PCT-410E plus Ver.04

DIGITAL PRESSURE CONTROLLER AND INDICATOR

Full Gauge CONTROLS

Functions lockdown | Control functions shutdown | Serial programming | System supervisor | IP 65 FRONT Protection level

PCT410E-03T-14662

WARNING

BEFORE INSTALLING THE CONTROLLER, WE RECOMMEND READING THROUGH THE ENTIRE INSTRUCTION MANUAL IN ORDER TO AVOID POSSIBLE DAMAGE TO THE PRODUCT.

PRECAUTIONS WHEN INSTALLING THE PRODUCT:
Before performing any procedure on this instrument, disconnect it from the mains;
Ensure that the instrument has adequate ventilation and avoid installation in panels containing devices that may cause it to operate outside the specified temperature limits;
Install the product away from sources that may generate electromagnetic disturbances such as: motors, contactors, relays, solenoid valves, etc;

AUTHORIZED SERVICE:
The installation or maintenance of the product must be performed by qualified professionals only;

ACCESSORIES:
Only use original Full Gauge Controls accessories.
If you have any questions, please contact technical support.

DUE TO YOUR CONSTANT EVOLUTION, THE FULL GAUGE CONTROLS RESERVES THE RIGHT TO CHANGE THE INFORMATION CONTAINED IN THIS MANUAL AT ANY TIME WITHOUT NOTICE.

1. DESCRIPTION

The **PCT-410E** *plus* is a pressure controller for refrigeration systems that require control in their suction and discharge lines.
It has seven control outputs: five digital outputs, one alarm output and one analog output for proportional control through a frequency inverter. It also includes three inputs: one input for a 4-20 mA pressure sensor, one input for a NTC temperature sensor, and one digital input.
Working in pairs it is able to control up to five fans and five compressors at the same time. A more precise and safe control of the process can be achieved by using the remote communication between the suction and discharge controllers.

The versatility of **PCT-410E** *plus* allows managing load switching in linear, rotation, capacities, and individual modes. And the RS-485 serial output allows communicating with SITRAD to manage the installation through the internet.

2. APPLICATION

- To be used in the control of cooling processes, used both in the suction and in the discharge lines.

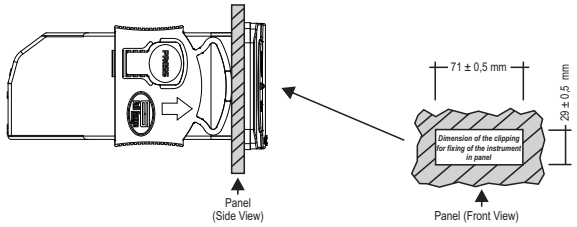
3. TECHNICAL SPECIFICATIONS

- **Power:** 12 Vdc / 250 mA
- **Pressure control range:** 0 to 850 psi / 0 to 58.6 bar (user-configurable sensor operating range)
- **Sensors available for purchase:** SB69-200A* (0 to 200 psi / 0 to 13.8 bar)
  SB69-500A* (0 to 500 psi / 0 to 34.4 bar)
  SB69-850A* (0 to 850 psi / 0 to 58.7 bar)
  *** Sensors sold separately**
- **Pressure resolution:** 0.1 bar / 1 psi
- **Temperature sensor operating range:** -50 to 105° C (SB41*)
  -50 to 200° C (Sb59*)
  *** Sensors sold separately**
- **Temperature resolution:** 0.1° C between -10 and 100° C, and 1° C for the rest of the range
  1° F in the full range
- **Maximum output current:** OUT1 to OUT5 - 1 A / 250 Vac
  ALARM - 3 A / 250 Vac
- **Analog output maximum current:** 10 mA
- **Controller operating temperature:** 0 to 50° C
- **Operating humidity:** 10 to 90% RH (without condensation)
- **Digital input: Configurable dry contact**
- **Control outputs:**

DIGOUT1 – Digital control output 1
DIGOUT2 – Digital control output 2
DIGOUT3 – Digital control output 3
DIGOUT4 – Digital control output 4
DIGOUT5 – Digital control output 5
ALARM – Digital alarm output
ANOUT – Analog output 0~10 Vdc

- **Product dimensions:** 76 x 34 x 77 mm (WxHxD)
- **Dimensions of the cut to fasten the instrument:** 71 ± 0.5 x 29 ± 0.5 mm (see item 5)

5. INSTALLATION - ASSEMBLING AND ELECTRICAL CONNECTIONS



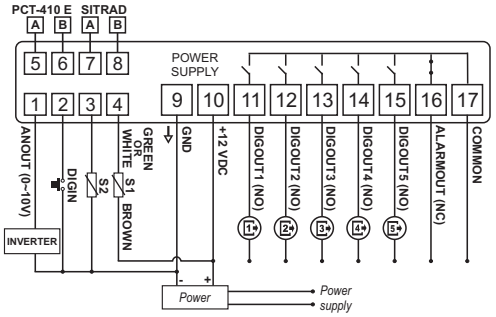
ATTENTION

FOR INSTALLATIONS WHERE A SEALING IS REQUIRED TO AVOID LIQUID CONTACT, THE CUT FOR THE CONTROLLER MUST BE OF 70,5X29mm MAXIMUM. THE SIDE LOCKS MUST BE FIXED SO IT PRESSES THE RUBBER SEALING AVOIDING INFILTRATION BETWEEN THE CUT AND THE CONTROLLER.

IMPORTANT

THE USE OF APPROPRIATE TOOLS IS ESSENTIAL TO AVOID DAMAGE IN THE CONNECTION AT INSTRUMENT TERMINALS:
⊖ SCREWDRIVER SLOT 3/32"(2.4mm) FOR ADJUSTMENTS IN THE SIGNAL TERMINALS;
⊕ SCREWDRIVER PHILLIPS #1 FOR ADJUSTMENTS IN THE POWER TERMINALS;

Connection 12 Vdc

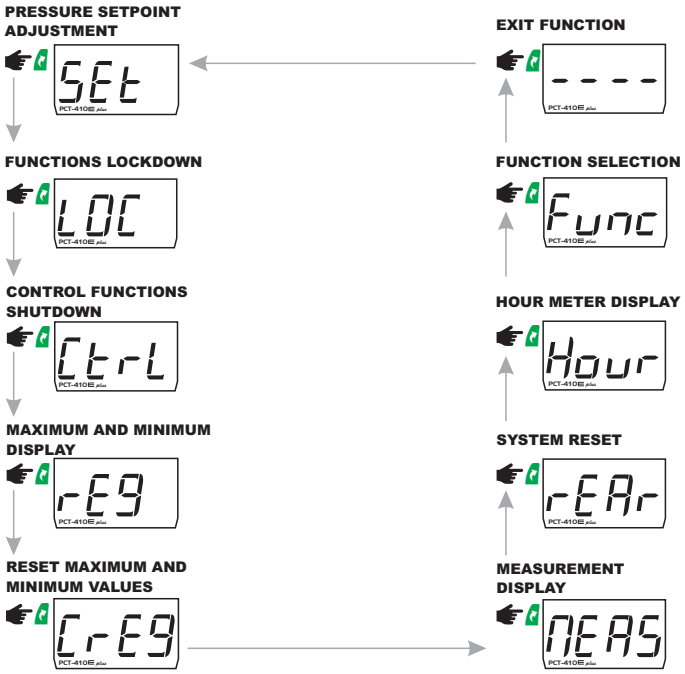


ELECTRICAL CONNECTION TRANSDUCER:
Brown: 12Vdc
Green or White: 4~20mA
S1 - Pressure sensor
S2 - Temperature sensor

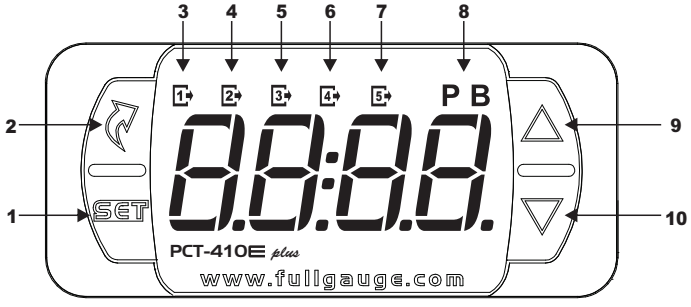
6. OPERATIONS

6.1 Quick Access Menu Map

By pressing it is possible to navigate through the function menus. See the functions map below:



4. INDICATIONS AND KEYS



1	Set key
2	Easy menu key
3	LED indicator (digital output 1 on / off)
4	LED indicator (digital output 2 on / off)
5	LED indicator (digital output 3 on / off)
6	LED indicator (digital output 4 on / off)
7	LED indicator (digital output 5 on / off)
8	LED indicator (pressure units: psi / bar)
9	Increase key
10	Decrease key

6.2 Quick access keys map

When the controller is displaying the pressure, the following keys work as shortcuts for the following functions:

▲	**Short press: Maximum and minimum display [rEG].**
▼	**Short press: Measurement/process display [MEAS].**
SET	**Long press: Daytime pressure setpoint adjustment.**
↩	**Short press: Easy menu access.**
▲+▼	**Short press: Go to function selection.**

6.3 Basic operations

6.3.1 Function lock [LOC]

For safety reasons the controller has a feature to allow locking functions. When this configuration is active, the parameters are protected from undue changes. However, the parameters can be viewed.
In this condition the message [LOC] will be displayed when trying to change those values. To lock functions you need to first adjust the parameter "[F43] - Time for function locking" with a value greater than 14 (below 15, [no] is displayed and it means that function locking is not allowed). Select [LOC] using the ↩ key (short touch), and then press SET (short touch). Then keep ▼ pressed until [LOC] is displayed. The message [On] will be displayed upon releasing the key. To unlock the system, turn the controller off and then turn it on again with the key ▼ pressed. Keep the key pressed until [LOC] is displayed. The message [OFF] will be displayed when the key is released.

6.3.2 Turn off the control functions [CtrL]

When the control functions are turned off, the controller starts to operate only as a pressure/temperature indicator with the digital and analog outputs turned off.
The type of operation used to turn off the control functions depends on the configuration of the parameter "[F44] - Turn off the control functions":
[0] Do not allow the control functions to be turned off.
[1] Allow turning the control functions on and off only if the functions are not locked.
[2] Allow turning the control functions on and off even if the functions are locked.
You can access this function using the easy menu [CtrL] and pressing SET to select it. The message [CtrL] [OFF] soon will be displayed. With the control functions turned off the system's pressure display will alternate with the message [OFF]. To turn the control functions back on, follow the same procedure used to turn them off, selecting with the ↩ key (short touch). The message [CtrL] [On] will be displayed as soon as the user presses the SET key.
NOTE: When the control functions are turned on again, PCT-410E *plus* will observe the value configured in the function "[F29] Minimum time between activations.

