



ESM-4410 48 x 48 1/16 DIN
Digital, On/Off Temperature Controller

- 3 Digits display
- J type thermocouple or
K type thermocouple or
PT-100 2-wire or 3-wire temperature input
(It must be determined in order)
- ON/OFF control form
- Selectable heating and cooling function
- Operating type selection with hysteresis
- Adjustment of temperature offset value
- Minimum Pulling Time Adjustment for Control Outputs

Instruction manual of ESM-4410 Temperature Controller consists of three main sections. Explanation of these sections are below. Also, there are other sections which include order information and technical specifications of the device. All titles and page numbers in instruction manual are in "CONTENTS" section. User can reach to any title with section number.

Installation:

In this section, physical dimensions of the device, panel mounting, electrical wiring are explained.

Operation and Parameters:

In this section, user interface of the device, how to access to the parameters, description of the parameters are explained.

Control Algorithm:

Configurable control function that is on the device is explained.

Also in these sections, there are warnings to prevent serious injury while doing the physical and electrical mounting or using the device.

Explanation of the symbols which are used in these sections are given below.



This symbol is used for safety warnings. User must pay attention to these warnings.



This symbol is used to determine the dangerous situations as a result of an electric shock. User must pay attention to these warnings definitely.



This symbol is used to determine the important notes about functions and usage of the device.

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EU DECLARATION OF CONFORMITY

Manufacturer Company Name : Emko Elektronik A.S.

Manufacturer Company Address: DOSAB, Karanfil Sokak, No:6, 16369 Bursa, Turkiye

The manufacturer hereby declares that the product conforms to the following standards and conditions.

Product Name : Temperature Controller

Model Number : ESM-4410

Type Number : ESM-4410

Product Category : Electrical equipment for measurement, control and laboratory use

Conforms to the following directives :

73 / 23 / EEC The Low Voltage Directive as amended by 93 / 68 / EEC

89 / 336 / EEC The Electromagnetic Compatibility Directive

Has been designed and manufactured according to the following specifications

EN 61000-6-4:2001 EMC Generic Emission Standard for the Industrial Environment

EN 61000-6-2:2001 EMC Generic Immunity Standard for the Industrial Environment

EN 61010-1:2001 Safety Requirements for electrical equipment for measurement, control and laboratory use

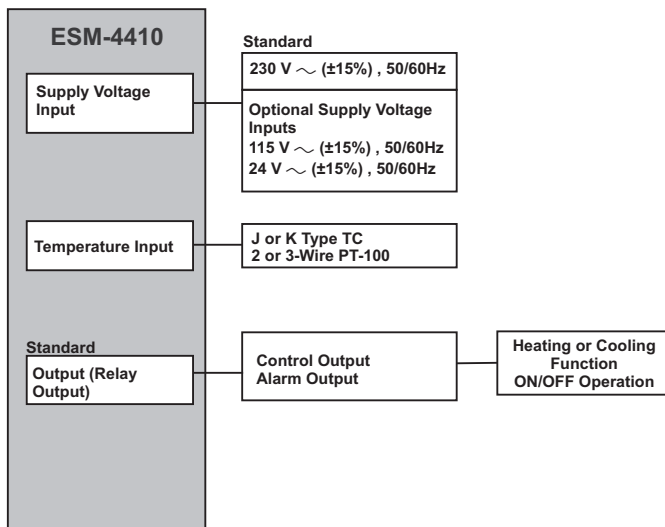
1.Preface

ESM series temperature controllers are designed for measuring and controlling temperature. They can be used in many applications with On/Off control form and heating and cooling selection. Some application fields which they are used are listed below:

