# EMKO

## PID TEMPERATURE CONTROL UNIT


EMKO Eco PID

**Eco PID, PID Temperature Control Unit**
- 3 digit process (PV) and 4 digit set (SV) display
- Temperature sensor input (TC,RTD)
- Programmable ON/OFF, P, PI, PD and PID control forms
- Adaptation of PID Coefficients to the system with Self-Tune and Auto-Tune
- Programmable Heating or Cooling Functions for Control Output
- Selectable Alarm Functions for Alarm Output
- Serial RS485 Communication (optional)

Eco series temperature controllers are designed for measuring and controlling a temperature value. They can be used in many applications with their TC and RTD temperature measurement input, multi-function control outputs, selectable alarm functions.

They are mainly used in glass, plastic, petro-chemistry, textile, automotive and machine production industries. Accurate and advanced controlling is performed with selectable ON-OFF, P, PI, PD, PID and Self Tune/Auto Tune PID functions.

### SPECIFICATIONS
**Process Input:** Thermocouple (TC): J, K, R, S, T and L (IEC584.1)(ITS90)
Thermoresistance (RTD): Cu-50 and PT-100 (IEC751)(ITS90)
**Measurement Range:** Please refer to process input type selection in process menu parameters section.
**Accuracy:**
Thermocouple (TC):(±0.25% of full scale or ±3ºC, which one is greater) ±1 digit max.
Thermoresistance (RTD):(±0.25% of full scale or ±2ºC, which one is greater) ±1 digit max.
**Cold Junction Compensation:** Automatically ±0.1°C/1°C
**Line Compensation:** Maximum 10 Ohm
**Sensor Break Protection:** Upscale
**Sampling Cycle:** 0.1 second
**Input Filter:** Programmable
**Control Form:** ON/OFF, P, PI, PD or PID (Control form can be programmed by the user)
### OUTPUT
**Process Output:** Relay (5A@250V∼ at resistive load) or SSR Driver Output (Maximum 10mA, Max. 12V⎓ )
**Alarm Output:** Relay (5A@250V∼ at resistive load)
**SUPPLY VOLTAGE** (It must be determined in order)
230V∼ (±15%) 50/60Hz - 2VA
115V∼ (±15%) 50/60Hz - 2VA
100-240V∼ 50/60Hz - 2VA
24V∼ (±%15) 50/60Hz - 2VA
24V⎓∼ (±%15) 50/60Hz - 2VA
10...30V⎓ - 2W
### DISPLAY
**Process Display:** 16 mm Red 3 digit LED Display
**Set Value Display:** 9 mm Orange 4 digit LED Display
**Led Indicators:** PO1 (SSR Process Output Status Led), PO2 (Relay Process Output Status Led), AL1, AL2 (Alarm Output Status Leds), ºC, ºF LEDs
### ENVIRONMENTAL RATINGS and PHYSICAL SPECIFICATIONS
**Operating Temperature:** 0...50ºC
**Humidity :** 0-90%RH (none condensing)
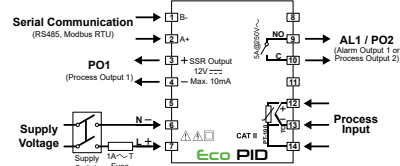**Protection Class:** IP65 at front, IP20 at rear
**Weight:** 150 gr.
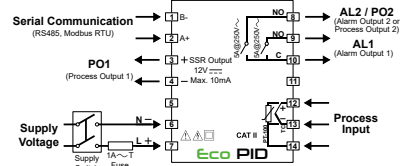**Dimension:** 48 x 48 mm, Depth: 86,5 mm
**Panel CutOut:** 46 x 46 mm

CE

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## Electrical Wirings

### The Device with One Relay:
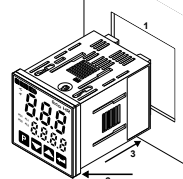


### The Device with Two Relays:



⚠ To reduce the effect of electrical noise on device, low voltage line (especially sensor input cable) wiring must be separately from high current and voltage line. If possible, use shielded cable and shield must be connected to ground only one side.
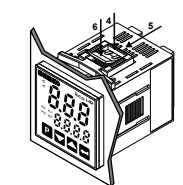
## Dimensions



