EMKO

PROCESS CONTROL UNITS
ESM-XX31

CE

**ESM-4431, ESM-7731, ESM-9931, ESM-4931, ESM-9431
PID Process Controllers**

- 4 digit process (PV) and 4 digit set (SV) display
- Universal process input (TC, RTD)
- Programmable ON/OFF, P, PI, PD and PID control forms
- Auto-tune and Self-tune PID
- Manual/Automatic mode selection for control outputs
- Bumpless transfer
- Programmable heating, cooling and alarm
  functions for control outputs

SPECIFICATIONS
PROCESS INPUT
Process Input: TC, RTD
Thermocouple (TC): L(DIN 43710) ,J , K , R , S , T , B , E and N
(IEC584.1)(ITS90) ,C (ITS90)
Thermoresistance (RTD): PT-100 (IEC751)(ITS90)
Measurement Range : Please refer to Table-1 for selection of input
type and scale
Accuracy:± 0.25% of full scale for thermocouple, thermoresistance
Cold Junction Compensation: Automatically ±0.1°C/1°C
Line Compensation: Maximum 10 Ohm
Sensor break protection: Upscale
Sampling Cycle:3 samples per second
Input Filter: 0.0 to 900.0 seconds
CONTROL
Control Form: ON/OFF, P, PI, PD or PID (Control form can be
programmed by the user)

OUTPUT
Standard Relay Outputs : Two relays. 5A@250V∼(at resistive load)
(They can be programmed as Control or Alarm output)
SSR Driver Output : Maximum 17mA , Max. 25V ⎓

SUPPLY VOLTAGE
100-240 V ∼ 50/60 Hz (-15%;+10%), - 6VA
24V ∼ 50/60 Hz (-15% ; +10%), - 6VA
24V ⎓ (-15% ; +10%), - 6W
(Must be determined in order)

DISPLAY
Process Display :
ESM-4431 : 10.1 mm Red 4 Digits LED Display
ESM-4931 : 13.2 mm Red 4 Digits LED Display
ESM-7731 : 13.2 mm Red 4 Digits LED Display
ESM-9931 : 19 mm   Red 4 Digits LED Display
ESM-9431 : 10.1 mm Red 4 Digits LED Display
Set Value Display :
ESM-4431 : 8 mm   Green 4 Digits LED Display
ESM-4931 : 8 mm   Green 4 Digits LED Display
ESM-7731 : 9.1 mm   Green 4 Digits LED Display
ESM-9931 :10.8 mm   Green 4 Digits LED Display
ESM-9431 : 8 mm   Green 4 Digits LED Display
LEDS : AT(Auto Tune), M (Manual Mode), A (Automatic Mode),
PSET / ASET1 / ASET2 (Control or Alarm Set) Leds, PO, AO1, AO2
(Control or Alarm Status) °C / °F Leds

