is energized.
When adjusted over or under voltage limit is exceeded, Normal LED is turned on and relay contact is de-energized immediately, without waiting any delay time. When the phase voltages return into adjusted normal range (also considering the difference), adjusted 1-10 min delay time is counted and at the end of this time, Normal LED is turned on and relay contact is re-energized.



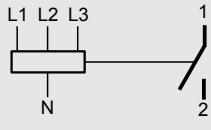
► **Sudden Switch Off :** When any phase voltage's difference respect to nominal voltage exceeds 35%, without any time delay Normal LED is turned off and relay contact is de-energized.

► **Voltage Adjustment Range :**
Umin= (0.70 – 0.95) x Un;
Umax= (1.05-1.30)xUn
When the adjusted limits are not exceeded, Normal (Un) LED is on and the relay contact is energized.

Simple Connection :

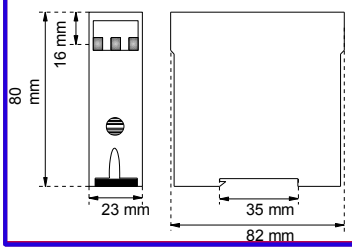


L1,L2,L3 : 3 x 380 V ac
L1,N : 220 V ac



TECHNICAL DATA:

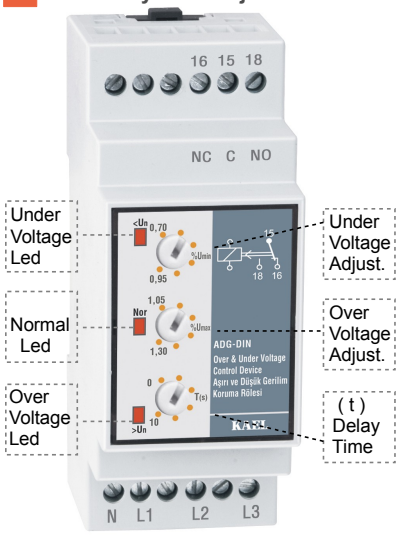
Rated Voltage, Un	: 3 phase and 1 neutral 230 VAC
Operating Range	: (0,5-1,5) x Un (Un nominal votlage)
Frequency	: 50/60 Hz
Over and Under Voltage Adjustment Range	: Please refer to table
Delay Time Adj.	: Please refer to table
Sudden Switch Off	: Below Un x 0.65 and above Un x 1.35
Sudden Switch Off Time	: 500 msec
Output Contacts (1-2)	: Normally Open Contact
Contact Current	: max. 5A/240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5 °C.....+50 °C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm



ADGxx-DIN

OVER and UNDER VOLTAGE CONTROL RELAY

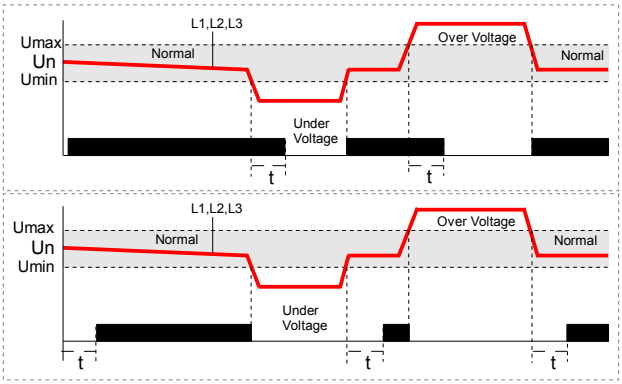
- ► Over & Under Voltage % Adjustment
- ► Phase Failure
- ► Phase Sequence
- ► Delay Time Adjustment



PRODUCTION CODE	VOLTAGE ADJUSTMENT INTERVAL (%)		TIME DELAY INTERVAL		SUDDEN OPENING <0,65xUn >1,35xUn	PHASE SEQUENCE CONTROL	TRI PHASE	MONO PHASE	USAGE FIELDS	DIMENSIONS
	Under Voltage % (<Un)	Over Voltage % (>Un)	Time Delay	Function						
ADG-31	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 s.	Off Delay	•		•		Command, control or compensation systems, electrical motors, condensers	35x90x58
ADG-33	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 s.	Off Delay	•	•	•			
ADG-35	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 min.	On Delay	•		•		Air conditioners and compressors	
ADG-37	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 min.	On Delay	•	•	•			
ADG-11	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 s.	Off Delay	•			•	Command, control systems	
ADG-15	(0,70-0,95)xUn	(1,05-1,30)xUn	1-10 min.	On Delay	•			•	Air conditioners.	

General:
Microprocessor controlled. Three or single phase relay is used in systems exposed to over or under voltage, such as command, control or compensation systems and protects devices such as condensers, motors, air conditioners and compressors.
It is divided into sub-categories depending on the voltage adjustment range, phase sequencing control, on or off start modes.

► **Phase Sequencing Control :** For the models with phase sequencing control, when device is energized, if the phase sequence is wrong, over (>Un) and under (<Un) LEDS are turned on together and phase sequence error is indicated. Meanwhile, Normal LED (Un) is turned off and relay contact is open circuit. In case of phase sequence is correct and phase voltages are in adjusted percentage range, the delay time for turning the Normal LED on and energizing the relay depends on the Off Delay or On Delay type of device. For further information please refer to graph 1 & 2 and Delay Time Modes section of this manual.



► **Delay Time Modes :** There are two types, one is Off-Delay and the other is On-Delay.

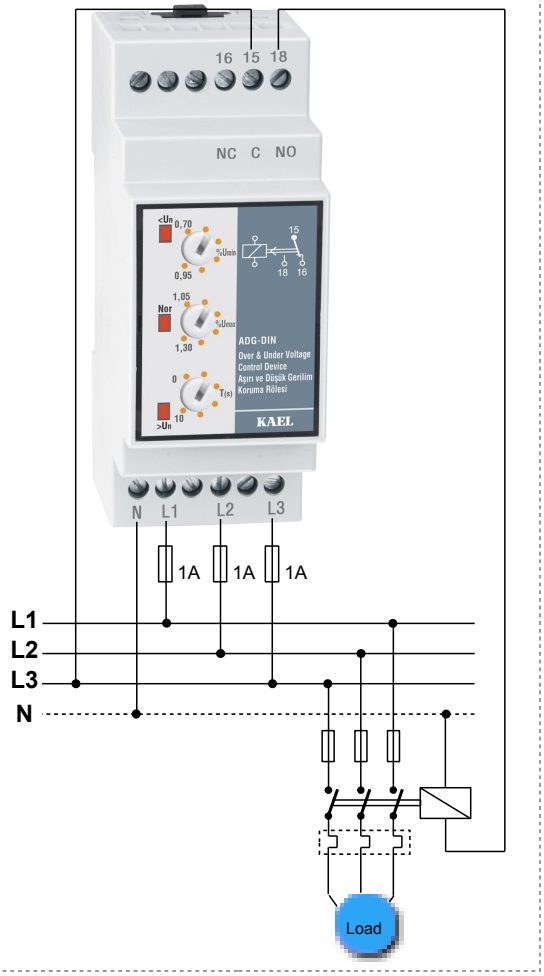
■ **Off Delay :** (refer graph 1)
If phase voltages are in the adjusted percentage range, normal LED turns on and relay contact is energized. When adjusted over or under voltage limit is exceeded 1-10 sec delay time is started. During this time interval, appropriate error LED is also on together with Normal LED and at the end of delay time, Normal LED is turned on and relay contact is de-energized. When the error condition is disappeared, Normal LED is turned on and relay contact is re-energized.

■ **On Delay :** If phase voltages are in the adjusted percentage range, adjusted delay time, 1-10 min, is counted and at the end of delay time Normal LED is turned on and relay contact is energized. When adjusted over or under voltage limit is exceeded, Normal LED is turned on and relay contact is de-energized immediately, without waiting any delay time. When the phase voltages return into adjusted normal range (also considering the difference), adjusted 1-10 min delay time is counted and at the end of this time, Normal LED is turned on and relay contact is re-energized.

► **Sudden Switch Off :** When any phase voltage's difference respect to nominal voltage exceeds 35%, without any time delay Normal LED is turned off and relay contact is de-energized.

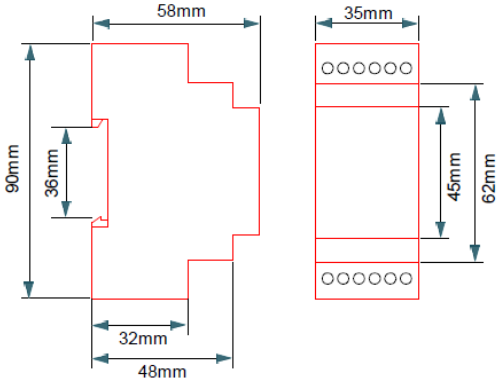
► **Voltage Adjustment Range :**
Umin= (0.70 – 0.95) x Un;
Umax= (1.05 – 1.30) x Un ; When the adjusted limits are not exceeded, Normal (Un) LED is on and the relay contact is energized.

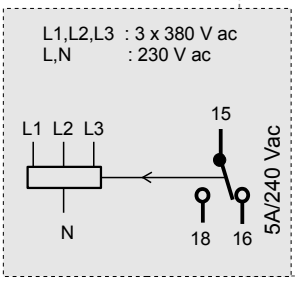
Connection Scheme



TECHNICAL DATA:

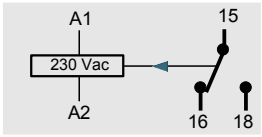
Rated Voltage	: 3 Phase and 1 Neutral; 230 Vac)
Operating Range	: (0.5 – 1.5) x Un ; (Un nominal voltage)
Frequency	: 50/60 Hz
Over and Under Voltage Adjustment Range	: Please refer to table
Delay Time Adj.	: Please refer to table
Sudden Switch Off	: Below Un x 0.65 and above Un x 1.35
Sudden Switch Off Time	: 500 msec
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 35x90x58 mm

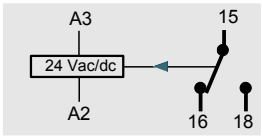




ke – ZR30

30 Sec. TIME RELAY

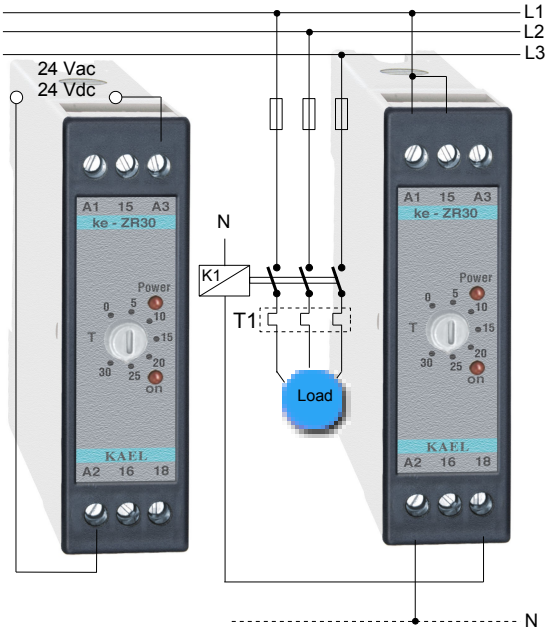




► Operating Principle:

When 230 Vac is feed from the A1 – A2 terminals, the power led becomes on and the time starts to count. At the end of the adjusted time, on led turns on and switches on the contact of the output relay.
Until the energy on the A1 and A2 terminals is cut off, the contacts don't change their positions. When the energy is cut off, the relay resets itself.

Simple Connection :



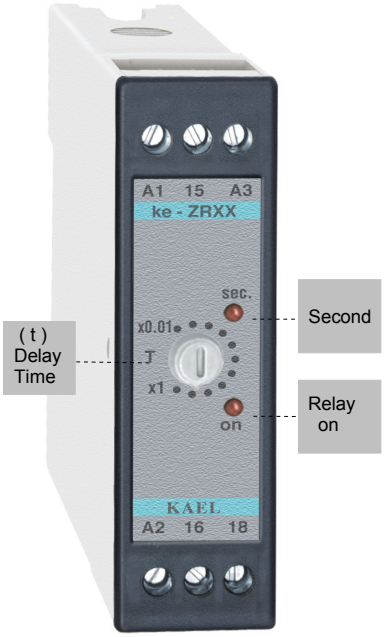
TECHNICAL DATA:

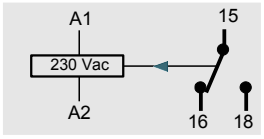
Operational Voltage (Un)	
A1 – A2 terminals	: 230 Vac
A3 – A2 terminals	: 24 Vac or 24 Vdc
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm

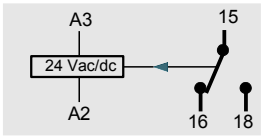
ke – ZRXX

MULTI FUNCTION TIME RELAY

- ► 32 Time Interval Selection
- ► Off – On Delay Operation Selection
- ► 230 Vac or 24 V ac/dc







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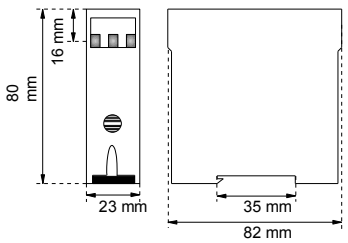
Dimensions	: 23x82x80 mm

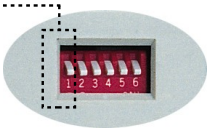


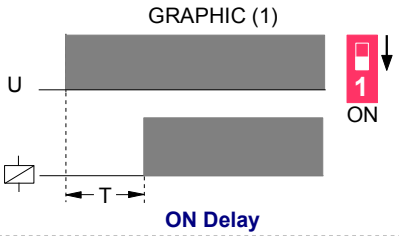
General:

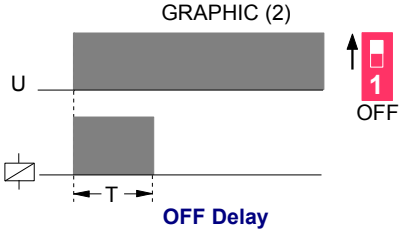
It is microprocessor controlled. It is possible to make 32 different time interval selections by using the dip-switch that is located near the equipment. Also, on-off start mode is selectable.