Maximum 9 mm / 0.35 inch
48 mm / 1.89 inch
48 mm / 1.89 inch
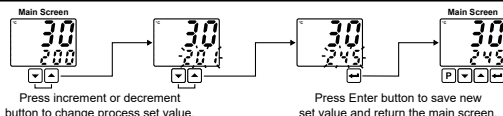6 mm / 0.24 inch
80,52 mm / 3.17 inch
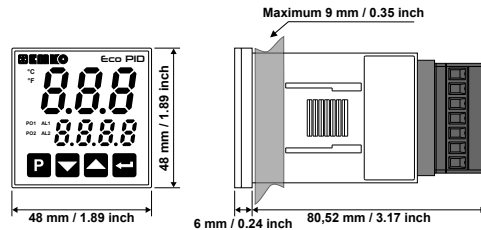
## Panel Mounting



1- Before mounting the device in your panel, make sure that the cutout is of the right size.
2- Check front panel gasket position.
3- Insert the device through the cutout. If the mounting clamps are on the unit, put out them before inserting the unit to the panel.
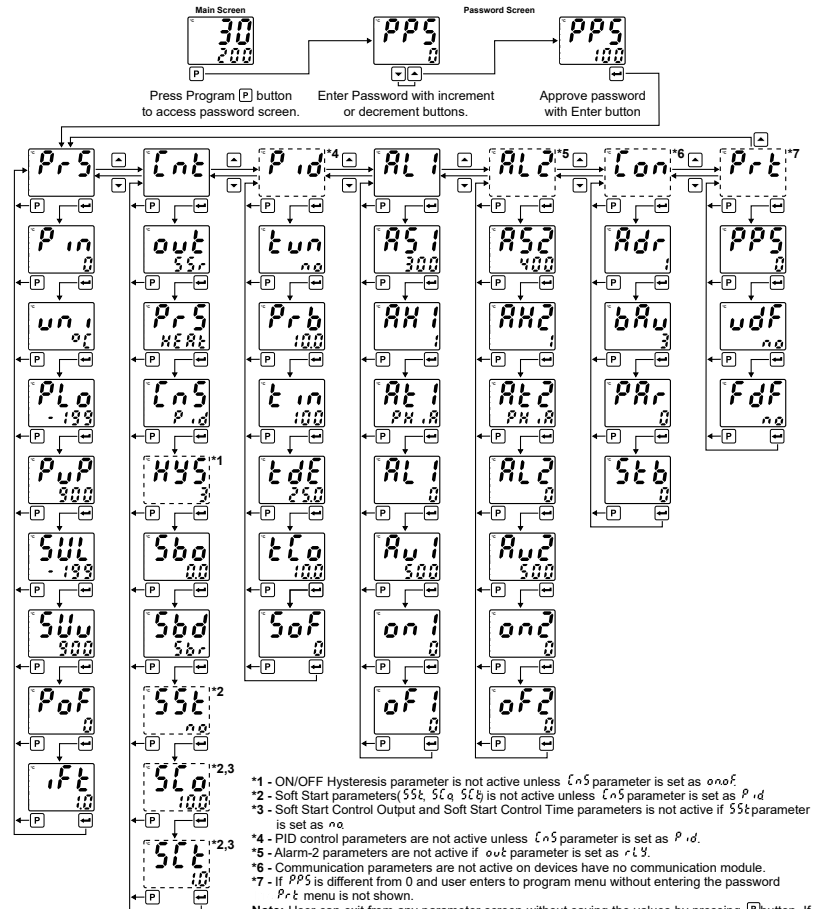
4- Insert the mounting clamps to the two of designated holes that located four sides of device.
5- Drag the mounting clamps in direction 5 until the device completely immobile within the panel.
6- In order to remove device push on the mounting clamp as shown with arrow 6 and pull back.

## Access and Change Set Values



Press increment or decrement button to change process set value.

Press Enter button to save new set value and return the main screen.

Temperature Set Value Parameter (Default: 200) MODBUS ADDRESS: 40000
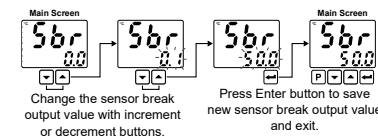
**Note-1:** User can exit from set value section without saving the values by pressing P button. If no operation for 120 seconds, device automatically exits from Set Value section.
**Note-2:** Set value can be adjusted between Set Value Low and High Limit (SUL - SUu).

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## Easy Access Diagram For Program Parameters



Press Program P button to access password screen.

Enter Password with increment or decrement buttons.

