PCT-3001 *plus*

DIGITAL PRESSURE CONTROLLER FOR COOLING PLANTS

Ver.02

PCT3001V02-04T-14727

1 - DESCRIPTION

Pressure controller for refrigeration systems capable to control suction (compressors) and discharge (fans) pressures. It is possible to connect 4 pressure sensors for up to 2 independent refrigeration groups (2 suctions and 2 discharges). Using the pressure readings from these 4 pressure sensors and from up to 6 temperature sensors, it executes several control modes using up to 26 digital and 4 analog outputs. The last 4 digital outputs can be used by external alarms, that can be driven by a controller's internal information (i.e. temperature, pressure, etc) or by the 5 digital inputs available, which can be used as well to activate a night mode between other functions.
The **PCT-3001** *plus* has a dead band logic as well, which can be used to reduce energy consumption and machinery wear (compressors). It allows the use of several pressure sensors through its configurable pressure sensor range. Another important feature is the start/stop command, which can be used to deactivate a frequency inverter.
Through its advanced parameters table, it is possible to configure several temperature and pressure alarms, liquid gathering output, sub-cooling outputs, breeze system, etc. Using a user defined gas curve and the pressure and temperature readings, the **PCT-3001** *plus* is capable to measure the sub-cooling and super-heating of the refrigeration system.

It has a serial port to connect with Sitrad supervisory software.
The product comes with 1 pressure sensor for suction SB69-200A (0 to 200psi), 1 for discharge SB69 – 500A (0 to 500psi), 1 temperature sensor (-50°C to 105°C) and 1 sensor SB59 (-50°C to 200°C).

2 - APPLICATION

To be applied in complex refrigeration process control, used in compressor bank(s) (suction) and in the fan bank (discharge).

3 - TECHNICAL SPECIFICATIONS

- **Power Supply:** 12 Vdc / 1,3A
- **Control Pressure:** 0 to 200 psi / 0 to 13,8 bar (using the SB69-200A transducer)
  0 to 500 psi / 0 to 34.4 bar (using the SB69-500A transducer)
- **Pressure Resolution:** 1 psi / 0.1 bar
- **Control Temperature:** -50 to 200°C / -58 to 392°F
- **Temperature Resolution:** 0.1°C between -10 and 100°C and 1°C in the rest of the range
  1°F in all range
- **Maximum current per digital outputl:** 200mA (250Vac)
- **Maximum current per analogue output:** 10mA (0 to 10Vdc)
- **Controller operating temperature:** 0 to 50°C
- **Pressure transducer operating temperature:** -25 to 80°C
- **Temperature transducer operating temperature:** -50 to 105°C (SB19), -50 to 200°C (SB59)
- **Operating humidity:** 10 to 90% RH (without condensation)
- **Pressure inputs:** PRES 1 Pressure in the gas line of pressure switch 1
  PRES 2 Pressure in the gas line of pressure switch 2
  PRES 3 Pressure in the gas line of pressure switch 3
  PRES 4 Pressure in the gas line of pressure switch 4

- **Temperature inputs:** TEMP 1 temperature of the gas line of pressure switch 1
  TEMP 2 temperature of the gas line of pressure switch 2
  TEMP 3 temperature of the gas line of pressure switch 3
  TEMP 4 temperature of the gas line of pressure switch 4
  TEMP 5 temperature of the liquid discharge line 1
  TEMP 6 temperature of the liquid discharge line 2

- **Digital inputs:** DIG 1 to 5 - dry contact digital inputs
- **Control outputs:** OUT 0 to 22 digital control outputs (max 200mA/250Vac)
  OUT 23 to 26 digital control outputs or alarm output (max 200mA/250Vac)
  AN 1 analogue output for pressure switch 1 (0 to 10Vdc, max 10mA)
  AN 2 analogue output for pressure switch 2 (0 to 10Vdc, max 10mA)
  AN 3 analogue output for pressure switch 3 (0 to 10Vdc, max 10mA)
  AN 4 analogue output for pressure switch 4 (0 to 10Vdc, max 10mA)
- **Dimensions (WxHxD):** 220x134x54mm

4 - NOMENCLATURE ADOPTED IN THEMANUAL

P1 - Internal pressure switch 1
P2 - Internal pressure switch 2
P3 - Internal pressure switch 3
P4 - Internal pressure switch 4

PRES 1 - Pressure input 1
PRES 2 - Pressure input 2
PRES 3 - Pressure input 3
PRES 4 - Pressure input 4

TEMP 1 - Temperature input 1
TEMP 2 - Temperature input 2
TEMP 3 - Temperature input 3
TEMP 4 - Temperature input 4
TEMP 5 - Temperature input 5
TEMP 6 - Temperature input 6

THERMO1 - Internal thermostat 1
THERMO2 - Internal thermostat 2
THERMO3 - Internal thermostat 3
THERMO4 - Internal thermostat 4
THERMO5 - Internal thermostat 5
THERMO6 - Internal thermostat 6

DIG 1 - Digital input 1
DIG 2 - Digital inputl 2
DIG 3 - Digital input 3
DIG 4 - Digital input 4
DIG 5 - Digital input 5

AN 1 - analogue output 1
AN 2 - analogue output 2
AN 3 - analogue output 3
AN 4 - analogue output 4

Gp1 - Pressure switches group 1
GP2 - Pressure switches group 2

S1 - Suction 1
S2 - Suction 2
S3 - Suction 3

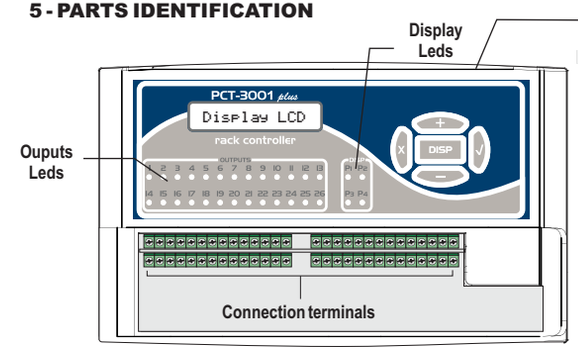
Suc1 - Suction1
Suc2 - Suction 2
Suc3 - Suction 3

D1 - Discharge 1
D2 - Discharge 2

Desc1 - Discharge 1
Desc2 - Discharge 2

OUT X - Digital output X (that X can be 1 to 26)

5 - PARTS IDENTIFICATION



DISP -Activate themain temporary display
-Exit the secondary display (quick press)
-Reset the secondary display value (long press)

√ -Confirm / advance
-Secondary alarm display
-Next pressure switch

X -Cancel / back
-Secondary hourmeter display
-Previous pressure switch

+ -Increment value
-Secondary minimum and maximum display
-Next item

– -Decrement value
-Secondary general information display
-Previous item

6 - OPERATING MODES

6.1 - Description

The **PCT-3001** *plus* can be configured to operate in four different ways. Each option is called as Operating Mode. The operating modes establish how many internal pressure switches the controller must operate, as well as which pressure inputs and temperature inputs must be used. Depending on the operation mode, the interlocking of pressure switch alarms will change according to the groups formed by different pressure switches (alarm interlocking occurs only between same group pressure switches). The available operating modes are:

One suction and one discharge: In this mode the controller will have two internal pressure switches, being one to control the compressors(suction) and another one to control the fans (discharge).
The suction pressure switch uses one sensor from 0 to 200 psi to measure the pressure in the gas line together with an optional temperature sensor **(optional).**
The discharge pressure switch uses one sensor from 0 to 500 psi to measure the pressure in the gas line together with an optional temperature sensor **(optional).** The discharge pressure switch has an additional option for using a second temperature sensor to control the condensation temperature of the refrigerant fluid.

Two suctions and one discharge: In this mode the controller will have three internal pressure switches, being two to control the compressors (suction 1 and suction 2) and another one to control the fans (discharge).
Each suction pressure switch uses one sensor from 0 to 200 psi to measure the pressure in the gas line together with an optional temperature sensor **(optional).**
The discharge pressure switch uses one sensor from 0 to 500 psi to measure the pressure in the gas line together with an optional temperature sensor **(optional).**The discharge pressure switch has an additional option for using a second temperature sensor to control the condensation temperature of the refrigerant fluid.

Three suctions and one discharge: In this mode, the controller will have 4 internal switches, 3 of which control the compressors (suction 1, suction 2 and suction 3) and the other controls the fans (discharge).
Each suction pressure switch will use a 0-200 psi sensor to measure the pressure in the gas line, along with an optional temperature sensor **(optional).**
The discharge pressure switch will use a 0-500 psi sensor to measure the pressure in the gas line, along with an optional temperature sensor **(optional).**

The discharge pressure switch also offers the option to use a second temperature sensor to control the condensing temperature of the refrigerant.
In this operation mode, suction pressure switches (P1, P2 and P3) and discharge pressure switch (P2) form a single pressure switch group.

Two suctions and two discharges: In this mode, the controller will have 4 internal switches, 2 of which control the compressors (suction 1 and suction 2) and the other 2 control the fans (discharge 1 and discharge 2).
Each suction pressure switch will use a 0-200 psi sensor to measure the pressure in the gas line, along with an optional temperature sensor
Each of the discharge pressure switches will use a 0-500 psi sensor to measure the pressure in the gas line, along with an optional temperature sensor **(optional).** Each discharge pressure switch also offers the option to use a second temperature sensor to control the condensing temperature of the refrigerant.
In this operation mode, suction pressure switch 1 (P1) and discharge pressure switch 2 (P2) form the pressure switch 1 group, while suction pressure suction 2 (P3) forms the second pressure switch group along with discharge pressure switch 2 (P4).

6.2 - Type of internal pressure switch depending on the operating mode

The table below shows the function each pressure switch to control the refrigeration system.

Operating Mode	Internal pressure switch			
	P1	P2	P3	P4
1 suction 1 discharge	Suction	Discharge		
2 suctions 1 discharge	Suction	Suction	Discharge	
3 suctions 1 discharge	Suction	Suction	Suction	Discharge
2 suctions 2 discharges	Suction	Discharge	Suction	Discharge

6.3 - Pressure switch groups according to operation mode

Because the switches in a cooling system operate in an interrelated manner, their pressure control logic should consider that an alarm situation in one of the switches triggers an equivalent corrective action in all other pressure switches in the same system.As **PCT-3001** *plus* is capable of controlling up to 2 different cooling systems, "Pressure Switch Groups" were created to represent all internal pressure switches that belong to the same cooling system. The table below shows the pressure switch groups that each operation mode will have, noting that interlocking in case of alarm will occur only between same group switches.

Operating Mode	Internal pressure switch			
	P1	P2	P3	P4
1 suction 1 discharge	Group 1	Group 1		
2 suctions 1 discharge	Group 1	Group 1	Group 1	
3 suctions 1 discharge	Group 1	Group 1	Group 1	Group 1
2 suctions 2 discharges	Group 1	Group 1	Group 2	Group 2

6.4 - Abbreviations and colors of the internal pressure switches depending on the operating mode

The **PCT-3001** *plus* uses a color system to quickly identify which internal pressure switch is being viewed. This color system is the same for all operating modes and can be observed in the indicating leds of the display and outputs.

Green - Internal pressure switch 1
Yellow - Internal pressure switch 2
Violet - Internal pressure switch 3
Blue - Internal pressure switch 4
Cyan - Internal thermostat

Besides the indication of colors, **PCT-3001** *plus* also uses abbreviations in the display to indicate which internal pressure switch certain information refers to. These abbreviations do not account for the type of pressure switch (suction or discharge) and thus they are the same for all indication modes. The function of the abbreviations shown below is only to indicate the number of the internal pressure switch.

P1 - Internal pressure switch 1
P2 - Internal pressure switch 2
P3 - Internal pressure switch 3
P4 - Internal pressure switch 4

In similar way the nomenclature of pressure switches, the abbreviations below indicate the number of internal thermostat:

T1 - Internal thermostat 1
T2 - Internal thermostat 2
T3 - Internal thermostat 3
T4 - Internal thermostat 4

T5 - Termostato interno 5
T6 - Termostato interno 6

For a more complete indication with the type and number of the pressure switch, **PCT-3001** *plus* uses the codes presented in the table below. As these abbreviations indicate the type of pressure switch, they are different for each operating mode.

Operating Mode	Internal pressure switch			
	P1	P2	P3	P4
1 suction/ 1 discharge	S1	D1		
2 suctions/ 1 discharge	S1	S2	D1	
3 suctions/ 1 discharge	S1	S2	S3	D1
2 suctions/ 2 discharges	S1	D1	S2	D2

These are the most used indicators on the controller screen; however, users must be aware that, depending on the operation mode, a particular abbreviation may be associated with different internal pressure switches, for instance: abbreviation S2 in operation mode "2 suctions / 1 discharge" refers to internal pressure switch 2 (P2), whereas in operation mode "2 suctions / 2 discharges", S2 refers to internal pressure switch 3 (P3).

6.5 - Link of each sensor input to each type of internal pressure switch depending on the operating mode

The table below shows how the sensor inputs are linked to the internal pressure switches. For cases where no link exists, the sensor input is not used and thus no connection to a sensor is required.

Operating Mode	Pressure input				Inlet temperature for gas line				Inlet liquid line temperature	
	PRES 1	PRES 2	PRES 3	PRES 4	TEMP 1	TEMP 2	TEMP 3	TEMP 4	TEMP 5	TEMP 6
1 suction 1 discharge	P1	P2			P1	P2			P2	
2 suctions 1 discharge	P1	P2	P3		P1	P2	P3		P3	
3 suctions 1 discharge	P1	P2	P3	P4	P1	P2	P3	P4	P4	
2 suctions 2 discharges	P1	P2	P3	P4	P1	P2	P3	P4	P2	P4

6.6 - Pressure and temperature reading limits for each sensor input depending on the operating mode

The table below shows the measurement limits for the sensors for each sensor input.

Operating Mode	Pressure input				Inlet temperature for gas line				Temperature input for subcooling	
	PRES 1 (psi)	PRES 2 (psi)	PRES 3 (psi)	PRES 4 (psi)	TEMP 1 (°C)	TEMP 2 (°C)	TEMP 3 (°C)	TEMP 4 (°C)	TEMP 5 (°C)	TEMP 6 (°C)
1 suction 1 discharge	0~200	0~500			-50~200	-50~200	**-50~200**	**-50~200**	-50~200	**-50~200**
2 suctions 1 discharge	0~200	0~200	0~500		-50~200	-50~200	-50~200	**-50~200**	-50~200	**-50~200**
3 suctions 1 discharge	0~200	0~200	0~200	0~500	-50~200	-50~200	-50~200	-50~200	-50~200	**-50~200**
2 suctions 2 discharges	0~200	0~500	0~200	0~500	-50~200	-50~200	-50~200	-50~200	-50~200	-50~200

Note: Values in bold correspond to sensors that are not used by the pressure switches in the selected operating mode, but can be used by independent internal thermostats.

6.7 - Setting the operating mode

The operating mode is set through the advanced parameter menu. For more information on this procedure, go to "Advanced parameter menu → Access code → Operating mode setting" in this manual. When setting the operating mode, **PCT-3001** *plus* will save the default values for all functions in the internal memory. Therefore it is essential to set the operating mode before starting to set the parameters of the product.

7 - CONNECTIONS

7.1 - Pressure sensors

The table below shows the pressure sensors that must be used as well as the respective inputs. It is mandatory to use the pressure sensors for each internal pressure switch that is active

	Operating Mode			
	1 suction/ 1 discharge	2 suctions/ 1 discharge	3 suctions/ 1 discharge	2 suctions/ 2 discharges
Input PRES 1	SB69-200A	SB69-200A	SB69-200A	SB69-200A
Input PRES 2	SB69-500A	SB69-200A	SB69-200A	SB69-500A
Input PRES 3		SB69-500A	SB69-200A	SB69-200A
Input PRES 4			SB69-500A	SB69-500A

7.2 - Temperature Sensors

Note: SB19 and SB59 sensors have a response curve similar, but sensor SB19 withstands temperatures from -58ºF to 221ºF (-50 ºC to 105ºC), since the sensor SB59 withstands temperatures from -58ºF to 392ºF (-50ºC to 200ºC). Care must be observed for proper use of the sensor according to the operation temperatures of the refrigerant.

7.2.1 - Temperature Sensors of Fluid Line

The temperature sensors that must be used and their respective inputs are reported in the table below. The use of temperature sensors of fluid line is optional. To enable use of the temperature sensors must be configured on each internal switch, the temperature alarm mode as active.

	Operating Mode			
	1 suction/ 1 discharge	2 suctions/ 1 discharge	3 suctions/ 1 discharge	2 suctions/ 2 discharges
Input TEMP 1	SB19/SB59	SB19/SB59	SB19/SB59	SB19/SB59
Input TEMP 2	SB19/SB59	SB19/SB59	SB19/SB59	SB19/SB59
Input TEMP 3		SB19/SB59	SB19/SB59	SB19/SB59
Input TEMP 4			SB19/SB59	SB19/SB59

7.2.2 - Temperature Sensors of Sub-cooling Control

The temperature sensors that must be used and their respective inputs are reported in the table below. The use of temperature sensors of sub-cooling is optional. To enable use of the sub-cooling sensors must be configured on each discharge internal switch, the sub-cooling control mode as active.

	Operating Mode			
	1 suction/ 1 discharge	2 suctions/ 1 discharge	3 suctions/ 1 discharge	2 suctions/ 2 discharges
Input TEMP 5	SB19/SB59	SB19/SB59	SB19/SB59	SB19/SB59
Input TEMP 6				SB19/SB59

7.2.3 - Temperature Sensors of Thermostats Control

The same temperature sensors that can be used by the switches can also be used for internal thermostats. To activate a given thermostat, the user must select the control mode of the same (heating or cooling). In the table below it can be observed in which the analog input is connected to a given thermostat.

