ESM 4450 OWNER's MANUAL

Please read the following information before using and thank you very much for buying Emko products.

The safety requirements are classified as "warning" or "caution" according to the following explanations:
WARNING: Suggests that the user' s mishandling can result in personal death or serious injury.
CAUTION: Suggests that the user' s mishandling can result in personal injury or damage to the property.

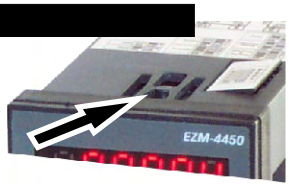
Packing List:
One unit.
Two fixing clamps.
One owner's manual.

1. INTRODUCTION:
ESM series process controllers can be adapted easily to all applications and automation systems to control heating, cooling or any process parameters. They are mainly used in the glass, plastics, petrochemical, textile, automotive and machine production industries.
ESM series products are highly developed offering sensitive control schemes by means of selectable control forms including ON/OFF, P, PI, PD, PID, Auto-tune and Self-tune.

2. INSTALLATION:
WARNING: A visual inspection of this product for possible damage 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, the user shall provide the unit with an appropriate external protective circuit.
The unit is normally supplied without a power switch or a fuse. Use power switch and fuse as required (fuse rating is 1A@250VAC)
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 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 aren't properly tightened.
WARNING: Before beginning installation of this product:
Disconnect all electrical power to the machine.
Make sure the machine cannot operate during installation.
Follow all safety warnings of the machine manufacturer.
CAUTION: Forbidden Conditions: Corrosive and explosive atmospheres, Home application.
This unit is for industrial applications, only.

Carefully read and follow all installation instructions.

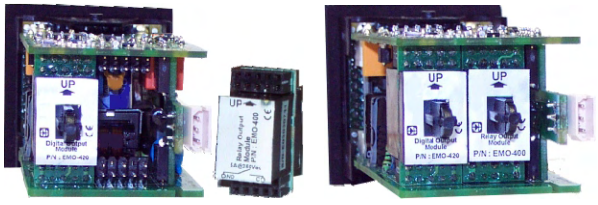
Installing / Replacing I/O Modules



❶ Remove power from unit. Firmly grip the facia, push the locking tabs top and bottom and pull the unit from its case.

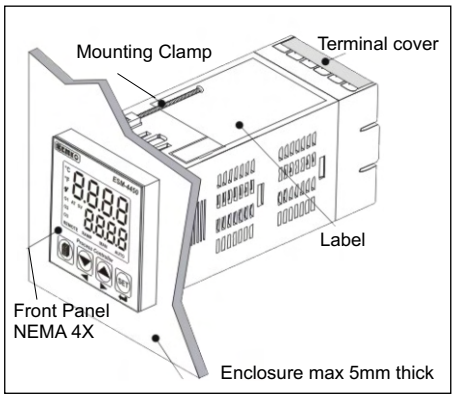
❷ Insert the module(s) into the cavity(ies as shown).

❸ Carefully reinsert the unit into its housing. Make certain that the communications port lines up with the hole at the back of the housing and snap into place.

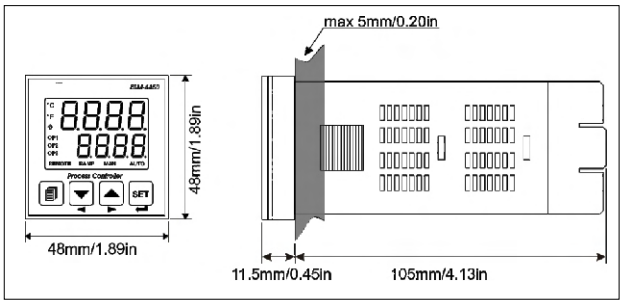


	Plug-in Modules	Product Code
Outputs	Relay 3A@250Vac	EMO-400
	SSR 20mA@18Vdc	EMO-410
	Transistor 40mA@18Vdc	EMO-420
	Volt/Current (0 to 20mA, 0 to 10V)	EMO-430
second Input	Digital switch (NPN, PNP, Contact)	EMI-400
	0 to 20 mA Current	EMI-410
	0 to 5AAC Current Transformer	EMI-420
	TC Input	EMI-430
	RTD Input	EMI-440
	0-10vdc Input	EMI-450

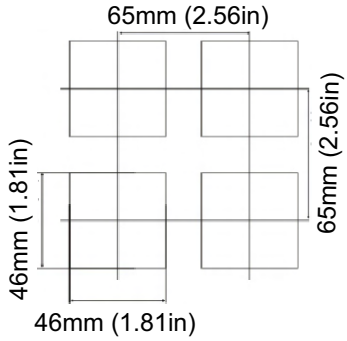
2.1 GENERAL DESCRIPTION:



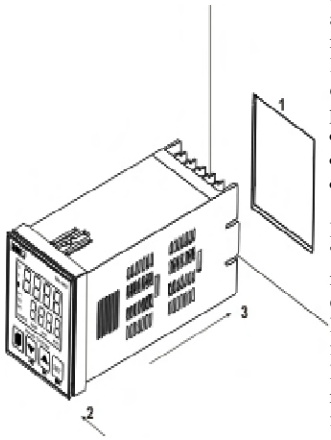
2.2 DIMENSIONS:



2.3 PANEL CUT-OUT:



2.4 PANEL MOUNTING:



Inserting into Panel:
WARNING: 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 aren't properly tightened.
- Prepare panel cut-out.
- Check front panel gasket position.
- Insert the device through the cut-out.

Installing the Fixing Clamp:
The unit is designed for panel mounting. Fixing is by mounting clamps.
Insert the unit in the panel cut-out from the front.
Insert the mounting clamps from the rear side of the device and tighten the fixing screws to secure the unit against the panel.

Removing from panel:
1) Loosen screws.
2) Pull the fixing clamps from the device while holding the unit in place.
3) Pull the unit through the front of the panel.

3 ELECTRICAL CONNECTIONS:

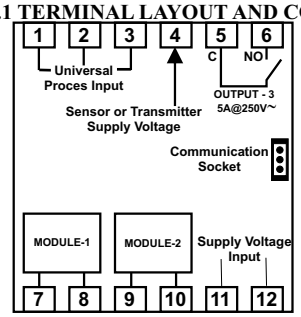
WARNING: You must ensure that the controller is correctly configured for your application. Incorrect configuration could result in damage to the process being controlled, and/or personal injury. It is your responsibility, as the installer, to ensure that the configuration is correct. The controller may either have been configured when ordered, or may need configuring now.

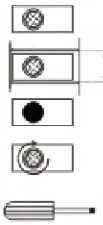
WARNING: This equipment does not contain any parts and material related to users. Only qualified personnel and technicians trained specially should work on this equipment. This equipment contains internal circuits with voltage dangerous to human life. There is severe danger for human life in the case of unauthorized intervention.

WARNING: Be sure to use the rated power supply voltage and a 1 amp fuse to protect the unit against damage and to prevent failure.

WARNING: 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:





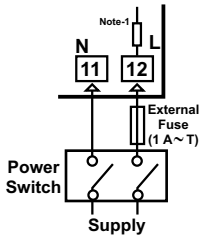
M3 screw terminals

6mm/0.23in
wire size:
18AWG/1mm^2
solid/stranded

Torque 0.5Nm

0.8 x 3mm

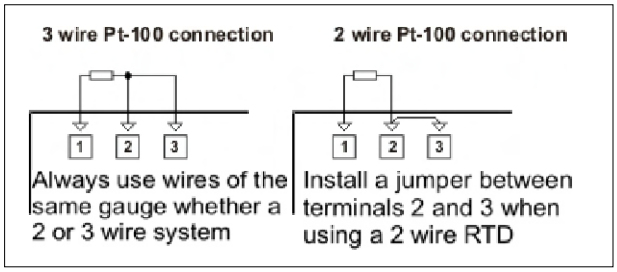
3.2 POWER SUPPLY:



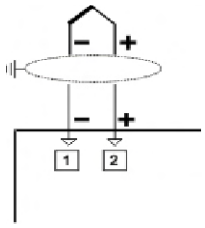
Note-1 :
Internal fusible flameproof resistor.
External 1 amp fuse must be used in circuit.

100-240V ~ (-15%;+10%) 50/60Hz - 6VA
24 V ~ (-15%;+10%) 50/60Hz - 6VA
24V ⎓ (-15%;+10%) - 6W
12 V ⎓ (-15%;+10%) - 6W

3.3 PT100 INPUT:

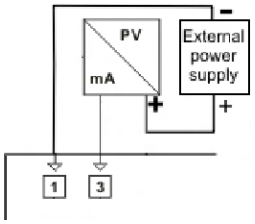


3.4 THERMOCOUPLE SENSOR:

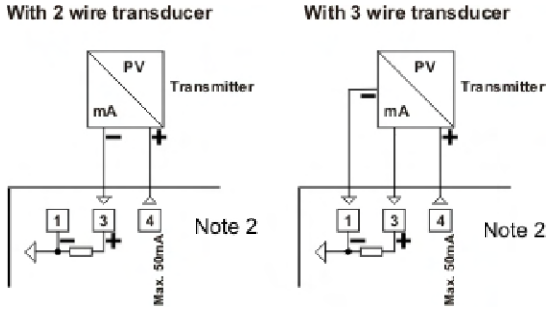


Connect the wires with the polarity as shown. Always use compensation wire corresponding to the thermocouple used. If present, the shield must be connected to a proper ground.

