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UNICONT PM

PMG–500
UNIVERSAL CONTROLLER

QUICK SETUP GUIDE
2nd edition

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1. INTRODUCTION

In addition to the 1/16 DIN *(48 × 48 mm [1.8 × 1.8"])* design, the UNICONT PM universal controller family is characterized by easy setpoint adjustment and easy programming. The universal analog PID controller is suitable for processing signals from Pt100 resistance thermometers, various thermocouples, and transmitters with a 4…20 mA and 0…10 V DC, 0…5 V DC, 1…5 V DC, 0…100 *mV* DC signal. The control output can be a relay, a continuous 0…20 mA or 4…20 mA current signal, or an output suitable for operating an SSR *(solid-state relay)*. The self-learning autotuning *(AT)* mode helps users determine PID parameters. The device provides automatic wire compensation for the Pt100 input signal and automatic cold junction compensation for the thermocouple input signal. Some PM–500 series members are also capable of RS485 communication.
The UNICONT PM–500 enables more efficient control with a super-fast 50 ms sampling cycle and ±0.3% display accuracy. Moreover, it supports a variety of control modes, including simultaneous control of heating and cooling and automatic/manual control and communication functions.

2. SPECIFICATIONS

2.1 GENERAL DATA

		PMG–500
Power supply	AC	100…240 V AC, 50/60 Hz, 8 VA
	AC/DC	24 V AC 50/60 Hz, 8 VA / 24…48 V DC, 5 W
Voltage tolerance		±10% deviance from nominal voltage
Ambient temperature		–10…+50 °C (14…122 °F)
Ambient humidity		35...85% RH
Display		Process Value (PV): 7-segment, red, 7.0 × 14.0 mm (0.27 × 0.55"). Set Value (SV): 7-segment, green, 5.0 × 10.0 mm (0.2 × 0.39"). Status LEDs with labels
Primary input	RTD mode	Compatible resistance temperature sensors: JPt 100 Ω, DPt 100 Ω, DPt 50 Ω, Cu 100 Ω, Cu 50 Ω, and Nikel 120 Ω
	TC mode	Compatible thermocouple sensors: K, J, E, T, L, N, U, R, S, B, C, G, and PLII
	Analog mode	Voltage: 0…100 mV, 0…5 V, 1…5 V, 0…10 V Current: 0…20 mA, 4…20 mA
Optional inputs	CT input	0…50 mA (for external 1/1000 CT connection)
	Digital input (DI)	Active input for passive switches, measuring current: 0.5 mA / 5 V Contact switch – sensing threshold: 'On' < 2 kΩ / 'Off' > 90 kΩ Transistor switch – sensing threshold: 'On' < 1.0 V DC / 'Off' < 0.1 mA
Display accuracy	RTD mode	Room temperature (23 °C ±5 °C): (PV ±0.3% or ±1 °C) ±1 digit Full ambient-temperature range: (PV ±0.5% or ±2 °C) ±1 digit
	TC mode	
	Analog mode	Room temperature (23 °C ±5 °C): ±0.3% F.S. ±1 digit Full ambient-temperature range: ±0.5% F.S. ±1 digit
	CT input	±5% F.S. ±1 digit
Control outputs	Relay (OUT1 / 2)	250 V / 3 A AC-1
	SSR (OUT2)	11 V DC ±2 V / 20 mA
	Current (OUT2)	4…20 mA / 0…20 mA selectable (max. loop resistance 500 Ω)
Alarm output	Relay (AL1)	250 V / 3 A AC-1
Optional outputs	Transmitter output	4…20 mA: output accuracy ±0.3% F.S (max. loop resistance 500 Ω)
	Communication	RS485 communication Modbus RTU protocol
Control algorithms:		ON/OFF, P, PI, PD, PID
Hysteresis		RTD / Thermocouples: 1…100 °C (0.1…100 °C) (33.8…212 °F [32.2…212 °F])
Proportional band (P)		0.1…999.9 °C (32.2…1 831.8 °F) (0.1…999.9%)
Integral time (I)		0…9999 s
Differential time (D)		
Control period (T)		Relay output, SSR driver output: 0.1…120.0 s Current loop output + SSR driver output: 1.0…120.0 s
Manual reset value		0…100%
Sampling period		50 ms
Vibration resistance		0.75 mm (0.03")amplitude at frequency 5 to 55 Hz (for 1 min) in each X, Y, Z direction for 2 hours
Relay life cycle	Mechanical	OUT1/OUT2: min. 5,000,000 operations AL1: min. 20,000,000 operations
	Electrical	OUT1/OUT2, AL1: min. 100,000 operations
Memory retention		~10 years (non-volatile semiconductor memory)
Ingress protection		Behind mounting plane: IP20, front panel: IP54
Insulation type		Reinforced insulation between the input and the power part (dielectric breakdown: 2 kV)
Bounding box size		48 × 48 × 70.5 mm (1.89 × 1.89 × 2.77")
Weight		~105 g (3.7 oz)

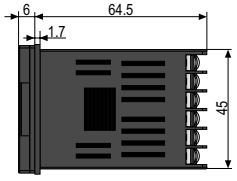
2.2 ACCESSORIES

– User's and Programming Manual
– Mounting bracket
– Warranty Card
– EU Declaration of Conformity

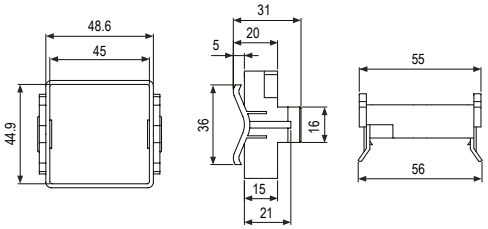
2.4 OUTLINES AND DIMENSIONS

The device can be mounted in a 48×48 mm *(1.8 × 1.8")* cutout *(1/16 DIN board instrument)*.
The insertion depth is 64.5 mm, other main dimensions are shown in the figure.

PMG–5☐☐

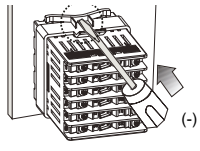
Front	Side
	

Mounting Bracket

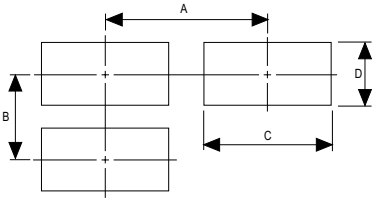


3. Mounting

The panel is mounted on the front panel in a 1/16 DIN *(48 × 48 mm [1.8 × 1.8"])* cutout with the supplied mounting frame. Make sure that the rubber seal fits, which ensures tightness from the front. When installing multiple instruments, ensure adequate distances. Insert the unit into the bracket panel and secure the bracket with a straight screwdriver.

