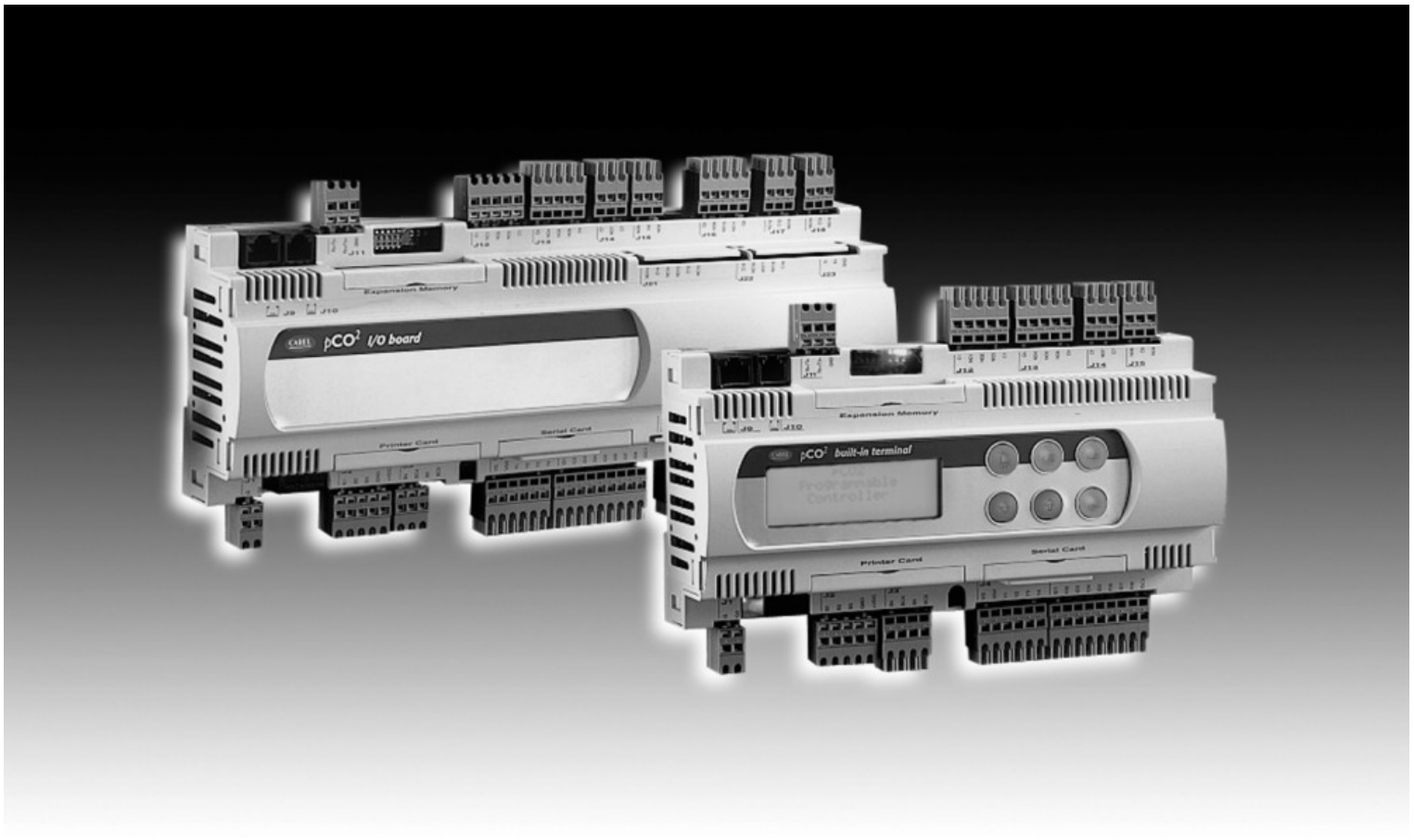
pCO² electronic programmable COntroller



User manual

LEGGI E CONSERVA QUESTE ISTRUZIONI

READ AND SAVE THESE INSTRUCTIONS

CAREL

Technology & Evolution

We wish to save you time and money!
We can assure you that a thorough reading of this manual will guarantee correct installation and safe use of the product described.

CONTENTS

IMPORTANT

BEFORE INSTALLING OR OPERATING ON THE DEVICE, READ CAREFULLY THE INSTRUCTIONS ON THIS MANUAL.

This instrument has been designed to operate without risks only if:

- Installation, operation and maintenance are performed according to the instructions of this manual;
- Environmental conditions and supply voltage fall within the values indicated here below;

Any different use or changes which have not been authorised by the manufacturer previously, are considered improper.
Responsibility for injures or damage caused by improper use will fall exclusively on the user.
Be careful: voltage is present in some electrical components of this instrument, thus all the service or maintenance operations must be done by expert and skilled personnel only, aware of the necessary precautions to be taken.
Before accessing the internal parts, cut off the power supply.

Disposal of the instrument:

The controller is made up of metal and plastic parts and a Lithium battery. All these components must be disposed of according to the standards in force in your own country.

INTRODUCTION

The pCO^2 represents the evolution of the well-known pCO electronic control, developed by Carel and designed for multiple applications in the fields of air-conditioning and refrigeration. The new range has been designed to satisfy the needs of the leading manufacturers in the sector, who require increasingly innovative and flexible products. There are three sizes, differentiated according to the I/O and power requirements: **pCO^2 SMALL**, **pCO^2 MEDIUM**, **pCO^2 LARGE**.
The pCO^2 ensures absolute application versatility, allowing the development of specific products upon customer request.
All of the terminals in the current pCO range are compatible with the new series of boards. In the LARGE version, microprocessor-based I/O expansions can be connected without requiring a pLAN network.

1. GENERAL FEATURES

All the versions of these controls feature a 16-bit microprocessor and up to 6 MByte of FLASH memory, guaranteeing high performance in terms of speed and available memory. The pCO² control comes in three sizes, differentiated according to the number of inputs and outputs, thus ensuring the best possible price/performance ratio.

1.1 pCO^2: SMALL, MEDIUM, LARGE

1.1.1 Features common to all the versions

- 16-bit microprocessor, 14 MHz, internal registers and 32 bit operation, 512 Byte internal RAM;
- up to 6 MByte FLASH MEMORY per program;
- 256 kByte static RAM, upon prior request expandable to 1 MByte;
- 1 RS485 serial port for pLAN;
- ready for connection to RS485 supervisory network;
- clock with replaceable lithium battery;
- 56 Byte of battery backed-up RAM;
- selection of address and LEDs for pLAN;
- DIN plastic case for installation on omega rail;
- 24Vac/Vdc power supply;
- telephone connector for pCO terminals;
- telephone connector for synoptic;
- LED power signal.

1.1.2 Features of the individual versions

pCO² SMALL (13 DIN modules)

- 8 optically-isolated digital inputs, 24Vac 50/60Hz or 24Vdc;
- 8 relay digital outputs (1 of which with changeover contact);
- 2 analogue inputs, selectable between NTC, PT1000, ON/OFF;
- 3 analogue inputs, selectable between NTC, 0÷1V, 0÷10V, 0÷20 mA, 4÷20mA;
- 4 analogue outputs, 0÷10 V.

pCO² MEDIUM (18 DIN modules)

- 12 optically-isolated digital inputs, 24Vac 50/60Hz or 24Vdc;
- 2 optically-isolated digital inputs, 24Vac/Vdc or 230Vac (50/60Hz);
- 13 relay digital outputs (3 of which with changeover contacts);
- 2 analogue inputs, selectable between NTC, PT1000, ON/OFF;
- 6 analogue inputs, selectable between NTC, 0÷1V, 0÷10V, 0÷20 mA, 4÷20mA;
- 4 analogue outputs, 0÷10 V.

pCO² LARGE (18 DIN modules)

- 14 optically-isolated digital inputs, 24Vac 50/60Hz or 24Vdc;
- 4 optically-isolated digital inputs, 24Vac/Vdc or 230Vac (50/60Hz);
- 18 relay digital outputs (3 of which with changeover contacts);
- 4 analogue inputs, selectable between NTC, PT1000, ON/OFF;
- 6 analogue inputs, selectable between NTC, 0÷1V, 0÷10V, 0÷20 mA, 4÷20mA;
- 6 analogue outputs, 0÷10 V;
- 1 serial port for I/O expansion.

pCO² with built-in terminal

The three different sizes feature a version with LCD and keypad built-into the plastic case, and fitted with:

- an LCD display, 4 x 20, with back-lighting (selectable via software);
- 6 buttons;
- 4 LEDs managed by application software.

1.2 Programmability

The Carel pCO[2] can be programmed using the EasyTools[1] development system, which offers the following advantages:
- transportability of the software onto different Carel hardware. The applications developed for the pCO or Macroplus can be simply and quickly transferred to the pCO² (and vice-versa), adapting the inputs and outputs only;
- rapid development, at competitive costs, of customised programs;
- reliability guaranteed by the use of standard routines, tested in the field.

The use of EasyTools, furthermore, offers customers the guarantee of the maximum degree of confidentiality and independent management should they decide to develop their own new programs.

The possibility to use the same hardware in different applications guarantees standardisation, with the significant advantages of being able to have test in-circuit, functional testing and burn-in procedures on all products, and thus achieve a high degree of reliability both overall and of the individual electronic components.

Applications

The programmability of the Carel pCO[2] ensures absolute applicational flexibility. The same standard hardware can be used for the control of:
- chillers and heat pumps;
- roof-top units;
- air-conditioners;
- small / medium air handling units (upon request);
- showcases (upon request and on specifications);
- cold rooms (upon request and on specifications);
- seasoning rooms;
- refrigeration units;
- universal circuit-closing switches.

Other types of programs can be developed upon request and based on customer specifications.

Terminals

The terminal can be customised according to customer specifications.
For example, the following features can be chosen:
- standard or graphic LCD display; luminous segment (LED) display;
- number of buttons according to specific application needs;
- number of LED signals according to specific application needs;
- protective polycarbonate keypad label made to customer specifications.

[1] EasyTools: environment made up of a variety of different, user-friendly software, for programming, simulating, supervising and creating pLAN local networks, using terminals and Carel programmable controls (Macroplus, pCO and pCO²).

2. HARDWARE STRUCTURE

The structure of the Carel pCO^2 features:

- the **pCO^2 control**, fitted with a 16-bit microprocessor for running the regulation program, and the set of terminals required for connection to the controlled devices (for example: valves, compressors, fans). The program and the set parameters are saved permanently in **FLASH memory**, preventing data loss in the event of power failure (without requiring a back-up battery).
  The pCO^2 also allows connection to a local pLAN network made up of a series of pCO² and terminals. Each board can exchange information (any variable, digital or analogue, according to the application software) at high transmission speeds. Up to 32 units can be connected, sharing information in very short times. The connection to the supervisor/telemaintenance serial line, based on the RS485 standard, is made using the optional serial boards (PCO2004850) and the Carel communication protocol.

- the **terminal,** also managed by microprocessor, fitted with display, keypad and LEDs to allow the programming of the control parameters (Set Point, differential band, alarm thresholds) and fundamental operation by the user (ON/OFF, display of the controlled values, optional printing). The terminal does not have to be connected to the pCO^2 for normal operation, but can be used for the initial programming of the fundamental parameters.

The power of the application software means that the user terminal allows:
- the initial programming of the machine, with password-protected access to guarantee security;
- the possibility to modify, at any time, the fundamental operating parameters, optionally protected by password;
- the display and acoustic signalling (buzzer) of the alarms detected;
- the display of the active functions, using the LEDs;
- the display of all the quantities measured;
- the printing of the alarms recorded, and the periodical printing of the status of the main machine variables (optional);
- the possibility to simulate the function buttons of the standard keypad, with LED indication of the selected function (depending on the application software);

the possibility to simulate a numeric keypad on the standard keypad, for setting the data (depending on the application software)
.

The hardware structure is defined as follows:
1. user terminal with keypad, display and LED signals;
2. pCO^2 (SMALL version);
3. pCO^2 (LARGE version);
4. connecting cable between terminal and pCO^2;
5. connecting cable between terminal and serial printer (provided by customer);
6. serial printer (provided by customer);
7. AWG20/22 cable for pLAN connection between a series of pCO^2 boards;
8. connection terminal kit (in this case disconnected from the board to make them completely visible);
9. connection to supervisory systems;
10. connection to I/O expansions (LARGE version only).

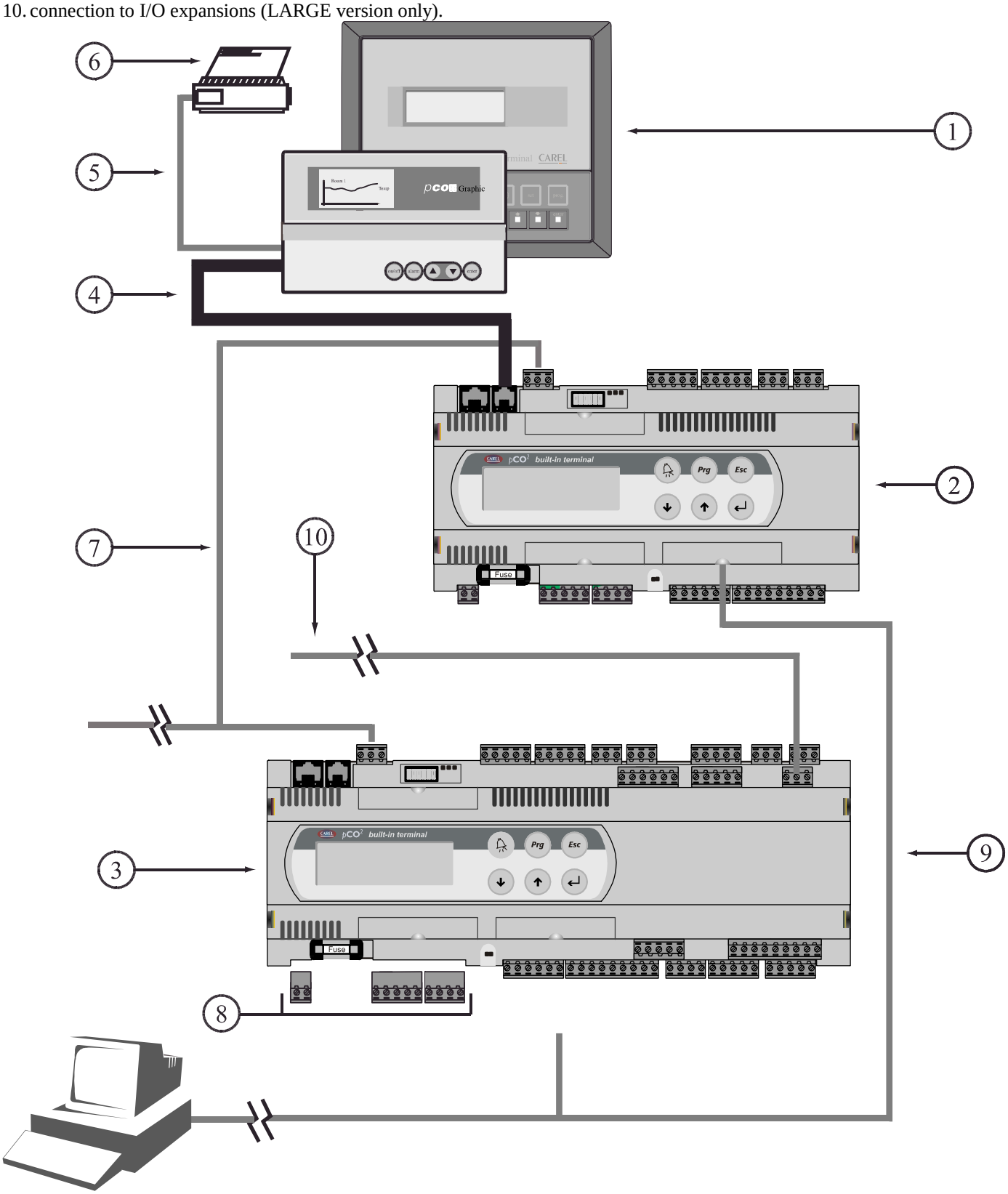


Fig. 2.1

2.1 Instrument and accessory codes

pCO²

interface and control version	code
LARGE with removable connectors	**PCO2000AL0**
MEDIUM with removable connectors	**PCO2000AM0**
SMALL with removable connectors	**PCO2000AS0**
LARGE with removable connectors - built-in terminal	**PCO2000BL0**
MEDIUM with removable connectors - built-in terminal	**PCO2000BM0**
SMALL with removable connectors - built-in terminal	**PCO2000BS0**
LARGE with removable connectors - one SSR (output no.7)	**PCO2001AL0**
MEDIUM with removable connectors - one SSR (output no.7)	**PCO2001AM0**
SMALL with removable connectors - one SSR (output no.7)	**PCO2001AS0**

Tab. 2.1.1

Removable connector kits

screw	code	spring	code
for pCO² SMALL	**PCO2CON0S0**	for pCO² SMALL	**PCO2CON1S0**
for pCO² MEDIUM	**PCO2CON0M0**	for pCO² MEDIUM	**PCO2CON1M0**
for pCO² LARGE	**PCO2CON0L0**	for pCO² LARGE	**PCO2CON1L0**
IDC (insulator displacement connector)	**code**	**pitch header**	**code**
for pCO² SMALL	**PCO2CON2S0**	for pCO² SMALL	**PCO2CON3S0**
for pCO² MEDIUM	**PCO2CON2M0**	for pCO² MEDIUM	**PCO2CON3M0**
for pCO² LARGE	**PCO2CON2L0**	for pCO² LARGE	**PCO2CON3L0**

Tab. 2.1.2

pCO² user terminal

plastic case for panel mounting	code
graphic display 240x128 pixel, back-lit	**PCOI00PGL0**
LCD display 4x20 back-lit	**PCOI000CBB**
LCD display 4x20	**PCOI000CB0**
plastic case for panel mounting and wall-mounting	**code**
graphic display 64x128 pixel, back-lit	**PCOT00PGH0**
LCD display 4x20	**PCOT000CB0**
LCD display 4x20 ready for printer connection	**PCOT00SCB0**
LCD display 4x20 back-lit	**PCOT000CBB**
6 digit LED display	**PCOT000L60**
plastic case for panel mounting 32X72	**code**
3 digit LED display	**PCOT32RN00**

Tab. 2.1.3

User terminal/interface connecting cables

length (m)	type	code
0.8	telephone connectors	**S90CONN002**
1.5	telephone connectors	**S90CONN000**
3	telephone connectors	**S90CONN001**
6	telephone connectors	**S90CONN003**

Tab. 2.1.4

Remote terminal installation

accessories for electrical connections	code
board for user terminal remote-installation	**TCONN60000**

Tab. 2.1.5

Optional boards

options	code
optically-isolated RS485 serial connection board for pCO²	**PCO2004850**
non optically-isolated RS232 modem serial connection board for pCO²	**PCO200MDM0**
printer interface board for graphic display	**PCOSERPRN0**
control board for Carel OEM steam humidifier	**PCOUMID000**
flash memory expansion board for pCO²	**PCO200MEM0**
parallel printer interface board for pCO²	**PCO200PRN0**
programming key board for pCO²	**PCO200KEY0**

Tab. 2.1.6

The following is a description of the pCO^2 with reference to the basic layout.

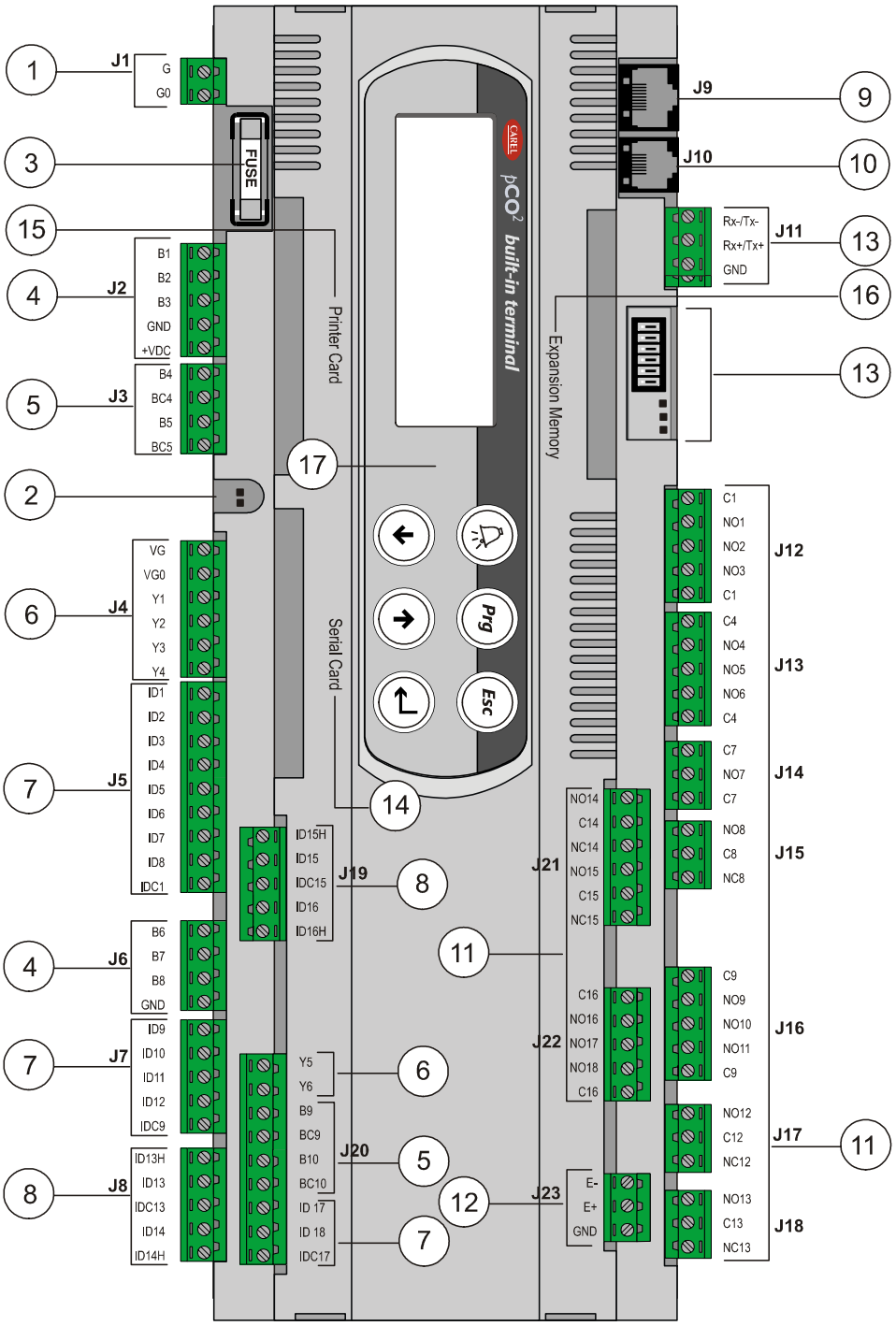


Fig. 2.1.1

1. Power connector [G(+), G0(-)];
2. Yellow power LED, and red alarm LED;
3. 250Vac, 2A slow-blow fuse (T2 A)
4. universal analogue inputs, NTC, 0/1V, 0/10V, 0/20mA, 4/20mA;
5. passive analogue inputs, NTC, PT1000, ON/OFF;
6. analogue outputs, 0/10V;
7. digital inputs, 24Vac/Vdc;
8. digital inputs, 230Vac or 24Vac/Vdc;
9. connector for synoptic terminal;
10. connector for all standard terminals, PCOT*, PCOI*, in the pCO^2 series and for downloading the application software;
11. relay digital outputs;
12. connector for connection to I/O expansion modules;
13. connector, address definition and LED for pLAN local network;
14. hatch for inserting the RS485 (for serial connection to Carel supervisor) or RS232 serial board (for modem interface);
15. hatch for inserting the board for connection to a parallel printer;
16. hatch for inserting the programming key/memory expansion;
17. built-in terminal (LCD, buttons and LEDs).