Application Fields

Glass
Plastic
Petro-Chemistry
Textile
Automotive
Machine Production Industries

1.1 General Specifications



1.2 Ordering Information

ESM-4410 (48x48 1/16 DIN)		A	BC	D	E	/	FG	HI	/	U	V	W	Z
				0	1	/	00	/	0	0	0	0	
A Supply Voltage													
3	24V ~ (±15%) 50/60Hz												
4	115V ~ (±15%) 50/60Hz												
5	230V ~ (±15%) 50/60Hz												
9	Customer (Max.240V~ (±15%)) 50/60Hz												
BC Input Type						Scale(°C)							
09	PT 100 , IEC751(ITS90)					-19.9°C 99.9°C							
03	PT 100 , IEC751(ITS90)					0°C 400°C							
05	J ,Fe CuNi IEC584.1(ITS90)					0°C 800°C							
10	K ,NiCr Ni IEC584.1(ITS90)					0°C 999°C							
E Output-1													
1	Relay Output (7A@250V ~ , 1 NO)												
FG Output-2													
01	-												

All order information of ESM-4410 Temperature Controller are given on the table at left. User may form appropriate device configuration from information and codes that at the table and convert it to the ordering codes.

Firstly, supply voltage then other specifications must be determined. Please fill the order code blanks according to your needs.

Please contact us, if your needs are out of the standards.



~ Symbol means Vac,
 --- Symbol means Vdc

1.3 Warranty

EMKO Elektronik warrants that the equipment delivered is free from defects in material and workmanship. This warranty is provided for a period of two years. The warranty period starts from the delivery date. This warranty is in force if duty and responsibilities which are determined in warranty document and instruction manual performs by the customer completely.

1.4 Maintenance

Repairs should only be performed by trained and specialized personnel. Cut power to the device before accessing internal parts.

Do not clean the case with hydrocarbon-based solvents (Petrol, Trichlorethylene etc.). Use of these solvents can reduce the mechanical reliability of the device. Use a cloth dampened in ethyl alcohol or water to clean the external plastic case.

2. Installation



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

In package ,

- One piece unit
- One piece mounting clamp
- One piece instruction manual

A visual inspection of this product for possible damage occurred 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 separate 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 result in malfunction, electric shock or fire.

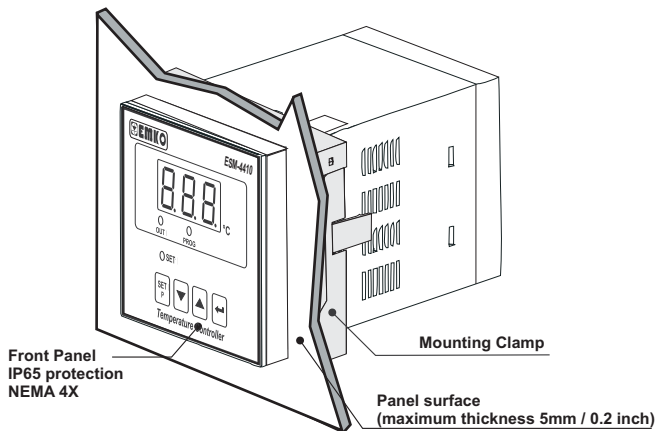
Do not use the unit in combustible or explosive gaseous atmospheres.

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.

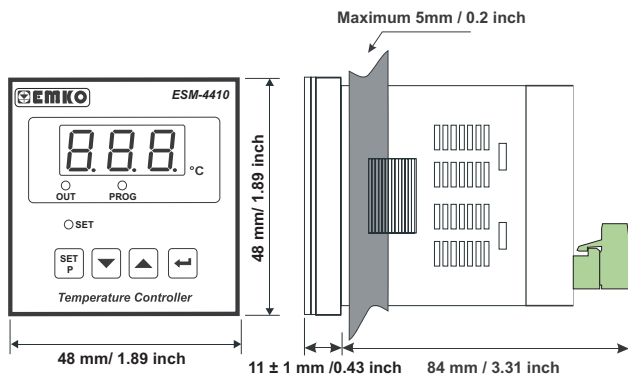
Montage of the product on a system must be done with it's own fixing clamps. Do not do the montage of the device with inappropriate fixing clamps. Be sure that device will not fall while doing the montage.