ENVIRONMENTAL RATINGS and PHYSICAL SPECIFICATIONS
Operating Temperature: 0...50°C
Humidity : 0-90%RH (none condensing)
Protection Class : IP65 at front, IP20 at rear
Weight:
ESM-4431 : 170 gr.
ESM-4931 : 230 gr.
ESM-7731 : 230 gr.
ESM-9931 : 320 gr.
ESM-9431 : 230 gr.
Dimensions:
ESM-4431 : (48 x 48mm, Depth:87.5 mm)
ESM-4931 : (96 x 48mm, Depth:86.5 mm)
ESM-7731 : (72 x 72mm, Depth:87.5 mm)
ESM-9931 : (96 x 96mm, Depth:87.5 mm)
ESM-9431 : (48 x 96mm, Depth:86.5 mm)
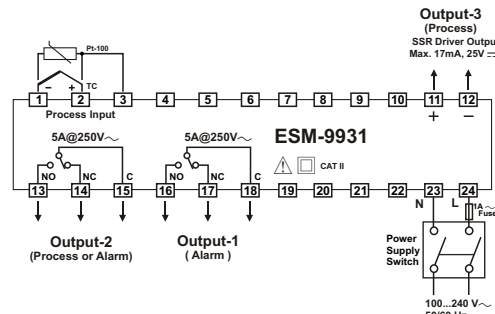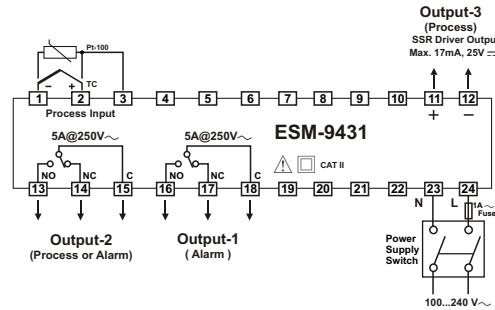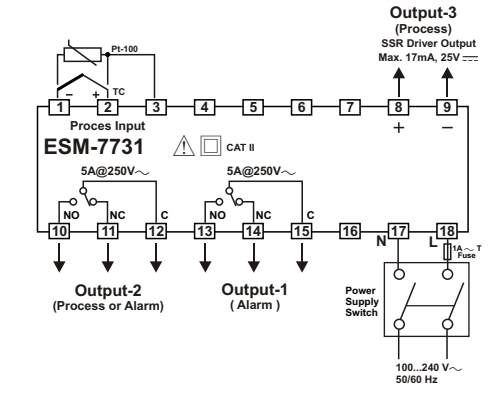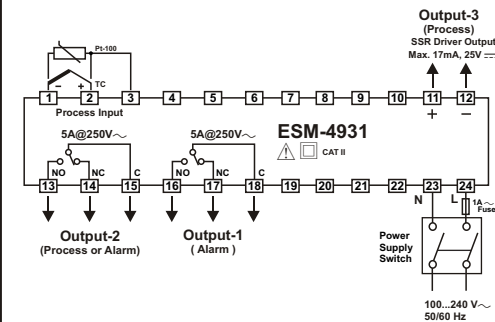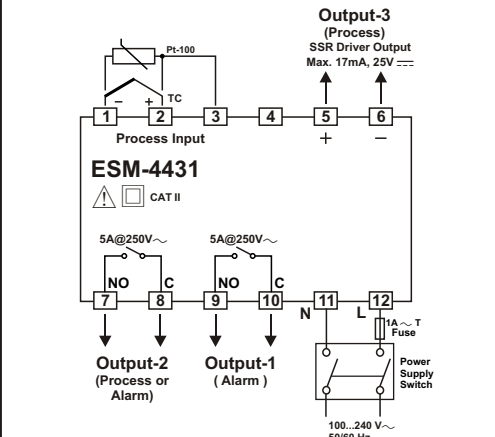**Panel Cut-Out:**
ESM-4431 : (46 x 46mm)
ESM-4931 : (92 x 46mm)
ESM-7731 : (69 x 69mm)
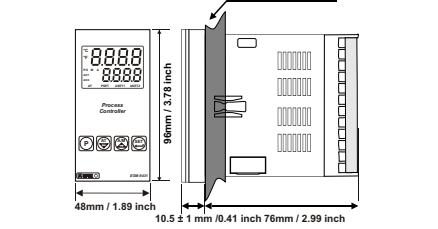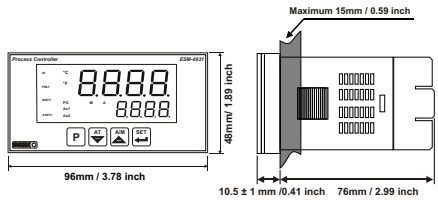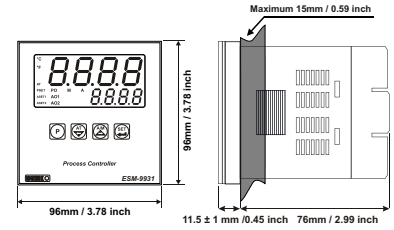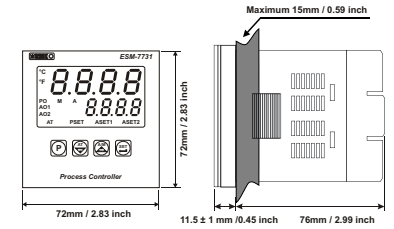ESM-9931 : (92 x 92mm)
ESM-9431 : (46 x 92mm)

