PPT245

CONTROLLER
User Manual

Summary

1 Introduction

Controller PPT245 is specifically designed for DIN rail mounting.
PPT245 makes available in a single device all the options relevant to sensor input and actuator command, in addition to the extended power range 24…230 Vac/Vdc. With 18 sensors to select and outputs configurable as relay, SSR command, 4…20 mA and 0…10Volt, the user or retailer can reduce warehouse stock by rationalising investment and device availability. The PPT245 is equipped with serial communication RS485 Modbus RTU and with a loading control function via the current transformer. The configuration is further simplified by the Memory cards which are equipped with internal battery and therefore do not require cabling to power the controller.

2 Model identification

PPT245-21-ABC-T	2 Relays 5A + 1 SSR/V/mA + RS485 +TA*

* Input TA for Loop Break Alarm, supply 24…230 Vac/Vdc +/- 15% 50/60Hz – 5,5VA.

3 Technical data

3.1 General features

Displays	4 0,40 inch displays+ 4 0,30 inch displays
Operating temperature	0-45°C, humidity 35..95%non condensing
Sealing	IP65 front panel, IP20 casing and terminals
Material	PC ABS UL94VO self-exstinguishing
Weight	165 g

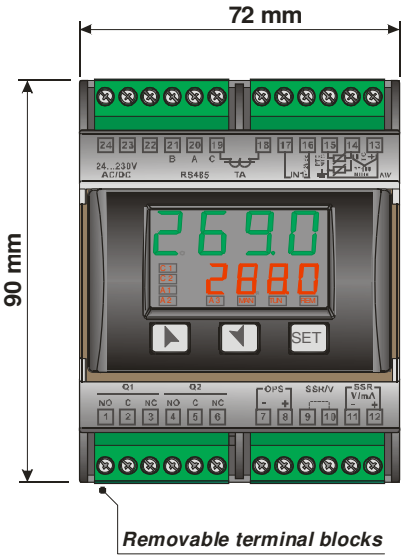
3.2 Hardware features

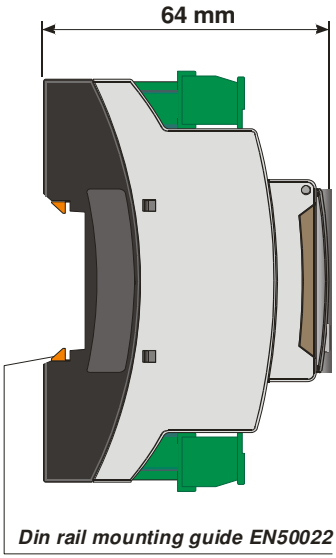
Analogue input	**1**: AN1 Configurable via software **Input** Thermocouple type K, S, R, J Automatic compensation of cold junction from from 0°C to 50°C. **Resistance thermometer:** PT100, PT500, PT1000, Ni100, PTC1K, NTC10K (β 3435K) **Linear:** 0-10V, 0-20 or 4-20mA, 0-40mV, current transformer TA 50mA 1024 points Potentiometers: 6K, 150K,	Tolerance (25°C) +/-0.2 % ± 1 digit for thermocouple input, resistance thermometer and V/mA. Cold junction accuracy 0.1°C/°C
Relay outputs	**2** relays Configurable for command or alarm.	Contacts 5°-250V~
SSR output	**1** linear 0/4…20mA /SSR/0…10Volt Configurable as command or retransmission of setpoint/process	Configurable: > SSR > 4-20mA, > 0…10Volt, > 0-20mA. Resolution 4000 points

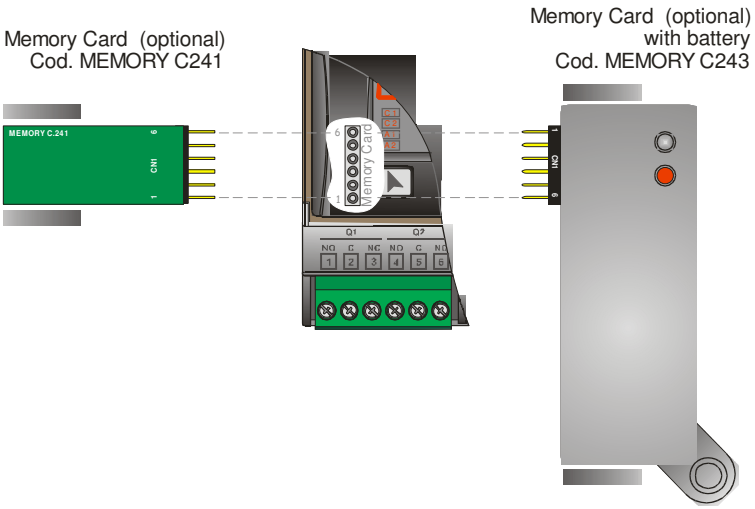
3.3 Software features

Regulation algorithms	ON-OFF with hysteresis P, PI, PID, PD with proportional time
Proportional band	0...9999°C or °F
Integral time	0,0...999,9 sec (0 excluded)
Derivative time	0,0...999,9 sec (0 excluded)
Controller functions	Manual or automatic tuning, configurable alarms, protection of command and alarm setpoints, activation of functions via digital input, preset cycle with Start/Stop.

4 Dimensions and installation





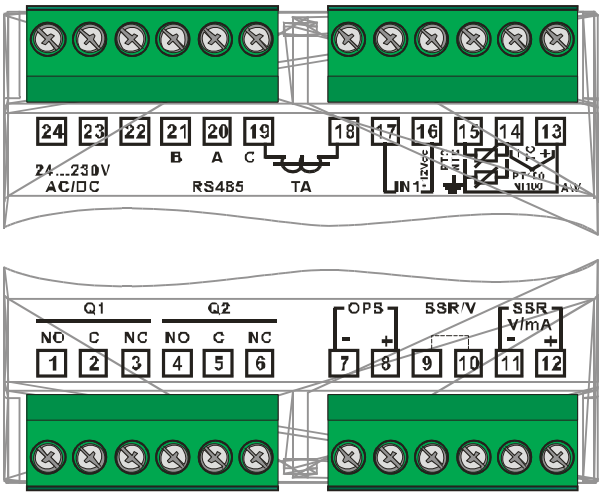


5 Electrical wiring

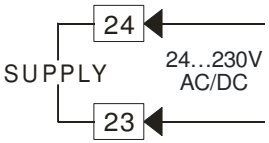
Although this controller was designed to resist electromagnetic interference in industrial environments, pease observe the following safety guidelines:

- Separate the feeder line from the power lines.
- Avoid placing near units with remote control switches, electromagnetic contactors, high powered motors and in all instances use specific filters.
- Avoid placing near power units, particularly if phase controlled.

5.1 Wiring diagram



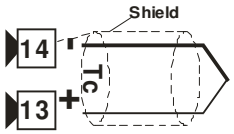
Power supply



Switching power supply with extended range

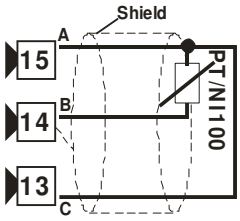
24…230 Vac/dc ±15% 50/60Hz – 5,5VA

Analog input AN1



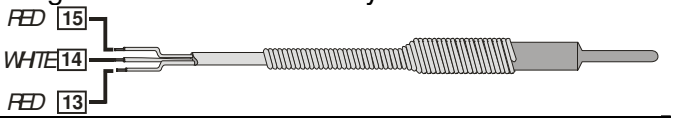
Thermocouples K, S, R, J.