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

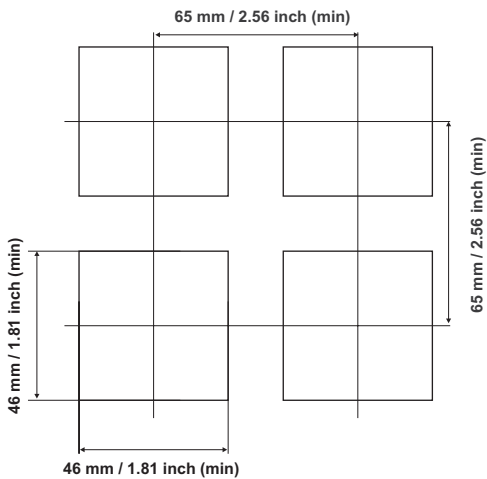
2.1 General Description



2.2 Front View and Dimensions of ESM-4410 Temperature Controller



2.3 Panel Cut-Out



2.4 Environmental Ratings

Operating Conditions



Operating Temperature : 0 to 50 °C



Max. Operating Humidity : 90% Rh (non-condensing)



Altitude : Up to 2000m.



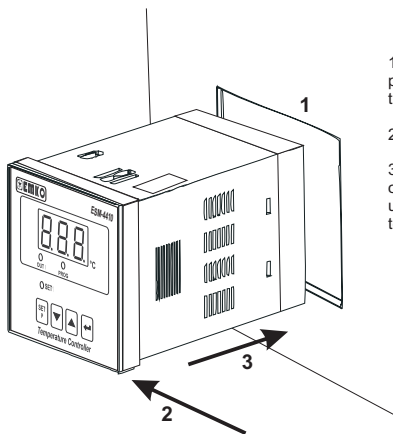
Forbidden Conditions:

Corrosive atmosphere

Explosive atmosphere

Home applications (The unit is only for industrial applications)

2.5 Panel Mounting



1-Before mounting the device in your panel, make sure that the cut-out is of the right size.

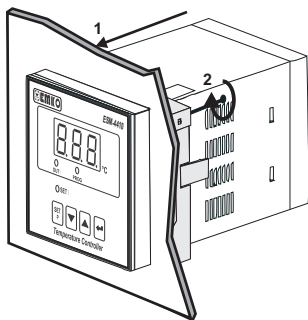
2-Check front panel gasket position

3-Insert the device through the cut-out. If the mounting clamp is on the unit, put out it before inserting the unit to the panel.



During installation into a metal panel, care should be taken to avoid injury from metal burrs which might be present. The equipment can loosen from vibration and become dislodged if installation parts are not properly tightened. These precautions for the safety of the person who does the panel mounting.

2.6 Installation Fixing Clamp



The unit is designed for panel mounting.

1-Insert the unit in the panel cut-out from the front side.

2-Insert the mounting clamp from the rear side of the unit and screw up the fixing screws until the unit completely immobile within the panel

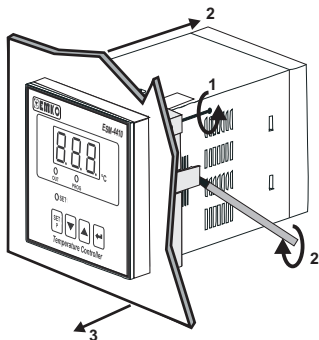


Montage of the unit to a system must be done with it's own fixing clamps. Do not do the montage of the device with inappropriate fixing clamps. Be sure that device will not fall while doing the montage.

2.7 Removing from the Panel



Before starting to remove the unit from panel, power off the unit and the related system.



1-Loosen the screws.

2-Lift the locking tabs located on both the right and left hand sides and pull the fixing clamp from the device while holding the unit in place.

3-Pull the unit through the front side of the panel

3. Electrical Wirings



You must ensure that the device is correctly configured for your application. Incorrect configuration could result in damage to the temperature being controlled, and/or personal injury. It is your responsibility, as the installer, to ensure that the configuration is correct.