Electrical Wirings

ESM-4431

ESM-4931

ESM-7731

ESM-9431

ESM-9931

Output-3 (Process) SSR Driver Output Max. 17mA, 25V ⎓
Process Input
5A@250V∼
Output-2 (Process or Alarm)
Output-1 (Alarm)
Power Supply Switch
100...240 V∼ 50/60 Hz
1A∼ T Fuse

DIMENSIONS

ESM-4431
48mm/ 1.89 inch
11.5 ± 1 mm /0.45 inch 76mm / 2.99 inch
Maximum 5mm / 0.2 inch
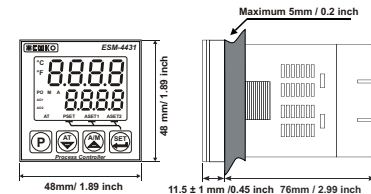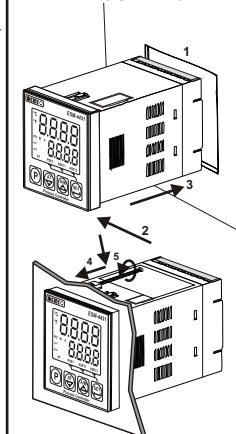
PANEL MOUNTING

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

2-Check front panel gasket position

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

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

5- Insert the mounting clamps to the holes that located top and bottom sides of device and screw up the fixing screws until the unit completely immobile within the panel

ESM-7731
72mm / 2.83 inch
11.5 ± 1 mm /0.45 inch 76mm / 2.99 inch
Maximum 15mm / 0.59 inch

ESM-9931
96mm / 3.78 inch
11.5 ± 1 mm /0.45 inch 76mm / 2.99 inch
Maximum 15mm / 0.59 inch

ESM-4931
96mm / 3.78 inch
10.5 ± 1 mm /0.41 inch 76mm / 2.99 inch
Maximum 15mm / 0.59 inch

ESM-9431
48mm / 1.89 inch
10.5 ± 1 mm /0.41 inch 76mm / 2.99 inch
Maximum 15mm / 0.59 inch

Introduction Brochure. ENG ESM-XX31 01 V00 05/14

Access and change Set values

Operation screen → **Process Set Screen** → Alarm-1 Set Screen → Alarm-2 Set Screen → **Operation Screen**

Press P Button → Press increment or decrement button to change Process Set value. → Press SET button to save process set value and access the Alarm1 set value. → Press increment or decrement button to change Set value. → Press SET button to save Alarm1 set value and access the Alarm2 set value. → Press increment or decrement button to change Set value. → Press SET button to save Alarm1 set value and return to the operation screen.

Note: 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.

Easy access diagram for Program Parameters

Main Operation Screen → **PASS tECH** → **Password Screen tCPS 0** → **Password Screen tCPS 850**

To enter Program menu press P button for 5 seconds. → Press SET Button to access Password screen. → Press increment or decrement button to enter password. → Press SET Button to approve password.

Note: Please refer PASS ConF section on the document

run LiSt → d iSP LiSt → P inP ConF → P id ConF → PCnF ConF → ALn1 ConF → ALn2 ConF → GEnn ConF → PASS ConF

Run LiSt: Selection of PID Tune and Operation Form

tunn **TUNE SELECTION:** By selecting one of the methods below, device can determine the PID parameters.
- **no** Device operates according to the defined PID parameters
- **Atun** **Auto tune** (Limit Cycle Tuning) operation
- **Stun** **Self tune** (Step Response Tuning) operation
- **AtSt** **Auto-Self Tune** Tunning methods are performed according to system conditions by itself.

Attn **AUTOMATIC TUNE SELECTION**
- **no** Device does not perform tunning.
- **YES** Device does perform tunning.

bPLt **BUMPLESS TRANSFER**
- **no** When automatic mode changes to manual mode, the process output will be last saved manuel mode output percentage. Process output value in manual control is not taken into consideration while passing from manual control to automatic control. New control output that is measured in automatic control is applied to process output.