2.2 Meaning of the inputs/outputs

This table summarises the inputs and the outputs and provides a brief description of each.

connector	signal	description
J1-1	G	power supply +24Vdc or 24Vac
J1-2	G0	power supply reference
J2-1	B1	universal analogue input 1 (NTC, 0÷1V, 0÷10V, 0÷20mA, 4÷20mA)
J2-2	B2	universal analogue input 2 (NTC, 0÷1V, 0÷10V, 0÷20mA, 4÷20mA)
J2-3	B3	universal analogue input 3 (NTC, 0÷1V, 0÷10V, 0÷20mA, 4÷20mA)
J2-4	GND	common for analogue inputs
J2-5	+VDC	power for active probes, 21Vdc (maximum current 200mA)
J3-1	B4	passive analogue input 4 (NTC, PT1000, ON/OFF)
J3-2	BC4	common analogue input 4
J3-3	B5	passive analogue input 5 (NTC, PT1000, ON/OFF)
J3-4	BC5	common analogue input 5
J4-1	VG	power for optically-isolated analogue output, 24Vac/Vdc
J4-2	VG0	power for optically-isolated analogue output, 0Vac/Vdc
J4-3	Y1	analogue output no. 1, 0÷10V
J4-4	Y2	analogue output no. 2, 0÷10V
J4-5	Y3	analogue output no. 3, 0÷10V
J4-6	Y4	analogue output no. 4, 0÷10V
J5-1	ID1	digital input no. 1, 24Vac/Vdc
J5-2	ID2	digital input no. 2, 24Vac/Vdc
J5-3	ID3	digital input no. 3, 24Vac/Vdc
J5-4	ID4	digital input no. 4, 24Vac/Vdc
J5-5	ID5	digital input no. 5, 24Vac/Vdc
J5-6	ID6	digital input no. 6, 24Vac/Vdc
J5-7	ID7	digital input no. 7, 24Vac/Vdc
J5-8	ID8	digital input no. 8, 24Vac/Vdc
J5-9	IDC1	common for digital inputs 1 to 8 (negative pole if the group is DC powered)
J6-1	B6	universal analogue input 6 (NTC, 0÷1V, 0÷10V, 0÷20mA, 4÷20mA)
J6-2	B7	universal analogue input 7 (NTC, 0÷1V, 0÷10V, 0÷20mA, 4÷20mA)
J6-3	B8	universal analogue input 8 (NTC, 0÷1V, 0÷10V, 0÷20mA, 4÷20mA)
J6-4	GND	common for analogue inputs
J7-1	ID9	digital input no. 9, 24Vac/Vdc
J7-2	ID10	digital input no. 10, 24Vac/Vdc
J7-3	ID11	digital input no. 11, 24Vac/Vdc
J7-4	ID12	digital input no. 12, 24Vac/Vdc
J7-5	IDC9	common for digital inputs 9 to 12 (negative pole if the group is DC powered)
J8-1	ID13H	digital input 13, 230Vac
J8-2	ID13	digital input 13, 24Vac/Vdc
J8-3	IDC13	common for digital inputs 13 and 14 (negative pole if the group is DC powered)
J8-4	ID14	digital input 14, 24Vac/Vdc
J8-5	ID14H	digital input 14, 230Vac
J9		8-way telephone connector for connection to a synoptic terminal
J10		6-way telephone connector for connection to standard user terminal
J11-1	TX-	RX-/TX- connector for RS485 connection to the pLAN network
J11-2	TX+	RX+/TX+ connector for RS485 connection to the pLAN network
J11-3	GND	GND connector for RS485 connection to the pLAN network
J12-1	C1	common relay: 1, 2, 3
J12-2	NO1	normally-open contact relay no. 1
J12-3	NO2	normally-open contact relay no. 2
J12-4	NO3	normally-open contact relay no. 3
J12-5	C1	common relay: 1, 2, 3
J13-1	C4	common relay: 4, 5, 6
J13-2	NO4	normally-open contact relay no. 4
J13-3	NO5	normally-open contact relay no. 5
J13-4	NO6	normally-open contact relay no. 6
J13-5	C4	common relay: 4, 5, 6
J14-1	C7	common relay no. 7
J14-2	NO7	normally-open contact relay no. 7
J14-3	C7	common relay no. 7

Tab. 2.2.1 - cont.

cont.

Connector	signal	description
J15-1	NO8	normally-open contact relay no. 8
J15-2	C8	common relay no. 8
J15-3	NC8	normally-closed contact relay no. 8
J16-1	C9	common relay: 9, 10, 11
J16-2	NO9	normally-open contact relay no. 9
J16-3	NO10	normally-open contact relay no. 10
J16-4	NO11	normally-open contact relay no. 11
J16-5	C9	common relay: 9, 10, 11
J17-1	NO12	normally-open contact relay no. 12
J17-2	C12	common relay no. 12
J17-3	NC12	normally-closed contact relay no. 12
J18-1	NO13	normally-open contact relay no. 13
J18-2	C13	common relay no. 13
J18-3	NC13	normally-closed contact relay no. 13
J19-1	ID15H	digital input 15 a 230Vac
J19-2	ID15	digital input 15, 24Vac/Vdc
J19-3	IDC15	common digital inputs 15 and 16 (negative pole if the group is DC powered)
J19-4	ID16	digital input 16, 24Vac/Vdc
J19-5	ID16H	digital input 16, 230Vac
J20-1	Y5	analogue output no. 5, 0÷10V
J20-2	Y6	analogue output no. 6, 0÷10V
J20-3	B9	passive analogue input 9 (NTC, PT1000, ON/OFF)
J20-4	BC9	common analogue input 9
J20-5	B10	passive analogue input 10 (NTC, PT1000, ON/OFF)
J20-6	BC10	common analogue input 10
J20-7	ID17	digital input no. 17, 24Vac/Vdc
J20-8	ID18	digital input no. 18, 24Vac/Vdc
J20-9	IDC17	common digital inputs 17 and 18 (negative pole if the group is DC powered)
J21-1	NO14	normally-open contact relay no. 14
J21-2	C14	common relay no. 14
J21-3	NC14	normally-closed contact relay no. 14
J21-4	NO15	normally-open contact relay no. 15
J21-5	C15	common relay no. 15
J21-6	NC15	normally-closed contact relay no. 15
J22-1	C16	common relay: 16, 17, 18
J22-2	NO16	normally-open contact no. 16
J22-3	NO17	normally-open contact no. 17
J22-4	NO18	normally-open contact no. 18
J22-5	C16	common relay: 16, 17, 18
J23-1	E-	E- terminal for RS485 connection to I/O expansion modules
J23-2	E+	E+ terminal for RS485 connection to I/O expansion modules
J23-3	GND	GND terminal for RS485 connection to I/O expansion modules

Tab. 2.2.1

The following table gives examples of the distribution of the inputs and outputs in relation to the 3 versions:

		analogue inputs		analogue outputs	digital inputs		digital outputs	
		passive	universal		24Vac/Vdc	230Vac 24Vac/Vdc	NO contacts	changeov. contact
SMALL		2	3		8	0	7	1
	total	5		4	8		8	
MEDIUM		2	6		12	2	10	3
	total	8		4	14		13	
LARGE		4	6		14	4	13	5
	total	10		6	18		18	

Tab. 2.3.1

3. TERMINAL USER

3.1 Contrast control in LCD Display

4x20 LCD display models have a trimmer for adjusting the display contrast. The trimmer can be accessed using a flat-head screwdriver through the hole located on the top right corner of the rear cover (PCOT* models) or by removing the rear cover (PCOI* models); in the latter case the potentiometer is located on the top right corner of the main board itself. Graphic display models allow control of contrast by pressing simultaneously the Menu and ↓ buttons (or Menu and ↑). Here follows the description of terminal user available versions (display).

3.2 Display LCD 4x20 for wall or panel mounting

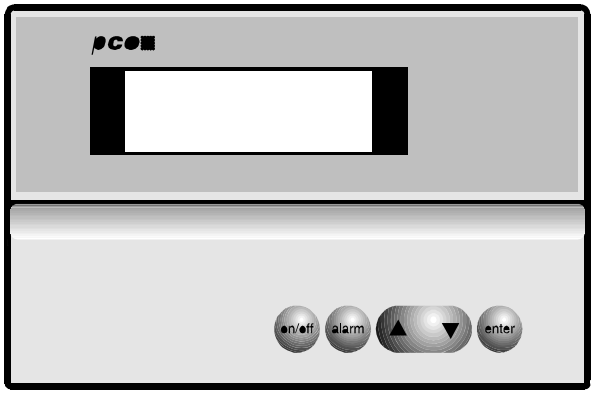


Fig. 3.2.1

code	**PCOT00*CB***
features	
Number of rows	4
Number of columns	20
Font height (mm)	5

Other features available:

- version fitted for connection to a serial printer (PCOT00SCB0);
- version with LCD back-lit (PCOT000CBB).

3.3 LED Display for wall or panel mounting

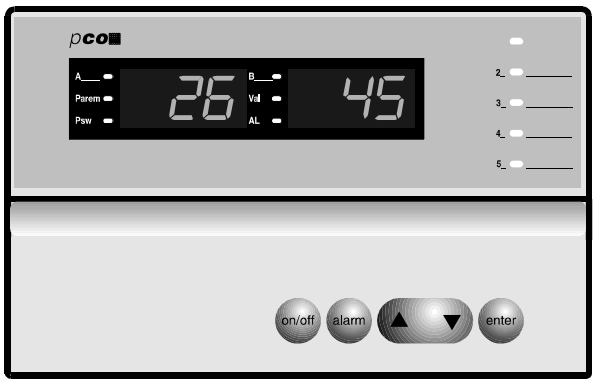


Fig. 3.3.1

Code	**PCOT000L60**
features	
Number of digits	6
Colour	Green
Height (mm)	13
Font height (mm)	5
LED number of side indicators	5
LED number of indicators (of the function displayed)	3+3

3.4 LCD Graphic Display for wall or panel mounting

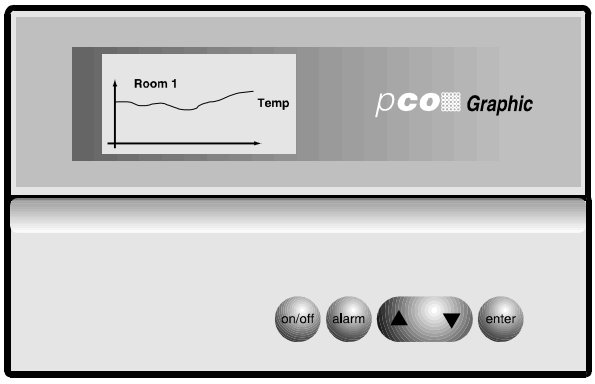


Fig. 3.4.1

Code	**PCOT00PGH0**
features	
LCD	128x64 pixel, graphic, back-lit
LCD	128x64 pixel, graphic, back-lit
Number of rows	8
Number of columns	16

3.5 4x20 LCD Display for panel mounting

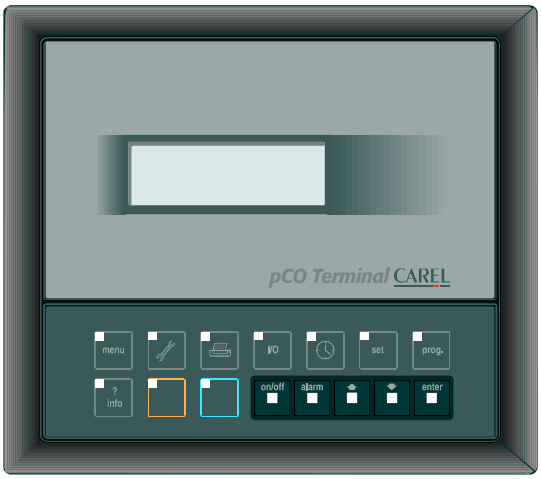


Fig. 3.5.1

code	**PCOI000CB***
features	
Number of rows	4
Number of columns	20
Font height (mm)	5

Other features available:

- version with back-lit LCD (**PCOI000CBB**).

3.6 LCD Graphic Display for panel mounting

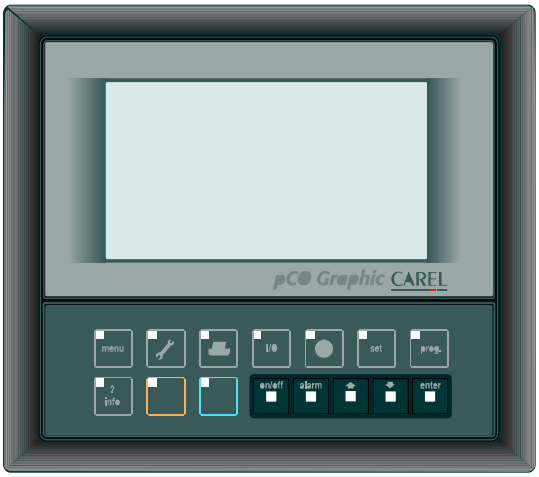


Fig. 3.6.1

code	**PCOI00PGL0**
features	
LCD	240x128 pixel, graphic, back-lit
Number of rows	16
Number of columns	30

3.7 3-Digit Display - LED 32x72

Fig. 3.7.1

code	**PCOT32RN00**
features	
Number of LED digits	3
Number of buttons	4

3.8 Built-in display

The three versions (SMALL, MEDIUM, LARGE) feature a version with display and keypad directly built into the plastic case:

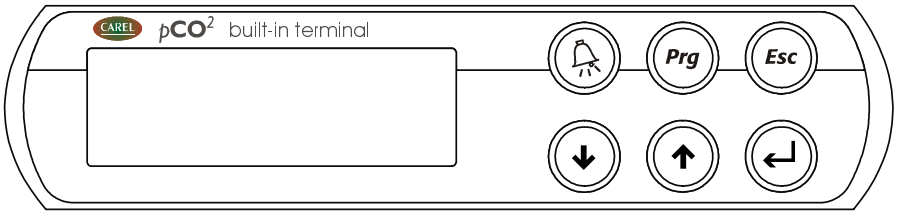


Fig. 3.8.1

codes	**PCO2000BS0, PCO2000BM0, PCO2000BL0**
features	
LCD	4x20, back-lit
no. of buttons	6
no. of LEDs	4

Tab. 3.8.1

* see **Instruments and Accessories codes.**

These versions with LCD and built-in keypad also support connection to all the terminals in the pCO series (the two displays, built-in and standard, work together, showing the same information at the same time).
This terminal version also allows the contrast of the display to be adjusted.
To do this:

1. press Enter and Esc together;
2. keep the two buttons pressed, and use the Up or Down button to adjust the contrast (increase or decrease respectively).

The table below shows the function of the buttons relative to the keypads on the built-in and standard terminals:

built-in keypad	**standard terminal keypad**
Alarm button	alarm button
Prg button	prg button
Esc button	menu button
up button	up button
down button	down button
enter button	enter button

Tab. 3.8.2

On the built-in terminal keypad pressing the up-down-enter buttons together allows the user to quickly check the inputs and outputs.

3.9 pCO terminal keypad

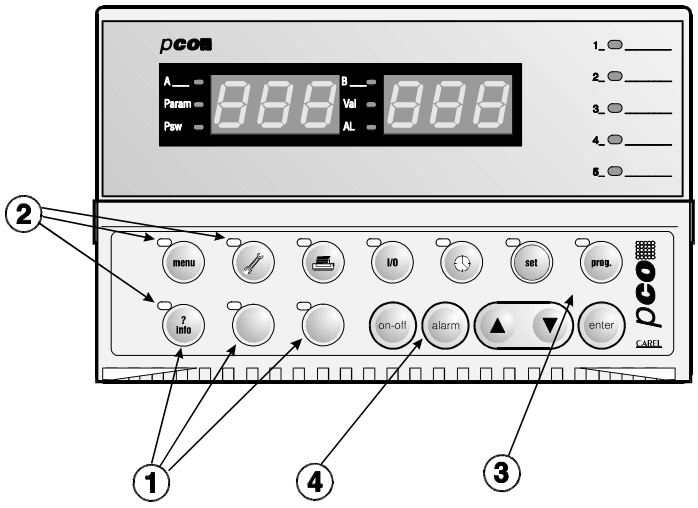


Fig. 3.9.1

n.	**description**
1	mechanical buttons protected by polycarbonate cover
2	function-indicator LEDs
3	polycarbonate label (customisable)
4	external rubber buttons

Tab. 3.8.1

3.9.1 Typical use of the buttons in standard Carel applications

displays the values measured by the probes


displays the values relating to the maintenance of the devices (working hours and operating hour counter reset);

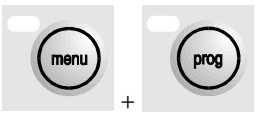

accesses the group of screens for printer management (where included);

displays the status of inputs and outputs (both digital and analogue);


allows the display/programming of the clock (if present);

allows the Set-Point setting;

allows the various operating parameters to be set (safety parameters, thresholds)



by pressing simultaneously these buttons you access the unit configuration (number of instruments connected to the pCO^2, scale setting, probe calibration etc.);

displays the version of the application program and other information;

The LED next to each button are illuminated when the relative function is active (depending on the application program).
External silicone rubber buttons (standard version).

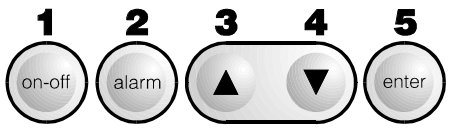


Fig. 3.9.1.1

Ref. Fig. 3.2.1.1 (relating to Carel standard application programs):

1. **ON/OFF:** switches the unit on or off. The green LED that lights up in the button shows if the machine is turned on;
2. **alarm** button: used for displaying or manually resetting the alarms and for silencing the buzzer. If the button lights up (red), at least one alarm has been detected;
3. **The arrow pointing upwards** to manage the currently displayed screen and to set the values of the control parameters (not back-lit);
4. **The arrow pointing downwards** to manage the currently displayed screen and to set the values of the control parameters (not back-lit);
5. **enter** button: to confirm the set data. The button is constantly back-lit (yellow) indicating the presence of mains power.

3.10 Functions and features of the terminal with graphic display

The fonts of the digits can be configured by the user-programmer, both for style and dimension. Therefore it is possible to represent all alphabets. You can display the measured values in large format so that they can be seen from a distance.
Other object displayed include:

- static graphic objects (created by the programmer);
- graphic objects in motion (created by the programmer);
- graphs of the acquired variables.

If you want to save the graphic progress of the acquired variables it is necessary to install the clock/addressing card of the pLAN local network in the terminal (version equipped with 32 kByte EPROM, code PCOCLKMEM0). This card must be inserted in the pin connector marked CLOCK/MEM.

WARNING: all operations involving mounting/removal should be performed when the unit is Off.

3.10.1 Graphic display board

The board supports the microprocessor, the memory and the EPROM which holds the application program for managing the display and the keypad. It also includes a connector for the optional serial card for printer management (code PCOSERPRN0) and for the card containing the clock and the 32 of EEPROM. Here below are described the components of the terminal with graphic display.

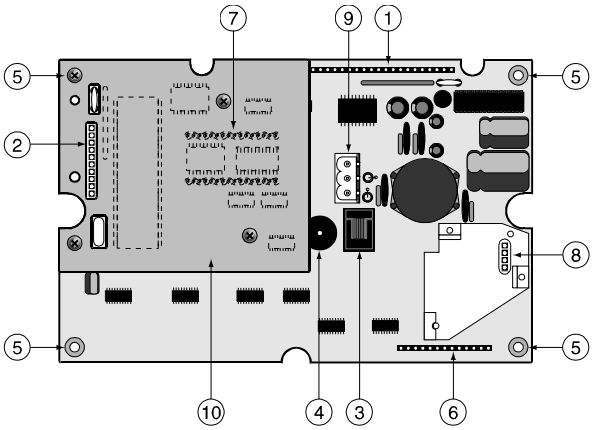


Fig. 3.10.1.1

n.	description
1	connector to the inverter and signal management card for the display
2	connector for the optional printer card
3	telephone-type connector card for terminal connection to the pCO² (PCOB*21) or junction TCONN6J000
4	buzzer for acoustic alarm signals
5	metal-plated mounting holes
6	connector for connection to an additional keypad card
7	EPROM program and mounting/direction orientation
8	connector for real time clock/32kB EEPROM
9	power connector (to be used with PCOI00PGL0 and for distances over 50 metres with PCOT00PGH0) - cross sections: from min 0,5mm² to max. 2,5mm²).
10	protective screen

Tab. 3.10.1.1

3.10.2 Inverter card for powering the fluorescent light on the display (CFL) and connecting to the pCO²

This card provides power to the fluorescent back-lighting on the display and allows the main board to correctly control the display used. The fluorescent light is available only on PCOI00PGLO, 240x128 pixels.

