Please read this document carefully before using this product. The guarantee will be invalidated if the device is damaged by not following instructions detailed in the manual. The company shall not be responsible for any damage or losses however caused, which may be experienced as a result of the installation or use of this product.

ENDA EU4430 PID UNIVERSAL CONTROLLER

Thank you for choosing **ENDA EU4430** Universal Controller Devices.

- 48x48mm sized.
- Dual setpoint value can be selected.
- PT100 ,J, K, L, T, S, R sensor (thermocouple) types can be selected.
- 0-20mA, 4-20mA, 0-10V, 2-10V, 0-25mV and 0-50mV input selections.
- Auto calculation for PID parameters (SELF TUNE).

Self tune for automatic PID calculation or manually enter PID parameters if known.

- Three different feature can be assigned to digital input.
- Three different feature can be assigned to F function key.
- Soft-Start feature.
- Analogue, SSR or Relay Output Control selection.
- 0-20mA and 4-20mA Analogue Output Control selection.
- A1 Relay output programmable as primary Alarm or PID Cooling Control output.
- C/A2 Relay output can be used as secondary Alarm or Temperature Control output.
- Heating/Cooling control selection.
- Zero point input shift.
- In case of sensor failure, periodically, auto-periodically running or relay state can be
- selected.
- RS485 Modbus RTU communication protocol feature (Specify at order).

R HS Compliant

Order Code : EU4430 - □□ (1) - □□ (2)

1- Suppy Voltage
UV.....90-250V AC
LV.....10-30V DC / 8-24V AC

2 - Modbus
RS..... Modbus (Specify at order)

Please see EU4430 Modbus Address Map and Connection Diagram Guide for Modbus feature.

Input Type		Scale Range °C	Scale Range °F	Accuracy
PT100 Resistance Thermometer	EN 60751	-199.9...600.0 °C	-199.9...999.9 °F	± 0,2% (for full scale) ± 1 digit
PT100 Resistance Thermometer	EN 60751	-200...600 °C	-328....1112 °F	± 0,2% (for full scale) ± 1 digit
J (Fe-CuNi) Thermocouple	EN 60584	-30.0....600.0°C	-22.0....999.9 °F	± 0,5% (for full scale) ± 1 digit
J (Fe-CuNi) Thermocouple	EN 60584	-30....600°C	-22....1112 °F	± 0,5% (for full scale) ± 1 digit
K (NiCr-Ni) Thermocouple	EN 60584	-30.0...999.9°C	-22.0....999.9 °F	± 0,5% (for full scale) ± 1 digit
K (NiCr-Ni) Thermocouple	EN 60584	-30...1300°C	-22....2372 °F	± 0,5% (for full scale) ± 1 digit
L (Fe-CuNi) Thermocouple	DIN 43710	-30.0....600.0°C	-22.0....999.9 °F	± 0,5% (for full scale) ± 1 digit
L (Fe-CuNi) Thermocouple	DIN 43710	-30....600°C	-22....1112 °F	± 0,5% (for full scale) ± 1 digit
T (Cu-CuNi) Thermocouple	EN 60584	-30.0...400.0°C	-22.0....752.0 °F	± 0,5% (for full scale) ± 1 digit
T (Cu-CuNi) Thermocouple	EN 60584	-30....400°C	-22.....752 °F	± 0,5% (for full scale) ± 1 digit
S (Pt10Rh-Pt) Thermocouple	EN 60584	-40...1700°C	-40....3092 °F	± 0,5% (for full scale) ± 1 digit
R (Pt13Rh-Pt) Thermocouple	EN 60584	-40...1700°C	-40....3092 °F	± 0,5% (for full scale) ± 1 digit
0-20mA input		-1999...+9999 (max. scale range 10000)		± 0,2% (for full scale) ± 1 digit
4-20mA input		-1999...+9999 (max. scale range 10000)		± 0,2% (for full scale) ± 1 digit
0-10V input		-1999...+9999 (max. scale range 10000)		± 0,2% (for full scale) ± 1 digit
2-10V input		-1999...+9999 (max. scale range 10000)		± 0,2% (for full scale) ± 1 digit
0-25mV input		-1999...+9999 (max. scale range 10000)		± 0,2% (for full scale) ± 1 digit
0-50mV input		-1999...+9999 (max. scale range 10000)		± 0,2% (for full scale) ± 1 digit