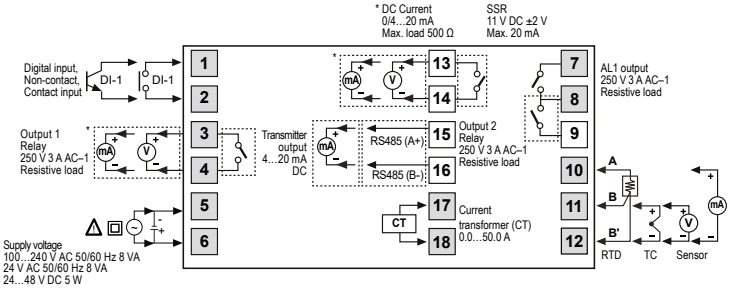


Tightening the mounting bracket



Minimum distance between devices
A – min. 65 mm *(2.55")*
B – min. 65 mm *(2.55")*
C – $45_{0}^{+0.6}$ mm
D – $45_{0}^{+0.6}$ mm

4. WIRING



Ally types have colored connection points (☐). Other connection point types depend on the particular variant.

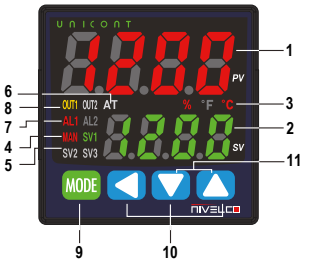
Important information for proper use:

- The digital input is not electrically isolated from internal circuits, so it must be insulated if it is connected to another circuit.
- Make sure that the connection polarity of the temperature sensor or analog input is correct.
- Make sure the polarity of the power supply is correct.
- Do not swap the output and input terminals.
- For thermocouple sensors, use a compensation cable with the same specifications as the input sensors. Using an extension cord of different specifications and/or materials makes temperature sensing less accurate. For more reliable operation, choosing a high-grade compensation cable is recommended.
- Do not place sensor wires near AC wires.
- Do not attach communication cables to the AC power cord. Use only twisted-pair wires for communication cabling. The length of the communication cable must not exceed 800 meters.

5. PROGRAMMING

5.1 PARTS AND DISPLAY

The seven-segment displays show the measured *(Process Value, PV)* and set values *(SV)* in regular operation, while in other modes, they show the corresponding text signals and values according to the current status of programming and setting. Use the 4 buttons to operate the menu system and perform programming.



1. **Measured Value (PV):**
   RUN mode: it shows the currently measured value *(PV)*.
   Setting mode: it shows the name of the parameter.
2. **Set value (SV):**
   RUN mode: it shows the set value *(SV)*.
   Setting mode: it shows the the parameter value.
3. **Unit (°C / °F / %) indicator:** It displays the unit set in parameter group 3. The unit applies to the displayed values of the *PV* and SV.
4. **Manual control indicator (MAN):** it switches on during manual control.
5. **Multi SV indicator (SV1, SV2, SV3) LEDs:** Indicates the different target value setting currently in use *(SV1-3)*. The base destination field *(SV0)* is valid if none is active. Not available for all models.
6. **Auto-tuning indicator (AT):** flashes every 1 second when auto-tuning is executed.
7. **Alarm output (AL1) indicator:** it turns on when the alarm output is on.
8. **Control output (OUT1, OUT2) indicator**: it turns on when the corresponding control output is active. During manual control, it switches off if the measured value is 0.0% when using a current output; otherwise, it is switched on continuously. During automatic control, it switches on when the measured value exceeds 3.0% and switches off when it falls below 2.0%.
9. MODE **button:** It is used when entering parameter group, returning to RUN mode, moving parameter, saving the set value.
10. ◀ ▼ ▲ buttons: they are used when entering the set value, changing mode, navigating between parameters/values, and changing values up/down.
11. Digital input key: When pressing the ▼ ▲ buttons together for 3 seconds, it operates the RUN/STOP, alarm clear, and auto tuning functions.

5.2 STARTUP

When energized, the display will flash for one second, at which point all display sections will illuminate. Then the hardware ID code and the input sensor type will flash twice, and the unit will switch to RUN mode. If '*Open*' is displayed, there is no source or there is a contact error on the universal input.

In RUN mode, the current temperature or the value provided by the sensor is displayed.

The parameters in each group are related to each other, so please follow the parameter order below.
Parameter group 3 **[PAR3]** → Parameter group 4 **[PAR4]** → Parameter group 5 **[PAR5]** → Parameter group 2 **[PAR2]** → Parameter group 1 **[PAR1]** → *SV* Setting **[SV]**

Note: Changing the parameters of parameter group 3 can sometimes restore other related parameters. Always check that such parameters are not affected.

5.3 INPUT SETTINGS [PAR3 → IN-T]

For normal operation, the universal input must first the universal input must be set in 'Setting' mode. Then the input type must be selected according to table 5.3.1 Input types. Default setting: KCaH.

	Input type	Accuracy	Indication	Temperature range (°C)	Temperature range (°F)
Thermocouple (TC)	K (CA)	1	KCaH	–200…1350	–328…2463
		0.1	KCaL	–199.9…999.9	–199.9…999.9
	J (IC)	1	JIcH	–200…800	–328…1472
		0.1	JIcL	–199.9…800.0	–199.9…999.9
	E (CR)	1	ECrH	–200…800	–328…1472
		0.1	ECrL	–199.9…800.0	–199.9…999.9
	T (CC)	1	TCcH	–200…400	–328…752
		0.1	TCcL	–199.9…400.0	–199.9…752.0
	B (PR)	1	B PR	0…1800	32…3272
	R (PR)	1	R PR	0…1750	32…3182
	S (PR)	1	S PR	0…1750	32…3182
	N (NN)	1	N NN	–200…1300	–328…2372
Thermocouple (TC)	C (TT)	1	C TT	0…2300	32…4172
	G (TT)	1	G TT	0…2300	32…4172
	L (IC)	1	LIcH	–200…900	–328…1652
		0.1	LIcL	–199.9…900.0	–199.9…999.9
	U (CC)	1	UCcH	–200…400	–328…752
		0.1	UCcL	–199.9…400.0	–199.9…752.0
	Platinel II	1	PLII	0…1390	32…2534
RTD	Cu 50 Ω	0.1	CU 5	–199.9…200.0	–199.9…392.0
	Cu 100 Ω	0.1	CU10	–199.9…200.0	–199.9…392.0
	JPt 100 Ω	1	JPtH	–200…650	–328…1202
	JPt 100 Ω	0.1	JPtL	–199.9…650.0	–199.9…999.9
	DPt 50 Ω	0.1	DPt5	–199.9…600.0	–199.9…999.9
	DPt 100 Ω	1	DPtH	–200…650	–328…1202
	DPt 100 Ω	0.1	DPtL	–199.9…650.0	–199.9…999.9
	Nickel 120 Ω	1	NI12	–80…200	–112…392
Analog	Voltage	0…10 V	AV1	–1999 … 9999 *(The display point changes according to the decimal point.)*	
		0…5 V	AV2		
		1…5 V	AV3		
		0…100 mV	AMV1		
	Current	0…20 mA	AMA1		
		4…20 mA	AMA2		