	Thermostat 1	Thermostat 2	Termostato 3	Thermostat 4	Thermostat 5	Thermostat 6
Input TEMP 1	SB19/SB59					
InputTEMP 2		SB19/SB59				
Input TEMP 3			SB19/SB59			
Input TEMP 4				SB19/SB59		
Input TEMP 5					SB19/SB59	
Input TEMP 6						SB19/SB59

7.3 - Digital outputs

7.3.1 - Digital control outputs

The 26 digital outputs can be freely associated with the internal pressure switches at the time of setting the operating mode. The **PCT-3001** *plus* reserves the outputs in increasing order of the internal pressure switches (P1, P2, P3 and P4). For the first pressure switch (P1), the outputs are reserved starting from OUT1, for the second pressure switch (P2), starting from the last P1 output and so on.

7.3.2 - Control Outputs (Thermostats)

Up to 6 digital outputs can be used as thermostats outputs. The configuration of outputs as thermostat is made together with the setting of operation mode and immediately before they are assigned to the alarm outputs. Example: 2 alarm outputs, 1 thermostat output, OUT 25 and OUT 26 are assigned for alarms, OUT 24 assigned for thermostats.

7.3.3 - Alarm outputs

The four last digital outputs (OUT 23, OUT 24, OUT 25 and OUT 26) can be used as alarm outputs. The configuration of these outputs as alarms is done together with the operating mode setup. If only one alarm is configured, the last output (OUT 26) will be reserved. If two alarms are configured, the two last outputs (OUT25 and OUT26) will be used, and so on.

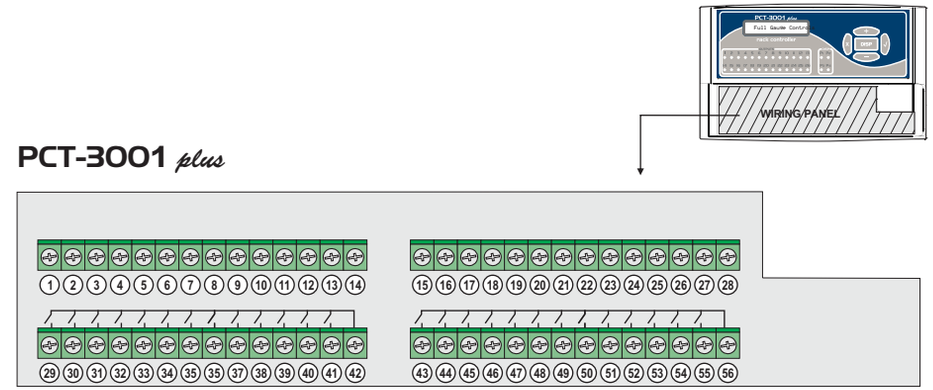
7.4 - Analogue outputs

The four analogue outputs (AN 1,AN2,AN3 and AN4) will always be used with the respective pressure switches (P1, P2, P3 and P4). Thus each pressure switch uses only a single analogue output. The analogue output can control a frequency inverter to change the capacity of a compressor or fan in order to provide a more efficient control of the plant.

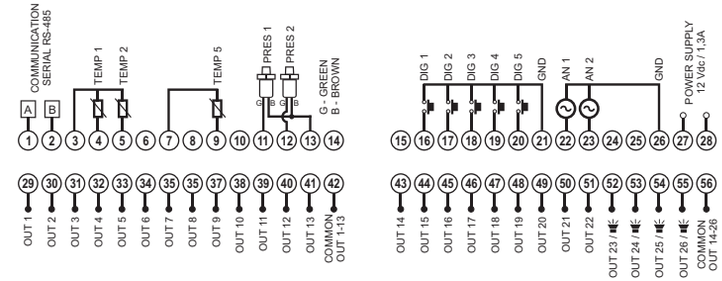
7.5 - Digital inputs

The digital inputs can be used to control the day / night setpoint or to activate external alarms. For the latter, the user can configure the action the input will trigger, as well as which internal pressure switches will be affected.

7.6 - Wiring diagram

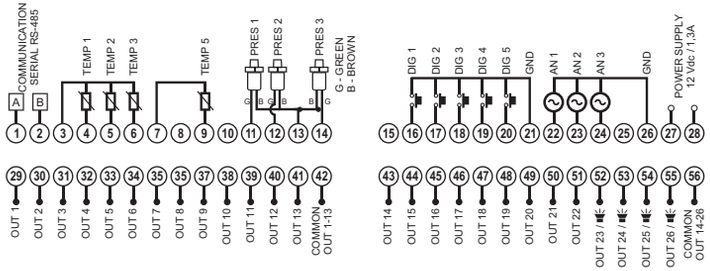


7.6.1 - Operating mode with one suction and one discharge



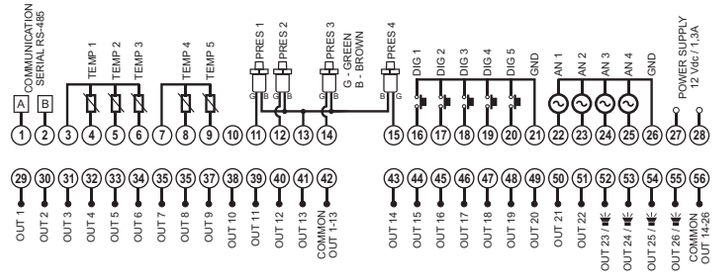
TEMP 1	Temperature Sensor (Option): - Pressure Switch: suction gas line - Thermostat: Thermostat 1	PRES 1	Suction Pressure Sensor (SB69-200A)
		PRES 2	Discharge Pressure Sensor (SB69-500A)
TEMP 2	Temperature Sensor (Option): - Pressure Switch: discharge gas line - Thermostat: Thermostat 2	PRES 3	Not used
		PRES 4	Not used
TEMP 3	Temperature Sensor (Option): - Pressure Switch: Not used - Thermostat: Thermostat 3	AN 1	Suction Frequency Inverter (Option)
		AN 2	Discharge Frequency Inverter (Option)
TEMP 4	Temperature Sensor (Option): - Pressure Switch: Not used - Thermostat: Thermostat 4	AN 3	Not used
		AN 4	Not used
TEMP 5	Temperature Sensor (Option): - Pressure Switch: discharge fluid line - Thermostat: Thermostat 5	DIG 1~5	Freely configurable between pressure switches
		OUT 1~26	Freely configurable between pressure switches
TEMP 6	Temperature Sensor (Option): - Pressure Switch: Not used - Thermostat: Thermostat 6	OUT 17~OUT 26	Configurable between pressure switches and thermostats
		OUT 23~OUT 26	Configurable between pressure switches, thermostats and alarms

7.6.2 - Operating mode with two suctions and one discharge



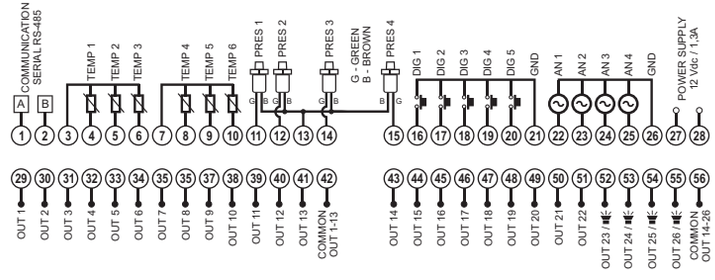
TEMP 1	Temperature Sensor (Option): - Pressure Switch: suction gas line 1 - Thermostat: Thermostat 1	PRES 1	Suction Pressure Sensor 1 (SB69-200A)
		PRES 2	Suction Pressure Sensor 2 (SB69-200A)
TEMP 2	Temperature Sensor (Option): - Pressure Switch: suction gas line 2 - Thermostat: Thermostat 2	PRES 3	Discharge Pressure Sensor (SB69-500A)
		PRES 4	Not used
TEMP 3	Temperature Sensor (Option): - Pressure Switch: discharge gas line - Thermostat: Thermostat 3	AN 1	Suction Frequency Inverter 1 (Option)
		AN 2	Suction Frequency Inverter 2 (Option)
TEMP 4	Temperature Sensor (Option): - Pressure Switch: Not used - Thermostat: Thermostat 4	AN 3	Discharge Frequency Inverter (Option)
		AN 4	Not used
TEMP 5	Temperature Sensor (Option): - Pressure Switch: discharge fluid line - Thermostat: Thermostat 5	DIG 1~5	Freely configurable between pressure switches
		OUT 1~26	Freely configurable between pressure switches
TEMP 6	Temperature Sensor (Option): - Pressure Switch: Not used - Thermostat: Thermostat 6	OUT 17~OUT 26	Configurable between pressure switches and thermostats
		OUT 23~OUT 26	Configurable between pressure switches, thermostats and alarms

7.6.3 - Operating mode with three suctions and one discharge



TEMP 1	Temperature Sensor (Option): - Pressure Switch: suction gas line 1 - Thermostat: Thermostat 1	PRES 1	Suction Pressure Sensor 1 (SB69-200A)
		PRES 2	Suction Pressure Sensor 2 (SB69-200A)
TEMP 2	Temperature Sensor (Option): - Pressure Switch: suction gas line 2 - Thermostat: Thermostat 2	PRES 3	Suction Pressure Sensor 3 (SB69-200A)
		PRES 4	Discharge Pressure Sensor (SB69-500A)
TEMP 3	Temperature Sensor (Option): - Pressure Switch: suction gas line 3 - Thermostat: Thermostat 3	AN 1	Suction Frequency Inverter 1 (Option)
		AN 2	Suction Frequency Inverter 2 (Option)
TEMP 4	Temperature Sensor (Option): - Pressure Switch: discharge gas line - Thermostat: Thermostat 4	AN 3	Suction Frequency Inverter 3 (Option)
		AN 4	Discharge Frequency Inverter (Option)
TEMP 5	Temperature Sensor (Option): - Pressure Switch: discharge fluid line - Thermostat: Thermostat 5	DIG 1~5	Freely configurable between pressure switches
		OUT 1~26	Freely configurable between pressure switches
TEMP 6	Temperature Sensor (Option): - Pressure Switch: Not used - Thermostat: Thermostat 6	OUT 17~OUT 26	Configurable between pressure switches and thermostats
		OUT 23~OUT 26	Configurable between pressure switches, thermostats and alarms

7.6.4 - Operating mode with two suctions and two independent discharges



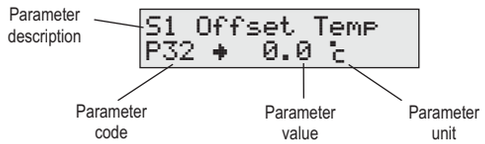
TEMP 1	Temperature Sensor (Option): - Pressure Switch: suction gas line 1 - Thermostat: Thermostat 1	PRES 1	Suction Pressure Sensor 1 (SB69-200A)
		PRES 2	Suction Pressure Sensor 2 (SB69-200A)
TEMP 2	Temperature Sensor (Option): - Pressure Switch: suction gas line 2 - Thermostat: Thermostat 2	PRES 3	Discharge Pressure Sensor 1 (SB69-500A)
		PRES 4	Discharge Pressure Sensor 2 (SB69-500A)
TEMP 3	Temperature Sensor (Option): - Pressure Switch: discharge gas line 1 - Thermostat: Thermostat 3	AN 1	Suction Frequency Inverter 1 (Option)
		AN 2	Suction Frequency Inverter 2 (Option)
TEMP 4	Temperature Sensor (Option): - Pressure Switch: discharge gas line 2 - Thermostat: Thermostat 4	AN 3	Discharge Frequency Inverter 1 (Option)
		AN 4	Discharge Frequency Inverter 2 (Option)
TEMP 5	Temperature Sensor (Option): - Pressure Switch: discharge fluid line 1 - Thermostat: Thermostat 5	DIG 1~5	Freely configurable between pressure switches
		OUT 1~26	Freely configurable between pressure switches
TEMP 6	Temperature Sensor (Option): - Pressure Switch: discharge fluid line 2 - Thermostat: Thermostat 6	OUT 17~OUT 26	Configurable between pressure switches and thermostats
		OUT 23~OUT 26	Configurable between pressure switches, thermostats and alarms

8 - ADVANCED PARAMETER MENU

The advanced parameter menu allows configuring the operating settings of the internal pressure switches, as well as the settings of other features of the controller. To enter the advanced parameter menu, press + and − for 2 seconds until the display changes to the code option. To select an option, just press √ .To go back use the X key. The setting is changed using the + and − keys. The √ key confirms the operation and the X key cancels it. The available options are:

01 - CODE	Access code
02 - PRESSOSTATS	Parameters of the internal pressure switches
03 - THERMOSTATS	Parameters of the internal thermostats
04 - DIG. INPUTS	Parameters of the digital inputs
05 - ALARMS	Parameters of the alarm outputs
06 - MAINTENANCE	Maintenance of the digital outputs
07 - CONFIG.	General configuration parameters

To set any parameter, just press √ . If the change is available, the corresponding value will start to flash. The function value can be changed by pressing + or − . Press X again to confirm the new value.To cancel and go back, press √ .



The advanced parameter menu will close automatically if no keys are pressed for 15 seconds.

8.1 - Access code

Enter "123" in this option to be able to change the advanced parameters. This option also allows entering the code to change the operating mode and the units of measurement for pressure and temperature. Follow the steps below to perform these procedures:

01 - CODE	Access code
02 - PRESSOSTATS	Parameters of the internal pressure switches
03 - THERMOSTATS	Parameters of the internal thermostats
04 - DIG. INPUTS	Parameters of the digital inputs
05 - ALARMS	Parameters of the alarm outputs
06 - MAINTENANCE	Maintenance of the digital outputs
07 - CONFIG.	General configuration parameters

8.1.1 - Operating mode setting

Enter the code "717" and confirm with the √ key. **PCT-3001 *plus*** will then request you to set the following items:

1 - Operating Mode
2 - Number of alarm outputs
3 - Number of thermostats outputs
4 - Number of outputs for the pressure switch 1
5 - Number of outputs for the pressure switch 2
6 - Number of outputs for the pressure switch 3 (only if the operating mode uses the P3)
7 - Number of outputs for the pressure switch 4 (only if the operating mode uses the P4)
8 - Temperature measurement unit
9 - Pressure measurement unit

Set all items in accordance with the needs of the refrigeration system and confirm the values using the √ key. Note that during these adjustments you cannot go back using the X key and the menu will not terminate automatically if no key is pressed. During the configuration of the operating mode, the leds of the relays are activated in order to show the final association of the internal pressure switches with the respective digital outputs. The user must record the final configuration of the outputs in order to be able to proceed with the right connection of the compressors and fans.

Upon changing the operating mode, **PCT-3001 *plus*** will save the default values for all functions in the internal memory. Therefore it is essential to set the operating mode before starting to set the parameters of the product.

After the operation mode change, the user must configure the ranges of the pressure sensors to match the sensors installed on the refrigeration system (pressure at 4mA and pressure at 20mA).

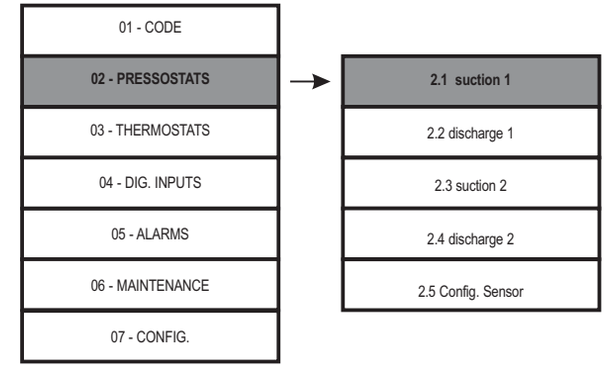
8.1.2 - Setting the units for temperature and pressure

Enter the code "231" and confirm with the √ . O **PCT-3001 *plus*** will request the adjustment for the units of temperature and then for the units of pressure. Set both as needed and then confirm using the √ key. Upon changing the units of measurement, **PCT-3001 *plus*** will save the default values for all temperature and pressure functions in the internal memory. Therefore it is essential to set the operating mode before starting to set the parameters of the product.

8.2 - Parameters of the internal pressure switches

In the option "Pressure switches" you can configure the parameters of each **PCT-3001 *plus***, internal pressure switch individually. To access this menu item, press the √ key. In the following screen, the controller will show a list containing the available pressure switches to be adjusted. Select the required pressure switch and press √ to proceed. Within the configuration of each internal pressure switch, **PCT-3001 *plus*** wil make available several types of options, which will vary in accordance with the function of the pressure switch (suction or discharge).

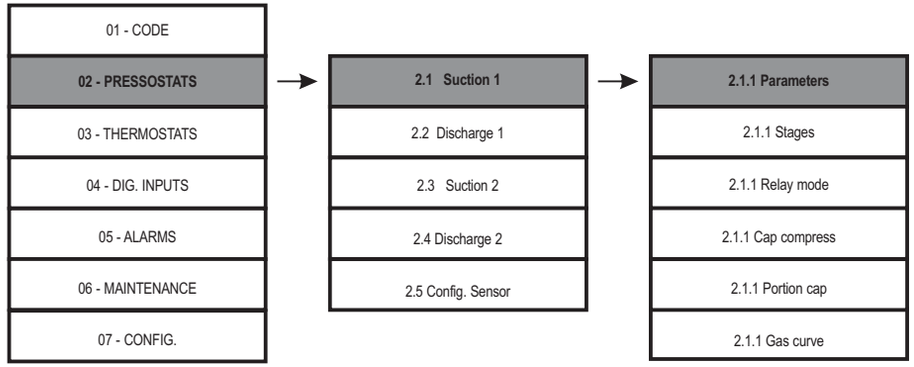
Example: configuration with two suctions, two discharges



To change the settings of a pressure switch, select it from the menu pressure switches through the keys (+ and −) and press OK to proceed. Within configuration of each internal pressure switch, **PCT-3001 *plus*** will provide different types of options, these options will vary according to the type the pressure switch (suction or discharge).

8.2.1 - Suction Switches

The shares available for suction pressure switches are described below:



8.2.1.1 - Parameters

When adjusting the operation of an internal pressure switch, **PCT-3001** *plus* makes available the parameters in the display according to the type of pressure switch. Thus there will be two parameter tables, being one for the suction type pressure switches and another one for the discharge type pressure switches.