► OPERATIONAL MODE SELECTION:

The dip-switch, numbered as 1, determines the operational mode.
If it is adjusted to the on position, the equipment starts in on-delay mode (graphic 1).
While in the off position, it starts in off-delay mode (graphic 2).

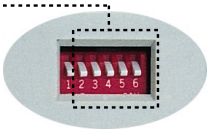






► TIME INTERVAL SELECTION:

You may select the desired time interval by using the 2,3,4,5,6 numbered switches of the dip-switch that are at the side of the equipment. The time selection table is given below.



Min - Max	Min - Max	Min - Max	Min - Max
0,1 – 1sec	0,7 – 70sec	12 sec – 20 min	1 min – 100 min
0,1 – 5sec	0,8 – 80sec	18 sec – 30 min	2 min – 200 min
0,1 – 10sec	0,9 – 90sec	24 sec – 40 min	3 min – 5 hrs
0,2 – 20sec	1 – 100sec	30 sec – 50 min	6 min – 10 hrs
0,3 – 30sec	2 – 200sec	36 sec – 60 min	9 min – 15 hrs
0,4 – 40sec	3 sec - 5 min	42 sec – 70 min	12 min – 20 hrs
0,5 – 50sec	6 sec – 10 min	48 sec – 80 min	15 min – 25 hrs
0,6 – 60sec	9 sec - 15 min	54 sec – 90 min	18 min – 30 hrs

► THE TIME ADJUSTMENT SCALER:

The scaler of the adjustment potentiometer located over the equipment, is set from 0,1 to 1. When you select your adjustment with the dip-switch, it can be adjusted at the range specified by the interval mode, by the steps of 1%.

Example 1:

1sec–100sec

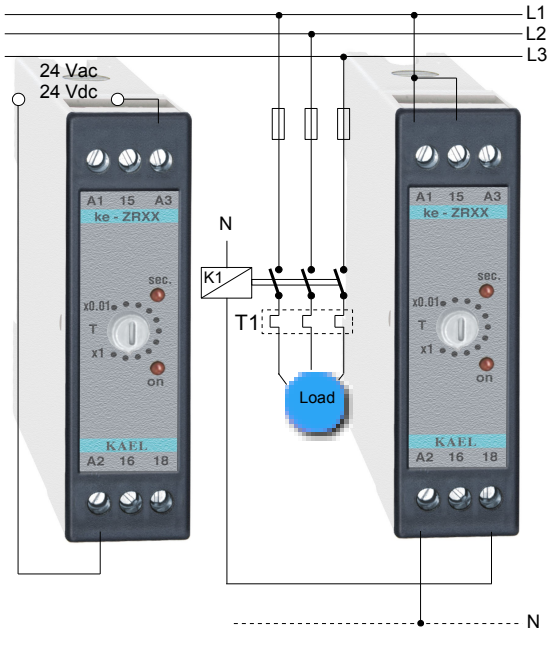
If you had already selected the time interval mode above, in the situation of the potentiometer becoming maximum, the relay would have counted 100 sec; while in minimum, it would have counted 1 sec. You can do your adjustment at steps of 1 sec. (The min. value in the table is the adjustment step period)

Example 2:

12sec–20 min

At this time interval, though you can do your adjustment in the of 12 sec. to max.1200 sec=20 minutes, by the steps of12 sec (The min. value in the table is the adjustment step period). If you adjust the potentiometer to the 0,4 point on the scaler, the time counted by the equipment, will be calculated in the following manner. **Time =0,4 x 20 min=8 minutes** (The 20 minute value in the formula is the maximum value of the time interval that you have selected with the dip-switch).

Simple Connection :



ke-ZRXX (D)

KAEL ISO 9001:2008 www.kael.com.tr ®

Multi Function Digital Timer

- Time Interval
  0,1 ..... 9999 sec
  0,1 ..... 9999 min
- 2 Relay Output
- 19 different function
- Start Input :
  NPN with proximity sensor or switch
- Easy Programming

General

Device is microprocessor based. Many time relay applications collect inside. Sensitively time adjustment of classic time relays cause problems,then it is developed fully digital. There are 19 different applications of functions selection inside. Moreover some applications need to start input. Because of this reason using with both NPN type proximity sensor and switch.

Advance Programming

For safe access parameters in this section ,pressing both up and down buttons during 2 sec. same time. Firstly during 1 sec Prog will appear then **P – ...** function number will appear and set LED start to flash.

Function Selection :
In this section determining device work in which function. Therefore need to enter number of selected function,In this section press Set button and when **P-....** flashing then using direction button come to related function number then press Set button to store.

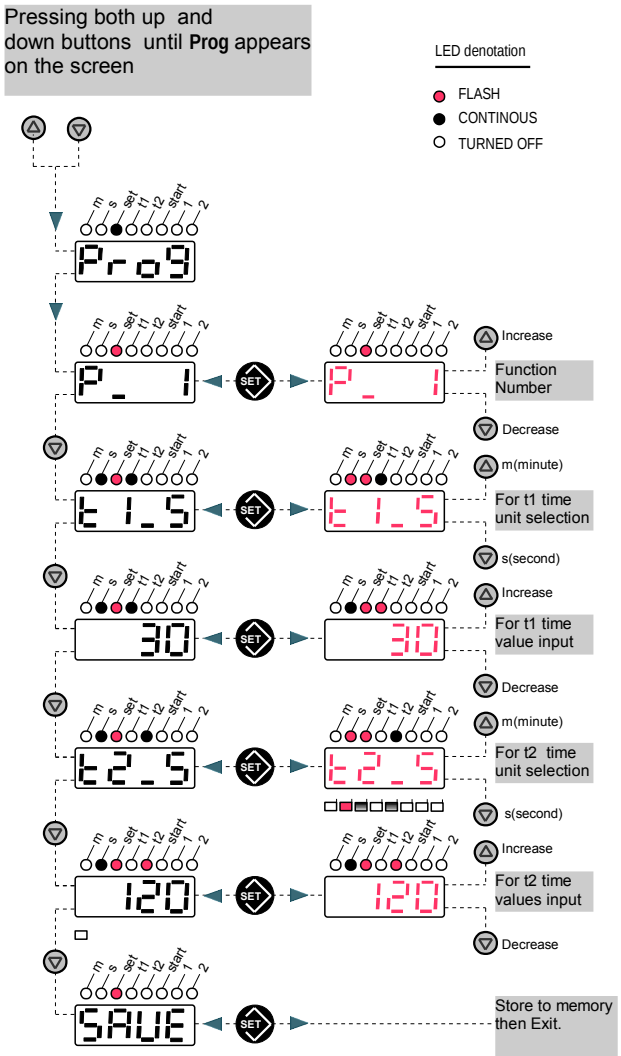
For t1 Time Unit Selection : Minutes (min),Second (s)
According to selected function, device accessing to t1 unit if t2 available to t2 unit decide itself . After function selection when down button pressed t1-S displayed on screen which is relating to unit of first time (t1). While Set LED flashing Unit LED where is memory related t1 LED with t1 time (min or sec) turned on. For changing this unit press to Set button. t1-S appears ,Set LED and Unit LED flash. In this case using direction buttons provide turning on min(minute) or s(second) LED and repressed Set button stored selected time for t1.

For t1 Time Value Selection : 0,1 – 9999
After time unit selection when pressing down button one time then t1 value displays on the screen. Meanwhile turning on selected time unit LED and t1 LED Set LED flash. For changing value press SET button then numeric value,set LED and t1 LED start to flash. Using direction buttons come required time value and pressing SET to store value to memory.

For t2 Time Unit Selection : Minute (min), Second(s)
If t2 using only in selected function device turn on its t2 settings. Otherwise any parameter does not return related to t2. After time values selection for t1 then when press down button displays t2-S to screen, which is related to second time(t2) unit appears. While Set LED flashes unit LED(min or s) where is memory related t2 LED with t2 time. For changing this unit press to Set button t2-S appears,set LED and unit LED flash. In this case using direction buttons proving turning on min (minute) or s(second) and repress Set stored selected time for t2.

For t2 Time Value Selection : 0,1 – 9999
After time unit selection when down direction button press once t2`s numeric values appears. Meanwhile turning on selected time unit LED and t1 LED Set LED flash. For changing value press SET button then numeric value, set LED and t2 LED start to flash. Using direction buttons come required time value and pressing SET to store value to memory.

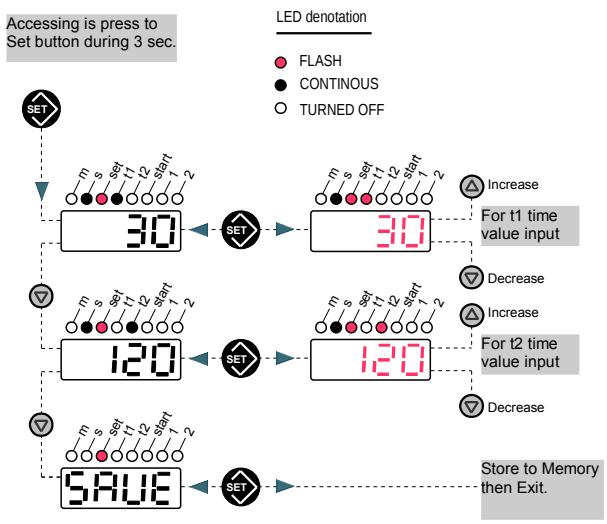
Storing Memory:
Press last of all down direction button and **SAVE** appears on the screen. In this case pressing Set button all data stored to memory and start work device according to function. If not press Set when device screen is SAVE all change cancel. Device continue to work current functions.



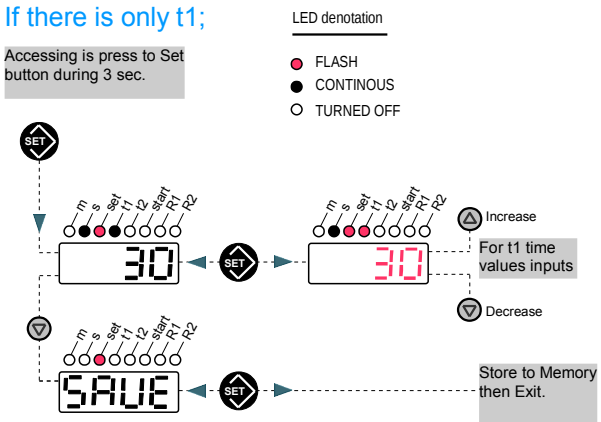
User Menu

This is adjusting section for end-users. When device working 3 sec. Press to Set button for entering this section. t1 LED and t1 time unit LED (second and minute) turned on, Set LED flash and t1 time related values comes to screen from memory. For changing t1 time, press to Set button t1 and set LED with values where is on screen start to flash. Using direction find required time values and press set button then quiting from t1 time adjustment. If t1 time values does not require changing, press down direction button ,if there is t2 time in selected function, t2 LED and t2 time unit (second and minute) turn on, set LED flash and memory value comes to screen related with t2 time. For changing t2 time value press set button t2 and Set LEDs with value where is on screen start to flash. Using direction button find required time and press to set button and quitting from t2 time adjustment. Therefore press down button and **SAVE** appear on the screen. In this case if press Set button all changes store to memory and device continue to work. Otherwise all changes cancel.

If function have both t1 and t2 ;



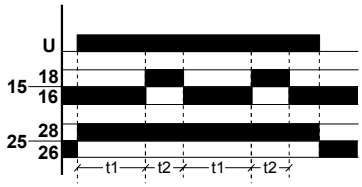
If there is only t1;



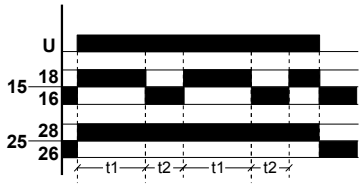
Functions

Most used 19 application define in device memory . Suitable function number entering have discussed in advance programming section.