5.3.1 Sensor Temperature Unit

When the input temperature sensor is selected, the **[PAR3 - UNIT]** can be set to display the desired unit *(°C, °F)*. However, this parameter is not displayed when an analog input is selected. The default unit is °C
When analog input is selected, it is possible to specify the unit **[PAR3 - dUNT]** *(°C, °F,%, OFF)*. When OFF is selected, the displayed unit is not specified. The LED unit display does not turn on. The default setting is %.

5.3.2 Low-Limit Input Value [PAR3 → L-RG]

The actually used lower limit values can be set within the analog input range. The temperature range from the minimum value to the upper limit **[H-RG]** - F.S. adjustable up to 10%. Default: 0.

5.3.3 Upper-Limit Input Value [PAR3 → H-RG]

The actually used limit values can be set within the analog input range. The lower input limit **[L-RG]** + F.S. can be set from 10% to the maximum value of the temperature range. Default: 10.

5.3.4 Input Offset Correction [PAR3 → IN-B]

This function is used to correct the offset provided by thermocouples, RTDs, or analog input devices. The input correction function is mainly used when the sensor cannot be fixed directly to the controlled objects. Temperature difference compensation must be performed between the sensor installation point and the actual measuring point. Default setting: 0, unit: °C / °F / -.

Example: If the controller shows 78 °C *(172.4 °F)* when the actual temperature is 80 °C *(176 °F)*, set the input correction **[IN-B]** to "002" to set the temperature displayed on the controller to 80 °C *(176 °F)*.

5.4 OUTPUT SETTINGS

5.4.1. Control output (OUT1/OUT2) selection [PAR3 → OUT1/OUT2]

On models with a current loop output, current *(CURR)* or SSR drive output can be selected. Default setting: SSR.

5.4.2. SSRP function [PAR3 → O1SR]

SSRP function of SSR drive output is selectable one of standard ON/OFF control, cycle, phase control. By parameter setting, standard SSR drive is available. Also, cycle control connecting with a zero cross turn-on method SSR, phase control connectiong with a random turn-on method SSR are available.

1. **Standard ON/OFF control [STND]**
   A mode to control the load in the same way as Relay output type.*(ON: output level 100%, OFF: output level 0%)*
2. **Cycle control [CYCL]**
   A mode to control the load by repeating output ON / OFF according to the rate of output within setting cycle. Having improved ON / OFF noise feature by Zero Cross type.
3. **Phase control [PHAS]**
   A mode to control the load by controlling the phase within AC half cycle. Serial control is available. Random turn-on SSR must be used for this mode.

5.4.3 Current output range settings [PAR3 → O1MA/O2MA]

If the control output is set to current output, you can select upper and low-limit range for the current output as either 4…20 mA or 0…20 mA.

O1MA: Sets OUT1's current output range. **O2MA:** Sets OUT2's current output range.

Note: This parameter is only available on models supporting current output [OUT1, OUT2].

5.5 CONTROL OUTPUT

Output modes for general temperature control include heating mode or cooling mode and heating and cooling mode. Heating control and cooling control are opposite operations with inverted outputs. The *PID* time constant varies depending on the characteristics of the section controlled during *PID control*. **The value of the control output is *MV (Manipulated Variable).*** *MV* is a percentage value that controls the switching of the assigned device output according to the settings.

Setting group	Parameter	Range	Default
PAR3	O-FT	Standard model: HEAT / COOL	HEAT
		Heating/cooling model: HEAT / COOL / H-C	H-C

5.5.1 Heating Control [PAR3 → O-FT → HEAT] or Cooling Control [PAR3→ O-FT → COOL]

Heating control mode: If the Process Value *(PV)* falls below the Set Value *(SV)*, the output will power the heater.
Cooling control Mode: If the Process Value *(PV)* rises above the Set Value *(SV)*, the output will power the cooler.

5.5.2 Heating & Cooling Control [PAR3 → O-FT → H-C]

Heating and cooling control mode: heating and cooling with a single temperature controller if it is difficult to control the temperature of the object by heating or cooling alone. The heating and cooling control mode uses different PID time constants to control heating and cooling. It is possible to set the heating and cooling control in both *PID* control and *ON / OFF* control modes.

For heating and cooling control, the relay control output *OUT1* is assigned to the heating control, and the SSR / current control output *OUT2* is assigned to the cooling control. Note that the *OUT2* SSR drive output uses Ex ia standard *(on / off)* control.

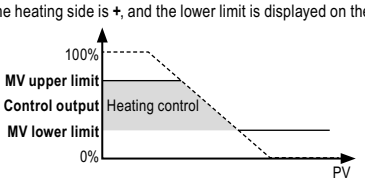
5.5.3 Deadband/Overlap Band [PAR2 → DB]

It is possible to assign a deadband between the heating and cooling control bands based on the Set Value *(SV)* for heating and cooling. A deadband is formed around the *SV* when a positive *(+)* value is set. There is no regulation in the deadband, so the heating and cooling *MV (Manipulated Variable)* will be 0.0% in the deadband formed. When the negative *(-)* value is set, an overlap band *(simultaneous heating and cooling MVs)* is formed around the SV. Set to 0 if no deadband or overlap band is used.