ENVIRONMENTAL CONDITIONS	
Ambient/storage temperature	0 ... +50°C/-25 ... +70°C
Max. Relative humidity	Relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C.
Rated pollution degree	According to EN 60529; Front panel : IP65, Rear panel : IP20
Height	Max. 2000m
KEEP AWAY device from exposed to corrosive, volatile and flammable gases or liquids and DO NOT USE the device in similar hazardous locations.	
ELECTRICAL CHARACTERISTICS	
Supply	90-250V AC 50/60Hz,10-30V DC / 8-24V AC SMPS
Power consumption	Max. 5VA
Wiring	Power screw-terminal connections: 2.5mm², Signal screw-terminal connections: 1,5mm².
Line resistance	Max. 100 Ohm
Data retention	EEPROM (minimum 10 years)
EMC	EN 61326-1: 2013 (Performance criterion B satisfied for EN 61000-4-3 standard).
Safety requirements	EN 61010-1: 2010 (Pollution degree 2, overvoltage category II)
OUTPUTS	
C/A2 Output	Relay : 250V AC, 10A (for resistive load), NO+NC (Control or Alarm2 Output selection).
A1 Output	Relay : 250V AC, 5A (for resistive load), NO (Alarm1 and Cooling Control Output selection).
ANL/SSR Output	Max. SSR Output ; 0-20mA, 4-20mA, 24V 20mA. Max. load resistance ; 600 Ohm (12 bit 0.2% accuracy).
Life expectancy for relay	Without load 30.000.000 switching; 250V AC, 8A (resistive load) 300.000 switching.
CONTROL	
Control type	Single Setpoint and Alarm Control.
Control algorithm	On-Off / P, PI, PD, PID (selection).
A/D converter	14 bit.
Sampling time	Min. 100ms.
Proportional band	Can be adjusted between %0.0 and %100.0 . If Pb=%0.0 , ON-OFF control is selected.
Control period	Can be adjusted between 1 and 125secs.
Hysteresis	Can be adjusted between 1 and 50°C/F.
Output power	Setpoint value ratio can be adjusted between %0 and %100 .
HOUSING	
Housing type	Suitable for flush-panel mounting according to DIN 43 700.
Dimensions	W48xH48xD87mm
Weight	Approx. 250g
Enclosure material	Self extinguishing plastics
Avoid any liquid contact when the device is switched on. DO NOT clean the device with solvent (thinner, gasoline, acid etc.) and / or abrasive cleaning agents.	

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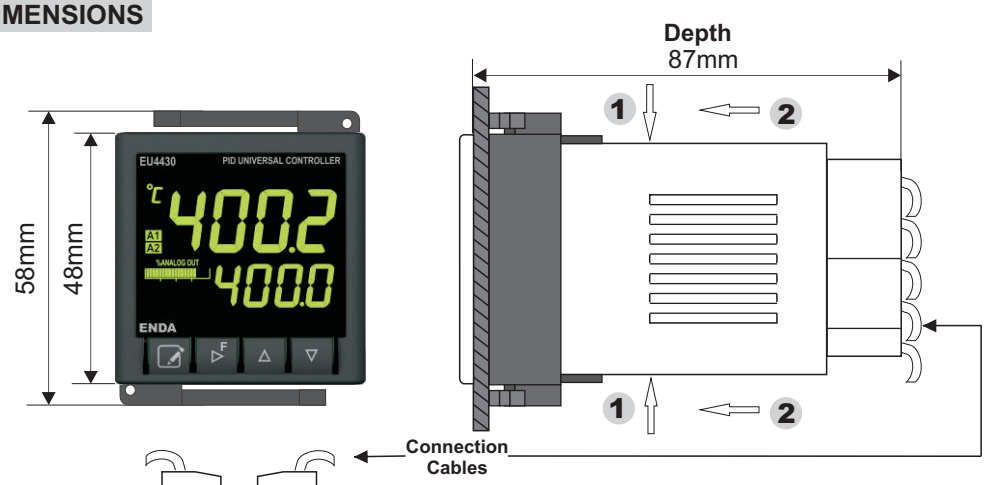
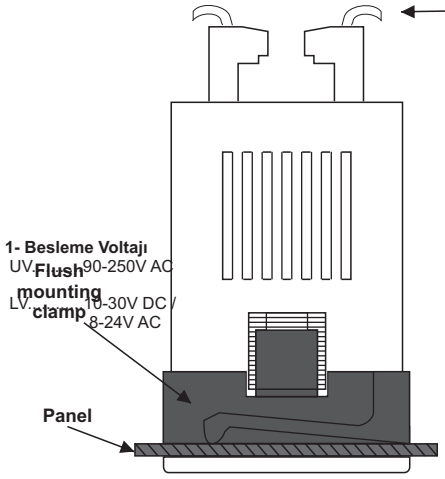
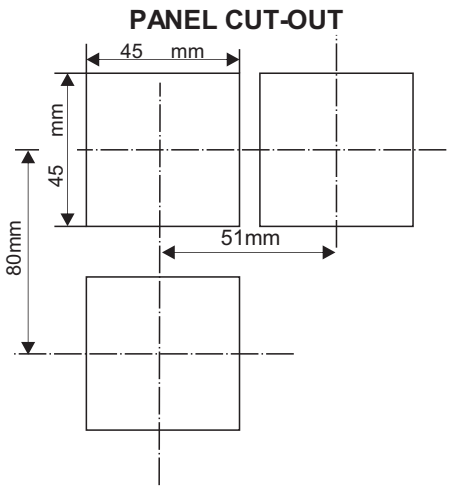
DIMENSIONS