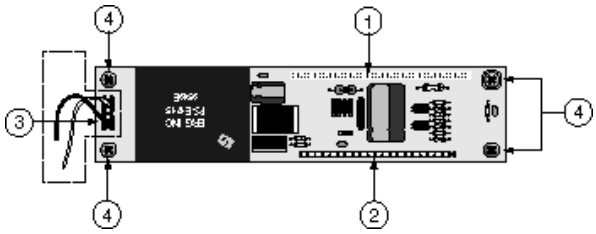


Fig. 3.10.2.1

n.	description
1	connection to the pCO display for model PCOI00PGL0
2	connection to the display (LCD)
3	connection to the light
4	mounting holes

Tab. 3.10.2.1

WARNING: The dotted area in Fig. 3.9.2.1 indicates the high voltage area (around 360 Vac); do not in any circumstances touch this area with your fingers or with conducting tools.

3.10.3 Protective screen (optional printer card)

For all pCO graphic terminal models an optional card can be inserted in the pin connector marked by number 2 as shown in Fig. 3.9.3.1. for managing a serial printer. To insert the card, first remove the protective screen which is found in the area reserved for the optional printer card. The function of the screen is to increase immunity against terminal disturbances. Mounting is made by tightening the three screws in the three holes marked by no.1, Fig. 3.3.1.3.1.

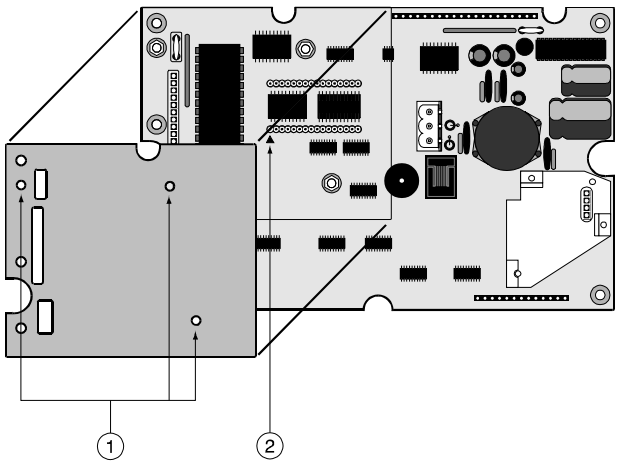


Fig. 3.10.3.1

4. INSTALLATION

4.1 Anchoring the pCO²

The pCO² should be installed on a DIN rail. To fasten the unit to the DIN rail, lightly press it against the rail. The rear tabs will click into place, locking the unit to the rail. Removing the unit is just as simple, using a screwdriver through the release slot to lever and lift the tabs. The tabs are kept in the locked position by springs.

4.2 Power supply

The pCO² can be powered at: 22÷40Vdc and 24Vac ±15%, 50/60Hz. The maximum power consumed is P_{max} = 20W.
For alternating current power supplies, during installation use a **Class II** safety transformer, rated to at least 50VA and with a 24Vac output. This is valid for the power supply to just one pCO² control.
If you supply more pCO² controller with the same transformer, its rated voltage must be *n.* x 50VA, where *n.* is the number of controllers to be supplied by the transformer, independently from the controller version.
The power supply to the pCO² control and the terminal (or to a series of pCO² and terminals) must be separated from the power supply to the other electrical devices (power contactors and other electromechanical components), inside the electrical panel.
If the transformer secondary is earthed, check that the ground wire is connected to terminal G0. When powering a series of pCO² boards connected in a pLAN network, check that the references G and G0 are respected (G0 must be same for all the boards).

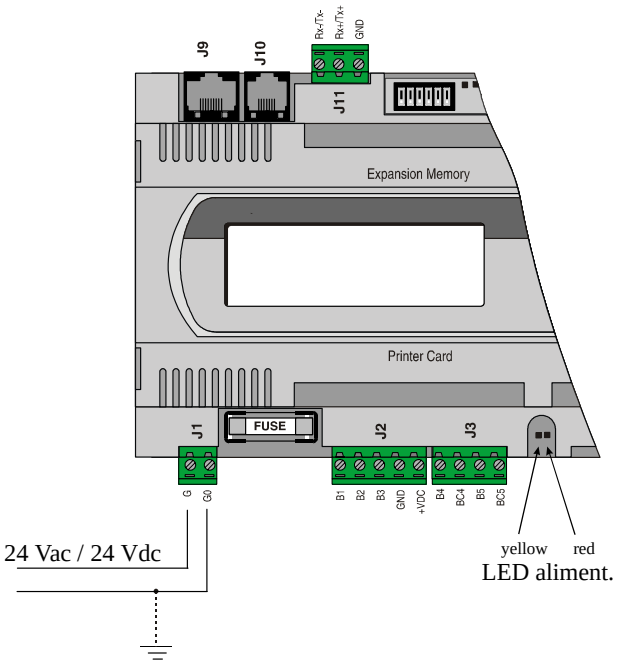


Fig. 4.2.1

The following table summarises the states of the power LEDs.

LED	status	description
yellow	ON/OFF	power supply active / not active
red	ON	probe power current overload signal (short circuit or anomaly)
	OFF	regular probe power

Tab. 4.2.1

4.3 Installation warnings - destination and connection environments

Avoid mounting of the boards in environments with the following characteristics:

- relative humidity over 90%;
- strong vibrations or bumps;
- exposure to continuous jets of water;
- exposure to aggressive and polluting environments (e.g.: sulphuric and ammoniac gases, saline mists, fumes) with consequent corrosion and/or oxidation;
- high levels of magnetic and/or radio-frequency interference (thus avoid installing the machine near transmitting antennae);
- exposure of the pCO² to direct sunlight and atmospheric agents in general;
- large and rapid fluctuations in ambient temperature;
- environments where explosives or inflammable gases are present;
- exposure to dust (formation of corrosive patina with possible oxidation and reduction of insulation);

The following warnings must be respected for correct connection:

- electrical power supply different from that specified can seriously damage the system;
- use cable plugs suitable for the terminals being used. Loosen each screw and insert the cable plug, then tighten the screws. At the end of the operation lightly tug the cables to check that they are tight;
- separate as much as possible the probe signal and digital input cables from the inductive load and power cables, to avoid possible electromagnetic disturbance. **Never use the same channelling (including that used for the electrical cables) for the power cables and probe cables**. Avoid the probe cables being installed in the immediate vicinity of power devices (contactors, circuit breakers or others);
- reduce the length of the sensor cables where possible and avoid spiralling around power devices. The probe connection must be made using shielded cables (minimum cross-section for each lead: 0.5 mm^2);
- avoid touching or nearly-touching the electronic components on the boards, to avoid (extremely dangerous) electrostatic discharges from the user to the components;
- if the power supply transformer secondary is earthed, check that the ground wire corresponds to the lead which goes to the control and enters terminal **G0**;
- separate the power supply to the digital outputs from the power supply to the pCO^2;
- do not fasten the cables to the terminals by pressing the screwdriver with excessive force, to avoid damaging the pCO^2.

4.4 Connecting the analogue inputs

The pCO² analogue inputs can be configured for the more common sensors on the market: NTC, PT1000, 0÷1V, 0÷10V, 0÷20mA, 4÷20mA. The different types of sensors can be selected via a parameter in the user terminal (if featured in the application software).

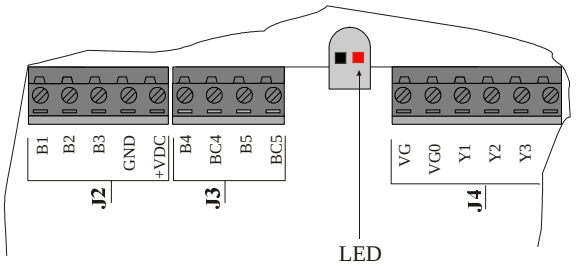


Fig. 4.4.1

NOTE: the 21Vdc available at the +VDC terminal can be used for the power supply to the active probes, the maximum current being 200mA, protected by circuit-breaker against short-circuits. The activation of the latter is signalled by the switching on of the red LED on the right (see Fig. 4.4.1).

4.4.1 Connecting active temperature and humidity probes

The pCO[2] can be connected to all the Carel series AS*[2] active temperature and humidity probes configured as 0÷1V or 4÷20mA. The inputs which can accept these sensors are: B1, B2, B3, B6, B7, B8. The inputs must be pre-configured for 0÷1V or 4÷20mA signals by the application software resident in the flash memory. The following shows the connection diagram:

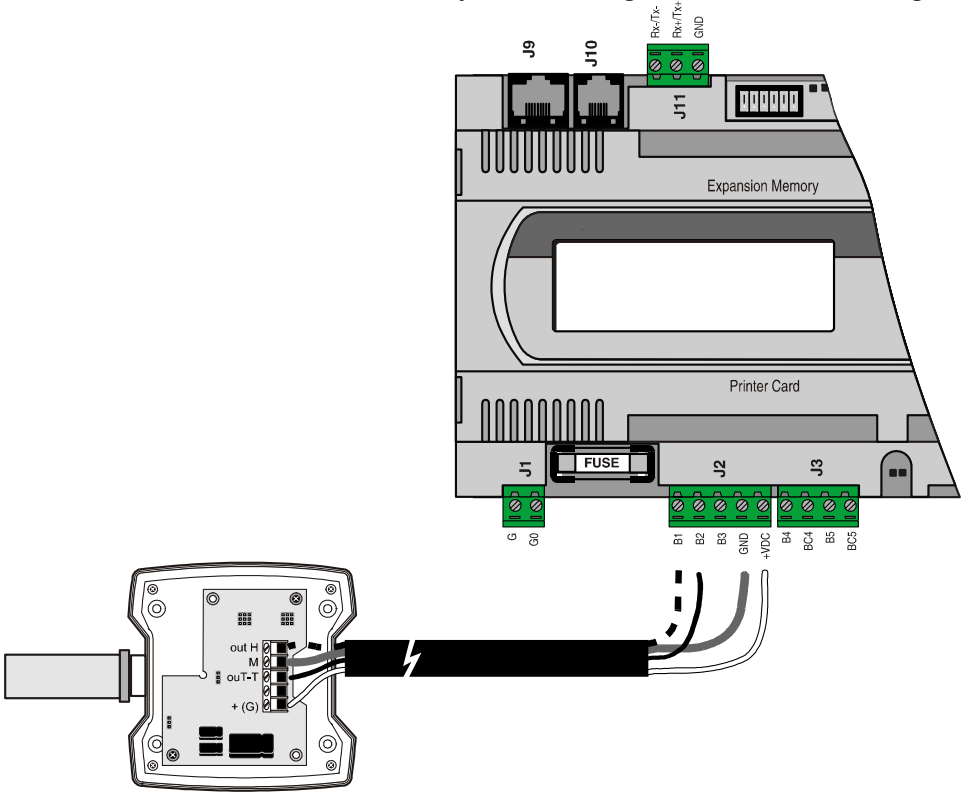


Fig. 4.4.1.1

pCO[2] terminals	**probe terminals**	**description**
GND	M	reference
+Vdc	+(G)	power supply
B1, B2, B3, B4, B5, B6	out H, ntc	universal probe inputs

Tab. 4.4.1.1

[2] for further details on the series AS* active probes refer to the technical manual, code: +030221275.

4.4.2 Connecting the universal NTC temperature probes

The analogue inputs from B1 to B10 are compatible with 2-lead NTC sensors. The inputs must be pre-configured for NTC signals by the application software resident in the flash memory. The following shows the connection diagram:

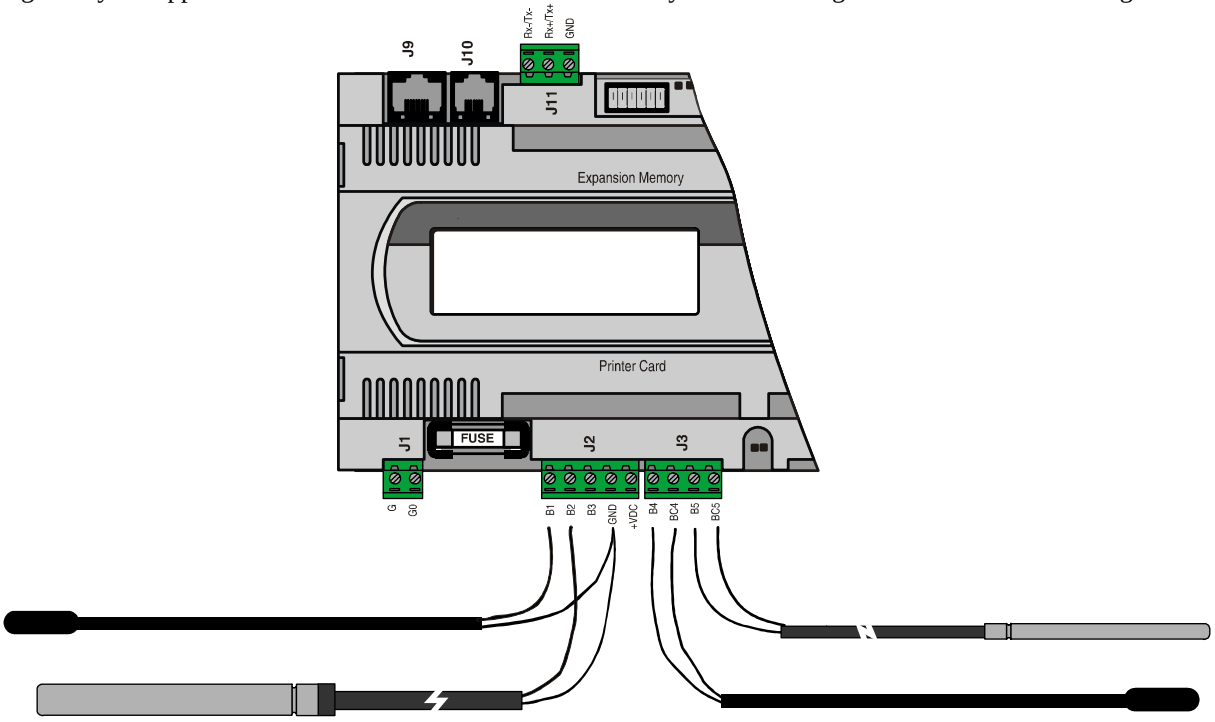


Fig. 4.4.2.1

pCO² terminals	**NTC probe lead**
GND, BC4, BC5, BC9, BC10	1
B1, B2, B3, B4, B5, B6, B9, B10	2

Tab. 4.4.2.1

NOTE: the two NTC probe leads are the same, in that they have no polarity; therefore it is not necessary to respect any specific order when connecting to the terminal block.

4.4.3 Connecting the PT1000 temperature probes

The pCO^2 features connection for PT1000-type 2 lead sensors for all high-temperature applications; the operating range is -100°C ÷ 200°C. The inputs which can accept this type of sensor are B4, B5, B9, B10. The inputs must be pre-configured for PT1000 signals by the application software resident in the flash memory. The following shows the connection diagram:

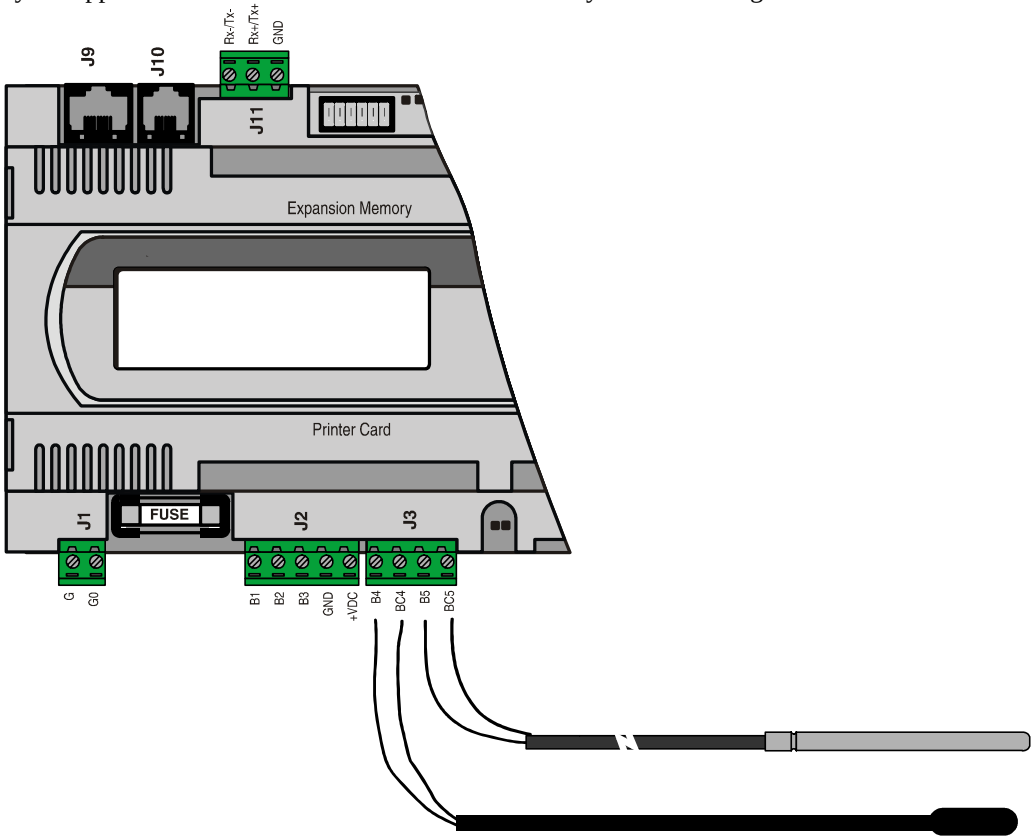


Fig. 4.4.3.1

pCO^2 terminals				PT1000 probe lead
probe 1	**probe 2**	**probe 3**	**probe 4**	
BC4	BC5	BC9	BC10	1
B4	B5	B9	B10	2

Tab. 4.4.3.1

WARNINGS:

- In order to get a correct measurement from the PT1000 probe it is necessary to connect each probe lead to one single terminal as shown in fig. 4.4.3.1;
- The two leads of the PT1000 probes do not have polarity. It is not necessary to respect any polarity order when connecting to the terminal block.

4.4.4 Connecting the pressure probes

The pCO^2 can be connected to all Carel series SPK* active pressure probes or any pressure sensor on the market with an 0÷20mA or 4÷20mA signal. The inputs which can accept these sensors are: B1, B2, B3, B6, B7, B8. The inputs must be pre-configured for 0÷20mA or 4÷20mA signals by the application software resident in the flash memory. The following shows the connection diagram:

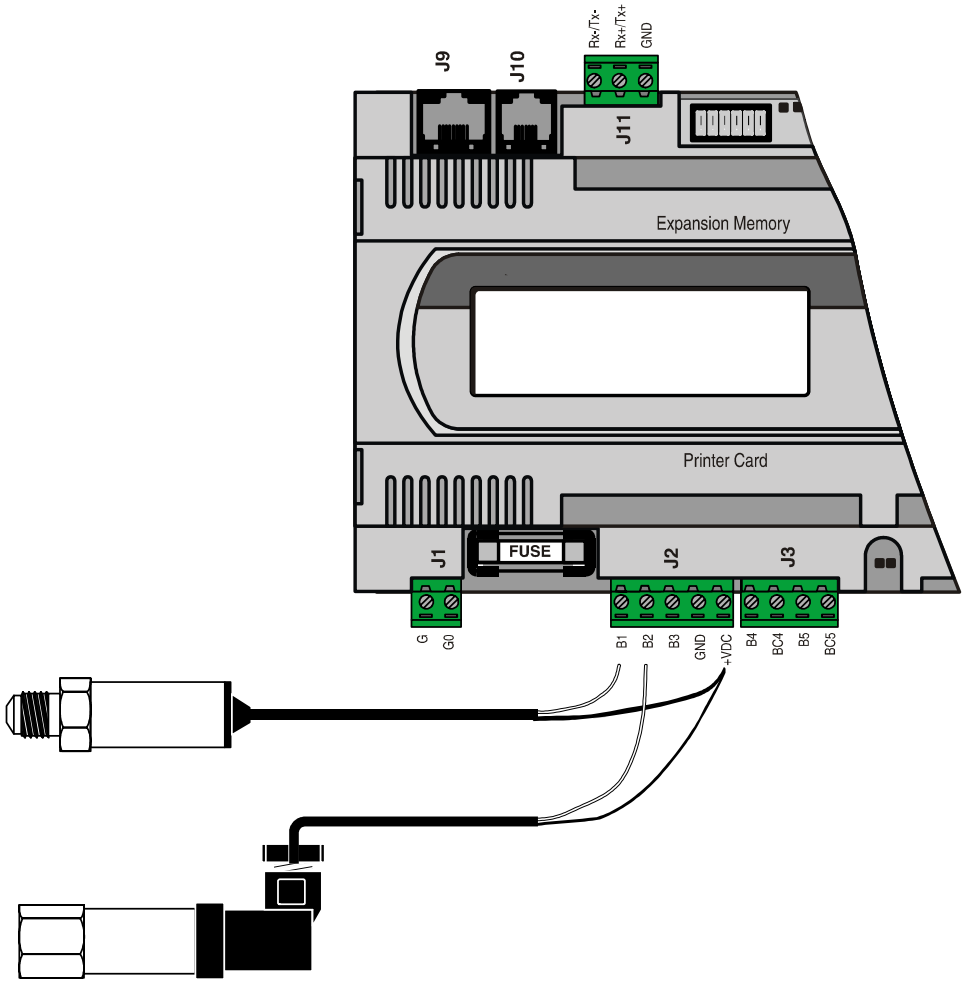


Fig. 4.4.4.1

pCO^2 terminal	probe lead colour	description
+Vdc	brown	power supply
B1, B2, B3, B6, B7, B8	white	signal

Tab. 4.4.4.1

4.4.5 Connecting the ON/OFF selectable analogue inputs

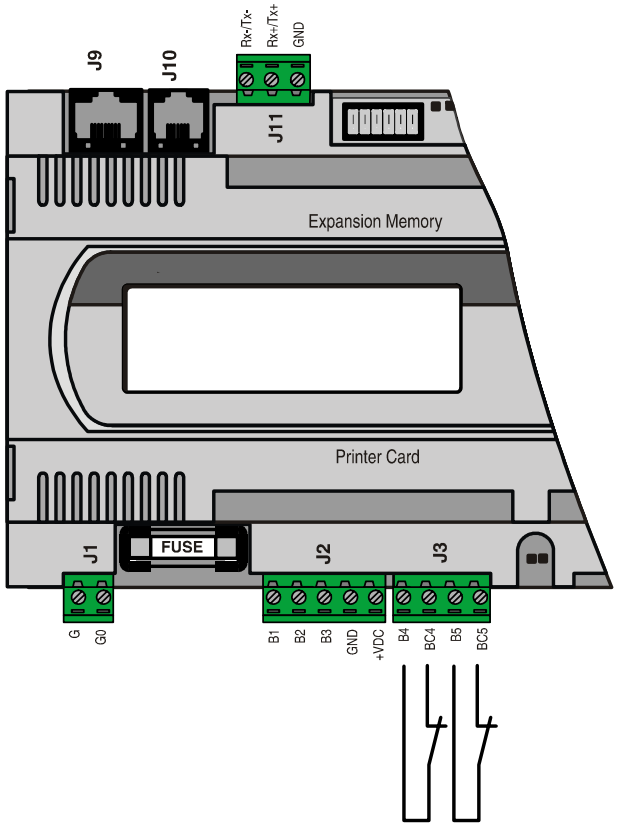


Fig. 4.4.5.1

The pCO^2 allows some analogue inputs to be configured as clean digital inputs. The inputs in question are B4, B5, B9, B10. The inputs must be pre-configured as clean digital inputs by the application software resident in the flash memory. The following shows the connection diagram:

WARNINGS: The maximum current delivered by the digital input is 5mA (thus the rating of the external contact must be at least 5mA). These inputs are not optically-isolated.