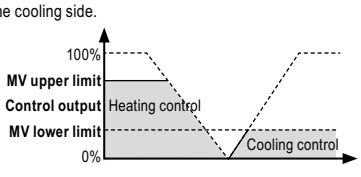
When setting the integral time, this applies if the integral time for the heating control and cooling control is set. It also acts as a P-P controller for PI-P control and P-PI control.

5.5.4 MV Upper Limit Value [PAR2 → H-MV] and MV Lower Limit Value [PAR2 → L-MV]

The upper / lower limits of the control output *MV* **[H-MV / L-MV]** can be set to the actual *MV*, provided that the *MV* calculation of the temperature controller exceeds the limits.
When controlling heating and cooling, the cooling *MV* contains a „**-**" prefix. Therefore, the upper limit displayed on the heating side is **+**, and the lower limit is displayed on the cooling side.



Standard control *(heating)*



Heating and cooling control

Parameter	Description / Range	Default
H-MV	Standard control: MV lower limit value [L-MV] +0.1…100.0	100.0%
	Heating and cooling control: 000.0…100.0 (PID) 0.0 (OFF)/100.0 (ON) (ON/OFF)	100.0%
L-MV	Standard control: 000.0…MV upper limit value [H-MV] –0.1	0.0%
	Heating and cooling control: –100.0…000.0 (PID), –100.0 (ON) / 0.0 (OFF) (ON/OFF)	–100.0%

Note: The same MV limits apply during auto-tuning. The MV limits do not apply to manual control, MV when control is stopped, MV sensor failure, and initial manual control. The MV upper / lower limit configuration is not available in the ON / OFF standard control mode (heating or cooling control).

5.5.5 MV Settings for Sensor Break Error [OPEN] [PAR5 → ErMV]

In the event of an open sensor error, the output value of the controller can be set to a predefined *MV* value instead of ON / OFF or PID control. Ignores the *MV* based on the ON / OFF or PID control and sends a control value based on the specified *MV*. Default setting: 0.0%.

5.5.6 Auto/Manual control settings

The automatic mode is for the temperature to reach SV with the MV value calculated by the PID control. The purpose of the manual mode is for the temperature to reach SV with a user-defined MV value.
It is possible to switch to manual mode during STOP state. It is also possible to switch between automatic / manual mode during adjustment, but automatic tuning will stop if manual control is switched on during automatic tuning.
If a sensor break alarm occurs in **[SBA]** normal mode, the *MV* **[Er***MV***]** sensor fault will occur. The *MV* settings for manual and automatic control can be changed in this state.
Operational priority: Manual control > Stop > Open *(sensor disconnected)*

5.5.6.1 Switching Between Manual/Auto Control

Switching to manual mode for standard control (heating or cooling):

- In 'Normal' mode, press the MODE button, and the device will switch to *MV* monitoring mode. The *SV* display shows **H** *(heating control)* or **C** *(cooling control)* and shows *MV*, indicating the start of *MV* monitoring.
- If any of ◀ ▼ ▲ is pressed during *MV* monitoring, the *MAN* indicator will turn on, and the lowest digit *(100 digits)* will flash to indicate that the manual control is active.
- Press the ◀ button to move the flashing digit *($10^0 \rightarrow 10^1 \rightarrow 10^2 \rightarrow 10^3 \rightarrow 10^0$)*!
  Select the digit and configure the desired *MV* value with the ◀ ▼ ▲ buttons 0 → 1 → 2 → 3 → 4 → 5 → 6 → 7 → 8 → 9 → 0 using the ▼ ▲ buttons.
- In either state, press the MODE button to end manual control. The *MAN* indicator light goes out, and the system returns to automatic control mode.

Switching to manual mode for heating and cooling control:

- The procedure is the same as for heating or cooling. After setting the heating, the next step is to set the cooling *(C)*.

Note: After heating and cooling control, the system returns to automatic control in the order of heating monitoring, manual heating control, cooling monitoring, and manual cooling control. To switch between automatic and manual mode, press the MODE button once. The heating MV remains valid during cooling monitoring and manual cooling control. When the [DI-1] digital input function is set to AUTO / MANUAL [MAN], the MODE button on the front panel and the auto / manual control functions via communication do not work.

5.5.6.2 Initial MV Manual Control [PAR5 → PrMV]

If the basic MV for manual control is set to PrMV, the initial MV can be set to manual mode. For ON / OFF and PID control, the default setting is Standard or Heating and Cooling: 0.0%.

5.6 TEMPERATURE CONTROL

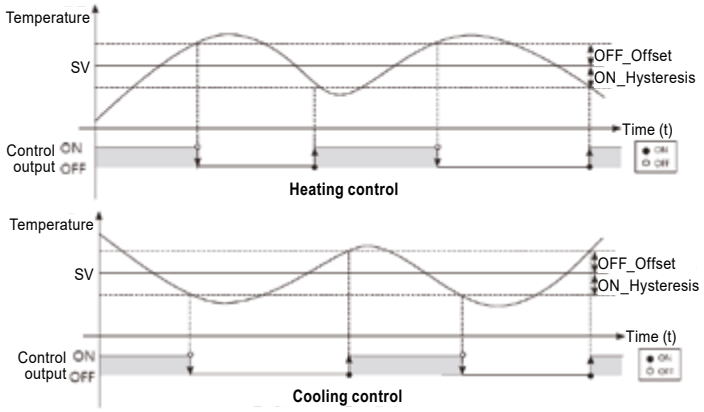
5.6.1 Temperature Control Mode [PAR3 → C-MD]

Choose the type of temperature control method.
Default setting: PID/PP.

Setting		Description	
		Heating	Cooling
Standard Control	**PID**	PID	
	ONOF	ON/OFF	
Heating & Cooling Control	**PP**	PID	PID
	PON	PID	ON/OFF
	ONP	ON/OFF	PID
	ONON	ON/OFF	ON/OFF

5.6.2 ON/OFF Control with Hysteresis Function [PAR3 → C-MD → ONOF]

It controls the temperature by comparing the process value *(PV)* with the set value *(SV)* and switching the load on or off.



Hysteresis [PAR2 → hHYS/hOFT/cHYS/cOFT]

Hysteresis is the setting of the control output on and off point in ON / OFF mode. *ON_Hysteresis* sets the output to an ON point, and *OFF_Offset* sets an off point. The values are set in *°C / °F*.