Approve password with Enter button

*1 - ON/OFF Hysteresis parameter is not active unless CnS parameter is set as onoF.
*2 - Soft Start parameters(SSt, SCo, SCb is not active unless CnS parameter is set as Pid.
*3 - Soft Start Control Output and Soft Start Control Time parameters is not active if SSt parameter is set as no.
*4 - PID control parameters are not active unless CnS parameter is set as Pid.
*5 - Alarm-2 parameters are not active if out parameter is set as rLy.
*6 - Communication parameters are not active on devices have no communication module.
*7 - If PPS is different from 0 and user enters to program menu without entering the password Prt menu is not shown.
**Note:** User can exit from any parameter screen without saving the values by pressing P button. If no operation for 120 seconds, device automatically return to main screen.

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## Easy Access Diagram For Sensor Break Output Value From Main Screen



Change the sensor break output value with increment or decrement buttons.

Press Enter button to save new sensor break output value and exit.

**Note1:** User can exit from parameter screen without saving the values by pressing P button. If no operation for 120 seconds, device automatically exits from parameter screen.
**Note2:** Sensor break output value can be adjusted on programming section too.

## Tune Operation

**Starting the Tune operation**
1- Enter to the tunE parameter in Pid menu and select SELF or Auto ,then press ↵ button for saving parameter and turn to main screen. Or easily press ↵ button for 3 seconds* in main screen.
2- Observe that tunE blinks in set display.
*Only Auto tune can be started by this way.

**Canceling Tune operation:**
1- If sensor breaks;
2- If tune operation can not be completed in 8 hours;
3- While heating self tune is running, if process value becomes greater than process set value;
4- While cooling self tune is running, if process value becomes less than process set value;
5- While tune operation is running, if user changes the process set value;
6- While tune operation is running, if user changes the tunE parameter in Pid menu;
Then tune operation is canceled, device continues to run with former PID parameters without changing PID parameters.

## PɾS : Process Menu Parameters

**Pın:** Process input type selection; (Default:0) Modbus Address: 40004
- J type (Fe,Cu,Ni) Thermocouple , -199ºC,900ºC ; -199ºF,999ºF
- 1: J type (Fe,Cu,Ni) Thermocouple , -19.9ºC,99.9ºC ; -19.9ºF,99.9ºF
- 2: K type (Ni,Cr,Ni) Thermocouple , -199ºC,999ºC ; -199ºF,999ºF
- 3: K type (Ni,Cr,Ni) Thermocouple , -19.9ºC,99.9ºC ; -19.9ºF,99.9ºF
- 4: R type (Pt13%RhPt) Thermocouple , 0ºC,999ºC ; 32ºF,999ºF
- 5: R type (Pt13%RhPt) Thermocouple , 0.0ºC,99.9ºC ; 32.0ºF,99.9ºF
- 6: S type (Pt10%RhPt) Thermocouple , 0ºC,999ºC ; 32ºF,999ºF
- 7: S type (Pt10%RhPt) Thermocouple , 0.0ºC,99.9ºC ; 32.0ºF,99.9ºF
- 8: T type (Cu,Cu,Ni) Thermocouple , -199ºC,400ºC ; -199ºF,752ºF
- 9: T type (Cu,Cu,Ni) Thermocouple , -19.9ºC,99.9ºC ; -19.9ºF,99.9ºF
- 10: L type (Ni,Cr,Co / Ni,Fe,Mn,Cu) Thermocouple , -150ºC,800ºC ; -199ºF,999ºF
- 11: L type (Ni,Cr,Co / Ni,Fe,Mn,Cu) Thermocouple , -19.9ºC,99.9ºC ; -19.9ºF,99.9ºF
- 12: Cu-50 , -199ºC,200ºC ; -199ºF,392ºF
- 13: Cu-50 , -19.9ºC,99.9ºC ; -19.9ºF,99.9ºF
- 14: Pt-100 , -199ºC,650ºC ; -199ºF,999ºF
- 15: Pt-100 , -19.9ºC,99.9ºC ; -19.9ºF,99.9ºF

