



I Foglio istruzioni

GB Technical leaflet

D Betriebsanleitung

F Mode d'emploi

**LEGGI E CONSERVA
QUESTE ISTRUZIONI**
➤ **READ AND SAVE
THESE INSTRUCTIONS** ◀

CAREL
Technology & Evolution

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GENERAL CHARACTERISTICS

pCO³ is a microprocessor-based electronic controller compatible in both hardware and software terms with the pCO² family. Developed by CAREL in compliance with the European RoHS directives, it provides a solution for many applications in the air-conditioning and refrigeration sectors. It ensures absolute versatility, allowing specific products to be created to customer request.

pCO³ runs the control program, and is fitted with the set of terminals required for connection to the devices (compressors, fans...). The program and the parameters are saved to FLASH-MEMORY and E²prom, ensuring they are stored even in the event of power failures (without requiring a backup battery).

The program can be loaded using a PC (28.8 kbps and 115.2 kbps) or the special programming key.

pCO³ also allows connection to the pLAN (pCO Local Area Network) and can be connected, as well as to other pCO³ controllers, to all the other controllers in the pCO sistema and all the pGD family terminals. All the controllers in the pLAN can exchange information (variables, digital or analogue, depending on the application software used) at high transmission speed. Up to 32 units can be connected, including pCO controllers and terminals, so as to share the information effectively.

The connection to the supervisor/telemaintenance serial line, via the CAREL or Modbus™ communication protocol over the RS485 standard, is performed by inserting an optional serial board in the pCO³.

Other optional cards can be used to connect to a supervisor via standards other than RS485. Finally, the serial field bus interface, using the optional board, ensures connection to the field devices controlled (for example: valves, pCOe I/O expansions, electronic valve drivers...).

Versions available:

- SMALL, MEDIUM, LARGE, EXTRALARGE N.O. and EXTRALARGE N.C.;
- with or without Built-In terminal;
- with additional flash memory and optically-isolated pLAN;
- with or without solid state relay (SSR) digital outputs.

Note: the application software can be downloaded to the flash memory using the smart key PCOS00AKY0, see Fig. 6; or a PC using the USB-485 adapter "CVSTDUTLFO" and the "WINLOAD32" program, to be ordered from CAREL.

Power supply

A Class II safety transformer with a minimum rating of 50 VA must be used in the installation to supply just one pCO³ controller. The power supply to the pCO³ controller and terminal (or pCO³ controllers and terminals) should be separated from the power supply to the other electrical devices (contactors and other electromechanical components) inside the electrical panel. If the secondary of the transformer is earthed, make sure that the earth wire is connected to terminal G0. This is true for all the devices connected to the pCO³. If powering more than one pCO³ board connected in the pLAN network, make sure that the references G and G0 are observed (the reference G0 must be maintained for all the boards).

If using the pLAN network and for further explanations and information, please refer to the CAREL manual pCO³.

Field Bus options

optically isolated 485	PCO100FD10
tLAN	PCO100TLN0
Belimo MPbus	PCO100MPB0
modem	PCOS00FD20
CAN hydronic	PCOS00HBF0

BMS options

CANbus	PCOS00HBB0
485/Modbus	PCOS004850
modem	PCO100MDM0
Ethernet board	PCO1000WB0

LonWorks

LonWorks	FTT10	PCO10000F0
LonWorks	FTT10	PCO10001F0
	standard chiller profile	

Connettori

Example of coding: PCO3CON***, see the following table for the description:

PCO3CON	*	*	0
	0= screw 1= spring	S= small M= medium L= large Z= extra large N.O. C= extra large N.C.	