Parameter	Description / Range	Default
hHYS	Sets *ON_Hysteresis* to heating control	**002**
hOFT	Sets *OFF_Offset* to heating control	
cHYS	Sets *ON_Hysteresis* to cooling control	**000**
cOFT	Sets *OFF_Offset* to cooling control	

5.6.3 PID Control [PAR3 → C-MD → PID]

PID control is a combination of the proportional *(P)*, integral *(I)*, and differential *(D)* control and provides excellent control over the devices, even with a delay time. The device uses the same *PID* time constant for SV0… SV1.

Proportional control *(P)* follows the set control value well with a small error; integral control *(I)* automatically corrects the error, and differential control *(D)* accelerates the response to the control. Through these operations, PID control achieves ideal temperature control.
Note: The PID controller can also be set as a P, PI, or PD controller.
Proportional control (P): Select PID control and set the integration and differential time to 0000.
Proportional Integral Control (PI): Select PID control and set the differential time to 0000.
Proportional Differential Control (PD): Select PID control and set the integration time to 0000.

5.6.3.1 Setting the Proportional Band for Heating [PAR2 → H-P] and Cooling [PAR2 → C-P]

If the Process Value *(PV)* is within the proportional band *(P)*, the ON / OFF ratio must be adjusted during the proportional period *(T)*. The defined proportional control *(time proportional control)* section is called the proportional band. Default value: 10.0. It is set in *°C / °F / %*.

5.6.3.2 Setting Integral Time for Heating [PAR2 → H-I] and Cooling [PAR2 → C-I]

*MV*s from integrative and proportional operation become identical if the deviation is consistent. The time required for the two *MV*s to match is called the integral time. Default value: 0 s.
Note: Integration does not occur if the integral time is set to 0. Setting the integral time too short can increase correction movements and cause control oscillations.

5.6.3.3 Setting Derivative Time for Heating [PAR2 → H-D] and Cooling [PAR2 → C-D]

According to the difference of the ramp, the *MV* obtained from the derivative operation and the time required to reach the *MV* obtained from the proportional control are called the derivative time.
Note: The differentiation member stops when the derivative time is set to 0.

5.6.3.4 Setting Control Period for Heating [PAR3 → H-T] and Cooling [PAR3 → C-T]

If a relay or SSR is used with control proportional to the *MV* output, the output will be on for a period of time *(within the control period, as a percentage of the MV)* and will remain off for the rest of the time. The preset period when the output is ON / OFF is called the proportional control period.
Control with SSR drive output is faster than relay output. Therefore, setting a shorter control period can achieve more sensitive temperature control.
Default – Relay: 20.0 s / SSR: 2.0 s.
Note: If heating and cooling control is used, configure the control period for heating and cooling separately.

5.6.4 Auto-Tuning

Automatic tuning measures the controlled section's temperature characteristics and thermal response rate and then determines the required PID time constants. *(If the* **[C-MD]** *control type is PID, it is displayed.)*

This operation will stop automatically if an **[OPEN]** error occurs during auto-tuning.
To stop auto-tuning, change the setting to OFF. *(In this case, the P, I, D values before auto-tuning are retained.)*

5.6.4.1 Auto-Tuning ON/OFF [PAR2 → AT]

Auto Tuning automatically stores the PID time constants when completed. These PID time constants can then be modified according to their usage environment. Default setting: OFF.
When auto-tuning is in progress, the *AT* indicator on the controller's front flashes every 1 second. When auto-tuning is completed, the *AT* indicator will automatically turn off, and the auto-tuning parameter will return to the *OFF* position.

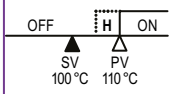
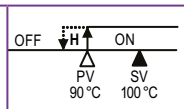
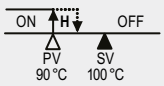
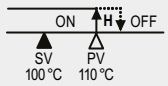
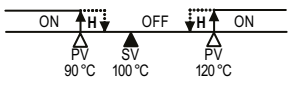
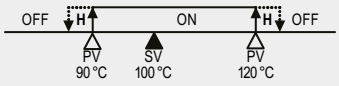
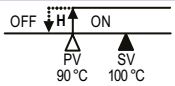
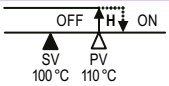
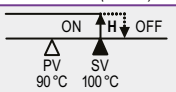
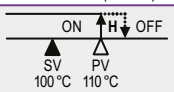
Setting	Description
OFF	Auto-tuning is off or finished
ON	Auto-tuning is in progress

5.7 ALARM OUTPUT

There are three alarms that operate separately. In addition, the combined alarm operation and alarm option can be set. Use the digital input setting as **[AIRE]** or turn off the unit and restart the unit to clear the alarm operation.

5.7.1 Alarm Operation [PAR4 → AL-1]

Select the alarm operation. Default setting is "*DV* [["

Mode	Name	Alarm operation		Description (default)
OFF	-	-		No alarm output
DV]]	Deviation upper limit alarm	 Upper deviation: Set to 10 °C *(50 °F)*	 Upper deviation: Set to –10 °C *(14°F)*	If the deviation between *PV* and *SV* is higher than the set value for the high temperature deviation, the alarm output will turn on. The upper limit deviation temperature can be set at **AL1H.**
]]DV	Deviation lower limit alarm	 Lower deviation: Set to 10 °C *(50 °F)*	 Lower deviation: Set to –10 °C *(14°F)*	If the deviation between *PV* and *SV* is higher than the deviation temperature setpoint as a lower limit, the alarm output will turn on. The lower limit can be set for the **AL1L**.
]DV[	Deviation upper / lower limit alarm	 Lower deviation: Set to 10 °C *(50 °F)* Upper deviation: Set to 20 °C *(68 °F)*		If the deviation of the upper / lower limit between *PV* and *SV* is higher than the deviation temperature setpoint, the alarm output will turn on. The upper limit deviation temperature can be set in **AL1H**. The lower limit deviation temperature can be set in **AL1L**.
[DV]	Reverse alarm upper / lower limit	 Lower deviation: set to 10 °C *(50 °F)* Upper deviation: set to 20 °C *(68 °F)*		If the difference between the *PV* and *SV* upper / lower limit is higher than the set temperature difference, the alarm output will turn off. The upper limit deviation can be set in **AL1H**. The lower limit deviation can be set in the **AL1L**.
PV[[	Absolute value upper limit alarm	 Absolute value of alarm: set to 90 °C *(194 °F)*	 Absolute value of alarm: set to 110 °C *(230 °F)*	If the *PV* is higher than the absolute value, the output will turn on. The absolute value alarm **can be set in AL1H.**
]]PV	Absolute value lower limit alarm	 Absolute value of alarm: set to 90 °C *(194 °F)*	 Absolute value of alarm: set to 110 °C *(230 °F)*	If the *PV* is lower than the absolute value, the output will turn on. The absolute value of the alarm **can be set in the AL1L.**
LBA	Loop break alarm	–		Turns on when it detects a loop break.
SBA	Sensor error alarm	–		It turns on when the connection to the sensor is lost.
HBA	Heating error alarm	–		It turns on when the CT detects a break in the heater.