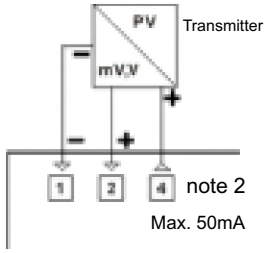
3.5 CURRENT OUTPUT TRANSDUCER WITH SEPARATE POWER SUPPLY:



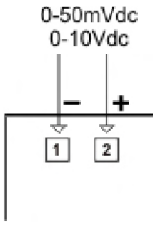
3.51 CURRENT OUTPUT TRANSDUCER:



3.6 VOLTAGE OUTPUT TRANSDUCER:

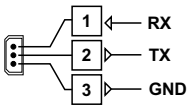


3.61 VOLTAGE INPUT:

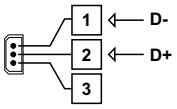


Note 2: Auxilliary power supply for external transmitter; please specify 12 or 24 vdc at time of order

RS-232 Terminal Definitions



RS-485 Terminal Definitions



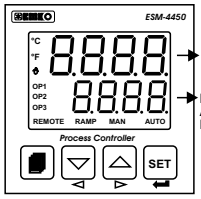
4. TECHNICAL SPECIFICATIONS AND RATINGS

Equipment use:	Process controller equipment
Housing & Mounting:	48mm x 48mm x 105mm 1/16 DIN 43700 Plastic housing for panel mounting.
Panel cut out:	46x46mm.
Protection:	NEMA 4X (IP65 front, IP20 rear).
Weight:	Approximately 0.15 Kg.
Environmental rating:	Standard, indoor at an altitude of less than 2000 meters with non condensing humidity
Polution degree:	II, Normal office or workplace, non conductive pollution
Mode of operation:	Continuous
Supply voltage:	100 to 240 VAC 50/60 Hz. 24Vac/dc 50/60 Hz
Process Inputs:	User selectable (TC, RTD, DC Voltage/Current)
Accuracy:	± 0,25% of FS for thermocouple, thermoresistance, voltage and + 0,70% of FS for current measurement.
Sampling Cycle:	3 samples per second.
Input Filter:	Adjustable from 0.0 to 900.0 Seconds.
Control Form:	Programmable ON/OFF, P, PI, PD or PID.
Standard Relay Output:	1 rated 5A@250Vac (Programmable control or alarm output)
Plug-in modules:	optional, 2 max.
Process Display:	10 mm Red 4 digit LED display
Set Display:	8 mm Green 4 digit LED display
LED indicators:	AT (Autotune, M(Manual Mode), A (Auto Mode) PSET (Process set), ASET1 (Alarm set-1), ASET2 (Alarm set-2), °C (Centigrade LED), °F (Fahrenheit LED), V (Other), PO (Process output), AO1 (Alarm output-1), AO2 (Alarm output-2).
Operating / Storage temperature:	-5 °C to +55 °C / -40 °C to +85 °C
Operating / Storage humidity:	90 % max. (non condensing)
Installation overvoltage category:	II, Distribution level, fixed installation category
Thermocouple input types:	User selectable (L,J,K,R,S,T,B,E,N,C)
Thermoresistance input type:	PT 100 (2 and 3 wires)
DC Voltage input types:	User selectable (0 to 50mV, 0 to 5V, 0 to 10V)
DC Current input types:	User selectable (0 to 20mA, 4 to 20mA)
Cold Junction Compensation:	Automatically ±0.1°C/1°C
Line Compensation:	Maximum 10 Ohm
Sensor Break Protection:	Within the operating scale.
Sensor Power Supply	12 or 24 vdc 50mAdc maximum

WARRANTY:
We warrant that the products will be free from defects in material and workmanship for 2 years from the date of purchase.
The warranty above shall not apply for any damage caused by the use of the product and is limited only to the repair or replacement of the product.

ESM 4450 Programming Guide

Front Panel Description



Keyboard

	Access all menus and to move up to another menu.
SET	Access process set value and OK button when in the program mode.
	Increase the parameter values and access the program menus.
	Decrease the parameter values and access the program menus.

Display & Indicators

°C	°C unit LED
°F	°F unit LED
	An LED indicator for units other than °C and °F
OP1	Output1(Process or Alarm) LED
OP2	Output2(Process or Alarm) LED
OP3	Output3(Process or Alarm) LED
AUTO	Automatic operation LED (for process output)
MAN	Manual operation LED (for process output)
RAMP	LED for Ramp&Soak operations
REM	LED for operation with remote set value
SV	Process set value LED
AT	Autotune LED

Table-1 (Process Input Type and Scale selection)

Process Input Type(TC)		Scale(°C)		Scale(°F)	
0	L(FeConst DIN43710)	-100°C	850°C	-148°F	1562°F
1	L(FeConst DIN43710)	-100.0°C	850.0°C	-148.0°F	999.9°F
2	J(FeConst IEC-584)	-200°C	900°C	-328°F	1652°F
3	J(FeConst IEC-584)	-199.9°C	900.0°C	-199.9°F	999.9°F
4	K(NiCrNi DIN/IEC)	-200°C	1300°C	-328°F	2372°F
5	K(NiCrNi DIN/IEC)	-199.9°C	999.9°C	-199.9°F	999.9°F
6	R(Pt13%RhPt DIN/IEC)	0°C	1700°C	32°F	3092°F
7	R(Pt13%RhPt DIN/IEC)	0.0°C	999.9°C	32.0°F	999.9°F
8	S(Pt10%RhPt DIN/IEC)	0°C	1700°C	32°F	3092°F
9	S(Pt10%RhPt DIN/IEC)	0.0°C	999.9°C	32.0°F	999.9°F
10	T(CuConst DIN/IEC)	-200°C	400°C	-328°F	752°F
11	T(CuConst DIN/IEC)	-199.9°C	400.0°C	-199.9°F	752.0°F
12	B(Pt18%RhPt DIN/IEC)	-200°C	400°C	-328°F	752°F
13	B(Pt18%RhPt DIN/IEC)	-199.9°C	400.0°C	-199.9°F	752.0°F
14	E(CrConst DIN/IEC)	-150°C	700°C	-238°F	1292°F
15	E(CrConst DIN/IEC)	-150.0°C	700.0°C	-199.9°F	999.9°F
16	N(NicrosilNisil DIN/IEC)	-200°C	1300°C	-328°F	2372°F
17	N(NicrosilNisil DIN/IEC)	-199.9°C	999.9°C	-199.9°F	999.9°F
18	C(... DIN/IEC)	0°C	2300°C	32°F	4172°F
19	C(... DIN/IEC)	0.0°C	999.9°C	32.0°F	999.9°F
Process Input Type(RTD)		**Scale(°C)**		**Scale(°F)**	
0	PT 100	-200°C	650°C	-328°F	1202°F
1	PT 100	-199.9°C	650.0°C	-199.9°F	999.9°F
Process Input Type(DC Voltage and Current)				**Scale**	
0	0...50 mV				Configurable
1	0...5 V				Configurable
2	0...10 V				Configurable
3	0...20 mA				Configurable
4	4...20 mA				Configurable

Entering Process Set Value and Parameters

Setting the process values:

When the SET button is pressed, the SV LED, next to the process value on the bottom display, flashes. Adjust the desired process set value using the ▲ and ▼ buttons. Press the SET button again to save the new value to memory. If, instead, the button is pressed, the new set value isn't saved to memory and the unit exits the setting mode. *You can't change the SV value when the AT LED is lit.*

Setting the alarm values:

All outputs on the device can be configured as alarms. Alarm set values are shown as ALr1, ALr2 and ALr3 in the SET LIST menu. To access the Set List menu press the button then the SET button. Pressing the SET button again allows you to access and change the values of PSEt, ALr1, ALr2 and ALr3.

Observing and changing parameter values:

The parameters have been divided into three groups: Operator, Technician and Calibration. The calibration parameters can be accessed by the manufacturer only. The operator can not access the parameters for running mode and configuration. Whenever you want to enter either the operator's or technician's parameter groups, the device will require a password. The default value of the user-changeable passwords is "0". To enter new passwords, you must first access the technician's parameters and scroll to "PASS ConF". After entering the password press the SET button to save it to memory.

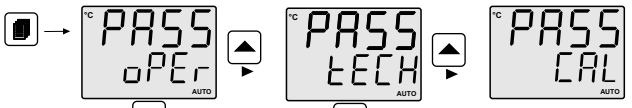
You can access the main titles of the menu by using the ▲ and ▼ buttons. Press the SET button to move to the next level of any menu. Change the value of your chosen parameter by using ▲ and ▼ buttons. The new value is saved to memory by using the SET Button.