TECHNICAL SPECIFICATIONS

Mechanical characteristics

dimensions	SMALL version fitted on 13 DIN rail modules, 110 x 227,5 x 60 mm MEDIUM, LARGE and EXTRALARGE version fitted on 18 DIN rail modules, 110 x 315 x 60 mm
installation	DIN rail

Plastic case

- fitted on DIN rail according to DIN 43880 and CEI EN 50022 standards;
- material: technopolymer;
- flame retardancy: V0 (UL94) and 960°C (IEC 695);
- ball pressure test: 125°C;
- resistance to creeping current: ≥250 V;
- colour: grey RAL7035;

Electrical specifications

power supply (controller with terminal connected)	28 TO 36 Vdc +10/-20% and 24 Vac +10/-15% 50 to 60 HZ maximum power input P= 15 W (24 Vdc power supply), P= 40 VA (24 Vac)
terminal block	with plug-in male/female connectors, max voltage 250 Vac; cable cross-section: min. 0.5 mm² - max 2.5 mm²
CPU	H8S2320, 16 bit, 24 MHz
memory (FLASH MEMORY)	2+2 MB; in the extended versions further memory of 32 MB or higher
data memory (static RAM)	512 kB at 16 bit (296 kB BIOS; 216 application sw)
parameter data memory	13 kB at 16 bit (max. limit: 400,000 writes per memory location) and a further 32 kB E ² prom (not available to the pLAN)
working cycle duration (applications of average complexity)	0.2 s (typical)
clock with battery	standard

Digital inputs

type	optically-isolated			
maximum number	8, 14, 18, respectively on the SMALL, MEDIUM and EXTRALARGE N.O and N.C., LARGE boards, according to the combinations shown below:			
		optoinsulated input no. to 24 Vac 50/60 Hz or 24 Vdc	optoinsulated input no. to 24 Vac/Vdc or 230 Vac (50/60 Hz)	inputs
	SMALL	8	none	8
	MEDIUM/ EXTRALARGE	12	2	14
	LARGE	14	4	18
classification of the measuring circuits (CEI EN 61010-1)	Category I (J5, J7, J20) 24 Vac/Vdc Category III (J8, J19) 230 Vac			

- WARNINGS:**
- 230 Vac 50/60 Hz (10/-15%);
 - the two 230/24 Vac inputs present on J8 and J12 have the same common pole and consequently will be both 24 Vac/Vdc or both 230 Vac. Basic insulation between the two inputs;
 - for DC inputs, connect the negative pole to the common terminal.

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

Analogue inputs

analogue conversion type	10 bit A/D converter in the CPU universal: (inputs B1, B2, B3, B6, B7, B8) CAREL NTC temperature sensor (-50T90°C; R/T 10 kΩ at 25°C), HT NTC 0T150°C, voltage: 0 to 1 Vdc, 0 to 5 V ratiometric or 0 to 10 Vdc, current: 0 to 20 mA or 4 to 20 mA, selectable via software. Input resistance in 0 to 20 mA= 100Ω passive: (inputs B4, B5, B9, B10) CAREL NTC temp. sensor (see universal type), PT1000 (-100T200°C; R/T 1000 Ω at 0°C) or voltage-free digital input (5 mA), selectable via software;
maximum number	5, 8, 10, on the SMALL, MEDIUM and EXTRALARGE N.O., LARGE and EXTRALARGE N.C. boards respectively
time constant for each input	0.5 s
precision	± 0.3 % of full scale
classification of the measuring circuits (CEI EN 61010-1)	Category I

WARNING: the 21 Vdc available at the +Vdc terminal (J2) can be used to power any active probes, the maximum current is 150 mA, thermally protected against short-circuits. To supply the ratiometric 0 to 5 V probes, use the +5V_{REF} (Imax: 60 mA) present at terminal J24.

Analogue outputs

type	0 to 10 Vdc optically-isolated
maximum number	4, 4, 6, on the SMALL, MEDIUM and EXTRALARGE N.O./N.C., LARGE boards respectively
power supply	external 24 Vac/Vdc
resolution	8 bit
maximum load	1 kΩ (10 mA)
precision	± 2 % of end scale on outputs: Y1, Y2, Y3 and Y4 -2%/+5% of end scale on: Y5 and Y6

Digital outputs

type	relay
maximum number	8: SMALL; 13: MEDIUM; 18: LARGE; 27: EXTRALARGE N.C.; 29: EXTRALARGE N.O.