5.7.2 Alarm Output Settings [PAR4 → AL1T]

Users can select alarm output settings. Default setting: AL-A

Setting	Mode	Description
AL-A	Standard alarm	If there is an alarm condition, the alarm output is ON. If there is no alarm condition, the alarm output is OFF.
AL-B	Alarm latch	If an alarm condition exists, the alarm output is ON and remains ON.
AL-C	Standby sequence 1	The first alarm condition is ignored, and the second alarm condition operates in normal alarm mode. If there is power supplied and there is an alarm condition, the first alarm condition is ignored and the standard alarm operates from the second alarm condition.
AL-D	Alarm latch and standby sequence 1	If there is an alarm condition, it activates the alarm latch and the standby sequence. If there is power and there is an alarm condition, the first alarm condition is ignored and the alarm latch operates from the second alarm condition.
AL-E	Standby sequence 2	The first alarm condition is ignored, and the second alarm condition is the normal alarm. When the standby sequence is re-applied and an alarm condition occurs, the alarm output will not turn on. After clearing the alarm condition, the standard alarm will operate.
AL-F	Alarm latch and standby sequence 2	The basic operation is the same as the alarm latch and the 1st standby sequence. Not only does it work by turning on / off, but also changing the alarm setting value or alarm option. Re-application of the standby sequence and if there is an alarm condition, the alarm output will not turn on. After clearing the alarm condition, the alarm latch will operate.

5.7.3 Alarm Output Lower [PAR1 → AL1L] and Upper [PAR1 → AL1H] Limit Value Settings

Output alarm activation values can be set. The **[AL1H / AL1L]** configuration parameters are activated for each setting according to the selected alarm operation. The upper / lower limit values are according to the individual input specification of the sensor. The lower limit is the reference value for determining burnout of the heating element. Default setting - Temperature: 1550 / Analog: 100.0

5.7.4 Alarm Output Hysteresis [PAR4 → A1HY]

Setting the on / off interval for alarm output 1 *(5.7.1 Alarm operation* **[PAR4 → AL-1]***)*. "H" means the hysteresis of the alarm output in alarm operation. It is used to set the interval between the ON / OFF periods of the alarm outputs. Default setting: 1. It is set to °C / °F / %.

5.7.5 Alarm NO/NC [PAR4 → A1N]

Selects the contact type for alarm output 1. The contact mode of the relay can be set in the event of an alarm. Default setting: NO.

Setting	Decription
NO	Normally open – Stays open normally and closes when there is an alarm.
NC	Normally closed – Stays closed normally, opens only when there is an alarm.

5.7.6 Alarm Output Delay Settings [PAR4 → A1ON / A1OF]

The alarm output delay can be set to prevent false alarms caused by faulty input signals due to interference or noise. The default setting for both parameters: 0 s.
If there is a preset delay time, the alarm output will not turn on for the preset time. Instead, the front alarm indicator flashes every 0.5 seconds.

5.7.7 Loop Break Alarm (LBA) [PAR4 → AL-1/ → LBA]

Diagnose the control loop by monitoring the temperature change in the control circuit and send alarms if necessary.

5.7.8 LBA Monitoring Period [PAR4 → LBaT]

The *LBA* monitoring time can be set to control the temperature changes of the controlled section. Automatic adjustment with automatic tuning. Default setting: 0 s.

5.7.9 LBA Detection Band [PAR4 → LBaB]

The minimum deviation value can be set to decrease during the LBA monitoring time. Automatic adjustment with automatic tuning. *(If the SV is outside the auto adjustment range, the auto adjustment will be set to the maximum or minimum value.)*

5.7.10 Sensor Break Alarm [PAR4 → AL-1 → SBA]

The controller can be set to send an alarm if no sensor is connected or it is disconnected during temperature control.

5.7.11 Heater Burnout Alarm [PAR4 → AL-1 → HBA]

If a heater is used to increase the temperature of the controlled section, the PMG-500 temperature controller can be set to monitor the heater power supply and send an alarm if it detects a heater connection fault.

The device detects the power supply to the heater using a current transformer *(CT)* which converts the current to the heater to a specified ratio *(CT ratio)* for inspection. If the heating current **[CT-A]** measured by the CT is less than the setting value of the heating sensor **[AL1L]**, the heater burnout alarm is activated.

Heater burnout detection settingsi [PAR1 → AL1L]

Set the alarm output value **[AL1L]** as the reference value to detect the heater burnout. Default setting: 0.0. Unit: A.

Note: Set to 0.0 to turn off. Set to 50.0 to turn on.

5.7.12 Alarm Output Deactivation [PAR5 → DI-K→ ALRE]

Available only when the alarm output is set to alarm latch or alarm latch and standby sequence 1, alarm latch and standby sequence 2. It can be set to turn off the alarm output when the alarm output is on, the alarm output conditions are cleared, or the alarm output deactivation signal is greater than the minimum signal band. *(However, deactivating the alarm output is not available if the alarm conditions are still valid.)*

5.8 ANALOG TRANSMISSION

5.8.1 Analog Transmission Output Value Settings [PAR4 → AoM1]

The analog transmission output is an auxiliary output that converts the controller present value, set value, heating *MV*, cooling *MV* to analog current *(DC 4… 20 mA)* for external transmission. Fixed to *PV* transmission mode, other modes are not supported yet.

5.8.2 Transmission Output Upper / Lower Limit Value Settings [PAR4 → FsL1/ FsH1]

If the transmission output value **[AoM 1]** is below the lower limit of the transmission output **[FsL1]**, an output value of 4 mA will be present. If the transmission output is between the lower limit **[FsL1]** and the upper limit **[FsH1]**, a certain proportional output value is transmitted in the range between 4 mA and 20 mA. If it exceeds the upper limit **[FsH1]**, an output value of 20 mA will be present. If the upper limit of the transmitter output **[FsH1]** is equal to the lower limit of the transmission output **[FsL1]**, the transmission output is 4 mA.

