

# UNICONT

PMM-500

Universal process controller and  
display unit

User's and Programming manual  
1<sup>st</sup> edition



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**Thank you for choosing a NIVELCO instrument.  
We are sure that you will be satisfied throughout its use!**

## 1. GENERAL DESCRIPTION

The UNICONT PMM-500 universal display and controller instruments are 1/16 DIN (48x48mm) size, panel mountable, modern, easy of use microprocessor based devices supporting versatile functions. EEPROM memory ensures data- and program protection during power outages.

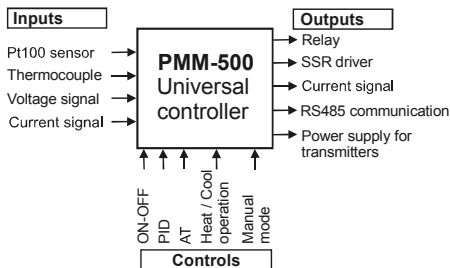
The universal input can be connected with wide range of temperature sensors (Pt-100 RTD-s and most type of thermocouples), or standard analogue current and voltage signals (mA, mV, V).

The instrument operates its control outputs in accordance to selected control algorithm generated from the measured input values of various physical parameters.

The control algorithm can be ON-OFF, or PID, therefore it can provide differential control, or can realize multiple control characteristics.

Using the Auto Tuning mode, the instrument provides optimal settings without entering any P-I-D parameters.

The controller has multiple outputs: relay, SSR-driver, analogue current-, or voltage output, RS485 communication. The modular structure provides wide selection of output variations. In accordance to the mechanical structure of the output boards (plug-in PCB-s) there is a possibility to order special (differing from the standard) variations.



The RS485 Modbus RTU serial output provides digital communication interface with PC and remote programming possibility.

Some models have 24V DC output performing power supply for transmitters.

The large bi-coloured 2-line, 7-segmented, 4-digit LED display provides easy reading even from far distance. It indicates the Process (PV) and a Set-point (SV) Value, as well the programming steps or other settings. Operation modes and alarm signals are indicated with LED-s. The 4 push-buttons provide easy programming.

## 2. ORDER CODE

### UNICONT PMM-500 series:

UNICONT PMM-5



INPUT	CODE
Universal (sensor or analogue)	1

POWER SUPPLY	CODE
100-240 V AC	1
20-48 V AC	2
22-65 V DC	

OUTPUT*	CODE
R1, R2, analogue OUT	1
R1, R2, U <sub>i</sub>	2
R1, analogue OUT, U <sub>i</sub>	3
R1, R2, R3	4
SSR1, SSR2, analogue OUT	5
SSR1, SSR2, U <sub>i</sub>	6
SSR1, analogue OUT, U <sub>i</sub>	7
SSR1, R1, analogue OUT	8
R1, R2, analogue OUT, RS485	A
R1, R2, U <sub>i</sub> , RS485	B
R1, analogue OUT, U <sub>i</sub> , RS485	C
R1, R2, R3, RS485	D
SSR1, SSR2, analogue OUT, RS485	E
SSR1, SSR2, U <sub>i</sub> , RS485	F
SSR1, analogue OUT, U <sub>i</sub> , RS485	G
SSR1, R1, analogue OUT, RS485	H

OUTPUT	DESCRIPTION
R1, R2, R3	SPDT relay outputs
analogue OUT	Analogue current- or voltage outputs
SSR1, SSR2	Solid State Relay driver output
U <sub>i</sub>	Transmitter power supply 24 V DC/ 22 mA
RS485	Serial communication line

Accessories:

NAME	ORDER CODE
Mounting accessory	pmm5111m00001
Front plate sealing	pmm5111m00002
Front plate size adapter from 96x48 mm cut-off size to 48x48 mm	PAM-500-0

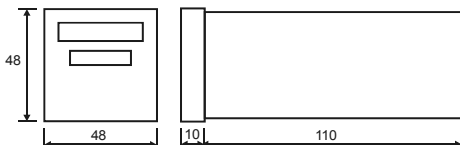
\* Special output versions differing from the above code-variations are available to order.

### 3. TECHNICAL DATA

<b>Type</b>		<b>PMM-5-□□-□</b>	
<b>Input</b>	<b>Sensor, or analogue input</b>	Pt100 RTD: -199 °C...+800 °C	
		Thermocouple: J, T, K, L, N, B, R, S, C, Pt Rh -240 °C...+2320 °C	
		Current: (DC) 4-20 mA, 0-20 mA Voltage: (DC) 0-50 mV, 10-50 mV, 0-5 V, 1-5 V, 0-10 V, 2-10 V	
<b>Input resistance</b>	Pt100 RTD: >10 MΩm, Current input (20 mA): 5 Ohm Voltage input (10 V): 47 kΩm		
<b>Other data</b>	Input Sampling rate: 4 / sec Digital Input Filter time constant: 0.5...100 sec Pt100 Sensor Current: 150 μA Isolated from all outputs (except SSR driver)		
<b>Outputs</b>	<b>Relay</b>	Max. 3 pcs., SPDT (Single pole double throw) 240 V AC, 2A, AC11	
	<b>SSR</b>	Max. 2 pcs., SSR (Solid State Relay) driver, 0-10 V DC / 20 mA	
	<b>Analogue DC</b>	4-20 mA, 0-20 mA / 500 Ohm max. 0-5 V, 0-10 V, 2-10 V/500 Ohm min. Short-circuit protected Accuracy: ±0.25 % Reinforced safety isolation from the input and other outputs	
	<b>Transmitter power supply</b>	19-28 V DC not regulated, Nominal value: 24 V DC / 22mA, Reinforced safety isolation from the input and other outputs	
	<b>Serial communication</b>	RS485 MODBUS RTU, Address range: 1-255, Bit rate: 1200-19200 Baud	
<b>Controls: ON / OFF P, PD, PI, PID, Dual PID AT AUTO / MANUAL Cooling / Heating</b>	<b>Features</b>	<b>Operation range</b>	<b>Resolution</b>
	Proportional Bands (P)	0.5-999.9%	0.1 %
	Derivative Time Constant (D)	0 - 100 min	1 sec
	Integral Time Constant (I)	1 sec - 100 min	1 sec
	Cycle Times	0.5 sec - 512 sec	binary steps
	ON/OFF Differential	0.1% - 10 % of input span	0.1 %
Deadband/Overlap	-20 % ...+20 % of input span	0.1 %	
<b>Indication</b>	<b>7-segment LED display</b>	Process Value (PV): 4 digit, red, height of characters: 10 mm Set Value (SV): 4 digit, green, height of characters: 8 mm	
	<b>LED</b>	Operation modes: <ul style="list-style-type: none"> <li>▪ Select mode, configuration</li> <li>▪ Automatic Tune</li> <li>▪ Alarms</li> <li>▪ Over-range indication</li> <li>▪ Under-range indication</li> </ul>	
<b>Configuration</b>	With press buttons of the front panel from -1999 to +9999 range		
<b>Measurement accuracy</b>	±0.1% of range ±1LSD, Thermocouple: ±0.1% of full range span ±1LSD		
<b>Linearization accuracy</b>	Better than ±0.2°C any point, any 0.1°C range (±0.05°C typical). Better than ±0.5°C any point, any 1 °C range		
<b>Temperature stability</b>	0.01% of range/°C change in ambient temperature		
<b>Sensor break protection</b>	Process Control outputs turn OFF within two seconds In case of analogue input: applicable for 4 to 20mA, 1 to 5V and 2 to 10V ranges only		
<b>Cold junction compensation</b>	> ±1 °C		
<b>Wire compensation</b>	3-wire Pt100, automatic		
<b>Power supply</b>	100-240 V AC 50/60 Hz 7.5 VA 20-48 V AC 50/60 HZ 7.5 VA; 22-65 V DC 5 W		
<b>Electrical connection</b>	Screw type terminals		
<b>Memory protection</b>	Data stored in EEPROM		
<b>Electrical protection</b>	Class II.		
<b>Ingress protection</b>	Front panel: IP66 Back panel: IP20		
<b>Ambient temperature</b>	0 °C...+55 °C		
<b>Storage temperature</b>	-20 °...+80 °C		
<b>Relative humidity</b>	Max. 85%		
<b>Dimensions</b>	48 x 48 x 110 mm		
<b>Mass</b>	~0.25 kg		

## 4. DIMENSIONS

The unit can be mounted into a suitable 1/16DIN (48x48 mm) cut-out place. Insertion length of the unit is 110mm, the additional dimensions can be seen on the drawing below.