For the requirements refer to Figs. 3 to 5 (reference NO*, NC* and C*). Note the presence of outputs with changeover contacts kept separately (that is, without the poles shared between different outputs). Groups from 2 to 5 outputs have 2 “common” poles easy assembly.

Make sure that the current running through the common terminals does not exceed the rated current of each individual terminal, that is 8A.

Insulation distance the outputs can be divided into groups. There is double insulation between groups (between cells in the table). Note: the relays in the same group must have the same power supply (24 or 230 Vac).

Makeup of the groups	version	relays with same insulation						
	SMALL	1...7	8	-	-	-		
	Type of relay	A type	A type					
	MEDIUM	1...7	8	9...13	-	-		
	Type of relay	A type	A type	A type				
	LARGE	1...7	8	9...13	14...18	-		
	Type of relay	A type	A type	A type	A type			
	EXTRALARGE N.O.	1...7	8	9...13	14...16	17...20	21...24	25...29
	Type of relay	A type	A type	A type	B type	B type	B type	B type
EXTRALARGE N.C.	1...7	8	9...13	14...16	17...20	21...24	25...27	
Type of relay	A type	A type	A type	C type	C type	C type	C type	
Note: the relays in the individual cells of the table have basic insulation between them, while between groups (cell-cell) there is double insulation.								
Changeover contacts	1: SMALL (relè 8); 3: MEDIUM e EXTRALARGE N.O./N.C. (relè 8, 12 e 13); 5: LARGE (relè 8, 12, 13, 14 e 15)							
Switchable power	warning: the relay outputs have different characteristics according to the model of pCO ³							
	relay type A	<u>type of relay:</u> SPDT, 2000 VA, 250 Vac, 8 A resistive <u>pCO³ approval:</u> UL873: 2.5 A resistive, 2 A FLA, 12 A LRA, 250 Vac, C300 pilot duty (30000 cycles) EN 60730-1: 2 A resistive, 2 A inductive, cosφ= 0.6, 2(2) A (100000 cycles)						
	relay type B	<u>type of relay:</u> SPDT, 1250 VA, 250 Vac, 5 A resistive <u>pCO³ approval:</u> UL873: 1 A resistive, 1 A FLA, 6 A LRA, 250 Vac, D300 pilot duty (30000 cycles) EN 60730-1: 1 A resistive, 1 A inductive, cosφ= 0.6, 1(1) A (100000 cycles)						
	relay type C	<u>type of relay:</u> SPDT, 1250 VA, 250 Vac, 5 A resistive <u>pCO³ approval:</u> UL873: 1 A resistive, 1 A FLA, 6 A LRA, 250 Vac, D300 pilot duty (30000 cycles) EN 60730-1: 1 A resistive, 1 A inductive, cosφ= 0.6, 1(1) A (100000 cycles)						
SSR outputs	1: SMALL (output 7); 2: MEDIUM - EXTRALARGE N.O./N.C. (outputs 7, 12); 3: LARGE (OUTPUTS 7, 12, 14) operating voltage 24 Vac/Vdc; maximum power: 10 W							

Relation between AWG and wire cross-section

AWG	Cross-section (mm ²)	Current
20	0.5	2
15	1.5	6
14	2.5	8

pLAN network/user terminal connection

type	RS485 half-duplex asynchronous
transmission speed	62.5 Kbps or 115.2 Kbps, selectable via software
terminal connector	6 pin telephone (J10)
pLAN network/graphic terminal/aria terminal connector	3 pin plug-in connector (J11)

The maximum distance between the pCO and user terminal is shown in the following table.

cable type	power supply distance	power supply
telephone	50 m	taken from the pCO (150 mA)
AWG24 shielded cable	200 m	taken from the pCO (150 mA)
AWG20/22 shielded cable	500 m	separate power supply via TCONN6J000

The maximum distance between two pCO³ controllers with AWG20/22 shielded cable is 500 m.