To removing the device from the panel :
- While pressing both side of the device in direction (1) and push it in direction (2).





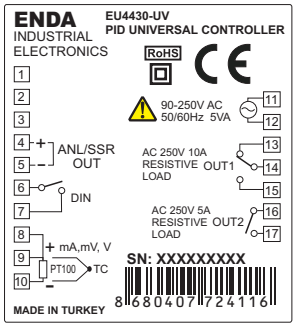
Note :
1) While panel mounting, additional distance required for connection cables should be considered.
2) Panel thickness should be 9mm maximum.
3) If there is no free space at back side of the device, it would be difficult to remove it from the panel. 100mm clearance should be left behind the device.

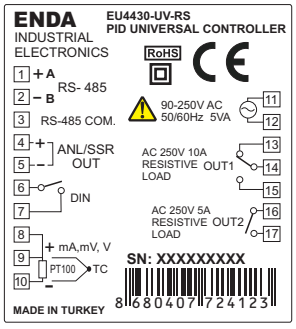
Holding screw
0.4-0.5Nm.

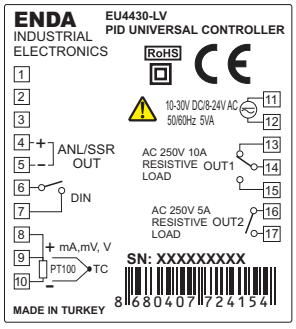
Equipment is protected throughout by DOUBLE INSULATION

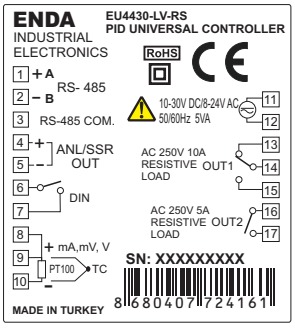
CONNECTION DIAGRAM

ENDA EU4430 PID Temperature Controllers are intended for installation in control panels. Make sure that the device is used only for intended purpose. The shielding must be grounded on the instrument side. During an installation, all of the cables that are connected to the device must be free of energy. The device must be protected against inadmissible humidity, vibrations, severe soiling. Make sure that the operation temperature is not exceeded. All input and output lines that are not connected to the supply network must be laid out as shielded and twisted cables. These cables should not be close to the power cables or components. The installation and electrical connections must be carried on by a qualified staff and must be according to the relevant locally applicable regulations





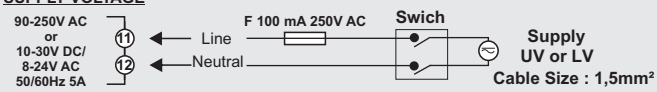




NOTE :

SUPPLY VOLTAGE

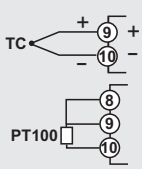
Fuse should be connected.