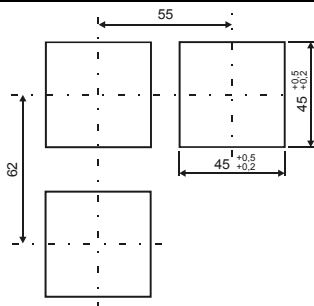


## 5. MOUNTING

The unit can be mounted with the help of the attached mounting accessory to the suitable cut-out hole. Be careful with the sealing, which provides proper sealing from the front panel. Suitable distances between multiple units should be taken into consideration.

The cut-out dimensions in case of single, or multiple units should be the following, and width of the mounting-plate is  $L_v=3-9$  mm.

Using the optional PAM-500-0 front plate size adapter the 48x48mm sized unit can be mounted to an existing 96x48mm cut-out hole. In case of using the front plate size adapter, the width of the mounting-plate is  $L_v=3-5$  mm



## 6. WIRING

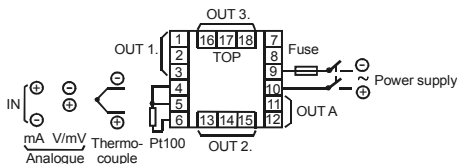
### 6.1 WIRING INSTRUCTIONS

#### POWER SUPPLY

PMM-5□□ -1	PMM-5□□ -2
100-240 V AC	20-48 V AC 22-65 V DC
T1A	T365 mA

#### Notes:

- Connect the line voltage (live and neutral) as illustrated via a two-pole isolating switch (preferably located near the equipment) and an anti-surge fuse.
- All analogue and communication signals must use shielded cable. The shield should be grounded at one end only.
- Two wire RTDs leads should be less than 3 metres long, resistive leg and the common legs of the RTD (4-5 points) should be connected.
- Four wire RTDs can be used, provided that the fourth wire is left unconnected.

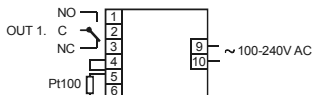


## 6.2 WIRING CHART OF THE OUTPUT VERSIONS

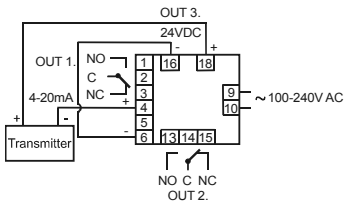
Type	Outputs										
	OUT1			OUT2			OUT3			OUTA	
	1	2	3	13	14	15	16	17	18	11	12
PMM-511-□	R1 			R2 			Analogue - +				
PMM-512-□	R1 			R2 			24V DC / 22mA - +				
PMM-513-□	R1 			Analogue + -			24V DC / 22mA - +				
PMM-514-□	R1 			R2 			R3 				
PMM-515-□	SSR1 10V DC / 20mA + -			SSR2 10V DC / 20mA + -			Analogue - +				
PMM-516-□	SSR1 10V DC / 20mA + -			SSR2 10V DC / 20mA + -			24V DC / 22mA - +				
PMM-517-□	SSR1 10V DC / 20mA + -			Analogue + -			24V DC / 22mA - +				
PMM-518-□	SSR1 10V DC / 20mA + -			R2 			Analogue - +				
PMM-51A-□	R1 			R2 			Analogue - +			RS485 B A	
PMM-51B-□	R1 			R2 			24V DC / 22mA - +			RS485 B A	
PMM-51C-□	R1 			Analogue + -			24V DC / 22mA - +			RS485 B A	
PMM-51D-□	R1 			R2 			R3 			RS485 B A	
PMM-51E-□	SSR1 10V DC / 20mA + -			SSR2 10V DC / 20mA + -			Analogue - +			RS485 B A	
PMM-51F-□	SSR1 10V DC / 20mA + -			SSR2 10V DC / 20mA + -			24V DC / 22mA - +			RS485 B A	
PMM-51G-□	SSR1 10V DC / 20mA + -			Analogue + -			24V DC / 22mA - +			RS485 B A	
PMM-51H-□	SSR1 10V DC / 20mA + -			R2 			Analogue - +			RS485 B A	

## Wiring examples:

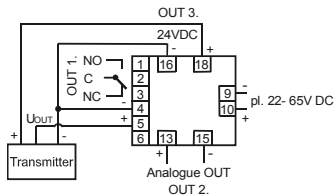
2-wire Pt 100 RTD, 1 relay output.



2-wire 4-20 mA transmitter, power supply for transmitter, 2 pcs. relay output.

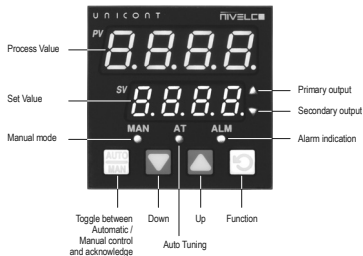


3-wire voltage output transmitter, power supply for transmitter, 1 relay output, 1 analogue output.



## 7. FRONT PANEL, KEYPAD, DISPLAYS

The 7-segmented displays show the measured and set process values (Process Value-PV, Set Value-SV) in normal operation, and show text signals and values in accordance to the actual state of programming and configuration. With the 4 push-buttons the menu-system can be handled and programming can be performed.





LED	Operation	
	• LIGHTS	* FLASHES
MAN	Setup mode	Manual mode
AT	Auto tuning mode	
	Self-Tune mode	Pre-Tune mode
ALM	-	Alarm condition is present
▲	For Current Proportioned outputs, <b>ON</b> indicates primary power is >0% It turns <b>ON</b> when the stored Max. PV value is displayed on indicators	<b>FLASHES</b> in unison with Time Proportioning Primary outputs
▼	For Current Proportioned outputs, <b>ON</b> secondary power is >0% It turns <b>ON</b> when the stored Min. PV value is displayed on indicators	<b>FLASHES</b> in unison with Time Proportioning Secondary outputs,

After powering ON the unit performs an automatic self-test and flashes all front-plate LEDs for a moment. At first turning ON, or after replacing an output module **Goto Conf** indication can be seen on the display, which means that the unit should be configured in Configuration Mode (see 9.1, 10.2. points). In all other cases after the self-test the unit returns to normal operation mode.

## 8. ERROR MESSAGES AND INDICATIONS

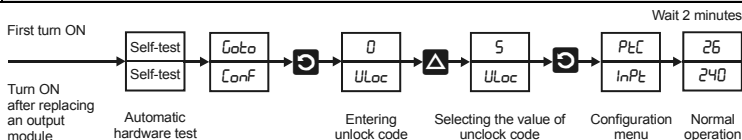
ERROR DESCRIPTION	PV DISPLAY	SV DISPLAY
Configuration & Setup is required at <b>first</b> turn ON or if hardware configuration changed! Press <b>☐</b> button to enter configuration mode, then press <b>☐</b> , or <b>☐</b> button to unlock code number, then press <b>☐</b> button to proceed. Configuration should be completed according to the configuration menu points.	<b>Goto</b>	<b>Conf</b>
Input more than 5% over-range <sup>1</sup>	<b>[HH]</b>	Normal display
Input more than 5% under-range <sup>2</sup>	<b>[LL]</b>	Normal display
Sensor Break. Break detected in the input sensor or wiring	<b>OPEN</b>	Normal display
OUTPUT 1 error	<b>Err 1</b>	<b>OPn 1</b>
OUTPUT 2 error	<b>Err2</b>	<b>OPn2</b>
OUTPUT 3 error	<b>Err3</b>	<b>OPn3</b>
OUTPUT A error	<b>ErrA</b>	<b>OPnA</b>

<sup>1</sup> If the PV display exceeds 9999 before 5% over-range is reached, an over-range indication is given.

<sup>2</sup> Indicators will allow up to 10% under-range on non-zero based Linear ranges. If the PV display is less than -1999 before the 5% under-range is reached, an under-range indication is given.

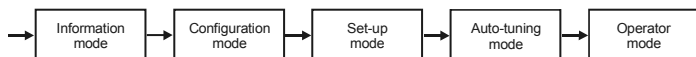
## 9. PROGRAMMING SEQUENCE

### 9.1 POWERING UP FOR THE FIRST TIME



### 9.2 SELECT MODE

#### 9.2.1 MODE SELECTION SEQUENCE FOR PROGRAMMING



Hold down button and press button in any mode to enter Select Mode. Once in Select Mode, press or to select the required mode, then press to enter the chosen mode.