Note:

- a maximum of one terminal (pCOT, pCOI, pGD0, pGD1) can be connected, or two terminals but without using the backlighting on display. One version of the pCO³ features optically-isolated connection to the pLAN network.
- the graphic terminal and aria terminal should be always powered with a separate power supply.
- the 21 Vdc present at +Vterm (J24) can be used to power an external terminal with a maximum input of 2 W. Only one terminal can be connected (for example PLD terminal or ARIA terminal) in addition to the one connected to terminal J10.

Other specifications

storage conditions	-40T70 °C, 90% RH non-condensing
operating conditions	-25T70 °C, 90% RH non-condensing
index of protection	IP20, IP40 front panel only
environmental pollution	normal
class according to protection against electric shock	to be incorporated into Class I and/or II appliances
PTI of the insulating materials	250 V
period of stress across the insulating parts	long
type of action	1 C
type of disconnection or microswitching	microswitching
category of resistance to heat and fire	category D (UL94 - V0)
immunity against voltage surges	category 1
ageing characteristics (operating hours)	80,000
no. of automatic operating cycles	100,000 (EN 60730-1); 30,000 (UL 873)
software class and structure	Class A
category of immunity to voltage surges (CEI EN 61000-4-5)	Category III
The device is not designed to be hand-held	

WARNING

- for applications subject to strong vibrations (1.5 mm pk-pk 10/55 Hz), secure the cables connected to the μ pCO³ using clamps placed around 3 cm from the connectors
- If the product is installed in industrial environments (application of the EN 61000-6-2 standard) the length of the output connections must be less than 30 m.
- installation must be performed according to the standards and legislation in force in the country where the appliance is used;
- for safety reasons the appliance must be housed inside an electrical panel, so that the only accessible part is the display and the control keypad;
- all the very low voltage connections (analogue and digital inputs at 24 Vac/Vdc, analogue outputs, serial bus connections, power) must have reinforced or double insulation from the mains;
- in the event of malfunctions do not attempt to repair the appliance, but rather contact the CAREL service centre;
- in domestic environments, the connection cable between the pCO³ and the terminal must be shielded.

DIMENSIONS

Dimensions pCO³ MEDIUM, LARGE, EXTRALARGE N.O. and N.C.

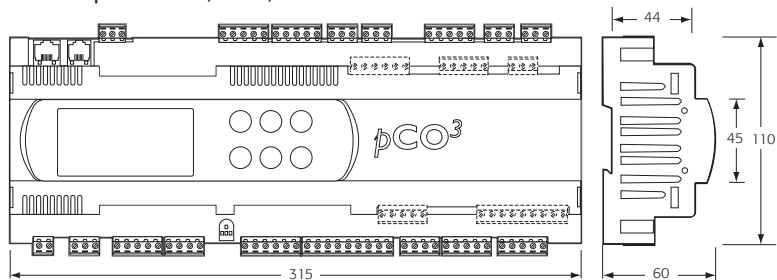


Fig. 4

Dimensions pCO³ SMALL

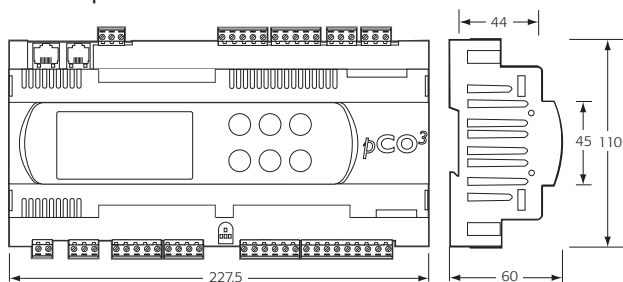


Fig. 5

PRODUCT CERTIFICATION

- CEI EN 50155 standard: "Railway applications – Electronic equipment used on rolling stock";
- UL 873 and C22.2 No. 24-93: "Temperature-Indicating and -Regulating Equipment";
- EC regulations 37/2005 of 12 January 2005; in particular, if the electronic controller is fitted with standard Carel NTC probes, it is compliant with standard EN13485 on "Thermometers for measuring the air temperature in applications on units for the conservation and sale of refrigerated, frozen and deep-frozen food and ice cream".