**Unı:** Unit Selection. ºC or ºF can be chosen. (Default: ºC) Modbus Address: 40005
**PLo:** Operation Scale minimum (Low Limit) value. It changes according to the process input type and scale. (Default: -199) Modbus Address: 40006
**PuP:** Operation Scale maximum (High Limit) value. It changes according to the process input type and scale. (Default: 900) Modbus Address: 40007
**SuL:** Process Set value Low Limit. Minimum set value is defined with this parameter. It can be adjusted between Operation Scale minimum and maximum (PLo - PuP) values. (Default: -199) Modbus Address: 40008
**Suu:** Process Set value High Limit. Maximum set value is defined with this parameter. It can be adjusted between Operation Scale minimum and maximum (PLo - PuP) values. (Default: 900) Modbus Address: 40009
**PoF:** Display offset for process value. It can be adjusted from -10% of scale to 10% of scale. It is added to the process display value. (Default: 0) Modbus Address: 40010
**ıFt:** Define filter time(sec) for displayed value. (Default: 1.0) Modbus Address: 40011

## Cnt : Control Menu Parameters

**out:** This parameter determines, which output will be Process control output. If rLY is chosen, process output is relay output, if SSr is chosen, process output is SSR output. (Default: SSr) Modbus Address: 40015
**PrS:** Process Type Selection. It can be HEAt(Heating) or Cool(Cooling).(Default: HEAt) Modbus Address: 40016
**CnS:** Process Control Type Selection. It can be onoF or Pıd. (Default: Pıd) Modbus Address: 40017
**HYS:** Hysteresis value. It can be adjusted from %0 to %50 of the Scale (PuP - PLo). If CnS is onoF, then this parameter can be seen. (Default: 3) Modbus Address: 40018
**Sbo:** Sensor Break Output Value. It can be adjusted from %0 to %100. (Default: 0.0) Modbus Address: 40019
**Sbd:** The choice of displayed text on process value display when sensor is broken. It can be Sbr or oro. (Default: Sbr) Modbus Address: 40020
**SSt:** Soft Start Set value. Device operates in Soft Start mode, until the temperature reaches Soft Start set value. If no is selected, Soft Start mode is disabled. (Default: no) Modbus Address: 40021
**SCo:** Soft Start Control Output. This parameter determines soft start mode control output percentage. It can be adjusted from %10 to %90. (Default: 10.0) Modbus Address: 40022
**SCt:** Soft Start Control Time. This parameter determines soft start mode control time. (Default: 1.0) Modbus Address: 40023

## Pıd : PID Menu Parameters

PID menu parameters can be seen only if CnS parameter is Pıd.
**tun:** If tune parameter is set to SELF or AUto, device start to calculate PID parameters automatically. (Default: no) Modbus Address: 40027
**Prb:** Proportional band. It can be adjusted from %1.0 to %100.0. (Default: 10.0) Modbus Address: 40028
**tın:** Integral Time. It can be adjusted from 0 to 3600 second. (Default: 100) Modbus Address: 40029
**tdE:** Derivative Time. It can be adjusted from 0.0 to 999.9 second. (Default: 25.0) Modbus Address: 40030
**tCo:** Output Control Period. It can be adjusted from 0.5 to 150 second. (Default: 1.0) Modbus Address: 40031
**SoF:** Set value offset. (Set +SoF ) is used as set value in PID calculations. This parameter is used for shifting the proportional band. It can be adjusted from (-PuP/2) to (PuP/2). (Default: 0) Modbus Address: 40032

## AL1 : Alarm-1 Menu Parameters

**AS1:** Alarm-1 set value. (Default: 300) Modbus Address: 40036
**AH1:** Alarm-1 hysteresis value. It can be adjusted from %0 to %50 of the scale (PuP - PLo). (Default: 0) Modbus Address: 40037
**At1:** Alarm-1 type selection. (Default: PHıA) Modbus Address: 40038
**AL1:** Alarm-1 set low limit parameter. It can be adjusted from operation scale minimum to alarm-1 set high limit. (Default: 0) Modbus Address: 40039
**Au1:** Alarm-1 set high limit parameter. It can be adjusted from alarm-1 set low limit to operation scale minimum. (Default: 500) Modbus Address: 40040
**on1:** Alarm-1 on Delay Time. It can be adjusted from 0 to 9999 seconds. (Default: 0) Modbus Address: 40041
**oF1:** Alarm-1 off Delay Time. It can be adjusted from 0 to 9998 seconds. If it is higher than 9998, LtCH is seen on the screen and alarm latching output is selected. In alarm latching output mode in order to make passive alarm outputs, press enter ⏎ button at main screen. (Default: 0) Modbus Address: 40042