Abbreviations

Parameters are listed in the left hand column in **bold lettering** followed by its description and available choices. Some abbreviations are defined as follow:

AT	Autotune	ST	Self Tune
FS	Full Scale (or Max. Scale)	Su-L	Minimum Operating Value
HYS	Hysteresis	Su-u	Maximum Operating Value
PV	Process Value	SV	Process Set Value or PSET

Programming Mode - Main Menus



see operator parameters — see technician parameters — factory settings

Parameters

OPERATOR PARAMETERS

Process and Alarm Set Value Parameters (SET LIST)

PSET This is the device's process set value. If there isn't any extra module in the device, this parameter is used for Output-3.

ALr1 Module-1's alarm set value when installed & configured as an alarm output.

ALr2 Module-2's alarm set value when installed & configured as an alarm output.

ALr3 Output-3's alarm set value when configured as an alarm output.

Tuning and Operating methods (RUN LIST) see p5 for explanation of tuning methods

tUnn This parameter defines the tuning type.
NO =Tuning is inactive. ATUN=Only Autotune is active.
STUN=Only Selftune is active. AT.ST=Autotune and selftune are active.

oftn NO= **Autotune** is inactive. YES= **Autotune** is active.

AUtO AUTO= Auto process mode. MAN=Manual process mode.

rSSL Ramp-Soak Function.
oFF=ramp-soak inactive run=Ramp-Soak is active hold=ramp-soak is paused

ULSL If output module 1 is a relay output, then this parameter can be used to define the motorized valve control form. Output 1 to open and Output 3 to close the valve:
No=inactive HEAt=operates with heating PID CooL=operates with cooling PID

bpLt Bumpless Transfer
NO=bumpless transfer is inactive. YES=Bumpless Transfer is active.

LtCC High Limit Latch Cancelling. If an Alarm output was configured as a latched output and that output is not in the latched condition, it can be returned to a non latching alarm output by entering YES. Once cancelled LtCC=NO

Display Parameters (DISP LIST)

tdSP Defines the function of the top display.
0=PV , 1= SV-PV, 2=2nd analog input's measured value (if unit is fitted with this option)

bdSP Defines the function of the bottom display.
Note: If device is running in manual mode, the bottom display shows % Power.
0=SV 1=%power 2=ramp-soak display
3 = 2nd sensor's measured value 4 = CT input measured value

Ramp / Soak Parameters (rmP SoA)

StrA From 0 to 99h 59min. (Inactive if 0.0)

rStO From 0 to 50% of SV. (Inactive if 0). If rSto or ramp & soak functions have been selected, then (set value-rSto)<starting temp<(set value+rSto). The unit operates within this range for the duration selected.

rSty Ramp-Soak type 0=1-4 segment 1= 5-8 segment 2=1-8 segment

PU-1to 8 Target SV (SU-L to SU-U)

Tr-1 to 8 Ramp segment time (from 0 to 99h 59min.)

TS-1 to 8 Soak segment time (from 0 to 99h 59min)

Notes on Ramp and Soak

There are three options: you can have two independent 4 segment processes (essentially giving you two recipes) or one 8 segment process.
If you want only one Ramp, use the Stra parameter. You do not have to use the Pu, Tr and TS parameters.
By using the Stra you are defining the amount of time the controller will take to get the temperature to the Set Value (time becomes the overriding factor).
If you want more than one R & S, make sure that Stra = 0.
Then choose rsty according to the number of segments desired.
If you want the controller to shut down after it has gone through all the R & S segments, it must be running in the Manual Mode (Operator Parameters – Run List).
If this parameter is defined as AUTO, then, at the end of the final segment, the controller will work to keep the temperature at the final target value. See p7 for graphic representation.
To run the R & S, Rssl in the Operator's Parameters must be set to RUN via the front mounted touch pad
OR
via an input module, EMI-400, which can be plugged into the controller. This is further explained on page **4**.

Parameters

Technician's parameters (PınP)

ıSSL Configuration for process input type.
0=TC, 1=RTD, 2=DC Voltage/Current

TC Input (issl=0)

tCSL TC input type selection for thermocouple and scale (ref. Table-1)
unıt Configuration for unit of measure (°C, °F)
LPAd Low point adjustment used together with uPAd to correct sensor error.
eg. reading is 26 (low) and 320 (high) but should read 25 and 325
LPAd = -1 and uPAd=5
uPAd Upper point adjustment
LOL Minimum value of operation scale
UPL Maximum value of operation scale
PUOF Process offset ±10% of FS. Added to process value & expressed in degrees.
ıFLt Input signal filtering time. (0.0 to 900.0 seconds)
CjnC NO = cold junction compensation is inactive. YES = active.

RTD Input (issl=1)

rtdS RTD input type selection for thermoresistance and scale (Ref. Table-1)
unıt Configuration for unit of measure (°C, °F)
LPAd Low point adjustment used together with uPAd to correct sensor error.
eg. reading is 26 (low) and 320 (high) but should read 25 and 325
LPAd = -1 and uPAd=5
uPAd Upper point adjustment
LOL Minimum value of operation scale
UPL Maximum value of operation scale
PUOF Process offset ±10% of FS. Added to process value & expressed in degrees.
ıFLt Input signal filtering time. (0.0 to 900.0 seconds)

DC Voltage/Curren (issl = 2)

UASL Input type selection for voltage and current (Table-1)

dPnt Decimal point position on the displays
0=0000 1=000.0 2=00.00 3=0.000

UCAL Dual or multi-point calibration 0=Lol is -1999 & Upl is 9999)
1=Dual point (adjust Lol & Upl to suit)
2=Multi-point (up to 16 points P000 to P016)

P000 to P016 Calibratiton points for multi-point configuration
Used for non-linear calibration

CoEF Input coefficient. Used to scale input. eg. If sensor input = 40mV, a coefficient of 1.25 (50mV÷40mV) is used to get a **F**ull **S**cale deflection (Upl).

unıt Configuration for unit of measure
°C=Centigrade °F=Fahrenheit U=other - =none

Lol Minimum value of operating scale

Upl Maximum value of operating scale

Puof Process offset ±10% of FS. Added to process value & expressed in degrees.

ıFLt Input signal filtering time (display refresh rate 0.0 to 900.0 seconds) .

PID parameters

P-Ht Proportional band for heating (0.0% to 999.9% of FS.)

I-Ht Integral time for heating (0 to 3600 seconds)

D-Ht Derivative time for heating (0.0 to 999.9 seconds)

Ct-H Control period for heating (1 to 150 seconds)
For Relay module: 30 seconds
For SSR driver module: 1 or 2 seconds.

oLLH Min. control output for heating.(0.0 to **OULH**).Inactive ın Heating/Cooling mode.

oULH Maximum control output for heating. (**OLLH** to 100%).

oLtH Min. output time for heating. (0.0 to **CT-H** or 50 miliseconds when = 0.0)

CCoE Cooling proportional band coefficient. (0.0% to 100.0%). If heating and cooling PID are used, tunning is performed by the heating output. Therefore (P-CL=P-HT * CCoE/100) eg. If P-Ht=10.0% and CCoE=50 then P-CL= 10.0*50/100=5.0%. If value is 0.0, coefficient is inactive.
Recommendation: CCoE=100 when cooling with air; 80 with oil; 40 with water

P-CL Cooling proportional band. (0.0% to 999.9% of FS.) eg. If uPL= 1000°C, LoL=0°C and P-CL=50% then in temperature P-CL=(1000-0)*50/100=500°C

I-CL Integral time for cooling. (0 to 3600 seconds)

d-CL Derivative time for cooling. (0.0 to 999.9 seconds)

Ct-C Cooling control period. (1 to 150 second)
Recommendation: Use an SSR output for control periods shorter than 30s. These are much better suited for frequent on/off operation than relay outputs.

oLLC Min. control output for cooling.(0.0%- **OULC**). Inactive in Heating/Cooling mode.

ouLC Maximum control output for cooling. (**OLLC** - 100.0%).

oLtC Minimum output time for cooling. (0.0 to **CT-C** or 50 miliseconds if value is 0.0)

Ar Anti-Reset Windup (0% to 100% of FS). During PID operation if PSEt - Ar≤PSEt≤PSEt+Ar then an integral value is calculated otherwise the last calculated integral value is used. See p6 for graphic example.
If ot.Ar is selected, then proportional band is used in PID process instead of Ar value.

SuoF Offsets the proportional band from the SV in the PID calculations (±50% of FS)

Parameters

PID parameters (cont'd)

PoFS PID output offset. Added to PID output. -100.0 to 0 for cooling PID
0.0 to 100.0 for heating PID
-100.0 to 100.0 for heating/cooling PID.

PoSS SV offset for PID. Added to PID output (PoSS * PSET / FS)
-100.0 to 0 for cooling PID
0.0 to 100.0 for heating PID
-100.0 to 100.0 for heating/cooling PID.