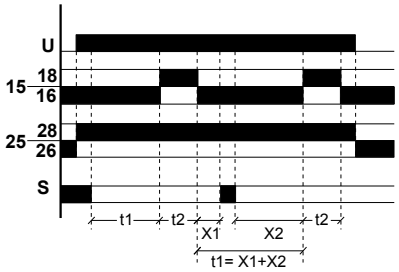
1) Double Time Adjustable Flasher Relay (OFF start)



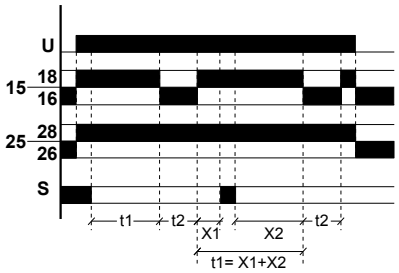
2) Double Time Adjustable Flasher Relay (ON start)



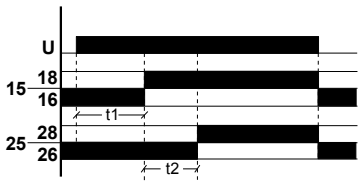
3) Double Time Adjustable Flasher Relay (OFF start)
Start with Start (S)



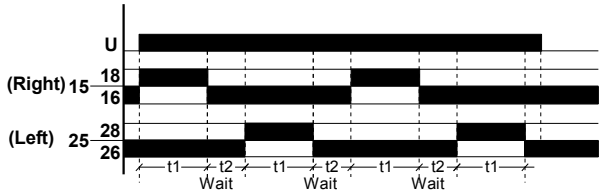
4) Double Time Adjustable Flasher Relay (ON start)
Start with Start (S)



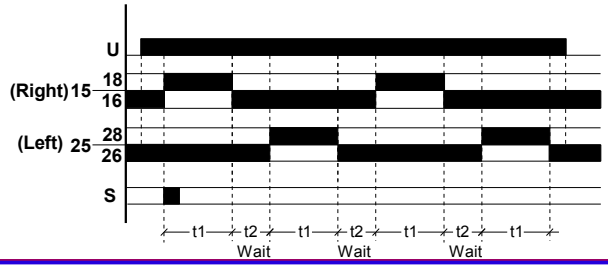
5) Double Time Relay(OFF start)



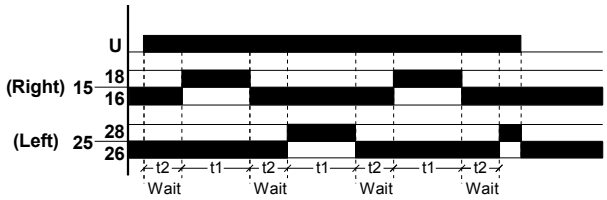
6) Direction Inverse Relay (ON start)



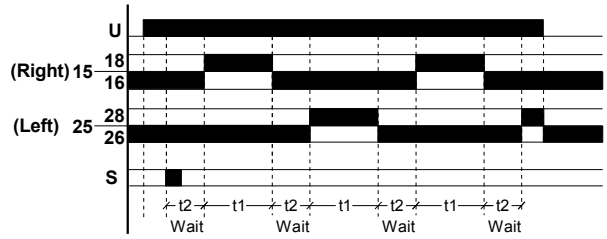
7) Direction Inverse Relay (ON start)
Start with Start (S)



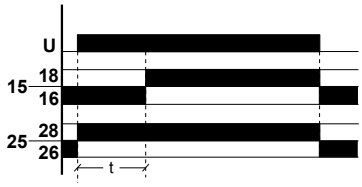
8) Direction Inverse Relay (OFF start)



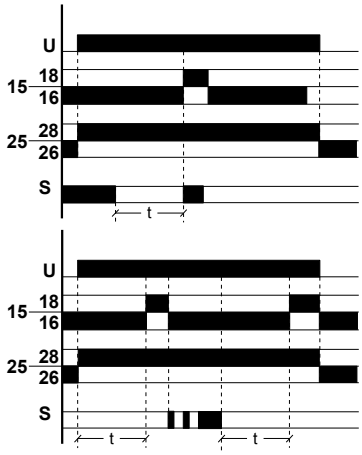
9) Direction Inverse Relay (OFF start)
Start with Start (S)



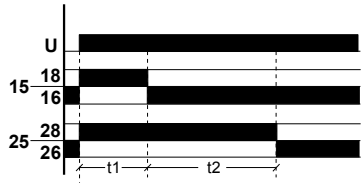
10) On Delay Time Relay



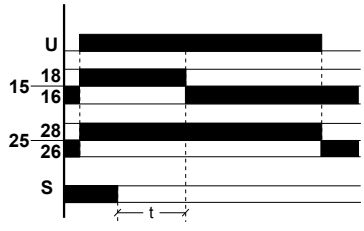
11) On Delay Time Relay
Start from Start (S) 's down edge

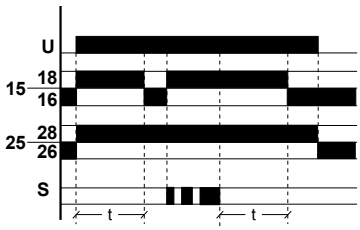


12) Off Delayed Double Timer

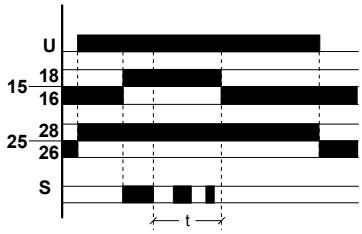


13) Off Delay Time Relay
Start when Start (S) remove

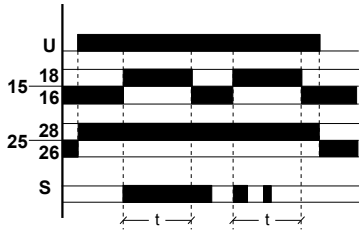




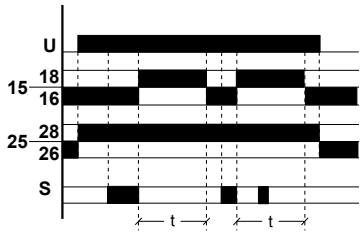
14) Off Delay Time Relay
Start, Start (S) 's up edge and down edge



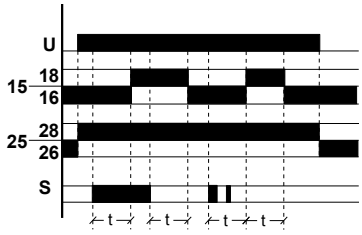
15) Off Delay Time Relay
Start with Start (S)



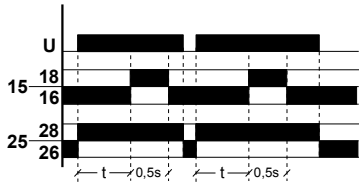
16) Off Delay Time Relay
Start, Start (S) 's down edge



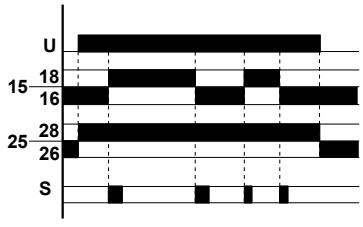
17) On – Off Time Relay
Start with Start (S)



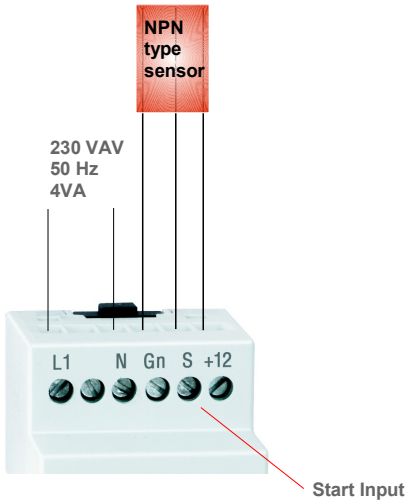
18) Impulse Relay

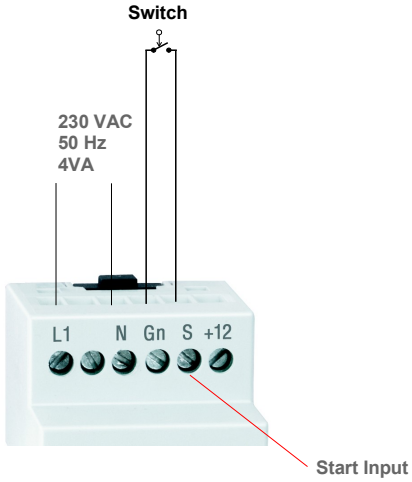


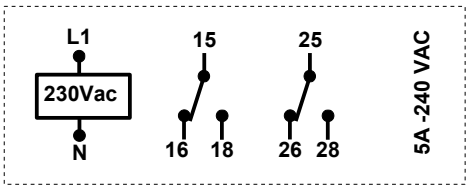
19) Impulse Relay
Start controlled by Start (S) 's up edge



Connection Scheme

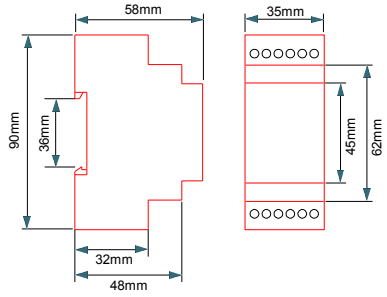






TECHNICAL DATA:

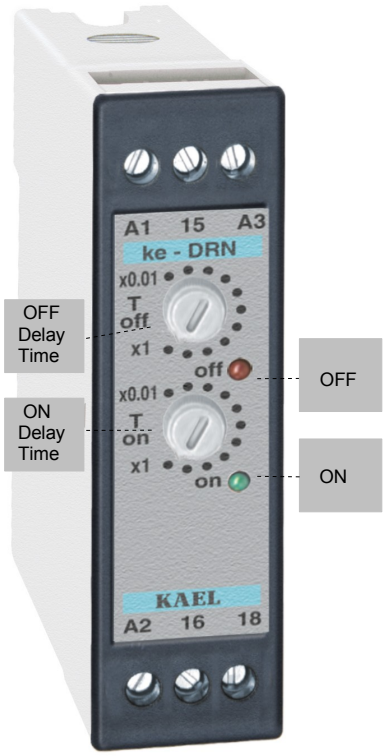
Rated Voltage(Un)
L1- N terminal : 230 VAC
Operation Range : (0,8-1,1) x Un
Frequency : 50/60 Hz.
Contact Current : Max.5 A / 240 VAC
Power
Consumption : < 4 VA
Display : 4 Digit LED
Device Protection
Class : IP20
Connector
Protection Class : IP00
Temperature : - 5 °C....+ 50 °C
Connection Type : To front panel tap
Dimensions :



ke – DRN

MULTI RANGE, DOUBLE TIME ADJUSTED FLASHER RELAY

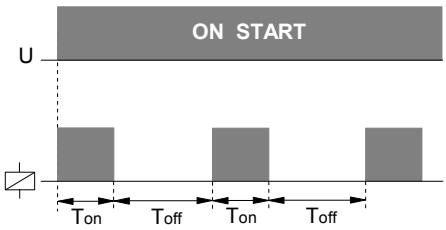
- ► 8 Items of ON time mode and
- ► 8 Items of OFF time mode selection
- ► 230 Vac or 24 V ac/dc



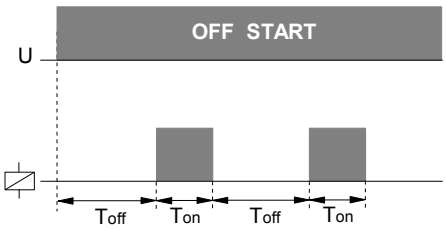
General:

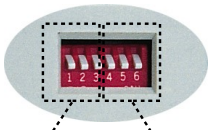
It is microprocessor controlled.8 different ON (operating) time interval and 8 different OFF (stand by) time interval mode selection can be made by the use of the dip-switch situated near the equipment. The selection of the ON and OFF time intervals are handled one by one.

ke-DRN1



ke-DRN2





OFF		ON	
5 sec	1 2 3	4 5 6	5 sec
10 sec	1 2 3	4 5 6	10 sec
30 sec	1 2 3	4 5 6	30 sec
60 sec	1 2 3	4 5 6	60 sec
5 m	1 2 3	4 5 6	5 m
10 m	1 2 3	4 5 6	10 m
30 m	1 2 3	4 5 6	30 m
60 m	1 2 3	4 5 6	60 m

► **THE TIME INTERVAL SELECTION:**
The switches,numbered **1,2,3** of the dip-switch are used at the selection of the OFF time interval, the switches numbered **4,5,6** are used at the selection of the ON time interval. Below is the time selection table for ON and OFF conditions.

► **THE TIME ADJUSTMENT SCALER:**
The scale of the adjustment potentiometer located on the equipment, is set between 0,01 to 1.When you select your adjustment with the dip-switch,it can be adjusted at the range specified by the interval mode,by the steps of 1%.

Example 1:

OFF
6 sec. – 10 min.

Let's select the OFF (stand by) time interval as above and adjust the value of the T(off) potentiometer to 0,7.

ON
0,6 sec. – 60 sec

Let's select the ON (operating) time interval as above and adjust the T(on) potentiometer to 0,3.In this case,we can calculate the ON and OFF periods.