		PSI / °C				Bar / °F			
Fun	Description	Min.	Max.	Unit.	Standard	Min.	Max.	Unit.	Standard
P01	Minimum setpoint threshold	0	500	PSI	0	0	34.4	bar	0
P02	Upper setpoint threshold	0	500	PSI	200	0	34.4	bar	13.8
P03	Daytime setpoint	0	500	PSI	20	0	34.4	bar	1.4
P04	Nighttime setpoint	0	500	PSI	20	0	34.4	bar	1.4
P05	Type of control of the digital outputs	0	3	-	1	0	3	-	1
P06	Digital output hysteresis	1	250	PSI	12	0.1	17.2	bar	0.8
P07	Control of the analogue output	0	1	-	0	0	1	-	0
P08	Hysteresis of the analogue output	1	250	PSI	12	0.1	17.2	bar	0.8
P09	Minimum value of the analogue output	0	50,0	%	10,0	0.0	50,0	%	10,0
P10	Power of the analogue output	0	10	HP	0	0	10	HP	0
P11	Minimum time of compressor switched on	0	999	sec.	0	0	999	sec.	0
P12	Minimum time of compressor switched off	0	999	sec.	0	0	999	sec.	0
P13	Time between activations (compressors)	0	999	sec.	0	0	999	sec.	0
P14	Time between deactivations (compressors)	0	999	sec.	0	0	999	sec.	0
P15	Time between activations (unloaders)	0	999	sec.	0	0	999	sec.	0
P16	Time between deactivations (unloaders)	0	999	sec.	0	0	999	sec.	0
P17	Minimum time of output start /stop off	0	999	sec.	60	0	999	sec.	60
P18	Time for maintenance alarm	0	999	x10h	999	0	999	x10h	999
P19	State of the digital outputs when an error occurs in the pressure sensors	0	100.0	-	0	0	100.0	-	0
P20	State of the analogue output when an error occurs in the pressure sensor	0	999	%	0	0	999	%	0
P21	Delay for the alarm upon powering on the controller	0	10	sec.	0	0	10	sec.	0
P22	Reset mode	0	999	-	0	0	999	-	0
P23	Time period for automatic resets	0	100	min	0	0	6.9	min	0
P24	Low pressure alarm	-1	500	PSI	-1	-0.1	34.4	bar	-0.1
P25	High pressure alarm	0	501	PSI	501	0.0	34.4	bar	34.5
P26	Hysteresis of the pressure alarms	1	250	PSI	20	1	250	bar	1.4
P27	Temperature sensor mode	0	1	-	0	0	221	-	59
P28	Low temperature alarm	-50.1	200	°C	off	-59	392	°F	off
P29	Hysteresis of the temperature alarm	0.1	0	°C	5.0	1	9	°F	9
P30	Time for liquid collection	0	999	sec.	10	0	999	sec.	10
P31	Lower limit of the dead band	0	500	°C	0	0	34.4	°F	0
P32	Upper limit of the dead band	0	500	°C	0	0	34.4	°F	0
P33	High superheating temperature	-50.0	200.1	°C	200.1	-58	393	°F	393
P34	Low superheating temperature	-50.1	200.0	°C	-50.1	-59	392	°F	-59
P35	Critical superheating temperature	-50.1	200.0	°C	-50.1	-59	392	°F	-59

P01 - Minimum setpoint threshold
Lower threshold aimed at preventing an exceedingly low pressure from being adjusted by mistake for daytime and nighttime setpoint.

P02 - Upper setpoint threshold
Upper threshold aimed at preventing an exceedingly high pressure from being adjusted by mistake for daytime and nighttime setpoint.

P03 - Daytime setpoint
Control pressure when the controller is in daytime mode

P04 - Nighttime setpoint
Control pressure when the controller is in nighttime mode

P05 - Type of control of the digital outputs
Function that selects the type of control of the compressors

`Off` - Control switched of
`Linear` - Linear activation
`Rotation` - Activation by time (rotation)
`Capacity` - Activation by capacity

P06 - Digital output hysteresis
It is the relative pressure value defining the pressure range within which the compressors must be activated. The points for which each compressor will be activated depend on the number of outputs and the type of digital control. The minimum hysteresis value is the number of digital outputs configured for the pressure control.

P07 - Control of the analogue output
Function that selects the method of control of the analogue output.
`Off` - Control switched off
`On` - Control switched on

P08 - Hysteresis of the analogue output
It is the relative pressure value defining the pressure range within which the analogue output will modulate its value.

P09 - Minimum value of the analogue output
It is the minimum value that the analogue output will have when activated. This value limits the minimum rotation speed of the compressor. This parameter also adjusts the value that will keep the compressor working when the **PCT-3001** *plus* is collecting the liquid if this function is configured.

P10 - Power of the analogue output
It is the power in HP of the compressor that is operating through the frequency inverter.

P11 - Minimum time of compressor switched on
It is the minimum time the compressor will remain switched on, that is, the length of time between the last start up and the next stop. It is aimed at avoiding high voltage surges in the power lines. This function is only present in the digital outputs configured as compressor.

P12 - Minimum time of compressor switched off
It is the minimum time the compressor will remain switched off, that is, the length of time between the last stop and the next start up. This function is only present in the digital outputs configured as compressor.

P13 - Time between activations (compressors)
This function ensures that stages configured as "compressors" will not be activated simultaneously, and its purpose is to avoid the overload of the power supply. The time starts to be counted after the activation of any stage configured as "compressor" or as "unloader".

P14 - Time between deactivations (compressors)
This function ensures that stages configured as "compressors" will not be deactivated simultaneously, and its purpose is to avoid the overload of the power supply. The time starts to be counted after the deactivation of any stage configured as "compressor" or as "unloader".

P15 - Time between activations (unloaders)
This function ensures that stages configured as "unloaders" will not be activated simultaneously, and its purpose is to avoid the overload of the power supply. The time starts to be counted after the activation of any stage configured as "compressor" or as "unloader".

P16 - Time between deactivations (unloaders)
This function ensures that stages configured as "unloaders" will not be activated simultaneously, and its purpose is to avoid the overload of the power supply. The time starts to be counted after the activation of any stage configured as "compressor" or as "unloader".

P17 - Minimum time of output start /stop off
It is the minimum time the output start /stop will remain switched off, that is, the length of time between the last stop and the next start up. This function is only present in the digital outputs configured as start/stop.

P18 - Time for maintenance alarm
Time expressed in tens of hours that the compressors can remain working without maintenance.

P19 - State of the digital outputs when an error occurs in the pressure sensors
Configures the state of the compressors when an error occurs in the pressure sensor:
`0` - All compressors off;
`1` - All compressors on;
`2` - Keep the compressors in the same status they were in the moment of the error.

P20 - State of the analogue output when an error occurs in the pressure sensor
Configures the percentage that will be kept in the analogue output if an error occurs in the pressure sensor.

P21 - Delay for the alarm upon powering on the controller
Time the controller waits after the initialization to activate the alarms and the alarm output (if active).

P22 - Reset mode
It configures the controller's reset method upon the occurrence of faults / alarms.
`00` - Manual reset only
`01` - One automatic reset
`02` - Two automatic reset
`03` - Three automatic reset
`04` - Four automatic reset
`05` - Five automatic reset
`06` - Six automatic reset
`07` - Seven automatic reset
`08` - Eigh automatic reset
`09` - Nine automatic reset
`10` - Always automatic resets

P23 - Time period for automatic resets
This function allows adjusting the time for which automatic resets will be allowed. If all automatic resets have already been performed within the time configured in this function and another fault occurs, the controller will only accept the next reset in manual mode.

P24 - Alarm of Low Pressure
Is the value of the pressure reference to actuates pressure signaling below the desired point. When this alarm occurs all outputs of the suction pressure switch will be turn off, being ignored the time specified in P14/P16 - Time between shutdowns.

P25 - Alarm of high pressure
Is the pressure reference value to actuate pressure signaling above the desired point. When this alarm occurs all outputs of the suction pressure switch will be turn on, being respected the time specified in P13/P15 - Time between activations.

P26 - Hysteresis of the pressure alarms
It is the pressure difference for leaving the alarm condition.

P27 - Temperature sensormode
It shows whether the temperature sensor of the gas line is active. The temperature alarm and overheating control functions will be available only if this sensor is active.

`Off` - Gas line temperature sensor switched off
`On` - Gas line temperature sensor switched on

P28 - Low temperature alarm
It is the reference value for activating the temperature signaling below the desired point. Upon the occurrence of this alarm, all outputs of the suction controller will be deactivated.

P29 - Hysteresis of the temperature alarm
It is the temperature difference for leaving the alarm condition.

P30 - Time for liquid collection
If there is a liquid protection output, the last compressor will remain active for this time when the pressure reaches the setpoint. This function allows for a compressor to keep the refrigerant fluid when the liquid protection output is activated, thus allowing collecting the gas.

P31 - Lower limit of the dead band
P32 - Upper limit of the dead band
If the operation mode is set to linear or rotary, and if the analogue output is switched off, a dead band region can be enabled. If the pressure is within the range bounded by the values set in the functions P31 and P32, the number of stages (digital outputs) that are active will remain unchanged, even if there are fluctuations in system pressure. A detailed description of the dead band operation is contained in chapter 9.1.1 - Types of control only by digital outputs.

P33 - High superheating temperature
Above this temperature will be triggered the alarm underperforming suction.

P34 - Low superheating temperature
Below this temperature, the liquid output protection (if any) will be triggered.

P35 - Critical superheating temperature
Below this temperature, all outputs suction are disabled and liquid output protection (if any) will be triggered.

8.2.1.2 - Stages

It allows adjusting the function of each digital output of the internal pressure switch. The options of each output are:
`Off` - Digital output off (free);
`Compressor` - Digital output to activate the compressor;
`Unloader` - Digital output to activate the capacity valve of a compressor. This type of output must be after a "Compressor" output or other "Unloader" output;
`Liq collec` - Digital output to activate a valve for liquid collection.
`Start/Stop` - Output of Start/Stop the frequency inverter.

8.2.1.3 Relay Mode

Allows you to adjust the digital output relay will operate in the normally open (NO) or normally closed (NC) mode.

8.2.1.4 Capacity of Compressors

Allows you to adjust the total power (HP) of each compressor.

8.2.1.5 Portions of Capacities

Allows you to adjust the portion of each capacity valve (Unloader) within the total power of the compressor.

8.2.1.6 Gas Curve

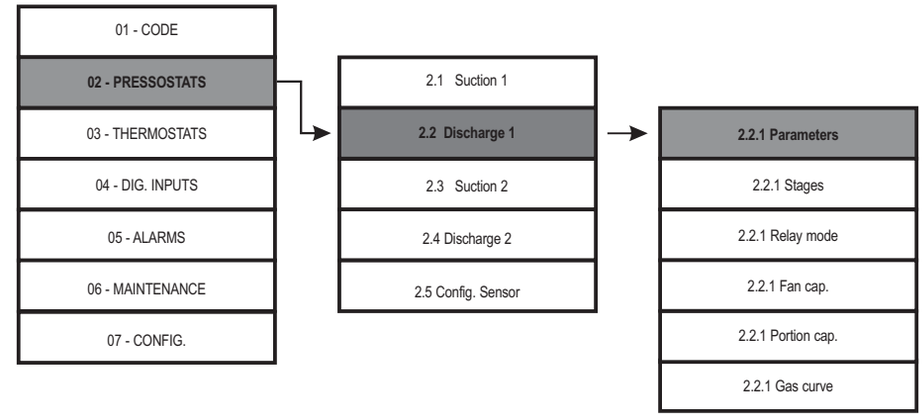
Allows you adjust the curve of saturated gas used in the group of switches. It is through this curve and the measured suction pressure, the **PCT-3001** *plus* will calculate the temperature of the saturated gas. The overheating temperature is obtained from the difference between the saturated gas and gas temperature (measured by a temperature sensor of the gas line).

		PSI / °C				Bar / °F			
Fun	Descrição	Min.	Max.	Unit.	Standard	Min.	Max.	Unit.	Standard
C01	Pressure point 1 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C02	Temperature point 1 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C03	Pressure point 2 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C04	Temperature point 2 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C05	Pressure point 3 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C06	Temperature point 3 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C07	Pressure point 4 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C08	Temperature point 4 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C09	Pressure point 5 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C10	Temperature point 5 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C11	Pressure point 6 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C12	Temperature point 6 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C13	Pressure point 7 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C14	Temperature point 7 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C15	Pressure point 8 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C16	Temperature point 8 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C17	Pressure point 9 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C18	Temperature point 9 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C19	Pressure point 10 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C20	Temperature point 10 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58

With the reading of the suction pressure, the controller calculates the gas temperature based on the saturated gas curve in the system. In suction parameters you can adjust the values of "high temperature of overheating", "Low temperature of overheating" and "critical temperature of overheating," to alarms system in case of low-income and protection of compressors.
The gas curve can be adjusted by inserting up to 10 points. Each point consists of one pressure value and one temperature of, for example: parameters C01 and C02 map the first point of the curve, C03 and C04 map to the second point, and so on. Adjusting a parameter to its minimum value, the point concerning this parameter is turned off.

8.2.2- Discharge Switches

The options available to discharge switches are described below.



8.2.2.1- Parameters

When adjusting the operation of an internal pressure switch, **PCT-3001** *plus* makes available the parameters in the display according to the type of pressure switch. The table below describes the parameters and setting ranges for the discharge pressure switches.

		PSI / °C				Bar / °F			
Fun	Description	Min.	Max.	Unit.	Standard	Min.	Max.	Unit.	Standard
P01	Minimum setpoint threshold	0	500	PSI	0	0	34.4	bar	0
P02	Upper setpoint threshold	0	500	PSI	500	0	34.4	bar	34.4
P03	Daytime setpoint	0	500	PSI	200	0	34.4	bar	13.8
P04	Nighttime setpoint	0	500	PSI	200	0	34.4	bar	13.8
P05	Type of control of the digital outputs	0	3	-	1	0	3	-	1
P06	Digital output hysteresis	1	250	PSI	50	0,1	17.2	bar	3.4
P07	Control of the analogue output	0	1	-	0	0	1	-	0
P08	Hysteresis of the analogue output	1	250	PSI	50	0,1	17.2	bar	3.4
P09	Minimum value of the analogue output	0	50,0	%	10,0	0	50,0	%	10,0
P10	Power of the analogue output	0	10	HP	0	0	10	HP	0
P11	Minimum time of fans switched on	0	999	sec.	0	0	999	sec.	0
P12	Minimum time of fans switched off	0	60	sec.	0	0	60	sec.	0
P13	Time between activations (fan)	0	60	sec.	0	0	60	sec.	0
P14	Time between deactivations (fan)	0	999	sec.	0	0	999	sec.	0
P15	Time between activations (auxiliary fan)	0	60	sec.	0	0	60	sec.	0
P16	Time between deactivations (auxiliary fan)	0	999	sec.	0	0	999	sec.	0
P17	Minimum time of output start /stop off	0	999	sec.	60	0	999	sec.	60
P18	Time for maintenance alarm	0	999	x10h	999	0	999	x10h	999
P19	State of the digital outputs when an error occurs in the pressure sensors	0	2	-	0	0	2	-	0

P20	State of the analogue output when an error occurs in the pressure sensor	0	100.0	%	0	0	100.0	%	0
P21	Delay for the alarm upon powering on the controller	0	999	sec.	0	0	999	sec.	0
P22	Reset mode	0	10	-	0	0	10	-	0
P23	Time period for automatic resets	0	999	min	0	0	999	min	0
P24	Low pressure alarm	-1	500	PSI	-1	-0.1	34.4	bar	-0.1
P25	High pressure alarm	0	501	PSI	501	0	34.5	bar	34.5
P26	Hysteresis of the pressure alarms	1	250	PSI	10	0.1	17.2	bar	0.7
P27	Temperature sensor mode	0	1	-	0	0	1	-	0
P28	High temperature alarm	-50.0	200	°C	150.0	-58	392	°F	302
P29	Hysteresis of the temperature alarm	0.1	5.0	°C	5.0	1	9	°F	9
P30	Breeze system mode	0	1	-	0	0	1	-	0
P31	Breeze system setpoint	-50.0	200	PSI	-50	-58	392	bar	-58
P32	Hysteresis of the breeze system	1	50	PSI	50	0.1	3.4	Bar	3.4
P33	Control mode of sub-cooling temperature	0	3	-	0	0	3	-	0
P34	Setpoint of sub-cooling temperature control	-50.0	200	°C	105	-58	392	°F	221
P35	Control hysteresis of sub-cooling temperature 1	0.1	5.0	°C	5.0	1	9	°F	9
P36	Control hysteresis of sub-cooling temperature 2	0.1	5.0	°C	5.0	1	9	°F	9

P01 -Minimum setpoint threshold
Lower threshold aimed at preventing an exceedingly low pressure from being adjusted by mistake for daytime and nighttime setpoint.

P02 - Upper setpoint threshold
Upper threshold aimed at preventing an exceedingly high pressure from being adjusted by mistake for daytime and nighttime setpoint.

P03 - Daytime setpoint
Control pressure when the controller is in daytime mode.

P04 - Nighttime setpoint
Control pressure when the controller is in nighttime mode.

P05 - Type of control of the digital outputs
Function that selects the type of control of the fans.
`Off` - Control switched off
`Linear` - Linear activation
`Rotation` - Activation by time (rotation)
`Capacity` - Activation by capacity

P06 - Digital output hysteresis
It is the relative pressure value defining the pressure range within which the fans must be activated. The points for which each fan will be activated depend on the number of outputs and the type of digital control. The minimum hysteresis value is the number of digital outputs configured for the pressure switch in question.

P07- Control of the analogue output
Function that selects the method of control of the analogue output.
`Off` - Control switched off
`On` - Control switched on

P08 - Hysteresis of the analogue output
It is the relative pressure value defining the pressure range within which the analogue output will modulate its value.

P09 - Minimum value of the analogue output
It is the minimum value that the analogue output will have when activated. This value limits the minimum rotation speed of the fan.

P10 - Power of the analogue output
It is the power in HP of the fan that is operating through the frequency inverter.

P11 - Minimum time of fan switched on
It is the minimum time the fan will remain switched on, that is, the length of time between the last start up and the next stop. It is aimed at avoiding high voltage surges in the power lines. This function is only present in the digital outputs configured as fan.