Device parameters has factory default values. These parameters must be set according to the system's needs.



Only qualified personnel and technicians should work on this equipment. This equipment contains internal circuits with voltage dangerous to human life. There is severe danger for human life in the case of unauthorized intervention.

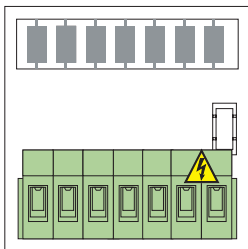


Be sure to use the rated power supply voltage to protect the unit against damage and to prevent failure.



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

3.1 Terminal Layout and Connection Instructions



Max. 2.5mm / 0.098 inch
Wire Size:
14AWG/1mm²
Solid /Stranded



Torque
0.5 Nm

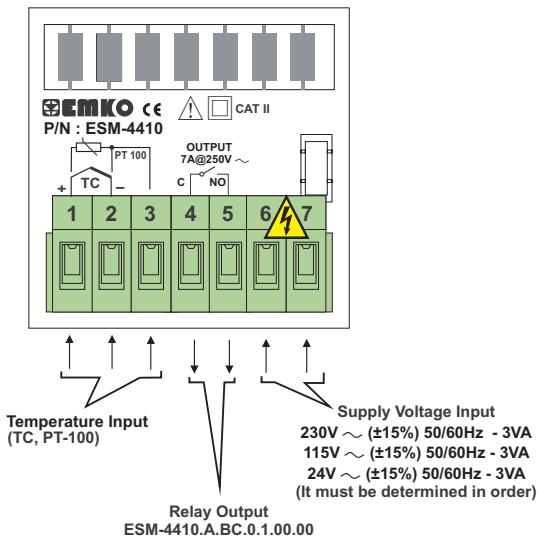


Screw driver
0.8x3mm

3.2 Electrical Wiring Diagram



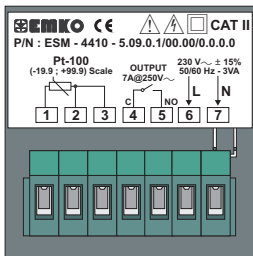
Electrical wiring of the device must be the same as 'Electrical Wiring Diagram' below to prevent damage to the te being controlled and personnel injury.



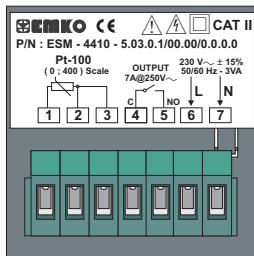
Temperature input is in CAT II class.

3.3 Labels for ESM-4410 Temperature Controller

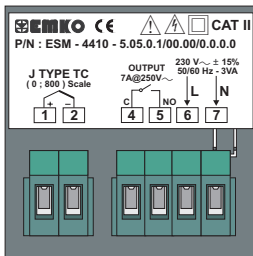
Rear label appearance of the device that have PT-100 (-19.9°C ; + 99.9°C) Scale



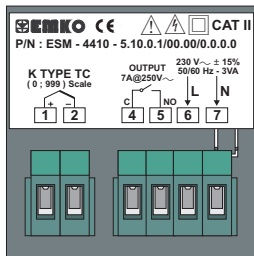
Rear label appearance of the device that have PT-100 (0°C ; 400°C) Scale



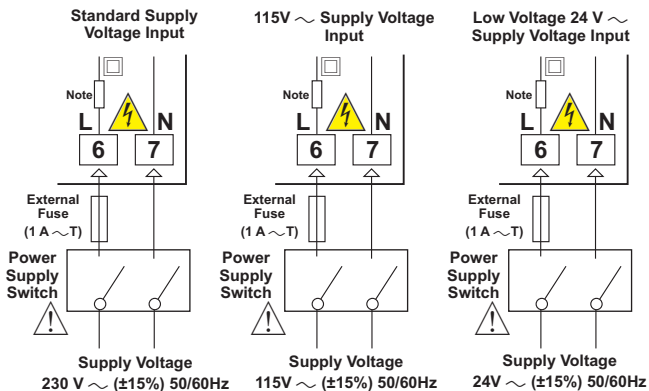
Rear label appearance of the device that have J Type Thermocouple (0°C ; 800°C) Scale