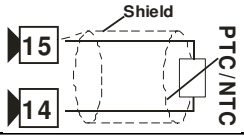
- Comply with polarity
- For thermocouple extensions, use compensated cable and terminals suitable for the thermocouples used (compensated)
- When shielded cable is used, it should be grounded at one end only



Resistance thermometer PT100, NI100

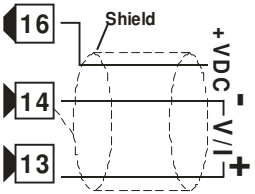
- For the three-wire connection use wires with the same cross-section
- For the two-wire connection short-circuit terminals 13 and 15.
- When shielded cable is used, it should be grounded at one end only





Resistance thermometer NTC, PTC, PT500, PT1000 and potentiometers

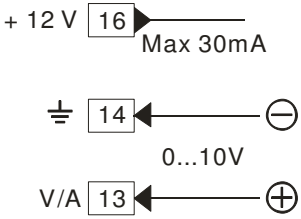
- When shielded cable is used, it should be grounded at one end only



Linear signals V/mA

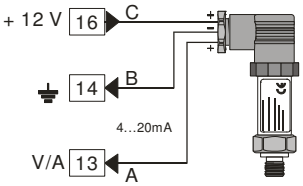
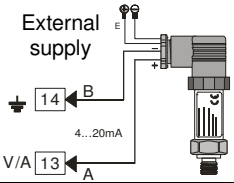
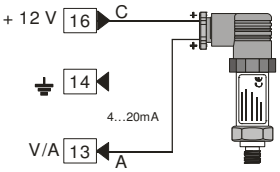
- Comply with polarity
- When shielded cable is used, it should be grounded at one end only

Examples of Connection for linear input

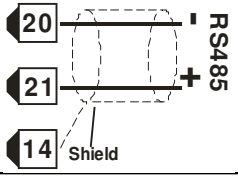


Linear signals 0….10V

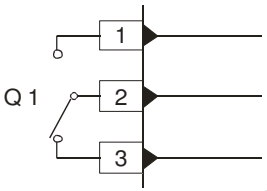
Comply with polarity

	Linear signals 0/4….20mA **With three-wire sensor** Comply with polarity A=Sensor output B=Sensor ground C=Sensor supply
	Linear signals 0/4….20mA with **external power of sensor** Comply with polarity A=Sensor output B=Sensor ground
	Linear signals 0/4….20mA with **two-wire sensor** Comply with polarity A=Sensor output C=Sensor supply

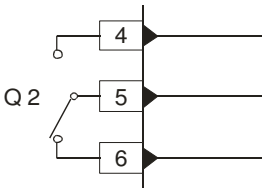
Serial input

	RS485 Modbus RTU communication • For networks with more than five instruments supply in low voltage

Relay output Q1

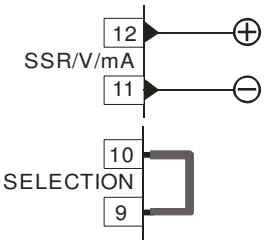
	Capacity 5A/250V~ for resistive loads

Relay output Q2



Capacity 5A/250V~ for resistive loads

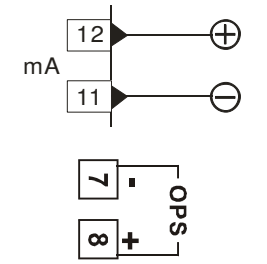
SSR output



SSR command 12V/30mA

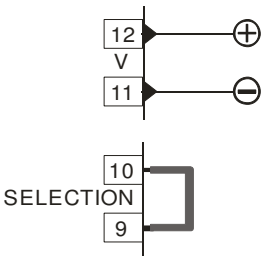
⚠ **Short-circuit pins 9 and 10 as in the figure to use SSR output**

mA or Volt output



Pins 11-12: linear output in **mA** configurable using parameters as command (Parameter c.out) or retransmission of process or setpoint (Parameter rEtr.).

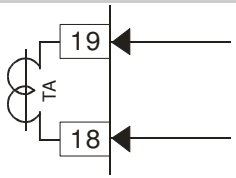
Pins 7-8: optional external power supply for current loop (max 24Vdc).



Linear output in **Volt** configurable using parameters as command (Parameter c.out) or retransmission of process or setpoint (Parameter rEtr.).

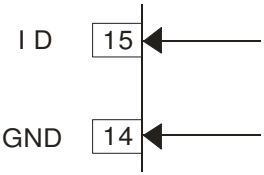
⚠ **Short-circuit pins 9 and 10 as in the figure to use linear output in Volt**

Current Transformer Input



- Input 50mA for current transformer
- Sampling time 80ms
- Configurable by parameters

Digital input (1)

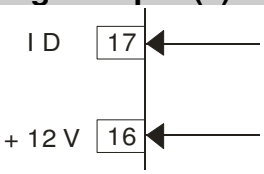


Combined use of digital input and TA input

Digital input according to parameter dGt. i.

⚠ **This combined use is possible only with sensors TC, 0…10V, 0/4…20mA, 0…40mV.**

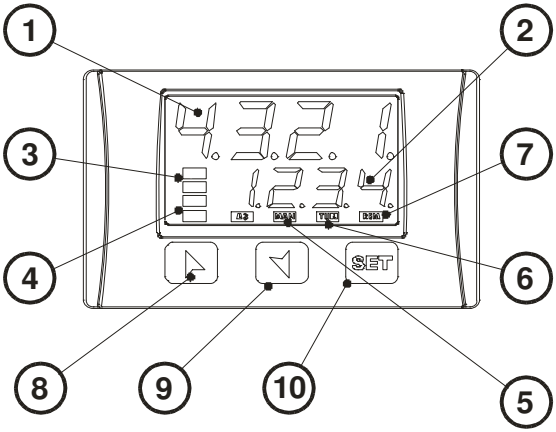
Digital input (2)



Use of digital input without TA input

Digital input according to parameter dGt. i..

6 Displays and key functions



6.1 Numeric Indicators (Displays)

1	123.4	Normally displays the process. During the configuration phase, it displays the parameter being inserted
2	123.4	Normally displays the setpoint. During the configuration phase, it displays the parameter value being inserted.

6.2 Status Lights (LED)

3	C 1 C 2	ON when the output command is on. C1 with relay/SSR/mA/Volt command or C1 (open) and C2 (close) for a motorised valve
4	A 1 A 2 A 3	ON when the corresponding alarm is on.
5	MAN	ON when the “Manual” function is on.
6	TUN	ON when the controller is running an “Autotuning” cycle.
7	REM	ON when the controller communicates via serial port.

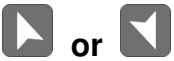
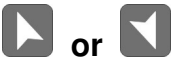
6.3 Keys

8		• Increases the main setpoint. • During the configuration phase, allows the user to scroll through parameters. Used with the SET key it modifies parameters. • Pressed after the SET key it increases the alarm setpoint.
9		• Decreases the main setpoint. • During the configuration phase, allows the user to scroll through parameters. Used with the SET key it modifies parameters. • Pressed after the SET key it decreases the alarm setpoint.
10		• Displays the alarm setpoint and runs the autotuning function. • Changes the configuration parameters

7 Controller Functions

7.1 Modifying Main Setpoint and Alarm Setpoint Values

The setpoint value can be changed from the key panel as follows:

	Press	Effect	Operation
1		Value on display 2 changes	Increases or decreases the main setpoint
2		Visualize alarm setpoint on display 1	
3		Value on display 2 changes	Increases or decreases the alarm setpoint value

7.2 Auto-tune

The Tuning procedure calculates the controller parameters and can be manual or automatic according to selection on parameter 57 tunE.

7.3 Manual Tuning

The manual procedure allows the user greater flexibility to decide when to update PID algorithm parameters. The procedure can be activated in two ways.

- **By running Tuning from keypanel**:

Press the SET key until display 1 shows the word tunE with display 2 showing oFF , press , display 2 shows on . The TUN LED switches on and the procedure begins.

- **By running Tuning from digital input**:

Select tunE on parameter 61 dGt. 1.

On first activation of digital input the TUN LED switches on and on second activation switches off.

7.4 Automatic Tuning

Automatic tuning activates when the controller is switched on or when the setpoint is modified to a value over 35%.
To avoid an overshoot, the treshold where the controller calculates the new PID parameters is determined by the setpoint value minus the "Set Deviation Tune" (see Parameter 58 SdtU).
To exit Tuning and leave the PID values unchanged, just press the SET key until display 1 shows the word tunE with the display showing on, press , display 2 shows oFF.
The TUN LED switches off and the procedure finishes.

7.5 Soft Start

To reach the setpoint the controller can follow a gradient expressed in units (e.g. degrees/ hour).
Set the increase value in parameter 62 GrAd with the desired units/hour; only on **subsequent activation** does the controller use the soft start function.
If parameter 59 oPMo is set on cont. and parameter 63 MAt i is different from 0, after switch-on and elapsing of the time set on parameter 63, setpoint does not follow the gradient anymore, but it reaches final setpoint with maximum power.
Autotuning **does not** work when Soft Start is activated: otherwise if parameter 63 MAt i is different from 0 and parameter 57 tunE is set on Auto, Autotuning starts when soft-start time is finished. If parameter 57 tunE is set on MAn, the Autotuning can be started only when soft start finishes.

7 . 6 Automatic/Manual Regulation for % Output Control

This function allows the user to select automatic control or manual control of the output percentage.

With parameter 60 AuMA, the user can select two methods.

1. **The first selection** En allows the user to enable the SET key with the text P.--- on display 1, while display two shows Auto.

   Press the ▶ key to show MAn; it is now possible, during the process display, to change the output percentage using the keys ▶ and ◀. To return to automatic mode, using the same procedure, select Auto on display 2: the MAN LED switches off and functioning returns to automatic mode.