P12 - Minimum time of fan switched off
It is the minimum time the fan will remain switched off, that is, the length of time between the last stop and the next start up. This function is only present in the digital outputs configured as fan.

P13 - Time between activations (fan)
This function ensures that stages configured as "fan" will not be activated simultaneously, and its purpose is to avoid the overload of the power supply. The time starts to be counted after the activation of any stage configured as "fan" or as "auxiliary fan".

P14 - Time between deactivations (fan)
This function ensures that stages configured as "fan" will not be deactivated simultaneously, and its purpose is to avoid the overload of the power supply. The time starts to be counted after the deactivation of any stage configured as "fan" or as "auxiliary fan".

P15 - Time between activations (auxiliary fan)
This function ensures that stages configured as "auxiliary fan" will not be activated simultaneously, and its purpose is to avoid the overload of the power supply. The time starts to be counted after the activation of any stage configured as "fan" or as "auxiliary fan".

P16 - Time between deactivations (auxiliary fan)
This function ensures that stages configured as "auxiliary fan" will not be activated simultaneously, and its purpose is to avoid the overload of the power supply. The time starts to be counted after the activation of any stage configured as "fan" or as "auxiliary fan".

P17 - Minimum time of output start /stop off
It is the minimum time the output start /stop will remain switched off, that is, the length of time between the last stop and the next start up. This function is only present in the digital outputs configured as start/stop.

P18 - Time for maintenance alarm
Time expressed in tens of hours that the fans can remain working without maintenance.

P19 - State of the digital outputs when an error occurs in the pressure sensors
Configures the state of the fans when an error occurs in the pressure sensor.
`0` - All fans off;
`1` - All fans on;
`2` - Keep the fans in the same status they were in the moment of the error.

P20 - State of the analogue output when an error occurs in the pressure sensor
Configures the percentage that will be kept in the analogue output if an error occurs in the pressure sensor.

P21 - Delay for the alarm upon powering on the controller
Time the controller waits after the initialization to activate the alarms and the alarm output (if active).

P22 - Reset mode
It configures the controller's reset method upon the occurrence of faults / alarms.
`00` - Manual reset only
`01` - One automatic reset
`02` - Two automatic reset
`03` - Three automatic reset
`04` - Four automatic reset
`05` - Five automatic reset
`06` - Six automatic reset
`07` - Seven automatic reset
`08` - Eight automatic reset
`09` - Nine automatic reset
`10` - Always automatic resets

P23 - Time period for automatic resets
This function allows adjusting the time for which the configured automatic resets will be allowed. If all automatic resets have already been performed within the time configured in this function and another fault occurs, the controller will only accept the next reset in manual mode.

P24 - Low pressure alarm
Is the value of the pressure reference to actuates pressure signaling below the desired point. When this alarm occurs all outputs of the discharge pressure switch will be turned off, being respected the time specified in P14/P16 - Time between deactivations.

P25 - High pressure alarm
Is the pressure reference value to actuate pressure signaling above the desired point. When this alarm occurs all outputs of the discharge pressure switch will be turned on being respected the time specified in P13/P15 - Time between activations and all outputs of the suction pressure gauge in the same group are switched off, being ignored the time specified in P14/P16 - Time between deactivations. In case of high pressure alarm of discharge and suction, the suction stages are turned off, in other words, the high pressure alarm in discharge has higher priority than the high pressure alarm of suction.

P26 - Hysteresis of the pressure alarms
It is the pressure difference for leaving the alarm condition.

P27 - Temperature sensor mode
It shows whether the temperature sensor of the gas line is active. The temperature alarm and overheating control functions will be available only if this sensor is active.
`Off` -Alarm and temperature sensor switched off
`On` -Alarm and temperature sensor switched on

P28 - High temperature alarm
Is the reference value to actuate pressure signaling above the desired point. When this alarm occurs all outputs of the discharge switch will be activated and all outputs of the suction pressure switch in the same group are turned off. The time specified in P13/P15 - Time between activations, and P14/P16 – Time between deactivations are respected in this alarm condition.

P29 - Hysteresis of the temperature alarm
It is the temperature difference for leaving the alarm condition.

P30 - Breeze system mode
Configures the operation of the breeze system.
`Off` - Breeze system control switched off
`On` - Breeze system control switched on

P31 - Breeze system setpoint
When the pressure is above this value, the breeze output will be activated, if this output exists.

P32 - Hysteresis of the breeze system
Pressure difference to switch off the breeze output.

P33 - Control mode of sub-cooling temperature
Configures to operation of the sub-cooling temperature control.

0- Off: Turn off the control of sub-cooling temperature.
1- 1output only: The `Sub-cool.` 1 output 1 is triggered when the `sub-cool.` temperature reaches the configured value in "setpoint of sub-cooling temperature control" + "Differential 1 of `sub-cool.` temperature control", and disengaged when it returns to the adjusted value in "setpoint of `sub-cool.` temperature control.

1- 1output only: The Sub-cool. 1 output 1 is triggered when the sub-cool. temperature reaches the configured value in "setpoint of sub-cooling temperature control" + "Differential 1 of sub-cool. temperature control", and disengaged when it returns to the adjusted value in "setpoint of sub-cool. temperature control.

2- 2 independent outputs: Triggers the Sub-cool. output 1 when the sub-cooling temperature reaches the value of "Setpoint of sub-cooling temperature control " + "Differential 1 of the sub-cooling temperature control". Upon reaching the value of "Setpoint of sub-cooling temperature control" + "Differential 2 of sub-cooling temperature control" is triggered Sub-cool. output 2 remaining triggered the Sub-cool. output 1. When the temperature drops below "setpoint of sub-cooling temperature control" + "Differential 1 of sub-cooling temperature control", the Sub-cool. output 2 is turned off, remaining triggered the Sub-cool. output 1 until the sub-cooling temperature is below the "setpoint of sub-cooling temperature control.

3- 2 intercalate outputs: Triggers the Sub-cool. output 1 when the liquid line temperature sensor reaches the value of "Setpoint of sub-cooling temperature control" + "Hysteresis 1 of temperature control of sub-cooling. Upon reaching the value of "Setpoint of sub-cooling temperature control" + "Hysteresis 2 of sub-cooling temperature control" is triggers the Sub-cool. output 2 and the Sub-cool. output 1 is turned off. When the sub-cool. temperature back to less than "Setpoint of sub-cool. temperature control" + "Hysteresis 1 of the sub-cool. temperature control", the Sub-cool. output 2 is turned off, and the Sub-cool. output 1 is trigged again. Both outputs will only be switched off when the temperature falls below the set value in "Setpoint of sub-cool. temperature control".

P34 - Setpoint of sub-cooling temperature control
It is the reference value for turn off outputs of sub-cooling temperature control

P35 - Control hysteresis of sub-cooling temperature 1
It is the temperature difference for turn on the first control output of sub-cooling.

P36 - Control hysteresis of sub-cooling temperature 2
It is the temperature difference for turn on the second control output of sub-cooling, if any.

8.2.2.2 - Stages

The setting options for each digital output of the discharge internal switches are:
Disabled - Digital output off (empty).
Fan - Digital output to drive the fan.
Aux. Fan- Digital output to drive the auxiliary fan. This type of output should be mandatory after an output type "Fan", or other output type "Aux. Fan".
Sub-cool 1 - Output 1 of sub-cooling temperature control.
Sub-cool 2 - Output 2 of sub-cooling temperature control, should be mandatory after the output 2.
Breeze - Control output of breeze system.
Start/Stop - Output of Start/Stop the frequency inverter.

8.2.2.3 - Relay Mode

Allows you to adjust the digital output relay will operate in the normally open (NO) or normally closed (NC) mode.

8.2.2.4 - Capacity of Compressors

Allows you to adjust the total power (HP) of each fan.

8.2.2.5 - Portions of Capacities

Allows you to adjust the portion of each ventilation auxiliary output (Aux Vent) within the total power of the fan.

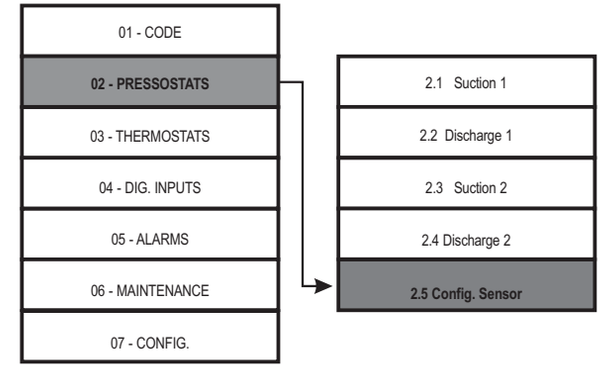
8.2.2.6 - Gas curve

Allows you adjust the curve of saturated gas used in the group of switches. It is through this curve and the measured suction pressure, the **PCT-3001 *plus*** will calculate the temperature of the saturated liquid. The sub-cooling temperature is obtained from the difference between the saturated liquid temperature and the liquid line temperature (measured by temperature sensor of gas line).

		PSI / °C				Bar / °F			
Fun	Description	Min.	Max.	Unit.	Standard	Min.	Max.	Unit.	Standard
C01	Pressure point 1 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C02	Temperature point 1 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C03	Pressure point 2 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C04	Temperature point 2 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C05	Pressure point 3 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C06	Temperature point 3 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C07	Pressure point 4 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C08	Temperature point 4 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C09	Pressure point 5 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C10	Temperature point 5 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C11	Pressure point 6 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C12	Temperature point 6 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C13	Pressure point 7 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C14	Temperature point 7 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C15	Pressure point 8 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C16	Temperature point 8 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C17	Pressure point 9 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C18	Temperature point 9 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58
C19	Pressure point 10 of the mapped curve	-1	500	PSI	-1	-0.1	34.4	Bar	-0.1
C20	Temperature point 10 of the mapped curve	-50.1	200	°C	-50.1	-58	392	°F	-58

With the reading of the suction pressure, the controller calculates the gas temperature based on the saturated gas curve in the system. In suction parameters you can adjust the values of "high temperature of overheating", "Low temperature of overheating" and "critical temperature of overheating," to alarms system in case of low-income and protection of compressors.
The gas curve can be adjusted by inserting up to 10 points. Each point consists of one pressure value and one temperature of, for example: parameters C01 and C02 map the first point of the curve, C03 and C04 map to the second point, and so on. Adjusting a parameter to its minimum value, the point concerning this parameter is turned off.

8.2.3 - Pressure sensors configurations



This menu allows configure the parameters regarding the pressure sensors used.

		PSI/°C				Bar/°F			
Nr	Description	Min	Max	Unit	Standard	Min	Max	Unit	Standard
OP 1	Pressure lower limit of the sensor 1 (Pressure at 4 mA)	0	500	PSI	0	0	34.4	bar	0
OP 2	Pressure upper limit of the sensor 1 (Pressure at 20 mA)	0	500	PSI	500	0	34.4	bar	34.4
OP 3	Offset adjustment of pressure sensor 1	-5	5	PSI	0	-0.3	0.3	bar	0
OP 4	Pressure lower limit of the sensor 2 (Pressure at 4 mA)	0	500	PSI	0	0	34.4	bar	0
OP 5	Pressure upper limit of the sensor 2 (Pressure at 20 mA)	0	500	PSI	500	0	34.4	bar	34.4
OP 6	Offset adjustment of pressure sensor 2	-5	5	PSI	0	-0.3	0.3	bar	0
OP 7	Pressure lower limit of the sensor 3 (Pressure at 4 mA)	0	500	PSI	0	0	34.4	bar	0
OP 8	Pressure upper limit of the sensor 3 (Pressure at 20 mA)	0	500	PSI	500	0	34.4	bar	34.4
OP 9	Offset adjustment of pressure sensor 3	-5	5	PSI	0	-0.3	0.3	bar	0
OP 10	Pressure lower limit of the sensor 4 (Pressure at 4 mA)	0	500	PSI	0	0	34.4	bar	0
OP 11	Pressure upper limit of the sensor 4 (Pressure at 20 mA)	0	500	PSI	500	0	34.4	bar	34.4
OP 12	Offset adjustment of pressure sensor 4	-5	5	PSI	0	-0.3	0.3	bar	0

OP01 - Pressure lower limit of the sensor 1 (Pressure at 4 mA)
Pressure applied to the pressure sensor 1 when it presents its output in an amperage of 4mA.

OP02 - Pressure upper limit of the sensor 1 (Pressure at 20 mA)
Pressure applied to the pressure sensor 1 when it presents its output in an amperage of 20mA.

OP03 - Offset of pressure sensor 1 of the gas line
To compensate pressure misreading of pressure switch 1.

0P04 - Pressure lower limit of the sensor 2 (Pressure at 4 mA)
Pressure applied to the pressure sensor 2 when it presents its output in an amperage of 4mA.

OP05 - Pressure upper limit of the sensor 2 (Pressure at 20 mA)
Pressure applied to the pressure sensor 2 when it presents its output in an amperage of 20mA.

OP06 - Offset of pressure sensor 2 of the gas line
To compensate pressure misreading of pressure switch 2.

OP07 - Pressure lower limit of the sensor 3 (Pressure at 4 mA)
Pressure applied to the pressure sensor 3 when it presents its output in an amperage of 4mA.

OP08 - Pressure upper limit of the sensor 3 (Pressure at 20 mA)
Pressure applied to the pressure sensor 3 when it presents its output in an amperage of 20mA.

OP09 - Offset of pressure sensor 3 of the gas line
To compensate pressure misreading of pressure switch 3.

OP10 - Pressure lower limit of the sensor 4 (Pressure at 4 mA)
Pressure applied to the pressure sensor 4 when it presents its output in an amperage of 4mA.

OP11 - Pressure upper limit of the sensor 4 (Pressure at 20 mA)
Pressure applied to the pressure sensor 4 when it presents its output in an amperage of 20mA.

OP12 - Offset of pressure sensor 4 of the gas line
To compensate pressure misreading of pressure switch 4.

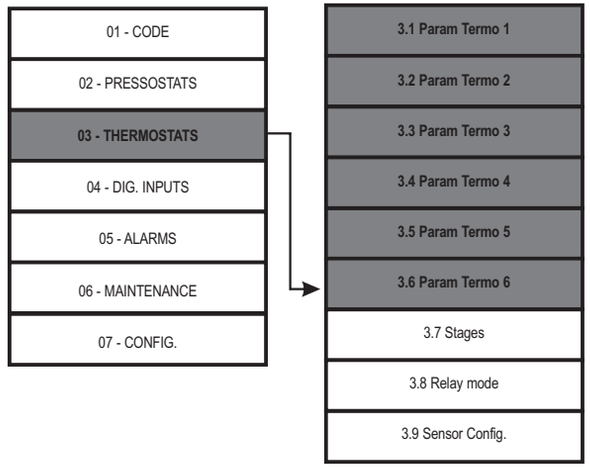
NOTE: Due to the pressure transmitter to measure gauge pressure, the controller may display a variation of up to 2 psi due to the altitude at which the controller will be installed. This variation can be corrected (offset) in the functions: **OP03, OP06, OP09 and OP12.**

8.3 - Parameters of internal thermostats

Inside the "option" Thermostats can individually configure the parameters for each internal thermostat of **PCT-3001** *plus*, as you can configure the action of each thermostat stage mode of relays (NO/NC) and finally adjust the displacement ("offset") of temperature measures. To access the menu of thermostats, access the main menu (+ and - keys at the same time), and navigate through the main menu by selecting "Thermostats", and finally press OK key. On the next screen the controller will display a list of available set options.

8.3.1 - Parameters

The table below describes the parameters and setting ranges of the thermostat functions (Param. Term 1 to 6, thermostats 1-6 respectively).



		PSI/°C				Bar/°F			
Nr	**Description**	**Min**	**Max**	**Unit.**	**Standard**	**Min**	**Max**	**Unit.**	**Standard**
T01	Control Setpoint	-50.0	200.0	°C	20.0	-58	392	°F	68
T0 2	Control Hysteresis	0.1	5	°C	5	1	9	°F	9
T0 3	Operation Mode	0	2	-	0	0	2	-	0
T0 4	Low temperature alarm	-50.0	200.0	°C	-50.0	-58	392	°F	-58
T0 5	High temperature alarm	-50.0	200.0	°C	200.0	-58	392	°F	392
T0 6	Alarm hysteresis	0.1	5	°C	5	1	9	°F	9

T01 - Control Setpoint
When the thermostat temperature reaches this value, the thermostat associated outputs are disabled.

T02 - Control hysteresis
Control hysteresis of thermostat temperature. See description of the function T03 for details on the operation of the thermostat.

T03 - Operation Mode
The operation of the thermostat depends on its operation mode:
`Off` - Thermostat off (thermostat control and alarms inhibited).

`Cooling` - Outputs associated with the thermostat will be triggered when the thermostat temperature reaches a value equal to or greater than the "Control Setpoint" + "Control Hysteresis", and are switched off when the temperature is equal to or greater than the value set in "Control Setpoint" .

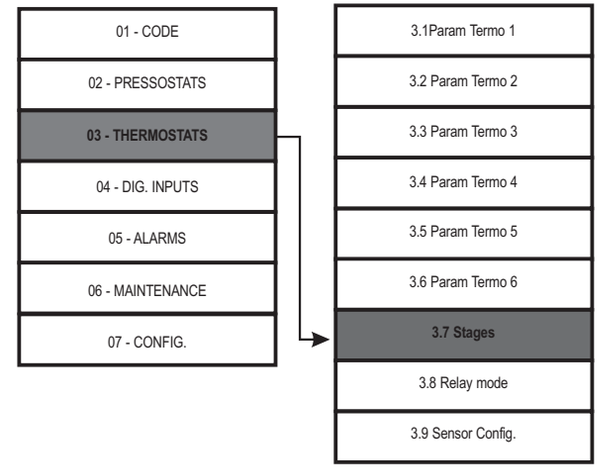
`Heating` - Outputs associated with the thermostat will be triggered when the thermostat temperature reaches a value equal to or less than the "Control Setpoint" + "Control Hysteresis", and are switched off when the temperature is equal to or less than the value set in "Control Setpoint" .