Strn Stability value. Adjustable from 1 to max scale. If tunn=no or Stun, oscillation might occur. PSEt-Strn≤PSEt≤PSEt+Strn

O-db Proportional band shifting. Adjustable from ±50.0% of FS. This value is added to PSET value for cooling. If SV for heating =PSEt+SuoF then SV for cooling=PSEt+SuoF+o-db

Sbou Control output value for duration of Sensor break error
-100.0 to 0 for cooling PID
0.0 to 100.0 for heating PID
-100.0 to 100.0 for heating/cooling PID
To continue controlling the process if sensor breaks, enter a value. Inactive if 0.0

Input/Output Modules Configuration (MODULE-1/MODULE-2) ıoP1 & ıoP2

out1 / out2 Output configuration (heat, cool, Lout)

Con1 / Con2 Control type (ON/OFF or PID)

HYS1 / HYS2 Hysteresis value 0% to 50% of FS (expressed in degrees)

HYn1 / HYn2 Mode of Hysteresis [0=SV+(HYS/2) and SV-(HYS/2)]
[1=SV and SV+HYS or SV and SV-HYS]

tm1 / tm2 Minimum OFF time (0.0 to 100.0 Seconds)

Lou1 / Lou2 (Loutputs) 0=Alarm output 1=Manual/Automatic 2=Sensor break alarm
3=PV is out-of-range 4=Ramp/Soak finished
5=Sensor break alarm for analogue input module
6=PV is out-of-range for analogue input module

ALS1 / ALS2 Alarm sensor selection 0 = Process input sensor (on terminals 1,2,3)
1 = Analogue module (1 or 2) sensor

ALt1 / ALt2 (alarm types) 0=Process high alarm 1=Process low alarm
2=Deviation high alarm 3=Deviation low alarm
4=Deviation band alarm 5=Deviation range alarm
6=Heater failure alarm (CT input module must be installed)

ALH1 / ALH2 Alarm hysteresis 0% to 50% of FS (expressed in degrees)

Aon1/ Aon2 Alarm delay from fault 0.0 to 9999 seconds

AoF1/ AoF2 Alarm reset from fault 0.0 to 9998 seconds. For high limit with manual reset only, select 9999. Display will read LtCH to indicate latch feature selected.

If Module 1 or 2 is EMO-430

oAt1 / oAt2 Output scale 0= 0...20mA (connect parallel 500 ohm for 0-10VDC)
1= 4...20mA (connect parallel 500 ohm for 2-10VDC)

ouA1 / ouA2 Output type: Heat / Cool / Retransmission

ret1 / ret2 Rt.pr=Retransmission of PV Rt.er=Retransmission of error
Rt.pu=Retransmission of SV

If Module 1 or 2 is EMI-400

LIN1 / LIN2 0=Manual / Automatic when logic input closed, changes AUTO program parameter, if MAN changes to AUTO, if AUTO changes to MAN
1=Start Stop the AT when logic input closed, changes ATTN program parameter, if NO changes to YES, if YES changes to NO
2=Run / off Ramp/Soak RSSL program parameter,when logic input is closed, changes RUN or HOLD to OFF, if OFF changes to RUN)
3=Run / hold Ramp/Soak RSSL program parameter when logic input is closed, changes RSSL program parameter, if RUN changes to HOLD, if HOLD changes to RUN)
4=Cancel Alarm Latching when logic input is triggered, unless the alarm condition still exists.

If Module 1 or 2 is EMI-420

Hb1 / 2 Heater break alarm set value = (Amps without failure + amps with heater failure)/2
For correct measurements, heating output must be active for at least 0.2 sec.

Ctr1 / 2 Current transformer ratio can be adjusted from 0 to 100.
eg. For a 100:5A CT this parameter would read 0020 (100/5)

If Module 1 or 2 is EMI-410, EMI-430, EMI-440 or EMI-450

ISL1 / ISL2 Configuration for second sensor input type: 0=TC 1=RTD 2=DC volt/current

If ISL1 = or ISL2= 0

tSL1/2 TC input type selection for thermocouple and scale (ref. Table-1)
UNT1/2 °C=Centigrade °F=Fahrenheit
LoL1/2 Minimum value of second sensor input range
uPL1/2 Maximum value of second sensor input range
IPu1/2 Module's display offset value ±10% of Fs1. Added to process value in degrees.
iFL1/2 Module's input signal filtering time. (From 0,0 to 900,0 seconds)
CJn1/2 Analogue input Module's cold junction compensation setting
NO = cold junction compensation is inactive YES = active
rES1/2 Analogue input remote selection. Determines whether the measured value is the result of the input on terminals 1,2, 3 or from the input module. Visible only when decimal point and unit parameters are the same for both inputs.

Parameters

If Module 1 or 2 is EMI-410, EMI-430, EMI-440 or EMI-450 (continued)

If ISL1 or ISL2= 1

RTS1 / 2 Selection of sensor type and scale (see Table 1)
UNT1 / 2 °C=Centigrade °F=Fahrenheit
LoL1 / 2 Minimum value of second sensor input range
uPL1 / 2 Maximum value of second sensor input range
IPu1 / 2 Module 1 / 2 PV offset ±10% of FS1. Added to the input reading in degrees
iFL1 / 2 Module 1 / 2 Input signal filtering time. (From 0,0 to 900,0 secs)
rES1 / 2 Determines whether the measured value is the result of the input on terminals 1,2, 3 or from the input module. Visible only when decimal point and unit parameters are the same for both inputs. If YES, then analogue input module's value is used as the Set Value. If NO, then SV=PSET

If ISL1 = or ISL2= 2

UAS1 / 2 Selection of sensor type and scale. (See Table1)
DPN1 / 2 Analogue input module decimal point position
0 = 9999 1 = 999.9 2 = 99.99 3 = 9.999
ICA1 / 2 Analogue input module calibration type
0 = None 1 = Dual point
ICL1 / 2 Minimum value for dual point calibration
ICH1 / 2 Maximum value for dual point calibration
uNT1 / 2 °C=Centigrade °F=Fahrenheit U=Other units
LoL1 / 2 Minimum value of second sensor input range
uPL1 / 2 Maximum value of second sensor input range
Ipu1 / 2 Module 1 / 2 PV offset ±10% of FS1. Added to the input reading.
iFL1 / 2 Module 1 / 2 Input signal filtering time. (From 0.0 to 900.0 secs)
rES1 / 2 Determines whether the measured value is the result of the input on terminals 1,2, 3 or from the input module. Visible only when decimal point and unit parameters are the same for both inputs. If YES, then analogue input module's value is used as the Set Value. If NO, then SV=PSET

Output - 3

out3 Output configuration (heat, cool, Lout)

Con3 Control type (ON/OFF or PID)

HYS3 Hysteresis value 0% to 50% of FS (expressed in degrees)

HYn3 Mode of Hysteresis 0=SV+(HYS/2) and SV-(HYS/2)
1=SV and SV+HYS or SV and SV-HYS

tm3 Minimum OFF time (0.0 to 100.0 seconds). Active in on.off control

Lou3 0=Alarm output 1=Manual / Automatic data output
2=Sensor break alarm 3=Output active when PV is outside operating range
4=Output activates at end of R/S 5=Analog input module sensor break alarm
6=PV of second input is <LoL1 / 2 or >uPL1 / 2

ALS3 Alarm sensor selection. If output 3 is an alarm output and an analogue module is installed: 0 = Alarm in accordance with input sensor (on terminals 1,2,3)
1 = Alarm in accordance with analogue input module (1 or 2)

aLt3 Alarm type:
0-Process high alarm 1-Process low alarm 2-Deviation high alarm
3-Deviation low alarm 4-Deviation band alarm 5-Deviation range alarm
6=Heater failure alarm (CT input module must be installed)
NOTE: 2,3,4,5,are not available if Lou3 ≠ 0.

aLH3 Alarm hysteresis. Active if output 3 is alarm output. If ALS3=0 or there is no second sensor input, adjustment is 0 - 50% of process input scale (uPL-LoL).
If ALS3=1and an analogue input is present, then it can be adjusted from 0 to 50% of the input module's scale.
If a CT input module is installed and ALt3=0006, adjust from 0.0 to 20.0A.

Aon3 Alarm delay from fault 0.0 to 9999 seconds

AoF3 Alarm reset from fault 0.0 to 9998 seconds.
For high limit with manual reset only, select 9999. Display will read LtCH to indicate latch feature has been selected.

General Configuration (Genn ConF)

SU-L SV min. limit. Adjustable from min. scale to SU-u value . It's the minimum value of the operation scale.

SU-u SV max. limit. Adjustable from SU-L value to max. scale. It's the maximum value of the operation scale.

Su-L2 Second sensor SV min. limit. Adjustable from min. scale to SU-u2 value . It's the minimum value of the operation scale.

SU-u2 Second sensor SV max. limit. Adjustable from SU-L2 value to max. scale. It's the maximum value of the operation scale.

ULtt Motorized valve travel time can be adjusted from 5 to 600 sec.

ULHY Min. activation time of motorized valve and is adjustable from 0.1 to 5.0%.
eg. If ULtt=100s and ULHY=1.0% then the minimum activation time is (100s*1%) or 1 second.