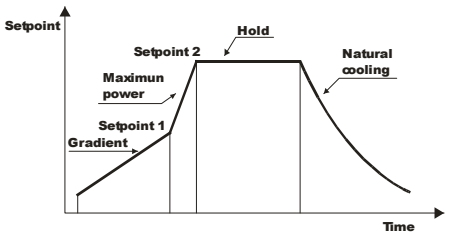
2. **The second selection** EnSt enables the same functioning, but with two important variants:

- If there is a temporary lack of voltage or after switch-off, the manual functioning will be maintained as well as the previously set output percentage value.
- If the sensor breaks during automatic functioning, the controller moves to manual mode while maintaining the output percentage command unchanged as generated by the PID immediately before breakage.

7.7 Pre-programmed cycle

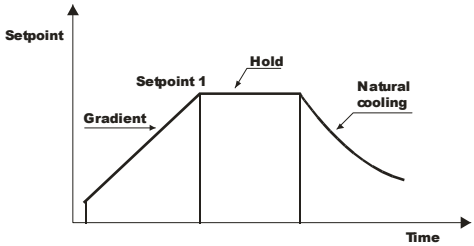
The pre-programmed cycle function activates by setting PrcY or PcSS in parameter 59 oPMo.

First option PrcY : the controller reaches setpoint1 based on the gradient set in parameter 62 GrAd, then it reaches maximum power up to setpoint2. When the process reaches maximum power, this setpoint is maintained for the time set in parameter 63 MAt. On expiry, the command output is disabled and the controller displays StoP.



The cycle starts at each activation of the controller, or via digital input if it is enabled for this type of functioning (see parameter 61 dGt.).

Second option PcSS : start-up is initiated only on activation of the digital input, according to the setting of parameter 61 dGt.. On start-up, the controller reaches setpoint 1 based on the gradient set in parameter 62 GrAd . When the process reaches this gradient, it is maintained for the time set in parameter 63 MAt. On expiry, the command output is disabled and the controller displays StoP.

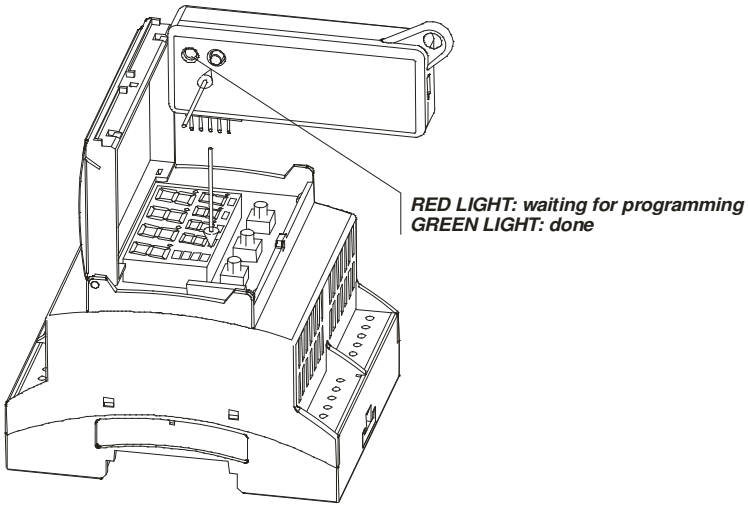


7.8 Memory Card

Parameters and setpoint values can be copied from one controller to another using the Memory card.
There are two methods:

- With the controller connected to the power supply

Insert the memory card **<u>when the controller is off</u>**.
On activation display 1 shows  and display 2 shows  **(Only if the correct values are saved in the memory card).** By pressing the  key display 2 shows  , then confirm using the  key. The controller loads the new data and starts again.



- With the controller disconnected from the power supply.

The memory card is equipped with an internal battery with a life of about 1000 uses.
Insert the memory card and press the programming buttons.
When writing the parameters, the LED turns red and on completing the procedure it changes to green. It is possible to repeat the procedure without any further action.

⚠ Updating Memory Card

To *update* the memory card values, follow the procedure described in the first method, setting display 2 to ---- so as not to load the parameters on controller[2].
Enter configuration and **change at least one parameter**.
Exit configuration. Changes are saved automatically.

7.9 Loading default values

This procedure restores the factory settings of the instrument.

	Press	Effect	Operation
1	SET for 3 seconds.	Display 1 shows 0000 with the 1st digit flashing, while display 2 shows PASS	
2	or	Change the flashing digit and move to the next one using the SET key.	Enter password 9999
3	SET to confirm	Instrument loads default settings and resets	

8 LATCH ON Function

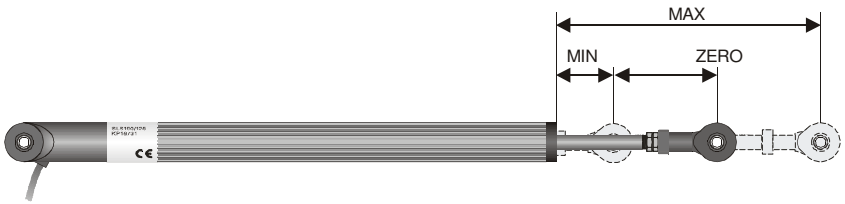
For use with input Pot.1 (potentiometer 6K) and Pot2 (potentiometer 150K) and with linear input (0…10V, 0...40mV, 0/4… 20mA), the user can set the start value of the scale (parameter 6 LoL.i) to the minimum position of the sensor and value of the scale end (parameter 7 uPL.i) to the maximum position of the sensor (parameter 8 LAtc. configured as Std.).

[2] If on activation the controller does not display nEno it means no data has been saved on the memory card, but it is possible to update values.

It is also possible to fix the point at which the controller will display zero (whilst keeping the scale range between LAL. 1 and uPL. 1)by using the "virtual zero" option and setting u.0St. or u.0 in. in parameter 8 LAtc.. If you set u.0 in. the virtual zero will reset after each activation; if you set u.0St. the virtual zero will remain fixed once activated.

To use the LATCH ON function configure the parameter LAtc..[3]
For the calibration procedure refer to the following table:

	Press	Effect	Operation
1	SET	Exit parameters configuration. Display 2 shows the writing LAtc..	Position the sensor on the minimum functioning value (associated with LAL. 1)
2	◥	Set the value to minimum. The display shows LoU	Position the sensor on the maximum functioning position (associated with uPL. 1)
3	◣	Set the value to maximum. The display shows H iGH	To exit the standard procedure press SET. For "virtual zero" settings position the sensor on the zero point.
4	SET	Set the virtual zero value. The display shows u irt. N.B.: for selection of u.0 in the procedure in point 4 should be followed on each re-activation.	To exit the procedure press SET



[3] The tuning procedure starts by exiting the configuration after changing the parameter.

8.1 Loop Break Alarm on Current Transformer TA

This function allows the user to measure load current and to manage an alarm during a malfunction with the power in short circuit or continually off. The current transformer connected to terminals 15 and 16 must be 50mA (sampling time 80ms).

- Set scale end value of the current transformer in Ampere on parameter 47 tA
- Set the alarm threshold of the Loop break alarm in Ampere on parameter 48 LbAt
- Set the alarm delay time of the Loop break alarm on parameter 49 LbAd
- The user can associate the alarm with a relay by setting the parameter AL1, AL2 or AL3 as LbA.

If a remote control switch or SSR remains closed, the controller signals the fault by showing LbAc on display 2 (alternatively with a command setpoint)**.**
If the power stage remains open, or the load current is lower than the value set on LbAt, the controller shows LbAo on display**.**
The user can display the current absorbed during the closure phase of the power stage.

	Press	Effect	Operation
1	SET	This key enables the user to scroll on display 2 the output percentage, auto/man selection, setpoint and alarms	Press SET until the text AntA appears on display 1 and display 2 shows the current in amperes (tA >0). The value is also maintained when no current circulates on the load.

By setting on parameter 48 LbAt the value 0 it is possible to visualize the current absorbed without activating the Loop Break Alarm.

8.2 Digital input Functions

The digital input is programmable for several functions which are useful to simplify controller operability. Select the desired function on parameter 62 dGt. i.

1. Hold function (enabled by setting L.rn.a. or L.rn.c.) allows the user to lock the reading of sensors when the digital input is active (useful for wide ranging oscillation on less significant values). During the lock phase, display 2 flashes and shows Loct.
2. Enables/disables the autotuning function from digital input if the parameter tunE is set on nAn.
3. Enable regulation with r.rn.a. or r.rn.c.
4. Switch from automatic to manual functioning if AuMA is set on En. or En.St.
5. Start of pre-programmed cycle (see paragraph 7.7) with St.St.
6. Change setpoint function.

This function is useful where there are 2 to 4 working thresholds required during system functioning without having to press the arrow keys.
To enable the function use the parameter oPMa, by selecting the number of setpoints desired (no. thresholds switch). They can be switched during functioning by pressing the SET key.

N.B.: For electrical wiring of digital input see paragraph 5.1
The digital input functions **<u>are not</u>** available with sensors PT100 and NI100 if input is used also for current transformer TA.