- **YES** When automatic mode changes to manual mode, the process output will be last automatic mode output percentage. While passing from manual control to automatic control, last process output value in manual control is accepted as first process output value in automatic control.

LtCC **ALARM LATCH CANCELING**
- **no** Alarm latch canceling is not performed.
- **YES** If there is an alarm output with latching and there is no alarm status, latching operation will be finished by the device. This parameter becomes **no** automatically.

diSP LiSt: Function Selection for Top and Bottom Display

tdSP **Top Display Function**
This parameter determines which value is shown in top display.
- **0** Process value (PV) is shown in top display.
- **1** Difference between process set value and process value (SV-PV) is shown in top display.

bdSP **Bottom display Function**
This parameter determines which value is shown in bottom display.
- **0** Process set value (SV) is shown in bottom display.
- **1** %Output value that is applied to process control output is shown in bottom display.

PinP ConF: Process Input Type and Relevant Parameters

iSSL **Process Input Type**
- **0** TC input type selection
- **1** RTD input type selection

tCSL **TC Input Selection**
This parameter is active if TC input type is selected.
- **0** L (-100°C;850°C) or (-148°F;1562°F)
- **1** L (-100.0°C;850.0°C) or (-148.0°F;999.9°F)
- **2** J (-200°C;900°C) or (-328°F;1652°F)
- **3** J (-199.9°C;900.0°C) or (-199.9°F;999.9°F)
- **4** K (-200°C;1300°C) or (-328°F;2372°F)
- **5** K (-199.9°C;999.9°C) or (-199.9°F;999.9°F)
- **6** R (0°C;1700°C) or (32°F;3092°F)
- **7** R (0.0°C;999.9°C) or (32.0°F;999.9°F)
- **8** S (0°C;1700°C) or (32°F;3092°F)
- **9** S (0.0°C;999.9°C) or (32.0°F;999.9°F)
- **10** T (-200°C;400°C) or (-328°F;752°F)
- **11** T (-199.9°C;400.0°C) or (-199.9°F;752.0°F)
- **12** B (44°C;1800°C) or (111°F;3272°F)
- **13** B (44.0°C;999.9°C) or (111.0°F ; 999.9°F)
- **14** E (-150°C;700°C) or (-238°F;1292°F)
- **15** E (-150.0°C;700.0°C) or (-199.9°F;999.9°F)
- **16** N (-200°C;1300°C) or (-328°F;2372°F)
- **17** N (-199.9°C;999.9°C) or (-199.9°F;999.9°F)
- **18** C (0°C;2300°C) or (32°F;3261°F)
- **19** C (0.0°C;999.9°C) or (32.0°F;999.9°F)

rtdS **RTD Input Selection**
This parameter is active if RTD input is selected.
- **0** PT-100 (-200°C ; 650°C) or (-328°F ; 1202°F)
- **1** PT-100 (-199.9°C ; 650.0°C) or (-199.9°F ;999.9°F)

un it **Unit selection**
- **°C** Unit is °C
- **°F** Unit is °F

Scale

LoL **Operating Scale Minimum Value**
(Scale Low Point, Scale High Point)Unit
Used for Proportional band calculation and display blink.

uPL **Operating Scale Maximum Value**
(Scale Low Point, Scale High Point)Unit
Used for Proportional band calculation and display blink.

PUoF **Display offset for process value (Scale -10%, Scale +10%)Unit** This parameter value is added to the process value.

iFLt **Filter Time (0.0, 900.0)Second**
Defines filter time for display value.

CJnC **Cold Junction Compensation**
This parameter is active if process input is selected TC input.
- **YES** Cold junction compensation is active.
- **no** Cold junction compensation is not active.

Scale: The difference, between high point and low point of the process input type. Example: If tCSL = 2 (low point is -200, high point is 900), then scale is 1100.