T04 - Low temperature alarm
Is the reference temperature value to actuates temperature signaling of thermostat below the desired point. Alarms of thermostats do not interfere with system resets (resets of temperature alarms of the thermostats always occur automatically). When this alarm occurs all thermostat outputs related to the thermostat being configured are disabled.

T05 - High temperature alarm
Is the reference temperature value to actuates temperature signaling of thermostat over the desired point. Alarms of thermostats do not interfere with system resets (resets of temperature alarms of the thermostats always occur automatically). When this alarm occurs all thermostat outputs related to the thermostat being configured are disabled.

T06 - Alarm Hysteresis
It is the difference between the current temperature and the detection alarm temperature threshold (alarm temperature is low or high) to exit the alarm situation.

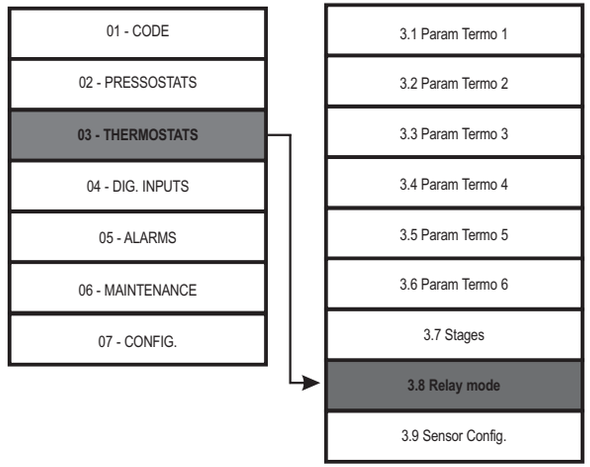
8.3.2 - Stages



The setting options for each digital output reserved for thermostats are:

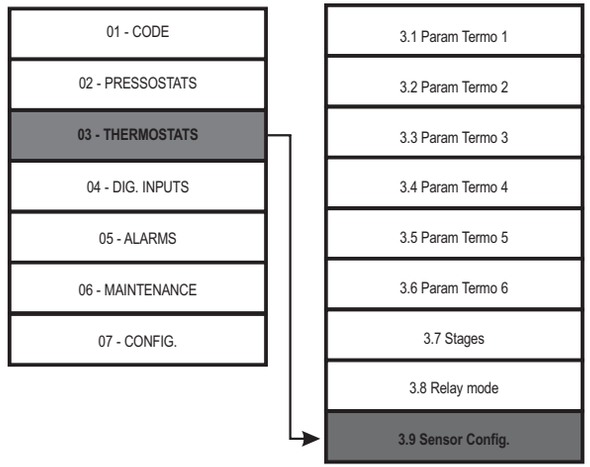
`Disabled`- Digital output off (empty)
`Thermo 1`- Digital output reserved to drive for thermostat 1.
`Thermo 2`- Digital output reserved to drive for thermostat 2.
`Thermo 3`- Digital output reserved to drive for thermostat 3.
`Thermo 4`- Digital output reserved to drive for thermostat 4.
`Thermo 5`- Digital output reserved to drive for thermostat 5.
`Thermo 6`- Digital output reserved to drive for thermostat 6.

8.3.3 - Relay Mode



Allows you to adjust the digital output relay will operate in the normally open (NO) or normally closed (NC) mode.

8.3.4 - Temperature sensors configurations



This menu is used to compensate possible deviations in the temperature reading from the temperature sensor replacement.

		PSI/°C				Bar/°F			
Nr	**Description**	**Min**	**Max**	**Unit.**	**Standard**	**Min**	**Max**	**Unit.**	**Standard**
OT 1	Offset adjustment of temperature sensor 1	-5	5	°C	0	-9	9	°F	0
OT 2	Offset adjustment of temperature sensor 2	-5	5	°C	0	-9	9	°F	0
OT 3	Offset adjustment of temperature sensor 3	-5	5	°C	0	-9	9	°F	0
OT 4	Offset adjustment of temperature sensor 4	-5	5	°C	0	-9	9	°F	0
OT 5	Offset adjustment of temperature sensor 5	-5	5	°C	0	-9	9	°F	0
OT 6	Offset adjustment of temperature sensor 6	-5	5	°C	0	-9	9	°F	0

OT01 - Temperature Offset of Sensor 1
To compensate temperature misreading of sensor 1.

OT02 - Temperature Offset of Sensor 2
To compensate temperature misreading of sensor 2.

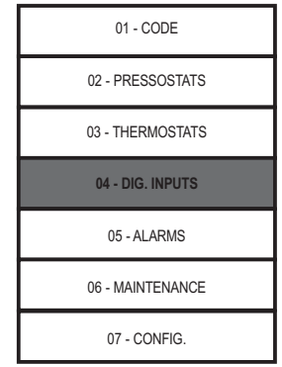
OT03 - Temperature Offset of Sensor 3
To compensate temperature misreading of sensor 3.

OT04 - Temperature Offset of Sensor 4
To compensate temperature misreading of sensor 4.

OT05 - Temperature Offset of Sensor 5
To compensate temperature misreading of sensor 5.

OT06 - Temperature Offset of Sensor 6
To compensate temperature misreading of sensor 6.

8.4 - Parameters of Digital Outputs



		PSI / °C				Bar / °F			
Fun	**Description**	**Min.**	**Max.**	**Unit.**	**Standard**	**Min.**	**Max.**	**Unit.**	**Standard**
D01	Digital input mode 1	0	4	-	0	0	4	-	0
D02	State when the contact of the digital input 1 is open	0	1	-	0	0	1	-	0
D03	Pressure switches associated to the digital input 1	0	34	-	0	0	34	-	0
D04	Digital input mode 2	0	4	-	0	0	4	-	0
D05	State when the contact of the digital input 2 is open	0	1	-	0	0	1	-	0
D06	Pressure switches associated to the digital input 2	0	34	-	0	0	34	-	0
D07	Digital input mode 3	0	4	-	0	0	4	-	0
D08	State when the contact of the digital input 3 is open	0	1	-	0	0	1	-	0
D09	Pressure switches associated to the digital input 3	0	34	-	0	0	34	-	0
D10	Digital input mode 4	0	4	-	0	0	4	-	0
D11	State when the contact of the digital input 4 is open	0	1	-	0	0	1	-	0
D12	Pressure switches associated to the digital input 4	0	34	-	0	0	34	-	0
D13	Digital input mode 5	0	4	-	0	0	4	-	0
D14	State when the contact of the digital input 5 is open	0	1	-	0	0	1	-	0
D15	Pressure switches associated to the digital input 5	0	34	-	0	0	34	-	0

DXX - Digital input mode
It allows adjusting the operating mode of the digital output.
- `Off` - Input disabled
- `Day/Nigth` - Selection of the daytime / nighttime setpoint
- `All on` - Enable all outputs
- `All off` - Disable all outputs
- `Virtual alarm.` - Virtual alarm

Note 1: If the digital input mode is virtual alarm, pressure switches that are associated with that input will have their alarms digital input active, but there is no change in the operating system (no drives / shutdowns stages).
Note 2: Virtual alarm is not counted by system resets.

DXX - State when the contact of the digital input Xis open

`Deactive` - Digital input considered disabled
`Active` - Digital input considered enabled

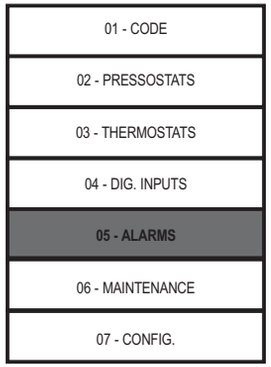
DXX - Pressure switches associated to the digital input

It allows adjusting which pressure switches are linked to the digital input.

`All` - All pressure switches
`P1` - Pressure switch 1
`P2` - Pressure switch 2
`P3` - Pressure switch 3
`P4` - Pressure switch 4
`Todos GP1` - All of pressure switch group 1
`Succ GP1` - All suctions of pressure switch group 1
`Todos GP2` - All of pressure switch group 2
`Succ GP2` - All suctions of pressure switch group 2
`Stage "x"` - Where x is the number of the stage to be associated (1 to 26)

Note 3: Only stages type compressor or fan can be selected.
Note 4: If a stage type compressor is selected, the stages type unloader associated with it will also be turned on/off if the digital input is activated.
Note 5: If a stage type fan is selected, the stages type auxiliary fan associated with it will also be turned on / off if the digital input is activated.

8.5 - Parameters of Alarm Outputs



		PSI / °C				Bar / °F			
Fun	Description	Min.	Max.	Unit.	Standard	Min.	Max.	Unit.	Standard
A01	Alarm 1 mode	0	19	-	0	0	19	-	0
A02	Pressure switches associated to the alarm 1	0	8	-	0	0	8	-	0
A03	Alarm 1 on time	0	999	sec	0	0	999	sec	0
A04	Alarm 1 off time	0	999	sec	0	0	999	sec	0
A05	Alarm 1 output in reverse mode	0	1	-	0	0	1	-	0
A06	Alarm 2 mode	0	19	-	0	0	19	-	0
A07	Pressure switches associated to the alarm 2	0	8	-	0	0	8	-	0
A08	Alarm 2 on time	0	999	sec	0	0	999	sec	0
A09	Alarm 2 off time	0	999	sec	0	0	999	sec	0
A10	Alarm 2 output in reverse mode	0	1	-	0	0	1	-	0
A11	Alarm 3 mode	0	19	-	0	0	19	-	0
A12	Pressure switches associated to the alarm 3	0	8	-	0	0	8	-	0
A13	Alarm 3 on time	0	999	sec	0	0	999	sec	0
A14	Alarm 3 off time	0	999	sec	0	0	999	sec	0
A15	Alarm 3 output in reverse mode	0	1	-	0	0	1	-	0
A16	Alarm 4 mode	0	19	-	0	0	19	-	0
A17	Pressure switches associated to the alarm 4	0	8	-	0	0	8	-	0
A18	Alarm 4 on time	0	999	sec	0	0	999	sec	0
A19	Alarm 4 off time	0	999	seg	0	0	999	sec	0
A20	Alarm 4 output in reverse mode	0	1	-	0	0	1	-	0

AXX - Alarm 1 mode

It allows adjusting the operating mode of the alarm output xx.

`Off` - Control switched off
`All` - All alarms
`Low press` - Low pressure alarm
`High press` - High pressure alarm
`Pressure` - All pressure alarms
`Low temp` - Low temperature alarm
`High temp` - High temperature alarm
`Temperat` - All temperature alarms
`Dig in` - Digital input alarm
`Locked` - Controller locked alarm
`Remote` - Interlocking alarm
`Low superh` - Low superheating alarm
`Crit superh` - Critical superheating alarm
`Low efic` - Low efficiency alarm (high superheating)
`Superheat` - All superheating alarms
`Maintenanc` - Maintenance alarms
`Pres sensor` - Pressure sensor error alarm
`Temp sensor` - Temperature sensor error alarm
`Liq. L Sensor` - Error alarm in the liquid line temperature sensor
`Sensors` - Error alarm for any sensor

AXX - Pressure switches associated to the alarms

It allows adjusting which pressure switches the alarm output will be linked to.

`All` - All pressure switches
`P1` - Pressure switch 1
`P2` - Pressure switch 2
`P3` - Pressure switch 3
`P4` - Pressure switch 4
`All GP1` - All of pressure switch group 1
`Succ GP1` - All suctions of pressure switch group 1
`All GP2` - All of pressure switch group 2
`Succ GP2` - All suctions of pressure switch group 2

AXX - Alarm X on time

It is the time the alarm Xoutput will be active when cycling. To make the output stay continuously on, just configure this function to zero.

AXX - Alarm X off time

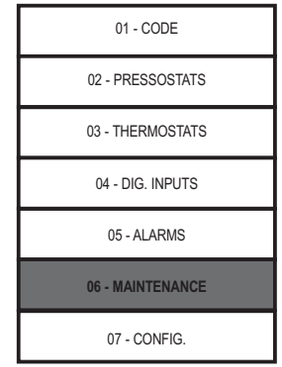
It is the time the alarm Xoutput will be deactivated when cycling. To make the output stay continuously on, just configure this function to zero.

AXX - Alarm X output in reverse mode

It indicates whether the relay of alarm Xwill close or open the contact in an alarm condition.

`No` - Relay contact open when no alarm is present
`Yes` - Relay contact closed when no alarm is present

8.6 - Maintenance of the digital outputs



It allows placing any output of the **PCT-3001 *plus***, in maintenance regardless of its function.

8.7- General configuration parameters

01 - CODE
02 - PRESSOSTATS
03 - THERMOSTATS
04 - DIG. INPUTS
05 - ALARMS
06 - MAINTENANCE
07 - CONFIG.

It allows adjust various parameters of the **PCT-3001** *plus*.

		PSI/°C				Bar/°F			
Nr	**Description**	**Min**	**Max**	**Unit.**	**Standard**	**Min**	**Max**	**Unit.**	**Standard**
F01	Preferred indication	0	6	-	1	0	6	-	1
F02	Contrast	0	10	-	4	0	10	-	4
F03	Language	0	2	-	0	0	2	-	0
F04	RS-485 address	1	247	-	1	1	247	-	1

F01 - Preferred indication
It allows adjusting the preferred indication in the display.
`Inform` - Screen with the type of each internal switch
`Pressure` - Screen with the pressures of gas line
`Temperat` - Screen with the temperatures of gas line
`Temp SA/SR` - Screen with the sub-cooling and overheating temperatures
`Thermo 1` - Screen with temperatures of the thermostats 1 to 4
`Thermo 2` - Screen with temperatures of the thermostats 5 to 6
`Dig out` - Screen with the states of digital outputs
`Rotation` - All the above screens alternately

F02 - Contrast
It allows adjusting the contrast of the display.

F03 - Language
It allows adjusting the language of the controller between Portuguese, English and Spanish.

F04 - RS-485 address
Alt adjusts the address of the controller in the RS-485 network.
Note: One network must not have different instruments with the same address.

9 - OPERATION

9.1 - Pressure control

PCT-3001 *plus* pressure control system has an option to control variable capacity compressors and fans by activating digital outputs or using the analogue output. Using the analogue output the compressor is controlled by means of a frequency inverter and the capacity is directly modulated by the controller. In the case of activating by the digital outputs, the compressors must be fitted with capacity valves (unloaders) or the fans must be fitted with auxiliary devices (evaporative system). First we have to establish a nomenclature for the components to understand better the operation of the logic of the variable capacity compressors and fans using the digital outputs.

Master stage: It is the output connected directly to the motor of the compressor, i.e. it is the stage that switches the compressor / fan on or off.
Slave stage: It is the output connected to the device that changes the capacity of the master stage (unloader or fan auxiliary). One master stage may have slave stages or not. If there are no slaves the compressor / fan will not have variable capacity. If there are slaves, they may be present in any number. One slave stage can only be activated when the master is already active and one master stage can only be deactivated when all its slaves are switched off.
Total power in HP: It is the total power of the master stage together with the slave stages expressed in HP, i.e. it is the maximum power that the compressor / fan can exert on the refrigeration system.

Portion of the total capacity: It is the portion of power that each stage (master and slave) contributes to the total power in HP. The portions of the capacity are adjusted in percentage (%) levels. Thus the sum of the value of the master and the values of the slaves for a same compressor / fan must be 100%.

The possible combinations in **PCT-3001** *plus* pressure control are adjusted by the parameters "Type of control of the digital outputs" and "Type of control of the analogue output". The possible combinations are:
- Control only by the digital outputs
- Control only by the analogue output
- Mixed control by the digital outputs and analogue output

9.1.1 - Types of control only by the digital outputs

Configuring the type of digital control as on and the type of analogue control as off, the pressure control will be performed only by the digital outputs. The possible control methods under these conditions are:
- Digital outputs in linear mode
- Digital outputs in rotation mode
- Digital outputs in capacity mode

9.1.1.1 - Digital outputs in linear mode

The digital outputs will be used in this control mode, and thus the controller will assume only the hysteresis value configured in the function: "digital output hysteresis". The controller will add digital outputs (master and slaves) as the pressure deviates from the setpoint. The activation point for each output is calculated in accordance with the hysteresis value and the number of stages (master and slave) configured.

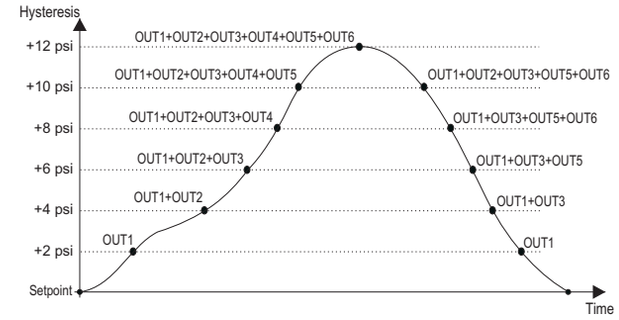
Activation step of the digital outputs

$$\text{Step} = \frac{\text{Hysteresis of the digital output}}{\text{Number of master and slave stages}}$$

***Pressure for activating output* "N"**
Activation = Setpoint + (N x Step)
Pressure for deactivating output "N"
Activation = Setpoint + (N-1 x Step)

Example:
Setpoint: 10 psi
Hysteresis of the digital output: 12 psi
Number of master stages: 4
Number of slave stages: 2
Configuration of the stages:
OUT 1 → Compressor (master 1)
OUT 2 → Unloader (slave 1 of master 1)
OUT 3 → Compressor (master 2)
OUT 4 → Unloader (slave 1 of master 2)
OUT 5 → Compressor (master 3)
OUT 6 → Compressor (master 4)

In this example the total of digital outputs is 6 (4 master and 2 slave). Thus the step of each digital output is 2 psi (12 psi divided by 6). The first digital stage will be activated when the pressure reaches 12 psi (setpoint plus step), the second at 14 psi (setpoint plus 2 times the step), the third at 16 psi (setpoint plus 3 times the step), and so on. Please note that at 22 psi (setpoint plus digital hysteresis) all digital outputs will be on.