Communication Configuration (Comm Conf)

SAdr Slave Address from 1 to 247

BAud Baud Rate: 0- 1200 1- 2400 2- 4800 3- 9600 4- 19200

Prty Parity 0- none 1- ODD 2-EVEN

StPb Stop Bit 0- 1 stop bit 1- 2 stop bit

Passwords (PASS ConF)

opps Operator password (0 to 9999).

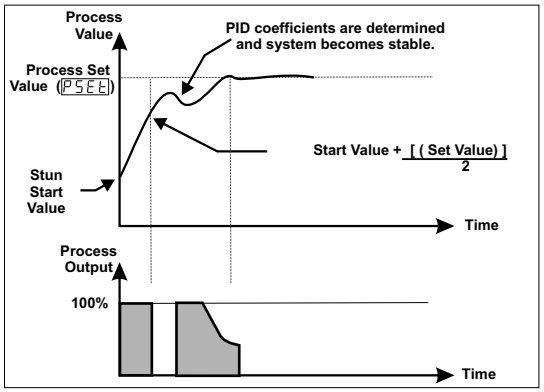
Tcps Technician password (0 to 9999).

Manufacturer's Calibration Page (PASS CAL) - Factory Set

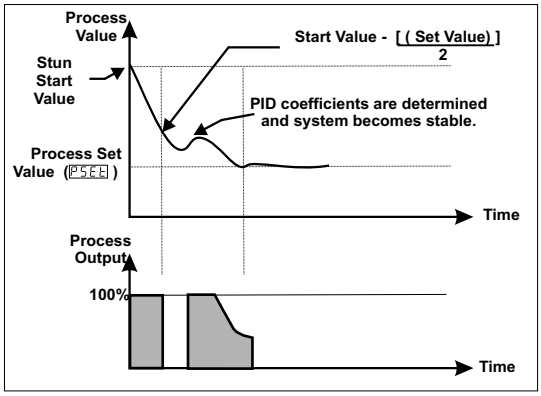
Explanations

STEP RESPONSE TUNING (Self Tune)

Firstly, the control form must be PID in order for this tuning method to operate.



If the tunn parameter is Stun or At.St, step response tuning is selected. When the device is first energized, the actual value is compared to the set value. If the set value is greater than the actual value, the process output is enegized until the **start value+((set value)/2)** is reached. The process output is reduced to 0% and the device ensures that the temperature has begun to fall. The PID coefficients are calculated and saved to memory. If the tuning is completed successfully, the tunn parameter is changed from Stun to NO or At.St to Atun depending on the original choice.

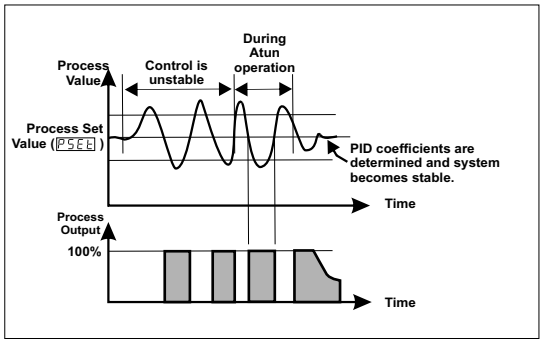


If the set value is less than the actual value and the cooling PID is selected, the process output is energized until the **start value-((set value)/2)** is reached**.** The process output is reduced to 0% and the device ensures that the temperature has begun to rise. The PID coefficients are calculated and saved to memory. If the tuning is completed successfully, the tunn parameter is changed from Stun to NO or At.St to Atun depending on the original choice.

During tuning, the set value can not be changed. Step response is canceled without changing the PID set values when any of the following conditions applies: the heating PID is canceled during Heating step response; when the cooling PID is canceled during Cooling step response; when there is a sensor break error or when the step response tuning operation can not be completed within 8 hours (the AT LED flashes. The error can be cleared with the "SET" button). If the power to the device is removed and reapplied, the device carries out step response tuning again.

LIMIT CYCLE TUNING (Auto Tune)

Firstly, the control form must be PID in order for this tuning method to operate.

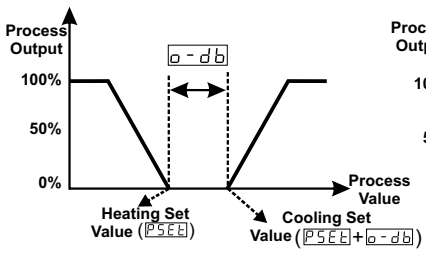


The user can decide at any time to use this tuning method by selecting Atun or At.St for the tunn parameter in the run list. After changing the set value, if the difference between the newly defined and former set values is greater than the proportional band **+/-(scale x P-Ht)/1000** if heating or heating/cooling or **+/-(scale x P-CL)/1000** if cooling, the contoller will automatically start this function.

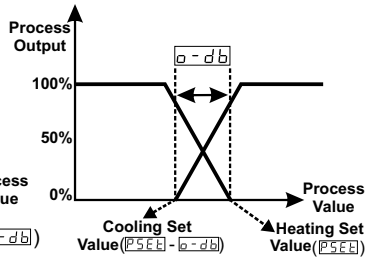
In the event that the actual value moves outside the set value by **+/-Strn** 3 times while the device is executing the PID control, the Attn parameter becomes YES and tuning is started.
If the Attn parameter is YES, the device begins tuning from the point where it stands at that moment. If the heating and cooling PIDs are selected together, or if only the heating PID is selected, Heating Limit Cycle is performed; if only the cooling PID is selected Cooling Limit Cycle is carried out. If the Limit Cycle operation can not be completed within 8 hours, tuning is cancelled and the Attn parameter becomes NO. The PID parameters remain as they were before this failed session.
If Heating Limit Cycle is being done, tuning is performed according to **set-((set temperature)/4),** if cooling Limit Cycle is being done, tuning is performed according to **set+((set temperature)/4)** .
At the end of tuning the Attn parameter becomes NO and the PID parameters are saved to memory.
If a sensor break error occurs, the tuning operation is paused until the sensor connection is re-established. When the sensor connection returns to normal, the tuning operation is recommenced. If the Limit Cycle tuning operation can not be completed within 8 hours the tuning operation is cancelled (the AT LED flashes. The error can be cleared with the "SET" button).
While the tuning operation is under way, the Process Set Value (PSEt) can not be changed.

PROPORTIONAL BAND SHIFTING o-db

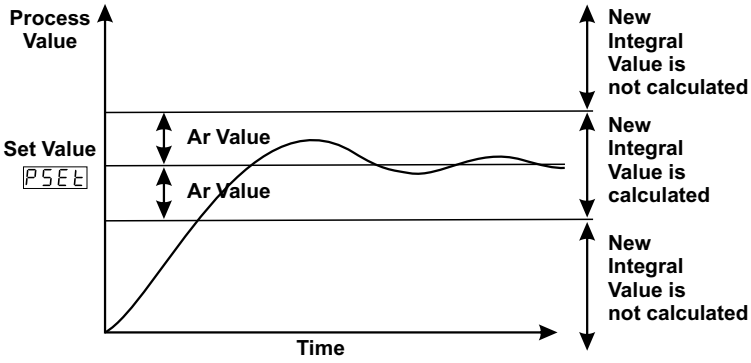
If o-db > 0 (Dead Band)



If o-db < 0 (Overlap Band)

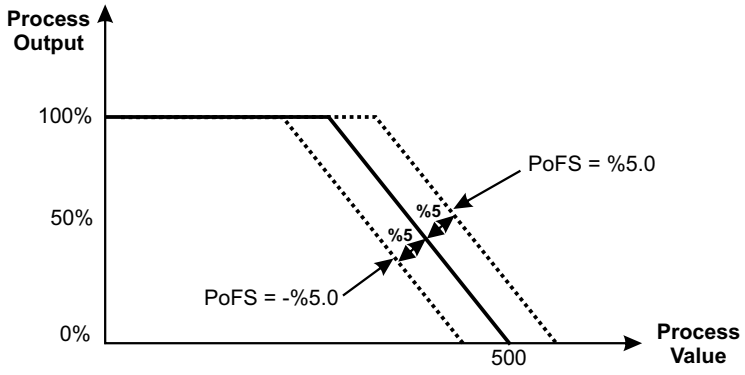


ANTI-RESET WINDUP AR



PID OUTPUT OFFSET POFS

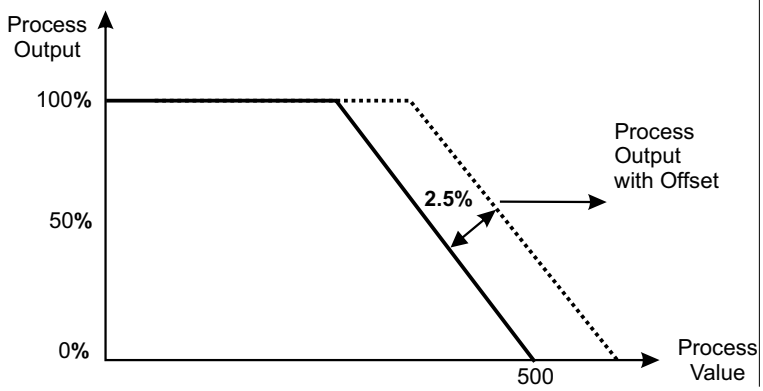
Added to Output % which is calculated at the end of the PID.