Pid ConF: PID Configuration Parameters

P **PROPORTIONAL BAND (0.0, 999.9)%**
If **uPL** = 1000 °C, **LoL** = 0 °C and **P** = 50.0 then,
Proportional Band = (**uPL** - **LoL**)* **P** / 100.0
Proportional Band = (1000-0)*50.0/100.0 = 500 °C

I **INTEGRAL TIME (0, 3600)Second**
Can be changed by the user. After complated the tunning correctly, integral time value changes automatically. If it is 0, integral control is deactivated.

d **DERIVATIVE TIME (0.0, 999.9)Second**
Can be changed by the user. After complated the tunning correctly, integral time value changes automatically. If it is 0, derivative control is deactivated.

Ct **CONTROL PERIOD TIME (1, 150)Second**
Process output period time

oLL **MINIMUM CONTROL OUTPUT (0.0, oul)%**
Even as a result of the PID calculation device calculates the %output value less than this parameter, heating or cooling output is active minimum for OLL parameter.

oul **MAXIMUM CONTROL OUTPUT (oLL , 100.0)%**
Even as a result of the PID calculation device calculates the %output value greater than this parameter, heating or cooling output is active maximum for OUL parameter.

oLt **MINIMUM CONTROL OUTPUT TIME (0.0, Ct)Second**
Heating or cooling output can not be active less than this parameter. Even if this parameter is 0, this parameter is accepted as 50 msecs.

Ar **ANTI-RESET WINDUP (0, SCALE HIGH POINT)Unit**
While PID operation is running if
PSEt - **Ar** <= **process value** <= **PSEt** + **Ar**
condition is true, integral value is calculated. If the condition is not true, integral value is not calculated and last calculated integral value is used.
If Ar Parameter is selected **otAr**, heating proportional band is used for heating PID process instead of Ar Parameter and cooling proportional band is used for cooling PID process instead of Ar Parameter.

SUoF **SET VALUE OFFSET**
((- SCALE HIGH POINT / 2) , (SCALE HIGH POINT / 2))Unit
PSEt + **SUoF** is used as set value in PID calculations. This parameter is used for shifting the proportional band.

PoFS **PID OUTPUT OFFSET**
(FOR HEATING PID 0.0, 100.0)%
(FOR COOLING PID -100.0, 0.0)%
This parameter is added to "Output %" which is calculated at the end of the PID.

PoSS OUTPUT OFFSET RELATED TO PID SET

(FOR HEATING PID 0.0, 100.0)%
(FOR COOLING PID -100.0, 0.0)%
This parameter is added to the %process output that is calculated at the end of the PID according to process set value.
$PoSS * PSEt / (uPL - LoL)$

Strn PROCESS VALUE STABILIZATION
(1, SCALE HIGH POINT)Unit

It is used for controlling if process value oscillates or not when tunn Parameter is At.un or AtSE If;
$PSEt - Strn <= Process Value <= PSEt + Strn$
condition is not true, then device start tunn operation automatically.

SCALE LOW POINT : Minimum process input value in Pt-100 and Tc inputs.

SCALE HIGH POINT : Maximum process input value in Pt-100 and Tc inputs.

o-db PROPORTIONAL BAND SHIFTING
((- SCALE HIGH POINT / 2) , (SCALE HIGH POINT / 2))Unit

If cooling function is performed ; Cooling process set value is calculated by adding set value PSEt with parameter o-db Control form can be ON/OFF or PID.

If set value for heating = $PSEt + SUoF$;
Then set value for cooling = $PSEt + SUoF + o-db$

Sbou SENSOR BREAK OUTPUT VALUE
(FOR HEATING PID 0.0, 100.0)%
(FOR COOLING PID -100.0, 0.0)%

When sensor breaks, controlling of the process can continue by entering %output value to Sbou parameter.
If this parameter 0.0, process control output does not perform an output when sensor breaks.

SSEt Soft Start Set value (0, 9999)Unit

If parameter is selected no, Soft start function becomes inactive.
When the device power on, if the Soft start set value different from no and temperature value is lower than soft start value on processes, device starts soft start operation,until temperature reaches soft start set value. On soft start device output period will be SSCt parameter value and device control output will be SSCo parameter value.