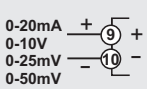
SENSOR INPUT:

For Thermocouples :
Use the correct compensating cable. Do not make any supplement to cables. Connect the thermocouple cables to the right places at the input terminal.

For resistance (PT100) Sensor :
In order to using 2-wire resistance sensors (PT100), 8th and 9th terminals must be short circuited. Please check connection diagrams carefully.



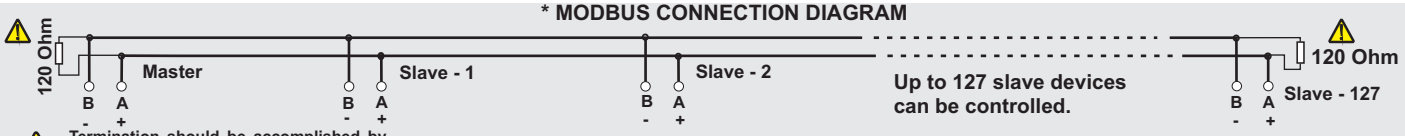
For 0-20mA,4-20mA, 0-10V, 2-10V, 0-25mV and 0-50mV inputs : Check carefully sensor pinouts and terminal signs before connecting the device.



Logic output of the instrument is not electrically insulated from the internal circuits. Therefore, when using a grounding thermocouple, do not connect the logic output terminals to the ground.

Note :
1) Mains supply cords shall meet the requirements of IEC 60227 or IEC 60245.
2) In accordance with the safety regulations, the power supply switch shall bring the identification of the relevant instrument and it should be easily accessible by the operator.

* MODBUS CONNECTION DIAGRAM



Termination should be accomplished by attaching 120 Ohm resistors to the start and at the end of the communication line.

Please see EUPx420 Series Modbus Address Map and Connection Diagram Guide for Modbus feature.

**** Applies to devices with Modbus function.***

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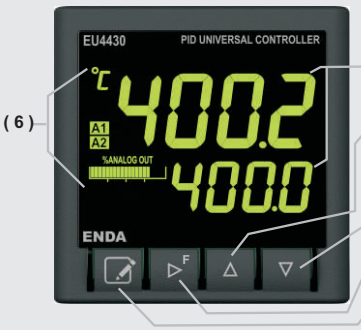
TERMS



(1) Indicates measured value and set values in “Running Mode”.
Indicates the parameters and names in “Programming Mode”.

(2) Increment key in “Running Mode” and “Programming Mode”.
Parameter selection key in “Programming Mode”.

(3) Decrement key
By pressing this key in “Running Mode”, software version can be displayed.
Parameter selection key in “Programming Mode”.

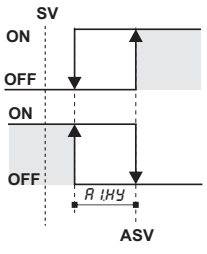
(4) Selectable function key “Running Mode”.
Menu selection key in “Programming Mode”.

(5) Control and Alarm set key in “Runnig Mode”.
Parameter set key in “Programming Mode”

(1) PV and SV Indicators	PV 7 Segment 4 digits green LED , SV 7 Segment 4 digits green LED display.
Character Height	PV Display 12.0mm , SV Display 8.13mm
(2),(3),(4),(5) Keypads	Micro switch
(6) Status Indicators	Control, Alarm1, Alarm2, Analog output, SSR output and status indicator symbols.

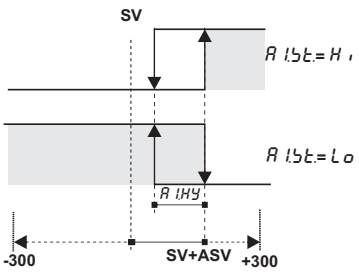
ALARM1 AND ALARM2 OUTPUT TYPES

Independent Alarm
A1tP= indE



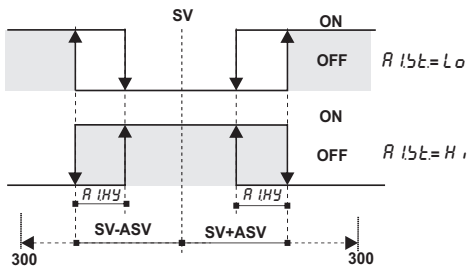
(ASV min. = beginning of scale
ASV max. = end of scale)
SV = CONT output set value

Deviation Alarm
A1tP= dE.