6.3.3 Setpoint adjustment [SEt]

To enter the pressure setpoint adjustment mode (Function C05). Operation only available if the control type is not individual (C01 = 0, 1, 2, 3). Adjust the new setpoint value using the ▲ and ▼ keys and press SET (short touch) to save the value.

6.3.4 Minimum and maximum display [rEG]

In this display mode the minimum and maximum values measured/calculated by the controller can be viewed. The minimums and maximums to be displayed are selected using the ▲ and ▼ keys.
The following information is available: [PrES] (pressure)→ [tEMP] (temperature)→ [SAtE] (saturated gas temperature) → [SCSH] (overheating/sub-cooling temperature)→ [dEMA] (demand).
When selecting the required information wait a few seconds for the minimum value and the maximum value measured/calculated to be displayed. These values are reset if the controller is turned off. After the information is displayed, the message indicating which information was previously selected will be briefly displayed. If you want to reset the minimum and maximum records of the information selected, press SET (short touch). If no key is pressed, the message [----] is displayed and the instrument returns to the pressure display.
NOTE: If there are no records, the messages [----] and [____] will be displayed.

6.3.5 Reset maximum and minimum values [CrEG]

This option resets all the minimum and maximum records of the values measured/calculated by the controller. To reset the minimum and maximum values, press SET (short touch) to select.

6.3.6 Measurement display [MEAS]

In this display mode the values currently measured/calculated by the controller can be viewed. The information to be displayed is selected using the ▲ and ▼ keys. The following information is available: [PrES] (pressure) → [tEMP] (temperature) → [SAtE] (saturated gas temperature) → [SCSH] (overheating/sub-cooling temperature) → [dEMA] (demand) → [A oo] (percentage of analog output).

After the required information has been selected, the controller will display it continuously for up to 15 seconds if no key is pressed. The message [nA] will be displayed if the selected information is not available. Finally the message [----] is displayed and the instrument returns to the pressure display.

6.3.7 Controller reset [rEAr]

If the maximum number of automatic resets is reached, the controller will stay locked in an interlock alarm condition. This option allows the controller to be reset if no alarm condition is present in the system. This option also allows the controller to be reset if there is any remote alarm.

6.3.8 Hour meter display [Hour]

This display mode allows the viewing of the number of hours and minutes for which each digital output remained switched on. It is also possible to view the time during which the analog output remained switched on. Use ▲ and ▼ to select the hour meter of the output to be displayed:
[Sto1] → [Sto2] → [Sto3] → [Sto4] → [Sto5] → [Sto6] → [AnOu]. After the output is selected wait a few seconds for the hourmeter to be displayed.
[05:30] Hours: Minutes
If any output is active for more than 99 hours the display changes to: [102h]
Note: If you want to reset the hour meter of one output, select the output and press SET (short touch).

6.3.9 Function menu [Func] access

Access to the controller's advanced operations menu.

6.4 Advanced operations

6.4.1 Main menu access

Access the main menu by pressing ▲ and ▼ at the same time. The menus will be displayed after the keys are released. It is also possible to access the main menu through the easy menu ([Func]). Select the menu you want using ▲ and ▼. Press SET (short touch) to enter the selected menu. The following menus are available:
[CodE] Enter the access code
[Func] Change system's general parameters
[CtrL] Change system's control parameters
[gAS] Change gas curve parameters
[MA.n] Output maintenance mode on/off

6.4.2 Access code [CodE]

Use the ▲ and ▼ keys to enter in the access code and press SET (short touch) when ready. To change any parameter of the controller from within the advanced functions, use the access code [123].

6.4.3 Changing the controller's parameters [Func], [CtrL], [gAS]

Use the ▲ and ▼ keys to select the function you want. Press SET (short touch) after selecting the function to view its value. Use ▲ and ▼ to change the value of the function. If you want to return to the main menu without changing the value of the function, press SET (long touch) until [----] is displayed. If you want to save the changed value, press SET (short touch) to store the configured value in the system memory and go back to the main menu. To leave the menu and return to the main menu, press SET (long touch) until [----] is displayed.
NOTE: If the function lock is active, the controller will show the message [LOC] in the display upon pressing ▲ or ▼ and will not allow the value to be changed.

6.4.4 Output maintenance mode on / off [MA.n]

Allows the maintenance mode to be turned on/off for an output (either digital or analog). Use ▲ and ▼ to select the output:
[Sto1] → [Sto2] → [Sto3] → [Sto4] → [Sto5] → [Sto6] → [AnOu]
After selecting the desired output, if the output is active, it is set to maintenance mode by pressing SET (short touch) and the messages [MA.n] and [On] are displayed. If the output is already in maintenance, when SET is pressed (short touch) the maintenance mode is turned off for the output and the messages [MA.n] and [OFF] are displayed.

6.5 Parameters table

6.5.1 General system parameters [Func]

		psi/ºC				bar/ºF			
Fun	**Description**	**Min**	**Max**	**Unit**	**Standard**	**Min**	**Max**	**Unit**	**Standard**
[F01]	Lower pressure limit of sensor 1 (pressure at 4 mA)	0	850	psi	0	0	58,7	bar	0
[F02]	Upper pressure limit of sensor 1 (pressure at 20 mA)	0	850	psi	500	0	58,7	bar	34,4
[F03]	Pressure offset (sensor 1)	-5	5	psi	0	-0,3	0,3	bar	0
[F04]	Temperature sensor enabling	OFF	ON	-	OFF	OFF	ON	-	OFF
[F05]	Temperature offset (sensor 2)	-5	5	ºC	0	-9	9	ºF	0
[F06]	Low pressure alarm	0	850	psi	-1	0	58,7	bar	-0,1
[F07]	High pressure alarm	0	851	psi	851	0	58,7	bar	58,7
[F08]	Hysteresis of the pressure alarms	1	20	psi	1	0,1	1,4	bar	0,1
[F09]	Low temperature alarm	-50,1	200	ºC	-50,1	-58	392	ºF	-58
[F10]	High temperature alarm	-50	200,1	ºC	200,1	-58	392	ºF	392
[F11]	Critical overheating/sub-cooling temperature	-0,1	50	ºC	-0,1	-1	90	ºF	-1
[F12]	Low overheating/sub-cooling temperature	-0,1	50	ºC	-0,1	-1	90	ºF	-1
[F13]	High overheating/sub-cooling temperature	0	50,1	ºC	50,1	0	90	ºF	90
[F14]	Temperature alarm hysteresis	0,3	20	ºC	5	1	36	ºF	1
[F15]	Alarm validation time	0	999	sec	0	0	999	sec	0

		psi/ºC				bar/ºF			
Fun	Description	Min	Max	Unit	Standard	Min	Max	Unit	Standard
F16	Reset mode	0	10	-	0	0	10	-	0
F17	Delay for automatic resets	1	999	min	1	1	999	min	1
F18	Startup delay (power up)	0	999	sec	0	0	999	sec	0
F19	Alarm inhibition time (power up)	0	999	sec	0	0	999	sec	0
F20	Cyclic timer inhibition time (power up)	0	999	min	0	0	999	min	0
F21	State of the digital outputs when an error occurs in the pressure sensor	0	31	-	0	0	31	-	0
F22	State of the digital outputs in the event of a low pressure alarm	0	31	-	0	0	31	-	0
F23	State of the digital outputs in the event of a high pressure alarm	0	31	-	0	0	31	-	0
F24	State of the digital outputs in the event of a remote alarm	0	31	-	0	0	31	-	0
F25	Value of the analog output when an error occurs in the pressure sensor	0	100,0	%	0	0	100,0	%	0
F26	Value of the analog output in the event of a low pressure alarm	0	100,0	%	0	0	100,0	%	0
F27	Value of the analog output in the event of a high pressure alarm	0	100,0	%	0	0	100,0	%	0
F28	Value of the analog output in the event of a remote alarm	0	100,0	%	0	0	100,0	%	0
F29	Minimum time between activations	0	999	sec	0	0	999	sec	0
F30	Minimum time between deactivations	0	999	sec	0	0	999	sec	0
F31	Stage on minimum time	0	999	sec	0	0	999	sec	0
F32	Stage off minimum time	0	999	sec	0	0	999	sec	0
F33	Operation mode of the digital input	0	4	-	0	0	4	-	0
F34	Digital input inverter	0	1	-	0	0	1	-	0
F35	Operation mode of the alarm output	0	5	-	0	0	5	-	0
F36	Alarm on time	0	999	sec	0	0	999	sec	0
F37	Alarm off time	0	999	sec	0	0	999	sec	0
F38	Cyclic timer on time	1	999	sec/min	1	1	999	sec/min	1
F39	Cyclic timer off time	1	999	sec/min	1	1	999	sec/min	1
F40	Cyclic timer time base	0	1	sec/min	0	0	1	sec/min	0
F41	Pressure switch type	0	1	-	1	0	1	-	1
F42	Master/slave selection	0	1	-	1	0	1	-	1
F43	Key press time to lock function adjustment	14	60	sec	14	14	60	sec	14
F44	Turning off the control functions	0	2	-	0	0	2	-	0
F45	Temperature units	ºC	ºF	-	ºC	ºC	ºF	-	ºC
F46	Pressure units	psi	bar	-	psi	psi	bar	-	psi
F47	RS485 network address (**PCT-410E** *plus* network)	1	247	-	1	1	247	-	1
F48	RS485 network address (Sitrad)	1	247	-	1	1	247	-	1

(1): The lower limit of the function disables it.
(2): The upper limit of the function disables it.

Legend: On = on
OFF = off

6.5.1.1 Description of the general system parameters

F01 - Lower pressure limit of sensor 1 (pressure at 4 mA):
Pressure applied to pressure sensor 1 when its output has a current of 4 mA.

F02 - Upper pressure limit of sensor 1 (pressure at 20 mA):
Pressure applied to pressure sensor 1 when its output has a current of 20 mA.

F03 - Pressure offset (sensor 1):
Allows compensating deviations in the pressure reading of sensor 1.

F04 - Temperature sensor enabling:
OFF – Sensor off
ON – Sensor on

F05 - Temperature offset (sensor 2):
Allows compensating deviations in the temperature reading of sensor 2.

F06 - Low pressure alarm:
This is the reference pressure value that activates the signal indicating that the pressure of the desired point. When this alarm goes off, the pressure switch and start/stop outputs are activated/deactivated depending on the configuration of function F22 and the analog output remains with the fixed percentage value configured in F26. The activation/deactivation of the stages observe the times specified in F29 - Minimum time between activations and F30 - Minimum time between deactivations.

F07 - High pressure alarm:
This is the reference pressure value that activates the signal indicating that the pressure of the desired point. When this alarm goes off, the pressure switch and start/stop outputs are activated/deactivated depending on the configuration of function F23 and the analog output remains with the fixed percentage value configured in F27. The activation/deactivation of the stages observe the times specified in F29 - Minimum time between activations and F30 - Minimum time between deactivations.

F08 - Hysteresis of the pressure alarms:
This is the pressure difference that exits the alarm condition.