8.3 Dual Action Heating-Cooling

PPT245 is also suitable for systems requiring a combined heating-cooling action.

The command output must be configured as Heating PID (Actt. = HEAt and with a Pb greater than 0), and one of the alarms (AL. 1, AL. 2 or AL. 3) must be configured as cooL. The command output must be connected to the actuator responsible for heat, while the alarm will control cooling action.

The parameters to configure for the Heating PID are:

Actt. = HEAt Command output type (Heating)

Pb : Heating proportional band

t. i : Integral time of heating and cooling

td : Derivative time of heating and cooling

tc. : Heating time cycle

The parameters to configure for the Cooling PID are the following (example: action associated to alarm1):

AL. 1 = cooL Alarm1 selection (cooling)

Pbn : Proportional band multiplier

oudb : Overlapping/Dead band

cat.c. : Cooling time cycle

The parameter Pbn (that ranges from 1.00 to 5.00) determines the proportional band of cooling based on the formula:

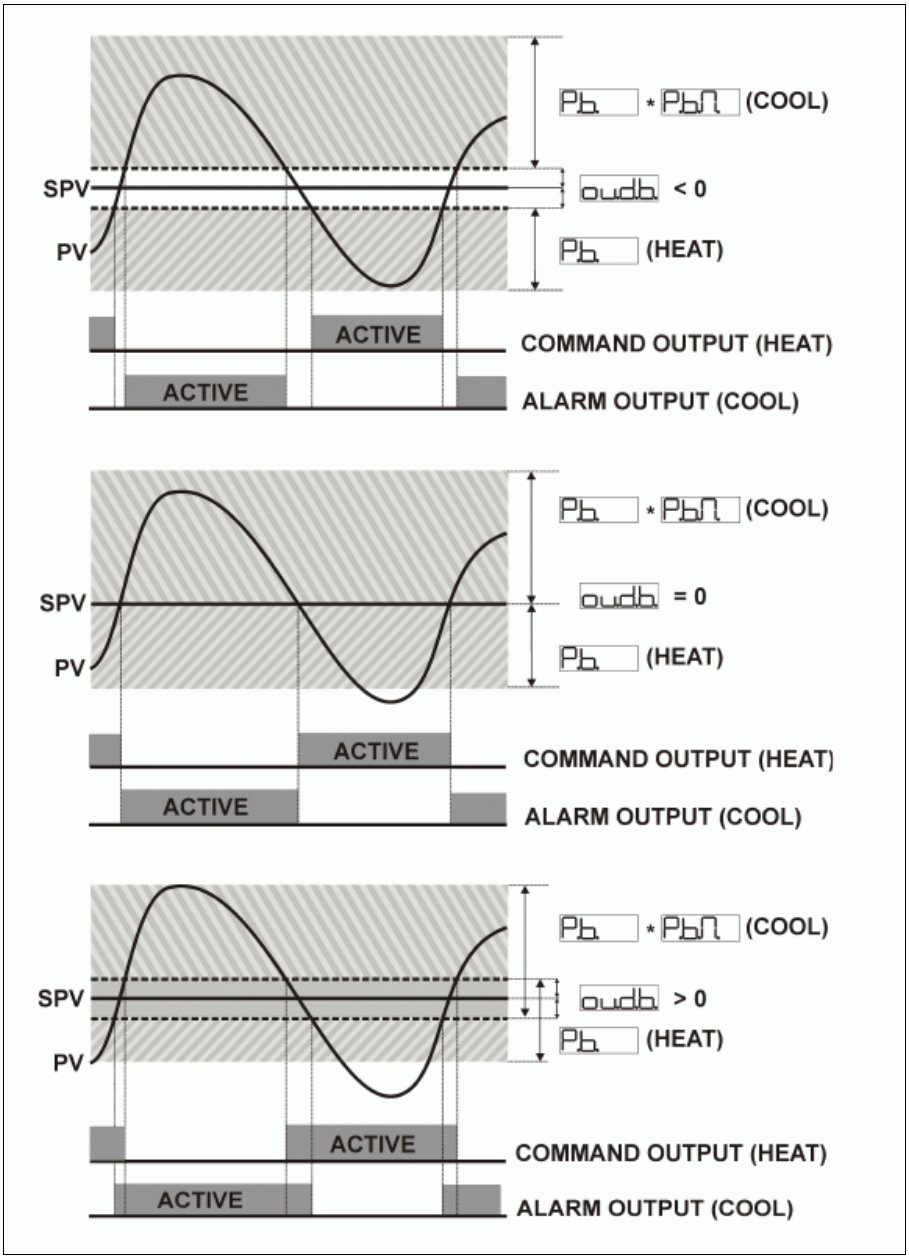
Cooling proportional band = Pb * Pbn

This gives a proportional band for cooling which will be the same as heating band if Pbn = 1.00, or 5 times greater if Pbn = 5.00.

The **integral time and derivative time** are the same for both actions.

The parameter oudb determines the percentage overlapping between the two actions. For systems in which the heating output and cooling output must never be simultaneously active a dead band (oudb $\leq$ 0) must be configured, and vice versa the user can configure an overlapping (oudb > 0).

The following figure shows an example of dual action PID (heating-cooling) with t.i = 0 and t.d = 0.



The parameter cAt.C. has the same meaning as the heating time cycle t.C. .

The parameter CooF. (cooling fluid) pre-selects the proportional band multiplier Pb.n. and the cooling PID time cycle cAt.C. based on the type of cooling fluid:

CooF.	Cooling fluid type	Pb.n.	cAt.C.
Air	Air	1.00	10
oil	Oil	1.25	4
H2o	Water	2.50	2

Once selected, the parameter CooF., the parameters Pb.n. , oudb. and cAt.C. can still be changed.

9 Serial Communication

PPT245-21ABC-T is equipped with with RS485 and can receive/ broadcast data via serial communication using MODBUS RTU protocol. The device can only be configured as a Slave. This function enables the control of multiple controllers connected to a supervisory system (SCADA).

Each controller responds to a master query only if the query contains the same address as that in the parameter SLAd. The addresses permitted range from 1 to 254 and there must not be any controllers with the same address on the same line.

Address 255 can be used by the master to communicate with all the connected equipment (broadcast mode), while with 0 all the devices receive the command, but no response is expected.

PPT245 can introduce a delay (in milliseconds) in the response to the master request. This delay must be set on parameter 72 SEdE.

Each parameter change is saved by the controller in the EEPROM memory (100000 writing cycles), while the setpoints are saved with a delay of ten seconds after the last change.

NB: Changes made to words that are different from those reported in the following table can lead to malfunction.

Features of protocol Modbus RTU

Baud-rate	Selectable on parameter 70   4800bit/sec  9600bit/sec  19200bit/sec  28800bit/sec  38400bit/sec  57600bit/sec
Format	8, N, 1 (8bit, no parity, 1 stop)
Supported functions	WORD READING (max 20 word) (0x03, 0x04) SINGLE WORD WRITING (0x06) MULTIPLE WORDS WRITING (max 20 word) (0x10)

The list below includes all the available addresses:

RO = Read Only
R/W = Read / Write
WO = Write Only

Modbus address	Description	Read Write	Reset value
0	Device type	RO	EEPROM
1	Software version	RO	EEPROM
5	Slave Address	R/W	EEPROM
6	Boot version	RO	EEPROM
50	Automatic addressing	WO	-
51	System code comparison	WO	-
500	Loading default values (write 9999)	RW	0
510	Setpoints storing time in eeprom (0-60s)	RW	10
999	Process subjected to the visualization filter	RO	?
1000	Process (with tenths of degree for temperature sensors; digits for linear sensors)	RO	?
1001	Setpoint1	R/W	EEPROM
1002	Setpoint2	R/W	EEPROM
1003	Setpoint3	R/W	EEPROM

1004	Setpoint4	R/W	EEPROM
1005	Alarm1	R/W	EEPROM
1006	Alarm2	R/W	EEPROM
1007	Alarm3	R/W	EEPROM
1008	Setpoint gradient	RO	EEPROM
1009	Relay status (0=off, 1=on) Bit 0 = relay **Q1** Bit 1 = relay **Q2** Bit 2 = reserved Bit 3 = **SSR**	RO	0
1010	Heating output percentage (0-10000)	RO	0
1011	Cooling output percentage (0-10000)	RO	0
1012	Alarms status (0=none, 1=active) Bit0 = Alarm 1 Bit1 = Alarm 2	RO	0
1013	Manual reset: write 0 to reset all alarms. In reading (0=not resettable, 1=resettable): Bit0 = Alarm 1 Bit1 = Alarm 2	WO	0
1014	Error flags Bit0 = Eeprom writing error Bit1 = Eeprom reading error Bit2 = Cold junction error Bit3 = Process error (sensor) Bit4 = Generic error Bit5 = Hardware error Bit6 = L.B.A.O. error Bit7 = L.B.A.C. error Bit8 = Missing calibration data error	RO	0
1015	Cold junction temperature (tenths of degree)	RO	?
1016	Start/Stop 0=controller in STOP 1=controller in START	R/W	0
1017	Lock conversion ON/OFF 0=Lock conversion off 1=Lock conversion on	R/W	0
1018	Tuning ON/OFF 0=Tuning off 1=Tuning on	R/W	0
1019	Automatic/manual selection 0=automatic ; 1=manual	R/W	0
1020	TA current ON (Ampere with tenths)	RO	?
1021	TA current OFF (Ampere with tenths)	RO	?
1022	OFF LINE[1] time (milliseconds)	R/W	0
1023	Instant Current (Ampere)	RO	0
1024	Digital Input State	RO	0