Rear label appearance of the device that have K Type Thermocouple (0°C ; 999°C) Scale



3.4 Supply Voltage Input Connection of the Device



Note :

There is an internal 33R Ω fusible flameproof resistor in 115V ~ and 230V ~ 50/60Hz
 There is an internal 4R7 Ω fusible flameproof resistor in 24V ~ 50/60Hz



Supply voltage range must be determined in order. While installing the unit, supply voltage range must be controlled and appropriate supply voltage must be applied to the unit. Controlling prevents damages in unit and system and possible accidents as a result of incorrect supply voltage.



There is no power switch or fuse on the device. So a power switch and a fuse must be added to the supply voltage input. Power switch and fuse must be put to a place where user can reach easily.



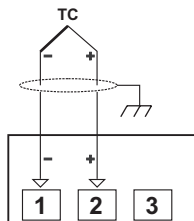
Power switch must be two poled for separating phase and neutral. On/Off condition of power switch is very important in electrical connection. On/Off condition of power switch must be signed for preventing the wrong connection.





External fuse must be on phase connection in ~ supply input.

3.5 Temperature Input Connection

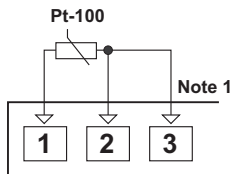
3.5.1 TC (Thermocouple) Connection



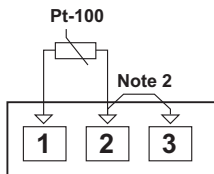
Connect the wires with the polarity as shown in the figure left.

-  Always use compensation wire corresponding to the thermocouple used. If present, the shield must be connected to a proper ground.
-  Input resistance is greater than $10\text{M}\Omega$.

3.5.2 RTD Connection



3-wire Pt-100 connection
(with line compensation)
(Max. Line impedance is $10\ \Omega$)




2-wire Pt-100 connection
(without line compensation)

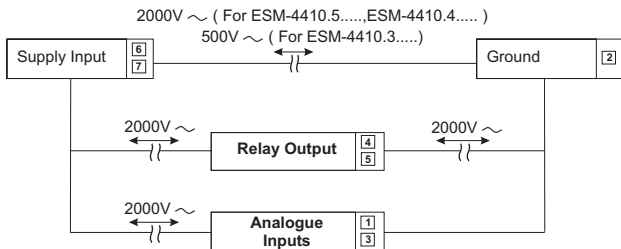
Note 1 : In 3-wire system, use always cables of the same diameter (min 1mm^2) Always use wires of the same gauge and type whether a 2-wire or 3-wire system.

Note 2 : Install a jumper between terminals 2 and 3 when using a 2-wire RTD.

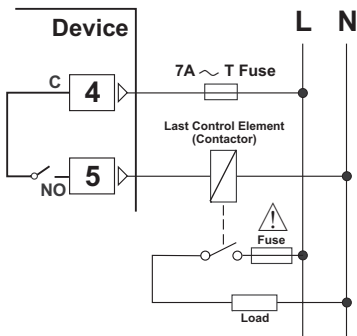
Note 3 : If the distance is longer than 10 meters, use 3-wire system

-  Input resistance is greater than $10\text{M}\Omega$.