F09 - Low temperature alarm:
This is the reference value that activates the signal indicating that the temperature is below the desired point.

F10 - High temperature alarm:
This is the reference value that activates the signal indicating that the temperature is above the desired point.

F11 - Critical overheating/sub-cooling temperature:
The critical overheating/sub-cooling temperature alarm is activated if the temperature falls below this level. If the instrument is configured to control the suction pressure, all pressure switch outputs will be deactivated, observing the time configured in F30 - Time between deactivations. If the instrument is configured to control the discharge pressure, all pressure switch outputs will be activated, observing the time configured in F29 - Time between activations.

F12 - Low overheating/sub-cooling temperature:
The low overheating/sub-cooling alarm is activated if the temperature falls below this level. The operation of the controller remains unchanged when this alarm goes off.

F13 - High overheating/sub-cooling temperature:
The low efficiency alarm is activated if the temperature rises above this level.

F14 - Temperature alarm hysteresis:
This is the temperature difference that exits the alarm condition.

F15 - Alarm validation time:
This is the time that the alarm will remain switched off even in alarm conditions. This inhibition timer starts counting after the startup delay has ended (F18).

F16 - Reset mode:
This parameter allows the reset method of the controller to be configured when faults/alarms occur.
0 - Manual reset only
01 to 09 – Number of automatic resets allowed within the interval configured in F17 - Time period for automatic resets
10 – Always reset automatically

F17 – Delay for automatic resets:
This function sets the minimum time for automatic resets. 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.

F18 - Startup delay (power up):
This is the time elapsed from initialization, during which the instrument displays just pressure and temperature without activating alarms and stages.

F19 - Alarm inhibition time (power up):
This is the time during which the alarms remain inhibited after the instrument is powered up even if there is an alarm condition. This inhibition timer starts counting after the expiration of the time specified in F18 - Startup delay (power up).

F20 - Cyclic timer inhibition time (power up):
This is the time during which the cyclic timers will remain inhibited after the instrument is powered on. This inhibition timer starts counting after the expiration of the time specified in F18 - Startup delay (power up).

F21 - State of the digital outputs when an error occurs in the pressure sensor:
This function defines the state of each digital output when an error occurs in the reading of the pressure sensor. Table 1 indicates the value of the function depending on the state of each output. Only pressure switch and start / stop stages are affected by this function.

F22 - State of the digital outputs in the event of a low pressure alarm:
This function defines the state of each digital output when a low pressure alarm occurs. Table 1 indicates the value of the function depending on the state of each output. Only the pressure switch and start/stop stages are affected by this function.

F23 - State of the digital outputs in the event of a high pressure alarm:
This function defines the state of each digital output when a high pressure alarm occurs. Table 1 indicates the value of the function depending on the state of each output. Only the pressure switch and start/stop stages are affected by this function.

F24 - State of the digital outputs in the event of a remote alarm:
This function defines the state of each digital output when a remote alarm occurs. Table 1 indicates the value of the function depending on the state of each output. Only the pressure switch and start/stop stages are affected by this function.

F25 - Value of the analog output when an error occurs in the pressure sensor:
This function defines the percentage that must be applied to the analog output when an error occurs in the reading of the pressure sensor. The maximum and minimum values of the analog output (functions C16 e C17) are ignored.

F26 - Value of the analog output in the event of a low pressure alarm:
This function defines the percentage that must be applied to the analog output when a low pressure alarm occurs. The maximum and minimum values of the analog output (functions C16 e C17) are ignored.

F27 - Value of the analog output in the event of a high pressure alarm:
This function defines the percentage that must be applied to the analog output when a high pressure alarm occurs. The maximum and minimum values of the analog output (functions C16 e C17) are ignored.

F28 - Value of the analog output in the event of a remote alarm:
This function defines the percentage that must be applied to the analog output when a remote alarm occurs. The maximum and minimum value of the analog output (functions C16 e C17) are ignored.

F29 - Minimum time between activations:
This time guarantees that no simultaneous activations of the pressure switch and/or start stop outputs will occur. The main purposes of this function are: to minimize interferences in the power grid of the facility caused by the simultaneous activation of loads, to avoid unnecessary activation of loads when there are fast variations in the pressure in the system.

F30 - Minimum time between deactivations:
This time guarantees that no simultaneous deactivations of the pressure switch and/or start/stop outputs will occur. The main purposes of this function are: to minimize interferences in the power grid of the facility caused by the simultaneous activation of loads, to avoid unnecessary activation of loads when there are fast variations in the pressure in the system.

F31 - Stage on minimum time:
This is the minimum time that a pressure switch or start/stop output will remain switched on, that is, the length of time between the last start up and the next stop. The main purpose of this function is to limit the number of activations of motors per hour.

F32 - Stage off minimum time:
This is the minimum time that a pressure switch or start/stop output will remain switched off, that is, the length of time between the last stop and the next start up. The main purpose of this function is to limit the number of deactivations of motors per hour.

F33 - Operation mode of the digital input:
It allows the operating mode of the digital output to be adjusted
0 – Off: Input disabled
1 – Enable economy setpoint: Selection of normal/economy setpoint
2 – Switch on all pressure switch outputs: Activate all outputs
3 – Switch off all pressure switch outputs: Deactivate all outputs
4 – Virtual alarm: Virtual alarm (1)(2)
(1): If the mode of the digital input is virtual alarm, the digital input alarm will be active, but there will be no change in the operation of the system (no outputs are activated/deactivated)
(2): The virtual alarm is not counted by the reset system

F34 - Digital input inverter:
0 – Off (open contact, input activated)
1 – On (open contact, input deactivated)

F35 - Operation mode of the alarm output:
This allows the operating mode of the dedicated alarm output to be adjusted.
0 – Off: Output disabled.
1 – Output activated only in the event of a transducer error: Alarm output active in the event of an error in the pressure measurement
2 – Output activated with pressure alarms: Alarm output active in the event of a low/high pressure alarm.
3 – Output activated with temperature alarms: Alarm output active in the event of a low/high temperature alarm.
4 – Output activated with digital input alarm: Alarm output active if the digital input alarm is active.
5 – Output activated with any alarm: Alarm output active if any alarm occurs.

F36 - Alarm on time:
This is the time during which the alarm output will be active when it is cycling.

F37 - Alarm off time:
This is the time during which the alarm output will be inactive when it is cycling.
Note: To make the output stay continuously on, just configure functions F36 and F37 with a value of zero.

F38 - Cyclic timer on time:
This is the time for which the outputs configured as cyclic timers will remain on.

F39 - Cyclic timer off time
This is the time for which the outputs configured as cyclic timers will remain off.

F40 - Cyclic timer time base:
This is the time base used by the functions of the cyclic timer:
0 - Seconds
1 - Minutes

F41 - Pressure switch type:
This function configures the type of the pressure switch (low- or high-pressure). This information is required for the overheating and sub-cooling calculations.
0 – Suction
1 – Discharge

F42 - Master/slave selection (PCT-410E *plus* network):

If you want to use two or more **PCT-410E *plus*** to control several suctions/discharges in a cooling system, it is possible to change the operations of the slave **PCT-410E *plus*** if the master **PCT-410E *plus*** has an alarm condition. This function configures whether the controller is master or slave in the secondary communication network. For more information, see Chapter 9.
0 – Master
1 – Slave

F43 - Key press time to lock function adjustment:
When this function is active, the parameters are protected from undue changes. When the controller is locked, the user can only view the parameters. To lock the functions, see Chapter 6.3.1 - Basic Operations, item Function lock.

F44 - Turning off the control functions:
This allows the output of the controller to be turned off, however the pressure and temperature measurements will continue to be performed. For more information, see Chapter 6.3.2 - Basic Operations, item Turning off the control functions.

F45 - Temperature units:
This selects the system's units of measurement for temperature.
0 – °C
1 – °F
Note: Changes to this parameter do not affect the rest of the table.

F46 - Pressure units:
This selects the system's units of measurement for pressure.
0 – psi
1 – bar
Note: Changes to this parameter do not affect the rest of the table.

F47 - RS485 network address (PCT-410E *plus* network):

This is the address of the instrument for communication between multiple **PCT-410E *plus*** instruments (secondary RS485 network).
Note: A single network must not have different equipment with the same address.

F48 - RS485 network address (Sitrad):
This is the instrument's network address for communicating with SITRAD® software (primary RS485 network).
Note: A single network must not have different equipment with the same address.

Table 1: State of the outputs corresponding to the configuration of functions F21 to F24

Function value	Output 5	Output 4	Output 3	Output 2	Output 1
0	Off	Off	Off	Off	Off
1	Off	Off	Off	Off	On
2	Off	Off	Off	On	Off
3	Off	Off	Off	On	On
4	Off	Off	On	Off	Off
5	Off	Off	On	Off	On
6	Off	Off	On	On	Off
7	Off	Off	On	On	On
8	Off	On	Off	Off	Off
9	Off	On	Off	Off	On
10	Off	On	Off	On	Off
11	Off	On	Off	On	On
12	Off	On	On	Off	Off
13	Off	On	On	Off	On
14	Off	On	On	On	Off
15	Off	On	On	On	On
16	On	Off	Off	Off	Off
17	On	Off	Off	Off	On
18	On	Off	Off	On	Off
19	On	Off	Off	On	On
20	On	Off	On	Off	Off
21	On	Off	On	Off	On
22	On	Off	On	On	Off
23	On	Off	On	On	On
24	On	On	Off	Off	Off
25	On	On	Off	Off	On
26	On	On	Off	On	Off
27	On	On	Off	On	On
28	On	On	On	Off	Off
29	On	On	On	Off	On
30	On	On	On	On	Off
31	On	On	On	On	On