Disposal of the product

The appliance (or the product) must be disposed of separately in accordance with the local waste disposal legislation in force.

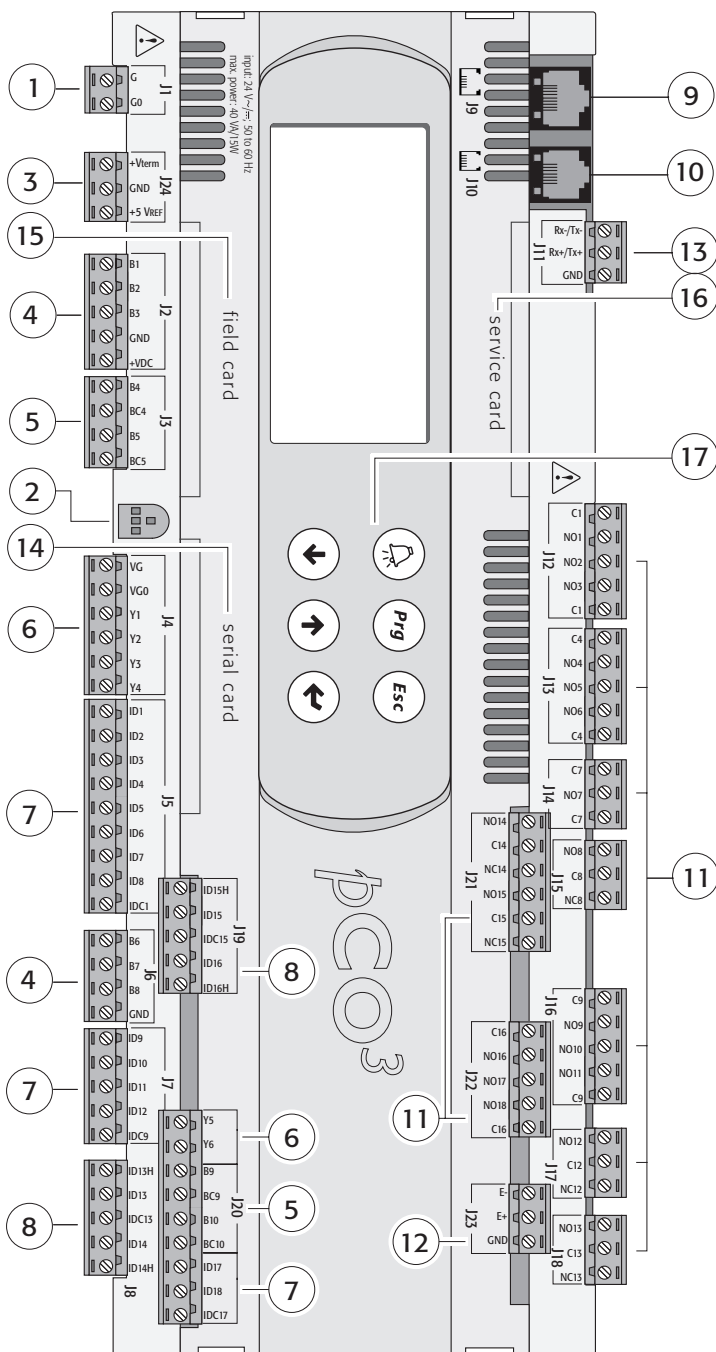


Fig. 3

EXTRALARGE N.O. version

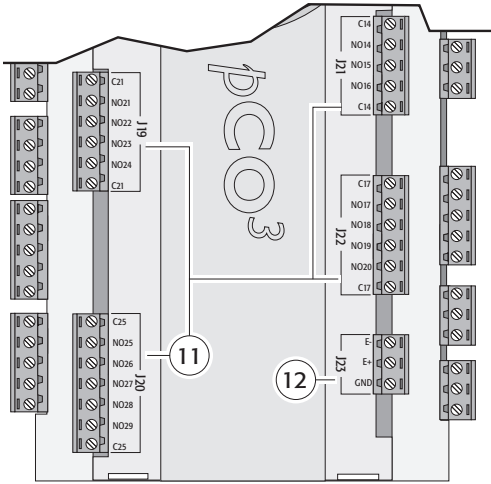


Fig. 4

EXTRALARGE N.C. version

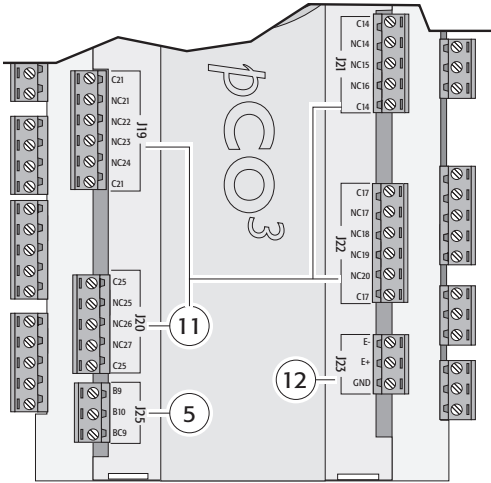


Fig. 5

Key (Figs. 3 to 5)

1. power supply connector [G (+), G0 (-)];
2. yellow power LED and 3 LEDs for the pLAN networks;
3. additional power supply (max. 200 mA) for the terminal and 0 to 5 V ratiometric probes;
4. universal NTC, 0 to 1 V, 0 to 5 V ratiometric, 0 to 10 V, 0 to 20 mA, 4 to 20 mA analogue inputs;
5. passive NTC, PT1000, ON/OFF analogue inputs;
6. 0 to 10 V analogue outputs;
7. 24 Vac/Vdc digital inputs;
8. 230 Vac or 24 Vac/Vdc digital inputs;
9. connector for terminal display (external panel with direct signals);
10. connector for all the standard pCO series terminals and for downloading the application software;
11. digital relay outputs;
12. connector for the I/O board expansion;
13. pLAN connector;
14. cover for inserting the optional supervisor serial board;
15. cover for inserting the optional field board;
16. cover for inserting the optional service board;
17. Built-In terminal (LCD, buttons and LEDs).

PRELIMINARY NOTES FOR THE INSTALLER: COMPARISON BETWEEN pCO³ AND pCO²