SSCo Soft Start Control Output (10.0, 90.0)%

SSCt Soft Start Control Period (1, 100)Second

PCnF ConF: Process Output Configuration Parameters

oCnF Output Configuration

Determines if Process Output (SSR Driver Output) and Alarm-2 Output operates together or not.

- 0 Process Output (SSR Driver Output) and Alarm-2 Output operates separately.
- 1 Process Output (SSR Driver Output) and Alarm-2 Output operates together. Alarm functions of Alarm-2 Output can not be used

oFnC Process Output Function

- HEAt Heating
- Cool Cooling

CtYP Process Output Control Type

- onoF ON/OFF control algorithm
- Pid PID control algorithm

HYS Hysteresis of Process Output (Scale 0%, Scale 50%)Unit
Active if ON/OFF control is selected.

HYn Operation form of hysteresis
Active if ON/OFF control is selected.

- 0 SV + HYS/2 and SV - HYS/2
- 1 SV and SV+HYS or SV and SV-HYS

oFFt OFF Time (0.0, 100.0)Second
In ON/OFF operation, this time must be passed for the output to be energised again. (Active if ON/OFF control is selected)

AIn1 ConF: Alarm Output-1 Configuration Parameters

Lou1 Logic Output-1

Determines logic output function for Alarm-1 Output

- 0 Alarm output
- 1 Manual / Automatic selection output
- 2 Sensor break alarm output
- 3 Output is active when the process value is out of the band which is defined with minimum value of operating scale LoL and maximum value of operating scale uPL

ALt1 Alarm-1 Type

Determines alarm type for Output-1. Active if logic output function of Alarm-1 Output is alarm output.

- 0 Process high alarm
- 1 Process low alarm
- 2 Deviation high alarm
- 3 Deviation low alarm
- 4 Deviation band alarm
- 5 Deviation range alarm

ALH1 Alarm-1 hysteresis value(Scale 0%, Scale 50%)Unit

Active if logic output function of Alarm-1 Output is alarm output.

Aon1 Alarm-1 On Delay Time (0, 9999)Second

Active if logic output function of Alarm-1 Output is alarm output.

AoF1 Alarm-1 Off Delay Time (0, 9998)Second
When the value is greater than 9998, LtCH is seen on the screen. It means alarm latching output is selected. Active if logic output function of Alarm-1 Output is alarm output.

ALS1 Alarm-1 Stabilization Time (0, 99)Second
Active if logic output function of Alarm-1 Output is alarm output. After the unit is power-on and Alarm Stabilisation Time is expired, if an alarm condition which is selected with Alt1 is present, then Alarm-1 output becomes active.

AIn2 ConF: Alarm-2 Output Configuration Parameters

(i) "AIn2 Conf" Menu is accessible if oCnF parameter in "PCnF ConF" is 0

Lou2 Logic Output-2

Determines logic output function for Alarm-2 Output

- 0 Alarm output
- 1 Manual / Automatic selsction output
- 2 Sensor break alarm output
- 3 Output is active when the process value is out of the band which is defined with minimum value of operating scale LoL and maximum value of operating scale uPL

ALt2 Alarm-2 Type

Determines alarm type for Output-2. Active if logic output function of Alarm-2 Output is alarm output.

- 0 Process high alarm
- 1 Process low alarm
- 2 Deviation high alarm
- 3 Deviation low alarm
- 4 Deviation band alarm
- 5 Deviation range alarm

ALH2 Alarm- 2 hysteresis value(Scale 0% , Scale 50%)Unit

Active if logic output function of Alarm-2 Output is alarm output.

Aon2 Alarm-2 On Delay Time (0, 9999)Second
Active if logic output function of Alarm-2 Output is alarm output.

AoF2 Alarm-2 Off Delay Time (0, 9998)Second
When the value is greater than 9998, LtCH is seen on the screen. It means alarm latching output is selected. Active if logic output function of Alarm-2 Output is alarm output.