4.4.6 Table summarising the analogue inputs according to the available versions

		analogue inputs	
		passive NTC, PT100 and ON/OFF	**universal 0÷1 V, 0÷10 V, 0÷20 mA, 4÷20 mA and NTC**
SMALL		2 (B4, B5)	3 (B1, B2, B3)
	total	5	
MEDIUM		2 (B4, B5)	6 (B1, B2, B3, B6, B7, B8)
	total	8	
LARGE		4 (B4, B5, B9, B10)	6 (B_1, B_2, B_3, B_6, B_7, B_8)
	total	10	

Tab. 4.4.6.1

When remoting the analogue inputs, the cross section of the leads must be as reported in the following table (Tab. 4.4.6.2)

input type	**size (mm^2) for up to 50m long leads**	**size (mm^2) for up to 100m long leads**
NTC	0,5	1,0
PT1000	0,75	1,5
I (current)	0,25	0,5
V (voltage)	0,25	0,5

Tab. 4.4.6.2

4.5 Connecting the digital inputs

The pCO^2 features up to 18 digital inputs for connecting safety devices, alarms, device status, remote triggers. These inputs are all optically-isolated. They can work at 24Vac, 24Vdc and some at 230Vac.

WARNING: separate the probe signal and digital input cables as much as possible from the inductive load and power cables, to avoid possible electromagnetic disturbance.

4.5.1 Digital inputs powered at 24Vac

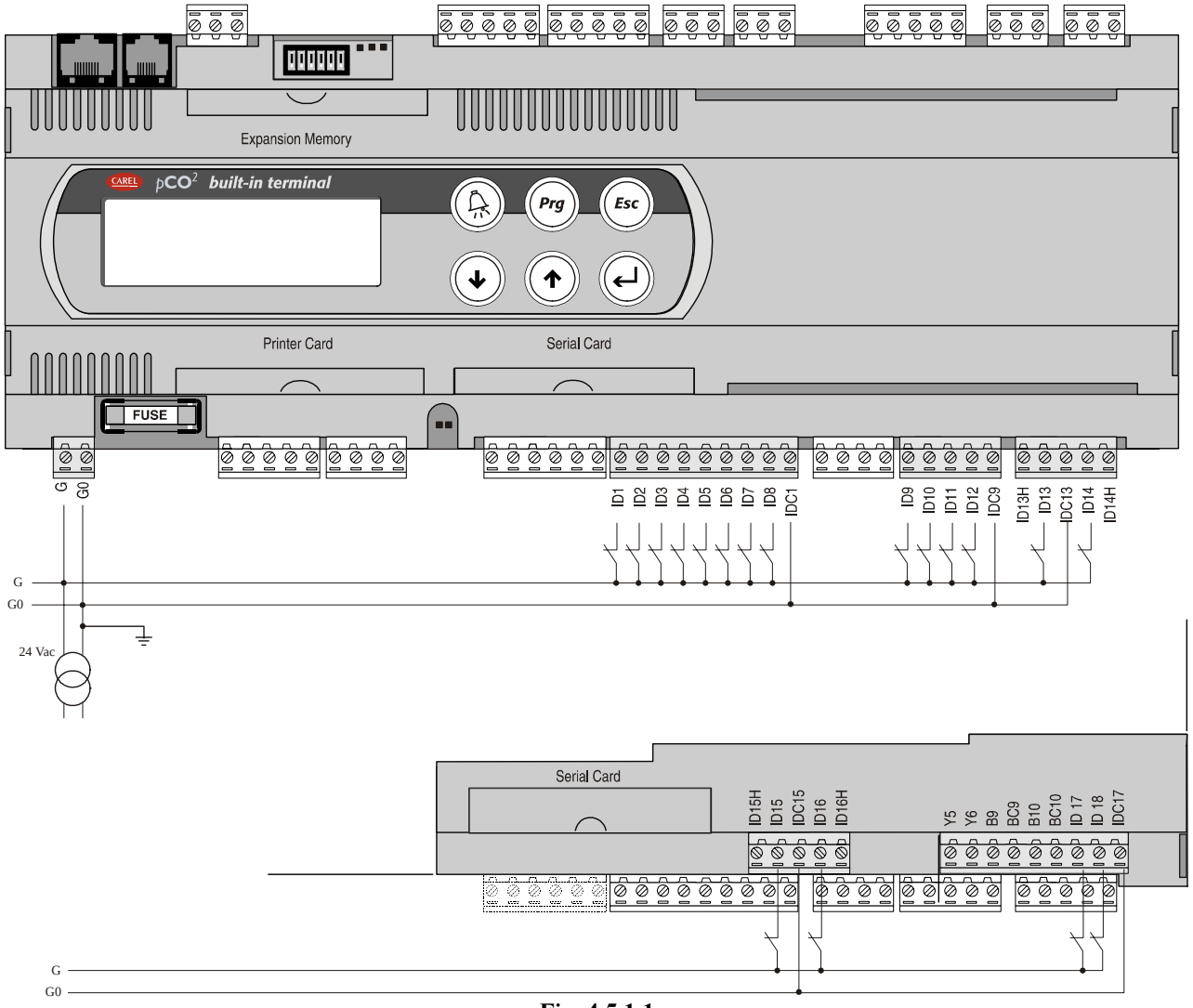


Fig. 4.5.1.1

The following figure represents one of the more common connection diagrams for the 24Vac digital inputs.

4.5.2 Digital inputs powered at 24Vdc

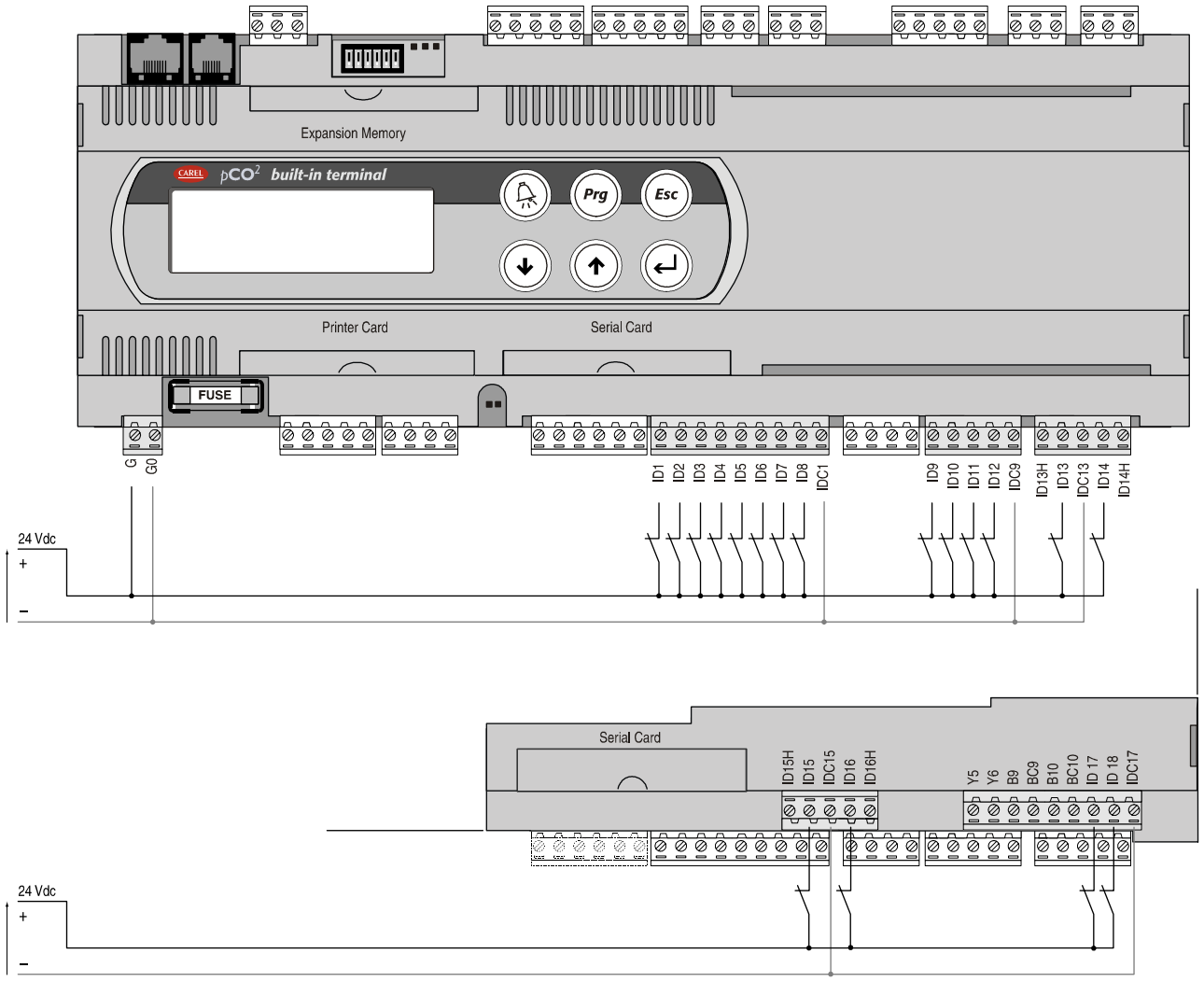


Fig. 4.5.2.1

The following figure represents one of the more common connection diagrams for the 24Vdc digital inputs.

IMPORTANT WARNINGS: to maintain the optical isolation of the digital inputs a separate power supply must be used just for the digital inputs; Figs. 4.5.2.1 and .2 show the versions: MEDIUM (in full) and LARGE (limited to the terminals located more internally, on the board).
The connection diagrams in Figs. 4.5.2.1 and .2, while being the more common and the more convenient, do not exclude the possibility of powering the digital inputs **independently from to the power supply to the pCO²**.

4.5.3 Digital inputs powered at 230Vac

The following figure represents one of the more common connection diagrams for the 230Vac digital inputs. Each group (see **Meaning of I/O inputs**) can have different voltages. Within each the digital inputs are not independent, however: for example, with reference to Fig. 4.5.3.1, the inputs ID15 and ID16, due to the common terminal, must be powered at the same voltage to avoid dangerous short-circuits and/or the powering of lower-voltage circuits at 230Vac.

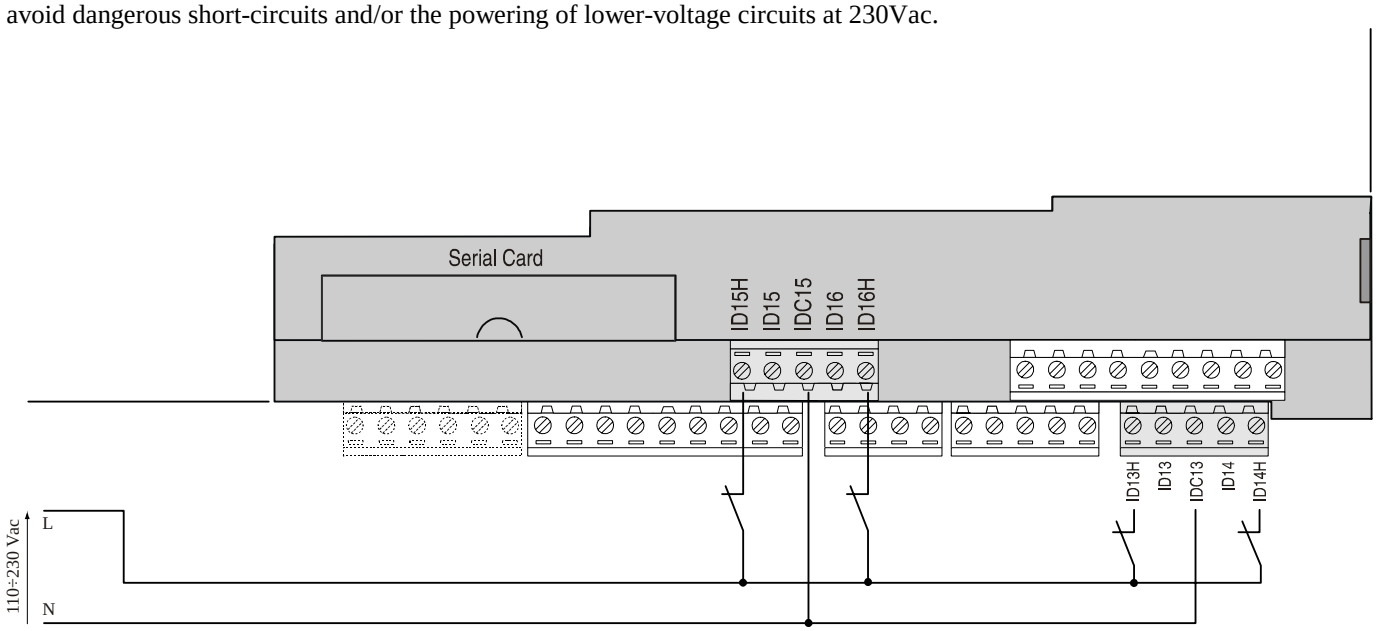


Fig. 4.5.3.1

4.5.4 Table summarising the digital inputs according to the available versions

version	no. opto-isolated inputs at 24Vac 50/60Hz or 24Vdc	no. opto-isolated inputs a 24Vac or 230Vac 50/60Hz	total inputs
SMALL	8	0	8
MEDIUM	12	2	14
LARGE	14	4	18

Tab. 4.5.4.1

IMPORTANT WARNINGS: do not connect other devices to the IDN inputs (for example, relay coils for sending signals to other instruments). In the specific case of the inputs at 230Vac, a dedicated RC filter (typical characteristics: 100Ω, 0.5 µF, 630V) should be placed in parallel to the coil; Fig. 4.2.1.3 shows the part of the pCO^2 involving the terminals described. The MEDIUM and LARGE models are very similar.
If safety devices (alarms) are connected to the digital inputs, **please keep the following in mind**: the presence of voltage at the ends of the contact is a normal operating condition, while the absence of voltage is an alarm condition. In this way any interruption (or disconnection) of the input can be signalled.
When remoting the analogue inputs, the cross section of the leads must be as reported in the following table (Tab. 4.5.4.2)

size (mm^2) for up to 50m long leads	size (mm^2) for up to 100m long leads
0,25	0,5

Tab. 4.5.4.2

4.6 Connecting the analogue outputs

The pCO^2 provides up to six optically-isolated 0÷10V analogue outputs powered externally at 24Vac/Vdc. Fig. 4.6.1 shows the connection wiring diagram; the 0V (zero) voltage of the power supply is also the reference for the voltage of the outputs.

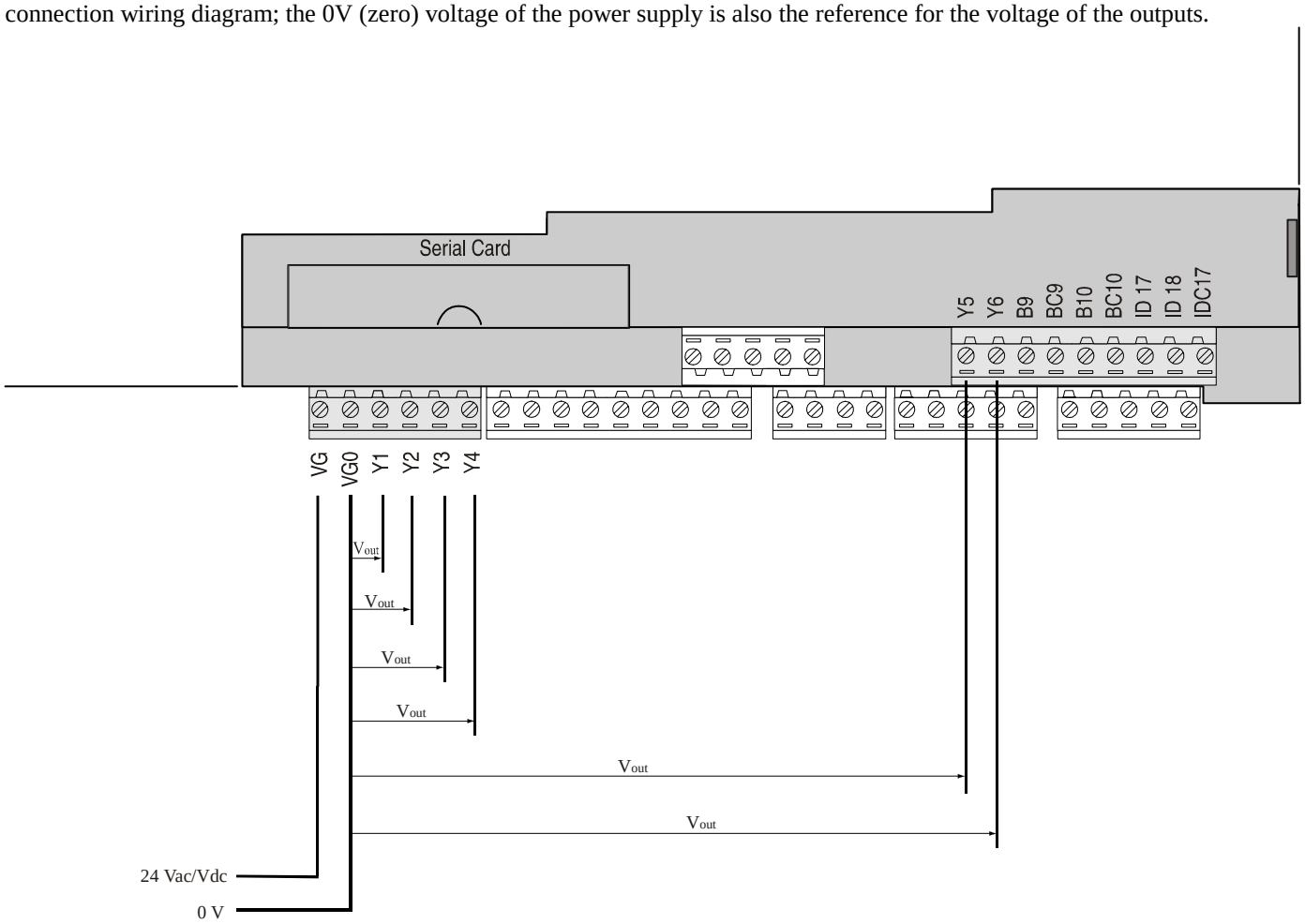


Fig. 4.6.1

Tab. 4.6.1 summarises the distribution of the analogue outputs according to the available versions.

version	no. analogue outputs
SMALL	4
MEDIUM	4
LARGE	6

Tab. 4.6.1

When remoting the analogue inputs, the cross section of the leads must be as reported in the following table (Tab. 4.5.4.2)

size (mm^2) for up to 50m long leads	size (mm^2) for up to 100m long leads
0,25	0,5

Tab. 4.6.2

4.7 Connecting the digital outputs

The pCO² features up to 18 digital outputs with electromechanical relays; upon request with solid state relays (SSR).
To simplify assembly the common terminals of some relays have been grouped together. If the diagram in Fig. 4.7.1 is used, **the current at the common terminals must not exceed the rating (nominal current) of a single terminal**, that is 8A resistive.
The relays are divided into groups, according to the distance of insulation. Inside each group, the relays have just single insulation and thus must have the same voltage (generally 24Vac or 110÷230Vac). Between the groups there is double insulation and thus the groups can have different voltages.

4.7.1 Electromechanical relay digital outputs

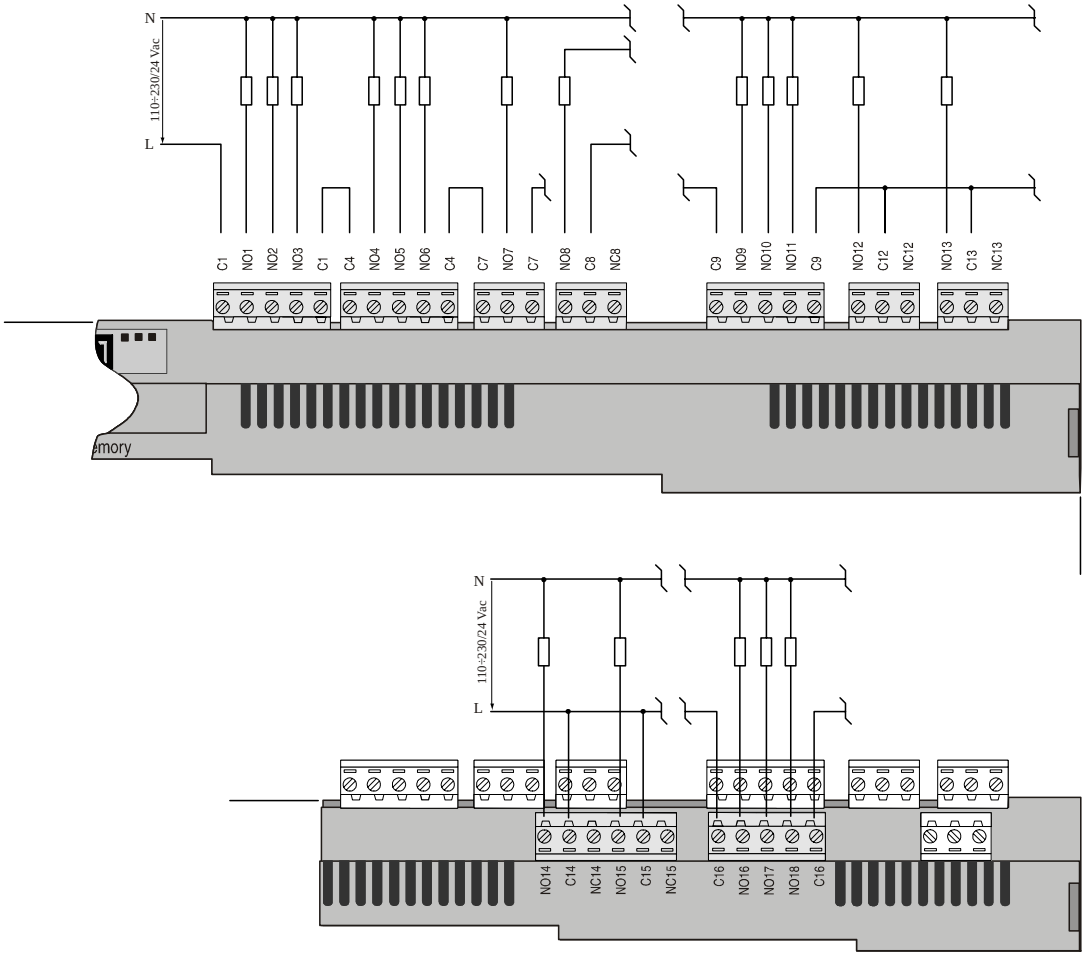


Fig. 4.7.1.1

4.7.2 Solid state relay digital outputs (SSR)

The pCO² also features a version with solid state relays (SSR) for piloting devices which require an unlimited number of switchings which would not be supported by electromechanical relays. They are dedicated to loads powered at 24Vac/Vdc with a maximum power P_{max} = 10W. Please see codes in **Accessories and instruments codes**.