- the pCO³ family controllers do not have the connector using the programming key code PCO201KEY0. To program the controller, use the new Smart Key (PCOS00AKY0) available from September 2005. Otherwise use WinLoad ver. 3.35 and higher:



Fig. 6

- An application cannot be run from the Smart Key;
- unlike the pCO², there is no fuse between J1 and J2. All pCO³ family controllers have an internal thermal protector on the power supply. No external fuse is required;
- a further terminal J24 (in place of the fuse) is provided for the power supply to the ratiometric probes (+5 VREF), as well as 20 Vdc to supply a secondary terminal, such as the aria terminal (TAT***), in alternative to the standard one;
- the terminal J11 (connection to the pLAN network) in the first prototypes of the pCO³ only has a pitch of 3.81, rather than the 5.08 on the pCO²;
- the LEDs near the dipswitches for setting the pLAN address have been moved between connectors J3 and J4;
- the red probe power supply overload LED has been removed.

pCO³ simulator:



If testing the pCO³ with a simulator, note that the pCO² simulator cannot be used in place of the pCO³ simulator. Contact CAREL for the availability of the latter.

Procedure for setting the address of the controller and terminal

Setting the address of the controller

The pCO³ controller does NOT have dipswitches for setting the pLAN address. The address must be set by software, as for the pCO^{1/VS}.