ALS2 Alarm-2 Stabilization Time (0, 99)Second
Active if logic output function of Alarm-2 Output is alarm output. After the unit is power-on and Alarm Stabilisation Time is expired, if an alarm condition which is selected with Alt2 is present, then Alarm-2 output becomes active.

Gen ConF: General Parameters

SU-L Process Set Value Low Limit (Scale Low Point, SU-u)Unit

SU-u Process Set Value Up Limit (SU-L, Scale High Point)Unit

Prt1 Alarm Set Values Protection

- no Alarm Set values can be changed
- YES Alarm Set values can not be changed. Alarm set values parameters, ALr1 and ALr2 , are not accessible

Prt2 AUTO / MANUAL Selection Button Protection

- no Auto or Manual selection is possible with A/M button in Main Operation screen
- YES Auto or Manual selection is not possible with A/M button in Main Operation screen

Prt3 AT (AUTO TUNE) Button Protection

- no Limit Cycle Tuning operation can be activated or deactivated with AT (Auto Tune) Button in Operation screen
- YES Limit Cycle Tuning operation can not be activated or deactivated with AT (Auto Tune) Button in Operation screen

PASS ConF: Password Parameters

tCPS Technician Password (0, 9999)

Uses for protecting and accessing to the technician parameters.
If this parameter is 0 ; there is no password protection while entering to the technician parameters.
**If this parameter is different from " 0" and user wants to access to the technician parameters;**
1- If technician does not enter tCPS password correctly:
It turns to operation screen without entering to technician parameters.
2- When tCPS in top display and 0 in bottom display, if technician presses SET button without entering tCPS password (For observing parameter)
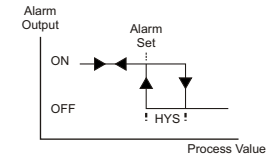Technician can see all menus and parameters except Technician Password menu ("Pass Conf"), but parameters can not be changed.
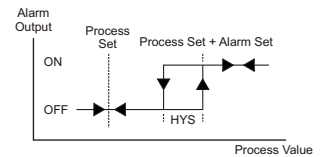

Alarm Types

Process high alarm
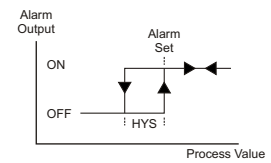
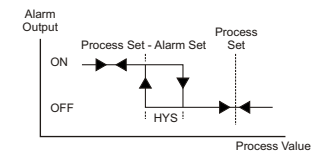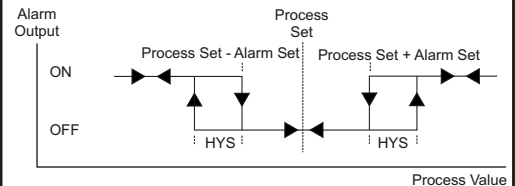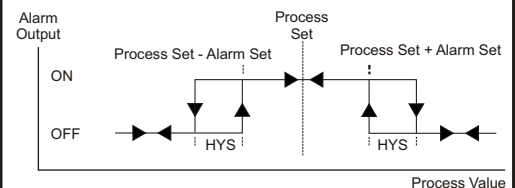**Process low alarm**

Deviation high alarm

Deviation low alarm

Deviation Band Alarm

Deviation Range Alarm

Failure message in ESM-XX31 Process Controllers

1 - Sensor failure in analogue input. Sensor connection is wrong or there is no sensor connection.

2 - If value on top display blinks : If analogue input value is less than minimum value of operating scale `LoL`, display value on the top display starts to blink.

3 - If value on top display blinks : If analogue input value is greater than maximum value of operating scale `uPL`, display value on the top display starts to blink.
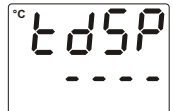
4 - If technician password is different from "0" and technician accesses to the parameters by Set button without entering the technician password and wants to change a parameter, device does not allow to do any changes in parameters. If increment or decrement button is pressed, a warning message will appear on the bottom display as shown on the left.

5 - If tuning operation can not be completed in 8 hours, AT led starts to blink. Blinking can be canceled by pressing Enter button.

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 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 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.

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.

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.