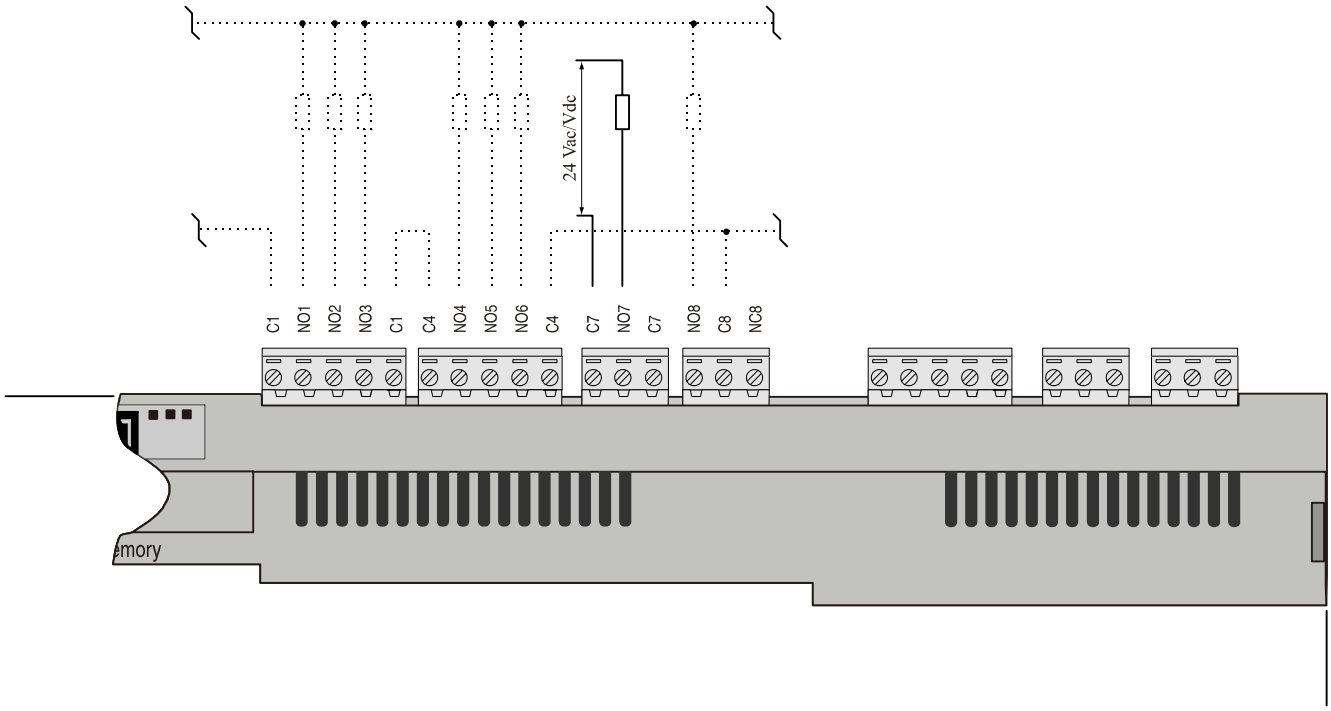


Fig. 4.7.2.1

IMPORTANT WARNING: the load of the SSR relay is powered at 24Vac/Vdc, thus all the other terminals in the group, from 1 to 6, must be powered at 24Vac/Vdc due to the absence of double insulation within the group. Therefore, terminals from 1 to 6 can be powered at 110÷230Vac using a safety transformer (Class II) for the power supply to the 24Vac/Vdc load of the SSR relay (separation of power supply).

version	availability of SSR outputs	standard output reference	requested output references
SMALL	up to one output	7	---
MEDIUM	up to one output (upon request, two outputs)	7	12
LARGE	up to one output (upon request, two or three outputs)	7	12 and/or 14

Tab. 4.7.2.1

4.7.3 Table summarising the digital outputs according to the available versions

version	NO contacts	changeover contacts	total outputs	output reference with SSR, standard	output references with SSR, not available yet
SMALL	7	1	8	7	---
MEDIUM	10	3	13	7	12
LARGE	13	5	18	7	12 and/or 14

Tab. 4.7.3.1

IMPORTANT WARNING: the groups which feature **double insulation** between them are:

outputs*	group
1, 2, 3, 4, 5, 6, 7	1
8	2
9, 10, 11, 12, 13	3
14, 15	4
16, 17, 18	5

Tab. 4.7.3.2

* the main insulation is guaranteed between the output of one group.

4.8 Installing the user terminal

The connection between the user terminal and pCO^2 is made using a 6-way telephone cable supplied by Carel.
To make the connection simply insert the telephone connector in terminal J10 of the pCO^2 and in terminal B on the user terminal. Insert the connector fully into in the terminal until it clicks into place.
To remove the connector simply press lightly on the plastic flap and remove the cable.
The pCO^2 can also work without the terminal; **do not disconnect and then reconnect the terminal to the pCO^2 without first having waited around 5 seconds** (if the operation is performed with the machine on).
When standard terminals – connected by J10 - of domestic or similar use devices, thus subjected to CEI EN 55014-1 - 04/98 direction, **are remoted**, they must have shielded cable. The shield must be connected to the GND terminal of J11.
Inserire figura appropriata.

4.8.1 Installing the wall/panel-mounting terminals (pCOT) and relative electrical connections

This type of terminal has been designed for panel mounting and wall-mounting. The drilling template, in the case of panel mounting, must measure 167x108 mm.
When installing pay attention to the following instructions;

1. unscrew the two screws on the rear cover of the terminal, and remove the cover;
2. rest the front cover against the front part of the panel;
3. insert the cover from the rear, lining up the two holes with the two studs positioned on the front cover;
4. tighten the screws.

The maximum thickness of the panel is 6 mm. Then perform the electrical connections. The wall-mounting features the use of the special mounting brackets and standard 3-module wall-mounting switch box to allow the passage of the cables. Fasten the bracket to the wall, using the screws; finally, make the electrical connections and click the rear the of instrument onto the bracket.

The electrical connections are the following. Connect the telephone cable (code S90CONN00*) from the power board (code PCOB* and PCO2*) into the relative jack. The model with graphic display (code PCOT00OGH0) is fitted with a further screw terminal block.

4.8.2 Installing the panel-mounted terminals(pCOI) and relative electrical connections

These terminals have been designed for panel mounting; the drilling template must measure 173x154 mm. When installing refer to the following instructions;

1. remove the click-on frame;
2. insert the plastic part containing the display and electronic boards on the drilled front part of the panel making sure the gasket on the lower edge of the front cover rests properly against the front part of the panel;
3. make four 2.5mm diameter holes in the panel, in line with the holes in the instrument;
4. insert the fastening screws supplied, choosing between self-tapping and self-threading screws according to the type of material used for the panel (plastic or metal).

Then perform the electrical connections.

The electrical connections are the following. Connect the telephone cable (code S90CONN00*) from the power board (code PCO2*) into the relative jack. For the model PCOI00PGL0 only connect the 24Vac (30VA) power supply to the screw terminal block. **If the same transformer is used for the pCO^2, G and G0 must be the same for the pCO^2 and the terminal**.

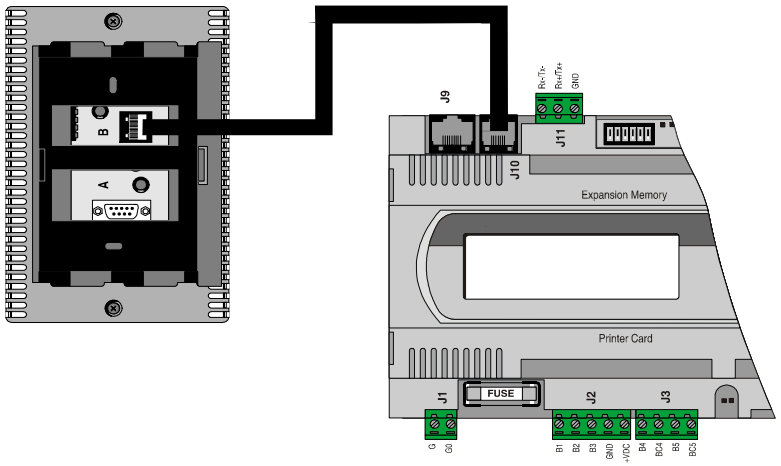


Fig. 4.8.2.1

4.9 Installing the program EPROM in the terminal with graphic display

Before inserting/removing the EPROM disconnect the power supply to the terminal with graphic display.
For correct system operation, the EPROM has to be inserted in the special socket on the board, making sure that **the notch on the surface of the EPROM matches the reference notch silk-screened on the board**. The program can be saved to two different types of EPROM, according to the its memory requirements. The more commonly used in the case of the terminal with graphic display is outlined in Tab. 4.9.1.

type of EPROM	capacity	size
27C1001	128 kByte	32 pin

Tab. 4.9.1

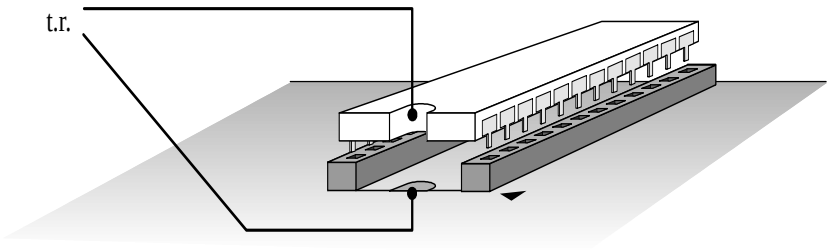


Fig. 4.9.1

All the information relating to the management of the graphic display (fonts, graphs and various symbols displayed) are created by the application software contained in an EPROM. To install the EPROM remove the board shield (see Fig. 4.9.1) or the optional serial printer board (if present), removing the relative screws; then mount the EPROM, making sure that the reference notch matches the notch silk-screened on the EPROM. (ref. **t.r.** Fig. 4.9.1).

Be extremely careful when handling this component, keeping the following in mind:

1. remove the board which acts as a shield or if necessary the optional printer board (when installing the EPROM, be careful **not to touch the SMD components** on the board in the space inside the socket);
2. if already present, to remove the EPROM from the socket, use a small screwdriver **being careful not to damage the tracks on the printed circuit or any other associated component**;
3. **before touching the EPROM**, touch a grounded part to discharge the necessary static electricity accumulated (**do not touch any powered devices**);
4. insert the EPROM in the relative socket on the board, checking that all the pins are inserted correctly in place (exact correspondence between the pins and the slots; furthermore, do not bend the pins, carefully inserting them into the socket, holding the component by opposite end to the pins);
5. Once the EPROM has been inserted remount the board which acts a shield or if necessary the optional printer board, before closing the cover, and place the terminal in operation.

IMPORTANT WARNING: the **EPROM must be inserted/removed from the socket only when the terminal is off.**

5. pLAN NETWORK

As already mentioned, the pCO^2 controls can be connected to pLAN local network, allowing the communication of data and information from one location (node) to another.
Each pCO^2 can be connected to a CAREL supervisory network, using the optional PCO2004850 cards.
The pCO^2 terminals can monitor the control variables (temperature, humidity, pressure, I/O, alarms) from one or more boards. If one or more terminals are disconnected or malfunctioning, the control program continues to function correctly on each pCO^2 main board.
Generally, the application program can monitor the status of the network and intervene as a consequence to ensure the continuity of the control functions.
The figure below, 5.1, shows the network connection diagram: **a maximum of 32 units can be connected** (including I/O interface cards and user interface cards). The 32nd unit can only be a terminal.

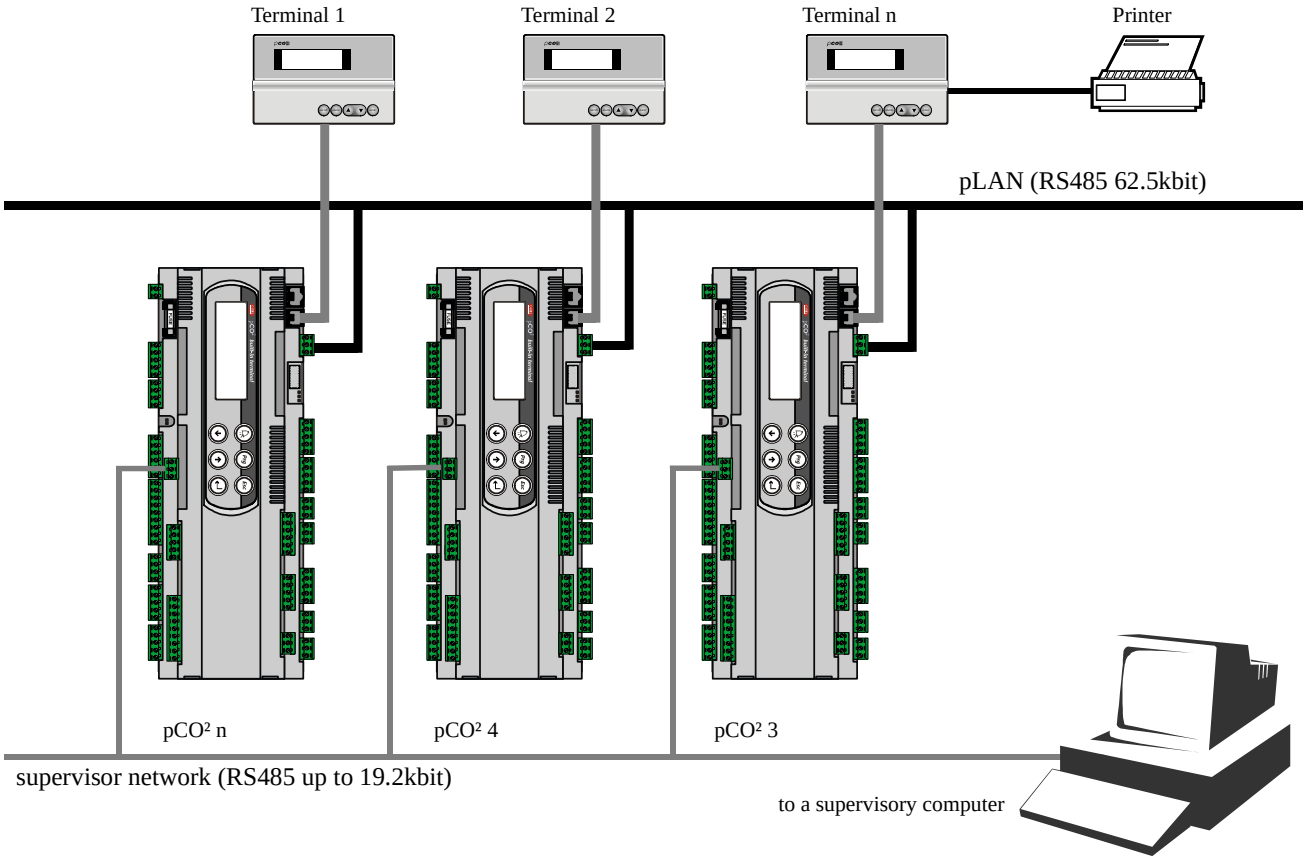


Fig. 5.1

All the versions of the pCO^2 can be connected in a local pLAN network without requiring additional boards.
The programs written for the different applications (e.g.: standard chiller, standard air-conditioners, compressor packs, ...) can not be automatically integrated into a local network: they must be modified to consider the network strategy and structure, and then be recompiled with the Easy-Tools system.
All the devices connected to the pLAN network are identified using their own individual address**. If the same address is assigned to more than one unit the network will not work**. As the terminals and the pCO^2 I/O boards use the same type of address, terminals and pCO^2 boards can not have the same identifier. The values which can be selected for the address range from 1 to 32 for the terminals and from 1 to 31 for the I/O boards.
The addresses are set for the terminals using the dip-switches on the rear, and on the pCO^2 boards using the dip-switches located near the telephone connector.
The network can be composed of each type of terminals LED, LCD 4x20 and graphic, as well as pCO and pCO^2 controls.

5.1 Addressing the pCO²

The address can be set in the range 1÷31 using the dip-switches 1÷5. The value of the address is obtained as in Tab. 6.1.1.

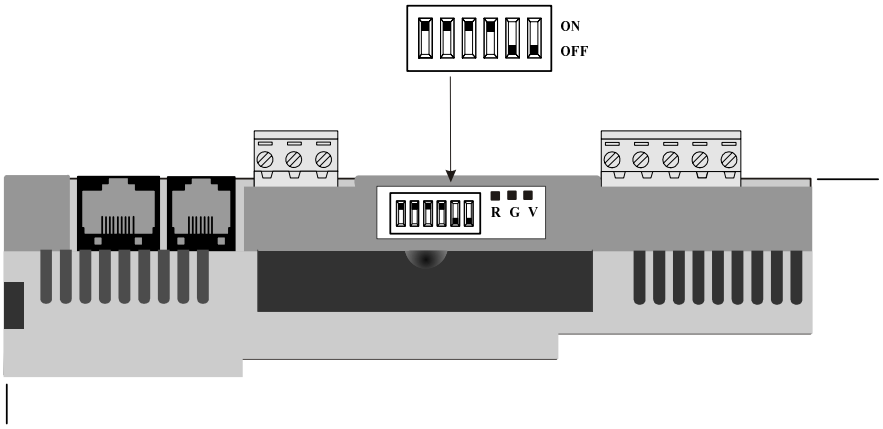


Fig. 5.1.1

weights	1	2	4	8	16	
addr.	**sw1**	**sw2**	**sw3**	**sw4**	**sw5**	**sw6***
0	without pLAN network connection					
1	ON	OFF	OFF	OFF	OFF	-
2	OFF	ON	OFF	OFF	OFF	-
3	ON	ON	OFF	OFF	OFF	-
4	OFF	OFF	ON	OFF	OFF	-
....	....	....	....	....	....	….
....	....	....	....	....	....	….
31	ON	ON	ON	ON	ON	-

status	
ON	1
OFF	0

Tab. 5.1.1

Formula:
address=w(SW1)+w(SW2)+w(SW3)+w(SW4)+ w(SW5);

application example – fit for address 19:
19=1+2+16= p(SW1)+p(SW2)+p(SW5).

*__NOTE__: dip-switch no. 6 on the pCO² is not connected and thus its position has no effect.

5.2 Addressing the terminals

The address of the terminals is set using the dip-switches at the rear.
The address can be set in the range 1÷32 using dip-switches 1÷6. The value of the address is calculated using the tables in the previous paragraph.
The graphic terminal does not need to be addressed as the address is established by the program EPROM.
Fig. 5.2.1 shows the rear view of the terminal board.

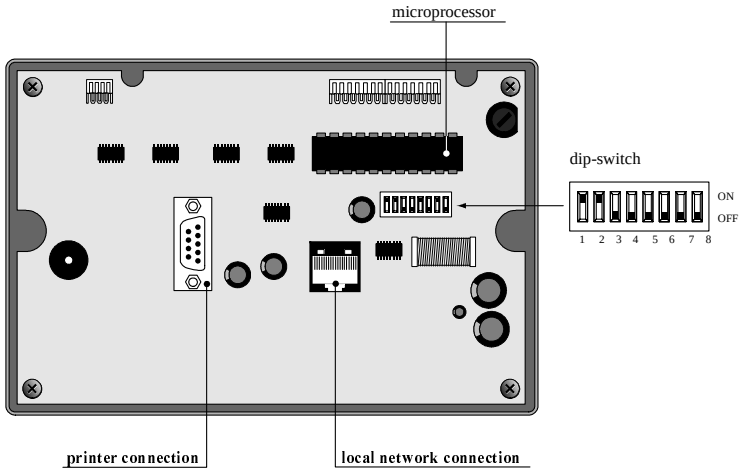


Fig. 5.2.1

IMPORTANT WARNING: if the application software is not featured in the local pLAN network, the dip-switches must be set to 0, otherwise the program will not work.

5.3 Private / shared terminals

Each pCO^2 board, connected to the network, can manage more than one terminal (max 3). **The display of the values on each these occurs simultaneously and not independently from one another;** it is like having a series of keypads and dispalys connected in parallel.
Each terminal associated to a specific board can be **private or shared.** A **terminal** is considered **private** if it alone displays the output of just one I/O board. A **terminal** is considered **shared** if, either automatically or via keypad, it can be switched between a number of control boards.