The procedure is as follows:

- switch the pCO³ off;
- prepare a standard Carel terminal with the address set to 0 (not necessary if the pCO³ Built-In terminal is used). For this operation, see the following paragraph;
- connect the terminal to the pCO³;
- disconnect any other devices connected in the pLAN from the pCO³ (terminal J11);
- switch the pCO³ on, pressing the UP + ALARM buttons at the same time. This combination of buttons is the same on the built in terminal. Alternatively, on the PCOT terminals, use the combination of the  and  buttons.
- after a few seconds, the following screen will be displayed:

```
PLAN ADDRESS: 0
UP:    INCREASE
DOWN:  DECREASE
ENTER: SAVE & EXIT
```

- to modify the address simply use the UP and DOWN buttons and then press ENTER to confirm.
- now set the pLAN address of the terminal and configure the pLAN network.

Setting the address of the terminal




pCO/pCOT terminal

The address of the terminal is set using the DIPSWITCHES on the rear of the terminal.


pGD0/1/2/3 terminal

The default value of the address is 32.

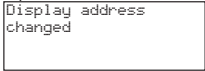
The address of the terminal can only be set after having connected the power supply via the telephone connector.

To enter configuration mode, press the    buttons at the same time (even when the terminal is already on), in all the versions, for at least 5 seconds; the following screen will be displayed, with the cursor flashing in the top left corner:

```
Display address
setting.....:nn
I/O Board address:xx
```

- to modify the address of the terminal (display address setting) press the  button once: the cursor will move to the address field (nn).

- use the ↓↑ buttons to select the desired value, and confirm by pressing the ↵ button. If the value selected is different than the value saved previously, the screen shown below will be displayed, and the new value will be saved to permanent memory.

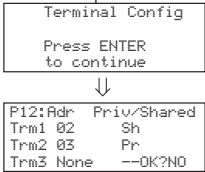


If the field nn is set to the value 0, the terminal will communicate with the pCO³ controller using the “point-to-point” protocol (not pLAN) and the “I/O Board address: xx” field will not be displayed, as it no longer has meaning.

pCO³: assigning the list of private and shared terminals

At this stage, to modify the list of terminals associated with each individual pCO³ board, proceed as follows:

- enter configuration mode by pressing the ↓↑↵ buttons, as described in the previous paragraph;
- press the ↵ button until the cursor reaches the field xx (I/O board address) ;
- use the ↓↑ buttons to select the desired address of the pCO³ board. The values that can be selected refer to the pCO³ boards that are effectively on line. If the pLAN network is not operating correctly, or alternatively no pCO³ board is connected, the field will not be able to be modified and will only show “-”;
- pressing the ↵ button again displays the following screens in sequence:



- here too the ↵ button moves the cursor from one field to another, and the ↓↑ buttons change the value of the current field. The field P:xx shows the address of the board selected; in the example shown in figure, the address 12 has been selected;
- to exit the configuration procedure and save the data, select the field “OK ?” and set to Yes, then confirm by pressing the ↵ button. The fields in the “Adr” column represent the addresses of the terminals associated with the pCO³ board address 12, while the Priv/Shared column indicates the type of terminal.

Important: the pGD terminals cannot be configured as “Sp” (shared printer), as they do not have the printer output.

If the terminal remains inactive (no button pressed) for more than 30 seconds, the configuration procedure is automatically ended without saving any changes.

NOTES ON USING WINLOAD, BOOT AND BIOS

The most recent version of WinLoad should always be used. Management of the pCO³ is supported by WinLoad version 3.35, available at <http://ksa.carel.com>.

From version 3.36, the download speed for the Bios and the application to the pCO³ has been increased to 115200 bit/s from the standard speed of 28800 bit/s, however this change does not require any new settings by the user.

The pCO³ BIOS and the BOOT are specific files, and different from the pCO¹ and pCO² BIOS and BOOT files. Consequently, these cannot be loaded onto the pCO³, and, obviously, the pCO¹ and pCO² BOOT and BIOS cannot be loaded onto the pCO³.

IMPORTANT WARNINGS

The CAREL product is a state-of-the-art product, whose operation is specified in the technical documentation supplied with the product or can be downloaded, even prior to purchase, from the website www.carel.com.