1025	Synchronized Tuning for multizone system 0 = Tuning OFF (Normal operating of the regulator) 1 = Output command OFF 2 = Output command ON 3 = Start Tuning 4 = End Tuning and output command OFF (Write 0 for normal operating)	R/W	0
1099	Process subjected to the visualization filter and decimal point selection	RO	?
1100	Process with decimal point selection	RO	?
1101	Setpoint 1 with decimal point selection	RW	EEPROM
1102	Setpoint 2 with decimal point selection	RW	EEPROM
1103	Setpoint 3 with decimal point selection	RW	EEPROM
1104	Setpoint 4 with decimal point selection	RW	EEPROM
1105	Alarm 1 with decimal point selection	RW	EEPROM
1106	Alarm 2 with decimal point selection	RW	EEPROM
1107	Alarm 3 with decimal point selection	RW	EEPROM
1108	Gradient Setpoint with decimal point selection	RO	EEPROM
1109	Percentage heating output (0-1000)	RW	0
1110	Percentage heating output (0-100)	RW	0
1111	Percentage cooling output (0-1000)	RO	0
1112	Percentage cooling output (0-100)	RO	0
2001	Parameter 1	R/W	EEPROM
2002	Parameter 2	R/W	EEPROM
2072	Parameter 72	R/W	EEPROM
3000	Disabling serial control of machine [2]	WO	0
3001	First word display1 (ascii)	R/W	0
3002	Second word display1 (ascii)	R/W	0
3003	Third word display1 (ascii)	R/W	0
3004	Fourth word display1 (ascii)	R/W	0
3005	Fifth word display1 (ascii)	R/W	0
3006	Sixth word display1 (ascii)	R/W	0
3007	Seventh word display1 (ascii)	R/W	0
3008	Eighth word display1 (ascii)	R/W	0
3009	First word display2 (ascii)	R/W	0
3010	Second word display2 (ascii)	R/W	0
3011	Third word display2 (ascii)	R/W	0
3012	Fourth word display2 (ascii)	R/W	0

[1] If value is 0, the control is disabled. If different from 0, it is the max. time which can elapse between two pollings before the controller goes off-line.

If it goes off-line, the controller returns to Stop mode, the control output is disabled but the alarms are active

[2] By writing 1 on this word, the effects of the writing are cancelled on all the Modbus addresses from 3001 to 3022. Control therefore returns to the controller.

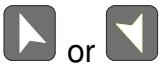
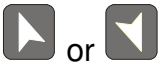
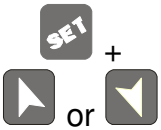
3013	Fifth word display2 (ascii)	R/W	0
3014	Sixth word display2 (ascii)	R/W	0
3015	Seventh word display2 (ascii)	R/W	0
3016	Eight word display2 (ascii)	R/W	0
3017	Word LED Bit 0 = LED **C1** Bit 1 = LED **C2** Bit 2 = LED **A1** Bit 3 = LED **A2** Bit 4 = LED **A3** Bit 5 = LED **MAN** Bit 6 = LED **TUN** Bit 7 = LED **REM**	R/W	0
3018	Word keys (write 1 to command keys) Bit 0 =  Bit 1 =  Bit 2 = 	R/W	0
3019	Word serial relay Bit 0 = relay **Q1** Bit 1 = relay **Q2**	R/W	0
3020	Word **SSR** serial (0=off, 1=on)	R/W	0
3021	Word output **0...10V** serial (0…10000)	R/W	0
3022	Word output **4...20mA** serial (0…10000)	R/W	0
3023	Relay state in case of off-line (only if controlled by serial) Bit 0 = relay Q1 Bit 1 = relay Q2	R/W	0
3024	Output state SSR/0…10V/4…20mA in case of off-line (only if controlled by serial) (0…10000)	R/W	0
3025	Serial process. Setting parameter 54 it is possible to make averages on the remote process.	R/W	0
4001	Parameter 1[4]	R/W	EEPROM
4002	Parameter 2[4]	R/W	EEPROM
4072	Parameter 72[4]	R/W	EEPROM

[4] Parameters modified using serial address 4001 to 4072 will be stored on eeprom only after 10” since last writing of one parameter.

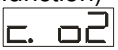
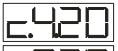
10 Configuration

10.1 Modify Configuration Parameter

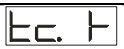
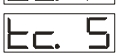
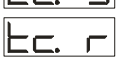
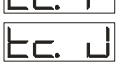
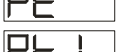
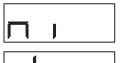
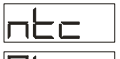
For configuration parameters see paragraph 11.

	Press	Effect	Operation
1	 For 3 seconds	Display 1 shows 0000 with the 1st digit flashing, while display 2 shows PASS.	
2		Change the flashing digit and move to the next one using the  key.	Enter password 1234
3	 To confirm	Display 1 shows the first parameter and display 2 shows the value.	
4		Scroll up/down through parameters	
5		Increase or decrease the value displayed by pressing firstly  and then an arrow key.	Enter the new data which will be saved on releasing the keys. To change another parameter return to point 4.
6	 Simultaneously	End of configuration parameter change. The controller exits from programming.	

11 Table of Configuration Parameters

no.	Display	Parameter description	Entering range
1	 Command Output	Select command output type	 Default (necessary to use retransmission function)      

	COMMAND	*ALARM 1*	*ALARM 2*
	Q1	Q2	SSR
	Q2	Q1	SSR
	SSR	Q1	Q2
	Q1(Open) Q2(Close)	SSR	-
	4...20mA	Q1	Q2
	0...20mA	Q1	Q2
	0...10V	Q1	Q2

2	 Sensor	Configuration of analogue input	 Tc-K 260 1360℃(Default)  Tc-S -40…1760℃  Tc-R -40…1760℃  Tc-J -200…1200℃  PT100 -200…600℃  PT100 -200…140℃  NI100 -60…180℃  NTC10K -40…125℃  PTC1K -50…150℃  PT500 -100…600℃  PT1000 -100…600℃

			0.10 0…10Volt 0.20 0…20mA 4.20 4…20mA 0.40 0…40mVolt Pot.1 Potentiometer Max 6KΩ Pot.2 Potentiometer Max 150KΩ tA. 50mA secondary current transformer
3	dP. Decimal Point	Select number of displayed decimal points	0 Default 0.0 0.00 0.000
4	LoL.S. Lower Limit Setpoint	Lower limit setpoint	**-999…+9999** digit* (degrees if temperature) Default: 0.
5	uPL.S. Upper Limit Setpoint	Upper limit setpoint	**-999…+9999** digit* (degrees if temperature) Default: 1750.
6	LoL.1 Lower Linear Input	Lower limit An1 only for linear input	**-999…+9999** digit* Default: 0.
7	uPL.1 Upper Linear Input	Upper limit An1 only for linear input	**-999…+9999** digit* Default: 1000.
8	LAtc. Latch On Function	Automatic setting of limits for Linear input	dis. (Disabled) Default Std. (Standard) u.0St. (Virtual Zero Stored) u.0 in. (Virtual Zero Initialized)
9	oCAL. Offset Calibration	Offset calibration Number added to displayed value of process (normally corrects the room temperature value)	**-999…+1000** digit* for linear sensors and potentiometers. **-200.0…+100.0 0** tenths for temperature sensors.

* The display of the decimal point depends on the setting of parameter SEn. and the parameter dP..