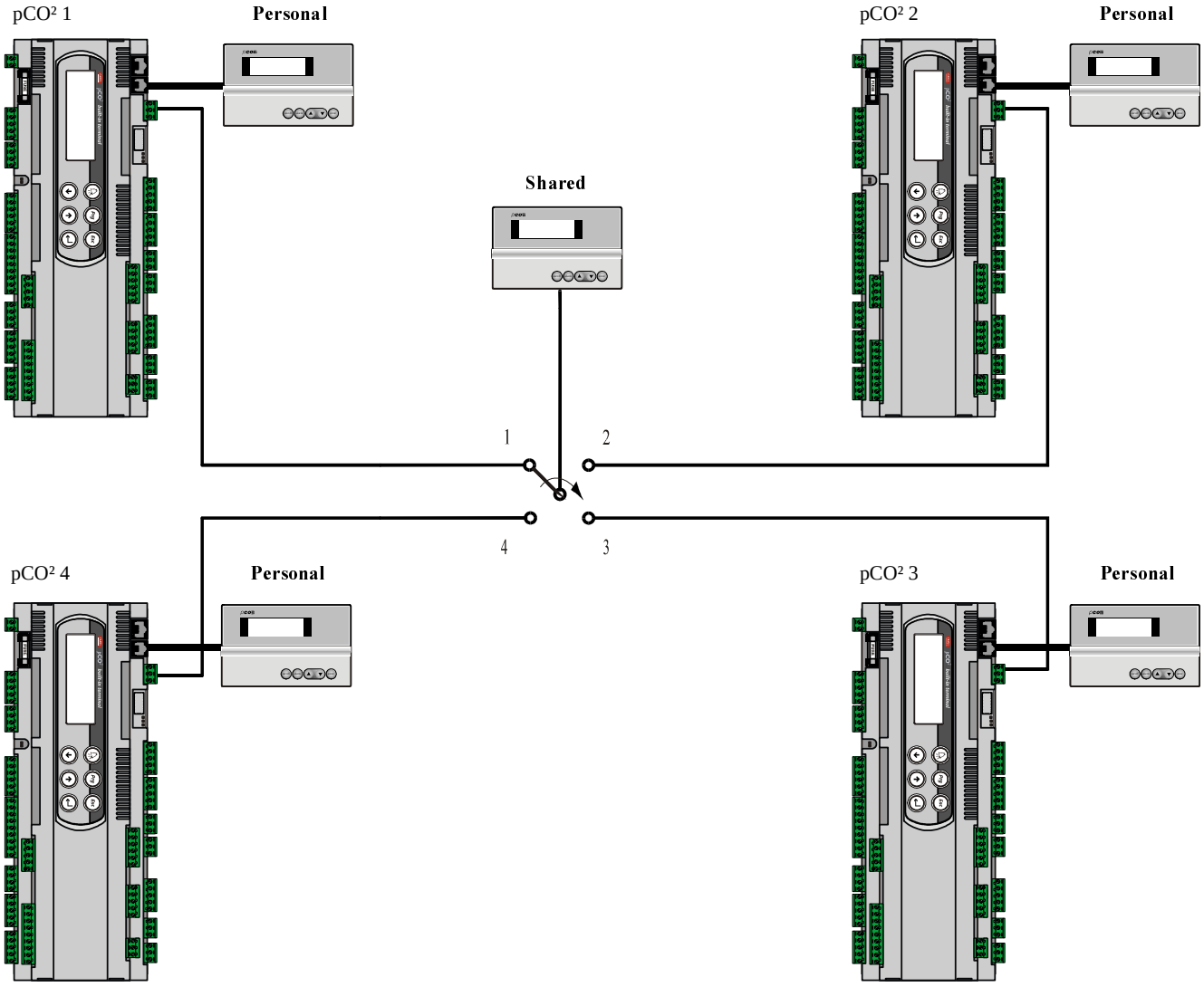


Fig. 5.3.1

Each pCO^2 constantly updates the display of its private terminals, on the other hand, are only updated if the pCO^2 in question is currently controlling it. This is described in the following **logical diagram,** Fig. 5.3.1.

In this example the shared terminal is associated to 4 I/O boards, yet at this moment only no. 1 can display data and receive commands from it. Switching of the boards occurs, in cyclical order (**1→2→3→4→1**....), by pressing a button set by the application program.
Switching can occur automatically on request, guided by the program. For example, an I/O board may request control of the shared terminal to display alarms or , alternatively, relinquish control to the next board after a set interval (cyclical rotation).
The number and type of terminals is established during the initial configuration of the network. The relative data is stored in the permanent memory of each I/O board.

5.4 pLAN electrical connections

Connection between boards in a pLAN network is carried out using an AWG20/22 shielded cable, made up of a twisted pair plus shield. The boards are connected in parallel, with terminal J11 as the reference.

Pay ATTENTION to the network polarity: RX/TX+ on one board must be connected to RX/TX+ on the other boards; the same is true for RX/TX-.

Fig. 5.4.1 shows a diagram of a number of boards connected in a pLAN network and powered by the same transformer (typical application: a number of boards connected inside the same electrical panel).

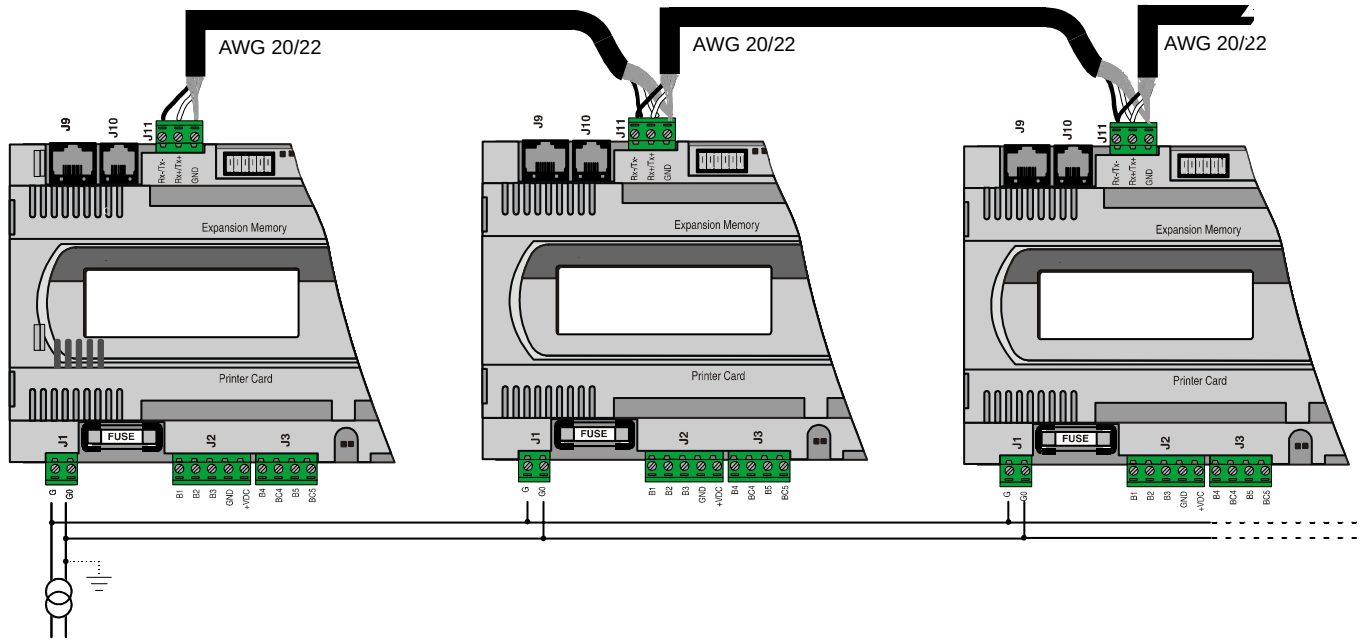


Fig. 5.4.1

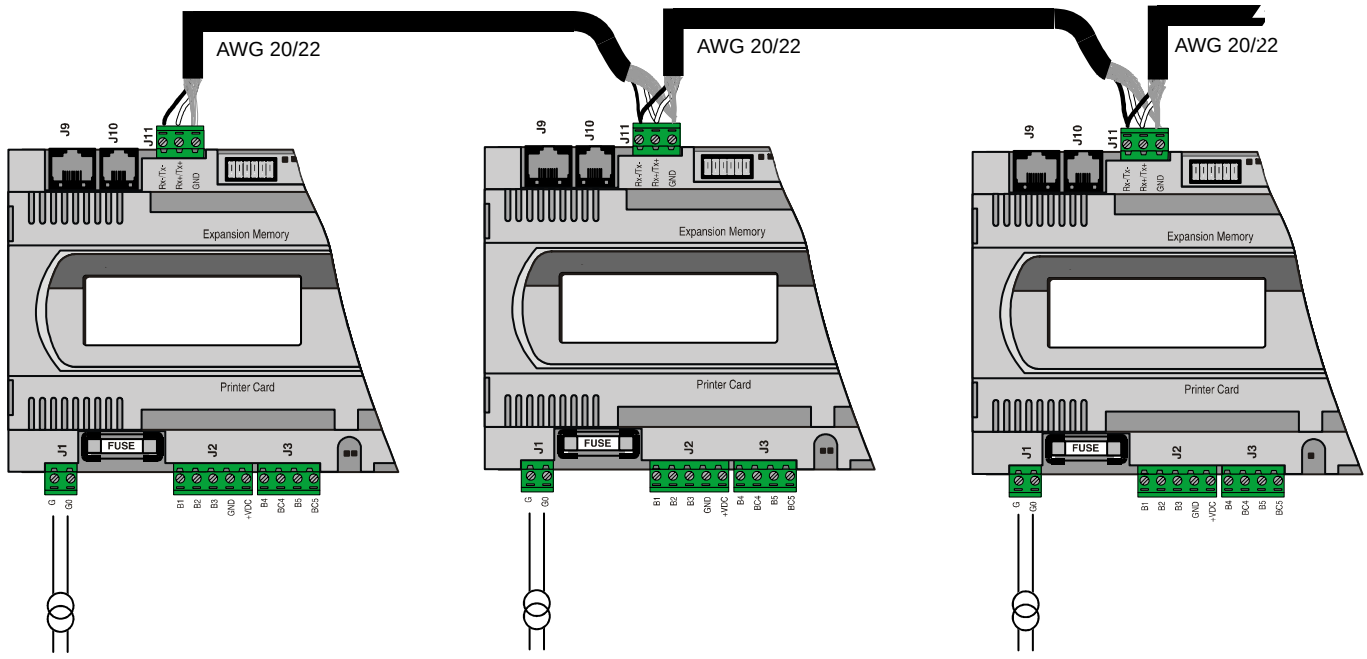


Fig. 5.4.2

Fig. 5.4.2 shows a diagram of a number of boards connected in a pLAN network and powered by different transformers (with G0 not earthed). Typical application: a number of boards inside different electrical panels

Fig. 5.4.2 shows a diagram of a number of boards connected in a pLAN network and powered by different transformers with the same earth reference. Typical application: a number of boards inside different electrical panels.

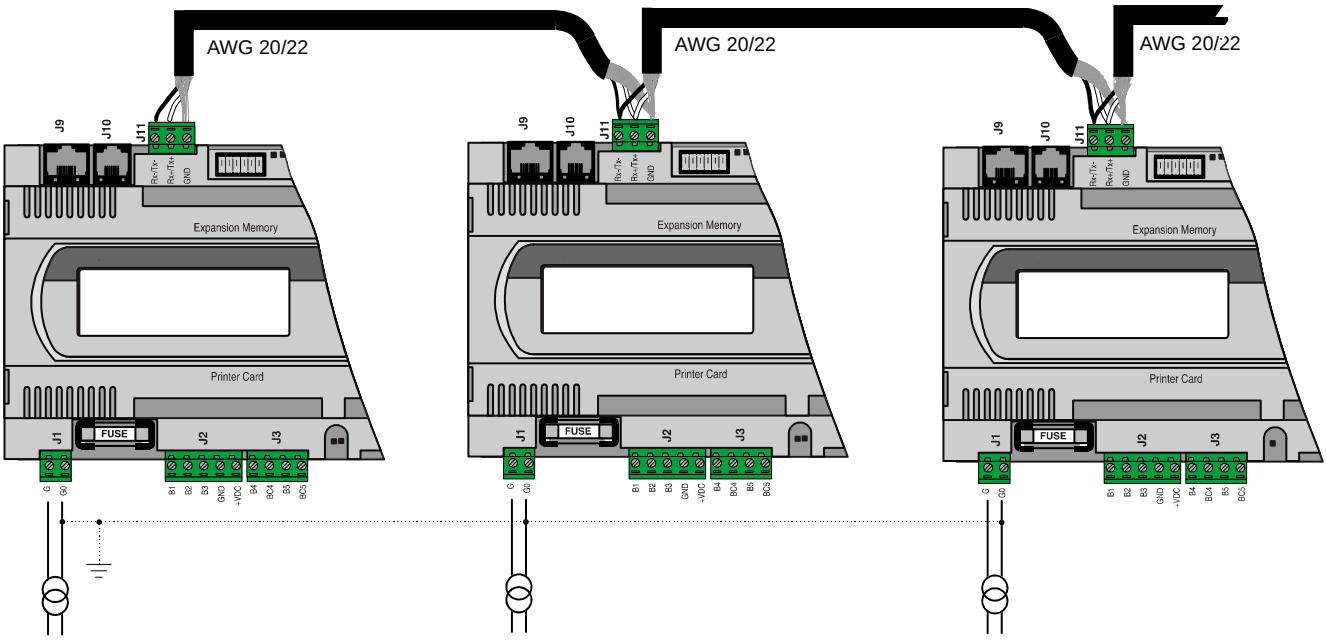


Fig. 5.4.3

IMPORTANT WARNINGS:

- **the ground connection must be made to the same ground (same ground pole, for all the pCO^2 boards);**
- **with these configurations (Figs. 6.4.1 .2 .3) Class II safety transformers must be installed.**

5.5 Remote installation of the terminal in a pLAN network

When pCO^2 boards are connected in a pLAN network the terminal can be remotely-located ad a distance of up to 50 metres if using a telephone-type cable; if using a shielded cable, it can be located at a distance of up to 200 metres. The following figures show the connection diagrams for the various configurations.

5.5.1 Remote terminal with pLAN network and telephone-type cable

Remote-installation requires the insertion of two ferrites - code 0907858AXX at the markings with the letter F in Fig. 5.5.1. Figs. 5.5.2 a and 5.5.2 b show respectively the ferrites to be installed the open and closed position. The ferrites are mounted on the telephone connecting cable, on the pCO² side (see Fig. 5.5.2 c) and the other terminal side (see Fig. 5.5.2 d).
WARNING: the telephone cable must leave the pCO² perpendicularly.

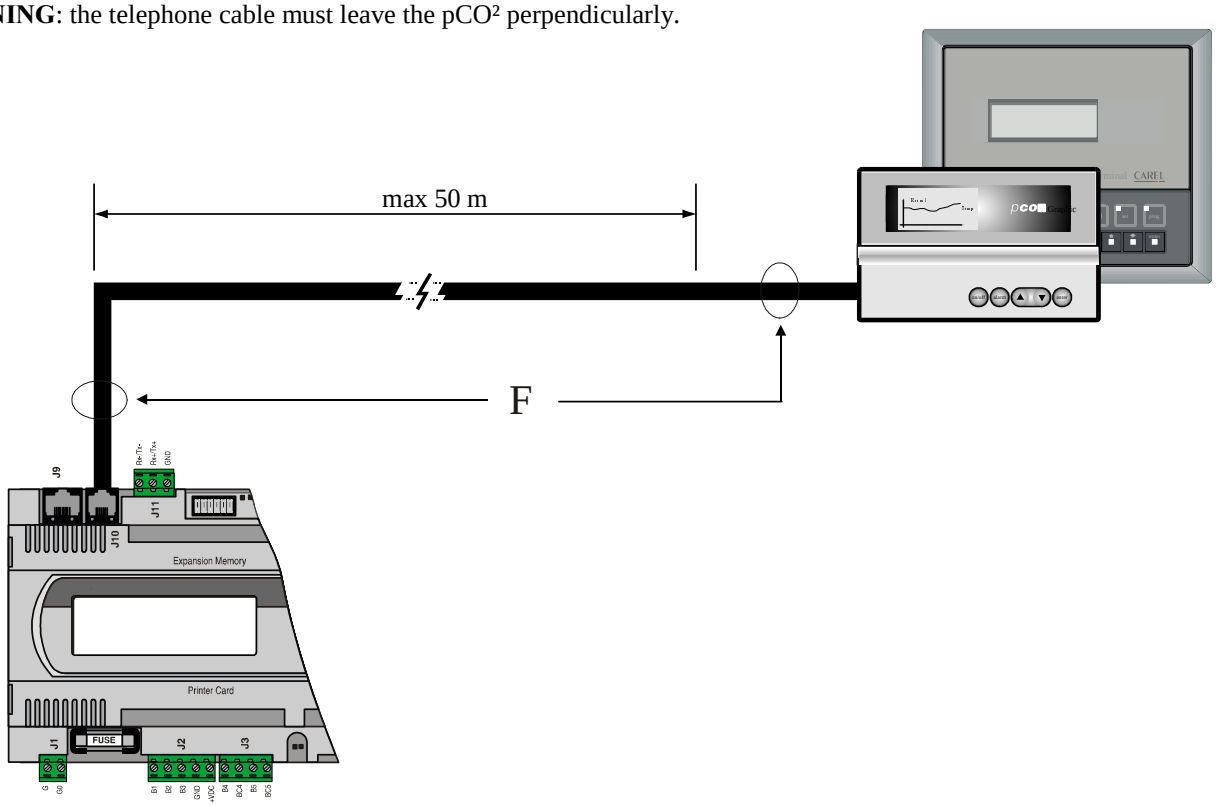


Fig. 5.5.1

Fig. 5.5.2 a

Fig. 5.5.2 b

Fig. 5.5.2 c

Fig. 5.5.2 d

5.5.2 Remote terminal installation on pLAN network using AWG24 shielded cable with 3 twisted pairs + shield.

This type of remote-installation is shown in Fig. 5.5.2.1

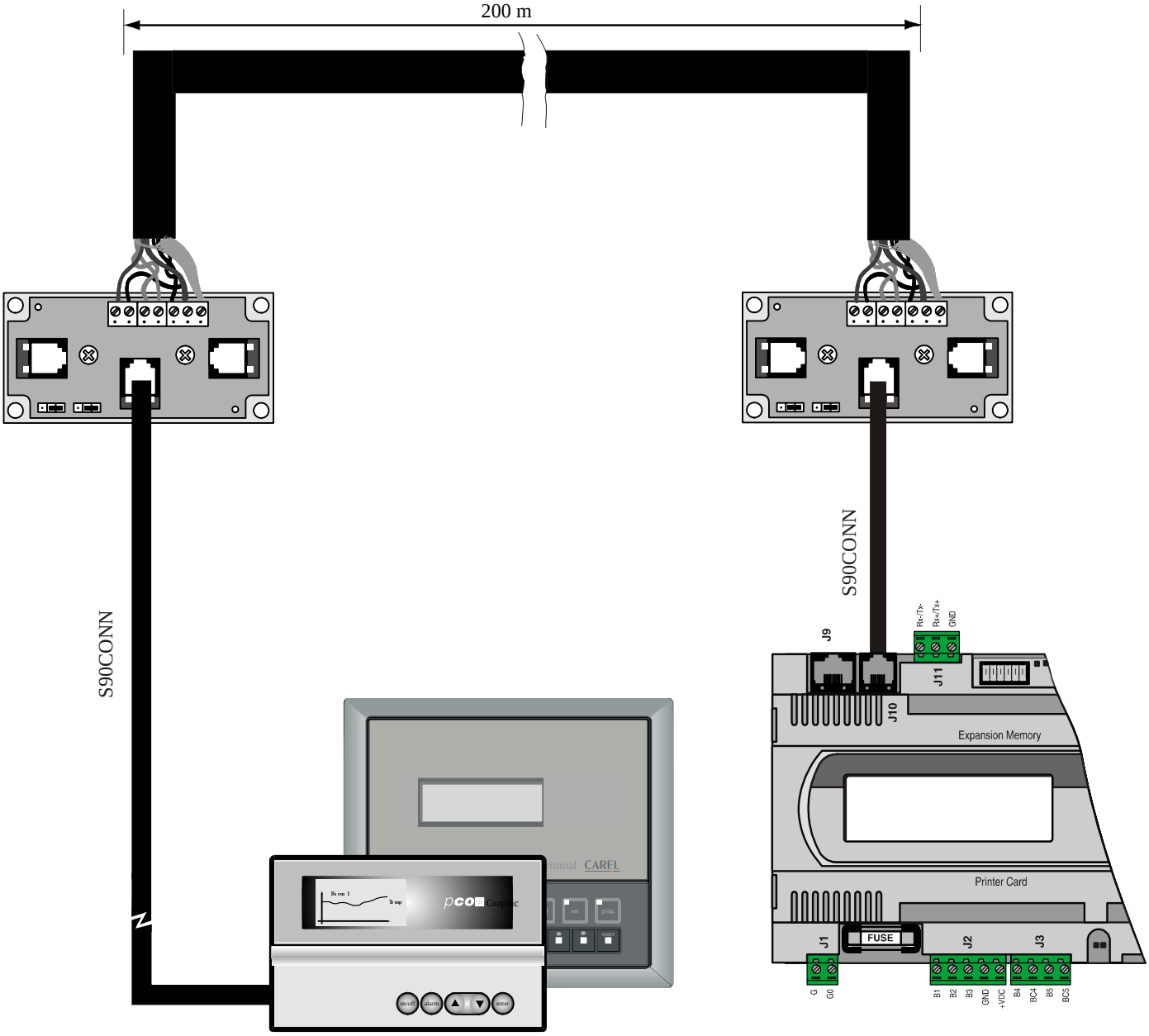


Fig. 5.5.2.1

Fig. 5.5.2.2 shows the TCONN6J000 connector, used in a pair for the remote-installation of the pCO² in a pLAN network using an AWG24 shielded cable.

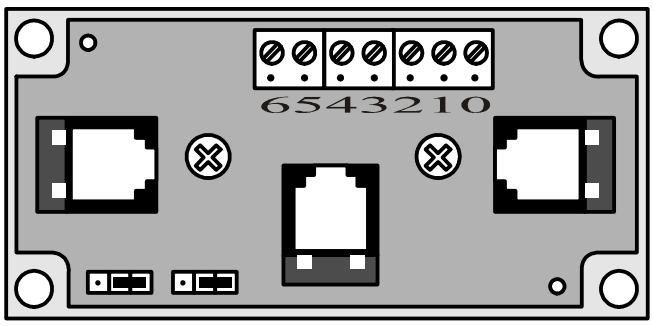


Fig.5.5.2.2

AWG24 cable (with power supply)		
terminal	**function**	**cable connections**
0	ground	shield
1	+VRL (≈30Vdc)	first pair A
2	GND	second pair A
3	Rx/Tx-	third pair A
4	Rx/Tx+	third pair B
5	GND	second pair B
6	+VRL (≈30Vdc)	first pair B

Tab. 5.5.2.1

5.5.3 Remote installation of the terminal in a pLAN network with AWG20/22 shielded cables.

This remote installation is shown in Fig. 5.5.3.1. Power supply is independent from the shared terminal.