3.6 Galvanic Isolation Test Values of ESM-4410 Temperature Controller



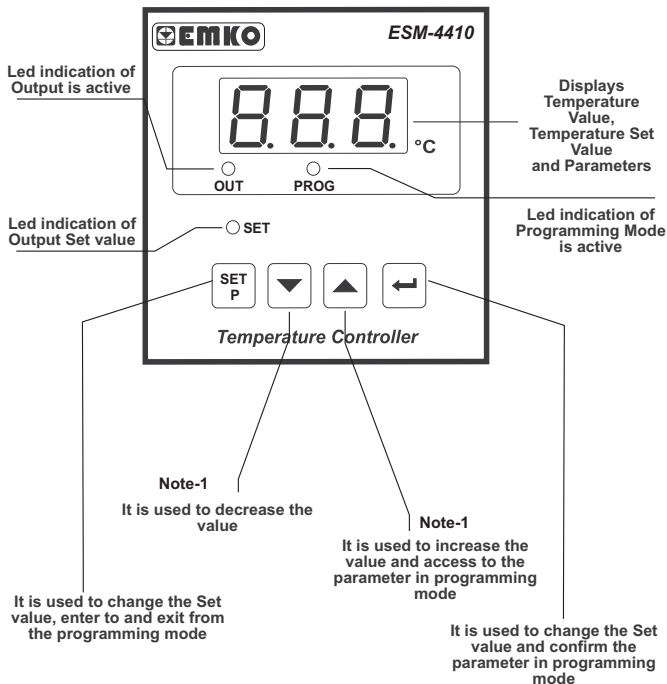
3.7 Output (Relay Output) Connection



Fuses must be selected according to the application

4. Front Panel Definition and Accessing to the Menus

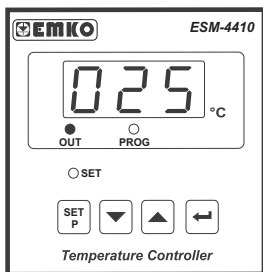
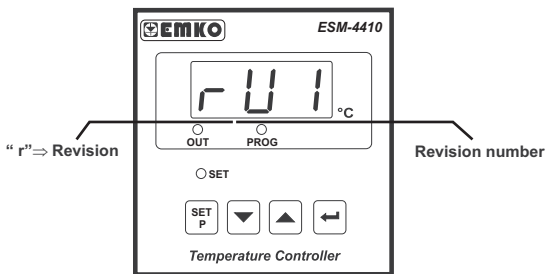
4.1 Front Panel Definition for ESM-4410



Note-1: In Set value or programming mode while changing the parameter, if increment or decrement button is pressed for 5 seconds continuously, increment and decrement number become 10, if increment or decrement button is pressed for 10 seconds continuously, increment and decrement number become 100.

4.2 Observation of ESM-4410 Temperature Controller Software Revision

When the power is applied to the device, software revision number is momentarily shown on the display .



Main operation screen is shown



If there is an unexpected situation while opening the device, power off the device and inform a qualified personnel.

4.3 Changing and Saving Set Values

Operation Screen



When SET button is pressed, SET LED lights on and SET value is observed on display.

○ SET



SET Value Screen



● SET



SET value can be changed with increment and decrement buttons.

SET Value Screen



● SET



Press SET button again to exit without saving SET value.

Press Enter button for saving SET value.

Operation Screen



For both conditions, SET LED lights off and it turns to main operation screen.

○ SET



If no operation is done in programming or Set value mode for 20 seconds, device turns back to main operation screen automatically.

4.4 Entering to Programming Mode, Changing and Saving Parameters

Operation Screen



When SET button is pressed for 10 seconds, Prog Led starts to flash and "Hs1" is seen on screen

○ SET



Programming Screen
Hysteresis Parameter



Prog Led starts to flash

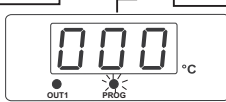
○ SET



Press SET button to exit from programming mode.

If Enter button is pressed next parameter is shown.

Value of Hysteresis parameter



Parameter value can be observed by pressing increment button.

If Enter button is pressed next parameter is shown.

Parameter can be changed with increment and decrement buttons.

○ SET



Press SET button to exit without saving parameter value.

Programming Screen



Value of Hysteresis parameter



○ SET



Press SET button to exit programming mode.

○ SET



Press Enter button for saving parameter value.

Operation Screen

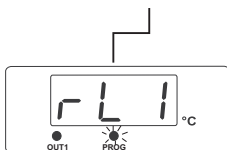


○ SET



Programming Screen

Operation Type Selection Parameter for Output



Press SET button to exit from programming mode.