10	GcAL. Gain Calibration	Gain calibration Value multiplied with process value to perform calibration on working point	**-99.9%…+100.0%** Default: 0.0.
11	Act.t. Action type	Regulation type	HEAt: Heating (N.O.) Default cooL: Cooling (N.C.) Hoo.S.: Heat Off Over Setpoint
12	c. rE. Command Reset	Type of reset for state of command contact (always automatic in PID functioning)	A-E. (Automatic Reset) Default M-E. (Manual Reset) M-ES. (Manual Reset Stored)
13	c. SE. Command State Error	State of contact for command output in case of error	c.o. Default c.c.
14	c. Ld. Command Led	State of the OUT1 LED corresponding to the relevant contact	c.o. c.c. Default
15	c. HY. Command Hysteresis	Hysteresis in ON/OFF or dead band in P.I.D.	**-999…+999** digit* (degrees if temperature) Default: 0.0.
16	c. dE. Command Delay	Command delay (only in ON/OFF functioning). (In case of servo valve it also functions in PID and represents the delay between the opening and closure of the two contacts)	**-180…+180** seconds (tenths of second in case of servo valve). Negative: delay in switching off phase. Positive: delay in activation phase Default: 0.
17	c. SP. Command Setpoint Protection	Allows or not to change the command setpoint value	FrEE Default Loch
18	Pb. Proportional Band	Proportional band Process inertia in units (E.g.: if temperature is in °C)	**0** on/off se t. i Equal to **0.** Default **1-9999** digit* (degrees if temperature)
19	t. i Integral Time	Integral time. Process inertia in seconds	**0.0-999.9** seconds (0 integral disabled) Default: 0.

* The display of the decimal point depends on the setting of parameter SEn and parameter dP.

20	td Derivative Time	Derivative time. Normally ¼ the integral time	**0.0-999.9** seconds (0 derivative disabled) Default: 0.
21	tc Cycle Time	Cycle time (for PID on remote control switch 10/15sec, for PID on SSR 1 sec) or servo time (value declared by servo-motor manufacturer)	**1-300** seconds Default: 10.
22	oPoL Output Power Limit	Upper limit heating output percentage	**0-100** % Default: 100%.
23	AL 1 Alarm 1	Alarm 1 selection. Intervention of the alarm is associated with AL1	dis (Disabled) Default A AL (Absolute Alarm) b AL (Band Alarm) HdAL (High Deviation Alarm) LdAL (Low Deviation Alarm) AcAL (Absolute Command setpoint Alarm) StAL (Start Alarm) Active in Run cool (Cooling) LbA (Loop Break Alarm)
24	A 1Sa Alarm 1 State Output	Alarm 1 output contact and intervention type	no S (n.o. start) Default Normally open, active at start nc S (n.c. start) Normally closed, active at start no t (n.o. threshold) Normally open, active on reaching alarm [5] nc t (n.c. threshold) Normally closed on reaching alarm[44]
25	A 1rE Alarm 1	Type of Reset for contact of alarm 1.	ArE (Automatic Reset)Default

[5] On activation, the output is inhibited if the controller is in alarm mode. Activates only if alarm condition reappers, after that it was restored.

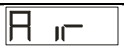
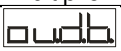
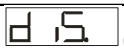
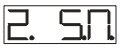
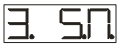
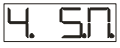
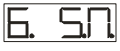
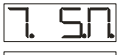
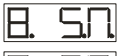
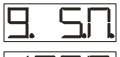
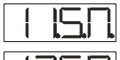
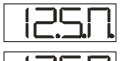
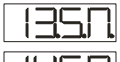
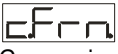
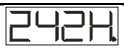
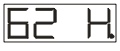
	Reset		nrE. (Manual Reset) nrES. (Manual Reset Stored)
26	A.ISE. Alarm 1 State Error	State of contact for alarm 1 output in case of error	c.o. c.c. Default
27	A.iLd. Alarm 1 Led	Defines the state of the OUT2 LED corresponding to the relative contact	c.o. c.c. Default
28	A.iHy. Alarm 1 Hysteresis)	Alarm 1 hysteresis	**-999…+999** digit* (tenths of degree if temperature). Default: 0.
29	A.dE. Alarm 1 Delay	Alarm 1 delay	**-180…+180** Seconds Negative: delay in alarm output phase. Positive: delay in alarm entry phase. Default: 0.
30	A.iSP. Alarm 1 Setpoint Protection	Alarm 1 set protection. Does not allow user to modify setpoint	FrEE Default Loct HidE
31	AL. 2 Alarm 2	Alarm 2 selection. Alarm intervention is associated with AL2	d.iS. (Disabled) Default A. AL. (Absolute Alarm) b. AL. (Band Alarm) HdAL. (High Deviation Alarm) LdAL. (Low Deviation Alarm) AcAL. (Absolute Command setpoint Alarm) StAL. (Start Alarm) cooL (Cooling) LbA. (Loop Break Alarm)
32	A2So. Alarm 2 State Output	Alarm 2 output contact and intervention type	no. S. (n.o. start) Default Normally open, active at start nc. S. (n.c. start) Normally closed, active at start

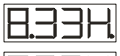
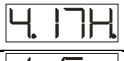
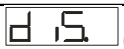
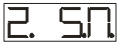
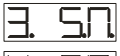
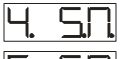
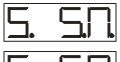
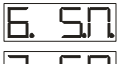
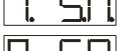
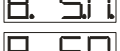
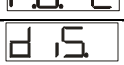
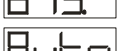
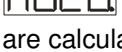
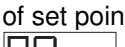
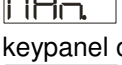
* The display of the decimal point depends on the setting of parameter SEn. and parameter dP.

			n.o. t. (n.o. threshold) Normally open, active on reaching alarm [6] n.c. t. (n.c. threshold) Normally closed, active on reaching alarm [5]
33	A2rE. Alarm 2 Reset	Type of Reset for contact of alarm 2	AuE. (Automatic Reset) Default MrE. (Manual Reset) MrES. (Manual Reset Stored)
34	A2SE. Alarm 2 State Error	State of contact for alarm 2 output in case of error	oA Default cC.
35	A2Ld. Alarm 2 Led	State of OUT2 LED corresponding to relative contact	oA cC. Default
36	A2HY. Alarm 2 Hysteresis	Alarm 2 hysteresis	**-999…+999** digit* (tenths of degree if temperature). Default: 0.
37	A2dE. Alarm 2 Delay	Alarm 2 delay	**-180…+180** Seconds Negative: delay in alarm output phase. Positive: delay in alarm entry phase. Default: 0.
38	A2SP. Alarm 2 Setpoint Protection	Alarm 2 set protection. Does not allow the operator to change value set	FrEE Default Loch HidE
47	tA Amperometric Transformer	Activation and scale range of current transformer	**0** Disabled **1-200** Ampere Default: 0.
48	LbAt. Loop Break Alarm Threshold	Intervention threshold of Loop break alarm	**0.0-200.0** Ampere Default: 50.0.
49	LbAd. Loop Break Alarm Delay	Delay time for Loop break alarm intervention	**00.00-60.00** mm.ss Default: 01.00.

[6] On activation, the output is inhibited if the controller is in alarm mode. Activates only if alarm condition reappears after it was restored.

* The display of the decimal point depends on the setting of parameter SEn. and parameter dP.

50	 Cooling Fluid	Type of cooling fluid	 Default  
51	 Proportional Band Multiplier	Proportional band multiplier	**1.00-5.00** Default: 1.00.
52	 Overlap/Dead Band	Overlapping/Dead band	**-20.0-50.0%** Default: 0.
53	 Cooling Cycle Time	Cycle time for cooling output	**1-300** seconds Default: 10.
54	 Conversion Filter	ADC filter: number of samples on analog-digital conversions	 (Disabled)  (2 Samples Mean)  (3 Samples Mean)  (4 Samples Mean)  (5 Samples Mean)  (6 Samples Mean)  (7 Samples Mean)  (8 Samples Mean)  (9 Samples Mean)  (10 Samples Mean) Default  (11 Samples Mean)  (12 Samples Mean)  (13 Samples Mean)  (14 Samples Mean)  (15 Samples Mean)
55	 Conversion Frequency	Frequency of sampling of analog-digital converter	 (242 Hz)  (123 Hz)  (62 Hz)  (50 Hz)  (39 Hz)

			 (33.2 Hz)  (19.6 Hz)  (16.7 Hz) Default  (12.5 Hz)  (10 Hz)  (8.33 Hz)  (6.25 Hz)  (4.17 Hz)
56	 Visualization Filter	Visualisation filter	 (Disabled)Def.  (First Order)  (2 Samples Mean)  (3 Samples Mean)  (4 Samples Mean)  (5 Samples Mean)  (6 Samples Mean)  (7 Samples Mean)  (8 Samples Mean)  (9 Samples Mean)  (10 Samples Mean)  (Disabled)  (First Order)
57	 Tune	Tuning type selection	 (Disabled) Default  (Automatic) PID parameters are calculated at activation and change of set point  (Manual) Launch from keypanel or digital In.  (Synchronized) See word modbus 1025.
58		Select the deviation from the command setpoint, for the	**0-5000** digit* (tenths of degree if temperature). Default: 10.