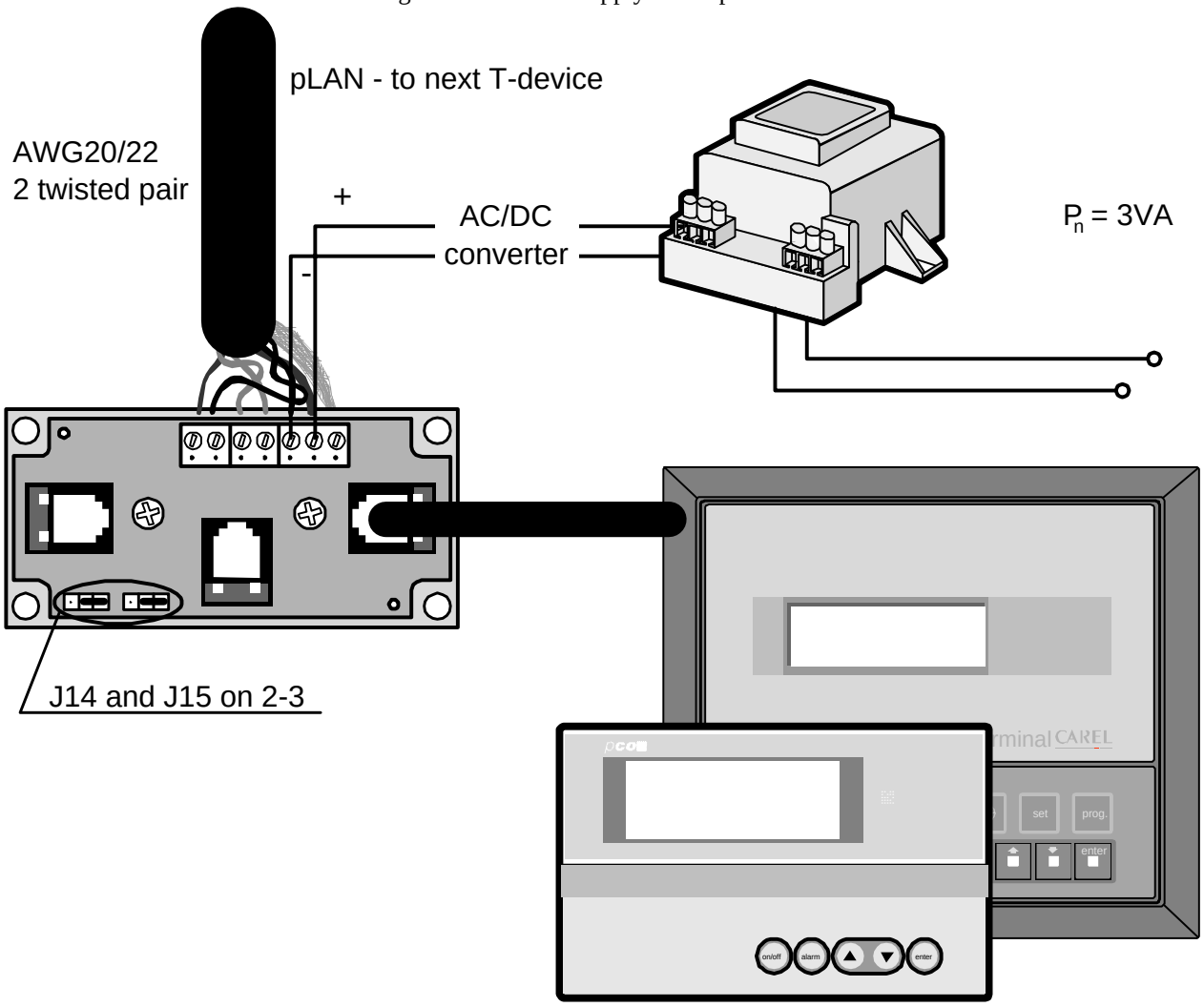


Fig. 5.5.3.1

5.6 pLAN network technical specifications

The technical specifications of the pLAN network are summarised in the following table.

description	characteristics
Communication standard	RS485
baud-rate (kbit/s)	65,2
Protocol	Multimaster (Carel proprietary control)
Maximum length of the network:	500 metres

Tab.5.6.1

6. OPTIONAL BOARDS

6.1 Programming key

The programming key, which represents one of the more interesting new features of the pCO^2, can transfer (upload and download) the application software.

Upload the program

The application software can be uploaded from the key to the pCO^2; in this way the same program can be transferred quickly to a series of pCO^2 boards.

Download the program

The application software can be downloaded from the pCO² to the programming key; in this way a copy can be made of the application software data and parameters from a particular pCO^2 board.

To choose one of the 2 functions simply move the switch on the key to the position corresponding to the type of transfer, as listed in Tab. 6.1.1.

switch position	type of program transfer
1	Upload (pCO² programming by key)
2	Download (copy on pCO² by key)

Tab. 6.1.1

To upload the program, run carefully through the following procedure:
1. disconnect power to the pCO² board;
2. place the switch on the key into position 1;
3. remove the “expansion memory” hatch (if possible use the screwdriver as shown in Figure x.x);
4. insert the key into the relative “expansion memory” connector;
5. press and hold the “up” and “down” buttons together;
6. connect power to the pCO² board;
7. confirm the operation with the “enter” button;
8. wait until the display on the user terminal shows: xxxxxxxx;
9. disconnect power to the pCO² board;
10. remove the key;
11. replace the hatch in the initial position;
12. at this point the program has been loaded from the key to the pCO² board.

To download the program follow the same steps described above, selecting position 2 on the key switch.

IMPORTANT WARNINGS: all operations involving the key and the relative exchange button must be performed with the machine off. Pay attention to the electrical contacts when handling the key, to avoid dangerous flexing of the terminal strip.

6.2 Memory expansion

If the flash memory is not sufficient for the application software or data logs, the pCO² allows the memory to be expanded with the addition of an expansion board.

For details on the technical specifications and the installation of the expansion board, refer to the instructions provided on the instruction sheet enclosed with the board itself.

6.3 RS485 serial board for supervisor and telemaintenance

The PCO2004850 board is an option for the pCO² electronic control which allows the latter to interface with an RS485 network. It guarantees the optical-isolation of the control from to the RS485 serial network. The maximum baud rate is 19200 baud (set via software).

For details on the technical specifications and the meaning of the pins, as well as the installation of the board, refer to the instructions provided on the instruction sheet enclosed with the board itself.

6.4 RS232 : modem interface card

The modem interface card PCO200MDM0 is an optional card which allows the pCO² to be interfaced with a HAYES standard modem. The hardware signals managed are:

- in output, "request to send" (RTS) in parallel to "data terminal ready" (DTR);
- in input, "carrier detect" (CD).

For details on the technical specifications and the meaning of the pins, as well as the installation of the board, refer to the instructions provided on the instruction sheet enclosed with the board itself.

6.5 Serial printer for LCD 4x20 or 6 LED display

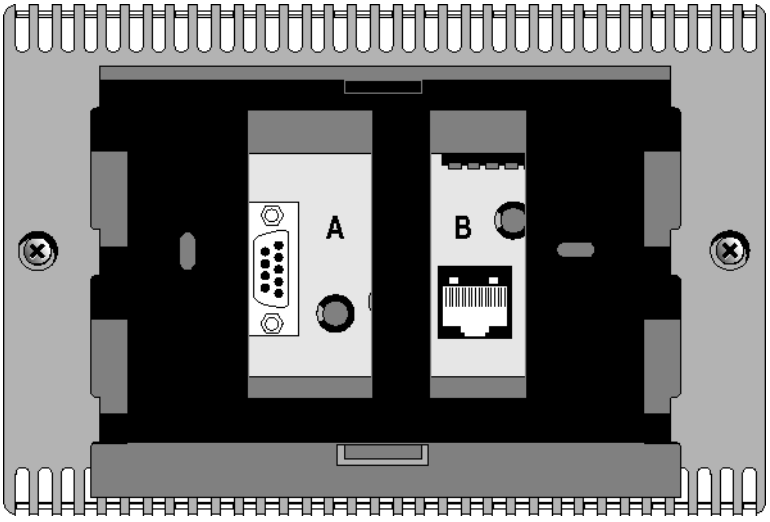


Fig. 6.5.1

A serial printer can only be used with the following pCO terminals:

- PCOT00SCB0 terminal with LCD 4x20
- PCOT00SL60 terminal with 6-digit LED display

These terminals are already fitted with a 9-pin male connector (connector **A**) for connecting the printer using a **serial printer cable,** 9-pin (pCO^2 end) - 25 pin (printer end).

Characteristics and settings of the serial printer port

Printer with RS232 serial interface

- baud-rate: 1200
- parity: none
- stop bits: 1 or 2
- data bits: 8
- protocol: hardware handshake

Refer to the diagrams of the previous optional card for information on the required cables.

6.6 PCOSERPRN0, serial printer card for graphic terminal

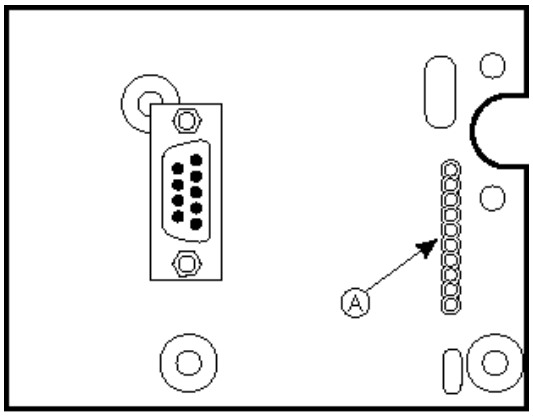


Fig. 6.6.1

The printer card (code PCOSERPRN0) is an optional card for all pCO^2 graphic terminal models (code PCOI00PGL0 and PCOT00PGH0). It allows interface with an external printer: the choice of data to print and the print properties depend on the application program contained in the pCO^2 EPROM.

This card can only be used with graphic terminals:

- PCOT00PGH0 (128x64 pixel);
- PCOI00PGL0 (240x128 pixel);

Type of serial cable for the printer

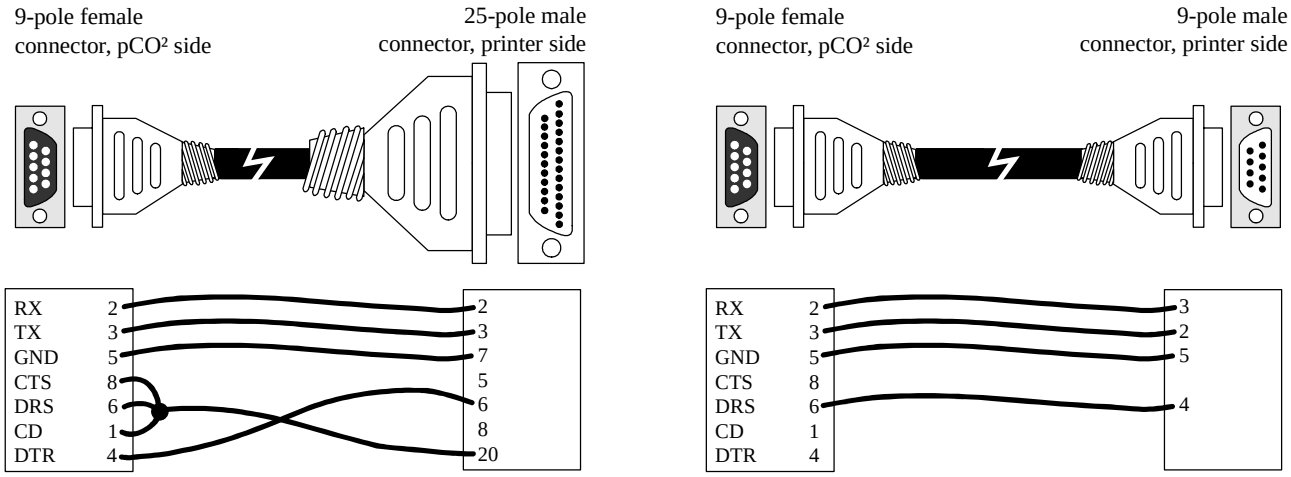
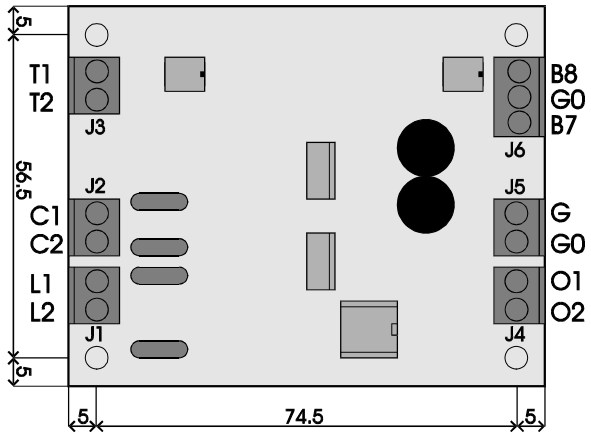


Fig. 6.6.2

Characteristics and settings of the serial printer port on the board for graphic display
Graphic dot matrix printer, Epson compatible, with RS232 serial interface.

- baud-rate: 19200
- parity: none
- stop bits: 1 or 2
- data bits: 8
- protocol: hardware handshake

6.7 Board for OEM humidifier management



This interface (code **PCOUMID000**) allows the control of the fundamental parameters of the OEM humidifiers manufactured by Carel (level and conductivity of the water in the cylinder, TAM sensor for current absorption) directly from the pCO^2 microprocessor-based electronic control. The values measured by the sensors are converted into signals which can be read by the inputs on the pCO^2 electronic board (for more information refer to the user manual for the application program).

Fig. 6.7.1

Warnings for operators: When handling the card, please follow the advice below:

To safeguard operators and the cards, disconnect power before working on them.
Electrical damage may occur to the electronic components as a result of electrostatic discharges from the operator. Suitable precautions must be therefore be taken when handling these components:

- before using any electronic component or card, ground yourself (not touching the card does not prevent a spike, as static electricity can produce a 10000V spike discharge which can form an arc of about 1cm);
- all components must be kept inside their original package as long as possible. If necessary, take the main board from its package and place it into an antistatic package without touching the back of the board with your hands;
- absolutely avoid non-antistatic plastic bags, polystyrene or sponges.
- absolutely avoid passing the card directly to other operators (to prevent from electrostatic induction and discharges).

7. GENERAL DIAGRAM OF THE ELECTRICAL CONNECTIONS

The following are two examples (Figg. 7.1 and 7.2) of how to connect the pCO^2 to the various devices.

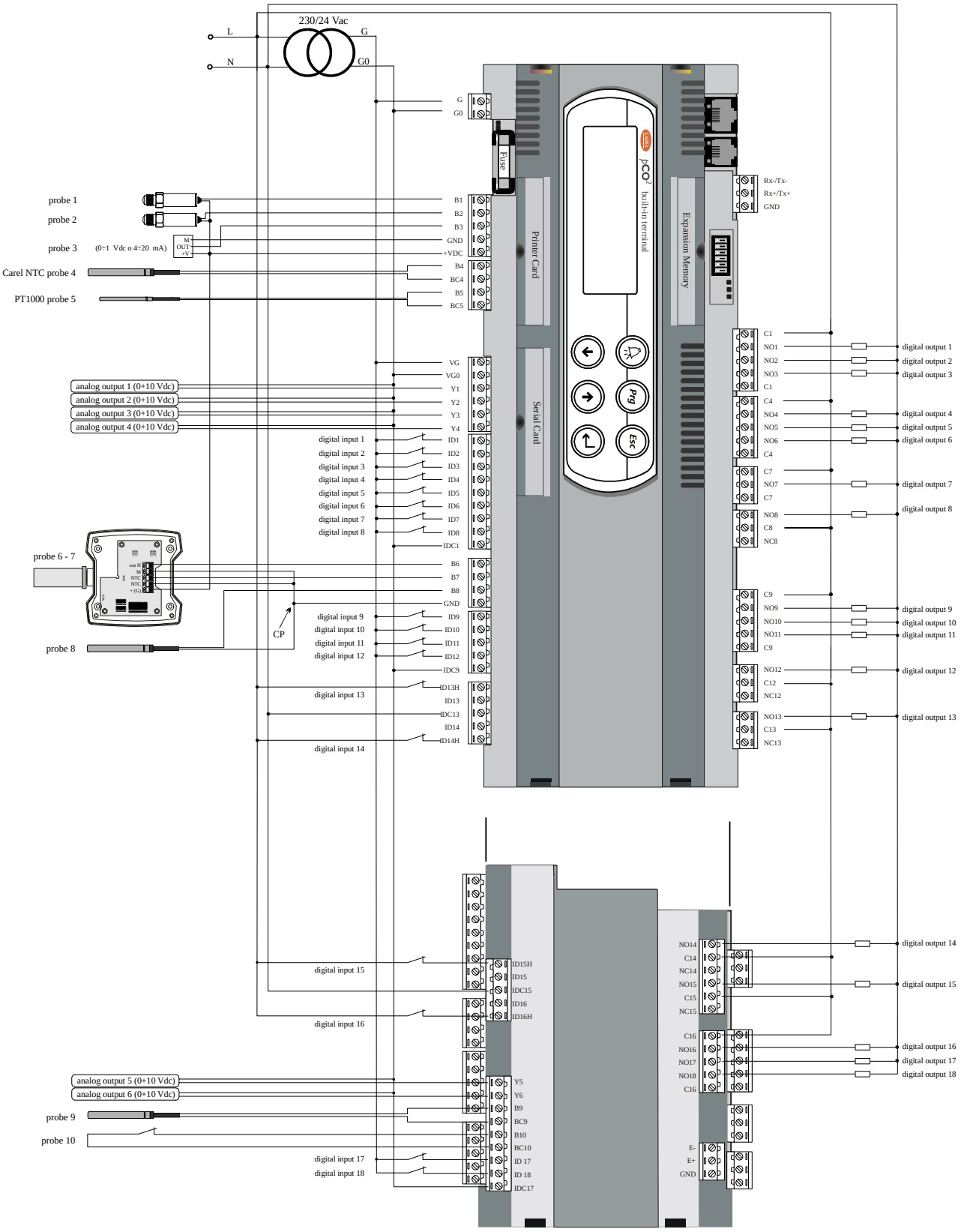


Fig. 7.1

WARNINGS:

- If the controlled devices are powered by 24Vac/Vdc, it is better it is **different** from the 24Vac/Vdc power supply used to power the pCO^2;
- The CP equipotential connection, Fig. 7.1 (probe 8), must be performed directly on GND terminal and **never** outside the electrical panel.

The following figure (Fig. 7.2) shows a special configuration where wiring of devices is further facilitated. In any case you must consider that the **max current value which can be supported by each terminal is 8A**.

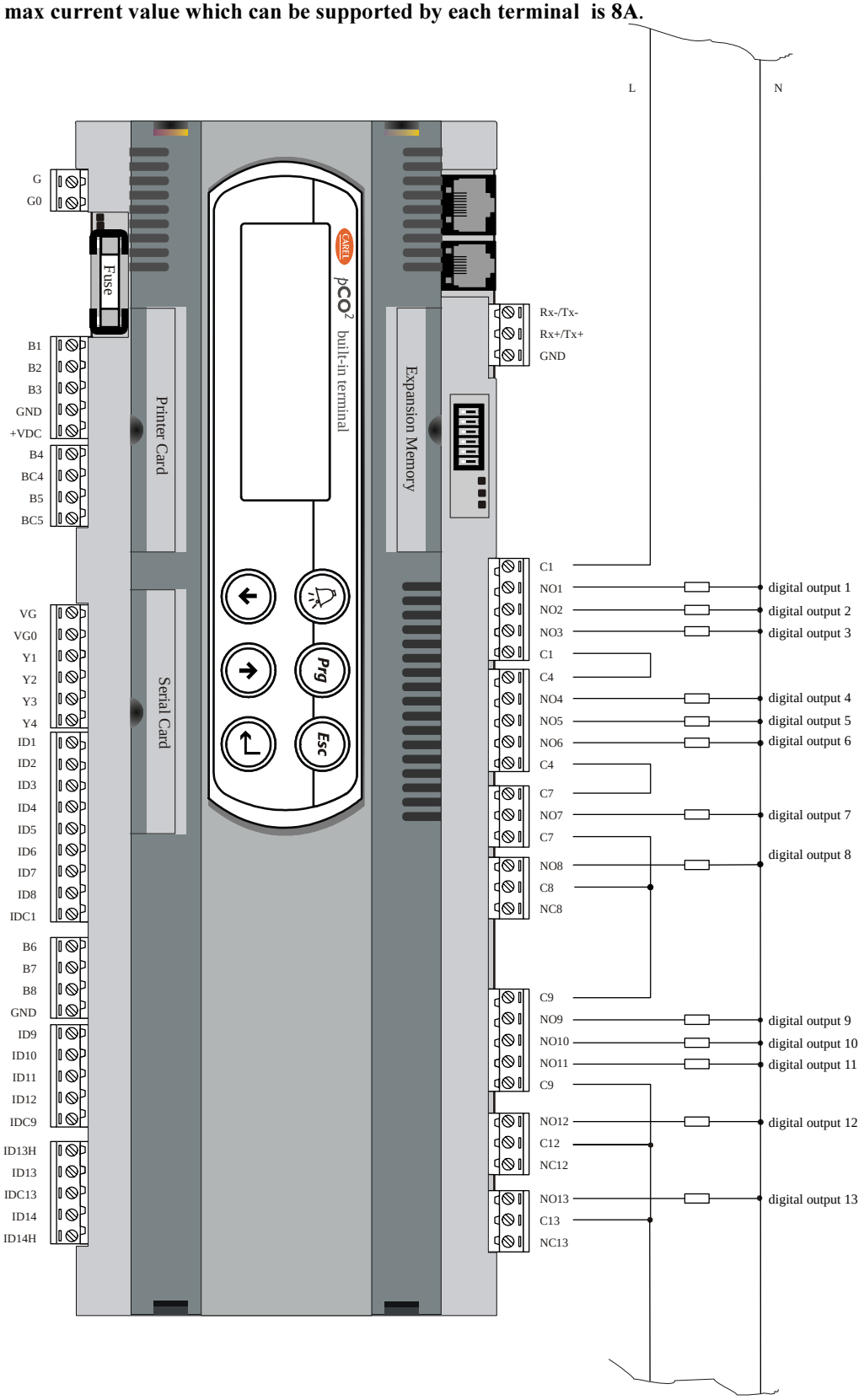


Fig.7.2

8. TECHNICAL SPECIFICATIONS

8.1 pCO² general characteristics

storage conditions	• -20T70°C • %rH 90 non-condensing
operating conditions	• -10T60°C (0T50°C versions with built-in terminal) • %rH 90 non-condensing
index of protection	IP20, IP40 front-panel only
environment pollution	normal
Classification according to protection against electric shock	to be integrated in Class I and/or II devices
PTI of insulating material	250V
period of electric stress across insulating parts	long
type of action	1C
type of disconnection or micro-switching	micro-switching
category of resistance to heat and fire	category D (UL94 - v0)
immunity against voltage surges	category 1
number of automatic cycles for each automatic action (e.g.: relay)	100,000
software class and structure	Class A
the device is not designed to be hand-held	

Tab. 8.1.1

In respect of the limits established by the safety standards on electromagnetic compatibility in the declaration of conformity (see installation manual), the only and sporadic malfunctions detected involve the indications on the display and the LEDs. The display and LEDs are automatically reset at the end of the disturbance.