If Enter button is pressed next parameter is shown.

Value of Operation Type Selection Parameter for Output Heating is selected



Press SET button to exit without saving parameter value.



Parameter value can be observed by pressing increment button.

Parameter can be changed with increment and decrement buttons.

Programming Screen



Press SET button to exit from programming mode.



Value of Operation Type Selection Parameter for Output

Cooling is selected

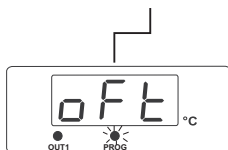
Press Enter button for saving parameter value.



Operation Screen

Programming Screen

Display Offset
Parameter



○ SET

Press SET button to exit
from programming mode.



If Enter button is
pressed, next parameter
is shown.

Value of Display Offset Parameter



○ SET

Press SET button to
exit without saving
parameter value.



Parameter value can be
observed by pressing
increment button.

Parameter can be
changed with increment
and decrement buttons.

Programming Screen



○ SET

Press SET
button to exit
from
programming
mode.



○ SET

Value of Display Offset Parameter

Press Enter
button for
saving
parameter
value.

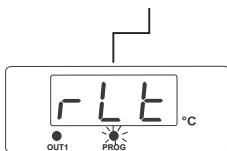


○ SET



Operation Screen

Programming Screen
Minimum Pulling Time Parameter for Output



○ SET

Press SET button to exit from programming mode.



If Enter button is pressed, next parameter is shown.

Value of Minimum Pulling Time Parameter for Output



○ SET

Press SET button to exit without saving parameter value.



Parameter value can be observed by pressing increment button.

Parameter can be changed with increment and decrement buttons

Programming Screen



○ SET

Press SET button to exit from programming mode.



○ SET

Value of Minimum Pulling Time Parameter for Output

Press Enter button for saving parameter value.



It turns to Hysteresis parameter.



○ SET

Operation Screen

Press SET button to exit from programming mode.



Continue to press Enter button to see the parameters.



○ SET



If no operation is done in programming or Set value mode for 20 seconds, device turns to main operation screen automatically.

5. Parameters

Parameters are divided into two groups as SET and PROGRAM parameters.

5.1 Set Parameters

SET

SET value for Output. Control of output relay is done according to this value. This value can be adjusted according to input type, minimum and maximum of scale.

5.2 Program Parameters

H51

Hysteresis value for Output

It can be adjusted from 0.0 to 10.0 for PT-100 (-19.9 ; +99.9)°C scaled devices

It can be adjusted from 0 to 100 for PT-100 (0 ; 400)°C , J Type Thermocouple (0 ; 800)°C , K Type Thermocouple (0 ; 999)°C scaled devices

rL1

Operation Type Selection parameter for output

000

Operation type of output relay can be adjusted as "HEATING". Normally energised.

001

Operation type of output relay can be adjusted "COOLING". Normally de-energised.

oFt

This parameter can make addition or reduction to the temperature value on the device screen. It has no effect to the control system.

It can be adjusted from -10.0 to 10.0 for PT-100 (-19.9 ; +99.9)°C scaled devices.

It can be adjusted from -100 to 100 for PT-100 (0 ; 400)°C , J Type Thermocouple (0 ; 800)°C , K Type Thermocouple (0 ; 999)°C scaled devices.

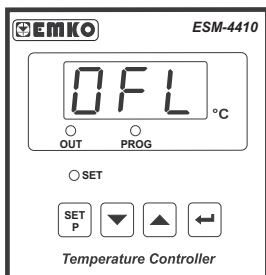
rLt

Minimum pulling time parameter for output (Minimum off time). When Output is inactive this time must be expired for Output to become active again. It can be adjusted from 0 to 100 seconds



If no operation is done in programming or Set value mode for 20 seconds, device turns back to main operation screen automatically.