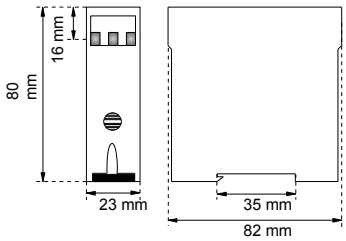
T(off) = 0,7 x 10 minutes = 7 minutes (The 10 minutes in the formula is the maximum value of the OFF time selected by the dip-switch)
T(on) = 0,3 x 60 seconds = 18 sec. (The 60 sec. in the formula is the maximum value of the ON time selected by the dip-switch)

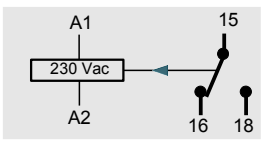
You may adjust;the OFF time with 6 second steps (the minimum value specified by the dip-switch indicates the adjustment step value),the ON time though,with 0,6 sec. Steps).

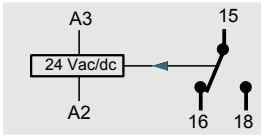
NOTE: During the operation of the relay,you may change the time interval selections and potentiometer adjustment.In this case,it continues to evaluate the new selections.

TECHNICAL DATA:

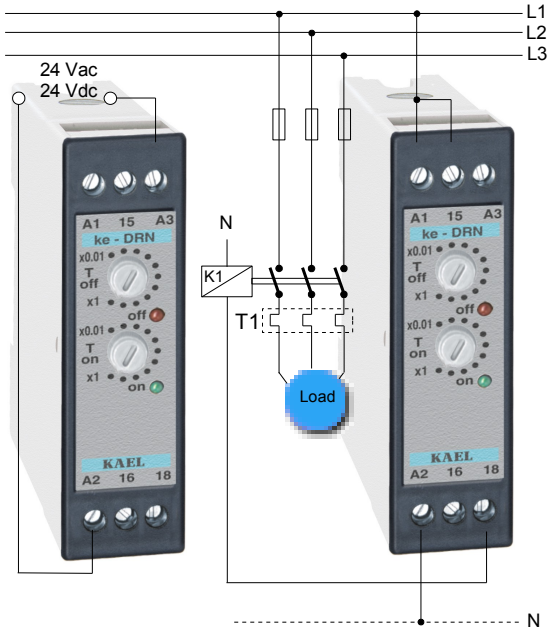
Operational Voltage (Un)	
A1 – A2 terminals	: 230 Vac
A3 – A2 terminals	: 24 Vac or 24 Vdc
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm







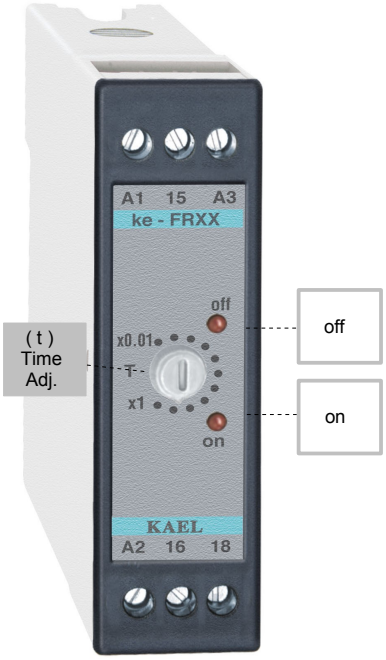
Simple Connection :

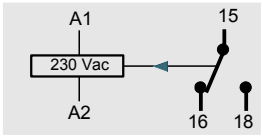


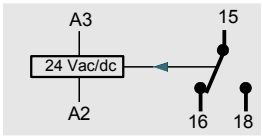
ke – FRXX

MULTI RANGE, TIME ADJUSTED FLASHER RELAY

- ► 16 Time interval selection
- ► 230 Vac or 24 V ac/dc

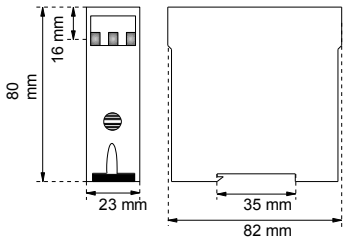




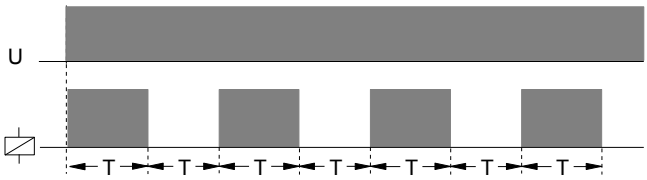


TECHNICAL DATA:

Operational Voltage (Un)	
A1 – A2 terminals	: 230 Vac
A3 – A2 terminals	: 24 Vac or 24 Vdc
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm

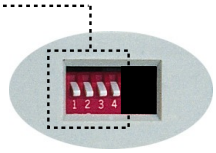


General:
It is microprocessor controlled. It is possible to make 16 different time interval selections by using the dip-switch that is located near the equipment.



► TIME INTERVAL SELECTION:

You may select the desired time interval by using the 1,2,3,4 numbered switches of the dip-switch that are at the side of the equipment. The time selection table is given below.



Min - Max		Min - Max	
1 2 3 4	0,1 – 1sec	1 2 3 4	9 sec - 15 min
1 2 3 4	0,1 – 5sec	1 2 3 4	18 sec – 30 min
1 2 3 4	0,1 – 10sec	1 2 3 4	36 sec – 60 min
1 2 3 4	0,3 – 30sec	1 2 3 4	3 min – 5 hrs
1 2 3 4	0,6 – 60sec	1 2 3 4	6 min – 10 hrs
1 2 3 4	1 – 100sec	1 2 3 4	9 min – 15 hrs
1 2 3 4	3 sec - 5 min	1 2 3 4	15 min – 25 hrs
1 2 3 4	6 sec – 10 min	1 2 3 4	18 min – 30 hrs

► THE TIME ADJUSTMENT SCALER:

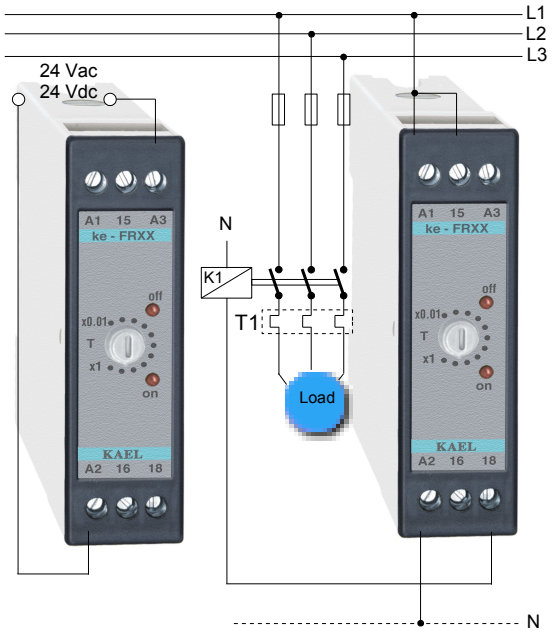
The scaler of the adjustment potentiometer located on the equipment, can be set between 0,1 to 1.
When you select your adjustment with the dip-switch, it can be adjusted at the range specified by the interval mode, by the steps of 1%.

Example :

1sec–100sec

If you had already selected the time interval mode above, in the situation of the potentiometer becoming maximum, the relay would have counted 100 sec; while in minimum, it would have counted 1 sec. You can do your adjustment at steps of 1 sec. (The min. value in the table is the adjustment step period)

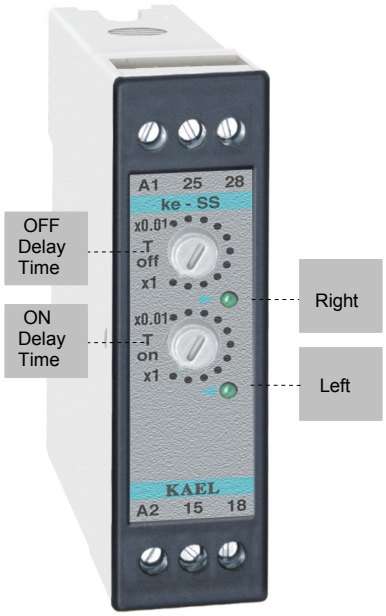
Simple Connection :

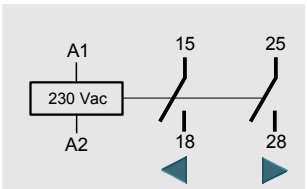


ke – SS

MULTI RANGE, ON and OFF ADJUSTED DIRECTION INVERSE RELAY

- 8 Items of ON (right-left) time mode and
- 8 Items of OFF time mode selection.

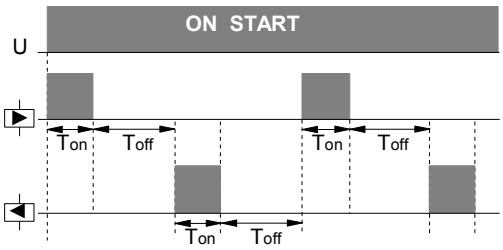




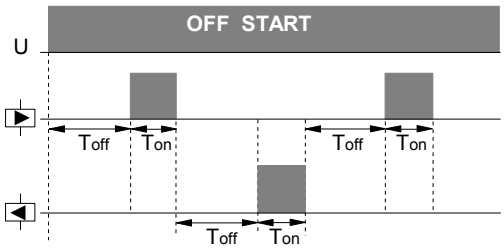
General:

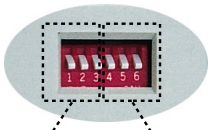
It is microprocessor controlled.8 different RIGHT-LEFT operational time interval and 8 different OFF time interval mode selection can be made by the use of the dip-switch situated near the equipment. The selection of the RIGHT-LEFT and OFF time intervals are handled one by one.

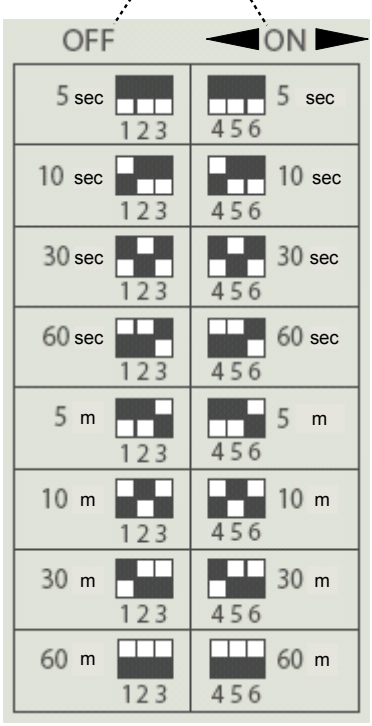
ke-SS1



ke-SS2







▶ THE TIME INTERVAL SELECTION:

The switches,numbered **1,2,3** of the dip-switch are used at the selection of the OFF time interval, the switches numbered **4,5,6** are used at the selection of the RIGHT-LEFT time interval. Below is the time selection table for RIGHT-LEFT and OFF conditions.

▶ THE TIME ADJUSTMENT SCALER:

The scale of the adjustment potentiometer located on the equipment, is set between 0,01 to 1.When you select your adjustment with the dip-switch,it can be adjusted at the range specified by the interval mode,by the steps of 1%.

Example 1:

OFF
6 sec. – 10 min.

Let's select the OFF (stand by) time interval as above and adjust the value of the T(off) potentiometer to 0,7.

ON
0,6 sec. – 60 sec

Let's select the ON (operating) time interval as above and adjust the T(on) potentiometer to 0,3.In this case,we can calculate the ON and OFF periods.

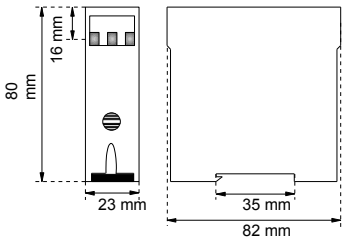
T(off) = 0,7 x 10 minutes = 7 minutes (The 10 minutes in the formula is the maximum value of the OFF time selected by the dip-switch)
T(on) = 0,3 x 60 seconds = 18 sec. (The 60 sec. in the formula is the maximum value of the ON time selected by the dip-switch)

You may adjust;the OFF time with 6 second steps (the minimum value specified by the dip-switch indicates the adjustment step value),the ON time though,with 0,6 sec. Steps).

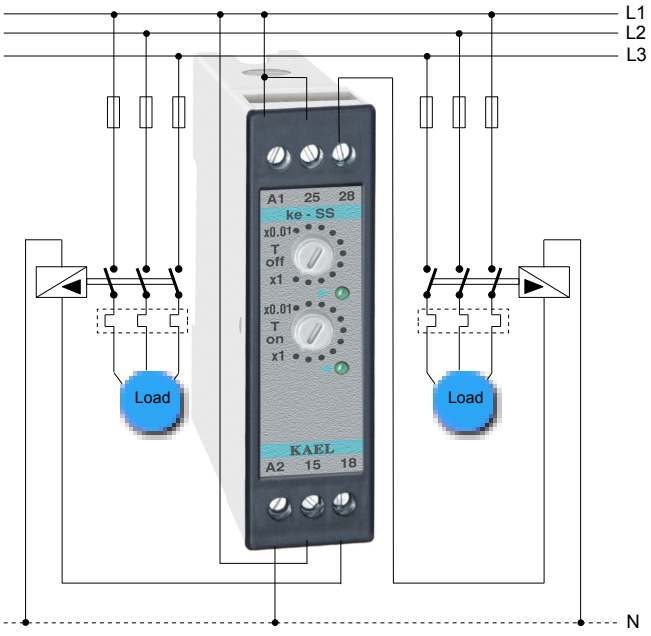
NOTE: During the operation of the relay,you may change the time interval selections and potentiometer adjustment. In this case,it continues to evaluate the new selections.