5.9 COMMUNICATION

This function is used by external systems *(PC, GP, PLC, etc.)* to monitor the controller. It can be used to transfer data transferred to external devices. There can be no redundant unit addresses on the same communication line. The communication cable must be a twisted pair that supports the RS485 standard.

Interface:

Type	Description
Communication protocol	Modbus RTU
Connection type	RS485
Application standard	EIA RS485 compliant
Maximum number of connections	31 unit (address: 01…99)
Synchronization method	Asynchronous
Communication method	2-wire, half-duplex
Communication distance	Max. 800 m
Communication speed	2400, 4800, 9600, 19200, 38400 bps
Communication response time	5…99 ms
Start bit	1-bit (fix)
Data bit	8-bit (fix)
Parity bit	None, odd, even
Stop bit	1-bit, 2-bit

5.9.1 Unit Address Settings [PAR4 → ADRS]

5.9.2 BPS (Bits Per Second) Settings [PAR4 → BPS]

5.9.3 Communication Parity Bit [PAR4 → PRTY]

5.9.4 Communication Stop Bit Settings [PAR4 → STP]

5.9.5 Response Timeout Settings [PAR4→ RSwT]

5.9.6 Enable / Disable Communication Writing [PAR4→ COMW]

This function can change the parameter settings stored in the memory with the PC, GP, PLC, etc. to enable or disable writing. Default setting: EnA.

5.10 OTHER FUNCTIONS

To access all functions and detailed settings of the device, read the User's and Programming Manual.

Download User's & Programming Manual

5.10.1 Heating MV Monitoring

5.10.2 Cooling MV Monitoring

5.10.3 Heating Current Monitoring [PAR1 → CT-A]

5.10.4 RUN/STOP [PAR1 → R-S]

5.10.4.1 Stop Control Output Settings [PAR5 → StMV]

5.10.4.2 Stopping the Alarm Output [PAR5 → StAL]

5.10.5 Multi SV

5.10.6 Digital Input

5.10.7 User Level Settings [PAR5 → USER]

5.10.8 SV Group Lock [PAR5 → LcSV]

5.10.9 Parameter Group Lock [PAR5 → LcP1/LcP2/LcP3/LcP4/LcP5]

5.10.10 Reset Parameter [INIT]

5.10.11 Password Settings [PAR5 → PWD]

6. ERROR CODES

The controller diagnoses the input signals for errors and displays the messages accordingly. These messages inform the user of device problems. When the input value returns to the appropriate range, the alarm is deactivated and the device returns to normal operation.

Message	Input	Description	Output
HHHH	Temperature sensor	Flashes at 0.5 second intervals when the input value is above the input range.	Standard: Heating: 0%, cooling: 100%. Heating and cooling: heating: 0%, cooling: 100%.
	Analog	Flashes every 0.5 seconds if the input value exceeds 5…10% of the upper or lower limit.	Standard output
LLLL	Temperature sensor	Flashes every 0.5 seconds if the input value is below the input range.	Standard: Heating: 100%, cooling: 0% Heating and cooling: heating: 100%, cooling: 0%
	Analog	Flashes every 0.5 seconds if the input value exceeds 5…10% of the lower or upper limit.	Standard output
OPEN	Temperature sensor	Flashes at 0.5 second intervals for input disconnection.	Sends out the set MV. [PAR5 → ErMV]
	Analog	Flashes at 0.5 second intervals when F.S. more than ±10%.	
ERR	Temperature sensor	Flashes every 0.5 seconds when an error has occurred in the setting and returns to the screen before the error.	–

If the upper and lower limit scale settings are the same, ERR flashes twice and the "Setting" mode will be displayed.

For analog input, ±5% of the set upper / lower limit is extended. The analog output is also expanded by comparing the input value. *(Using a ±5% extension within the temperature range for a temperature sensor input.)*

7. MAINTENANCE, REPAIR, AND STORAGE

The device does not require regular maintenance. The warranty card contains the terms and conditions. Before returning the device for repairs, it must be cleaned thoroughly. The parts in contact with the medium may contain harmful substances; therefore, they must be decontaminated. Our official form (Returned Equipment Handling Form) must be filled and enclosed in the parcel. Download it from our website www.nivelco.com. The device must be sent back with a declaration of decontamination. A statement must be provided in the declaration that the decontamination process was successfully completed and that the device is clean from any hazardous substances. Unused devices must be stored at –20…+60 °C (–4…+140 °F) ambient temperature and 35…85% RH ambient humidity.