OUTPUT OFFSET RELATED TO PID SET POSS

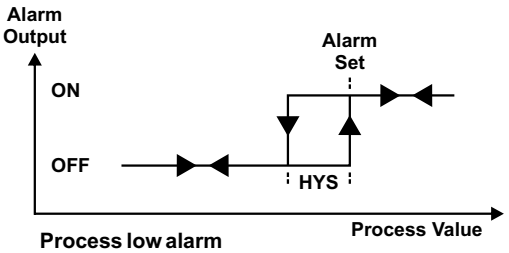
Added to the process output calculated at the end of the PID according to the process set value. PoSS * PSEt / (uPL - LoL)

eg: PSET = 500°C , uPL = 1000°C , LOL = 0 , PoSS = 5.0%
then 5.0 * 500 /(1000-0) = 2.5%

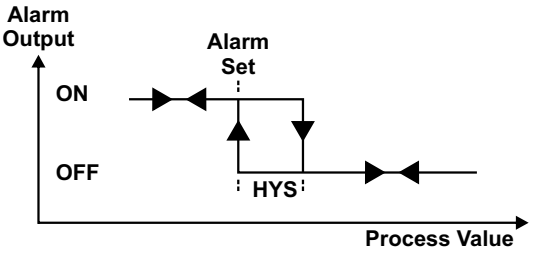


ALARM OPTION and OUTPUT FORMS

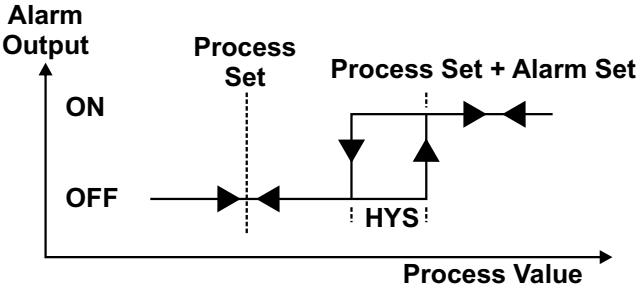
Process high alarm



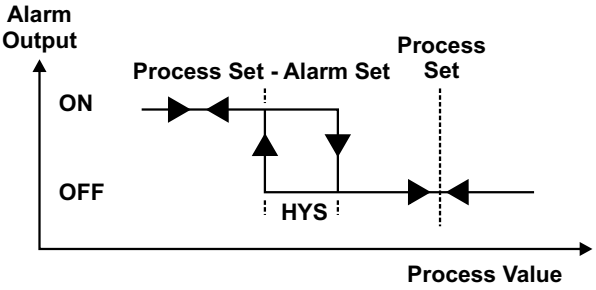
Process low alarm



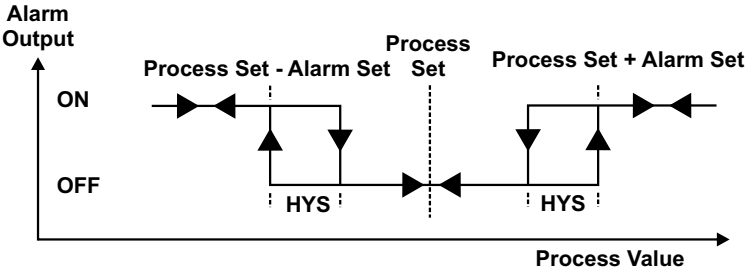
Deviation High Alarm



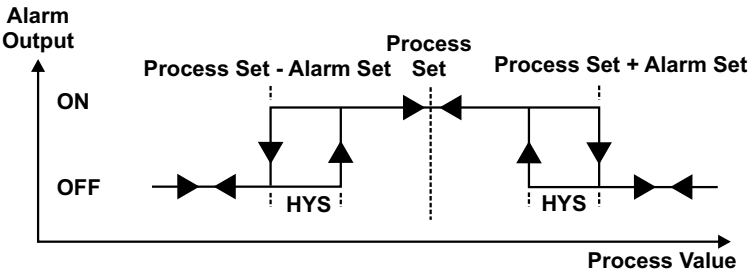
Deviation Low Alarm



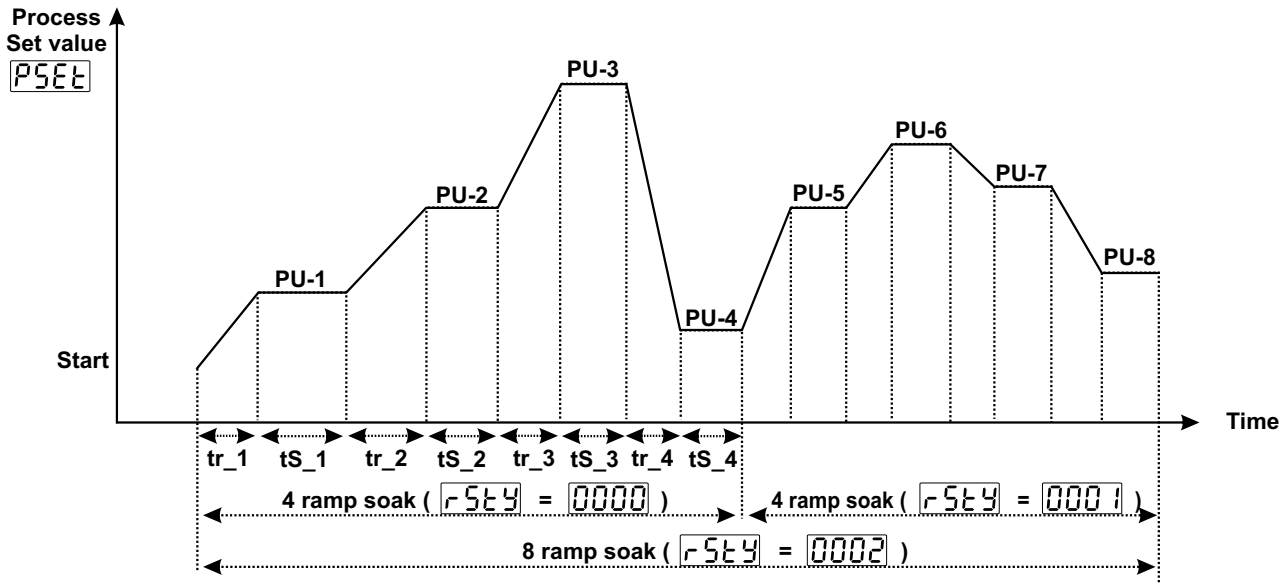
Deviation Band Alarm



Deviation Range Alarm

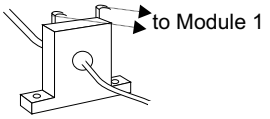


Graphic representation of Ramp and Soak function



HEATER BREAK ALARM

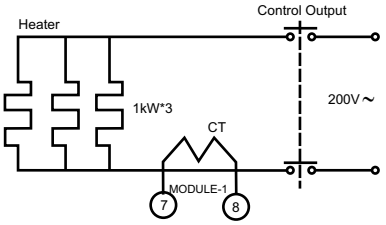
Current Transformer



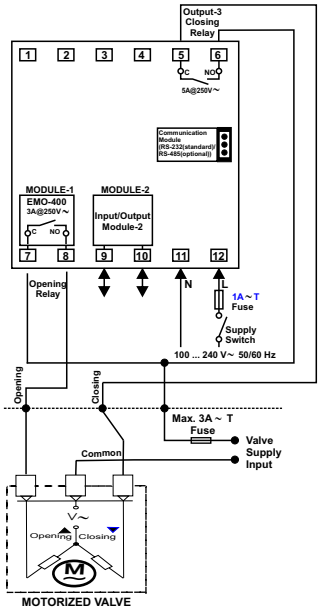
Current transformer ratio for Module-1 can be adjusted from 0 to 100.)
eg: For 100:5A type current transformer the Ctr 1 parameter would be 100/5 or 20

Calculating set value for heater failure

Set Value = [(Current value without failure + Current value with heater failure)] / 2
eg. A 200V system with three1KW heaters would normally draw 15 amps
[1000 / 200]*3 = 5A *3 = 15A
If one of the heaters is out of order, the current draw is now 5A*2 or 10A. The Set Value must be adjusted to (15+10) /2 or12.5A