TECHNICAL DATA:

Operational Voltage (Un)	
A1 – A2 terminals	: 230 Vac
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Contact Current	: Max. 3 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection	
Class	: IP20
Connector Protection	
Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm



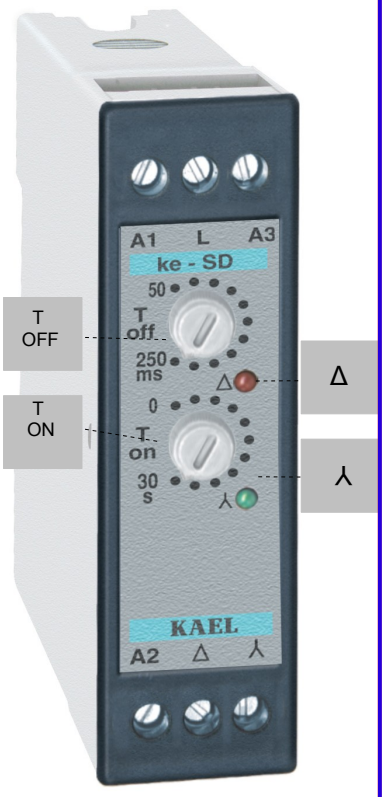
Simple Connection :



ke – SD

STAR – DELTA RELAY

- ► T (on) : 0 – 30 sec.
- ► λ ----► Δ Delay time
  T (off) : 50 – 250 ms
- ► 230 Vac or 24 V ac/dc

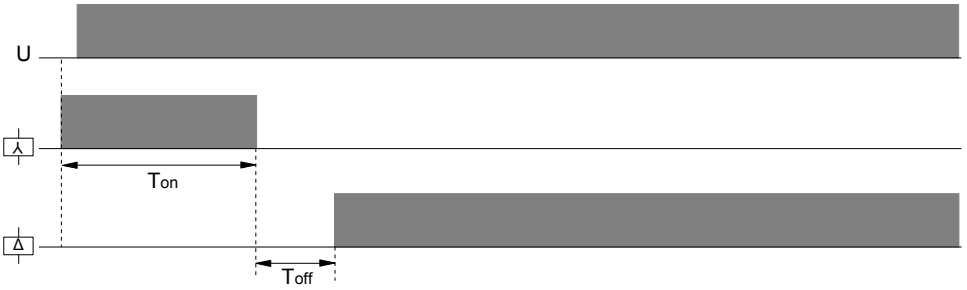


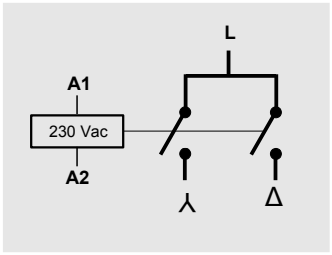
General:

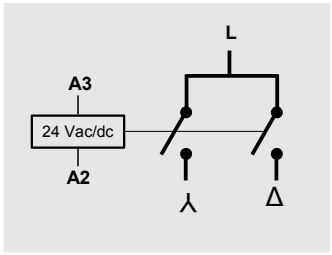
When 230 Vac is applied through "A1 " and " A2 " terminals, star relay is switched on and " λ " terminal becomes a phase output.

At the end of T(on) time,star relay is switched off and phase output from " λ " terminal lasts.
It stops for T(off) pass time.Then delta relay is switched on and " Δ " terminal becomes a phase output. It keeps this position till the energy of the relay is broken.
Because, the switch off time of the contactors depends on their power,brand and age,the pass time from star to delta should be adjusted by the user.

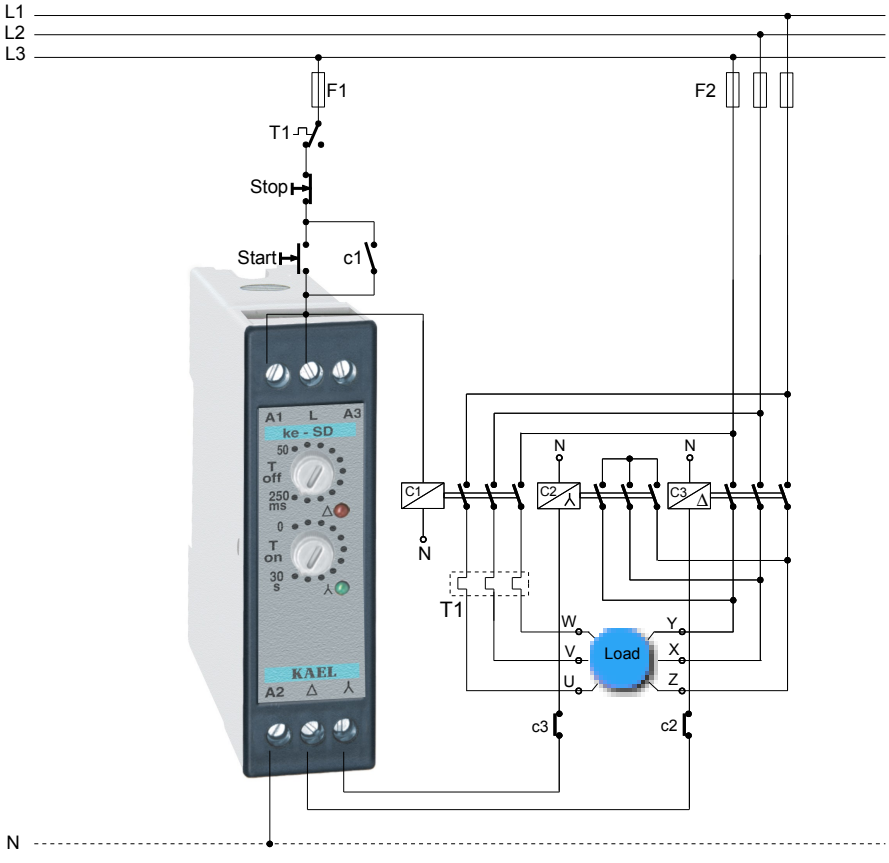
Operation graphic:





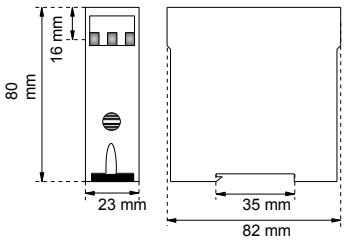


Simple Connection :



TECHNICAL DATA:

Operational Voltage (Un)	
A1 – A2 terminals	: 230 Vac
A3 – A2 terminals	: 24 Vac or 24 Vdc
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Contact Current	: Max. 3 A / 240 VAC
Power Consumption	: < 8 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 23x82x80 mm



ke – FTR

PHOTOCELL RELAY

► 1 – 10 LUX Adjustment

General :

The relay is used to automatically illuminate streets, avenues, parks and shop windows when the ambient is dark and to switch off the illumination system when the ambient is lit.

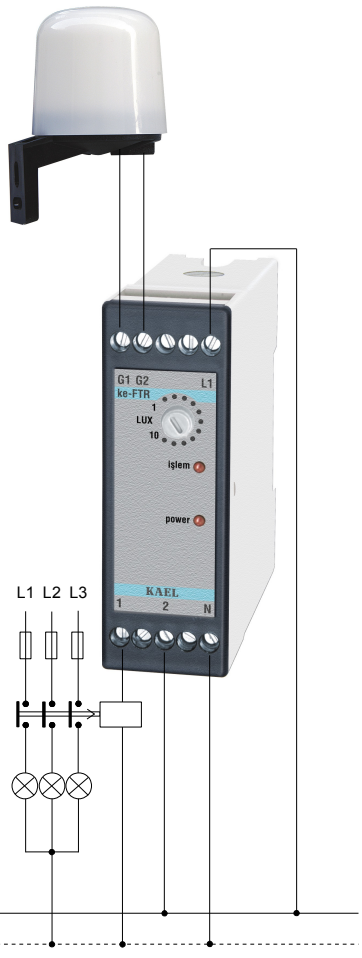
► **Operating Principle :**
The photocell sensor (PS), that contains a variable resistor sensitive to strength of illumination, must be place somewhere illuminated by sunlight but not affected from any external or relay's own illumination system.
At sunset time, when the strength of light goes below adjusted lux value, after a certain time delay, relay energizes its contact. Delay time serves to avoid any false decision caused by temporary illumination or headlights.
At dawn time, when the strength of light goes above adjusted lux value, after a certain time delay, relay de-energizes its contact.

■ **ke-FTR**
Traditional photocell relay. It has 1-10 lux light strength and 3s-5s turn on-off time delay adjustments.

■ **ke-FTR10M**
It has -10 lux light strength and 25s-40s turn on-off time delay adjustments. Additionally, contains 4A fuse protection in series with contact output stage and manual-auto selection switch.

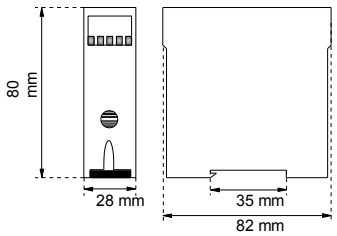
ke-FTR10M

Ke-FTR



TECHNICAL DATA:

Operational Voltage (Un)	
L1 – N terminals	: 230 Vac
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Contact Current	: Max. 5 A / 240 VAC
G1-G2	: Photocell sensor terminals
Light Strength	:1-10 lux
Hysteresis	: %5-30
Turn On-Off Delay Time	: for FTR : 3s for FTR10M :25-40s
Power Consumption	: < 4 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 28x82x80 mm



ke – SKR

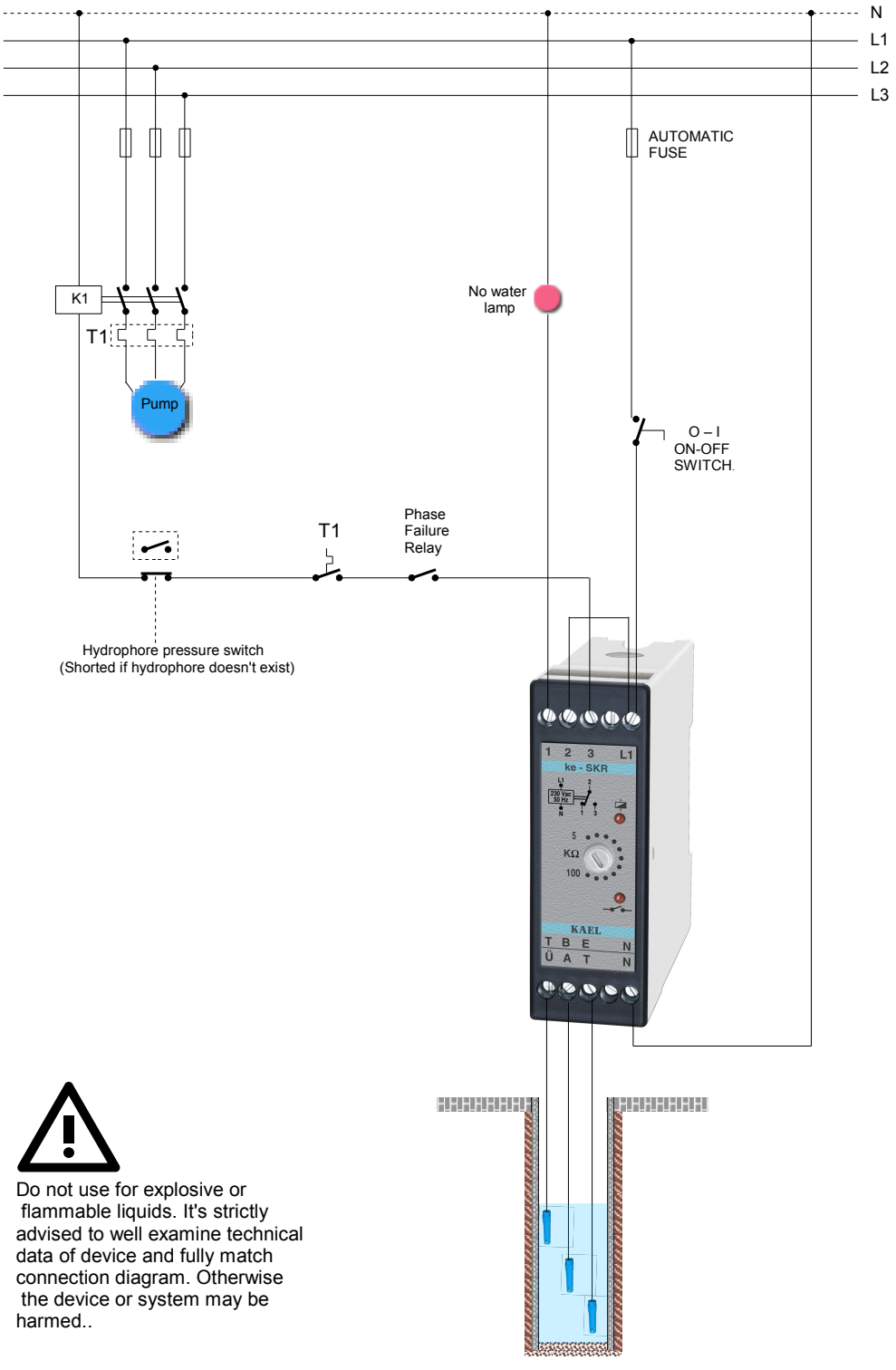
LIQUID LEVEL CONTROL RELAY

► 5 – 100 KΩ Sensitivity Adj.