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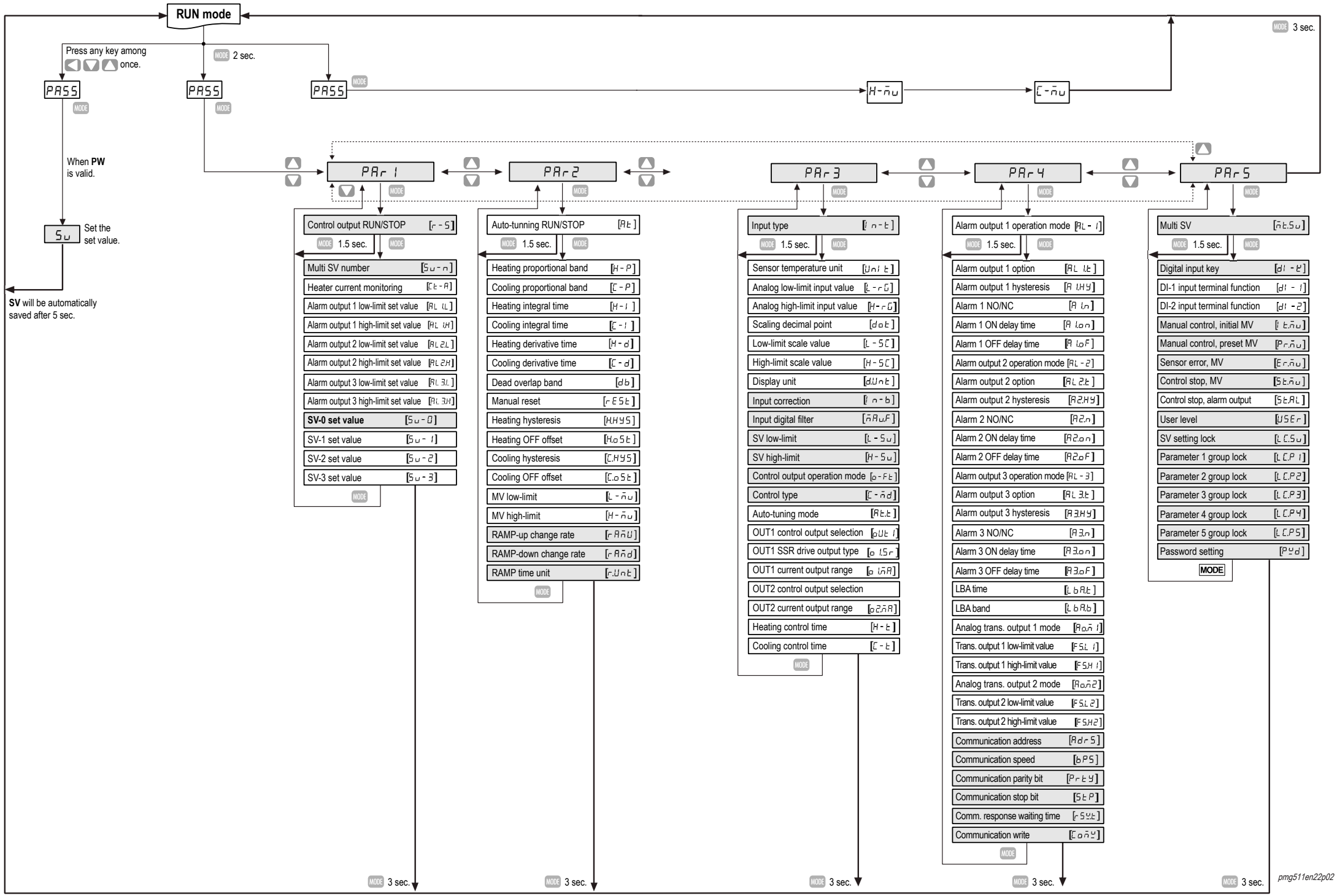
8. MENU MAP


RUN mode
Press any key among ◀ ▼ ▲ once.
MODE 2 sec.
MODE 3 sec.
PASS
When PW is valid.
Set the set value.
SV will be automatically saved after 5 sec.
H-ñu
C-ñu
PAr 1
PAr 2
PAr 3
PAr 4
PAr 5
MODE 1.5 sec.
Control output RUN/STOP [r-S]
Multi SV number [Su-n]
Heater current monitoring [Ct-A]
Alarm output 1 low-limit set value [AL 1L]
Alarm output 1 high-limit set value [AL 1H]
Alarm output 2 low-limit set value [AL2L]
Alarm output 2 high-limit set value [AL2H]
Alarm output 3 low-limit set value [AL3L]
Alarm output 3 high-limit set value [AL3H]
SV-0 set value [Su-0]
SV-1 set value [Su-1]
SV-2 set value [Su-2]
SV-3 set value [Su-3]
Auto-tunning RUN/STOP [AT]
Heating proportional band [H-P]
Cooling proportional band [C-P]
Heating integral time [H-I]
Cooling integral time [C-I]
Heating derivative time [H-d]
Cooling derivative time [C-d]
Dead overlap band [db]
Manual reset [rESt]
Heating hysteresis [HHYS]
Heating OFF offset [HoSt]
Cooling hysteresis [CHYS]
Cooling OFF offset [CoSt]
MV low-limit [L-ñu]
MV high-limit [H-ñu]
RAMP-up change rate [rAñU]
RAMP-down change rate [rAñd]
RAMP time unit [r.Unt]
Input type [In-t]
Sensor temperature unit [Unit]
Analog low-limit input value [L-rG]
Analog high-limit input value [H-rG]
Scaling decimal point [dot]
Low-limit scale value [L-SC]
High-limit scale value [H-SC]
Display unit [d.Unt]
Input correction [In-b]
Input digital filter [ñAuF]
SV low-limit [L-Su]
SV high-limit [H-Su]
Control output operation mode [o-Ft]
Control type [C-ñd]
Auto-tuning mode [AtE]
OUT1 control output selection [oUt1]
OUT1 SSR drive output type [o 1Sr]
OUT1 current output range [o 1ñA]
OUT2 control output selection
OUT2 current output range [o2ñA]
Heating control time [H-t]
Cooling control time [C-t]
Alarm output 1 operation mode [AL-1]
Alarm output 1 option [AL 1t]
Alarm output 1 hysteresis [A 1HY]
Alarm 1 NO/NC [A 1n]
Alarm 1 ON delay time [A 1on]
Alarm 1 OFF delay time [A 1oF]
Alarm output 2 operation mode [AL-2]
Alarm output 2 option [AL2t]
Alarm output 2 hysteresis [A2HY]
Alarm 2 NO/NC [A2n]
Alarm 2 ON delay time [A2on]
Alarm 2 OFF delay time [A2oF]
Alarm output 3 operation mode [AL-3]
Alarm output 3 option [AL3t]
Alarm output 3 hysteresis [A3HY]
Alarm 3 NO/NC [A3n]
Alarm 3 ON delay time [A3on]
Alarm 3 OFF delay time [A3oF]
LBA time [LbAt]
LBA band [LbAb]
Analog trans. output 1 mode [Aoñ1]
Trans. output 1 low-limit value [FSL1]
Trans. output 1 high-limit value [FSH1]
Analog trans. output 2 mode [Aoñ2]
Trans. output 2 low-limit value [FSL2]
Trans. output 2 high-limit value [FSH2]
Communication address [Adr S]
Communication speed [bPS]
Communication parity bit [PrtY]
Communication stop bit [StP]
Comm. response waiting time [rSUt]
Communication write [CoñY]
Multi SV [ñt.Su]
Digital input key [dI-K]
DI-1 input terminal function [dI-1]
DI-2 input terminal function [dI-2]
Manual control, initial MV [It.ñu]
Manual control, preset MV [Pr.ñu]
Sensor error, MV [Er.ñu]
Control stop, MV [St.ñu]
Control stop, alarm output [St.AL]
User level [USEr]
SV setting lock [LC.Su]
Parameter 1 group lock [LC.P1]
Parameter 2 group lock [LC.P2]
Parameter 3 group lock [LC.P3]
Parameter 4 group lock [LC.P4]
Parameter 5 group lock [LC.P5]
Password setting [PYd]
MODE 3 sec.
pmg511en22p02