6.5.2 System's control parameters [CtrL]

		psi/ºC				bar/ºF			
Fun	Description	Min	Max	Unit	Standard	Min	Max	Unit	Standard
C01	Control type	0	4	-	0	0	4	-	0
C02	Control mode	0	1	-	0	0	1	-	0
C03	Minimum setpoint limit	0	850	psi	0	0	58,7	bar	0
C04	Maximum setpoint limit	0	850	psi	850	0	58,7	bar	58,7
C05	Daytime setpoint	0	850	psi	100	0	58,7	bar	6,9
C06	Economy setpoint	0	850	psi	80	0	58,7	bar	5,5
C07	Hysteresis of the digital outputs	0	425	psi	32	0	29,3	bar	2,2
C08	Dead zone lower limit	0	850	psi	0	0	58,7	bar	0
C09	Dead zone upper limit	0	850	psi	0	0	58,7	bar	0
C10	Analog output enabling	OFF	ON	-	OFF	OFF	ON	-	OFF
C11	Mode of control of the analog output	0	1	-	0	0	1	-	0
C12	Minimum setpoint limit of the analog output	0	850	psi	0	0	58,7	bar	0
C13	Maximum setpoint limit of the analog output	0	850	psi	850	0	58,7	bar	58,7
C14	Analog output pressure setpoint	0	850	psi	100	0	58,7	bar	6,9
C15	Hysteresis of the analog output	0	425	psi	10	0	29,3	bar	0,7
C16	Analog output minimum value	0	100	%	20	0	100	%	20
C17	Analog output maximum value	0	100	%	100	0	100	%	100
C18	Analog output capacity	0	100	%	20	0	100	%	20
C19	Maximum operating time between maintenances of the analog output	0	999	x10h	999	0	999	x10h	999
C20	Stage 1 - Stage type	0	6	-	0	0	6	-	0
C21	Stage 1 - Maximum operating time between maintenances	0	999	x10h	999	0	999	x10h	999
C22	Stage 1 - Capacity (1)	0	100	%	20	0	100	%	20
C23	Stage 1 - Control type (2)	0	1	-	0	0	1	-	0
C24	Stage 1 - Minimum setpoint limit	0	850	psi	0	0	58,7	bar	0
C25	Stage 1 - Maximum setpoint limit	0	850	psi	850	0	58,7	bar	58,7
C26	Stage 1 - Setpoint (2)	0	850	psi	100	0	58,7	bar	6,9
C27	Stage 1 - Hysteresis (2)	0	425	psi	100	0	29,3	bar	6,9
C28	Stage 2 - Stage type	0	7	-	0	0	7	-	0
C29	Stage 2 - Maximum operating time between maintenances	0	999	x10h	999	0	999	x10h	999
C30	Stage 2 - Capacity (1)	0	100	%	20	0	100	%	20
C31	Stage 2 - Control type (2)	0	1	-	0	0	1	-	0
C32	Stage 2 - Minimum setpoint limit	0	850	psi	0	0	58,7	bar	0
C33	Stage 2 - Maximum setpoint limit	0	850	psi	850	0	58,7	bar	58,7
C34	Stage 2 - Setpoint (2)	0	850	psi	100	0	58,7	bar	6,9
C35	Stage 2 - Hysteresis (2)	0	425	psi	100	0	29,3	bar	6,9
C36	Stage 3 - Stage type	0	7	-	0	0	7	-	0
C37	Stage 3 - Maximum operating time between maintenances	0	999	x10h	999	0	999	x10h	999
C38	Stage 3 - Capacity (1)	0	100	%	20	0	100	%	20
C39	Stage 3 - Control type (2)	0	1	-	0	0	1	-	0
C40	Stage 3 - Minimum setpoint limit	0	850	psi	0	0	58,7	bar	0
C41	Stage 3 - Maximum setpoint limit	0	850	psi	850	0	58,7	bar	58,7
C42	Stage 3 - Setpoint (2)	0	850	psi	100	0	58,7	bar	6,9
C43	Stage 3 - Hysteresis (2)	0	425	psi	100	0	29,3	bar	6,9
C44	Stage 4 - Stage type	0	7	-	0	0	7	-	0
C45	Stage 4 - Maximum operating time between maintenances	0	999	x10h	999	0	999	x10h	999
C46	Stage 4 - Capacity (1)	0	100	%	20	0	100	%	20
C47	Stage 4 - Control type (2)	0	1	-	0	0	1	-	0
C48	Stage 4 - Minimum setpoint limit	0	850	psi	0	0	58,7	bar	0
C49	Stage 4 - Maximum setpoint limit	0	850	psi	850	0	58,7	bar	58,7
C50	Stage 4 - Setpoint (2)	0	850	psi	100	0	58,7	bar	6,9
C51	Stage 4 - Hysteresis (2)	0	425	psi	100	0	29,3	bar	6,9
C52	Stage 5 - Stage type	0	7	-	0	0	7	-	0
C53	Stage 5 - Maximum operating time between maintenances	0	999	x10h	999	0	999	x10h	999
C54	Stage 5 - Capacity (1)	0	100	%	20	0	100	%	20
C55	Stage 5 - Control type (2)	0	1	-	0	0	1	-	0
C56	Stage 5 - Minimum setpoint limit	0	850	psi	0	0	58,7	bar	0
C57	Stage 5 - Maximum setpoint limit	0	850	psi	850	0	58,7	bar	58,7
C58	Stage 5 - Setpoint (2)	0	850	psi	100	0	58,7	bar	6,9
C59	Stage 5 - Hysteresis (2)	0	425	psi	100	0	29,3	bar	6,9

(1): Valid for C01 = 0, 1, 2, 3 (control mode turned off, linear, rotation or capacities)
(2): Valid for C01 = 4 (individual control mode)

Legend: [On] = on
[OFF] = off

6.5.2.1 Description of the system's control parameters

C01 - Control type:
Function to configure the control type of the system. For more details, see Chapter 7.
0 – Off: Pressure control does not use the pressure switch digital outputs.
1 – Linear: Pressure control in linear mode.
2 – Rotation: Pressure control in rotation mode.
3 – Capacities: Pressure control in capacities mode.
4 – Individual: Pressure control in individual mode.

C02 - Control mode:
Function to configure the control mode of the system (pressurization, depressurization). Available when C01 = 0, 1, 2, 3.
0 – Depressurize
1 – Pressurize

C03 - Minimum setpoint limit:
Lower limit aimed at preventing an exceedingly low setpoint (both normal and economy) pressure from being set by mistake. Available when C01 = 0, 1, 2, 3.

C04 - Maximum setpoint limit:
Upper limit aimed at preventing an exceedingly high setpoint (both normal and economy) pressure from being set by mistake. Available when C01 = 0, 1, 2, 3.

C05 - Daytime setpoint:
Control pressure when the controller is in daytime mode. Available when C01 = 0, 1, 2, 3.

C06 - Economy setpoint:
Control pressure when the controller is in economy mode. This setpoint will be active when function F33 - Digital input operation mode is set to 1 (Activate economy setpoint) and the digital input is active. Available when C01 = 0, 1, 2, 3.

C07 - Hysteresis of the digital outputs:
This is the value of the relative pressure that defines the pressure range for activating the digital stages. The points at which each compressor will be activated depends on the number of outputs and the type of digital control. Available when C01 = 0, 1, 2, 3.

C08 - Dead zone lower limit:
C09 - Dead zone upper limit:
A dead zone can be enabled if the control type is set to linear or rotation, the control mode is set to depressurization, and the analog is off. If the pressure is within the range defined by functions P08 and P09, the number of active digital outputs configured as pressure switches will remain unchanged, even if there are fluctuations in the system pressure. A detailed description of the operation of the dead zone is included in Chapter 8 - Types of control by only digital outputs. Available when C01 = 0, 1, 2, 3.

C10 - Analog output enabling:
Function that selects the method of control of the analog output.
OFF – Control does not use the analog output
ON – Control uses the analog output

C11 - Mode of control of the analog output:
Function to configure the control mode of the output (pressurization, depressurization). Available when the control type is "Individual" (C01 = 4).
0 – Depressurize
1 – Pressurize

C12 - Minimum setpoint limit of the analog output:
Lower limit aimed at preventing an exceedingly low setpoint pressure for the analog output from being set by mistake. Available when the control type is "Individual" (C01 = 4).

C13 - Maximum setpoint limit of the analog output:
Upper limit aimed at preventing an exceedingly high setpoint pressure for the analog output from being set by mistake. Available when the control type is "Individual" (C01 = 4).

C14 - Analog output pressure setpoint:
Control pressure of the analog output. Available when the control type is "Individual" (C01 = 4).

C15 - Hysteresis of the analog output:
This is the value of the relative pressure that defines the pressure range for activating the analog output. The percentage of the analog output depends on the minimum and maximum percentages of the analog output, on the number of digital outputs configured as pressure switches, and on the control type.

C16 - Analog output minimum value:
This is the minimum value that the analog output will present when activated. This value limits the minimum rotation speed of the compressor/fan. The value is a % of 10 V (example: 50% = 5 V).

C17 - Analog output maximum value:
This is the maximum value that the analog output will present when activated. This value limits the maximum rotation speed of the compressor/fan. The value is a % of 10 V (example: 50% = 5 V).

C18 - Analog output capacity:
This function defines the capacity of the analog stage when the control type is "Capacities" (C01 = 3).

C19 - Maximum operating time between maintenances of the analog output:
Time (x10h) for which the analog stage must operate without maintenance.

C20, C28, C36, C44, C52 - Stage x - Stage type (x = 1, 2, 3, 4, or 5)?
The adjustment options for each of the controller's digital outputs are:
0 – Stage with no function: The stage remains always off.
1 – Pressure switch: Digital output to activate a compressor/fan
2 – Start/Stop: Output for frequency inverter start/stop.
3 – Cyclic timer (start: on): Cyclic timer with initial state on. On/off time in accordance with the values configured in F38, F39, and F40.
4 – Cyclic timer (start: off): Cyclic timer with initial state off. On/off time in accordance with the values configured in F38, F39, and F40.
5 – Intra-range alarm: Configures output x as an intra-range alarm. The functions "Minimum setpoint allowed for the setpoint of stage x" and "Maximum setpoint allowed for the setpoint of stage x" indicate respectively the upper and lower pressure limits to activate the alarm.
6 – Extra-range alarm: Configures output x as an extra-range alarm. The functions "Minimum setpoint allowed for the setpoint of stage x" and "Maximum setpoint allowed for the setpoint of stage x" indicate respectively the upper and lower pressure limits to activate the alarm.
7 – Extra-range alarm (stage 1 setpoint): Configures output x as an extra-range alarm related to setpoint 1. The alarm will be activated when the pressure is lower than C26 (stage 1 setpoint) minus C27 (stage 1 hysteresis) or higher than C26 (stage 1 setpoint) plus C27 (stage 1 hysteresis).
Note: This option (7) is not applicable to stage 1 (function C20).

C21, C29, C37, C45, C53 - Stage x - Maximum operating time between maintenances (x = 1, 2, 3, 4, or 5):
Time (x10h) for which stage x must operate without maintenance.

C22, C30, C38, C46, C54 - Stage x - Capacity (x = 1, 2, 3, 4, or 5):
This function defines the capacity of stage x when the control type is "Capacities" (C01 = 3).
Note: The sum of the capacities of all stages configured as pressure switches and those the analog output (if active) must not exceed 100%.

C23, C31, C39, C47, C55 - Stage x - Control type (x = 1, 2, 3, 4, or 5):
Function to configure the control mode (pressurization, depressurization) of stage x. Available when the control type is "Individual" (C01 = 4).
0 – Depressurize
1 – Pressurize

C24, C32, C40, C48, C56 - Stage x - Minimum setpoint limit (x = 1, 2, 3, 4, or 5):
Lower limit aimed at preventing an exceedingly low setpoint pressure from being set for stage x by mistake. Available when the control type is "Individual" (C01 = 4).

C25, C33, C41, C49, C57 - Stage x - Maximum setpoint limit (x = 1, 2, 3, 4, or 5):
Upper limit aimed at preventing an exceedingly low setpoint pressure from being set for stage x by mistake. Available when the control type is "Individual" (C01 = 4).