General :

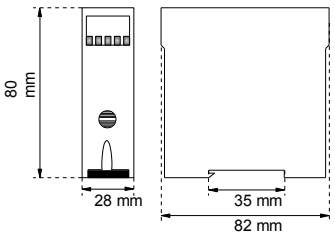
Three electrodes are connected to the “T”,”B” and ”E” terminals.
When the liquid level reaches the upper level electrode (T) then the relay energizes its contacts to turn on the pump.
When the liquid level reaches the bottom level electrode (B) then the relay de-energizes its contact and turns the pump off.
Sensitivity (empedance between electrodes) can be adjusted in the range of 5-100 KΩ using the knob on the front side of the relay.

- **the upper level electrode** : Top (**T**)
- **the bottom level electrode** : Bottom (**B**)
- **the earth electrode** : Earth (**E**)



TECHNICAL DATA:

Operational Voltage (Un)	
L1 – N terminals	: 230 Vac
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Sensitivity	: 5-100KΩ adjustable
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 4 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 28x82x80 mm



Do not use for explosive or flammable liquids. It's strictly advised to well examine technical data of device and fully match connection diagram. Otherwise the device or system may be harmed..

SKR-DIN

LIQUID LEVEL CONTROL RELAY

► 5 – 100 KΩ Sensitivity Adj.

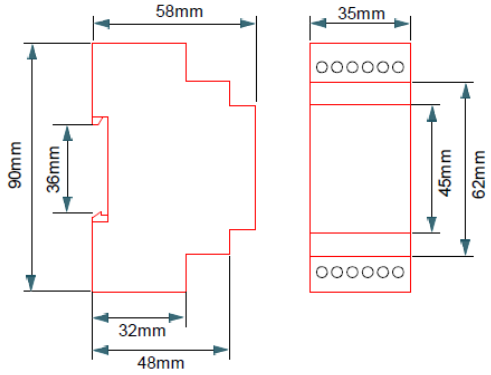
General :

Three electrodes are connected to the “e1”,”e2” and ”e3” terminals.
When the liquid level reaches the upper level electrode (e1) then the relay energizes its contacts to turn on the pump.
When the liquid level reaches the bottom level electrode (e2) then the relay de-energizes its contact and turns the pump off.
Sensitivity (empedance between electrodes) can be adjusted in the range of 5-100 KΩ using the knob on the front side of the relay.

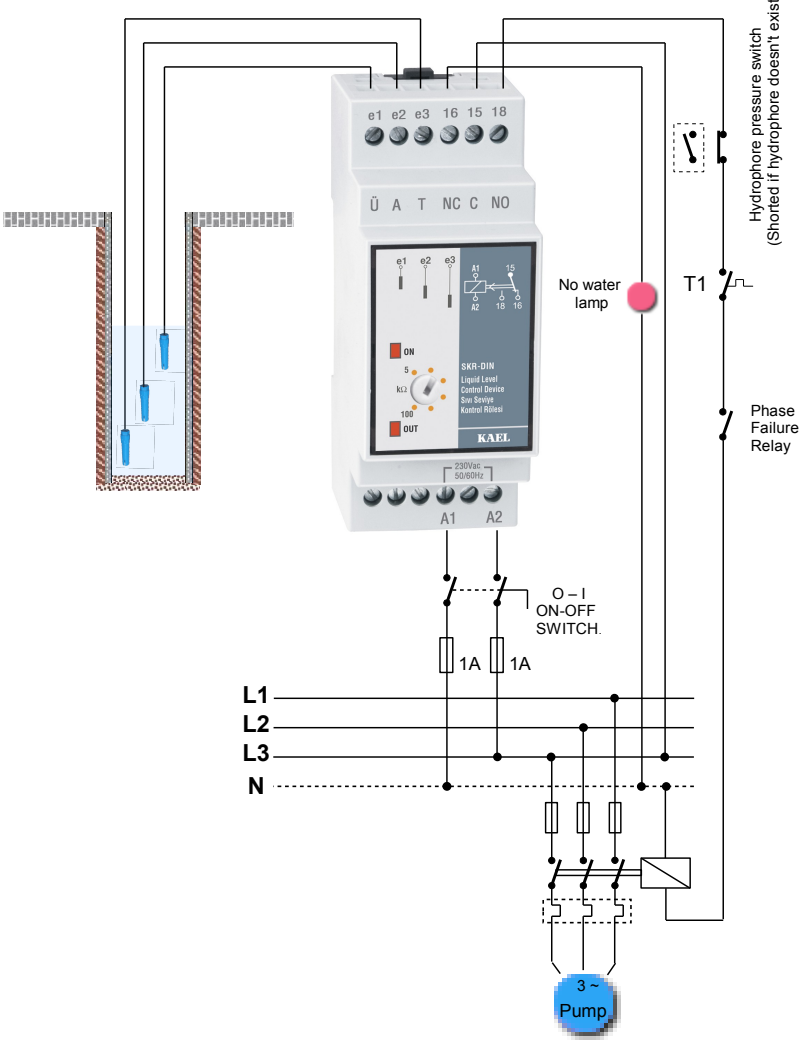
- ► **the upper level electrode** : Top (e1)
- ► **the bottom level electrode** : Bottom (e2)
- ► **the earth electrode** : Earth (e3)

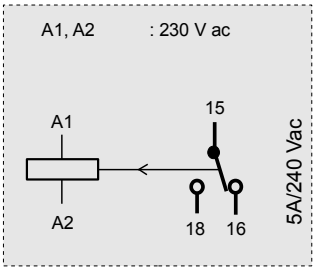
TECHNICAL DATA:

Rated Voltage	: 230 VAC
Operating Range	: (0.8 – 1.1)xUn (Un nominal voltage)
Frequency	: 50/60 Hz
Sensitivity	: 5-100KΩ adjustable
Contact Current	: Max. 5 A / 240 VAC
Power Consumption	: < 4 VA
Device Protection Class	: IP20
Connector Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 35x90x58 mm



Connection Scheme



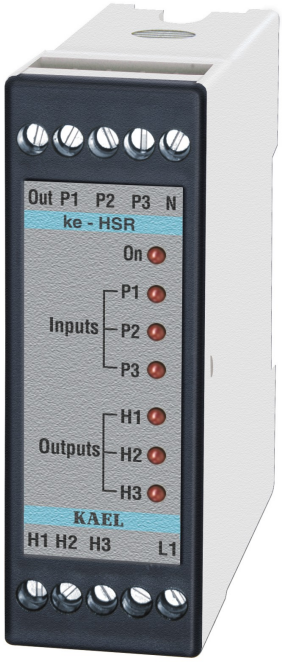


Do not use for explosive or flammable liquids. It's strictly advised to well examine technical data of device and fully match connection diagram. Otherwise the device or system may be harmed..

ke – HSR

HYDROPHORE SEQUENCING RELAY

- ke-HSR2 : 2 Outputs
- ke-HSR3 : 3 Outputs



General:

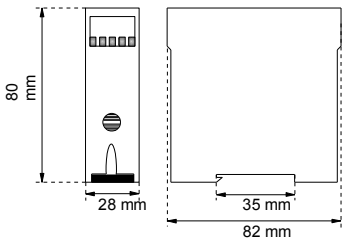
This product is developed for hydrophore pump systems that contain 2 or 3 to make the pumps work in sequence and with equal time periods. HSR2 is designed for systems that contain 2 pumps, HSR3 is designed for 3 pumps.

► Operation Principle

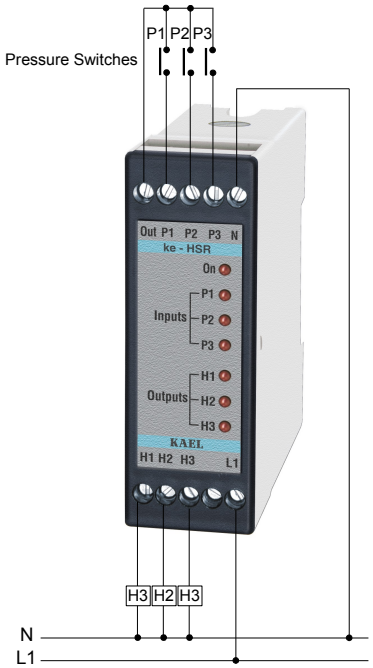
HSR3 :commands the pressure switches that are connected to the pressure tank (P1,P2,P3). The upper and bottom opening values are as follows.
P1 max. ≥ P2max. ≥ P3max.
P1min. > P2min. > P3min.
Hydrophore sequencing relay HSR, depending on the pressure switches that it commands, accepts P1 to be the highest pressure switch, then P2 and then P3 to be the lowest pressure switch and though it takes pumps in sequence when the pressure in the tank decreases starting from the highest to the lowest . When only P1 pressure switch is on, the device turns on the pump output H1 (if already on then it takes the next one) and for the following next 10 minutes (as long as P1 is on it keeps this position) .After 10 minutes if P1 is still on then the device turns off H1 and turns on H2. Same way after 10 minutes if P1 is still on then the device turns off H2 and turns on H3. This way the device sequences the use of the pumps and divide the time between them. The device remembers the sequence and takes always the following pump.
When P1 is off, the hydrophore output which is on goes off too, and next time when P1 goes on the device takes the next output (pump) . For example: if H1 was switched off after P1 switch was off, next time when P1 switch goes on the device takes the nest output H2 on. If P2 switch goes on while P1 is on then the device takes in the next pump that is not already on. The pumps then are shared in time the same way two by two. As long as P1 and P2 are on, the pumps will work as H1-H2, H2-H3, H3-H1 for 10 min for each couple. If P2 goes off, the device turns off the pump is row and works as mentioned above with one pump. While P1 and P2 are on, if P3 goes on too then the device takes the three pumps H1, H2 and H3 until P3 is off. When the pressure switches go off the device turns off the pump that is in the row sharing time between the pumps again as mentioned before.
If P2 goes on before P1 (P1 maybe out of order) then the device will start turning H1 on.

TECHNICAL DATA:

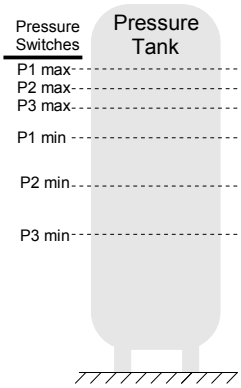
Operational Voltage (Un)	
L1 – N terminals	: 230 Vac
Operating Range	: (0,8 – 1,1)x Un (Un nominal voltage)
Frequency	: 50/60 Hz.
Pressure switch output	: Out
1.pressure switch input:	P1
2.pressure switch input:	P2
3.pressure switch input:	P3
Pump contact outputs	: H1,H2,H3
Contact Current	: Max.3 Amp/240Vac
Power Consumption	: < 5VA
Device Protection Class	: IP20
Terminal Protection Class	: IP00
Ambient Temperature	: -5°C....+50°C
Connection Type	: To connection rail in electrical panel
Dimensions	: 28x82x80 mm



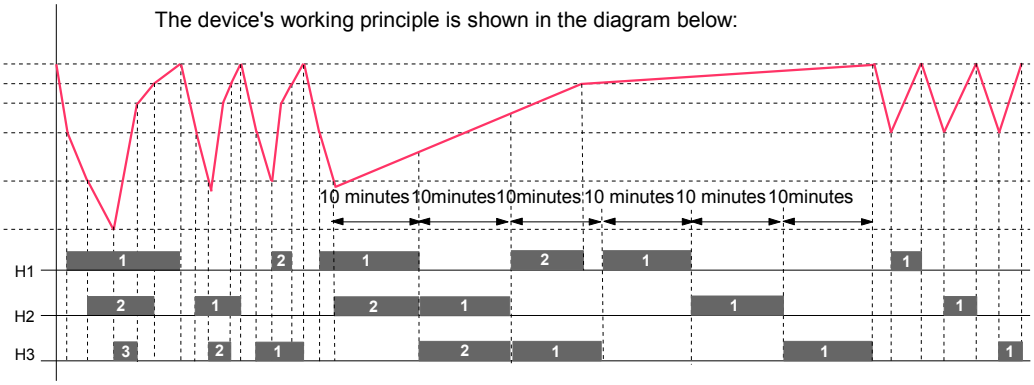
Simple Connection :



It's strictly advised to well examine technical data of device and fully match connection diagram.
Do not apply any energy to the Out, P1, P2, P3 inputs otherwise the device or system may be harmed.