MODE	FUNCTION	PV DISPLAY	SV DISPLAY
Operator mode	The Default Mode on power up used for normal operation	<b>OPtr</b>	<b>SLCt</b>
	Unlock code	none	
Set-up mode	Used to tailor the instrument to the application, adjustment of tuning terms etc.	<b>SEtP</b>	<b>SLCt</b>
	Unlock code	<b>0</b>	<b>ULoc</b>
		Default value: 5	
Configuration mode	Used to configure the instrument for first time use or on re-installation.	<b>CONF</b>	<b>SLCt</b>
	Unlock code	<b>0</b>	<b>ULoc</b>
		Default value: 5	
Production Information mode	Used to check the hardware, firmware and manufacturing information of the instrument	<b>inFD</b>	<b>SLCt</b>
	Unlock code	none	
Auto Tuning mode	Used to invoke pre-tune or self-tune on controllers.	<b>Atun</b>	<b>SLCt</b>
	Unlock code	<b>0</b>	<b>ULoc</b>
		Default value: 0	

If there is no key activity for 2 minutes the controller automatically returns to operator mode!

## 9.2.2 UNLOCK CODE

To enter a required menu point press **⏻** button then select the corresponding unlock code with **▲** and **▼** buttons. This procedure can prevent unauthorised entry to Configuration, Setup and Automatic Tuning modes. Entering an incorrect unlock code will result to return to Select Mode. The value of the lock codes only can be changed from within the modes that they apply to.

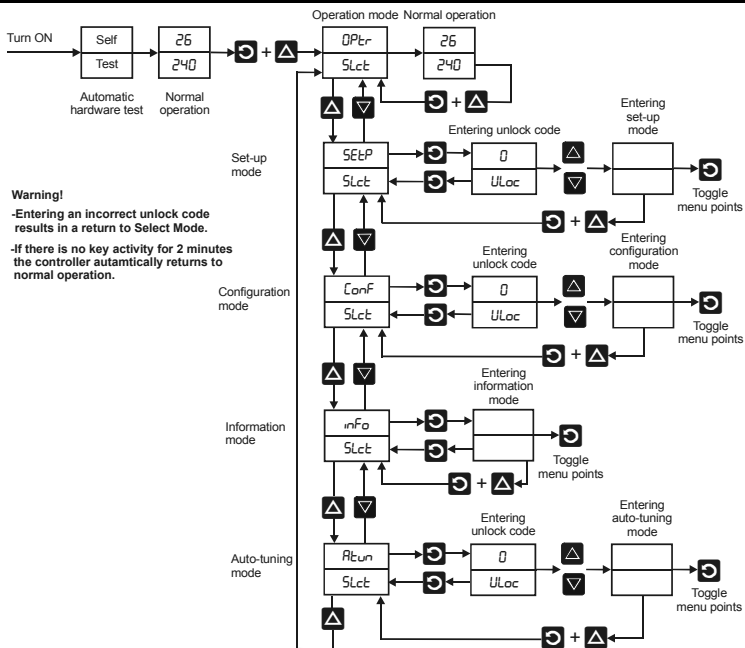
In the event that a lock code is not known or forgotten, the instrument lock code values can be seen in the lock code view. In this view the codes are read only, the codes can be changed from the mode to which they apply.

Turn OFF the device. Press **▲** and **⏻** together whilst the instrument is powering up until the display is shown. Once in this mode press **⏻** to step between lock codes.

LOCK CODE NAME	PV DISPLAY	SV DISPLAY
Configuration Lock Code	Max. 4 digit value, DEFAULT VALUE: 5	<b>CLoc</b>
Setup Lock Code	Max. 4 digit value, DEFAULT VALUE: 5	<b>SLoc</b>
Automatic Tune Lock Code	Max. 4 digit value, DEFAULT VALUE: 0	<b>tLoc</b>

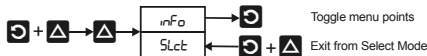
If there is no key activity for 2 minutes the controller automatically returns to operator mode!

## 10. OPERATION MODES, PROGRAMMING



## 10.1 INFORMATION MODE

This mode describes the instrument and the options fitted to it. It is advised to start Select Mode procedure with this point because toggling in the menu, hardware configuration, manufacturing data can be seen about the given instrument.



Parameters are read only!

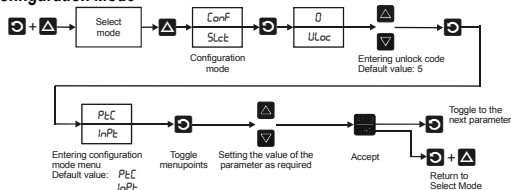
If there is no key activity for 2 minutes the controller automatically returns to operator mode!

PARAMETER	POSSIBLE VALUES	PV DISPLAY	SV DISPLAY
Input type	Universal input	Un 1	In_1
Option 1 module type	No option fitted	nonE	oPn1
	R1 Relay	rLY	
	SSR1 drive	SSr	
Option 2 module type	No option fitted	nonE	oPn2
	R2 Relay	rLY	
	SSR2 drive	SSr	
	Linear voltage / current output	L in	
Option 3 module type	No option fitted	nonE	oPn3
	R3 Relay	rLY	
	Linear voltage / current output	L in	
	24V Transmitter power supply	dc24	
Auxiliary option A module type	No option fitted	nonE	oPnA
	RS485	r485	
Firmware	Type number	4 characters	FLL
	Issue number	2 characters	ISS
Product Rev Level	Interior code	4 characters	PrL
Date of manufacture	Interior code	4 characters	dDmY
Serial number	Interior code	4 characters	Sn1
		4 characters	Sn2
		4 characters	Sn3

## 10.2 CONFIGURATION MODE

This mode is normally used only when the instrument is configured for the first time or when a major change is made to the instruments characteristics. The Configuration Mode parameters must be set as required before adjusting parameters in Setup Mode, or attempting to use the instrument in an application.

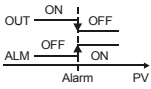
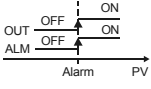
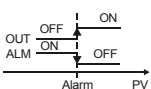
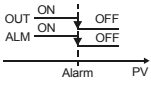
### Navigating in Configuration Mode

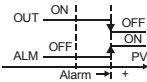
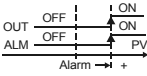
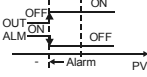
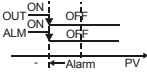
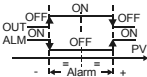
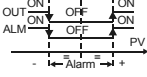


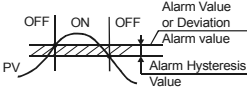
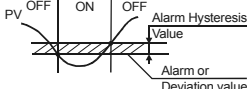
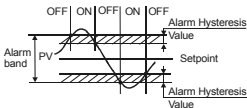
### Caution:

- Entering an incorrect unlock code will result to return to Select Mode. Only parameters that are applicable to the hardware options chosen will be displayed.
- Once the value is changed, the display will flash to indicate that confirmation of the change is required. The value will revert back if not confirmed within 10 seconds.
- If there is no key activity for 2 minutes the controller automatically returns to operator mode!

PARAMETER		SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
Input type and Range	Thermocouple	<b>InPt</b>	<b>bC</b>	B tip. 100...1824 °C	<b>PtC</b>
			<b>bF</b>	B tip. 211...3315 °F	
			<b>CC</b>	C tip. 0...2320 °C	
			<b>CF</b>	C tip. 32...4208 °F	
			<b>JC</b>	J tip. -200...120 °C	
			<b>JF</b>	J tip. -328...2192 °F	
			<b>J .C</b>	J tip. -188,8...537,7 °C	
			<b>J .F</b>	J tip. -199,9...999,9 °F	
			<b>PC</b>	K tip. -240...1373 °C	
			<b>PF</b>	K tip. -400...2503 °F	
			<b>P .C</b>	K tip. -128,8...537,7 °C	
			<b>P .F</b>	K tip. -199,9...999,9 °F	
			<b>LC</b>	L tip. 0...762 °C	
			<b>LF</b>	L tip. 32...1403 °F	
			<b>L .C</b>	L tip. 0,0...537,7 °C	
			<b>L .F</b>	L tip. 32,0...999,9 °F	
			<b>NC</b>	N tip. 0...1399 °C	
			<b>NF</b>	N tip. 32...2551 °F	
			<b>rC</b>	R tip. 0...1759 °C	
			<b>rF</b>	R tip. 32...3198 °F	
			<b>SC</b>	S tip. 0...1762 °C	
			<b>SF</b>	S tip. 32...3204 °F	
			<b>TC</b>	T tip. -240...400 °C	
			<b>TF</b>	T tip. -400...752 °F	
<b>T .C</b>	T tip. -128,8...400,0 °C				
<b>T .F</b>	T tip. -199,9...752,0 °F				
<b>P24C</b>	PtRh tip. 0...1850 °C				
<b>P24F</b>	PtRh tip. 32...3362 °F				
Input type and Range	Pt100		<b>PtC</b>	Pt100: -199...800 °C	
			<b>PtF</b>	Pt100: -328...1472 °F	
			<b>Pt .C</b>	Pt100: -128,8...537,7 °C	
			<b>Pt .F</b>	Pt100: -199,9...999,9 °F	
	Analogue		<b>0-20</b>	0-20 mA DC	
			<b>4-20</b>	4-20 mA DC	
			<b>0-50</b>	0-50 mV DC	
			<b>10 .50</b>	10-50 mV DC	
			<b>0-5</b>	0-5V DC	
			<b>1-5</b>	1-5 V DC	
<b>0-10</b>	0-10 V DC				
<b>2-10</b>	2-10 V DC				
Scale Range Upper Limit	<b>rUL</b>	Scale Range Lower Limit +100 to Range Max Between -1999...+9999		Linear inputs = 1000 (°C/°F inputs = max range)	
Scale Range Lower Limit	<b>rLL</b>	Range Min. to Scale range Upper Limit -100 Between -1999...+9999		Linear = 0 (°C/°F = min range):	
Decimal point position (Only for analogue input)	<b>dPos</b>	<b>0</b>	No decimal point	<b>1</b>	
		<b>1</b>	XXX.X		
		<b>2</b>	XX.XX		
		<b>3</b>	X.XXX		

PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
Control Type	<b>CTYP</b>	<b>SnGL</b>	Single outputs can drive the PV in one direction only (e.g. heat only, cool only, increase humidity etc)	<b>SnGL</b>
		<b>duAL</b>	Dual outputs can force the PV to increase or decrease (e.g heat & cool, humidity and dehumidify etc)	
Primary Output Control Action	<b>Ctrl</b>	<b>rEu</b>	Reverse action is typically used with heating applications; On-Off reverse outputs will turn off when the process variable exceeds setpoint. Proportional reverse outputs will decrease the percentage of output as the process value increases within the proportional band. The Secondary Output will be direct whenever the Primary Output is selected as reverse.	<b>rEu</b>
		<b>dir</b>	Direct action is typically used with cooling applications; On-Off direct outputs will turn on when the process variable exceeds setpoint. Proportional direct outputs will increase the percentage of output as the process value increases within the proportional band. The Secondary Output will be reverse whenever the Primary Output is selected as direct.	
Alarm 1 Type	<b>ALA 1</b>	<b>P_H ,</b>	Process High Alarm Reverse action  Direct action 	<b>P_H ,</b>
		<b>P_Lo</b>	Process Low Alarm Reverse action  Direct action 	

PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
		<b>dE</b>	Deviation Alarm <u>Up</u> Reverse action  Direct action 	
			<u>Down</u> Reverse action  Direct action 	
		<b>bAnd</b>	Band Alarm Reverse action  Direct action 	
		<b>nonE</b>	No alarm	
Process High Alarm 1 value Only visible when <b>ALR 1 = P.H</b> set Parameter is repeated in Set-up Mode	<b>PhR 1</b>		Range Min. to Range Max.	Range Max.
Process Low Alarm 1 value Only visible when <b>ALR 1 = P.Lo</b> set Parameter is repeated in Set-up Mode	<b>PLR 1</b>		Range Min. to Range Max.	Range Min.

PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
Deviation Alarm 1 Value Only visible when <b>ALA I = dE</b> set Parameter is repeated in Set-up Mode	<b>dAL I</b>		±span from setpoint	5
Band Alarm 1 Value Only visible when <b>ALA I = bAnd</b> set Parameter is repeated in Set-up Mode	<b>bAL I</b>		1 LSD to full span from setpoint	5
Alarm 1 Hysteresis Parameter is repeated in Set-up Mode	<b>AHY I</b>	Up to 100% of span	<p>Alarm hysteresis Process High Alarm or Deviation Alarm</p>  <p>Process Low Alarm or Deviation Alarm</p>  <p>Band Alarm</p> 	1
Alarm 2 Type	<b>ALAR2</b>	<b>P_H I</b> <b>P_Lo</b> <b>dE</b> <b>bAnd</b> <b>nonE</b>	As for Alarm 1.	<b>P_Lo</b>
Process High Alarm 2 Value Only visible when <b>ALAR2 = P_H I</b> set Parameter is repeated in Set-up Mode	<b>PhA2</b>		Range Min. to Range Max	Range max.
Process Low Alarm 2 Value Only visible when <b>ALAR2 = P_Lo</b> set Parameter is repeated in Set-up Mode	<b>PLA2</b>		Range Min. to Range Max	Range min.



PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
Deviation Alarm 2 Value Only visible when <b>AL2 = dE</b> set Parameter is repeated in Set-up Mode	<b>dAL2</b>		±span from setpoint	5
Band Alarm 2 Value Only visible when <b>AL2 = bAnd</b> set Parameter is repeated in Set-up Mode	<b>bAL2</b>		1 LSD to full span from setpoint	5
Alarm 2 Hysteresis Parameter is repeated in Set-up Mode	<b>AHY2</b>	1 LSD to 100% of span (in display units) on "safe" side of alarm point	As for Alarm 1.	1
Loop Alarm Enable	<b>LAE</b>	Disabled: <b>dISA</b>	<b>Loop Alarm</b> A loop alarm is a special alarm, which detects faults in the control feedback loop, by continuously monitoring process variable response to the control output(s). The loop alarm can be tied to any suitable output. When enabled, the loop alarm repeatedly checks if the control output(s) are at the maximum or minimum limit. If an output is at the limit, an internal timer is started: thereafter, if the high output has not caused the process variable to be corrected by a predetermined amount 'V' after time 'T' has elapsed, the loop alarm becomes active. Subsequently, the loop alarm mode repeatedly checks the process variable and the control output(s). When the process variable starts to change value in the correct sense or when the output is no longer at the limit, the loop alarm is deactivated. For PID control, the loop alarm time 'T' is always twice the Automatic Reset parameter value. For On-Off control, a user defined value for the Loop Alarm Time parameter is used. The value of 'V' is dependent upon the input type. For Temperature inputs, V = 2°C or 3°F. For Linear inputs, V = 10 least significant display units. Control output limits are: <ul style="list-style-type: none"> <li>▪ 0% for Single output (Primary only) controllers</li> <li>▪ -100% for Dual output (Primary and Secondary) controllers</li> </ul> Correct operation of the loop alarm depends upon reasonably accurate PID tuning. The loop alarm is automatically disabled during manual control mode and during execution of the Pre-Tune mode. Upon exit from manual mode or after completion of the Pre-Tune routine, the loop alarm is automatically re-enabled.	<b>dISA</b>
		Enabled: <b>EnAb</b>		

PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
Loop Alarm Time Only visible when $LAEn = EnAb$ set Parameter is repeated in Set-up Mode	<b>LA<sub>t</sub> I</b>		1 sec to 99 mins. 59secs Only applies if primary proportional band $Pb_P=0$	99.59
Alarm Inhibit	<b>Inh I</b>	<b>nonE</b>	No alarms Inhibited <b>AL<sub>1</sub> I</b> Alarm 1 inhibited <b>AL<sub>2</sub> I</b> Alarm 2 inhibited <b>both</b> Alarm 1 and alarm 2 inhibited	<b>nonE</b>
Output 1 Usage Only visible when $oPn 1 \neq nonE$	<b>USE 1</b>	<b>Pr I</b>	Primary Power <b>SEc</b> Secondary Power if $CTYP = duAL$ <b>RI<sub>d</sub></b> Alarm 1, Direct Acting <b>RI<sub>r</sub></b> Alarm 1, Reverse Acting <b>RA<sub>2d</sub></b> Alarm 2, Direct Acting <b>RA<sub>2r</sub></b> Alarm 2, Reverse Acting <b>LP<sub>d</sub></b> Loop Alarm, Direct Acting <b>LP<sub>r</sub></b> Loop Alarm Reverse <b>OR<sub>d</sub></b> Loop Alarm, Reverse Acting Alarm 1. OR Alarm 2. Direct Logical combinations of Alarms Direct Reverse Alarm 1 Alarm 2 OUT 1 Alarm 2 OUT1 OFF OFF OFF OFF OFF ON ON OFF ON ON OFF OFF OFF ON ON OFF ON OFF ON ON ON ON ON OFF <b>AD<sub>d</sub></b> Alarm1. AND Alarm 2. Direct Direct Reverse Alarm 1 Alarm 2 OUT 1 Alarm 2 OUT1 OFF OFF OFF OFF OFF ON <b>AD<sub>r</sub></b> Alarm 1. AND Alarm 2. Reverse ON OFF OFF ON OFF ON OFF ON OFF OFF ON ON ON ON ON ON ON OFF	<b>Pr I</b>
Output 2 Usage Only visible when $oPn 2 \neq nonE$	<b>USE2</b>	<b>Pr I</b>	Primary Power <b>SEc</b> Secondary Power if $CTYP = duAL$ <b>RI<sub>d</sub></b> Alarm 1, Direct Acting <b>RI<sub>r</sub></b> Alarm 1, Reverse Acting <b>RA<sub>2d</sub></b> Alarm 2, Direct Acting <b>RA<sub>2r</sub></b> Alarm 2, Reverse Acting <b>LP<sub>d</sub></b> Loop Alarm Direct Acting <b>LP<sub>r</sub></b> Loop Alarm Reverse Acting <b>OR<sub>d</sub></b> Logical combinations of Alarms Alarm 1. OR Alarm 2. Direct Reverse Alarm 1 Alarm 2 OUT 1 Alarm 2 OUT2 OFF OFF OFF OFF OFF ON ON OFF ON ON OFF OFF OFF ON ON OFF ON OFF ON ON ON ON ON OFF	<b>RA<sub>2d</sub></b>

PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE						DEFAULT VALUE
		<b>Rd_d</b> Alarm1 AND Alarm2 Direct	Alarm 1. és (AND) Alarm 2.						
			Direct			Reverse			
			Alarm 1	Alarm 1	OUT 2	Alarm 1	Alarm 1	OUT2	
		OFF	OFF	OFF	OFF	OFF	OFF		
		ON	ON	ON	ON	ON	ON		
		OFF	OFF	OFF	OFF	OFF	OFF		
<b>Rd_r</b> Alarm1 AND Alarm2 Reverse	ON	ON	ON	ON	ON	ON			
	OFF	OFF	OFF	OFF	OFF	OFF			
	ON	ON	ON	ON	ON	ON			
<b>rEtS</b>	Retransmit SP or PV Output if								
<b>rEtP</b>	<b>oPn2 = L in</b>								
Linear Output 2 Range Only visible when <b>oPn2 = L in</b>	<b>tYP2</b>	<b>0-5</b>	0-5V DC OUT2.					0-10	
		<b>0-10</b>	0-10V DC OUT2.						
		<b>2-10</b>	2-10V DC OUT2.						
		<b>0-20</b>	0-20 mA DC OUT2.						
		<b>4-20</b>	4-20 mA DC OUT2.						
Retransmit Output 2 Scale maximum Only visible when <b>USE2 = rEtS</b> or <b>rEtP</b>	<b>ro2H</b>	It may be adjusted within the range -1999 to 9999; the decimal position is always the same as that for the process variable input. If <b>ro IH &lt; ro IL</b> , the relationship between the process variable/setpoint value and the retransmission output is reversed.						Range max.	
Retransmit Output 2 Scale minimum Only visible when <b>USE2 = rEtS</b> or <b>rEtP</b>	<b>ro2L</b>	It may be adjusted within the range -1999 to 9999; the decimal position is always the same as that for the process variable input. If <b>ro IH &gt; ro IL</b> , the relationship between the process variable/setpoint value and the retransmission output is reversed.						Range min.	
Output 3 Usage Only visible when <b>oPn3 ≠ dc24</b>	<b>USE3</b>	<b>Pr I</b>	Primary Power					<b>R I_d</b>	
		<b>SEc</b>	Secondary Power if <b>CTYP = duRL</b>						
		<b>R I_d</b>	Alarm 1, Direct Acting						
		<b>R I_r</b>	Alarm 1, Reverse Acting						
		<b>R2_d</b>	Alarm 2, Direct Acting						
		<b>R2_r</b>	Alarm 2, Reverse Acting						
		<b>LP_d</b>	Loop Alarm Direct Acting						
		<b>LP_r</b>	Loop Alarm Reverse Acting						
		<b>Or_d</b> Alarm1 OR Alarm2 Direct	Logical combinations of Alarms						
		Alarm 1. OR Alarm 2.							
		Direct			Reverse				
		Alarm 1	Alarm 2	OUT 3	Alarm 2	Alarm 1	OUT3		
		OFF	OFF	OFF	OFF	OFF	ON		
		ON	OFF	ON	ON	OFF	OFF		
OFF	ON	ON	OFF	ON	OFF				
ON	ON	ON	ON	ON	OFF				
<b>Rd_d</b> Alarm1 AND Alarm2 Direct	Alarm1. AND Alarm 2.								
Direct			Reverse						
Alarm 1	Alarm 2	OUT 3	Alarm 1	Alarm 2	OUT3				
OFF	OFF	OFF	OFF	OFF	OFF				
ON	ON	ON	ON	ON	ON				
OFF	OFF	OFF	OFF	OFF	OFF				
ON	ON	ON	ON	ON	ON				
<b>Rd_r</b> Alarm1 AND Alarm2 Reverse									
ON	ON	ON	ON	ON	ON				
OFF	OFF	OFF	OFF	OFF	OFF				

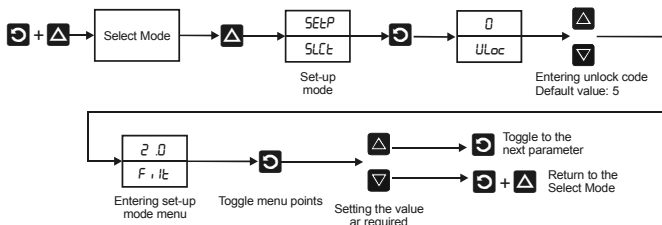
PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
		<b>rEtS</b>	Retransmit SP or PV Output if <b>oPn3 = L n</b>	
		<b>rEtP</b>		
Output 3 PV Retransmit Type Only visible when <b>oPn3 = L n</b>	<b>tYP3</b>	<b>0-5</b>	0-5 V DC OUT3	0-10
		<b>0-10</b>	0-10 V DC OUT3	
		<b>2-10</b>	2-10 V DC OUT3	
		<b>0-20</b>	0-20 mA DC OUT3	
		<b>4-20</b>	4-20 mA DC OUT3	
Retransmit Output 3 Scale maximum Only visible when <b>USE3 = rEtS</b> or <b>rEtP</b>	<b>ro3H</b>	It may be adjusted within the range -1999 to 9999; the decimal position is always the same as that for the process variable input. If <b>ro IH &lt; ro IL</b> , the relationship between the process variable/setpoint value and the retransmission output is reversed.		Range max.
Retransmit Output 3 Scale minimum Only visible when <b>USE3 = rEtS</b> or <b>rEtP</b>	<b>ro3L</b>	It may be adjusted within the range -1999 to 9999; the decimal position is always the same as that for the process variable input. If <b>ro IH &gt; ro IL</b> , the relationship between the process variable/setpoint value and the retransmission output is reversed.		Range min.
Display Strategy	<b>d,SP</b>	1, 2, 3, 4, 5, 6	see Operator Mode for details	1
Communication Protocol Configured for OUT A Only visible when <b>oPnA = r4BS</b>	<b>Prot</b>	<b>r7bn</b>	Modbus with no parity	<b>r7bn</b>
		<b>r7bE</b>	Modbus with Even Parity	
		<b>r7bo</b>	Modbus with Odd Parity	
Bit rate Only visible when <b>oPnA = r4BS</b>	<b>bAud</b>	1.2	1200 Baud	4.8
		2.4	2400 Baud	
		4.8	4800 Baud	
		9.6	9600 Baud	
		19.2	19200 Baud	
Communication Address	<b>Addr</b>	1	A unique address for each instrument between 1 to 255	1
Communications Write Enable	<b>CoEn</b>	<b>r_LW</b>	Read / Write. Writing via Comms is possible	<b>r_LW</b>
		<b>r_o</b>	Read only. Comms writes ignored	
Configuration Mode Lock Code	<b>CLoc</b>	Selectable between 0...9999		5

## 10.3 SET-UP MODE

This mode is normally selected only after Configuration Mode has been completed, or is used when a change to the process set up is required. These parameters must be set as required before attempting to use the indicator in an application.

When in Set-up Mode, the MAN LED indicator flashes.

### Navigating in Set-up Mode:



### Caution:

- Entering an incorrect unlock code will result to return to Select Mode.
- Only parameters that are applicable to the hardware options chosen will be displayed.
- Once the displayed value is changed, it is effective and immediately. No confirmation of the change is required.
- If there is no key activity for 2 minutes the controller automatically returns to operator mode!

PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
Input Filter Time constant	<b>F,lt</b>	This parameter is used to filter out extraneous impulses on the process variable. The filtered PV is used for all PV-dependent functions (display control, alarm etc). The time constant is adjustable from 0.0 seconds (off) to 100.0 seconds in 0.5 second increments.		2.0
Process Variable Offset	<b>OFFS</b>	±Span of controller between -999...+999		0
Primary Power	<b>PPLW</b>	The current Primary Output Power. Read Only		N/A
Secondary Power Only visible when <b>CtYP = dUL</b> set	<b>SPWJ</b>	The current Secondary Output Power. Read Only.		N/A
Primary Output Proportional Band (P)	<b>Pb_P</b>	0.0% (ON/OFF control) and 0.5% to 999.9% of input span.		10.0
Secondary Output Proportional Band (P) Only visible when <b>CtYP = dUL</b> set	<b>Pb_S</b>	0.0% (ON/OFF control) and 0.5% to 999.9% of input span		10.0
Automatic Reset (Integral Time Constant) (I) Only visible when <b>Pb_P</b> ≠ 0.0	<b>ArSt</b>	0.01 to 99.59 (1 sec to 99 mins 59 secs) OFF=0.00		5.00
Rate (Derivative Time Constant) (D) Only visible when <b>Pb_P</b> ≠ 0.0	<b>rAtE</b>	0.00 to 99.59 (OFF to 99 mins 59 secs)		1.15

PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
Overlap/Deadband Only visible when $Pb\_P \neq 0.0$ or $CtYP = duAL$	<b>OL</b>	Defines the portion of the primary and secondary proportional bands ( $Pb\_P + Pb\_S$ ) over which both outputs are active (Overlap), or neither is active (Deadband)		0
Manual Reset (Bias) Only visible when $Pb\_P \neq 0.0$	<b>b rAS</b>	0% to 100% (-100% to 100% if $CtYP = duALU$ Used to manually bias the proportional output(s) to compensate for process load variations. Bias is expressed as a percentage of output power and is adjustable in the range 0% to 100% (for Primary Output alone) or -100% to +100% (for both Primary and Secondary Outputs).		25
Primary Output ON/OFF Differential Only visible when $Pb\_P=0.0$	<b>d rFP</b>	0.1% to 10.0% of input span (enter in % span).		0.5
Secondary Output ON/OFF Differential Only visible when $Pb\_S=0.0$	<b>d rFS</b>	0.1% to 10.0% of input span (enter in % span). Differential band is symmetric to Setpoint Value.		0.5
Primary and Secondary Output ON/OFF Differential Only visible when $Pb\_P=0.0$ and $Pb\_S=0.0$	<b>d rFF</b>	0.1% to 10.0% of input span (enter in % span). Differential band is symmetric to Setpoint Value.		0.5
Setpoint Upper Limit	<b>SPuL</b>	Current Setpoint value to Scale Range Maximum		Range max.
Setpoint Lower limit	<b>SPLL</b>	Scale Range Minimum to current Setpoint value		Range min.
Primary (Heat) Output Upper Power Limit Only visible when $Pb\_P \neq 0.0$	<b>OPuL</b>	0% to 100% of full power		100
Output 1 Cycle Time Only visible when $USE I = Pr$ or $USE I = SEc$	<b>Ct I</b>	For time proportioning outputs, it is used to define time period over which the average on vs. off time is equal to the required PID output level. <b>Ct I</b> , is available when option slots 1, 2 or 3 are defined as time proportioning output types. The permitted range of value is 0.5, 1, 2, 4, 8, 16, 32, 64, 128, 256 or 512 seconds. Shorter cycle times will give better control, but at the expense of reduce life when used with an electromechanical control device (e.g. relays or solenoid valves).  For example Proportional Band $Pb\_P=25\%$ , Cycle Time: $Ct=32$ sec, then $100\%/25\% = 4$ $ON = 32/4 = 8$ sec. $OFF = 32-8=24$ sec.		32

PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
Output 2 Cycle Time Only visible when <b>USE2 = Pr 1</b> , or <b>USE2 = SEc</b>	<b>Ct2</b>	0.5, 1, 2, 4, 8, 16, 32, 64, 128, 256 or 512 secs. Not applicable to linear outputs.		32
Output 3 Cycle Time Only visible when <b>USE3 = Pr 1</b> , or <b>USE3 = SEc</b>	<b>Ct3</b>	0.5, 1, 2, 4, 8, 16, 32, 64, 128, 256 or 512 secs. Not applicable to linear outputs.		32
Process High Alarm 1 Value Only visible when <b>ALA 1 = P_H 1</b> set Parameter is repeated in Configuration Mode	<b>PhA 1</b>	Range Min. to Range Max.		Range max.
Process Low Alarm 1 Value Only visible when <b>ALA 1 = P.Lo</b> set Parameter is repeated in Configuration Mode	<b>PLA 1</b>	Range Min. to Range Max.		Range min.
Deviation Alarm 1 Value Only visible when <b>ALA 1 = dE</b> set Parameter is repeated in Configuration Mode	<b>dAL 1</b>	±span from setpoint between -999...+999		5
Band Alarm 1 Value Only visible when <b>ALA 1 = bAnd</b> set Parameter is repeated in Configuration Mode	<b>bAL 1</b>	1 LSD to full span from setpoint between 1...999		5
Alarm 1 Hysteresis Parameter is repeated in Configuration Mode	<b>AH1</b>	Up to 100% of span between 1...999	<p>Alarm Hysteresis Process High Alarm or Deviation Alarm</p> <p>Process Low Alarm or Deviation Alarm</p> <p>Band Alarm</p>	1
Process High Alarm 2 Value Only visible when <b>ALA2 = P_H 1</b> set Parameter is repeated in Configuration Mode	<b>PhA2</b>	Range Min. to Range Max.		Range max.
Process Low Alarm 2 Value Only visible when <b>ALA2 = P.Lo</b> set Parameter is repeated in Configuration Mode	<b>PLA2</b>	Range Min. to Range Max.		Range min.

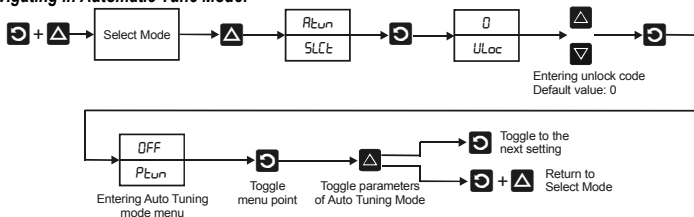
PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
Deviation Alarm 2 Value Only visible when <b>ALAZ</b> = <b>dE</b> set Parameter is repeated in Configuration Mode	<b>dALZ</b>	±span from setpoint		5
Band Alarm 2 Value Only visible when <b>ALAZ</b> = <b>bAnd</b> set Parameter is repeated in Configuration Mode	<b>bALZ</b>	1 LSD to full span from setpoint		5
Alarm 2 Hysteresis Parameter is repeated in Configuration Mode	<b>AHYZ</b>	1 LSD to 100% of span (in display units) on "safe" side of alarm point	As for Alarm 1.	1
Loop Alarm Time Only visible when <b>LAEn</b> = <b>EnAb</b> set Parameter is repeated in Configuration Mode	<b>LALt</b>	1 sec to 99 mins. 59secs Only applies if primary proportional band <b>Pb_P</b> =0		99.59
Auto Pre-tune enable / disable <b>Pb_P</b> , or <b>Pb_S</b> ≠ 0.	<b>APt</b>	<b>d, SA</b> disabled <b>EnAb</b> enabled Auto Pre-Tune is useful when the process to be controlled varies significantly each time it is run. Auto Pre-Tune ensures that tuning occurs at the start of the process. Self-Tune may also be engaged to fine tune the controller. AT LED indicator flashes.		<b>d, SA</b>
Manual Control select enable / disable	<b>PaEn</b>	<b>d, SA</b> disabled <b>EnAb</b> enabled, MAN LED indicator flashes. PV display: shows measured process value. SV display: shows PXXX, where X values are % of the output, adjustable by <input type="checkbox"/> and <input type="checkbox"/> buttons, for primary output: between 0 - 100 %, for primary and secondary output: between -100%...+100%		<b>d, SA</b>
Setpoint ramp shown in operator mode, enable / disable	<b>SPr</b>	<b>d, SA</b> disabled <b>EnAb</b> enabled		<b>d, SA</b>
Setpoint Ramp Rate Value	<b>rP</b>	The ramp rate may be adjusted in the range 1 to 9999 and OFF. Increasing the ramp rate value beyond 9999 will cause the upper display to go blank and setpoint ramping to be switched OFF. Setpoint ramping can be resumed by decreasing the ramp rate to 9999 or less. The actual setpoint will rise/fall at the ramp rate set, until it reaches the target setpoint value. Setpoint ramping is used to protect the process from sudden changes in the setpoint, which would result in a rapid rise in the process variable.		OFF
Setpoint Value	<b>SP</b>	Within scale range upper and lower limits		Range min.
Set-up Lock Code	<b>SLOC</b>	0 to 9999		5



## 10.4 AUTO-TUNING (AT) MODE

Automatic Tune Mode is selected when it is desired to use the Pre-tune and Self-tune facilities on a controller to assist the user in setting up Proportional band, Integral and Derivative parameter values. Refer to the following Automatic Tune Mode table.