	SdtU Setpoint Deviation Tune	threshold used by autotuning to calculate the PID parameters.	
59	oPMo Operating Mode	Select operating mode	cont. Controller) Default Prcy (Programmed Cycle) 2t.S. (2 Thresholds Switch) 2t.S. i (2 Thresholds Switch Impulsive) 3t.S. i (3 Thresholds Switch Impulsive) 4t.S. i (4 Thresholds Switch Impulsive) trES (Time Reset) Pc.SS (Programmed Cycle Start/Stop)
60	AuMA Automatic / Manual	Enable automatic/manual selection	d iS. (Disabled) Default En (Enabled) EnSt. (Enabled Stored)
61	dGt. i Digital Input	Digital input functioning (P59 selection must be cont. or Prcy)	d iS. (Disabled) Default: 0. St.St. (Start/Stop) rmo. (Run n.o.) rmc. (Run n.c.) L.c.no. (Lock Conversion n.o.) L.c.nc. (Lock Conversion n.c.) tunE (Tune) Manual AMA i (Auto Manual impulse) AMAc. (Automatic Manual Contact)

The display of the decimal point depends on the setting of the parameter SEn. and the parameter

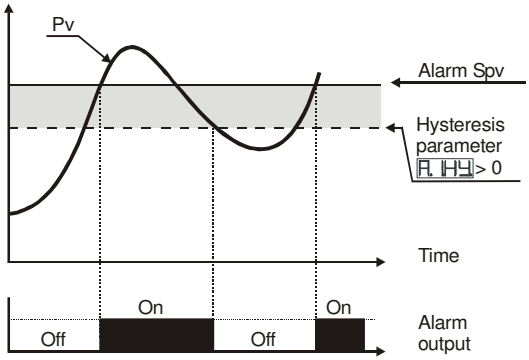
62	GrAd. Gradient	Increase gradient for soft start or pre-programmed cycle	**0** disabled **1-9999** Digit/hour* (degrees/hour with display of tenth if temperature) Default: 0.
63	MAt. Maintenance Time	Maintenance time for pre-programmed cycle.	**00.00-24.00** hh.mm Default: 00.00.
64	u.Mc.P. User Menu Cycle Programmed	Allows the rise gradient and the maintenance time to be changed from the user menu, in pre-programmed cycle functioning.	dIS. (Disabled) Default GrAd. (Gradient) MAt. (Maintenance Time) ALL (All)
65	u.ty. Visualization Type	Select visualization for display 1 and 2	1P.2S. (1 Process, 2 Setpoint) Default 1P.2H. (1 Process,2 Hide after 3sec) 1S.2P. (1 Setpoint, 2 Process) 1S.2H. (1 Setpoint,2 Hide after 3sec) 1P.2A. (1 Process, 2 Ampere.) 1P.2E. (1 Process, 2 emissivity)
66	dEGr. Degree	Select temperature unit	°C :Centigrade °F :Fahrenheit
67	rEtr. Retransmission	Retransmission for output 0-10V or 4… 20mA. ****Short-circuit pins 8,9, 10** Parameters 68 and 69 define the lower and upper limits of the scale	dIS. (Disabled) Default uo. P. (Volt Process) mA. P. (mA Process) uo. C. (Volt Command setpoint) mA. C. (mA Command setpoint) uo.oP. (Volt Output Percentage) mA.oP. (mA Output Percentage) uoA. 1 (Volt Alarm 1 setpoint) mAA. 1 (mA Alarm 1 setpoint)

* The display of the decimal point depends on the setting of parameter SEn. and parameter

			uoA2 (Volt Alarm 2 setpoint) nAA2 (mA Alarm 2 setpoint) uotA (Volt T.A.) nAtA (mA T.A.) uoEn (Volt Emissivity) nAEn (mA Emissivity)
68	LdLr Lower Limit Retransmission	Lower limit range of linear output (to rescale value)	**-999…+9999** digit* (degrees if temperature) Default: 0.
69	uPLr Upper Limit Retransmission	Upper limit range of linear output (to rescale value)	**-999…+9999** digit* (degrees if temperature) Default: 1000.
70	bdrt Baud Rate	Select baud rate for serial communication	4.8 K 9.6 K 19.2K Default 28.8K 38.4K 57.6K
71	SLAd Slave Address	Select slave address for serial communication	**1 – 254** Default: 254.
72	SEdE Serial Delay	Select serial delay	**0 – 100** milliseconds Default: 20.
73	LLoP Lower Limit Output Percentage	Lower limit heating output percentage	**0 – 100** % Default: 0%.

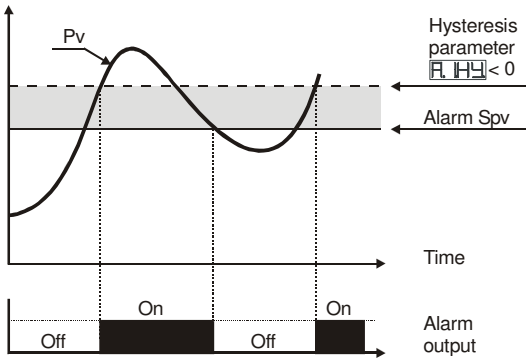
* The display of the decimal point depends on the setting of parameter SEn and parameter dP.

Absolute Alarm or Threshold Alarm (selection A. AL.)



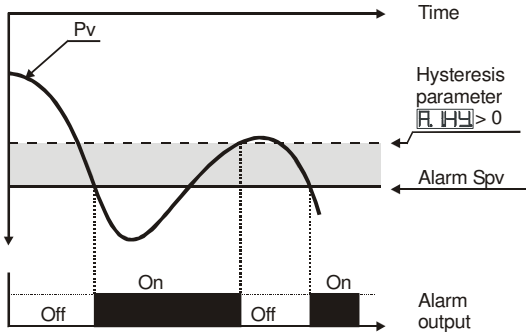
Absolute alarm with controller in heating functioning (Par.11 Act. selected HEAt) and hysteresis value greater than "0" (Par.28 A. HY > 0).

N.B.: The example refers to alarm 1; the function can also be enabled for alarm 2.

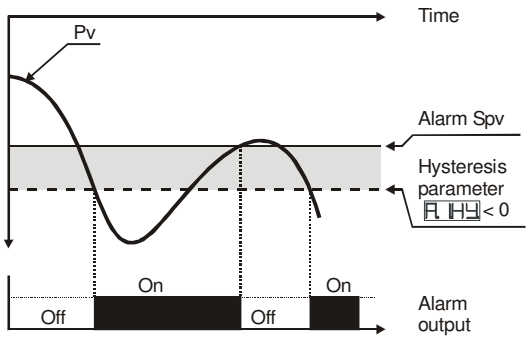


Absolute alarm with controller in heating functioning (Par.11 Act. selected HEAt) and hysteresis value less than "0" (Par.28 A. HY < 0).

N.B.: The example refers to alarm 1; the function can also be enabled for alarm 2.

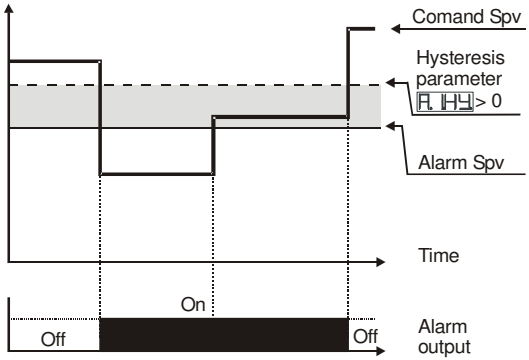


Absolute alarm with controller in cooling functioning (Par.11 Act. selected cool) and hysteresis value greater than "0" (Par.28 A. HY > 0).
N.B.: The example refers to alarm 1; the function can also be enabled for alarm 2.



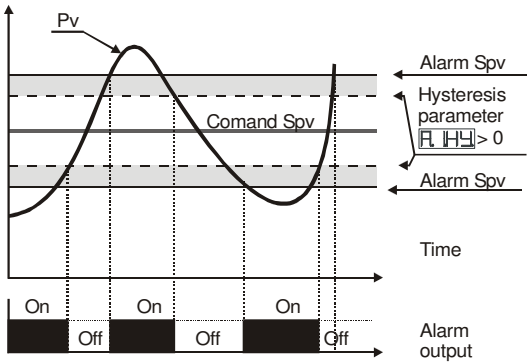
Absolute alarm with controller in cooling functioning (Par.11 AcTt. selected cooL) and hysteresis value less than “0” (Par.28 A.HY < 0).
N.B.: The example refers to alarm 1; the function can also be enabled for alarm 2.

Absolute Alarm or Threshold Alarm Referring to Setpoint Command (selection AcAL.)