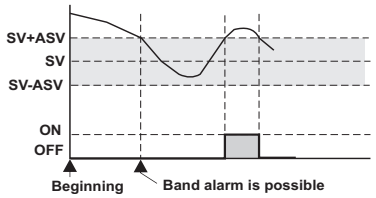
(ASV min. =-300, ASV maks. = +300)
ASV = Alarm output set value

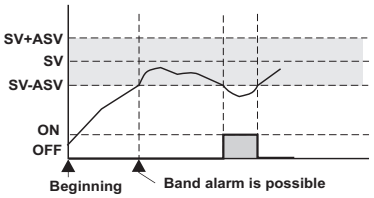
Band Alarm
A1tP= bAnd



SV =CONT output set value
ASV = AL1 output set value
(ASV min. = 0, ASV max. = +300)

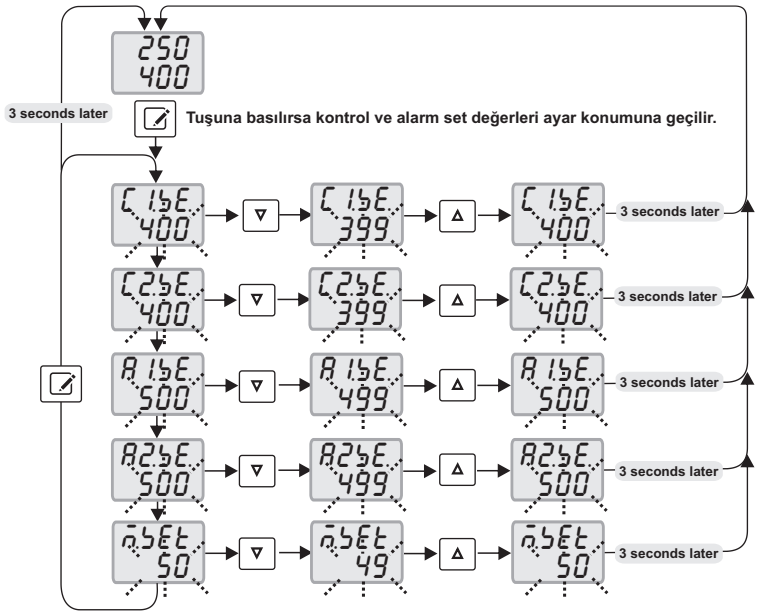
Band Alarm With Inhibition
A1tP= bAn.i





SV =Set point of CONT output
ASV = Set point of AL1 output
(ASV min. = 0, ASV max. = 300)

SETTING UP ALARM CONTROL AND SETPOINT VALUES



If one of the d.in.c. or FtEc. parameters are set to the C2SA value, this parameter can be displayed.

If the C.oSE. parameter is set to SSR out, this parameter can be displayed.

If one of the d.in.c. or FtEc. parameters are set to the nAnu. and if C. Pb is different from 0 , this parameter can be displayed.

ERROR MESSAGES

PFA 400	No communication with sensor. (Sensor and/or cable broken or not connected)
---- 400	Temperature value is higher than scale.
---- 400	Temperature value is lower than scale.

ENDA EU4430 PROGRAMMING DIAGRAM

ENTERING TO PROGRAMMING MODE

If [set] key is pressed while holding [▷] key, the "Programming Mode" is entered.

RUNNING MODE

During in "Programming Mode", if no key is pressed for 20 sec, settings automatically saved and device returns to the "Running Mode" (to the home screen). Alternatively, by pressing [▷] key "Running Mode" is entered and by pressing both [set] [▷] keys at once, settings automatically saved and device returns to the "Running Mode" (to the home screen).

Menus: Cono. (A) → AL 1o. (B) → AL 2o. (C) → ConF. (D) → 5tun. (E) → SECU. (F)

A – Cono.