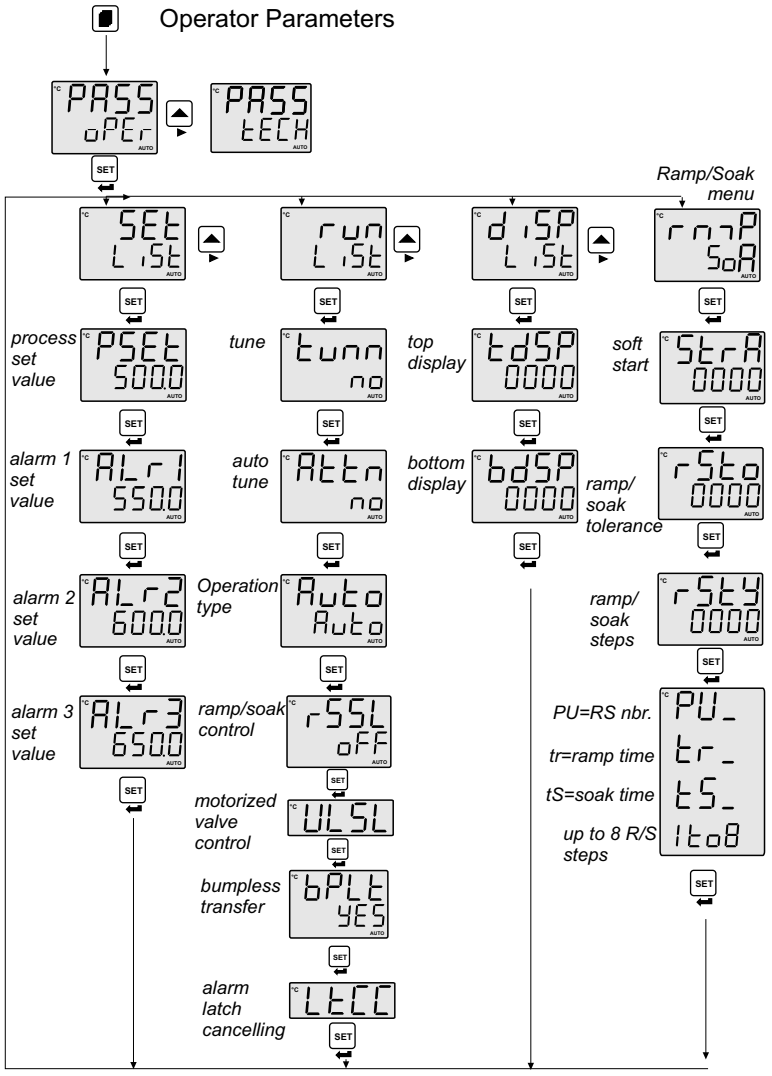
MOTORIZED VALVE CONTROL



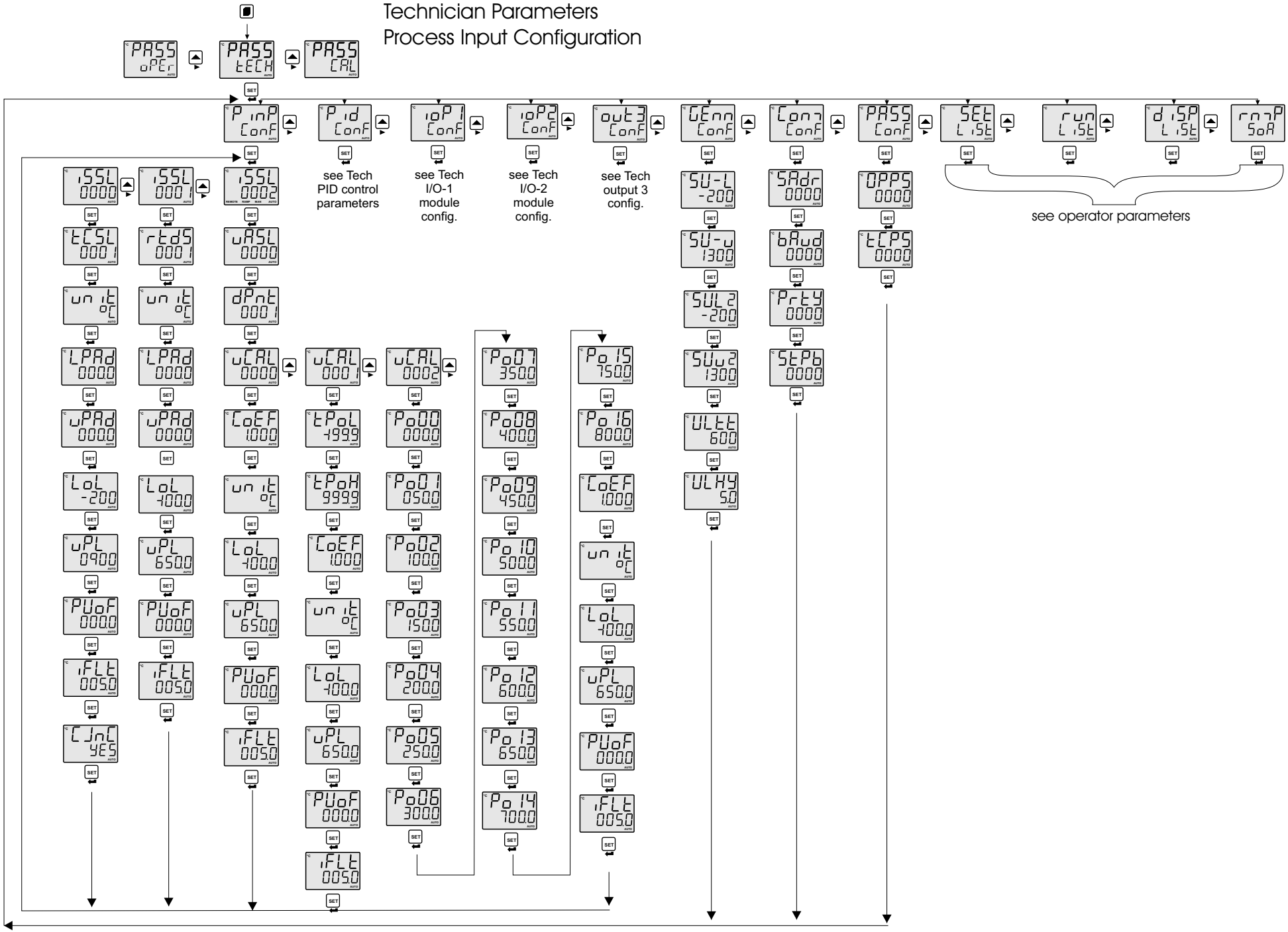
EMO-400 relay output module must be plugged into Module-1 socket.

In the RUN LIST grouping of the OPERATOR's section, select HEAT or COOL for parameter ULSL.
The ULtt parameter can be adjusted from 5 to 600 seconds. It defines the time required to open the valve completely.To determe this parameter correctly, close the valve manually. Be sure the valve is fully closed; then reopen it manually without stopping and measure how long it took to reopen it completely. Add 5% to this value and enter it for this parameter.
The ULHy parameter determines the increments as a percentage of the Ultt parameter and can be adjusted from 0.1 to 5.0 %. If the valve oscillates while opening or closing, INCREASE this parameter's value!