C26, C34, C42, C50, C58 - Stage x - Setpoint (x = 1, 2, 3, 4, or 5):
Lower limit aimed at preventing an exceedingly low setpoint pressure from being set for stage x by mistake. Available when the control type is "Individual" (C01 = 4).

C27, C35, C43, C51, C59 - Stage x - Hysteresis (x = 1, 2, 3, 4, or 5):
This is the pressure difference in relation to the setpoint of the stage used to define whether stage x must be activated/deactivated. Available when the control type is "Individual" (C01 = 4).

6.5.3 Gas curve parameters [GAS]

		psi/ºC				bar/ºF			
Fun	**Description**	**Min**	**Max**	**Unit**	**Standard**	**Min**	**Max**	**Unit**	**Standard**
P01	Gas curve selection	0	15	-	15	0	15	-	15
P02	Point 1 -Pressure of the mapped curve	-1	850	psi	-1	-0,1	58,7	bar	-0,1
P03	Point 1 - Temperature of the mapped curve	-50,1	200	°C	-50,1	-58	392	ºF	-58
P04	Point 2 - Pressure of the mapped curve	-1	850	psi	-1	-0,1	58,7	bar	-0,1
P05	Point 2 - Temperature of the mapped curve	-50,1	200	°C	-50,1	-58	392	ºF	-58
P06	Point 3 - Pressure of the mapped curve	-1	850	psi	-1	-0,1	58,7	bar	-0,1
P07	Point 3 - Temperature of the mapped curve	-50,1	200	°C	-50,1	-58	392	ºF	-58
P08	Point 4 - Pressure of the mapped curve	-1	850	psi	-1	-0,1	58,7	bar	-0,1
P09	Point 4 - Temperature of the mapped curve	-50,1	200	°C	-50,1	-58	392	ºF	-58
P10	Point 5 - Pressure of the mapped curve	-1	850	psi	-1	-0,1	58,7	bar	-0,1
P11	Point 5 - Temperature of the mapped curve	-50,1	200	°C	-50,1	-58	392	ºF	-58
P12	Point 6 - Pressure of the mapped curve	-1	850	psi	-1	-0,1	58,7	bar	-0,1
P13	Point 6 - Temperature of the mapped curve	-50,1	200	°C	-50,1	-58	392	ºF	-58
P14	Point 7 - Pressure of the mapped curve	-1	850	psi	-1	-0,1	58,7	bar	-0,1
P15	Point 7 - Temperature of the mapped curve	-50,1	200	°C	-50,1	-58	392	ºF	-58
P16	Point 8 - Pressure of the mapped curve	-1	850	psi	-1	-0,1	58,7	bar	-0,1
P17	Point 8 - Temperature of the mapped curve	-50,1	200	°C	-50,1	-58	392	ºF	-58
P18	Point 9 - Pressure of the mapped curve	-1	850	psi	-1	-0,1	58,7	bar	-0,1
P19	Point 9 - Temperature of the mapped curve	-50,1	200	°C	-50,1	-58	392	ºF	-58
P20	Point 10 - Pressure of the mapped curve	-1	850	psi	-1	-0,1	58,7	bar	-0,1
P21	Point 10 - Temperature of the mapped curve	-50,1	200	°C	-50,1	-58	392	ºF	-58

6.5.3.1 Description of the gas curve parameters

P01 - Gas curve selection:
This function configures the saturated gas curve of the cooling fluid used in the cooling system. This information is used in the overheating (if the controller is configured as a suction pressure switch) or sub-cooling (if the controller is configured as discharge pressure switch) calculations. The pre-configured gas curves are based on the pressure vs. temperature curve of the gases in the dew points.

0 – R22 1 – R32 2 – R134A 3 – R290	4 – R401A 5 – R404A/R507A 6 – R407A 7 – R407F	8 – R410A 9 – R422D 10 – R600 11 – R600A	12 – R717 (NH3) 13 – R744 (CO2) 14 – R1270 15 – Custom (manual value adjustment)

P02, P04, P06, P08, P10, P12, P14, P16, P18, P20 - Point x – Pressure of the mapped curve:
Pressure of the point x of the saturated gas curve.

P03, P05, P07, P09, P11, P13, P15, P17, P19, P21 - Point x – Temperature of the mapped curve:
Temperature of the point x of the saturated gas curve.

6.6 Stage maintenance [MAn]

This menu allows the maintenance mode to be turned on/off for any output, regardless of the function attributed to that output. Use ▲ and ▼ to select the output to have its maintenance mode turned on or off. The access code 123 must be entered in the menu [CodE] to change the maintenance state of an output.
The following options are available:
[St 91] → [St 92] → [St 93] → [St 94] → [St 95] → [St 96] → [AnOu]
To turn the maintenance mode on/off, press SET (short touch) after selecting the output. If the maintenance mode is turned on, the message [On] will be briefly displayed. Otherwise the message [OFF] will be displayed.

7. OPERATION

7.1 Pressure control

The **PCT-410E** *plus* pressure control system has an option for controlling variable capacity compressors and fans by activating digital outputs or by using the analog output. Using the analog output the compressor/fan is controlled by means of a frequency inverter and the capacity is directly modulated by the controller. We must first establish a nomenclature for the components to better understand the operation of the logic of the variable capacity compressors/fans using the digital outputs.

Pressure switch stage: This is the output that will control the activation/deactivation of a compressor/fan.

Stage capacity (%): This is the power fraction that each pressure switch stage contributes to the total system power. If the capacities mode is used, the technician must make sure during the controller's startup that the sum of all capacities of the pressure switch stages does not exceed 100%.

The possible combinations in **PCT-410E** *plus* pressure control are adjusted by the parameters "C01 – Control type", "C02 – Control mode" and "C10 – Analog output enable". The combination are as follows:

-Control using only the digital outputs (pressurizing/depressurizing)
-Control using only the analog output (pressurizing/depressurizing)
-Mixed control using the digital outputs and the analog output (pressurizing/depressurizing)
-Individual control where each digital stage and analog output as its own activation/deactivation criteria.

7.1.1 Types of control only through digital outputs

Upon configuring the type of digital control as switched on and the type of analog control as switched 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 capacities mode

7.1.1.1 Digital outputs in linear mode

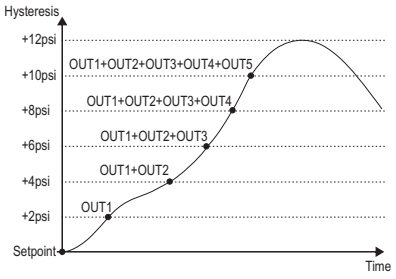
Only the digital outputs will be used in this control mode, and thus the controller will assume only the hysteresis value configured in the function: "digital output hysteresis." The controller will add digital outputs (pressure switch type) as the pressure deviates from the setpoint. The activation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

$$\text{Step} = \frac{\textit{Hysteresis of the digital output}}{\textit{N° Stage}}$$

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

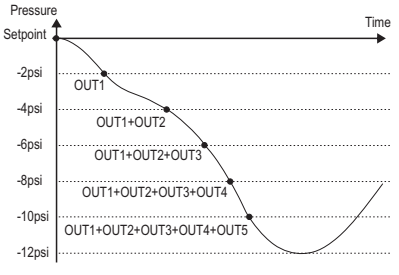
Example 1:
Depressurization mode:
Setpoint: 10 psi
Hysteresis of the digital outputs: 10 psi
Number of pressure switch stages: 5

The total number of digital outputs in this example is 5. Thus the step of each digital output is 2 psi (10 psi divided by 5). The first digital stage will be turned 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. Please note that at 20 psi (setpoint plus digital hysteresis) all digital outputs will be on.



Example 2:
Pressurization mode:
Setpoint: 100 psi
Hysteresis of the digital outputs: 10 psi
Number of pressure switch stages: 5

The total number of digital outputs in this example is 5. Thus the step of each digital output is 2 psi (10 psi divided by 5). The first digital stage will be turned on when the pressure reaches 98 psi (setpoint minus step), the second at 96 psi (setpoint minus 2 times the step), the third at 94 psi (setpoint minus 3 times the step), and so on. Please note that at 90 psi (setpoint minus digital hysteresis) all digital outputs will be on.



7.1.1.2 Digital outputs in linear mode with dead zone

Note: The control using a dead zone is only available in the depressurization mode.

If the dead zone is enabled, the output activation control "freezes" the number of stages that are activated when the pressure enters the dead zone. If the pressure leaves the region delimited by the functions of the dead zone, the number of command stages will be updated in accordance with the conditions below:

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

- The number of commend stages is immediately updated, and each command stage is added observing the value configured in function "F29 – Minimum time between activations".

If the pressure drops below the lower limit of the dead zone:

- The deactivation of stages must respect the function "F30 – Minimum 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 pressure of the system remains within the region delimited by the two transition thresholds for the period specified in F29;
- The pressure of the system keeps falling and reaches a value lower than the transition threshold pressure. In this case, function F29 is ignored, the number of active stages is immediately decreased, and the counter related to function F29 is reset. If the pressure keeps falling and reaches a new transition threshold before the time defined in F29 has expired, the number of active stages is decreased again, the counter related to function F29 is reset and so on.

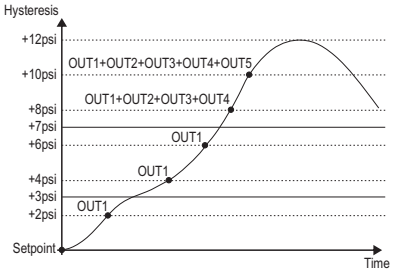
The pressure thresholds used to mark out the regions where function F29 is observed are calculated as follows:

$$\text{Step dead zone} = \frac{\textit{Lower dead zone - setpoint}}{\textit{N° factive stages when leaving dead zone region -1}}$$

Pressure thresholds for immediate update of the pressure stages:
Threshold N = Lower dead zone pressure – N x (Dead zone step)

Example 3:
Number of pressure switch stages: 5
Setpoint: 10 psi
Hysteresis of the digital outputs: 10 psi
Lower dead zone: 13 psi
Upper dead zone: 17 psi

The total number of digital outputs in this example is 5. Thus the step of each digital output is 2 psi (10 psi divided by 5). The first digital stage will be turned on when the pressure reaches 12 psi (setpoint plus step), then the number of active stages remains frozen until the pressure reaches 18 psi (upper dead zone limit = 17 psi). When the pressure reaches 18 psi, the number of active stages changes to 4 (OUT 1, OUT 2, OUT 3, OUT 4, with the time between stage activations being equal to the value configured in function F29). Upon leaving the dead zone, the control changes back to operate by updating the number of active stages as usual.