9.1.1.2 - Digital Outputs in Linear Mode with Dead band

Note: The dead band is only available in command of the suction switches

If the dead band is enabled, the drive control of compressors "freezes" the number of stages that are triggered when the pressure enters the dead band region. If the pressure is out of the region bounded by the functions of the dead band, the number of the command stages will be updated as conditions below:

If the pressure rises above the upper limit of the dead band:

- The number of the command stages is immediately updated, and each command stage is added respecting the value set in the function "**P13/P15 - Time between activations**".

If the pressure drops below the lower limit of the dead band.

The shutdowns of stages must respect the function **P14/P16 (Time between deactivations)** and the number of active stages will be updated to correct the pressure in the system if any of the following conditions occur:

- The system pressure remained within the region defined by two transition thresholds for the period specified in P14/P16.
- The system pressure continued to drop and reached a value lower than the transition threshold pressure, in this case the function P14/P16 is ignored, the number of active stage is decremented immediately, and the counter for the function P14/P16 is restarted. If the pressure continues to drop and it reaches a new transition threshold before the time in P14/P16 has elapsed, the number of active stages is decremented again and the counter for the function P14/P16 is restarted, and so on.

The pressure thresholds used to delimit the regions where the function P14/P16 is respected, are calculated as follows:

$$\text{Dead band pitch} = \frac{\text{Lower dead band - Setpoint}}{\text{Nro factive stages when leaving dead band region -1}}$$

Pressure thresholds for immediate upgrade of pressure stages:
Threshold N = Pressure of lower dead band – N x (Dead band pressure)

Example:
Setpoint: 10 psi
Hysteresis of digital outputs 12 psi
Number of stages: 6
Lower dead band: 13 psi
Upper dead band: 17 psi

Setting stages:

OUT 1 →Compressor (master 1)

OUT 2 →Unloader (slave 1 of master 1)

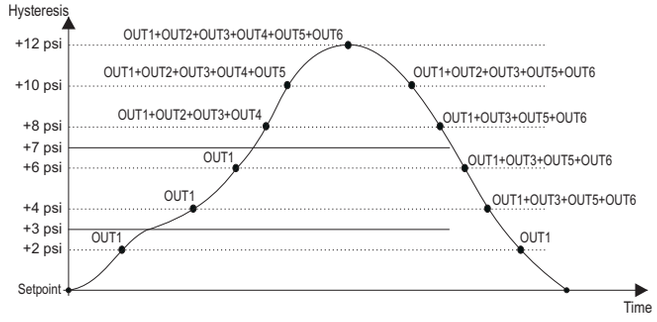
OUT 3 →Compressor (master 2)

OUT 4 →Unloader (slave 1 of master 2)

OUT 5 →Compressor (master 3)

OUT 6 →Compressor (master 4)

In this example we have that the total digital outputs are 6 (4 masters and 2 slaves), so that the pitch of each digital output is 2 psi (12 psi divided by 6). The first digital stage will be on when pressure is 12 psi (setpoint plus pitch), then the number of active stages is frozen until the pressure reaches 18 psi (threshold of upper dead band = 17 psi). When the pressure reaches 18 psi, the number of triggered stages becomes 4 (OUT 1, OUT 2, OUT 3, OUT 4 being the time between activations between each stage equal to the value set in the function P13/P15). When leaving the dead band region, the control back to work updating the number of active stages normally.



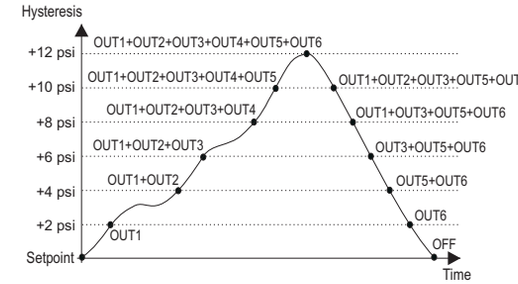
9.1.1.3 - Digital outputs in rotation mode

Only the digital outputs will be used in this control mode, and thus the controller will assume only the hysteresis value configured in the function: "digital output hysteresis". In this mode the digital outputs are controlled in accordance with the number of working hours, so that for switching on a new stage the controller checks which one has the least working time, and for switching off one stage it checks which one hasthe most working hours. This is aimed at ensuring balance in the operating time of the master stages. In the slave digital stages, the activation time of the corresponding master is considered.

Example:
Setpoint: 10 psi
Hysteresis of the digital output: 12 psi
Number of master stages: 4
Number of slave stages: 2
Configuration of the stages:

OUT 1 → Compressor (master 1)
OUT 2 → Unloader (slave 1 of master 1)
OUT 3 → Compressor (mestre 2)
OUT 4 → Unloader (slave 1 of master 2)
OUT 5 → Compressor (master 3)
OUT 6 → Compressor (master 4)

Like in the linear mode, the total of digital outputs is 6 (4 master and 2 slave). Thus the step of each digital output is 2 psi (12 psi divided by 6).Considering that the initial state of the hour meters of all stages is zero, the first digital stage will be switched on when the pressure reaches 12 psi (setpoint plus step), the second at 14 psi (setpoint plus 2 times the step), the third at 16 psi (setpoint plus 3 times the step), and so on. When the pressure reaches 22 psi (setpoint plus digital hysteresis) all digital outputs will be on. While a digital output is activated, the corresponding hour meter is incremented. Thus we can conclude that stage 1 will have a higher time than stage 2 because the former was activated earlier. Stage 2 will have a higher time than stage 3 and so on. When the pressure drops below 22 psi and the controller needs to switch off one stage, it will choose the one with more time. In the example in question stage 1 will be chosen.



9.1.1.4 Digital Outputs in Rotation Mode with Dead band

Note: The dead band is only available in command of the suction switches

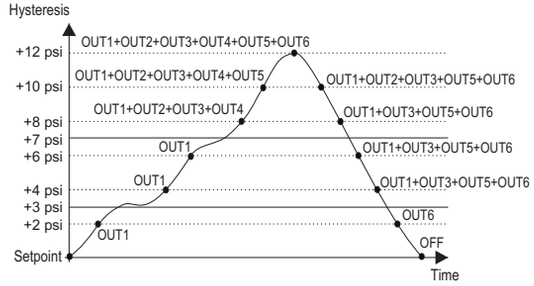
In rotation mode, the dead band works the same way as in the linear mode, but the stages with shorter working hours, have the highest priority in the drive (when it is necessary to increase the pressure) and the stages with more worked hours has highest priority on shutdown (when it is necessary to decrease the pressure).

Example:
Setpoint: 10 psi
Hysteresis of digital outputs 12 psi
Lower dead band: 13 psi
Upper dead band: 17 psi

Setting stages:
OUT 1 → Compressor (master 1)
OUT 2 → Unloader (slave 1 of master 1)
OUT 3 → Compressor (master 2)
OUT 4 → Unloader (slave 1 of master 2)
OUT 5 → Compressor (master 3)
OUT 4 → Compressor (master 4)

As in the linear mode, the total of digital outputs are 6 (4 masters and 2 slaves), so that the pitch of each digital output is 2 psi (12 psi divided by 6). Considering that all stages are initially with de hourmeter in "zero", the first digital stage will be on when pressure is 12 psi (setpoint plus pitch), then the number of active stages is frozen until the pressure reaches 18 psi (threshold of upper dead band = 17 psi).

When the pressure reaches 18 psi, the number of triggered stages becomes 4 (OUT 1, OUT 2, OUT 3, OUT 4 being the time between activations between each stage equal to the value set in the function P13/P15). When leaving the dead band region, the control back to work updating the number of active stages normally. When the pressure reaches 22 psi (setpoint plus digital hysteresis) all digital outputs are connected. While a digital output is triggered your hourmeter is being incremented, and thus we can conclude that the first stage will have more time to stage 2, because it has been drives before. Stage 2 will in turn have more time to stage 3, and so on. When the pressure drops to 22 PSI and you need to disconnect a stage, the controller will choose the more time engaged, in our example, we choose the first stage. When the pressure reenter the dead band region (pressure reaches 18 PSI), the number of outputs will remain frozen again. When the pressure reaches 12 PSI, the number of stages connected back to be updated, according to the conditions described in the function of dead band (time in P14/P16 function or dead band pitch).



9.1.1.5 - Digital outputs in capacity mode

Only the digital outputs (master and slave) will be used in this control mode, and thus the controller will assume only the hysteresis value configured in the function: "digital output hysteresis". The activation point for each output is calculated in accordance with the output capacity and the number of stages configured. The activation will occur in accordance with the demand of the system, and the controller will always activate the set with the smallest number of outputs meeting the current demand. The calculation of the demand is made considering the following formula:

$$\text{Demand (\%)} = \frac{\text{Pressure measured - Setpoint}}{\text{Total hysteresis}} \times 100$$

If more than one combination of stages is able to meet the demand, the combination that changes the state of the smaller number of relays will be considered.

Example:
Setpoint: 10 psi
Hysteresis of the digital output: 16 psi
Number of master stages: 3
Number of slave stages: 5
Configuration of the stages:

OUT 1 → Compressor (master 1)
OUT 2 → Unloader (slave 1 do master 1)
OUT 3 → Unloader (slave 2 do master 1)
OUT 4 → Unloader (slave 3 do master 1)
OUT 5 → Compressor (master 2)
OUT 6 → Unloader (slave 1 of master 2)
OUT 7 → Unloader (slave 2 of master 2)
OUT 8 → Compressor (master 3)

Capacity of the compressors stages:

OUT 1 → 4HP (total capacity of the compressor of master 1)
OUT 5 → 3HP (total capacity of the compressor of master 2)
OUT 8 → 3HP (total capacity of the compressor of master 3)

The sum of capacities is 10HP

Portion of capacities

OUT 1 → 40% (40% of the total capacity of the master 1,or, 40% de 4HP →1.6HP)
OUT 2 → 20% (20% of the total capacity of the master 1,or, 20% de 4HP →0.8HP)
OUT 3 → 20% (20% of the total capacity of the master 1,or, 20% de 4HP →0.8HP)
OUT 4 → 20% (20% of the total capacity of the master 1,or, 20% de 4HP →0.8HP)

The sum of the portions is 100%

OUT 5 → Compressor (70% of the total capacity of the master 2, or, 70% de 3HP →2.1HP)
OUT 6 → Unloader (15% of the total capacity of the master 2, or,15% de 3HP →0.45HP)
OUT 7 → Unloader (15% of the total capacity of the master 2, or, 15% de 3HP →0.45HP)

The sum of the portions is 100%

OUT 8 → Compressor (100% of the total capacity of the master 3, or, 100% de 3HP → 3HP)

The sum of the portions is 100% (in this case no slave)

As the sum of the total capacity is 10 HP, the demand of 100% is equal to 10 HP. Thus the capacity of each stage in relation to the system demand is:

Note: These values are internally calculated by **PCT-3001** *plus* and do not require to be entered.

OUT 1 →16% (1.6HP de 10HP = 16%)
OUT 2 →8% (0.8HP de 10HP = 8%)
OUT 3 →8% (0.8HP de 10HP = 8%)
OUT 4 →8% (0.8HP de 10HP = 8%)
OUT 5 →21% (2.1HP de 10HP = 21%)
OUT 6 →4.5% (0.45HP de 10HP = 4.5%)
OUT 7 →4.5% (0.45HP de 10HP = 4.5%)
OUT 8 →30% (3HP de 10HP = 30%)

The sum of the portions is 100%

With the values above, we can expect that the levels of operation of the capacity control will be in accordance with the chart forward:

	COMPRESSOR 1				COMPRESSOR 2			
Demand growing	OUT1 16%	OUT2 8%	OUT3 8%	OUT4 8%	OUT5 21%	OUT6 4.5%	OUT7 4.5%	OUT8 30%
0.0%								
6.2%	X							
12.5%	X							
18.7%	X							
25.0%	X	X						
31.0%								X
37.5%	X				X			
43.7%	X				X	X		
50.0%	X	X			X	X		
56.2%					X	X		X
62.5%	X	X	X					X
68.7%	X				X			X
75.0%	X	X			X			X
81.2%	X	X			X	X		X
87.5%	X	X	X		X	X		X
93.7%	X	X	X		X	X	X	X
100%	X	X	X	X	X	X	X	X

	COMPRESSOR 1				COMPRESSOR 2			
Demand decreasing	OUT1 16%	OUT2 8%	OUT3 8%	OUT4 8%	OUT5 21%	OUT6 4.5%	OUT7 4.5%	OUT8 30%
100.0%	X	X	X	X	X	X	X	X
93.7%	X	X	X	X	X	X		X
87.5%	X	X	X		X	X		X
81.2%	X	X	X		X			X
75.0%	X	X			X			X
68.7%	X	X	X	X				X
62.5%	X	X	X	X	X	X		
56.2%	X	X	X		X	X		
50.0%					X			X
43.7%	X	X			X			
37.5%	X	X	X	X				
31.0%	X	X	X					
25.0%					X	X		
18.7%					X			
12.5%	X							
6.2%	X							
0.0%								

9.1.1.6 - Digital Outputs in Capacities Mode with Dead band

The dead band is not available in this control mode.

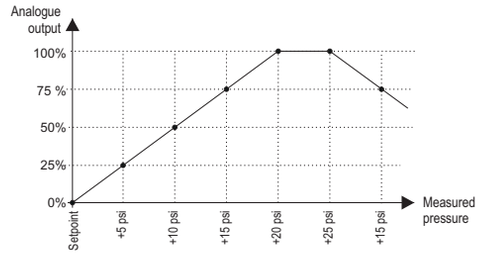
9.1.2 - Type control only for analog output

Setting up the type of digital control to off, and the type of analog control to on, we will have to control pressure will be realized only by the analog output. Possible methods to control these conditions are:

9.1.2.1 - Proportional analogue output

Only the analogue output will be used in this control mode, and thus the controller will assume only the hysteresis value configured in the function: "analogue output hysteresis." When the measured pressure drops below the setpoint, the analogue output will be at 0%. When the pressure rises above the setpoint, the value of the analogue output will increase until the measured pressure reaches a value equivalent to the setpoint plus the hysteresis, and then the proportional output will have 100% power.

Example:
Setpoint: 10 psi
Analogue output hysteresis: 20 psi



9.1.3 - Mixed control by the digital outputs and analogue output

Configuring the type of digital control as on and the type of analogue control as on, the pressure control will be performed by both types of outputs. The possible control methods under these conditions are:
- Digital outputs in linear mode with proportional analogue output
- Digital outputs in rotation mode with proportional analogue output
- Digital outputs in capacity mode with proportional analogue output

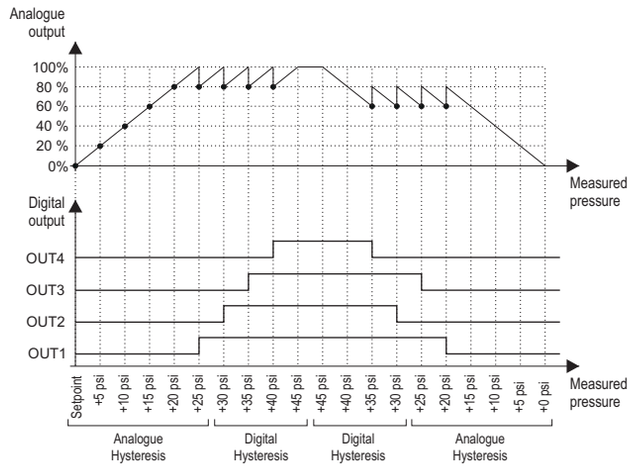
Note: The dead band is not available in this control mode.

9.1.3.1 - Digital outputs in linear mode with proportional analogue output

In this mode, the digital outputs will be activated whenever the analogue output reaches the maximum value (100%). The activation sequence of the digital loads will be linear as explained before. Due to the fact that this operating mode uses digital and analogue outputs, the controller will assume the hysteresis is equal to the sum of the following functions: "digital output hysteresis" and "analogue output hysteresis."

Example:
Setpoint: 10 psi
Hysteresis of the digital outputs: 20 psi
Number of master stages: 2
Number of slave stages: 2
Hysteresis of the analogue output: 25 psi
Total hysteresis: 45 psi
Configuration of the stages:
OUT 1 →Compressor (master 1)
OUT 2 →Unloader (slave 1 of master 1)
OUT 3 →Compressor (mestre 2)
OUT 4 →Unloader (slave 1 of master 2)

In this example the step for each digital output is 5 psi (20 psi divided by 4). The conclusion is that each digital stage corresponds to 16% of the analogue output (step divided by the analogue hysteresis), or: 5 psi divided by 25 psi. Thus, whenever the controller activates or deactivates a digital stage, the analogue output will be compensated by increasing or decreasing the corresponding portion (16%).

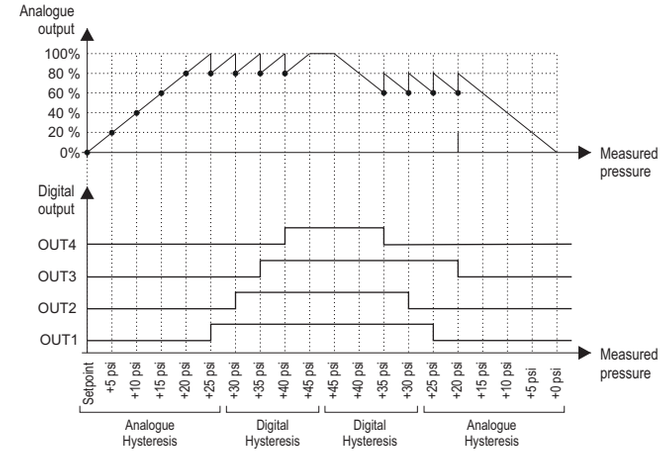


9.1.3.2 - Digital outputs in rotation mode with proportional analogue output

In this mode the digital outputs are controlled in accordance with the number of working hours, so that for switching on a new stage the controller checks which one has the least working time, and for switching off one stage it checks which one has the most working hours. This is aimed at ensuring balance in the operating time of the digital outputs. Due to the fact that this operating mode uses digital and analogue outputs, the controller will assume the hysteresis is equal to the sum of the following functions: "digital output hysteresis" and "analogue output hysteresis."