## AL2 : Alarm-2 Menu Parameters (Only for devices with two relays)

Alarm-2 menu parameters can be seen only if out parameter is SSr.
**AS2:** Alarm-2 set value. (Default: 400) Modbus Address: 40046
**AH2:** Alarm-2 hysteresis value. It can be adjusted from %0 to %50 of the Scale (PuP - PLo). (Default: 0) Modbus Address: 40047
**At2:** Alarm-2 type selection. (Default: PHıA) Modbus Address: 40048
**AL2:** Alarm-2 set low limit parameter. It can be adjusted from operation scale minimum to alarm-2 set high limit. (Default: 0) Modbus Address: 40049
**Au2:** Alarm-2 set high limit parameter. It can be adjusted from alarm-2 set low limit to operation scale maximum. (Default: 500) Modbus Address: 40050
**on2:** Alarm-2 on delay time. It can be adjusted from 0 to 9999 seconds. (Default: 0) Modbus Address: 40051
**oF2:** Alarm-2 off delay time. It can be adjusted from 0 to 9998 seconds. If it is higher than 9998, LtCH is seen on the screen and Alarm Latching Output is selected. In alarm latching output mode in order to make passive alarm outputs, press enter ⏎ button at main screen. (Default: 0) Modbus Address: 40052

## Con : Communication Parameters (Only for devices with RS-485 com.)

**Adr:** Communication accessing address of device. (Default: 1) Modbus Address: 40056
**bAu:** Communication Baud Rate. (Default: 3) Modbus Address: 40057
- 0: 1200 Baud Rate.
- 1: 2400 Baud Rate.
- 2: 4800 Baud Rate.
- 3: 9600 Baud Rate.
- 4: 19200 Baud Rate.
- 5: 38400 Baud Rate.

**PAr:** Parity Selection for Communication. (Default: 0) Modbus Address: 40058
- 0: No Parity.
- 1: Odd Parity.
- 2: Even Parity.

**Stb:** Stop Bit Selection for Communication. (Default: 0) Modbus Address: 40059
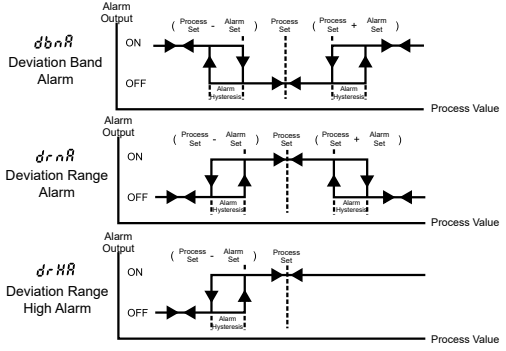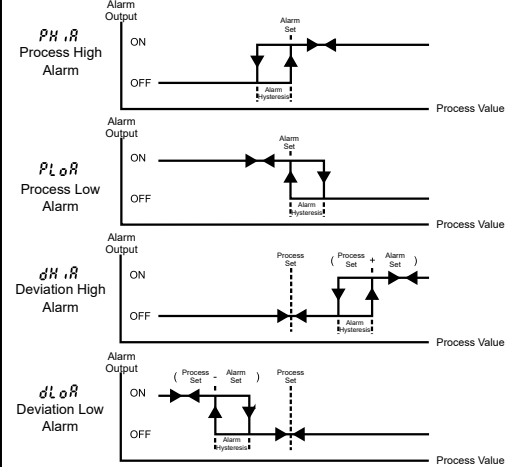- 0: 1 Stop Bit.
- 1: 2 Stop Bit.

## Prt : Protecion Menu Parameters

**PPS:** Password for accessing to the programming section. It can be adjusted from 0 to 9999. If PPS is 0, password screen is not seen. If PPS is different from 0 and user enters to the menu pages without entering the password, all the menus can be observed except protection menu Prt. But device does not allow to do any changes in parameters. (Default: 0) Modbus Address: 40063
**udF:** User default parameters. This parameter is used for saving all parameters to restore later or restore all parameters saved before. If GEt is chosen, all parameters saved before are restored. If SEt is chosen, all parameters saved to restore later. If no is chosen, nothing is changed. (Default: no) Modbus Address: 40064
**FdF:** This parameter is used for restore factory defaults. If GEt is chosen, factory defaults parameters restored. If no is chosen, nothing is changed. (Default:no) Modbus Address: 40065

⚠ Remove all input/output connections on terminals before restoring parameters to user/factory defaults.