6. Failure Message in ESM-4410 Temperature Controllers

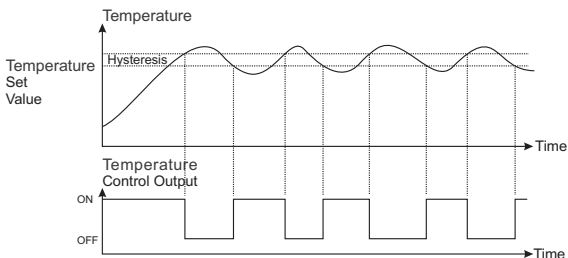


Sensor failure in analogue inputs. It means sensor connection is wrong or there is no sensor.

7. Control Algorithm

7.1 ON/OFF Control

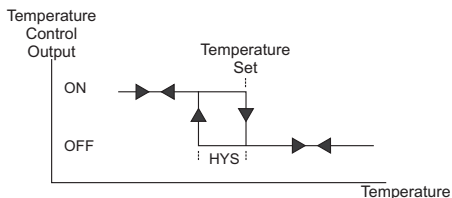
In ON/OFF control algorithm, temperature value is tried to keep equal to set value by opening or closing completely last control element. ON/OFF controlled system, temperature value oscillates continuously. Temperature value's oscillation period or amplitude around set value changes according to controlled system. For reducing oscillation period of temperature value, a threshold zone is formed below or around set value and this zone is named hysteresis. Action of control output is described with figures below.



7.1.1 ON/OFF Control in ESM-XX10 Temperature Controller

ON/OFF control algorithm in temperature control output which has heating function

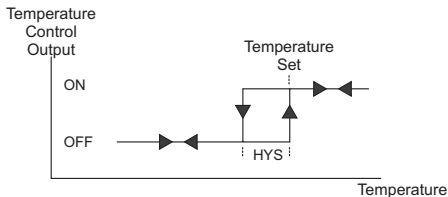
Two different operation according to defined hysteresis mode are explained in graphics below.



Hysteresis is described smaller than temperature set value. Maximum value of oscillation in temperature value is close to temperature set value.

ON/OFF control algorithm in temperature control output which has cooling function

Two different operation according to defined hysteresis mode are explained in graphics below.



Hysteresis is described smaller than temperature set value. Maximum value of oscillation in temperature value is close to temperature set value.

8. Specifications

Device Type	: Temperature Controller
Housing&Mounting	: 48mm x 48mm x 95mm 1/16 DIN 43700 plastic housing for panel mounting. Panel cut-out is 46x46mm.
Protection Class	: NEMA 4X (IP65 at front, IP20 at rear).
Weight	: Approximately 0.16 Kg.
Environmental Ratings	: Standard, indoor at an altitude of less than 2000 meters with non-condensing humidity.
Storage/Operating Temperature	: -40 °C to +85 °C / 0 °C to +50 °C.
Storage/Operating Humidity	: 90 % max. (Non-condensing)
Installation	: Fixed installation
Over Voltage Category	: II
Pollution Degree	: II, office or workplace, none conductive pollution
Operating Conditions	: Continuous
Supply Voltage and Power	: 230V ~ (±15%) 50/60 Hz. 3VA 115V ~ (±15%) 50/60 Hz. 3VA 24V ~ (±15%) 50/60 Hz. 3VA
Temperature Inputs	: TC, RTD
Thermocouple input types	: J, K (IEC584.1)(ITS90)
Thermoresistance input type	: PT 100 (IEC751)(ITS90)
Accuracy	: ± 1% of FS for Thermocouple, Thermoresistance
Cold Junction Compensation	: Automatically ± 0.1°C/1°C.
Line Compensation	: Maximum 10 Ω .
Sensor Break Protection	: Upscale
Sampling Cycle	: 3 samples per second
Control Forms	: ON / OFF
Relay Outputs	: 7A@250V ~ (Electrical Life : 100.000 Operation (Full Load))
Display	: 10 mm Red 3 digits LED display
Led Indicators	: SET (Green), OUT (Red), PROG (Red) 3 mm