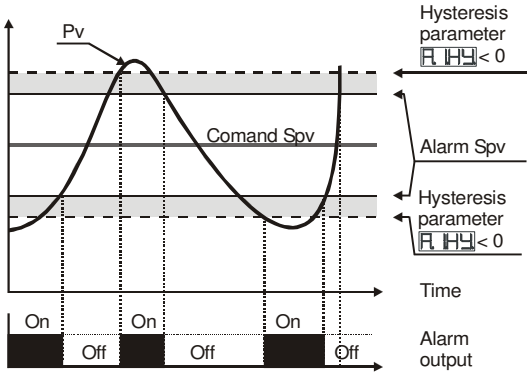
Absolute alarm refers to the command set, with the controller in heating function (Par.11 AcTt. selected HEAt) and hysteresis value greater than “0” (Par.28 A.HY. > 0).
The command set can be changed by pressing the arrow keys on front panel or using serial port RS485 commands.
N.B.: The example refers to alarm 1; the function can also be enabled for alarm 2.

Band Alarm (selection b. AL.)



Band alarm <u>hysteresis value greater than "0"</u> (Par.28 A. HY > 0).

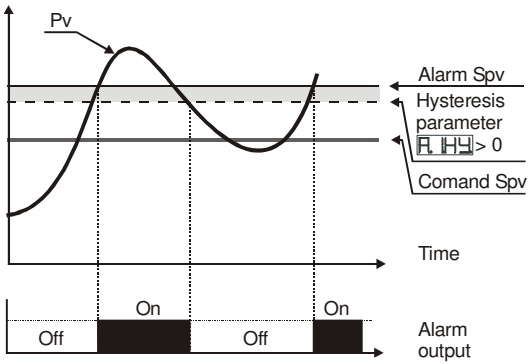
N.B.: The example refers to alarm 1; the function can also be enabled for alarm 2.



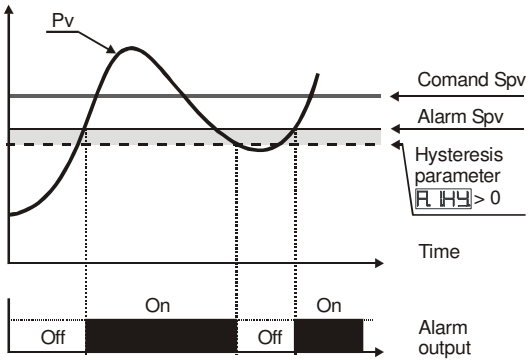
Band alarm <u>hysteresis value less than "0"</u> (Par.28 A. HY < 0).

N.B.: The example refers to alarm 1; the function can also be enabled for alarm 2.

Upper Deviation Alarm (selection HdAL.)



Upper deviation alarm <u>value of alarm setpoint greater than "0"</u> and <u>hysteresis value greater than "0"</u> (Par.28 A. HY > 0).
N.B.:
a) The example refers to alarm 1; the function can also be enabled for alarm 2
b) With hysteresis less than "0" (A. HY < 0) the broken line moves above the alarm setpoint.



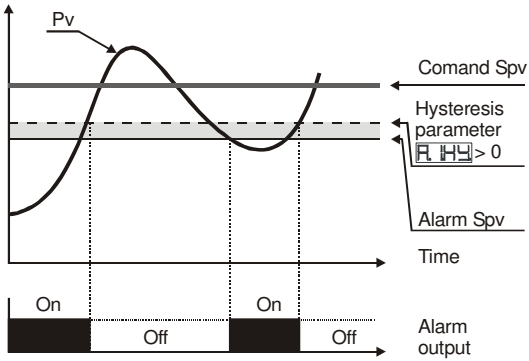
Upper deviation alarm value of alarm setpoint less than “0” and hysteresis value greater than “0” (Par.28 A1HY > 0).

N.B.:

a) The example refers to alarm 1; the function can also be enabled for alarm 2

b) With hysteresis less than “0” (A1HY < 0) the broken line moves above the alarm setpoint.

Lower Deviation Alarm (selection HdAL.)

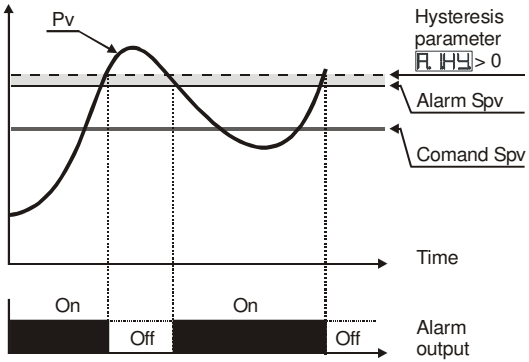


Lower deviation alarm value of alarm setpoint greater than “0” and hysteresis value greater than “0” (Par.28 A1HY > 0).

N.B.:

a) The example refers to alarm 1; the function can also be enabled for alarm 2

b) With hysteresis less than “0” (A1HY < 0) the broken line moves under the alarm setpoint.



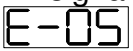
Lower deviation alarm value of alarm setpoint less than “0” and hysteresis value greater than “0” (Par.28 A1HY > 0).

N.B.:

a) The example refers to alarm 1; the function can also be enabled for alarm 2

b) With hysteresis value less than “0” (A1HY < 0) the broken line moves under the alarm setpoint.

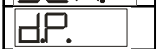
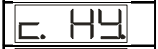
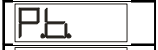
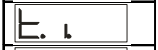
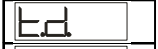
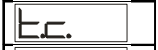
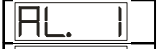
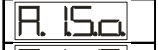
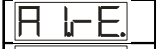
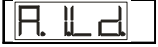
13 Table of Error Signals

In case of malfunctioning of the system, the controller switches off the regulation output and displays the type of error.
For example the controller will signal the breakage of any connected thermocouple by displaying  (flashing) on display. For other notifications, see the table below.

#	Cause	What to do
E-01	Error in E^2PROM cell programming	Call Assistance
E-02	Cold junction sensor fault or room temperature outside of allowed limits.	Call Assistance
E-04	Incorrect configuration data. Possible loss of calibration values.	Check if the configuration parameters are correct.
E-05	Thermocouple open or temperature outside of limits.	Check the connection with the sensors and their integrity.
E-08	Missing calibration data	Call Assistance

14 Summary of Configuration parameters

Date:	**Model PPT245:**
Installer:	**System:**
Notes:	

	Command output type selection	
	Analogue input configuration	
	Number of decimal points	
	Lower limit setpoint	
	Upper limit setpoint	
	Lower limit range An1 only for linear signals	
	Upper limit range An1 only for linear signals	
	Automatic setting of linear input limits	
	Offset calibration	
	Gain calibration	
	Regulation type	
	Command output reset type	
	Contact state for command output in case of error	
	Define the OUT1 led state	
	Hysteresis in ON/OFF or dead band in P.I.D.	
	Command delay	
	Command setpoint protection	
	Proportional band	
	Integral time	
	Derivative time	
	Cycle time	
	Upper Limit heating Output Percentage	
	Alarm 1 selection	
	Alarm 1 output contact and intervention type	
	Reset type of alarm 1 contact.	
	State of contact for alarm 1 output	
	State of OUT2 led	

A. HY	Alarm 1 hysteresis	
A. dE.	Alarm1 delay	
A. SP.	Alarm 1 set protection	
AL. 2	Alarm 2 selection	
A2Sa.	Alarm 2 output contact and intervention type	
A2rE.	Reset type of alarm 2 contact	
A2SE.	State of contact for alarm 2 output	
A2Ld.	State of OUT2 led	
A2HY.	Alarm 2 hysteresis	
A2dE.	Alarm 2 delay	
A2SP.	Alarm 2 set protection	
tA.	Enabling end scale range of amperometric transformer	
LbAt.	Threshold intervention of Loop break alarm	
LbAd.	Delay time for Loop break alarm intervention	
coaF.	Cooling fluid type	
Pbn.	Proportional band multiplier	
oudb.	Overlapping/Dead band	
cotc.	Cycle time for cooling output	
cFLt.	Analogue converter filter	
cFrn.	Sampling frequency of analog converter	
uFLt.	Display filter	
tunE	Autotuning type selection	
Sdtu.	Command setpoint deviation for tuning threshold	
oPMo.	Operating mode	
AuMA.	Automatic/manual selection	
dGt. i	Digital input functioning	
GrAd.	Gradient for soft start	
MAt i	Cycle maintenance time	
uMcP.	Gradient change and maintenance time by user	
u tY.	Display data selection	
dEGr.	Degree type selection	
rEtr.	Retransmission for output 0-10V or 4…20mA	
LoLr.	Lower limit range for linear output	

uPLr.	Upper limit range for linear output	
bdrt.	Select baud rate for serial communication	
SLAd.	Select slave address	
SEdE.	Select the serial delay	
LLoP.	Lower Limit heating Output Percentage	

Notes / Updates

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