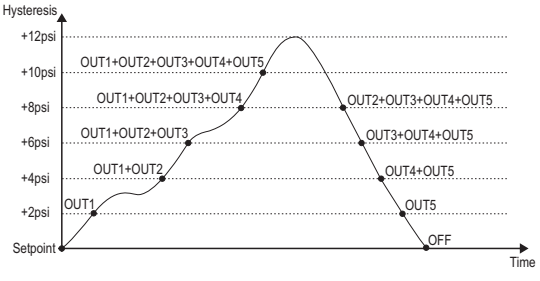


7.1.1.3 Digital outputs in rotation mode

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: "C07 - Hysteresis of the digital outputs". In this mode the digital outputs are controlled in accordance with the number of hours worked, so that for switching on a new stage, the controller checks which one has the shortest worked time, and for switching off a stage it checks which one has the most hours worked. This is aimed at ensuring balance in the operating time of compressors/fans.

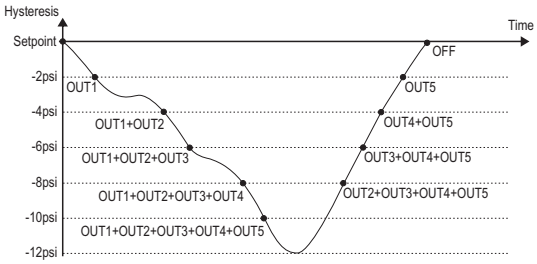
Example 4:
Depressurization mode:
Setpoint: 10 psi
Hysteresis of the digital outputs: 10 psi
Number of pressure switch stages: 5

As in the linear mode, the total of pressure switch digital outputs is 5. Thus the step of each digital output is 2 psi (10 psi divided by 5). 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 20 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 longer time than stage 3 and so on. When the pressure drops below 18 psi and the controller needs to switch off one stage, it will choose the one with most time active. In the example in question, stage 1 would be chosen.



Example 5:
Pressurization mode:
Setpoint: 100 psi
Hysteresis of the digital outputs: 10 psi
Number of pressure switch stages: 5

As in the linear mode, the total of pressure switch digital outputs is 5. Thus the step of each digital output is 2 psi (10 psi divided by 5). 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 98 psi (setpoint plus step), the second at 96 psi (setpoint plus 2 times the step), the third at 94 psi (setpoint plus 3 times the step), and so on. When the pressure reaches 90 psi (setpoint plus digital hysteresis) all digital outputs will be on. While a digital output is activated, the corresponding hourmeter is simultaneously increased. 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 92 psi and the controller needs to switch off one stage, it will choose the one with the most time active. In the example in question, stage 1 would be chosen.

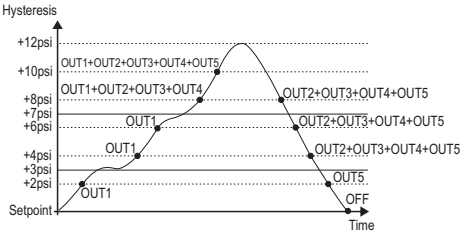


7.1.1.4 Digital outputs in rotation mode with dead zone

Note: The control using a dead zone is only available in the depressurization mode.
In the rotation mode the dead zone operates similarly to the linear mode, but the stages with fewer hours worked will have higher priority for activation (when increasing the pressure is required) and the stages with more hours worked have higher priority for deactivation (when decreasing the pressure is required).

Example 6:
Number of pressure switch stages: 5
Setpoint: 10 psi
Hysteresis of the digital outputs: 10 psi
Lower dead zone: 13 psi
Upper dead zone: 17 psi

As in the linear mode, the total number of digital outputs is 5. Thus the step of each digital output is 2 psi (10 psi divided by 5). 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). Then the number of active stages remain frozen until the pressure reaches 18 psi (upper dead zone threshold = 17 psi). When the pressure reaches 18 psi, the number of active stages changes to 4 (OUT 1, OUT 2, OUT 3, OUT 4, with the time between stage activations being equal to the value configured in function F29). Upon leaving the dead zone, the control changes back to operating by updating the number of active stages as usual. When the pressure reaches 20 psi (setpoint plus digital hysteresis) all digital outputs will be on. While a digital output is activated, the corresponding hour meter is simultaneously increased. Thus we can conclude that stage 1 will have a longer 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 18 psi and the controller needs to switch off one stage, it will choose the one with the most time active. In the example in question stage 1 would be chosen. When the pressure enters the dead zone again (reaches 17 psi), the number of outputs will be frozen again. When the pressure reaches 12 psi, the number of active stages starts to be updated again, observing the conditions described in item 7.1.1.2 of dead zone (time in function P30 or dead zone step).



7.1.1.5 Digital outputs in capacities mode

Note: The dead zone is not available in this control mode.
Only the digital outputs will be used in this control mode, and thus the controller will assume only the hysteresis value configured in function "C07 - 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:

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

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 employed.

Example 7:
Number of pressure switch stages: 5
Mode: Depressurization.
Setpoint: 10 psi
Hysteresis of the digital outputs: 50 psi
Stage capacity:

OUT1 → 10%
OUT2 → 15%
OUT3 → 20%
OUT4 → 25%
OUT5 → 30%

With the values above we can predict the control activation levels:

Demand rising:

DEMAND (%)	PRESSURE (psi)	OUT 1 10%	OUT 2 15%	OUT 3 20%	OUT 4 25%	OUT 5 30%	CAPACITY (%)
0	10						0
5	12,5						5
10	15	x					10
15	17,5		x				15
20	20			x			20
25	22,5				x		25
30	25					x	30
35	27,5	x			x		35
40	30	x				x	40
45	32,5		x			x	45
50	35			x		x	50
55	37,5				x	x	55
60	40	x		x		x	60
65	42,5	x			x	x	65
70	45		x		x	x	70
75	47,5			x	x	x	75
80	50	x	x		x	x	80
85	52,5	x		x	x	x	85
90	55		x	x	x	x	90
95	57,5	x	x	x	x	x	95
100	60		x	x	x	x	100

Demand falling:

DEMAND (%)	PRESSURE (psi)	OUT 1 10%	OUT 2 15%	OUT 3 20%	OUT 4 25%	OUT 5 30%	CAPACITY (%)
100	60	x	x	x	x	x	100
95	57,5	x	x	x	x	x	95
90	55		x	x	x	x	90
85	52,5	x		x	x	x	85
80	50	x	x		x	x	80
75	47,5	x	x	x		x	75
70	45	x	x	x	x		70
65	42,5	x			x	x	65
60	40	x		x		x	60
55	37,5	x	x			x	55
50	35	x	x		x		50
45	32,5	x	x	x			45
40	30	x				x	40
35	27,5	x			x		35
30	25	x		x			30
25	22,5	x	x				25
20	20			x			20
15	17,5		x				15
10	15	x					10
5	12,5	x					5
0	10						0

Example 8:
Number of pressure switch stages: 5
Mode: Pressurization.
Setpoint: 100 psi
Hysteresis of the digital outputs: 50 psi
Stage capacity:

OUT1 → 10%
OUT2 → 15%
OUT3 → 20%
OUT4 → 25%
OUT5 → 30%

With the values above we can predict the control activation levels:

Demand rising:

DEMAND (%)	PRESSURE (psi)	OUT 1 10%	OUT 2 15%	OUT 3 20%	OUT 4 25%	OUT 5 30%	CAPACITY (%)
0	100						0
5	97,5						5
10	95	x					10
15	92,5		x				15
20	90			x			20
25	87,5				x		25
30	85					x	30
35	82,5	x			x		35
40	80	x				x	40
45	77,5		x			x	45
50	75			x		x	50
55	72,5				x	x	55
60	70	x		x		x	60
65	67,5	x			x	x	65
70	65		x		x	x	70
75	62,5			x	x	x	75
80	60	x	x		x	x	80
85	57,5	x		x	x	x	85
90	55		x	x	x	x	90
95	52,5		x	x	x	x	95
100	50	x	x	x	x	x	100

Demand falling:

DEMAND (%)	PRESSURE (psi)	OUT 1 10%	OUT 2 15%	OUT 3 20%	OUT 4 25%	OUT 5 30%	CAPACITY (%)
100	50	x	x	x	x	x	100
95	52,5	x	x	x	x	x	95
90	55		x	x	x	x	90
85	57,5	x		x	x	x	85
80	60	x	x		x	x	80
75	62,5	x	x	x		x	75
70	65	x	x	x	x		70
65	67,5	x			x	x	65
60	70	x		x		x	60
55	72,5	x	x			x	55
50	75	x	x		x		50
45	77,5	x	x	x			45
40	80	x				x	40
35	82,5	x			x		35
30	85	x		x			30
25	87,5	x	x				25
20	90			x			20
15	92,5		x				15
10	95	x					10
5	97,5	x					5
0	100						0

7.1.2 Type of control only through analog output

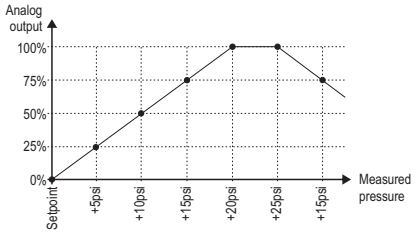
Upon configuring the type of digital control as switched off and the type of analog control as switched on, the pressure control will be performed only by the analog output. The possible control methods under these conditions are:
- Depressurization control using only the analog output
- Pressurization control using only the analog output

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

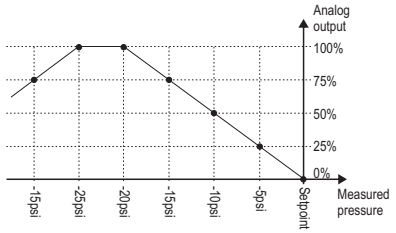
7.1.2.1 Proportional analog output

Only the analog output will be used in this control mode, and thus the controller will assume only the hysteresis value configured in the function: "C15 - Hysteresis of the analog output".
Depressurization mode: When the measured pressure drops below the setpoint, the analog output will be at 0%. When the pressure rises and gets higher than the setpoint, the analog output will change linearly to meet the system's demand.
Pressurization mode: When the measured pressure is above the setpoint, the analog output will be at 0%. When the pressure drops and gets lower than the setpoint, the analog output will change linearly to meet the system's demand.

Example 9:
Mode: Depressurization
Setpoint: 10 psi
Hysteresis of the analog output: 20 psi
Analog output minimum value: 0%
Analog output maximum value: 100%



Example 10:
Mode: Pressurization
Setpoint: 100 psi
Hysteresis of the analog output: 20 psi
Analog output minimum value: 0%
Analog output maximum value: 100%



7.1.3 Mixed control through digital and analog outputs

Upon configuring the type of digital control as switched on and the type of analog control as switched 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 analog output (pressurizing/depressurizing)
- Digital outputs in rotation mode with proportional analog output (pressurizing/depressurizing)
- Digital outputs in capacities mode with proportional analog output (pressurizing/depressurizing)

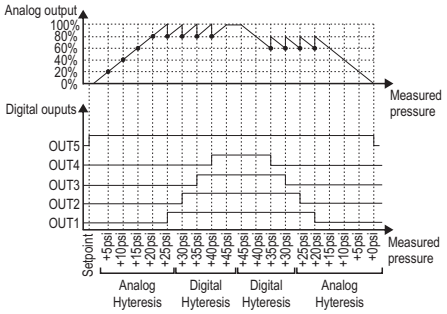
Note: The dead zone is not available in this control mode.