Other Informations

Manufacturer Information:
Emko Elektronik Sanayi ve Ticaret A.Ş.
Demirtaş Organize Sanayi Bölgesi Karanfil Sk. No:6 16369
BURSA/TURKEY

Phone : +90 224 261 1900
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Repair and Maintenance Service Information:
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Demirtaş Organize Sanayi Bölgesi Karanfil Sk. No:6 16369
BURSA/TURKEY

Phone : +90 224 261 1900
Fax : +90 224 261 1912

Ordering Information

ESM-4431 (48x48 DIN 1/16)													
ESM-4931 (96x48 DIN 1/8)	A	BC	D	E	/	FG	HI	/	U	V	W	Z	
ESM-7731 (72x72 DIN Size)													
ESM-9931 (96x96 DIN 1/4)			0	1	/	01	02	/	0	0	0	0	
ESM-9431 (48x96 DIN 1/8)													

A	Supply Voltage	
1	100-240V ∼ (-15%;+10%) 50/60Hz	
2	24V ∼ (-15%;+10%) 50/60Hz 24V ⎓ (-15%;+10%)	
9	Customer (Maximum 240V ∼ (-15%;+10%))50/60Hz	

BC	Input Type	Scale
20	Configurable(Table-1)	Table-1

D	Serial Communication
0	None

E	Output-1 (Alarm)
1	Relay Output (5A@250V∼ at resistive load)

FG	Output-2 (Process or Alarm)
01	Relay Output (5A@250V∼ at resistive load)

HI	Output-3 (Process)
02	SSR Driver Output (Maximum 17mA, 25V ⎓)

Table-1

BC	Input Type(TC)	Scale(°C)	Scale(°F)
21	L ,Fe Const DIN43710	-100°C,850°C	-148°F ,1562°F
22	L ,Fe Const DIN43710	-100.0°C,850.0°C	-148.0°F,999.9°F
23	J ,Fe CuNi IEC584.1(ITS90)	-200°C,900°C	-328°F,1652°F
24	J ,Fe CuNi IEC584.1(ITS90)	-199.9°C,900.0°C	-199.9°F,999.9°F
25	K ,NiCr Ni IEC584.1(ITS90)	-200°C,1300°C	-328°F,2372°F
26	K ,NiCr Ni IEC584.1(ITS90)	-199.9°C,999.9°C	-199.9°F,999.9°F
27	R ,Pt13%Rh Pt IEC584.1(ITS90)	0°C,1700°C	32°F,3092°F
28	S ,Pt10%Rh Pt IEC584.1(ITS90)	0°C,1700°C	32°F,3092°F
29	T ,Cu CuNi IEC584.1(ITS90)	-200°C,400°C	-328°F,752°F
30	T ,Cu CuNi IEC584.1(ITS90)	-199.9°C,400.0°C	-199.9°F,752.0°F
31	B ,Pt30%Rh Pt6%Rh IEC584.1(ITS90)	44°C,1800°C	111°F,3272°F
32	B ,Pt30%Rh Pt6%Rh IEC584.1(ITS90)	44.0°C,999.9°C	111.0°F,999.9°F
33	E ,NiCr CuNi IEC584.1(ITS90)	-150°C,700°C	-238°F,1292°F
34	E ,NiCr CuNi IEC584.1(ITS90)	-150.0°C,700.0°C	-199.9°F,999.9°F
35	N ,Nicrosil Nisil IEC584.1(ITS90)	-200°C,1300°C	-328°F,2372°F
36	N ,Nicrosil Nisil IEC584.1(ITS90)	-199.9°C,999.9°C	-199.9°F,999.9°F
37	C , (ITS90)	0°C,2300°C	32°F,3261°F
38	C , (ITS90)	0.0°C,999.9°C	32.0°F,999.9°F

BC	Input Type(RTD)	Scale(°C)	Scale(°F)
39	PT 100 , IEC751(ITS90)	-200°C,650°C	-328°F,1202°F
40	PT 100 , IEC751(ITS90)	-199.9°C,650.0°C	-199.9°F,999.9°F