The device's working principle is shown in the diagram below:



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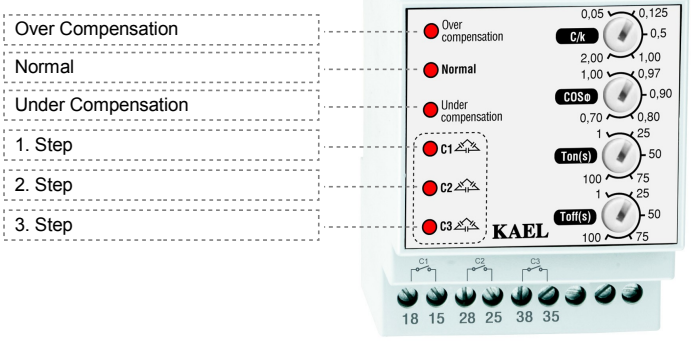
PFR-3 , PFR-2 , PFR-1

POWER FACTOR REGULATOR

- ►Adjustable Target Cosϕ (0,70 – 1,00)
- ►C/k (0,05 – 2)
- ►Switch on Time - Ton(1 – 100 s)
- ►Switch off Time - Toff(1 – 100 s)
- ►PFR-3 3 steps
- ►PFR-2 2 steps
- ►PFR-1 1 step



GENERAL:
it is used to work with a fixed load or for local compensation. Especially can be used for submersible pump compensation. Does not occupy a place within the panel, it is economical and it is very easy to use.The power value of the 1st step capacitor has to be the smallest between others.
$Q_{C1} < Q_{C2} < Q_{C3}$

ADJUSTMENT:

C/k : (0,05 – 2)
C: Power of first capacitor.
k : Current transformer ratio.
Example:
If C: 1 KVAR
and k: 50/5 A
In this case;
k=50/5 = 10 and C/k= 1/10= 0,1
Adjust C/k to 0,1

Target Cosϕ : (0,70 – 1,00)

Ton : (1 – 100 s) Switch on time.

Toff : (1 – 100 s) Switch off time.

Installation Instruction :

- ■ Read the user instructions and caution before installation.
- ■ Be sure that the panel you are installing in when power off.
- ■ The device designed to be installed to the rail where the installation tap into the panel,
- ■ Do not under case open the front of device.
- ■ You should open the Terminals at the back side of the device after you must be sure that there is no power in the panel. Connect the device as shown in the connection scheme.
- ■ Do not use current transformer less than nominal current
- ■ Please use fast type fuse to protect the device's power supply input
- ■ Clean the device using dry dust cloth after turned off device.
- ■ Read and follow the instruction on this manual and attached label.

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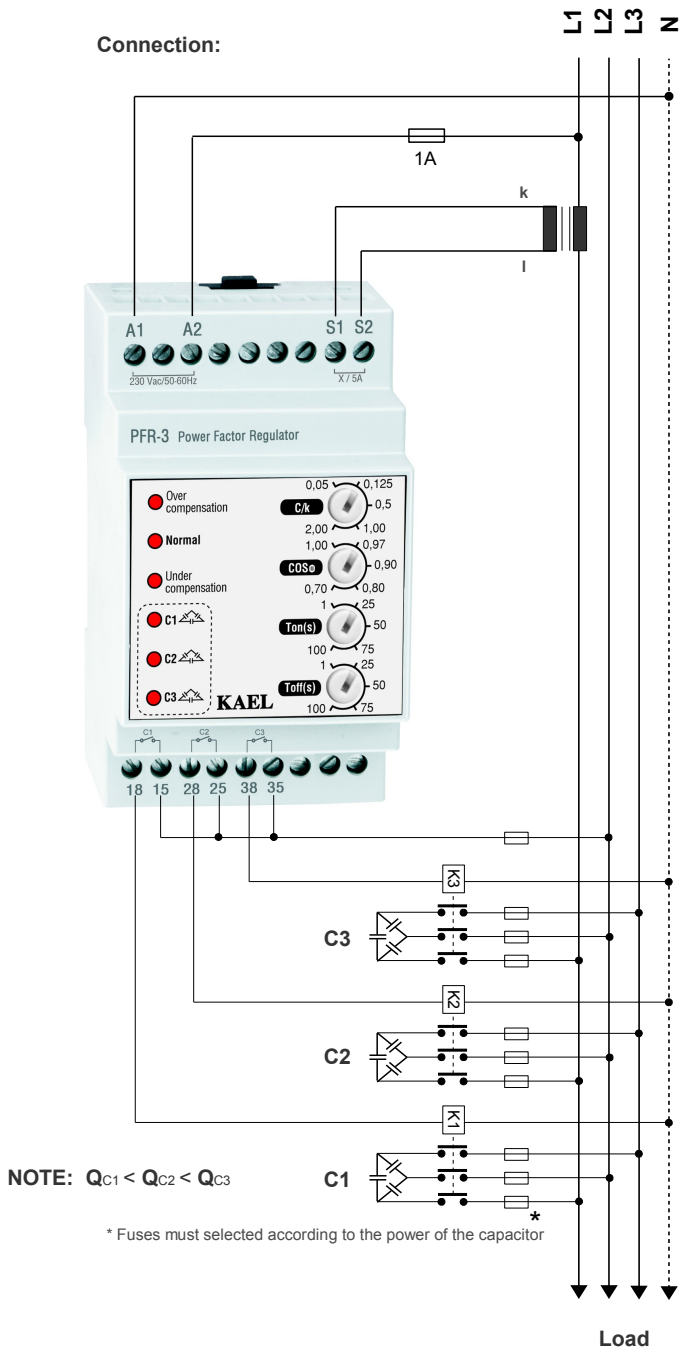
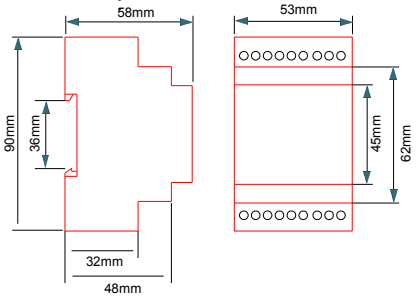
Connection:



* Fuses must selected according to the power of the capacitor

TECHNICAL INFORMATION:

Rated Voltage (Un)	: 230Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Operating Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Current Measurement Range	: 0,05 - 6 A
Current Transformer Ratio	: X / 5 Amper
Inputs Power Consumption	: <1VA
Contact Current	: Max. 3A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To connection rail in electrical panel
Dimension	



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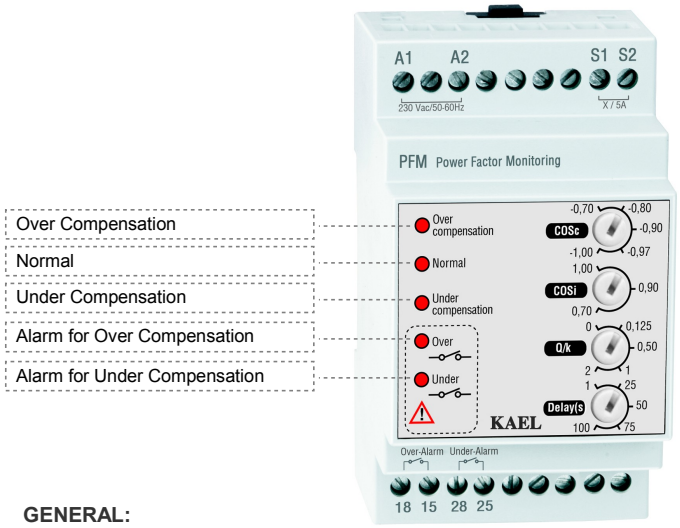
PFM

Power Factor Monitoring Device

- ►Cosϕc ; for over compensation alarm(-0,70... -1,00)
- ►Cosϕi ; for under compensation alarm(+0,70...+1,00)
- ►Q/k Adjustment (0 ... 2)
- ►Delay Time - Delay(1 – 100 s)



GENERAL:
If compensation of system exceeds the adjusted values of the over or under compensation alarm values, device switches on its contact for alarm. Does not occupy a place within the panel, it is economical and it is very easy to use.

ADJUSTMENTS:

Q/k : (0 ..... 2)
Ratio of Reactive power of the system to the current transformer ratio. Where,
Q: Reactive power of the system.
k : Current transformer ratio.
Example:
If Q: 1 KVAR
and k: 50/5 A
In this case;
k=50/5 = 10 and Q/k= 1/10= 0,1
Adjust Q/k to 0,1

Cos-c : (-0,70 ... -1,00) is cosϕ value for over compensation.
If the measured cosϕ value exceeds the Cos-c value after the time delay , over compensation relay is energized .
the relay's contact stays energized,until the cosϕ value returns to normal area.

Cos-i : (+0,70 ... +1,00) is cosϕ value for under compensation.
If the measured cosϕ value exceeds the Cos-i value after the time delay , under compensation relay is energized .
the relay's contact stays energized,until the cosϕ value returns to normal area.

Delay : (1 – 100 sn) Delay time

Installation Instruction :

- ■ Read the user instructions and caution before installation.
- ■ Be sure that the panel you are installing in when power off.
- ■ The device designed to be installed to the rail where the installation tap into the panel,
- ■ Do not under case open the front of device.
- ■ You should open the Terminals at the back side of the device after you must be sure that there is no power in the panel.
  Connect the device as shown in the connection scheme.
- ■ Do not use current transformer less than nominal current
- ■ Please use fast type fuse to protect the device's power supply input
- ■ Clean the device using dry dust cloth after turned off device.
- ■ Read and follow the instruction on this manual and attached label.

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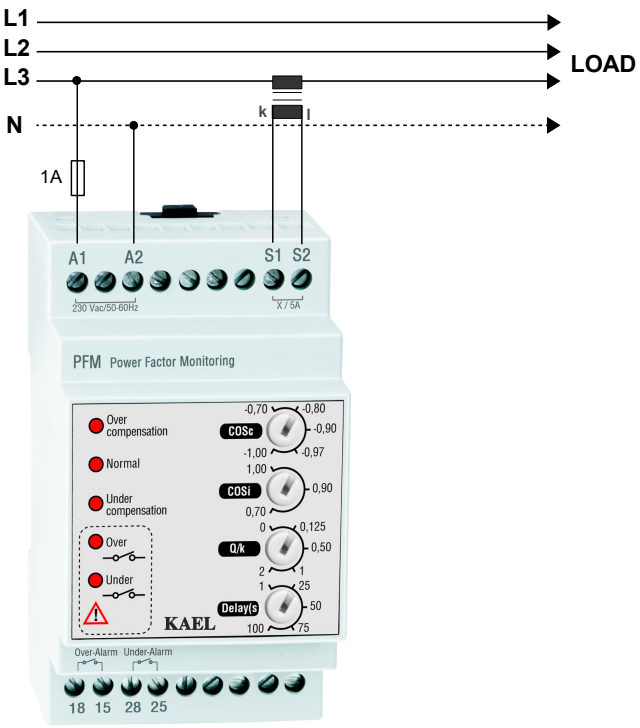
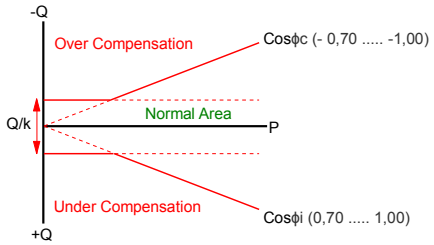
CONNECTION:

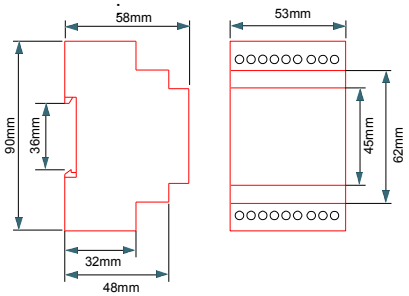


Operating logic



TECHNICAL INFORMATION:

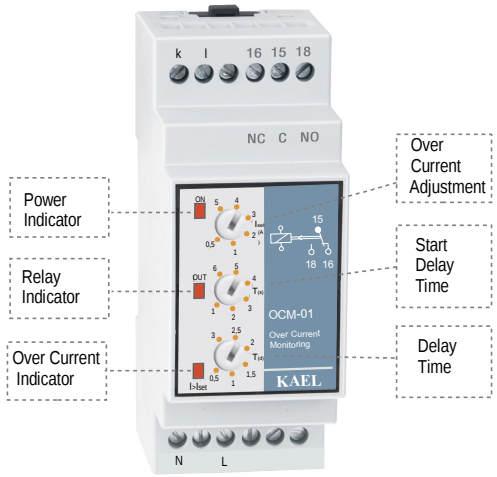
Rated Voltage (Un)	: 230Vac (L1-N)
Operating Range	: (0,8-1,1) x Un
Operating Frequency	: 50 / 60 Hz
Supply Power Consumption	: < 4VA
Current Measurement Range	: 0,05 - 6 A
Current Transformer Ratio	: X / 5 Amper
Inputs Power Consumption	: <1VA
Contact Current	: Max. 3A / 240Vac
Device Protection Class	: IP 20
Connector Protection Class	: IP 00
Temperature	: - 5 °C .... + 50 °C
Connection Type	: To connection rail in electrical panel
Dimension	.



OCM-01 and OCM-03

OVER CURRENT MONITORING DEVICES

- ► Over Current Adjustment (0,5 – 5 A) OCM-01
- ► Over Current Adjustment (2 – 100 A with current transformer) OCM-03
- ► Start Delay Time(1 – 6 sec)
- ► Delay Time (0,5 – 3 sec)



General:
OCM-01 and OCM-03 Over Current Monitoring Devices protects motors and the system they are connected.
If the measured current of a motor or a system less than adjusted overcurrent value, "relay indicator" turns on. When the measured current exceeds adjusted overcurrent value, relay indicator turns off and relay contact would be open circuit after delay time.