7.1.3.1 Digital outputs in linear mode with proportional analog output

In this mode the activations of the digital outputs occur when the analog output reaches the value configured in "C17 – Analog output maximum value". The activation sequence of the digital loads will be linear as described in item "7.1.1.1 Digital outputs in digital mode". Due to the fact that this operating mode uses digital and analog outputs, the controller will assume that the hysteresis is equal to the sum of the following functions: "C07 - Digital output hysteresis" and "C08 - Analog output hysteresis."

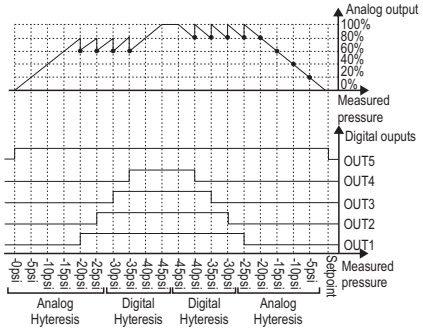
Example 11:
Mode: Depressurization
Setpoint: 10 psi
Hysteresis of the digital outputs: 20 psi
Hysteresis of the analog output: 25 psi
Analog output minimum value: 0%
Analog output maximum value: 100%
Configuration of the stages:

OUT1 to OUT4 → Pressure Switch
OUT5 → Start/stop



Example 12:
Mode: Pressurization
Setpoint: 100 psi
Hysteresis of the digital outputs: 20 psi
Hysteresis of the analog output: 25 psi
Analog output minimum value: 0%
Analog output maximum value: 100%
Configuration of the stages:

OUT1 to OUT4 → Pressure Switch
OUT5 → Start/stop



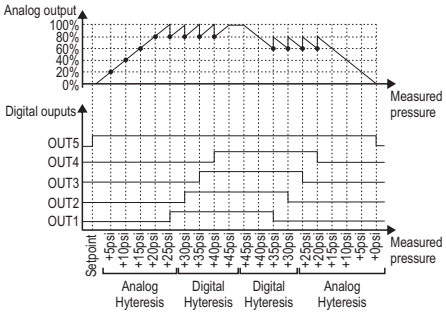
In examples 11 and 12, the step for each digital output is 5 psi (20 psi divided by 4). The conclusion is that each digital stage corresponds to 20% of the analog output (digital output step divided by the analog hysteresis, 5 divided by 25 psi in this case). Thus, whenever the controller activates or deactivates a digital stage, the analogue output will be compensated by being increased or decreased by 20%.

7.1.3.2 Digital outputs in rotation mode together with proportional analogue output

In this mode the digital outputs are controlled in accordance with the number of hours worked, so that for switching on a new stage the controller checks which one has the shortest time worked, and for switching off one stage it checks which one has the most hours worked. 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 analog outputs, the controller will assume that the hysteresis is equal to the sum of the following functions: "C07 - Digital output hysteresis" and "C08 - Analog output hysteresis."

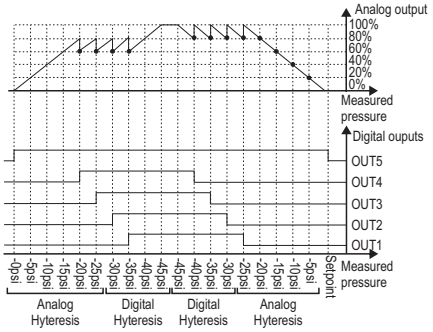
Example 13:
Mode: Depressurization
Setpoint: 10 psi
Hysteresis of the digital outputs: 20 psi
Hysteresis of the analog output: 25 psi
Analog output minimum value: 0%
Analog output maximum value: 100%
Configuration of the stages:

OUT1 to OUT4 → Pressure Switch
OUT5 → Start/stop



Example 14:
Mode: Pressurization
Setpoint: 100 psi
Hysteresis of the digital outputs: 20 psi
Hysteresis of the analog output: 25 psi
Analog output minimum value: 0%
Analog output maximum value: 100%
Configuration of the stages:

OUT1 to OUT4 → Pressure Switch
OUT5 → Start/stop



In examples 13 and 14 the step for each digital output is 5 psi (20 psi divided by 4). The conclusion is that each digital stage corresponds to 20% of the analog output (digital output step divided by the analog hysteresis, 5 divided by 25 psi in this case). Considering that the initial state of the hour meters of all stages is zero, the first digital stage that will be switched on when the analogue output reaches 100% is OUT 1. 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 hours worked.

7.1.3.3 Digital outputs in capacities mode together with proportional analog output

In this operating mode the analog 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 analog outputs, the controller will assume that the hysteresis is equal to the sum of the following functions: "C07 - Digital output hysteresis" and "C15 - Analog output hysteresis."

Example 15:
Mode: Depressurization
Number of pressure switch stages: 4
Analog output minimum value: 10% of 10V
Analog output maximum value: 100% of 10V
Setpoint: 10 psi
Hysteresis of the digital outputs: 40 psi
Hysteresis of the analog output: 10 psi
Configuration of the stages:

Stage	Type	Capacity
OUT 1	Start/Stop	-
OUT 2	Pressure Switch	18,8%
OUT 3	Pressure Switch	6,2%
OUT 4	Pressure Switch	12,5%
OUT 5	Pressure Switch	12,5%
Analog	-	50%

With the values above we can predict the control activation levels:

Demand rising:

DEMAND (%)	PRESSURE (psi)	Analog Cap. 50% (%)	Analog Cap. 50% (V)	OUT 1 -	OUT 2 Cap. 18,8%	OUT 3 Cap. 6,2%	OUT 4 Cap. 12,5%	OUT 5 Cap. 12,5%
0	10	0	0					
10	15	20	2,8	x				
20	20	40	4,6	x				
30	25	60	6,4	x				
40	30	80	8,2	x				
50	35	100	10	x				
60	40	82,4	8,4	x	x			
70	45	77,4	8	x	x			x
80	50	97,4	9,8	x	x			x
90	55	92,4	9,3	x	x		x	x
100	60	100	10	x	x	x	x	x

Demand falling:

DEMAND (%)	PRESSURE (psi)	Analog Cap. 50% (%)	Analog Cap. 50% (V)	OUT 1 -	OUT 2 Cap. 18,8%	OUT 3 Cap. 6,2%	OUT 4 Cap. 12,5%	OUT 5 Cap. 12,5%
100	60	100	10	x	x	x	x	x
90	55	80	8,2	x	x	x	x	x
80	50	60	6,4	x	x	x	x	x
70	45	40	4,6	x	x	x	x	x
60	40	20	2,8	x	x	x	x	x
50	35	0	1	x	x	x	x	x
40	30	16,7	2,5	x	x			x
30	25	22,3	3	x	x			
20	20	2,2	1,2	x	x			
10	15	20	2,8	x				
0	10	0						

Example 16:
Mode: Pressurization
Number of pressure switch stages: 4
Analog output minimum value: 10% of 10V
Analog output maximum value: 100% of 10 V
Setpoint: 100 psi
Hysteresis of the digital outputs: 40 psi
Hysteresis of the analog output: 10 psi
Configuration of the stages:

Stage	Type	Capacity
OUT 1	Start/Stop	-
OUT 2	Pressure Switch	18,8%
OUT 3	Pressure Switch	6,2%
OUT 4	Pressure Switch	12,5%
OUT 5	Pressure Switch	12,5%
Analog	-	50%

With the values above we can predict the control activation levels:

Demand rising:

DEMAND (%)	PRESSURE (psi)	Analog Cap. 50% (%)	Analog Cap. 50% (V)	OUT 1 -	OUT 2 Cap. 18,8%	OUT 3 Cap. 6,2%	OUT 4 Cap. 12,5%	OUT 5 Cap. 12,5%
0	100	0	0					
10	95	20	2,8	x				
20	90	40	4,6	x				
30	85	60	6,4	x				
40	80	80	8,2	x				
50	75	100	10	x				
60	70	82,4	8,4	x	x			
70	65	77,4	8	x	x			x
80	60	97,4	9,8	x	x			x
90	55	92,4	9,3	x	x		x	x
100	50	100	10	x	x	x	x	x

Demand falling:

DEMAND (%)	PRESSURE (psi)	Analog Cap. 50% (%)	Analog Cap. 50% (V)	OUT 1 -	OUT 2 Cap. 18,8%	OUT 3 Cap. 6,2%	OUT 4 Cap. 12,5%	OUT 5 Cap. 12,5%
100	50	100	10	x	x	x	x	x
90	55	80	8,2	x	x	x	x	x
80	60	60	6,4	x	x	x	x	x
70	65	40	4,6	x	x	x	x	x
60	70	20	2,8	x	x	x	x	x
50	75	0	1	x	x	x	x	x
40	80	16,7	2,5	x	x			x
30	85	22,3	3	x	x			
20	90	2,2	1,2	x	x			
10	95	20	2,8	x				
0	100	0						

7.1.4 Individual control type

In this operating mode, each output of the controller (digital outputs and analog output) has its own pressure setpoint and hysteresis, allowing them to be activated independently.

Example 17:
Analog output enabled
Analog output minimum value: 0%
Analog output maximum value: 100%

Configuration of the stages:

Stage	Type	Control Mode	Setpoint	Hysteresis
OUT 1	Start/Stop	-		
OUT 2	Pressure Switch	Pressurization	40 psi	5 psi
OUT 3	Pressure Switch	Pressurization	30 psi	5 psi
OUT 4	Pressure Switch	Depressurization	60 psi	5 psi
OUT 5	Pressure Switch	Depressurization	70 psi	5 psi
Analog	-	Depressurization	50 psi	25 psi

Pressure (psi)	AnOut (%)	AnOut (V)	OUT 1	OUT 2	OUT 3	OUT 4	OUT 5
20	0	0		x	x		
25	0	0		x	x		
30	0	0		x			
35	0	0		x			
40	0	0					
45	0	0					
50	0	0					
55	20	1	x				
60	40	4	x				
65	60	6	x				
70	80	8	x			x	
75	100	10	x			x	
80	100	10	x			x	x
75	100	10	x			x	x
70	80	8	x			x	
65	60	6	x			x	
60	40	4	x				
55	20	2	x				
50	0	0					
45	0	0					
40	0	0					
35	0	0					
30	0	0		x			
25	0	0		x			
20	0	0		x	x		

8. ALARM SYSTEM

8.1 Monitoring of the alarm conditions

The alarm conditions are monitored regardless of the configuration of the controller's alarm output. **PCT-410E** *plus* is equipped with a system that locks the pressure switch when a number of alarms are generated within a certain time. Whenever possible, the controller will try to correct the problem that generated the alarm. The reset system allows the user to configure how many times the **PCT-410E** *plus* will try the automatic correction (automatic reset) before quitting and switching off all loads (controller locked).
The table below lists the conditions that the controller can monitor for each alarm and which are considered by the reset system. Those that are not considered will not activate the interlock alarm.