### Navigating in Automatic Tune Mode:



### Caution:

- Entering an incorrect unlock code will result to return to Select Mode.
- If there is no key activity for 2 minutes the controller automatically returns to operator mode!

PARAMETER	SV-DISPLAY	PV-DISPLAY	ADJUSTMENT RANGE	DEFAULT VALUE
PRE-Tune Auto Pre-Tune ensures that first approximation of the PID values can be made. Auto Pre-Tune feature is activated on power up if <b>APt = EnAb</b> set.	<b>Ptun</b>	OFF or ON Indication remains OFF if Pre-Tune cannot be used at this time. This applies if: a). The setpoint is ramping b). The process variable is less than 5% of span from the setpoint c). The primary or secondary output proportional bands = 0 AT LED indicator flashes if PRE-Tune is ON		OFF
SELF-Tune Self-Tune continuously optimises tuning while a controller is operating	<b>Stun</b>	OFF or ON Indication remains OFF if Self-Tune cannot be used at this time. This applies if either proportional band = 0 AT LED indicator continuously lights if SELF-Tune is ON		OFF
Approximation of the PID values then continuous optimising PRE-Tune + SELF-Tune ON	<b>Ptun</b> then <b>Stun</b>	<b>Ptun</b> = ON <b>Stun</b> = ON under <b>Ptun</b> AT LED indicator flashes, then during <b>Stun</b> AT LED continuously lights		OFF
Automatic tune mode lock code	<b>tLoc</b>	0 to 9999		0

## 10.5 MANUAL SETTING OF PID PARAMETERS

If Auto Tuning mode is not enabled, controlling can be manually tuned. Manual setting of PID parameters is suitable only for processes that are not harmed by large fluctuations in the process variable. This technique needs technical competence and practise in process controlling, therefore changing of the parameters are allowed only if regulating system surely remains its safe operation.

All parameters should be set in Configuration and Set-up Modes before manual tuning of PID parameters!

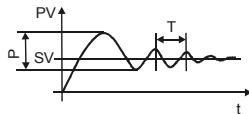
### Single Control Tuning (PID with Primary Output only) – cooling, or heating

- In Configuration mode select Single control type  
Primary control

SnCL
CLYP

- Select Setpoint Value in Operator Mode in accordance to the process.

- Check that the Setpoint Upper Limit (**SP<sub>UL</sub>**) and Setpoint Lower Limit (**SP<sub>LL</sub>**) are set to safe levels for the process. Adjust if required
- Select ON-OFF control (**P<sub>b\_P</sub>**=0)
- Switch on the process. The process variable will oscillate about the setpoint.



Record the Peak-to-Peak variation (P) of the first cycle (i.e. the difference between the highest value of the first overshoot and the lowest value of the first undershoot), and the time period of the oscillation (T) in minutes:

$$\begin{aligned} \text{Primary Proportional Band (P):} & \quad P_{b\_P} = \frac{P}{(SP_{UL} - SP_{LL})} \times 100 \\ \text{Integral Time Constant (I):} & \quad ArSt = T \text{ [min]} \\ \text{Derivative Time Constant (D):} & \quad rALtE = T/6 \text{ [min]} \end{aligned}$$

In Set-up Mode select PID parameters in accordance to the calculation using the formula above.

#### Dual Control Tuning (PID with Primary and Secondary Outputs) – cooling and heating

- In Configuration mode select Dual control type Primary and Secondary control
 

dual
CTSP
- Select Setpoint Value of Primary output as described above.
- Set **P<sub>b\_S</sub>** to the same value as **P<sub>b\_P</sub>** and monitor the operation of the controller in dual control mode.
- If there is a tendency to oscillate as the control passes into the Secondary Proportional Band, increase the value of **P<sub>b\_S</sub>**.  
If the process appears to be over-damped in the region of the Secondary Proportional Band, decrease the value of **P<sub>b\_S</sub>**.
- When the PID tuning values have been determined, if there is a kick to the process variable as control passes from one output to the other, set the Overlap/Deadband **OL** parameter to a positive value to introduce some overlap.

Adjust this value by trial and error until satisfactory results are obtained.

## 10.6 MANUAL FINE TUNING OF PID PARAMETERS

- Adjustment of Cycle Time (**CT**) parameter (in Set-up Mode) is provided for each time proportioning control output. Take into consideration that a shorter cycle time gives more accurate control but electromechanical components such as relays have a reduced life span.
- Increase the width of the proportional band if the process overshoots or oscillates excessively.
- Decrease the width of the proportional band if the process responds slowly or fails to reach setpoint.
- Increase the automatic reset (**ArSt**) (Integral Time Constant) until the process becomes unstable, and then decrease until stability has been restored.
- Modify Integrate Time to between 10-25% of the previous value. If the process overshoots or oscillates excessively, decrease its value.
- After making all other adjustments, if an offset exists between the setpoint and the process variable use the Bias **b rAS** (manual reset) to eliminate the error. When PV is below SV use a larger bias value, when PV is above SV use a smaller bias value.

## 10.7 OPERATOR MODE

This is the normal operating mode of the instrument from power-up. It can also be accessed from any other mode via Select Mode as follows.

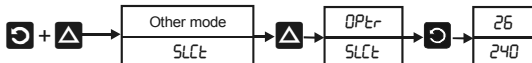
In order to provide proper operation, all parameters should be configured in the Configuration Mode and Set-up Mode before using the Operator Mode!

From any Mode if there is no key activity for 2 minutes the controller automatically returns to operator mode!

Display mode is in accordance to the selected value in Configuration Mode  $d$ ,  $SP$  parameter between 1...6.

Toggle between PV and SV can be performed with  $\odot$  button and values can be modified with  $\Delta$ , or  $\nabla$  buttons.

**Entering Operator Mode from an other mode:**

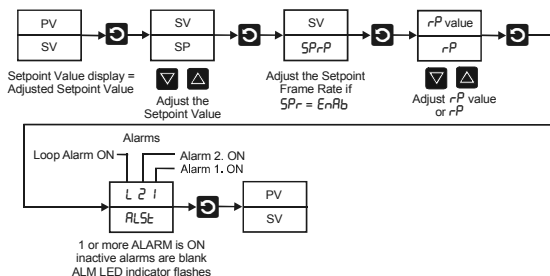


### 10.7.1 DISPLAY MODES

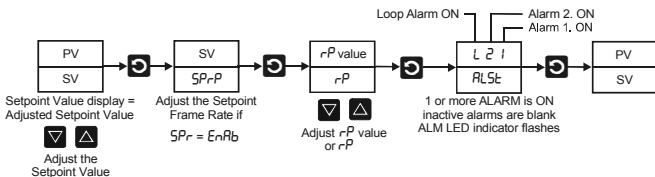
The required display mode can be selected in Configuration Mode.

Displaying of SP Ramp Rate Value can be performed if parameter is enabled in Set-up Mode.

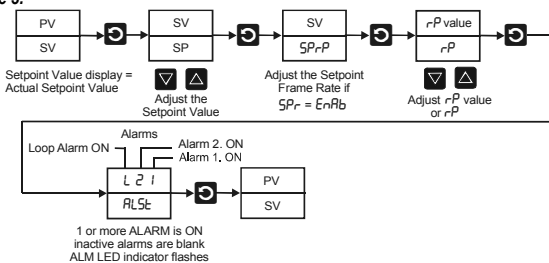
**Display mode 1.**



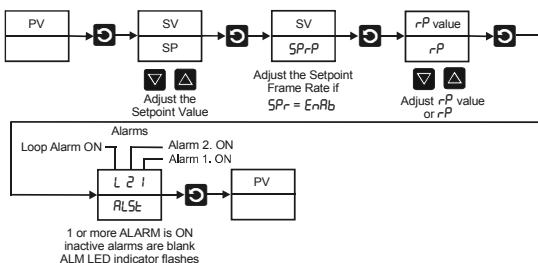
**Display mode 2.**



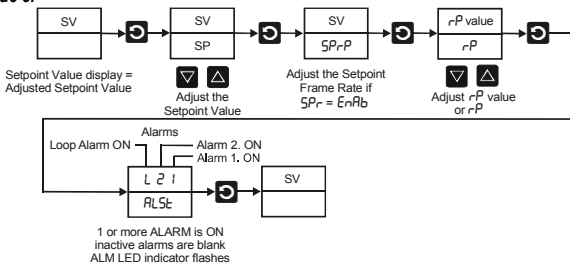
### Display mode 3.