C.5Lo = Lower limit for C/A1 Output control, setpoint value. Can be adjusted between **0** and C.5H i. (default -30)

C.5H i = Upper limit for C/A1 Output Control, setpoint value. Can be adjusted between C.5Lo and Upper scale value. (default 600)

C. Pb = Proportional band value for C/A1 Output. Can be adjusted between **0.0%** and **100.0.%** If C.Pb parameter set to **0.0%**, On-Off control will be accepted. (default 4.0)

A1 **CHY5 = Hysteresis value for C/A1 Output.** Can be adjusted between 1°C and 50°C. (default 2)

A2 **C. t i = Integral value for C/A1 Output.** Can be adjusted between 0.0 and 100.0 minutes. If C. t i parameter set to **0.0**, integral will be disabled. (default 4.0)

A2 **C. td = C/A1 Output Derivative value.** Asjustable between **0.00** and **25.00** minutes. If C. td parameter set to 0.0, derivative will be disabled. (default 1.00)

A2 **C. Ct = C/A1 Output periodic time duration.** Adjustable between **1** and **250** seconds. (default 1)

A2 **C.P5t = C/A2 output power percentage at C/A1 set value.** Can be adjusted between **0%** and **100%**. (default 0)

A2 **C.EC.t = Control type selection for sensor failures.** If E.P5 selected, controlling will be performed to according to C.E.P5 proportional control parameter. If Auto is selected, controlling will be performed to last recorded set value percentage before probe failure. (default E.P5)

A3 **C.E.P5 = C/A1 Output power percent selection on probe failure.** Can be adjusted between **%0** and **%100**. If C.Pb set to 0.0 (On/Off Control) and C.E.P5 set to 0, output will be OFF, on failure. If C.E.P5 set to different value from 0, output will be ON, in case of failure. (default 0)

5.5t.5 = Soft start timer set value. This parameter determines how many minutes will be reached to the setpoint value on power-up. Can be adjusted between 0 and 250 minutes. If set to 0, the soft start feature will be canceled and the setpoint value will be reached in maximum speed. (default 0)

CtYP = Output controlling type selection HEAt = Heating control can be performed. Cool = Cooling control can be performed. (default HEAt)

A1 This parameter will be activated if the C.Pb parameter set to "0".

A2 This parameter will be activated if the C.Pb parameter different from "0".

A3 This parameter will be activated if the C.Pb parameter set to "0" or C.EC.t set to E.P5.

B – AL 1o.

A 15L = Alarm1 set value lower limit. Can be adjusted between 0 and A 15H parameter value. (default -30)

A 15H = Alarm1 set value upper limit. Can be adjusted between A 15L and upper scale value. (default 600)

A 1HY = Hysteresis of the Alarm2 output. Can be adjusted between 1 and 50°C. (default 2)

A 1tP = Alarm1 types. Six alarm types can be selected.
- indE = Independent alarm
- dE = Deviation alarm
- bAnd = Band alarm
- bAn i = Band with inhibition
- inCo = A1 output independent cooling control
- rECo = A1 output relative cooling control

(default indE)

B1 **A 15t = Status selection for Alarm1 Output** If H i is selected, A1 output is above the Alarm1 set value ; ON. If Lo is selected, A1 Output is above the Alarm1 set value ; OFF. (default H i)

B1 **A 1Er. = Alarm1 condition selection on probe failure** on = A1 Output is ON, in case of probe failure. oFF = A1 Output is OFF, in case of probe failure. (default on)

B2 **A 1Pb = A1 Output, proportional band value.** Can be adjusted between 0% and 100%. If A 1Pb Parameter set to %0, On-Off control will be accepted. (default 0.0)

B3 **A 1t i = A1 Output, integral value.** Can be adjusted between 0.0 and 100.0 minute. If A 1t i parameter set to 0.0, integral will be disabled. (default 0.0)

B3 **A 1td = A1 output derivative value.** Can be adjusted between 0.00 and 25.00 minutes. If A 1td parameter set to 0.00, derivative will be disabled. (default 0)

B3 **A 1Ct = A1 Output Period Time.** Can be adjusted between 1 and 250 seconds. (default 1)

B3 **A 1P5 = A1 output power percentage at A1 set value.** Can be adjusted between 0% and 100%. (default 0)

B2 **A 1EP = A1 Output power percent selection on probe failure.** Can be adjusted between 0% and 100%. (default 0)

B1 A 1tP Parameter can not be displayed if inCo or rECo is selected.

B2 A 1tP Parameter will be activated if inCo or rECo is selected.