## Modbus Addresses of Device Operation Info. (Read Input Register)

Modbus Address: 30000    Displayed Temperature Value
Modbus Address: 30001    Status of LEDs: bit.1 **ALR1**, bit.2 **ALR2**, bit.9 **ºC** bit.10 **ºF**, bit.11 **PO2**, bit.12 **PO1**
Modbus Address: 30002    Status of Device: bit.0 Sensor Break Status

## Alarm Types



**PHıA** Process High Alarm

**PLoA** Process Low Alarm

**dHıA** Deviation High Alarm

**dLoA** Deviation Low Alarm



**dbnA** Deviation Band Alarm

**drnA** Deviation Range Alarm

**drHA** Deviation Range High Alarm

## Error Messages



**1-**Sensor failure in analog inputs. Sensor connection is wrong or there is no sensor connection.

**2-**If programming section entering password is different from "0" and user accesses to the parameter by enter button without entering the password and wants to change a parameter, the warning message is shown on the bottom display as shown on the left. Device does not allow to do any changes without entering the password correctly.

**3-**If value that is read from the analog input is lower than process set low limit parameter value (PLo), value on the top display starts to blink as shown in the picture.

**4-**If value that is read from the analog input is higher than process set high limit parameter value (PuP), value on the top display starts to blink as shown in the picture.

**5-**If value that is read from the analog input is lower than sensor scale low limit, value on the top display starts to blink as shown in the picture.

**6-**If value that is read from the analog input is higher than sensor scale high limit, value on the top display starts to blink as shown in the picture.

## Installation

⚠ **Before beginning installation of this product, please read the instruction manual and warnings below carefully.**

In package,
- One piece unit
- Two pieces mounting clamp
- One piece instruction manual

A visual inspection of this product for possible damage occured during shipment is recommended before installation. It is your responsibility to ensure that qualified mechanical and electrical technicians install this product.

If there is danger of serious accident resulting from a failure or defect in this unit, power off the system and the electrical connection of the device from the system.

The unit is normally supplied without a power switch or a fuse. Use power switch and fuse as required.

Be sure to use the rated power supply voltage to protect the unit against damage and to prevent failure.

Keep the power off until all of the wiring is completed so that electric shock and trouble with the unit can be prevented.

Never attempt to disassemble, modify or repair this unit. Tampering with the unit may results in malfunction, electric shock or fire.

Do not use the unit in combustible or explosive gaseous atmospheres. During the equipment is putted in hole on the metal panel while mechanical installation some metal burrs can cause injury on hands, you must be careful.

Montage of the product on a system must be done with it's mounting clamp. Do not do the montage of the device with inappropriate mounting clamp. Be sure that device will not fall while doing the montage.

It is your responsibility if this equipment is used in a manner not specified in this instruction manual.

## Ordering Information

| Eco PID ( 48x48 DIN 1/16 ) | A | B | C | D | E |
|---|---|---|---|---|---|
| | 4 | . | . | . | S | . |

| A | Dimension |
|---|---|
| 4 | 48x48 DIN 1/16 |

| B | Supply Voltage |
|---|---|
| 1 | 100-240V∿ 50/60Hz |
| 2 | 24V∿ (±%15) 50/60Hz |
| 3 | 115V∿ (±%15) 50/60Hz |
| 5 | 230V∿ (±%15) 50/60Hz |
| 6 | 10...30V⎓ |
| 7 | 24V∿ (±%15) 50/60Hz |
| 9 | Customer |

| C | Outputs-1 |
|---|---|
| 1R | 1 x Relay Output (5A@250V∿ at Resistive Load) (NO,C) |
| 2R | 2 x Relay Output (5A@250V∿ at Resistive Load) (NO,NO,C) |

| D | Outputs-2 |
|---|---|
| S | SSR Driver Output (Max. 10mA, Max. 12V⎓) |

| E | Communication |
|---|---|
| 0 | None |
| 485 | RS-485 Communication |

⚠ Before commissioning the device, parameters must be set in accordance with desired use. Incomplete or incorrect configuration can cause dangerous stiuations.

⚠ Because of limited mechanical life of relay output contact, SSR output is recommended which the device use PID control algoritm. The device with ON/OFF control algoritm, hysteresis parameter must be set a suitable value for your system, to avoid too much relay switching.

⚠ ∿ ⇒ Vac,
⎓ ⇒ Vdc,
⎓∿ ⇒ Vdc or Vac can be applied