Example:
Setpoint: 10 psi
Hysteresis of the digital outputs: 20 psi
Number of master stages: 2
Number of slave stages: 2
Analogue output hysteresis: 25 psi
Total hysteresis: 45 psi
Configuration of the stages:
OUT 1 → Compressor (master 1)
OUT 2 → Unloader (slave 1 of master 1)
OUT 3 → Compressor (master 2)
OUT 4 → Unloader (slave 1 of master 2)

Considering that the initial state of the hour meters of all stages is zero, the first digital stage will be switched on when the analogue output reaches 100% is OUT1. Being the first to be switched on, it will be also the first to be switched off as it will have the highest number of working hours.



9.1.3.3 - Digital outputs in capacity mode with proportional analogue output

In this operating mode the analogue output works together with the digital outputs in such a way to meet the full system demand. The activation point for each digital output is calculated in accordance with the output capacity and the number of stages configured. The activation will be made such that the digital stages meet most of the demand, thus leaving only the residual needs for the analogue output. Due to the fact that this operating mode uses digital and analogue outputs, the controller will assume the hysteresis is equal to the sum of the following functions: "digital output hysteresis" and "analogue output hysteresis."

Example:
Setpoint: 10 psi
Hysteresis of the digital outputs: 20 psi
Number of master stages: 2
Number of slave stages: 2
Analogue Output Capacity: 4HP
Minimum value of the analogue output:10%
Analogue output hysteresis: 10 psi
Total hysteresis: 30 psi
Configuration of the stages:
OUT 1 → Compressor (master 1)
OUT 2 → Unloader (slave 1 of master 1)
OUT 3 → Compressor (master 2)
OUT 4 → Unloader (slave 1 of master 2)

Capacity of the compressors stages:
OUT 1 → 2HP (total capacity of the compressor of master 1)
OUT 3 → 2HP (total capacity of the compressor of master 2)

The sumof capacities is 8HP(2 + 2 + 4HPof the nalogue output)

Portion of capacities:

OUT 1 → 75% (75% of the total capacity of the master 1,or, 75% de 2HP →1.5HP)
OUT 2 → 25% (25% of the total capacity of the master 1,or, 25% de 2HP → 0.5HP)

The sum of the portions is 100%

OUT 3 → 50% (50% of the total capacity of the master 2, or , 50% de 2HP →1HP)
OUT 4 → 50% (50% of the total capacity of the master 2, or , 50% de 2HP →1HP)

The sum of the portions is 100%

As the sum of the total capacity is 8 HP, the demand of 100% is equal to 8 HP. Thus the capacity of each digital and analogue stage in relation to the system demand is:
NOTE: These values are calculated internally by the **PCT-3001** *plus* and don´t need to be typed.

OUT 1 → 18.75% (1,5HP de 8HP = 18.75%)
OUT 2 → 6.25% (0,5HP de 8HP = 6.25%)
OUT 3 → 12.5 % (1HP de 8HP = 12.5%)
OUT 4 → 12.5 % (1HP de 8HP = 12.5 %)
AN 1 → 50,0%(4HP de 8HP = 50,0%)

The sum of the portions is 100%

With the values above, we can expect that the levels of operation of the capacity control will be in accordance with the chart below:

	COMPRESSOR 1		COMPRESSOR 2		COMPRESSOR 3
Demand growing	OUT1 18.75%	OUT2 6.25%	OUT3 12.50%	OUT4 12.50%	AN1 50.00%
0.0%					0.0%
10.0%					20.0%
20.0%					40.0%
30.0%					60.0%
40.0%					80.0%
50.0%					100.0%
60.0%			X		95.0%
70.0%			X	X	90.0%
80.0%	X		X		97.0%
90.0%	X		X	X	92.0%
100.0%	X	X	X	X	100.0%

	COMPRESSOR 1		COMPRESSOR 2		COMPRESSOR 3
Demand decreasing	OUT1 18.75%	OUT2 6.25%	OUT3 12.50%	OUT4 12.50%	AN1 50.00%
100.0%	X	X	X	X	100.0%
90.0%	X	X	X	X	80.0%
80.0%	X	X	X	X	60.0%
70.0%	X	X	X	X	40.0%
60.0%	X	X	X	X	20.0%
50.0%	X	X	X	X	10.0%
40.0%	X		X		17.0%
30.0%			X		35.0%
20.0%			X		15.0%
10.0%					20.0%
0.0%					0.0%

9.2 - Superheating monitoring

With the adjusted gas curve,**PCT-3001** *plus* is able to calculate the superheating for different suctions in the refrigeration system. These values help monitoring the system efficiency and can also be used to activate the protection system against liquid in the suction line, as well as to generate miscellaneous alarms.

9.2.1 - Alarm generation

The superheating monitoring uses three param high superheating temperature:

High superheating temperature: When the calculated superheating temperature is above this value, the internal pressure switch will activate the low efficiency alarm.

Low superheating temperature: When the calculated superheating temperature is below this value, the internal pressure switch will activate the low superheating alarm.

Critical superheating temperature: When the calculated superheating temperature is below this value, the internal pressure switch will activate the critical superheating alarm.

9.2.2 - Compressor protection

The superheating monitoring uses two parameters to determine the degree of protection for the compressors:

Low superheating temperature: When the calculated superheating temperatures is below this value, **PCT-3001** *plus* will only activate the liquid collection output (if any) and keep the compressors working normally.

Critical superheating temperature: When the calculated superheating temperatures is below this value, **PCT-3001** *plus* will switch off all compressors and keep the liquid collection output (if any) activated.

9.3 - Suction liquid collection system

The liquid collection system uses a digital output (if configured) to activate a valve to remove the liquid from the suction line. This output will be activated whenever all compressors are deactivated or the compressor protection system requests it. When the last active compressor is about to be deactivated, **PCT-3001** *plus* can keep it activated together with the collection output, so that the compressor makes the refrigerant circulate to the tank. The time the compressor will stay active can be adjusted in the "Time for liquid collection" parameter. If the last active compressor is linked to the analogue output, it will stay at the minimum value adjusted in the "Minimum value of the analogue output" parameter.

9.4 - Sub-cooling Temperature Control

The **PCT-3001** *plus* has the ability to calculate the sub-cooling of the various cooling system discharges. This calculation is made from the saturated liquid curve (curve entered by the user) and the temperature in the liquid line. The sub-cooling information assists in monitoring the cooling system efficiency, because it is used to perform the activation of one or two outlets of the discharge switch, and through these the user may actuate one or two extra expansion valves so that cooling fins of the condenser, thus increasing its performance. The control of extra expansion valves is accomplished through a setpoint and two hysteresis, and the outputs can be triggered in the following ways:
1 output only: Only 1 output and 1 hysteresis will be used to drive the extra expansion valve.
2 independent outputs: 2 outputs and the 2 hysteresis will be used to drive extra expansion valves, and both may be driven simultaneously.
2 intercalate outputs: 2 outputs and the 2 hysteresis will be used to drive extra expansion valves, and can only be activated one at a time.

9.5 - Breeze system control

The breeze system is controlled based on the discharge pressure of the refrigeration system. When the measured pressure exceeds the userdefined adjustment, the breeze-type output (if any) is activated. This output can be connected to an evaporative refrigeration system aimed at cooling the fins of the condenser to increase its efficiency.

9.6 - Digital outputs

The digital outputs of **PCT-3001** *plus* must be configured in four steps:

9.6.1 - Type of stage

The menu “Pressure switches”→“Stages” allows adjusting the functions associated to each relay. The available options are:
`Off` -Free stage, always off.
`Compressor` - Master stage of the compressor.
`Unloader` - Slave stage of the compressor. This stage must be in the sequence of its master stage or in the sequence of another slave stage (master with more than one slave).
`Liq. collec` - Suction liquid collection system.
`Fan` - Master stage of the fan.
`Aux fan` - Slave stage of the fan. This stage must be in the sequence of its master stage or in the sequence of another slave stage (master with more than one slave).
`Subcool. 1` - Stage 1 of the condensation temperature control.
`Subcool. 2` - Stage 2 of the condensation temperature control. This stage should be following the first stage.
`Breeze` - Output of the breeze system control.
`Start/Stop` - Output of Start/Stop the frequency inverter.

9.6.2 - Mode of the relays

The menu “Pressure switches → Relay mode” allows defining the state of the relay when the respective stage is active or not. As this configuration is individual for each relay, it gives a great versatility for the type of activation that the controller will perform.

9.6.3 - Total capacity of the compressor / fan

The menu “Pressure switches → Compressor / fan capacity” allows defining the full capacity (in HP) of the compressors or fans. Such capacity is the maximum capacity a compressor or fan can provide to the refrigeration system, regardless of having slave stages or not.

9.6.4 - Capacity portions

The menu “Pressure switches → Capacity portions” allows defining the portion (%) that each master and slave stage represents for the respective compressors / fans. It is this portion together with the total capacity that will define the individual capacity of each master and slave in the refrigeration system.

9.7 - Digital inputs

PCT-3001 *plus* has five digital inputs, which can be used for the following functions:
- Daytime / nighttime setpoint selector
- External alarm to switch on all pressure control outputs
- External alarm to switch off all pressure control outputs

In addition to the function, it allows defining which internal pressure switch is associated to each digital input.
Note: In the case involving a digital input up to any stage type compressor or fan, the stages associated with the selected stage are also affected.

9.8 - Alarm system

The alarm system of **PCT-3001** *plus* is divided into two parts:
- Monitoring of the alarm conditions
- Activation of the alarm outputs

9.8.1 - Monitoring of the alarm conditions

The alarm conditions are monitored regardless of the configuration of the digital outputs as alarms.
PCT-3001 *plus* will always monitor the error alarms for the pressure sensor and, if this is operating, the high and low pressure alarms. The remaining alarms are monitored depending on whether they are active or not. The table below shows the monitoring conditions for all alarms.

Alarm		1 suc / 1 disch	2 suc / 1 disch	3 suc / 1 disch	2 suc / 2 disch
Error in the pressure sensor of the the gas line	P1	Always	Always	Always	Always
	P2	Always	Always	Always	Always
	P3	Never	Always	Always	Always
	P4	Never	Never	Always	Always
Error in the pressure sensor of the the gas line	P1	Only if the temperature sensor is active	Only if the temperature sensor is active	Only if the temperature sensor is active	Only if the temperature sensor is active
	P2	Only if the temperature sensor is active	Only if the temperature sensor is active	Only if the temperature sensor is active	Only if the temperature sensor is active
	P3	Never	Only if the temperature sensor is active	Only if the temperature sensor is active	Only if the temperature sensor is active
	P4	Never	Never	Only if the temperature sensor is active	Only if the temperature sensor is active
Error in the pressure sensor of the the gas line	P1	Never	Never	Never	Never
	P2	Only if the condensation temperature control mode is active	Never	Never	Only if the condensation temperature control mode is active
	P3	Never	Only if the condensation temperature control mode is active	Never	Never
	P4	Never	Never	Only if the condensation temperature control mode is active	Only if the condensation temperature control mode is active
High and low pressure alarm	P1	Always	Always	Always	Always
	P2	Always	Always	Always	Always
	P3	Never	Always	Always	Always
	P4	Never	Never	Always	Always
High temperature alarm	P1	Never	Never	Never	Never
	P2	Only if the sensor is active	Never	Never	Only if the sensor is active
	P3	Never	Only if the sensor is active	Never	Never
	P4	Never	Never	Only if the sensor is active	Only if the sensor is active

Alarm		1 suc / 1 disch	2 suc / 1 disch	3 suc / 1 disch	2 suc / 2 disch
Alow temperature alarm	P1	Only if the sensor is active	Only if the sensor is active	Only if the sensor is active	Only if the sensor is active
	P2	Never	Only if the sensor is active	Only if the sensor is active	Never
	P3	Never	Never	Only if the sensor is active	Only if the sensor is active
	P4	Never	Never	Never	Never
Superheating alarm	P1	Only if the superheating is active	Only if the superheating is active	Only if the superheating is active	Only if the superheating is active
	P2	Never	Only if the superheating is active	Only if the superheating is active	Never
	P3	Never	Never	Only if the superheating is active	Only if the superheating is active
	P4	Never	Never	Never	Never
Interlocking alarm	P1	Always (between P1 and P2)	Always (between P1, P2 and P3)	Always (between P1,P2,P3 and P4)	Always (between P1 and P2)
	P2	Always (between P1 and P2)	Always (between P1, P2 and P3)	Always (between P1,P2, P3 and P4)	Always (between P1 and P2)
	P3	Never	Always (between P1, P2 and P3)	Always (between P1,P2,P3 and P4)	Always (between P3 and P4)
	P4	Never	Never	Always (between P1,P2,P3 and P4)	Always (between P3 and P4)
External alarm of the digital input	P1	Only if any digital input type alarm is linked and is not virtual alarm	Only if any digital input type alarm is linked and is not virtual alarm	Only if any digital input type alarm is linked and is not virtual alarm	Only if any digital input type alarm is linked and is not virtual alarm
	P2	Only if any digital input type alarm is linked and is not virtual alarm	Only if any digital input type alarm is linked and is not virtual alarm	Only if any digital input type alarm is linked and is not virtual alarm	Only if any digital input type alarm is linked and is not virtual alarm
	P3	Never	Only if any digital input type alarm is linked and is not virtual alarm	Only if any digital input type alarm is linked and is not virtual alarm	Only if any digital input type alarm is linked and is not virtual alarm
	P4	Never	Never	Only if any digital input type alarm is linked and is not virtual alarm	Only if any digital input type alarm is linked and is not virtual alarm

9.8.2 - Monitoring of Alarm Conditions (Thermostats)

The activation of the alarm outputs cannot be associated with the alarm conditions of thermostats, but the detection of an thermostat alarm, if activated, can be detected by the controller and displayed on Sitrad. If any thermostat alarm condition is present, the stages associated with the thermostat which alarm is active are disabled.

Alarm		Thermostat					
		Termo 1	Termo 2	Termo 3	Termo 4	Termo 5	Termo 6
Error in the temperature sensor	T1	Only if the temperature alarm is active and the thermostat is connected	Never	Never	Never	Never	Never
	T2	Never	Only if the temperature alarm is active and the thermostat is connected	Never	Never	Never	Never
	T3	Never	Never	Only if the temperature alarm is active and the thermostat is connected	Never	Never	Never
	T4	Never	Never	Never	Only if the temperature alarm is active and the thermostat is connected	Never	Never
	T5	Never	Never	Never	Never	Only if the temperature alarm is active and the thermostat is connected	Never
	T6	Never	Never	Never	Never	Never	Only if the temperature alarm is active and the thermostat is connected
High/Low temperature alarm	T1	Only if the temperature alarm is active and the thermostat is connected	Never	Never	Never	Never	Never
	T2	Never	Only if the temperature alarm is active and the thermostat is connected	Never	Never	Never	Never
	T3	Never	Never	Only if the temperature alarm is active and the thermostat is connected	Never	Never	Never
	T4	Never	Never	Never	Only if the temperature alarm is active and the thermostat is connected	Never	Never
	T5	Never	Never	Never	Never	Only if the temperature alarm is active and the thermostat is connected	Never
	T6	Never	Never	Never	Never	Never	Only if the temperature alarm is active and the thermostat is connected

9.8.3 - Activation of the alarm outputs

PCT-3001 *plus* can have up to four alarm outputs, which can be configured to be activated by different conditions and by more than one internal pressure switch. The available options for activation are:

All alarms: The output will be activated when any type of alarm is activated for one of the linked pressure switches.

Low pressure alarm: The output will be activated when the low pressure alarm is activated for one of the linked pressure switches.

High pressure alarm: The output will be activated when the high pressure alarm is activated for one of the linked pressure switches.

All pressure alarms: The output will be activated when the high or low pressure alarm is activated for one of the linked pressure switches.

Low temperature alarm: The output will be activated when the low temperature alarm is activated for one of the linked pressure switches.

High temperature alarm: The output will be activated when the high temperature alarm is activated for one of the linked pressure switches.

All temperature alarms: The output will be activated when the high or low temperature alarm is activated for one of the linked pressure switches.

Digital input alarm: The output will be activated when the external alarm of the digital input is activated for one of the linked pressure switches.
Locked controller alarm: The output will be activated when any linked pressure switch is locked (waiting for reset).

Interlocking alarm: The output will be activated when the interlocking alarm is activated for one of the linked pressure switches.

Low superheating alarm: The output will be activated when the low superheating alarm is activated for one of the linked pressure switches.

Critical superheating alarm: The output will be activated when the critical superheating alarm is activated for one of the linked pressure switches.

Low efficiency alarm: The output will be activated when the high superheating alarm (low efficiency) is activated for one of the linked pressure switches.

All superheating alarms: The output will be activated when any of the superheating alarms (high, low or critical) is activated for one of the linked pressure switches.

Maintenance alarm: The output will be activated when there is one or more maintenance alarms for one of the linked pressure switches.

Pressure sensor error alarm: The output will be activated when the error alarm of the gas line pressure sensor is activated for one of the linked pressure switches.

Temperature sensor error alarm: The output will be activated when the error alarm of the gas line temperature sensor is activated for one of the linked pressure switches.

Liquid line sensor error alarm: The output will be activated when the error alarm of liquid line temperature sensor is activated for one of the linked pressure switches.

Error alarm for any sensor: The output will be activated when any error alarm for a sensor is activated for one of the linked pressure switches.

The outputs can be linked to the internal pressure switches in the following ways:

All pressure switches: The output will be linked to the alarms of all internal pressure switches in the operating mode.

Pressure switch 1: The output will be linked only to the alarms of the internal pressure switch 1 (P1).

Pressure switch 2: The output will be linked only to the alarms of the internal pressure switch 2 (P2).

Pressure switch 3: The output will be linked only to the alarms of the internal pressure switch 3 (P3).

Pressure switch 4: The output will be linked only to the alarms of the internal pressure switch 4 (P4).

All of pressure switch group 1: The output will be linked only to the alarm switches that form the Group 1 (GP1) of the current operating mode.