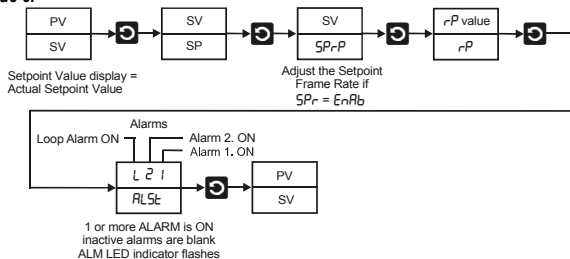
### Display mode 4.




### Display mode 5.

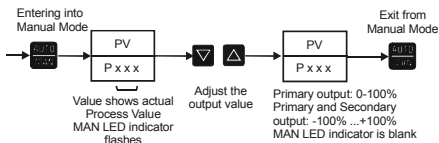


### Display mode 6.



## 10.7.2 MANUAL MODE

When manual mode is enabled  $POEn = Enob$  in Set-up Mode, then press  button to enter manual mode



### Caution!

Manual Mode should be used with care because the power output level is set by the operator, therefore the PID algorithm is no longer in control of the process. The operator must maintain the process as the desired level manually. Manual power is not limited by the  $OPuL$  (Primary Power Output Limit) parameter.

## 11. COMMUNICATION

Some types of UNICONT PMM-500 controllers has RS485 communication module (as per order codes) (OUT A module). For a complete description of the Modbus protocol refer to the description provided at <http://www.modbus.org>.

### 11.1 GENERAL DATA

Type:	Asynchronous Serial
Protocol:	Modbus RTU
Physical Layer:	RS485
Address range:	1...255
Bit rate:	1200...19200 Baud, selectable
Bits per character:	10 or 11, depending on parity setting
Stop bits:	1
Character format:	8 bit
Parity:	None, even or odd (selectable)
Isolation:	Reinforced safety isolation from inputs and outputs

#### Note!

Device address, data transfer speed, parity, Communication write enable parameters ( $Addr$ ,  $Prot$ ,  $bAud$ ,  $CoEn$ ) can be selected in Configuration Mode.

The instrument is assigned a unique device address by the user in the range 1 (default) to 255 using the  $Addr$  parameter in Configuration Mode. This address is used to recognise Modbus Queries intended for this instrument. The instrument will also accept global Queries using device address 0 no matter what device address is assigned. No responses are returned for globally addressed Queries. The transmitter must not start transmission until 3 character times have elapsed since reception of the last character in a message, and must release the transmission line within 3 character times of the last character in a message

DATA TRANSFER SPEED (BAUD)	3 CHARACTER TIMES (MSEC)
1200	24
2400	12
4800	6
9600	3
19200	1,5

## 11.2 MODBUS COMMUNICATION

The unit uses the following Modbus functions:

MODBUS			
DECIMAL FUNCTION CODE	PARAMETER FORMAT	MODBUS MEANING	DESCRIPTION
01/02	Bit	Read coil/ Input status	Read output/input status bits at given address
03/04	Word	Read holding/Input registers	Read current binary value of specified number of parameters at given address. Up to 64 parameters can be accessed with one Query
05	Bit	Force single coil	Writes a single binary bit to the Specified Slave Bit address
06	Word	Pre-set single register	Writes two bytes to a specified word address
08	-	Diagnostics	Used for loopback test.
16	Word	Pre-set multiple register	Writes up to 1 word parameter values to the specified address range.

## 11.3 COMMUNICATION PARAMETERS

Communication parameters RO indicates a parameter which is read only, R/W indicates it can also be written to. Communications writes will not implemented if the **CoEn** (Communications Write Parameter) is disabled in the Configuration Mode.

### 11.3.1 BIT PARAMETERS

MODBUS PARAMETER		CONTROLLING PARAMETER	NOTES
NUMBER	MODE		
1	RO	Communication Write Status	1 = Write Enabled 0 = Write Disabled
2	R/W	Auto / Manual	1 = Manual Control 0 = Automatic Control
3	R/W	Self Tune	1 = Activate(d) 0 = Dis-engage(d)
4	R/W	Pre tune	1 = Activate(d) 0 = Dis-engage(d)
5	RO	Alarm 1 Status	1 = Active 0 = Inactive
6	RO	Alarm 2 Status	1 = Active 0 = Inactive
7	R/W	Setpoint Ramping	1 = Enable(d) 0 = Disable(d)
10	R/W	Loop Alarm Status	1 = Active/Enable 0 = Inactive/Disable
12	R/W	Loop Alarm	Read to get loop alarm status. Write 0/1 to disable/enable

Note:

To set the bit value to 1 write FF, to set the bit value to 0 write 00.

### 11.3.2 WORD PARAMETERS

MODBUS PARAMETER		CONTROLLING PARAMETER	NOTES
NUMBER	MODE		
1	RO	Process Variable	Current value of PV If under-range = 62976, If over-range = 63232
2	R/W	Setpoint	Value of currently selected setpoint. Target setpoint if ramping.
3	R/W	Output Power	0% to 100% for single output; -100% to +100% for dual output control. Read Only if not in manual control
4	RO	Deviation	Difference between Process Variable and Setpoint (value = PV-SP)
5	R/W	Secondary Proportional Band	Adjustable 0.0% to 999.9% of input span. Read only when Self-Tuning
6	R/W	Primary Proportional Band	Adjustable 0.0% to 999.9% of input span. Read only when Self-Tuning
7	R/W	Direct / Reverse Acting	1 = Direct Acting, 0 = Reverse
8	R/W	Automatic Reset Time (or Loop Alarm Time)	Integral Time Constant value. (or Loop Alarm Time value in ON/OFF control mode if Loop Alarm Enabled) Read only if Self-Tuning. Modbus range: 0 to 5999
9	R/W	Rate	Derivative Time Constant value. Read only if Self-Tuning. Modbus range: 0 to 5999
10	R/W	Output 1 Cycle time	0.5, 1, 2, 4, 8, 16, 32, 64, 128, 256 or 512 seconds
11	R/W	Scale Range Lower Limit	Lower limit of scaled input range selectable between -1999...+9999
12	R/W	Scale Range Upper Limit	Upper limit of scaled input range selectable between -1999...+9999
13	R/W	Alarm 1 Value	Alarm 1 active at this level
14	R/W	Alarm 2 Value	Alarm 2 active at this level
15	R/W	Manual Reset	Bias value. 0% to 100% for single control output or -100% to +100% for dual outputs
16	R/W	Overlap / Deadband	20% to +20% of ( <b>Pb_P + Pb_S</b> ) Negative value = Deadband, Positive value = Overlap
17	R/W	ON - OFF Differential	0.1% to 10.0% of input span Used for Primary output on/off differential and for combined Primary and Secondary on/off differential.
18	R/W	Decimal Point Position	0 = xxxx, 1 = xxx.x, 2 = xx.xx, 3 = x.xxx Read only if not Linear Input
19	R/W	Output 2 Cycle Time	0.5, 1, 2, 4, 8, 16, 32, 64, 128, 256 or 512 seconds
20	R/W	Primary Output Power Limit	Safety power limit; 0 to 100 %
21	RO	Actual Setpoint	Current (ramping) value of selected setpoint
22	R/W	Setpoint Upper Limit	Maximum setpoint value. Current SP to Input Range Maximum
23	R/W	Setpoint Lower Limit	Minimum setpoint value. Current SP to Input Range Minimum
24	R/W	Setpoint Ramp Rate	0 = OFF, 1 to 9999 increments / hour. Dec Point position as for input range.
25	R/W	Input Filter Time Constant	0 to 100 seconds
26	R/W	Process Value Offset	Modified PV = Actual PV + PV Offset. Limited by Scale Range Maximum and Scale Range Minimum -999...+999

MODBUS PARAMETER		CONTROLLING PARAMETER	NOTES
NUMBER	MODE		
122	RO	Equipment ID	6100
123	RO	Interior code	4 characters
124	RO	Interior code	4 characters
125	RO	Interior code	4 characters
126	RO	Interior code	4 characters
129	RO	Interior code	16 characters
130	RO	Interior code	16 characters
133	RO	Input status	Input status. Read Only. Bit 0: Sensor break flag Bit 1: Under-range flag Bit 2: Over-range flag
2224	R/W	Option Slot 2 Re-transmit output Maximum	Maximum scale value for retransmit output in slot 2, -1999 to 9999
2225	R/W	Option Slot 2 Re-transmit output Minimum	Minimum scale value for retransmit output in slot 2, -1999 to 9999
2234	R/W	Option Slot 3 Re-transmit output Maximum	Maximum scale value for retransmit output in slot 3, -1999 to 9999
2235	R/W	Option Slot 3 Re-transmit output Minimum	Minimum scale value for retransmit output in slot 3, -1999 to 9999