B3 This parameter will be activated if the A 1tP parameter set to inCo or rECo and if the A 1Pb parameter is different from "0"

C – AL 2o.

⚠ If Co5E parameter is different from C-A2, this menu can be displayed in SSR Out devices.

A25L = Alarm2 set value lower limit. Can be adjusted between 0 and A25H parameter value. (default -30)

A25H = Alarm2 set value upper limit. Can be adjusted between A25L and upper scale value. (default 600)

A2HY = Hysteresis of the Alarm2 output. Can be adjusted between 1 and 50 (default 2)

A2tP = Alarm2 types. Four alarm types can be selected.
- indE = Independent alarm
- dE = Deviation alarm
- bAnd = Band alarm
- bAn i = Band with inhibition

(default indE)

A25t = Status selection for Alarm2 Output If H i is selected, A2 output is above the Alarm2 set value ; ON. If Lo is selected, A2 Output is above the Alarm2 set value ; OFF. (default H i)

A2Er. = Alarm2 condition selection on probe failure on = A2 Output is ON, in case of probe failure. oFF = A2 Output is OFF, in case of probe failure. (default on)

D – ConF.

D1 **inPt = Input Type Selection.** ⚠ *Please see "Input Type Selection Table" for details at the right side of this page.* (default J)

D1 **Un it = Temperature Unit Selection.** °C = °C / °F = °F (default °C)

FLtr. = Coefficient of Digital Filter. Provides to filter for displayed value. Adjustable between 1 and 200. If this parameter set to 1, digital filter runs quickly. If the parameter is set to 200, filter runs slowly. This parameter value shouldbe increased in interference environments. (default 20)

Co5E = Control output selection. C-A2 = C/A2 (Relay) output selection. 55r = SSR output selection. 0-20 = 0-20 mA analogue output selection. 4-20 = 4-20 mA analogue output selection. (default C-A2)

oFF5. = Offset Value. The offset value is added to the measurement value. This feature is used to eliminate errors that may occur due to the distance from the measuring probe to the measuring point. Can be adjusted between -99 and 100°C. Default value is 0.

D3 **dAdr. = Rs485 Connection Address.** Can be adjusted between 1 and 247. (default 1)

D3 **bAud = ModBus Baud Rate for RS485** Can be adjusted to off, 2.40, 4.80, 9.60, 19.20 and 38.40. (default 9.60)

d. in.C. = Digital input setting parameter.
- nonE = Digital input is closed.
- C25.A = if digital input is activated, 2nd set value is used.
- nAnu. = Manual mode start in case of digital outputs are active and rational output generated according to period value in C.Ct parameter and percentage value in A.5EE parameter.
- d5Po. = If the digital input is activated, only temperature value will be indicated.

(default nonE)

F.FEC. = Function key setting parameter.
- nonE = Function key is OFF.
- C25.A = 2nd. set value can be used by using function key.
- nAnu. = Manual mode can be accessed by using function key.
- d5Po. = Temperature value will be indicated by using function key.

(default nonE)

D4 **Ao.Lo = Minimum Output Percent for Analog Output.** Can be adjusted between 0 and AoH i. (default 0)

D4 **AoH i = Maximum Analog Output Percent for Analog Output.** Can be adjusted between Ao.Lo and 100 (default 100)

D5 **r.tr5. = Control Parameter for Retransmission Output.**
- nonE = Retransmission OFF.
- 0-20 = 0-20mA Analog retransmission output.
- 4-20 = 4-20mA Analog retransmission output.

(default nonE)

D6 **r.oLo = Lower Scale Value for Retransmission Output.** Can be adjusted between lower scale value and r.oH i. (default -30)

D6 **r.oHo = Upper Scale Value for Retransmission Output.** Can be adjusted between r.oLo. and upper scale value. (default 600)

D7 **dP5E = Decimal Point selection for mA Inputs.** Can be adjusted between 0 and 0.000 (default 0)

D7 **u5Lo = Lower Scale Value for mA Inputs.** Can be adjusted between **-1999** and (u5H i - **10**). (default -1999)

D7 **u5H i = Upper Scale Value for mA Inputs.** Can be adjusted between (u5Lo + 10) and **9999.** (default 2000)

d.LtH = Display Brightness Can be adjusted between 1 and 20. (default 10)

D1 Changes to this parameter may cause some parameter values to change.