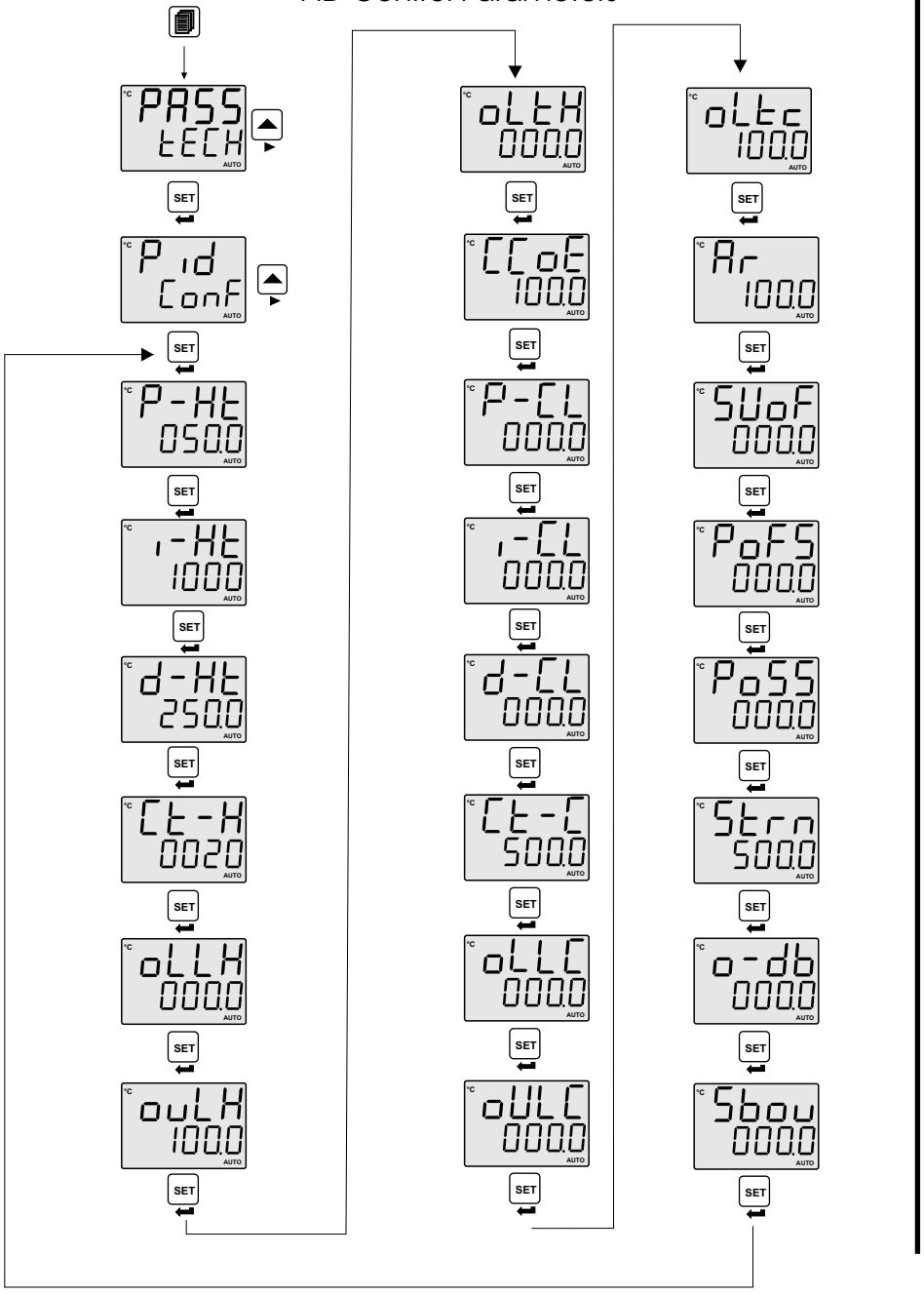
PNEUMONIC REPRESENTATION



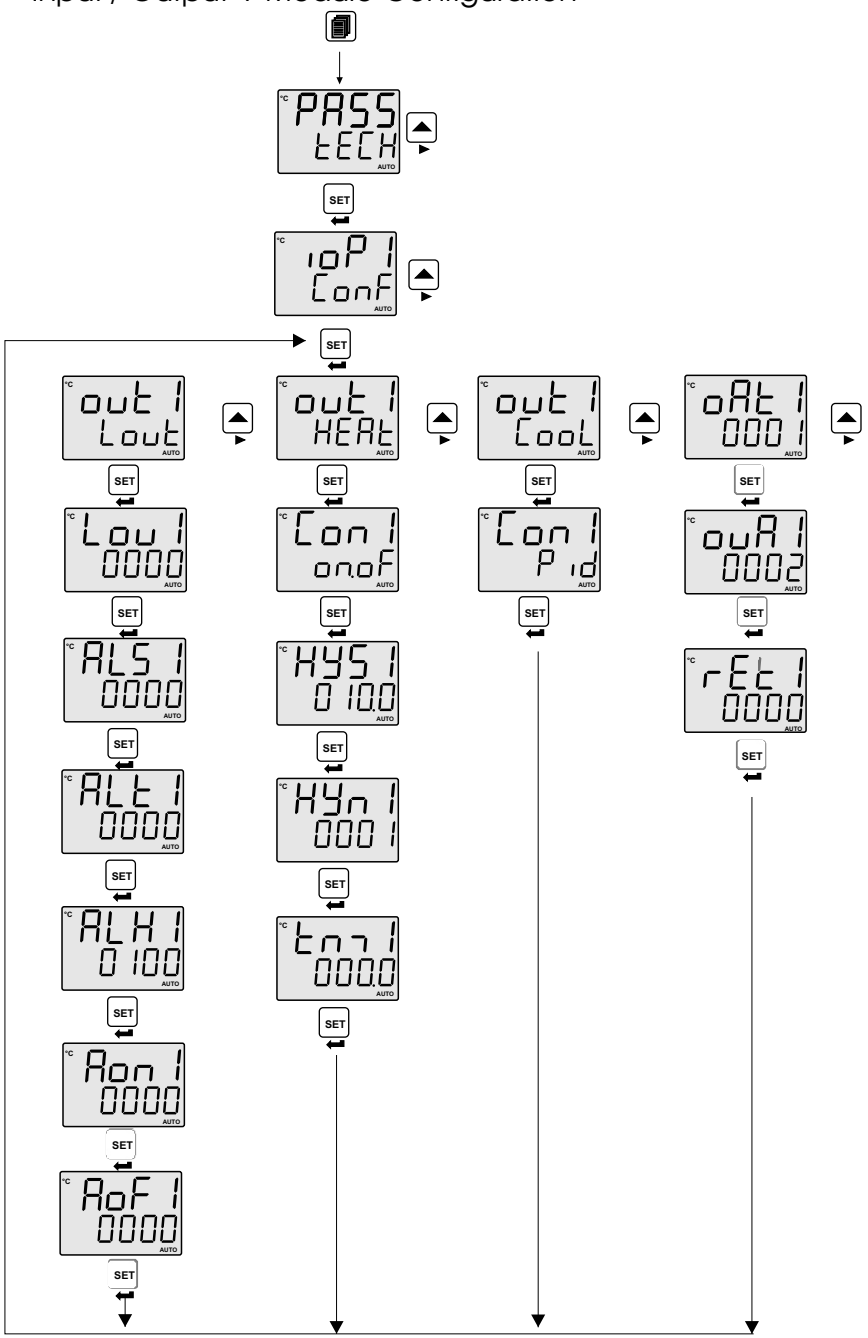
Technician Parameters
Process Input Configuration



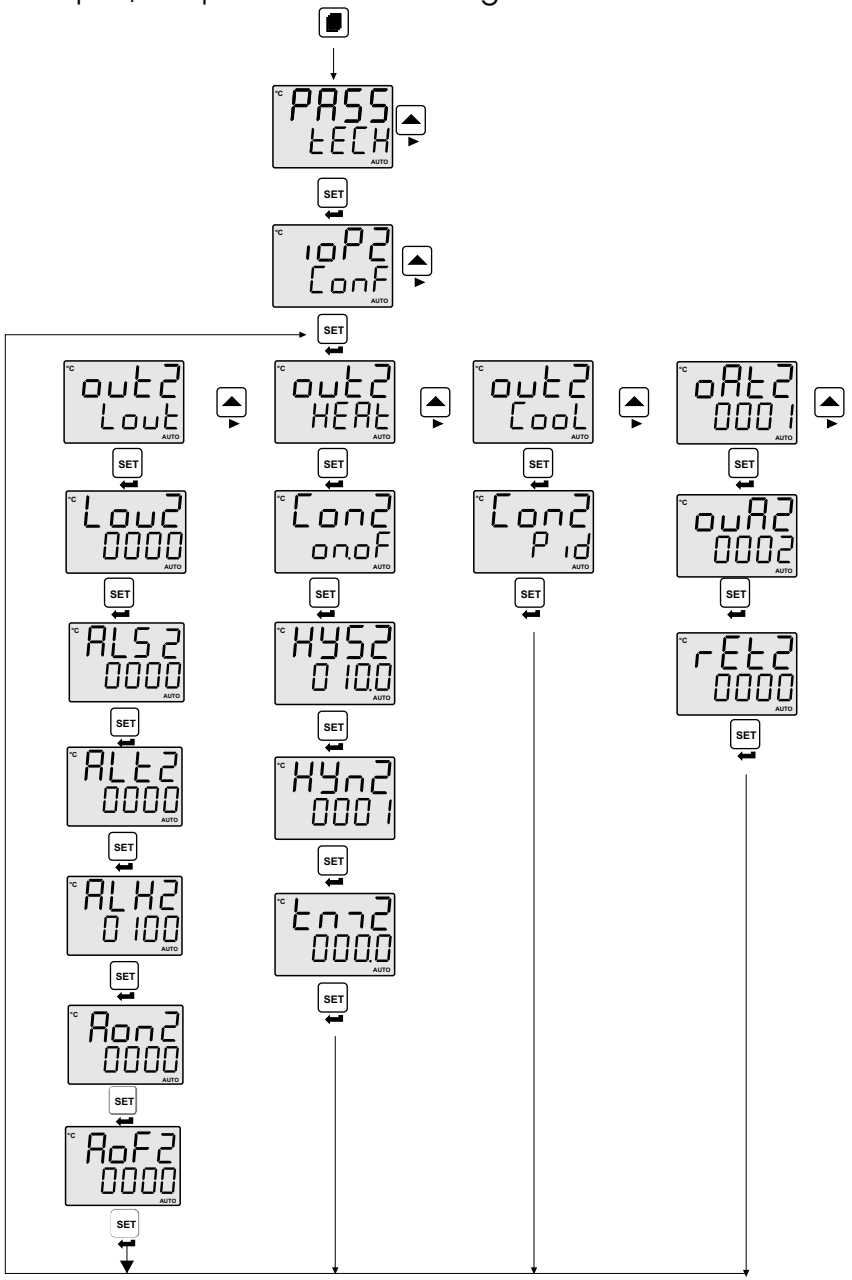
Technician Parameters
PID Control Parameters



Technician Parameters
Input / Output-1 Module Configuration



Technician Parameters
Input / Output Module-2 Configuration



Technician Parameters
Output-3 Configuration