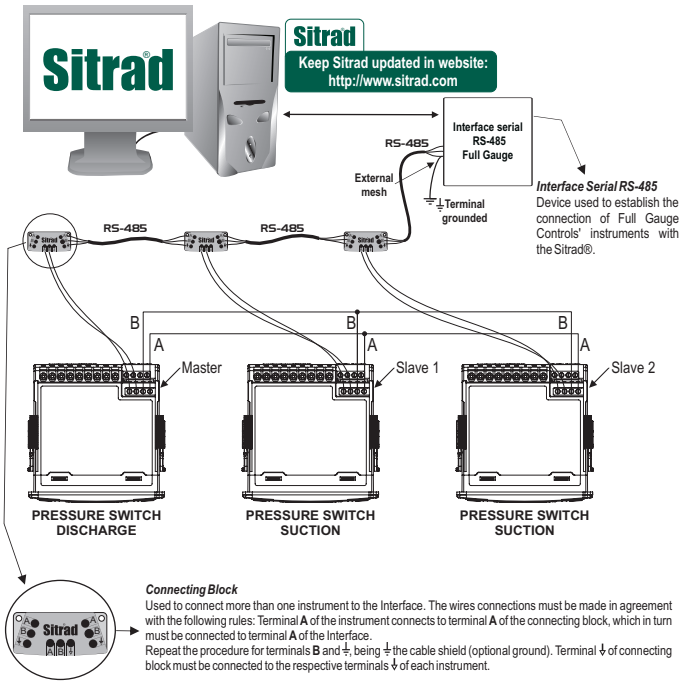
Alarm	Condition for monitoring the alarm	Counted by the reset system
Error in the gas line pressure sensor	Always	Yes
Error in the temperature sensor	Only if the sensor is enabled	Yes
Error in the calculation of the saturated gas temperature	Only if the temperature sensor is on and a gas curve is configured	No
Low/high pressure alarm (F06 and F07)	Only if the respective alarm is active	Yes
Low/high temperature alarm (F09 and F10)	Only if the respective alarm is active	Yes
Critical overheating/sub-cooling alarm (F11)	Only if the overheating is active (temperature sensor on and gas curve configured) and the respective alarm is enabled	No
Low overheating/sub-cooling alarm (F12)		No
High overheating/sub-cooling alarm (F13)		Yes
Digital input alarm (F33)	Only if the digital input is enabled	Only if the digital input is any other input than the virtual alarm
Remote alarm	Only if the controller is configured as a slave in the **PCT-410E** *plus* network	No
Maintenance alarm	Only if the stage is configured as a pressure switch or start/stop, or if it is the analog output	No

8.2 Activation priorities

PCT-410E *plus* considers the following priority order for making decisions on which state each pressure switch or start/stop output must assume.
Priority 1 – Output in maintenance mode (switch off the output);
Priority 2 – System in standby (control functions switched off, switch off the outputs);
Priority 3 – Error in the pressure sensor (state of the outputs depending on the configuration);
Priority 4 – Digital input alarm (state of the outputs depends on the configuration);
Priority 5 – Critical overheating/sub-cooling temperature alarm (suction pressure switch: switch off the outputs, discharge pressure switch: switch on the outputs);
Priority 6 – High pressure alarm (state of the outputs depends on the configuration);
Priority 7 – Low pressure alarm (state of the outputs depends on the configuration);
Priority 8 – High temperature alarm (switch off all outputs);
Priority 9 – Low temperature alarm (outputs unchanged);
Priority 10 – Interlock alarm (switch off the outputs).

9. COMMUNICATION NETWORK BETWEEN CONTROLLERS

It is possible to control a cooling system in a distributed form using up to 32 **PCT-410E** *plus* controllers (example: one controlling the suction pressure and another controlling the discharge pressure). In this case, it is possible to connect the instruments using a secondary RS-485 network (different from the network used to communicate with Sitrad) to increase the safety of the whole system.
The purpose of using this communication network is to interrupt the normal operation of the controllers configured as slaves when the controller configured as a master presents a pressure transducer error, low pressure alarm, or high pressure alarm. If any of these conditions occur, a command to activate the remote alarm is sent from the master to the slaves and the state of the outputs of those slaves will depend on the values configured in functions "F24 - State of the digital outputs in case of remote alarm" and "F28 - Value of the analog output in case of remote alarm".



10. SIGNALS

PErr	**Error in the pressure sensor.**
tErr	**Error in the temperature sensor.**
ESAt	**Error in the calculation of the saturated gas temperature.**
ESHC	**Error in the calculation of the overheating/sub-cooling temperature.**
APLO	**Low pressure alarm.**
APHI	**High pressure alarm.**
AtLO	**Low temperature alarm.**
AtHI	**High temperature alarm.**
Adin	**Digital input alarm.**
ArEn	**Remote alarm.**
ASHC	**Critical overheating/sub-cooling alarm.**
ASHL	**Low overheating/sub-cooling alarm.**
ASHH	**High overheating/sub-cooling alarm.**
AMAI	**Maintenance alarm.**
AILO	**Interlock alarm.**
OFF (flashing)	**Control functions turned off (standby mode active).**
PPPP	**Reconfigure the values of the functions.**

11. OPTIONAL ITEMS - Sold Separately

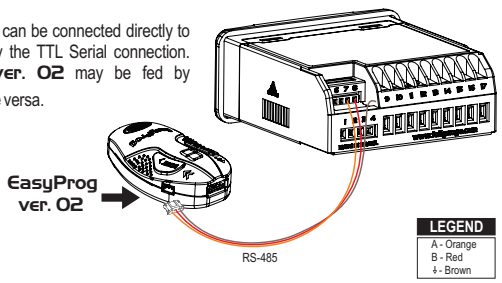
11.1 EasyProg ver. 02

It is an accessory that has as its main function to store the parameters of the controllers. At any time, you can load new parameters of a controller and unload them on a production line (of the same controller), for example. It has three types of connections to load or unload the parameters:

- Serial RS-485: It connects via RS-485 network to the controller (only for controllers that have RS-485).

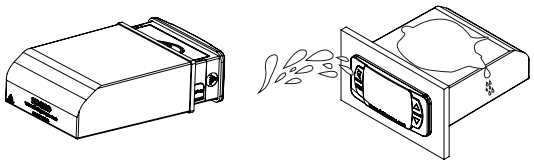
- USB: it can be connected to the computer via the USB port, using Sitrad's Recipe Editor. The parameters can be copied, edited and saved in **EasyProg ver. 02**. The USB port can also have the function of electrically feeding the **EasyProg ver. 02** and the controller (when the USB and Serial TTL are used together).

- Serial TTL: The controller can be connected directly to **EasyProg ver. 02** by the TTL Serial connection. Thus the **EasyProg ver. 02** may be fed by **PCT-410E** *plus*, or vice versa.



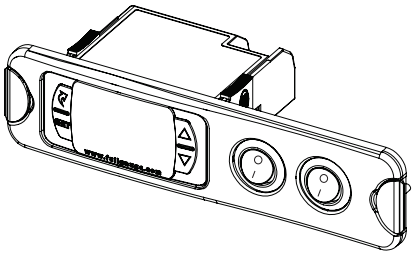
11.2 Ecase

Protective cover for controllers (Evolution line), which prevents the entrance of water and inner moisture. It protects the product when washing is carried out in the location where the controller is installed.



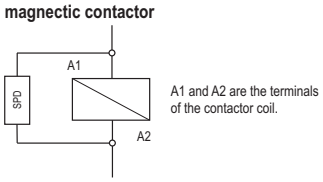
11.3 Extended Frame

The Full Gauge Controls extension frame allows the installation of Evolution / Ri line with measures 76x34x77 mm (dimensions of the clipping for fixing in the extension frame is 71x29mm) in varied situations, since it eliminates precision cut to embed the instrument. Allows customization via a sticker with the brand and the company contact, and accompany two 10A (250 Vac) switches that can trigger internal light, air curtain, on / off system or fan.

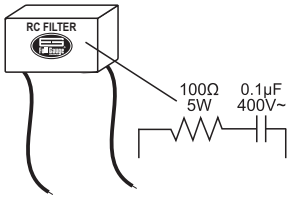


11.4 Surge Protective Device (SPD)

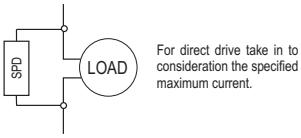
Wiring diagram for installation of SPD in magnectic contactor



A1 and A2 are the terminals of the contactor coil.



Wiring diagram for installation of SPD in line with loads



For direct drive take in to consideration the specified maximum current.

Note: The sensor cable lenght can be increased by the user up to 200 meters using PP 2 x 24 AWG cable.

IMPORTANT

According to the chapters from the IEC60364 standard:

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 wires pass through.

3: Install suppresor of transient in parallel to loads to increase the usefull life of the relays.

ENVIRONMENTAL INFORMATION

Packaging:

The materials used in the packaging of Full Gauge products are 100% recyclable. Try to perform disposal through specialized recyclers.

Product:

The components used in Full Gauge controllers can be recycled and reused if disassembled by specialized companies.

Disposal:

Do not incinerate or dispose the controllers that have reached the end of their service as household garbage. Observe the laws in your area regarding disposal of electronic waste. If in doubt, please contact Full Gauge Controls.

WARRANTY - FULL GAUGE CONTROLS

Products manufactured by Full Gauge Controls, as of May 2005, have a two (02) year warranty, as of the date of the consigned sale, as stated on the invoice. They are guaranteed against manufacturing defects that make them unsuitable or inadequate for their intended use.

EXCEPTIONS TO WARRANTY

The Warranty does not cover expenses incurred for freight and/or insurance when sending products with signs of defect or faulty functioning to an authorized provider of technical support services. The following events are not covered either: natural wear and tear of parts; external damage caused by falls or inadequate packaging of products.

LOSS OF WARRANTY

Products will automatically lose its warranty in the following cases:

- The instructions for assembly and use found in the technical description and installation procedures in Standard IEC60364 are not obeyed;
- The product is submitted to conditions beyond the limits specified in its technical description;
- The product is violated or repaired by any person not a member of the technical team of Full Gauge Controls;
- Damage has been caused by a fall, blow and/or impact, infiltration of water, overload and/or atmospheric discharge.

USE OF WARRANTY

To make use of the warranty, customers must send the properly packaged product to Full Gauge Controls together with the invoice or receipt for the corresponding purchase. As much information as possible in relation to the issue detected must be sent to facilitate analysis, testing and execution of the service.

These procedures and any maintenance of the product may only be provided by Full Gauge Controls Technical Support services in the company's headquarters at Rua Júlio de Castilhos, 250 - CEP 92120-030 - Canoas - Rio Grande do Sul – Brasil

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