D2 This parameter can be displayed if the Co5E Parameter set to Acon.

⚠ D3 This parameter availble in RS485-Modbus devices only.

D4 This parameter can be displayed if the Co5E parameter set to "0-20" or "4-20".

D5 This parameter can be displayed if the Co5E parameter set to "C-A2".

D6 This parameter can be displayed if the Co5E parameter set to "C-A2" and if the rtr5 parameter set to "0-20" or "4-20".

D7 This parameter can be displayed if the inPt parameter set to "mv", "mA" or "V".

⚠ *Please see EU4430 Modbus Address Map and Connection Diagram Guide for Modbus feature.*

E – 5tun.

5t.u5 = Selftune Control Parameter. If [set] [▲] keys are pressed together, main screen displayed and if the temperature is not high, P idt. message flashes on display and the self tune process starts automatically. If the initial temperature is higher to self-tune, tEH i. message appears and waits until the temperature goes down. Then P idt. message appears and self tune procedure starts automatically. After the self tune procedure, C.Pb, C.t, C.dt and C.Ct. values are stored in memory and "Running mode" (main screen) is entered. After the successful self tune completion, 5tun menu will be removed automatically. In order to re-tune, 5t.5c. parameter should be set to P.YE5 in 5ECU menu.

STOPPING SELF TUNE

When the self-tune operation needs to be terminated, "Programming Mode" should be entered by using [set] [▷] keys and 5tun menu should be selected. By using [▼] key, 5t.u5 parameter is selected and self-tune process can be terminated by pressing with together [set] [▼] keys.

F – SECU.

5Cod = Security menu access code. To accessing security menu, **430** should be entered. (default 0)

⚠ While 5Cod code 0 (5Cod = 0), by held down the [set] key and by pressing [▼] key for 4 seconds, dEFP message appears and default mode is entered.

Co5c. = Security Access Level for Cono Parameter.
- nonE = Menu invisible.
- PYE5 = Modification can be done.
- P. no = Only visible.

A 15c. = Security Access Level for AL 1o. Parameter.
- nonE = Menu invisible.
- PYE5 = Modification can be done.
- P. no = Only visible.

A25c. = Security Access Level for AL2o. Parameter.
- nonE = Menu invisible.
- PYE5 = Modification can be done.
- P. no = Only visible.

Cn5C. = Security Access Level for ConF. Parameter.
- nonE = Menu invisible.
- PYE5 = Modification can be done.
- P. no = Only visible.
- Pno = Menu visible only.

5t.5c. = Security Access Level for 5tun. Parameter.
- nonE = Menu invisible.
- PYE5 = Modification can be done.

ANNOTATIONS

Information tracking method about the parameters is as follows.

On the device screens shown on this page ;
- First line indicates the parameter name,
- Second line indicates the current parameter's value.

At the same time, the value shown in the second line is the default value of the device.

A ItD ⇒ Parameter name.
0 ⇒ Parameter value (default value).

⚠ Input Type Selection Chart

inPt	=	Input type selection.
Pt.0	=	PT100 - Decimal,
Pt	=	PT100 Non-decimal,
J.0	=	J Type - Decimal,
J	=	J Non-decimal,
H.0	=	K Type - Decimal,
H	=	K Non-decimal,
L.0	=	L Type - Decimal,
L	=	L Non-decimal,
t.0	=	T Type - Decimal,
t	=	T Type,
5	=	S Type ,
r	=	R Type
0-20	=	0-20 mA input,
4-20	=	4-20 mA input,
0-10	=	0-10 V input,
2-10	=	2-10 V input,
0-25	=	0-25 mV input,
0-50	=	0-50 mV input.

⚠ Changes to this parameter may cause some parameter values to change.

Parameter Setting Diagram

When holding [set] key, selected parameter flashes and desired value can be adjusted by using [▲] [▼] keys.

If [▲] key is pressed and held 0.6 seconds, the value of the selected parameter changes rapidly. If waited enough, the value increases 100 at each step. After 1 second following the release of the key, initial condition is returned. The same procedure is valid for the decrement key.

ERROR MESSAGES

PFA / 400	No communication with sensor. (Sensor and/or cable broken or not connected)
---- / 400	Temperature value is higher than scale.
---- / 400	Temperature value is lower than scale.

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