8.2 pCO² electrical specifications

power supply (control with terminal connected)	22÷40Vdc and 24Vac ±15% 50/60Hz. Maximum consumption P=20 W
terminal block	with removable male/female connectors; maximum voltage: 250Vac; max current: 8A; cable cross-sec. (mm^2): min. 0.2 - max 2.5
CPU	H83002 16bit, 14Hz
program memory (in FLASH MEMORY)	1 MByte structured at 16 bit (expandable up to 6 MByte)
data memory (static RAM)	256 kByte structured at 16 bit (expandable up to 1 MByte)
parameter data memory	2 kByte structured at 16 bit (maximum limit: 400,000 writes per memory location)
working cycle of the pCO^2 with applications of average complexity (seconds)	0.5 (typical)

Tab. 8.2.1

8.2.1 Analogue inputs

analogue conversion		10 bit A/D converter Built-in CPU
maximum number		5, 8, 10, respectively on the SMALL, MEDIUM, LARGE boards
type	• **passive**: Carel NTC temperature sensor (-50÷100°C; R/T 10kΩ ± 1% at 25°C, $B_{25/80}$=3.435°K ± 1%), PT1000 (-100÷200°C; R/T 1000Ω/°C) or clean digital input, selectable via software (inputs: B4, B5, B9, B10) • **universal**: Carel NTC temperature sensor (-50÷100 °C; R/T 10kΩ ± 1% at 25 °C, $B_{25/80}$=3,435 °K ± 1%), voltage: 0÷1Vdc or 0÷10Vdc, current: 0÷20mA or 4÷20mA, selectable via software (inputs B1, B2, B3, B6, B7, B8) For all kind of inputs the unit of measurement is by step	
settling time analogue inputs (s)		2
NTC input accuracy (°C)		± 0.5
PT1000 input accuracy (°C)		± 1
0÷1V input accuracy (mV)		± 3
0÷10V input accuracy (mV)		± 30
0÷20mA input accuracy (mA)		± 0.06
minimum impulse detection time for clean digital input, normally open (open-closed-open) in DC - analogue inputs 4, 5, 9, 10 (ms)		250
minimum impulse detection time for clean digital input, normally closed (closed-open-closed) in DC - analogue inputs 4, 5, 9, 10 (ms)		250

Tab. 8.2.1.1

* you must add this value with the processing time of the application programme.
WARNING: the 21Vdc available at the +Vdc terminal can be used for the power supply of any active probes, the maximum current being 200mA, protected thermally against short circuits.

8.2.2 Digital inputs

type	optically-isolated inputs, 24Vac 50/60Hz or 24Vdc or 230Vac 50/60Hz. For all the 230 Vac inputs the insulation is the main one.		
maximum no.	8, 14, 18, respectively on the SMALL, MEDIA, LARGE boards, according to the combinations described below:		
board size	no. optically-isolated inputs at 24Vac 50/60Hz or 24Vdc	no. optically-isolated inputs at 24Vac/Vdc or 230Vac 50/60Hz	total inputs
SMALL	8	none	8
MEDIUM	8 + 4	2	14
LARGE	8 + 4 + 2	2 + 2	18
minimum impulse detection time for digital input normally open (open-closed-open) in AC and DC (ms)			100
minimum impulse detection time for digital input normally closed (closed-open-closed) in AC and DC (ms)			200

Tab. 8.2.2.1

WARNINGS: for digital inputs at 230 Vac:

- 230Vac 50/60Hz (+10%, -15%);
- each group of two inputs at 24 Vac/Vdc or 230 Vac has the same common pole, and thus works both at 24Vac/Vdc or 230Vac;

8.2.3 Analogue outputs

maximum no.	4, 4, 6, respectively on the SMALL, MEDIA, LARGE boards
type	0÷10Vdc optically-isolated
power supply	external 24Vac/Vdc power supply
0÷10V output accuracy (mV)	± 200
Y1÷Y4 (mV) output resolutions	20
Y5÷Y6 (mV) output resolutions	80
settling time analogue outputs 1 ÷ 4 (s)	2
settling time analogue outputs 5 ÷ 6 (s)	15
maximum load current (mA)	10 (corresponding to a minimum impedance of 1kΩ)

Tab. 8.2.3.1

8.2.4 Digital outputs

maximum no.	8, 13, 18, respectively on the SMALL, MEDIA, LARGE boards
type	electromechanical relay

Tab. 8.2.4.1

These are divided into 3 groups with two common pole terminals to simplify assembly of the common pole. Pay attention to the current running through the common terminals, in that this must not exceed the rated current of a single terminal.
The relays are divided in groups, depending on the insulating distance.
Inside one group, the relays have single insulation among them and thus they must support the same voltage (generally 24Vac or 110÷230Vac). Among the groups there is double insulation and so the groups may be at different voltage.

groups	1, 2, 3, 4, 5, 6, 7 - 8 (alarm relay) - 9, 10, 11, 12, 13 – 14, 15 - 16, 17, 18
NO contacts	all with 250Vac varistor protection
changeover contacts	5 with 250Vac varistor protection on both contacts
switchable power and relative electrical parameters	2500VA, 250Vac, 8A resistive, 2A FLA, 12A LRA according to UL873 2A resistive, 2A inductive, cos φ=0.4, 2(2)A according to EN 60730-1

Tab. 8.2.4.2

8.2.5 Connection to the user terminal

type	asynchronous half duplex with 2 dedicated leads
connector	6 way telephone cable
driver	balanced differential CMR 7 V (RS485 type)

Tab. 8.2.5.1

The maximum allowable distances between the terminal and the pCO² are reported in Tab. 8.2.5.2.

telephone cable		**AWG24 shielded cable**	
cable resistance (Ω/m)	**maximum distance (m)**	**cable resistance (Ω/m)**	**maximum distance (m)**
≤ 0.14	600	≤ 0.078	600
≤ 0.25	400		

Tab. 8.2.5.2

8.3 pCO² plastic case

click-on to DIN rail according to DIN 43880 and EN 50022 standards
material: techno-polymer
self-extinguishing V0 (according to UL94) and 960°C (according to IEC 695)
marble test: 125°C
resistance to creeping currents: ≥ 250V
colour: grey RAL7035 or charcoal grey
cooling vent

Tab. 8.3.1

8.4 Technical specifications of the PCOI* and PCOT* user terminals

8.4.1 General terminal characteristics

- **Plastic case**

material	• polyamide 66 with 25% fibreglass for the PCOT*CB* • blend of ABS + PC for the PCOT32RN* and PCOI*
self-extinguishing	• UL94V0, UL-certified
colour	• RAL 7032 (grey/beige) for the PCOT*CB* • charcoal grey for the PCOT32RN* and PCOI*
continuous operating temperature (°C)	• 115 for 20,000h (IEC216) for the PCOT*CB* • 75 for 20,000h (IEC216) PCOT32RN* and PCOI*

Tab. 8.4.1.1

- **Display protection for PCOT*CB* and PCOI***

material	rigid transparent polycarbonate (from sheet)
category of resistance to fire and heat	self-extinguishing UL94V2 - Category D
operating temperature	-30T70 (-30÷70°C, -22÷158°F)
machining	silk screening on rear and double-sided adhesive on edge (for attaching to plastic case)

Tab. 8.4.1.2

- **Keypad polycarbonate label (Carel standard) for PCOT*CB* and PCOI***

thickness (mm)	0.175
treatment	4-colour silk screening

Tab. 8.4.1.3

NOTE: The standard case (PCOT*BC*) features a hatch which opens from the front with a maximum inclination of 150°. With the hatch closed only the five silicon rubber buttons are accessible, and the three LEDs which back-light them are visible (2 activated by application software and 1 always on).
To access the remaining buttons, the hatch must be opened; the LEDs below the polycarbonate are only visible with the hatch open. The physical dimensions, drilling template for panel installation, colours and mounting instructions for wall installation are indicated in the enclosed drawings.

- **Display protection for PCOT32RN***

material	green transparent polycarbonate
category of resistance to fire and heat	self-extinguishing UL94V0
operating temperature	-30T120 (-30÷120°C, -22÷248°F)
machining	silk screening on front panel

Tab. 8.4.1.4

- **Silicon keypad for PCOT32RN***

material	silicon rubber
category of resistance to fire and heat	self-extinguishing UL94V0
operating temperature	-30T70 (-30÷70°C, -22÷158°F)
Machining	silk screening on buttons

Tab.8.4.1.5

8.4.2 Terminal electrical specifications

power supply	• 24Vac (from Class II transformer and separate) for PCOI00PGL0/PCOT00PGL0 • 21÷30Vdc (from power board via the telephone cable) for all the other models
CPU	80C52 - 8MHz
operating conditions	• -10T60 (-10÷60ºC, 14÷149°F) for PCOT000L60 and PCOT00PGH0 • 0T50 (0÷50ºC, 32÷122°F) for all the other models, 90% rH non-condensing
storage conditions	• -20T70 (-20÷70ºC, -4÷158°F) for PCOT000L60 and PCOT00PGH0 • -20T50 (-20÷50ºC, -4÷158°F) for all the other models 90% rH non-condensing
index of protection	• IP55 front panel for panel mounting • IP20 for models PCOT*CB*, if wall-mounted • IP55 for models PCOT32RN* front panel for panel mounting
environment pollution	normal
classification according to protection against electric shock	to be incorporated in Class I and/or II
PTI of insulating materials	250V
period of electric stress across insulating parts	long
category of resistance to fire and heat	category D
category (immunity against voltage surges)	category I

Tab. 8.4.2.1

9. USER TERMINAL MOUNTING

9.1 Panel mounting

9.1.1 PCOT*

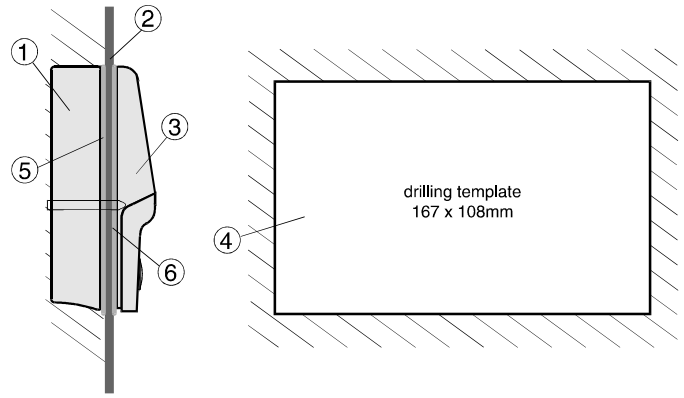


Fig. 9.1.1.1

Legend Fig. 7.1.1.1, (dimensions in mm).

n.	description
1	rear cover
2	panel
3	front cover
4	drilling template (tolerance: -0,5 ÷ +1mm on the indicated dimensions)
5	rear cover gasket
6	front cover gasket

Tab. 9.1.1.1

9.1.2 PCOI*

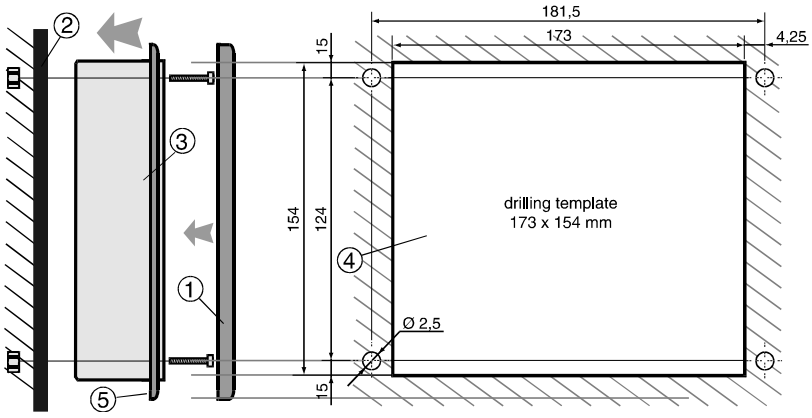


Fig. 9.1.2.1

Legend Fig. 7.1.2.1, (dimensions in mm).

n.	description
1	external frame
2	panel
3	terminal
4	drilling template (tolerance: ± 0,5mm on the indicated dimensions)
5	front basket

Tab. 9.1.2.1

WARNING: the maximum thickness of the panel is 6mm.

9.2 Wall mounting

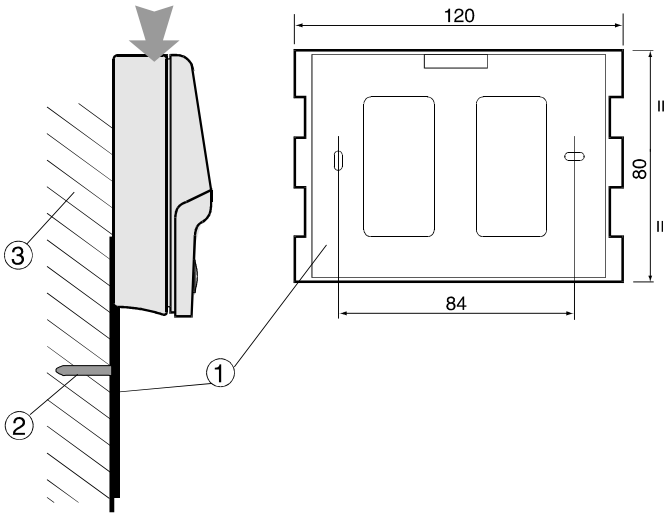


Fig. 9.2.1

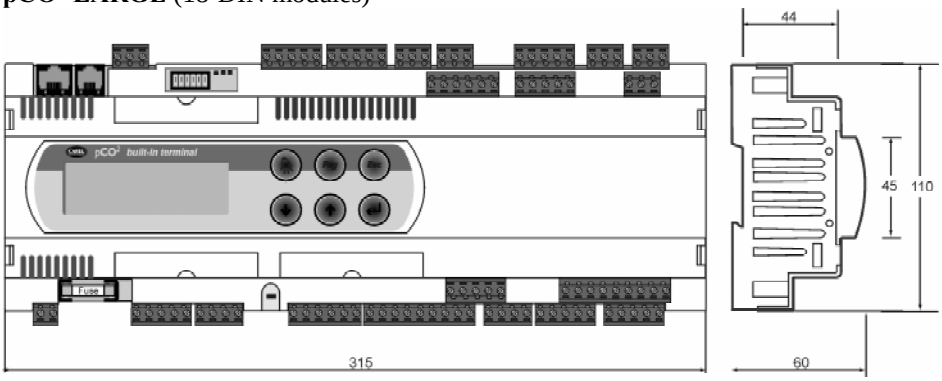
Wall mounting requires the use of a special mounting racket and a standard 3-module switchbox for the passage of the cable. With reference to Fig. 7.2.1, fasten the bracket (1) to the wall (3) using the screws (2); clip the rear of the instrument onto the bracket.

10. DIMENSIONS

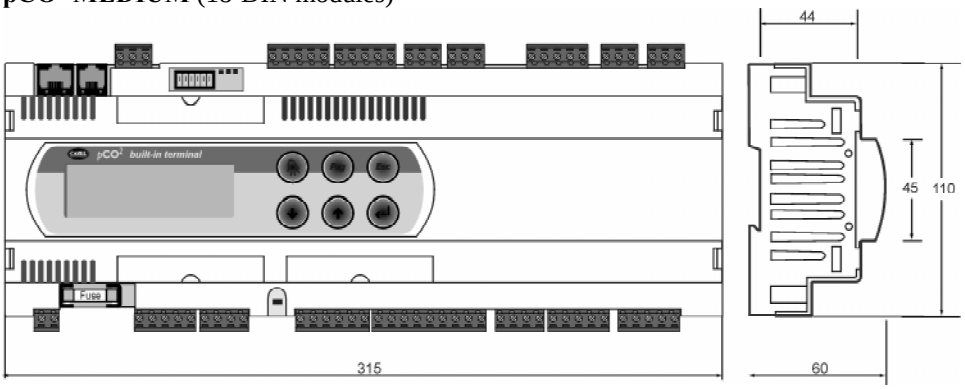
WARINING: all the dimensions are in mm.

10.1 pCO²

pCO² LARGE (18-DIN modules)



pCO² MEDIUM (18-DIN modules)



pCO² SMALL (13-DIN modules)

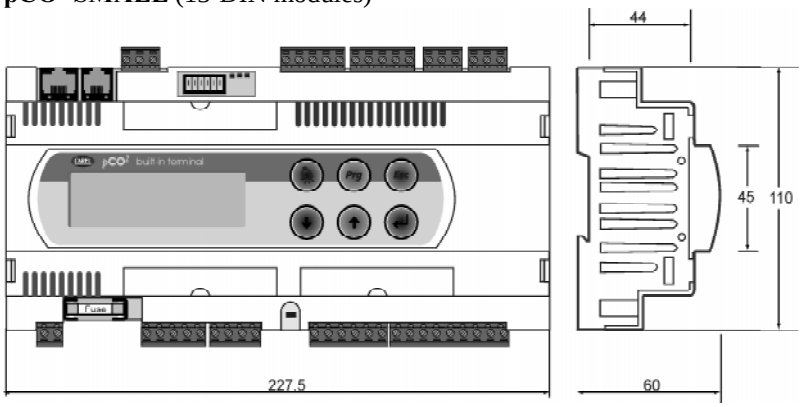


Fig. 10.1.1

10.2 Terminal user

10.2.1 PCOT*

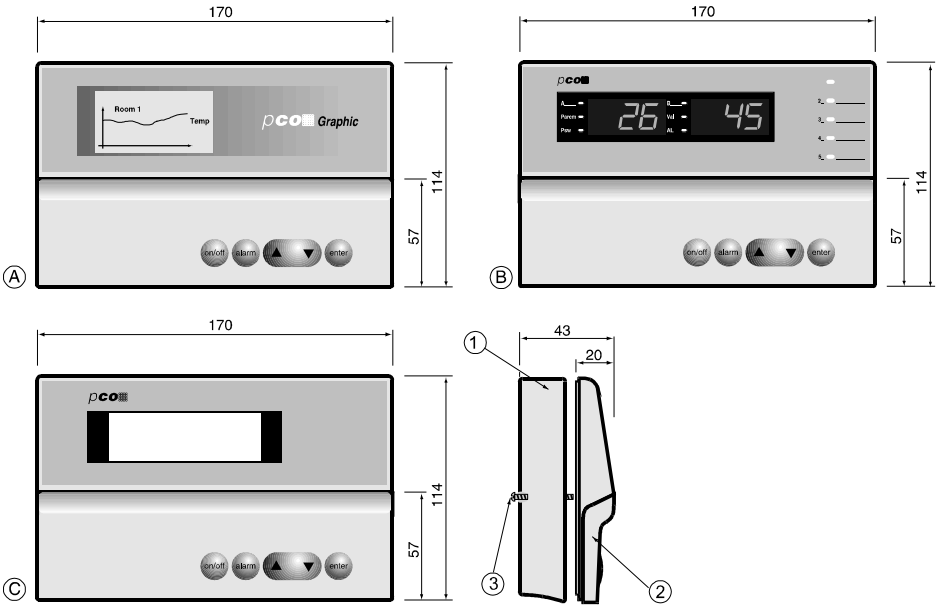


Fig. 10.2.1.1

1. rear cover;
2. front cover;
3. fastening screw.

10.2.2 PCOI*

PCOT32RN

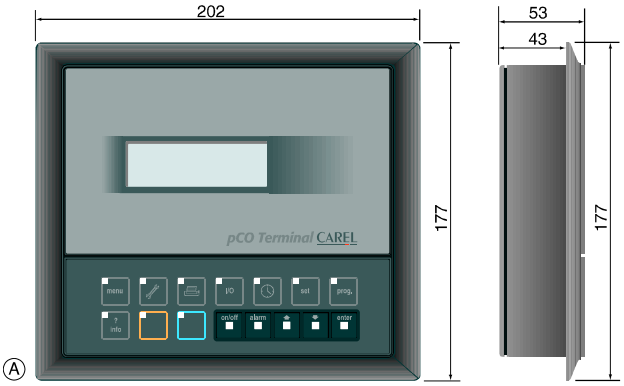


Fig. 10.2.2.1

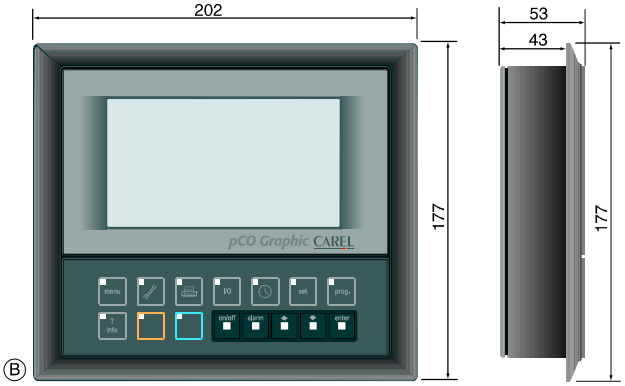


Fig. 10.2.2.2

10.2.3 PCOT32RN*

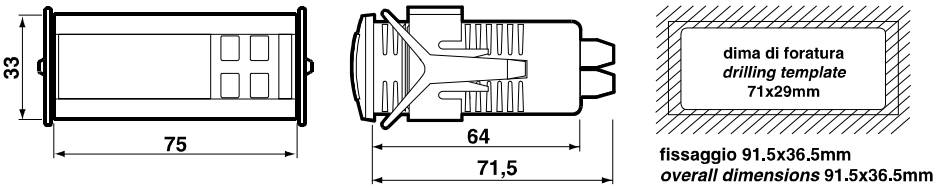


Fig. 10.2.3.1

Carel reserves the right to alter the features of its products without prior notice.

Note: _____

Note: _____

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