All suctions of pressure switches group 1: The output will be linked only to the alarms of the Group 1 (GP1) suction pressure switches of the current operating mode.

All of pressure switch group 2: The output will be linked only to the alarm switches that form the Group 2 (GP2) of the current operating mode.

All suctions of group 2 pressure switches: The output will be linked only to the alarms of the Group 2 (GP2) suction pressure switches of the current operating mode.

9.9 - Reset system

PCT-3001 *plus* is equipped with a system that locks the internal pressure switches when a number of alarms is generated within a certain time. Whenever possible, the controller will try to correct the problem that generated the alarm. The reset system allows for the user to configure how many times the **PCT-3001** *plus* will try the automatic correction (automatic reset) before quitting and switching off all loads (controller locked). The user must set how many automatic resets the controller can perform within a certain time. Each internal pressure switch can have an individual adjustment of these parameters. The table below lists which alarms are considered by the reset system. Those not considered will never lock the controller.

Alarm	Associated with the reset system
Error in the gas line pressure sensor	Yes
Error in the gas line temperature sensor	Yes
Error in the liquid line temperature sensor	Yes
Error calculating the ideal expansion temperature	No
Low pressure alarm	Yes
High pressure alarm	Yes
Low temperature alarm	Yes

Alarm	Associated with the reset system
High temperature alarm	Yes
Remote alarm of the digital input	Yes
Interlocking alarm	Yes
Low superheating alarm	No
Critical superheating alarm	No
Low efficiency alarm	No
Maintenance alarm	No

Note: 1: The resets act only the alarms generated by the pressure switches.
Note: 2: If a digital input is linked to some stage type compressor / fan (and not the entire switch or a group), the digital input alarm will not be counted by the reset system.

9.10 - Interlocking System (valid only for pressure switches)

As described under "Groups of switches according to each operation mode" the interlocking system operates only between switches in the same group. The states of the digital outputs configured to pressure control when alarms occur will be:

9.10.1 - Suction type pressure switches

- Alarm of low pressure in the pressure switch itself: All stages of the respective pressure switch will be deactivated.
- Alarm of high pressure in the pressure switch itself: All stages of the respective pressure switch will be activated.
- Alarm of low temperature in the pressure switch itself: All stages of the respective pressure switch will be deactivated.
- Locked pressure switch (waiting for manual reset): If any other suction pressure switch is present in the group, only the stages of the respective pressure switch will be deactivated. If there are no other pressure switches, all stages of the respective pressure switch and the discharge stage will be deactivated.
- Alarm of low pressure at the group discharge: No action will be taken for the suction outputs.
- Alarm of high pressure at the discharge: All suction stages of the group will be deactivated.
- Alarm of high temperature at the discharge: All suction stages of the group will be deactivated.
- Locked discharge pressure switch (waiting for manual reset): All suction stages of the group will be deactivated.

9.10.2 - Discharge type pressure switches

- Alarm of low pressure in the pressure switch itself: All stages of the respective pressure switch will be deactivated.
- Alarm of high pressure in the pressure switch itself: All stages of the respective pressure switch will be activated and all suction stages of the group will be deactivated.
- Alarm of high temperature in the pressure switch itself: All stages of the respective pressure switch will be activated and all suction stages of the group will be deactivated.
- Locked pressure switch (waiting for manual reset): All stages of all pressure switches in the group will be deactivated.
- Alarm of low pressure at the suction of the group: No action will be taken for the discharge outputs.
- Alarm of high pressure at the suction of the group: No action will be taken for the discharge outputs.
- Alarm of high temperature at the suction of the group: No action will be taken for the discharge outputs.
- Any suction pressure switch of the group locked (waiting for manual reset): If only one suction pressure switch is present at the group, all stages in the group will deactivated. If there are more than one suction present at the group, only the locked suction stages will be deactivated.

9.11 - Activation priority

PCT-3001 *plus* considers the following priority order for making decisions on which state the outputs of each pressure switch must assume.

Priority 1 - Output in maintenance mode (switch off the output)
Priority 2 - Locked pressure switch (switch off the outputs)
Priority 3 - External alarm of the digital output (depends on the configuration; may switch the output on or off)
Priority 4 - Sensor error (depends on the configuration; may switch the outputs on or off)
Priority 5 - Internal alarm of high / low pressure or high / low temperature (may switch the outputs on or off depending on the alarm)

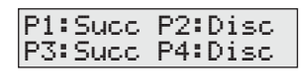
10 - DISPLAY INDICATION

The information is viewed in the **PCT-3001** *plus* display by means of three types of screens: main, secondary, and notification.

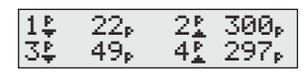
10.1 - Main screen

The main screen is the one the controller shows in the display when no operation is being performed. **PCT-3001** *plus* has five different variations of the main screen. The user can select which one will be used through the advanced parameter "Preferred indication". The available screens are:

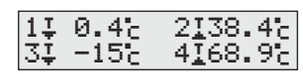
`Info` - Screen that indicates the type of each internal pressure switch



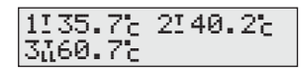
`Pressure` - Screen which indicates the gas line pressure measured by each internal pressure switch



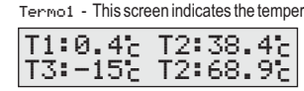
`Temperat` - Screen that indicates the temperature of the gas line measured by each internal pressure switch



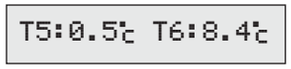
`Temp SA/SR` -This screen indicates the overheating and sub-cooling temperatures of suction and discharge switches, respectively.



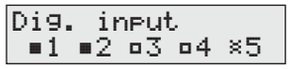
`Termo1` - This screen indicates the temperature of each internal thermostat (thermostats 1 to 4).



Termo2 - This screen indicates the temperature of each internal thermostat (thermostats 5 to 6).



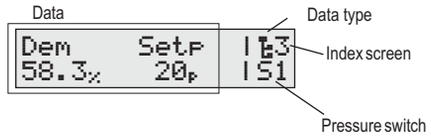
dig out - This screen indicates the state of each digital output.



When **PCT-3001** *plus* is displaying these screens, the leds of the outputs are used to indicate which stages are active in the moment. Any output that is activated will be marked with the color of the respective pressure switch / alarm.

10.2 - Secondary screens

The secondary screens are accessed through the quick access keys and are used by the **PCT-3001** *plus* to show specific details of the internal functions. Each secondary indication shows specific data of a single pressure switch. Each screen will show which pressure switch the information on the screen corresponds to. In addition, each screen will have an indication of the type of data and an index of the information.



Whenever the controller is showing a secondary indication screen the led of the respective pressure switch will be on, backing up the indication of the abbreviation already shown in the display.
To browse the screens of one type of data, just press + or −. Note that the index on the screen changes as the user presses the keys.
To change the selection of the pressure switch being displayed, just press √ or X . Note that the abbreviation and the led of the pressure switch change as the keys are pressed.
To exit the secondary indication and return, quickly press the **DISP** key or leave the keyboard idle for more than 2 minutes.

The types of data available in the **PCT-3001** *plus* for secondary viewing are:

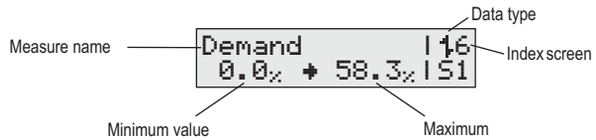
- t - Minimums and maximums
- 9 - Hour meters
- t - General information
- 0 - Alarms

10.2.1 - Minimums and maximums (t)

This indication allows viewing the minimum and maximum values measured by a pressure switch.
The recorded data is presented in pairs, using one screen for each measurement. The available options and the respective indexes on the screen are:

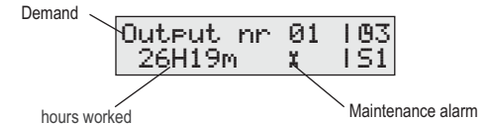
1 - Gas line pressure
2 - Gas line temperature
3 - Liquid line temperature
4 - Ideal expansion temperature
5 - Superheating temperature
6 - Demand

The information included on the screen of this indication is:



10.2.2 - Hour meters (9)

This indication allows viewing the working hours for each digital output configured as part of a compressor or fan. The recorded hours are presented individually, one for each digital output. When the **PCT-3001** *plus* is showing the indication of working hours, the leds of the outputs indicate the stage that corresponds to the hour meter. The output being shown is marked with white color while the other outputs remain with the color of the respective pressure switch.

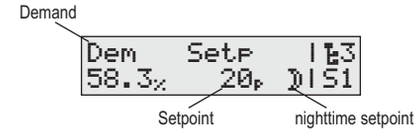


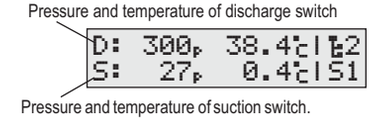
10.2.3 - General Information (t)

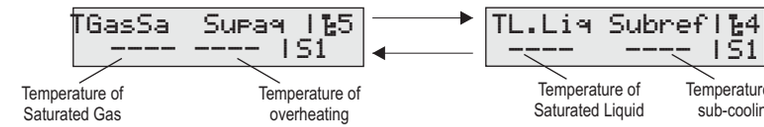
This indication can view various information relating to internal pressure switch, available options, and their index screen are:

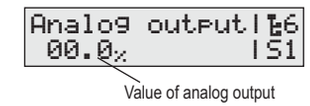
1 – Instantaneous pressure and temperature of the gas line
2 – Instantaneous demand and setpoint
3 – Instantaneous temperature of saturated and overheating gas (suction pressure switches) / instantaneous temperature and saturated and sub-cooling liquid (discharge switches)
4 – Current percentage of analog output

The information contained in the screens are:







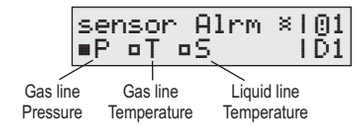


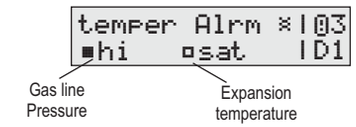
10.2.4 - Alarmes (0)

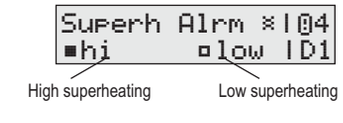
This indication allows viewing which alarms are active for each internal pressure switch. The available options and the respective indexes on the screen are:

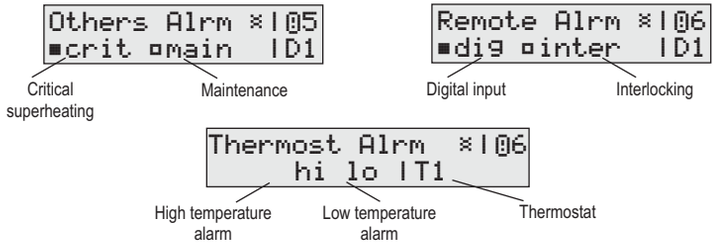
1 - Error alarm in the pressure and temperature sensors of the gas line and liquid line temperature
2 - Low and high pressure alarms
3 - Low / high temperature alarm and error calculating the ideal expansion temperature
4 - High and low superheating alarms
5 - Critical superheating and maintenance hours alarm
6 – Alarms of thermostats (temperature high/low)

The informations included on the screens are:







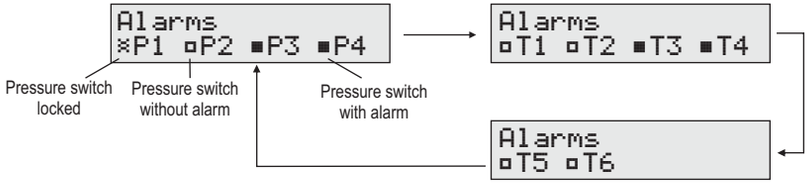


10.3 - Notification screens

The notification screens are displayed quickly when any sporadic event occurs in the controller. These events are:

10.3.1 - Alarms

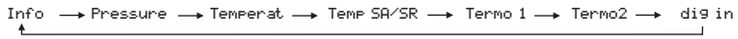
This screen will cycle along with the main screen whenever there is an alarm into an internal switch or thermostat. On notification alarm screen can check which switches (or thermostats) have active alarms and even which switches are blocked. Knowing this, you can, through the secondary display screens, access more details of active alarms.



11 - QUICK ACCESS KEYS

11.1 - Alternate the indication of the main screen

To alternate to other views, press the **DISP** key until the desired indication is displayed. The alternative view will be shown for 15 seconds and then the main screen will return to the indication adjusted in the "Preferred indication" function. The sequence of options is as follows:



11.2 - View and reset minimums and maximums

The secondary screen for minimums and maximums can be accessed by pressing the + key. To reset the record being displayed, just press the **DISP** key for 2 seconds.

11.3 - View the hour meters and reset the maintenance alarms

The secondary screen for the hour meters can be accessed by pressing the **X** key. To reset the record being displayed, just press the **DISP** key for 2 seconds.

11.4 - View the general information

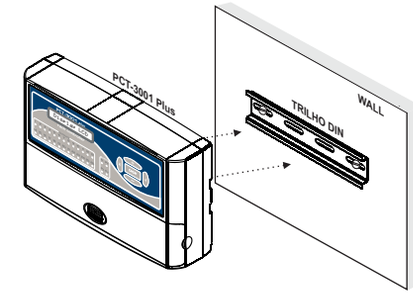
The secondary screen for the hour meters can be accessed by pressing the − key.

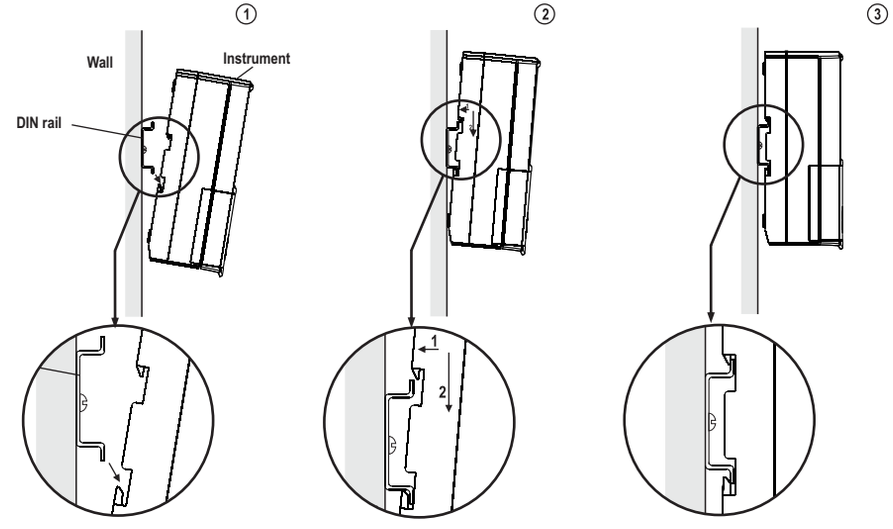
11.5 - View alarms and reset the pressure switch

The secondary screen for viewing the alarms can be accessed by pressing the √ key. To reset the pressure switch being displayed, just press the **DISP** key for 2 seconds.

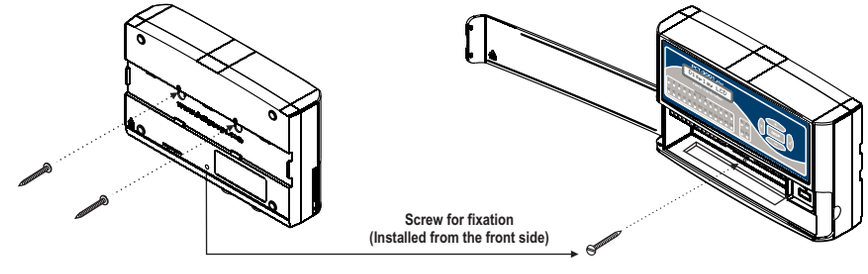
12. INSTRUMENT FIXATION MODE

12.1 DIN mount fixation

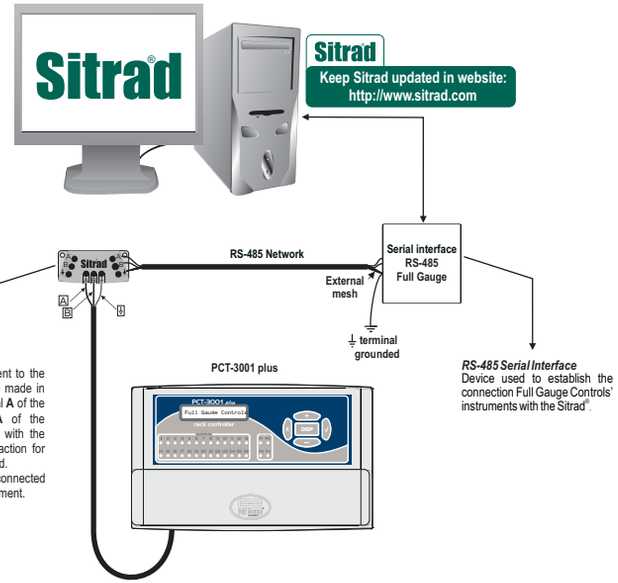




12.2 Screw fixation (wall-mounted)



13 - INTEGRATING CONTROLLERS, RS-485 SERIAL INTERFACE AND COMPUTER



IMPORTANT

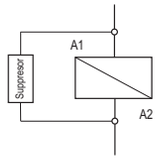
As chapters of IEC 60 364 norms:

1: Install protectors against over voltage on power supply

2: Sensor cables and computer signals can be together, however not at the same place where power supply And load drive pass for.

3: Install suppresor of transient (RC filters) in parallel to loads, as for to increase the useful life of the relays.

Wiring diagram of suppresor in contactors



A1 and A2 are the contactor coil.

ENVIRONMENTAL INFORMATION

Package:

The packages material are 100% recyclable. Just dispose it through specialized recyclers.

Products:

The electro components of Full Gauge controllers can be recycled or reused if it is disassembled for specialized companies.

Disposal:

Do not burn or throw in domestic garbage the controllers which have reached the end-of-life. Observe the respectively law in your region concerning the environmental responsible manner of dispose its devices. In case of any doubts, contact Full Gauge controls for assistance.