Over-Current Adjustment : Over current value could be set between 0,5 and 5A. It is the desired over current value for protection of a motor or a system. The hysteresis value is %3.

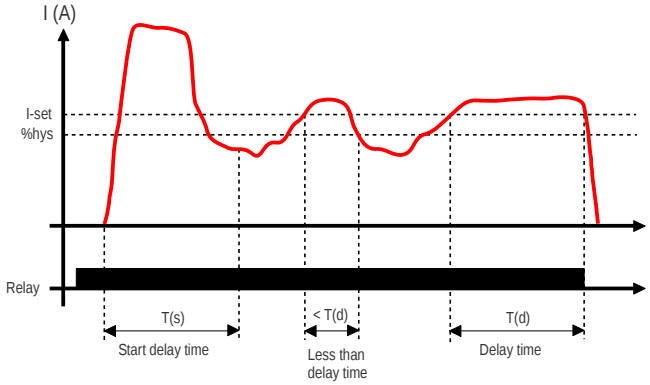
Start Delay Time Adjustment T(s) : Start delay time could be set between 1 and 6 seconds. After the motors start to run, they draw high current within a short time and the measured current value could exceed the adjusted over current value. To avoid the operation failure during this time, the device would not energize the relay. After start delay time the current would be measured.

Delay Time Adjustment T(d) : Delay time could be set between 0,5 and 3 seconds. When the measured current exceeds adjusted overcurrent value, relay contact would be open circuit after delay time and motor would be deenergized. If the measured current value falls below the limit during this time, delay time would be reset.

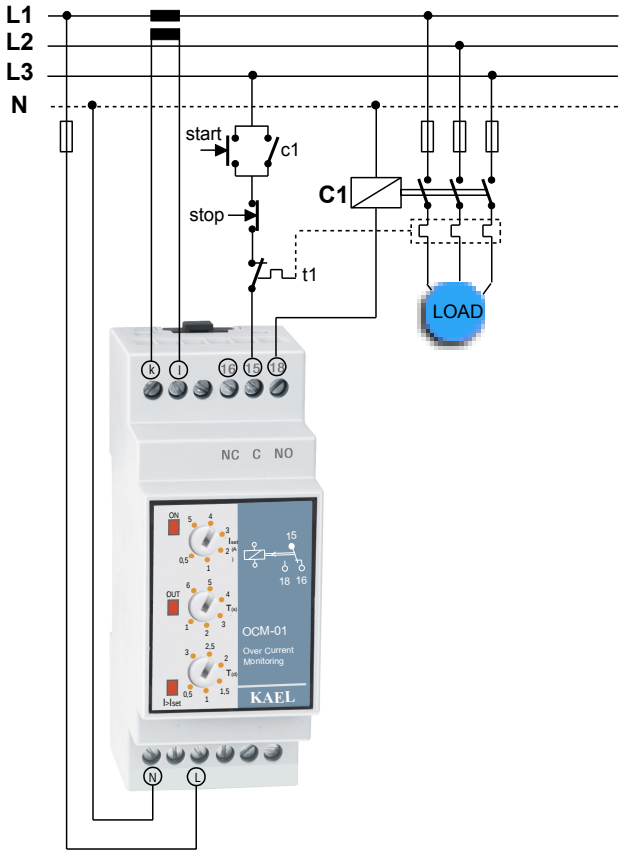
Warning Indicators:
ON (Power) : Turns on, if the device is powered.
OUT (Relay) : Turns on, if the relay contact is short circuit.
I>Iset : When the measured current exceeds adjusted overcurrent value, LED flashes during delay time. At the end of the delay time it turns on continuosly.

WARNINGS

1- Please do not open the device panel. There is no user serviceable parts inside the device.
2- Before making the connections to device's terminals, please be sure that there is no voltage across the cables or terminals. Also be sure that the panel is de-energized.
3- Before cleaning the device, please be sure that it is de-energized and use only dry tissue-paper to clean it. Water or any other chemicals used for cleaning may harm the device
4- Before commissioning the device, please be sure that the terminal connections are made exactly the same as in the connection diagram and so as not to cause contact problems.
5- Contact your authorized dealer, if a problem occurs with your device.
6- Following the precautions is to prevent the users from physically and spiritual damage. KAEL Elektronik Ltd. Şti. or dealer is not responsible for any injuries or damages due to violation of the warnings.



CONNECTIONS

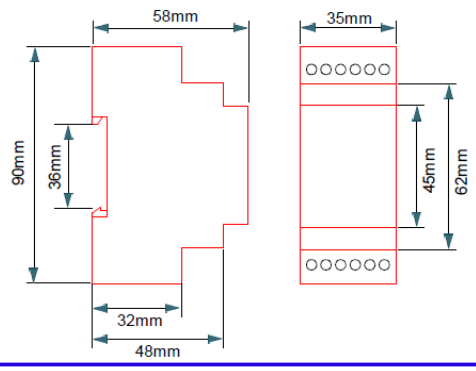


PROTECTION CASES BY CONNECTION:

- ► **If L1 phase disconnected** The device would be deenergized and the relay contact would be released immediately.
- ► **If L2 phase disconnected** Excessive current flows through the current transformer and relay contact would be released at the end of the delay time.
- ► **If L3 phase disconnected** Excessive current flows through the current transformer and relay contact would be released at the end of the delay time.
- ► **If N disconnected ;** The device would be deenergized and the relay contact would be released immediately.

TECHNICAL DATA

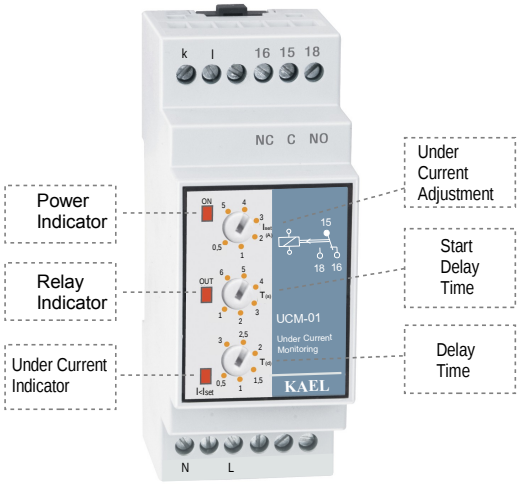
Rated Voltage (Un)	: 230 Vac
Operating Range	: (0,9 – 1,1) x Un (Un nominal voltage)
Frequency	: 50/60 Hz
Current Adjustment Range	: **OCM-01 ;** 0,5 – 5 A **OCM-03 ;** 2 – 100A with current transformer
Start Delay Time	: 1 – 6 sn
Delay Time	: 0,5 – 3 sn
Contact Current	: Max.5 A / 240 Vac
Power Consumption	: < 4 VA
Device Protection Class	: IP20
Ambient Temperature	: - 5 °C....+ 50 °C
Connection Type	: To connection rail in electrical panel
Dimensions	: 35x90x58 mm



UCM-01 and UCM-03

UNDER CURRENT MONITORING DEVICES

- ► Under current Adjustment (0,5 – 5 A) UCM-01
- ► Under current Adjustment (2 – 100 A with current transformer) UCM-03
- ► Start Delay Time Adjustment (1 – 6 sec)
- ► Delay Time Adjustment (0,5 – 3 sec)



General:
UCM-01 and UCM-03 Under Current Monitoring Devices protects devices such as motors, air conditioners, compressors and resistances for under current conditions. If the measured current of a motor or a system greater than adjusted undercurrent value, "relay indicator" turns on and the relay contact would be short circuit. When the measured current falls below adjusted undercurrent value, relay indicator turns off and relay contact would be released at the end of the delay time.

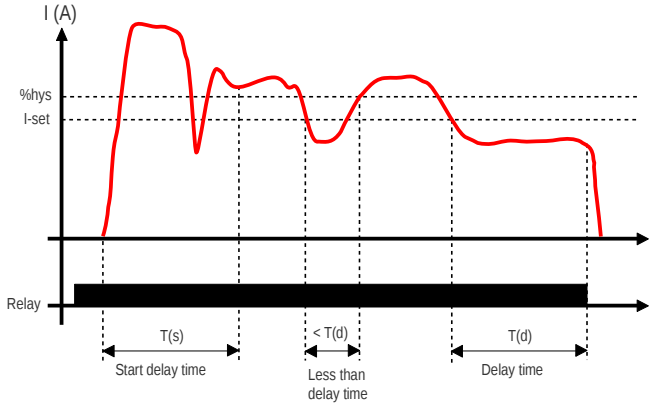
Under current Adjustment: Under current value could be set between 0,5 and 5A. It is the desired under current value for protection of a motor or a system. The hysteresis value is %3.

Start Delay Time Adjustment T(s) : Start delay time could be set between 1 and 6 seconds. After the motors start to run, they draw high current within a short time. However current could drop suddenly. To avoid the operation failure during this time, the device would not energize the relay. After start delay time the current would be measured.

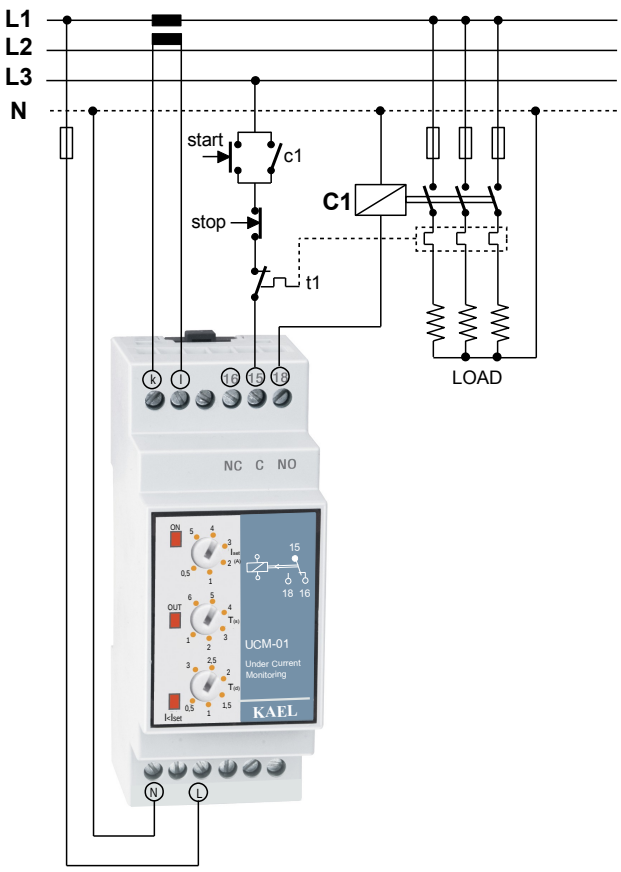
Delay Time Adjustment T(d) : Delay time could be set between 0,5 and 3 seconds.When the measured current falls below undercurrent value, relay contact would be open circuit after delay time and motor would be deenergized. If the measured current value exceeds the limit during this time, delay time would be reset.

Warning Indicators:
ON (Power) : Turns on, if the device is powered.
OUT (Relay) : Turns on, if the relay contact is short circuit.
I>Iset : When the measured current falls below adjusted undercurrent value, LED flashes during delay time(Td). At the end of the delay time it turns on continuosly.

WARNINGS
1- Please do not open the device panel. There is no user serviceable parts inside the device.
2- Before making the connections to device's terminals, please be sure that there is no voltage across the cables or terminals. Also be sure that the panel is de-energized.
3- Before cleaning the device, please be sure that it is de-energized and use only dry tissue-paper to clean it. Water or any other chemicals used for cleaning may harm the device
4- Before commissioning the device, please be sure that the terminal connections are made exactly the same as in the connection diagram and so as not to cause contact problems.
5- Contact your authorized dealer, if a problem occurs with your device.
6- Following the precautions is to prevent the users from physically and spiritual damage. KAEL Elektronik Ltd. Şti. or dealer is not responsible for any injuries or damages due to violation of the warnings.



CONNECTIONS:



PROTECTION CASES BY CONNECTION:
- ► **If L1 phase disconnected** The device would be deenergized and the relay contact would be released immediately.
- ► **If N disconnected** The device would be deenergized and the relay contact would be released immediately.
- ► **Load Protection** When the total current for three loads is 3 Amps and undercurrent value is adjusted to 2.5Amps. If a load would be disabled total current drops to 2 Amps and under current protection mode would be enabled. So all loads would be disabled.

TECHNICAL DATA

Rated Voltage (Un)	: 230 Vac
Operating Range	: (0,9 – 1,1) x Un (Un nominal voltage)
Frequency	: 50/60 Hz
Current Adjustment Range	: **UCM-01 ;** 0,5 – 5 A
	UCM-03 ; 2 – 100A with current transformer
Start Delay Time	: 1 – 6 sn
Delay Time	: 0,5 – 3 sn
Contact Current	: Max.5 A / 240 Vac
Power Consumption	: < 4 VA
Device Protection Class	: IP20
Ambient Temperature	: - 5 °C....+ 50 °C
Connection Type	: To connection rail in electrical panel
Dimensions	: 35x90x58 mm