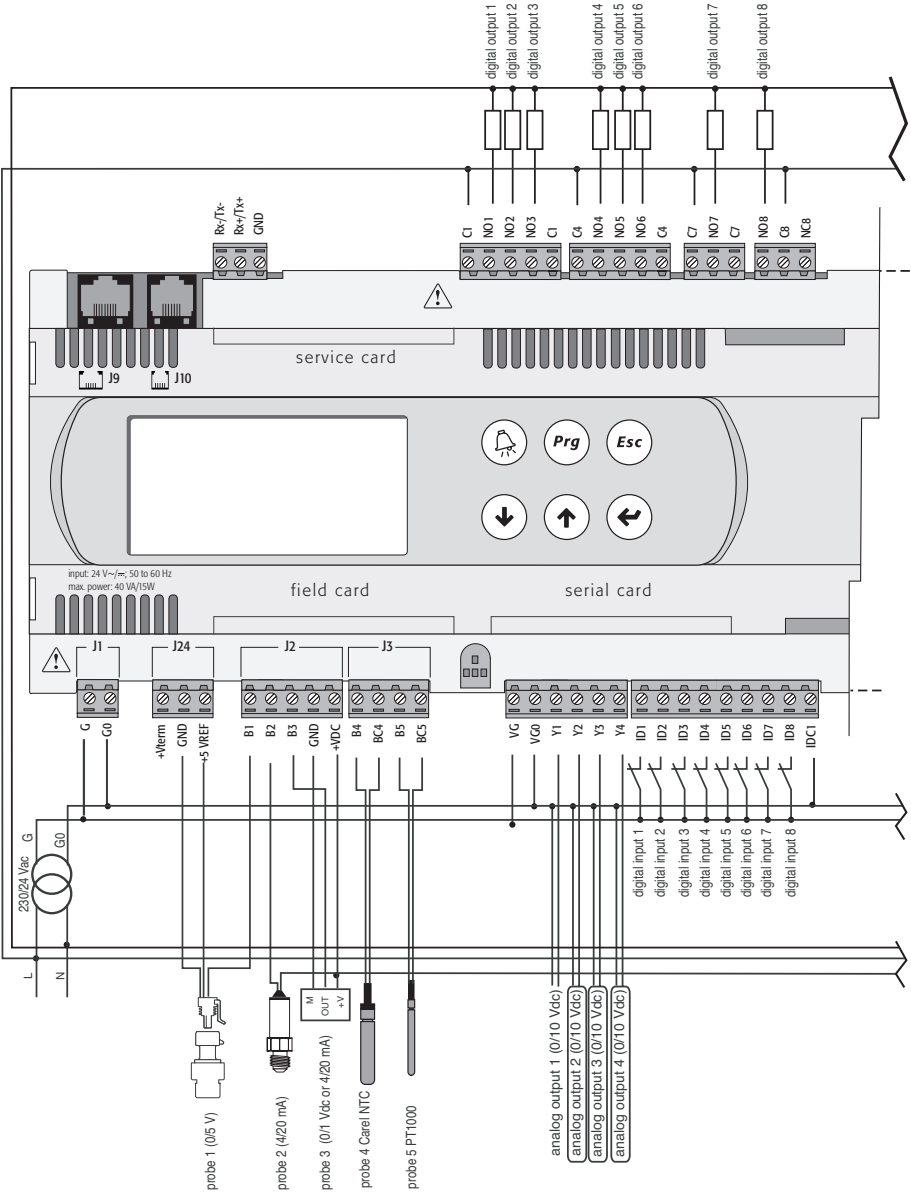
The client (builder, developer or installer of the final equipment) assumes every responsibility and risk relating to the phase of configuration the product in order to reach the expected results in relation to the specific final installation and/or equipment. The lack of such phase of study, which is requested/indicated in the user manual, can cause the final product to malfunction of which CAREL can not be held responsible.

The final client must use the product only in the manner described in the documentation related to the product itself.

The liability of CAREL in relation to its own product is regulated by CAREL's general contract conditions edited on the website www.carel.com and/or by specific agreements with clients.

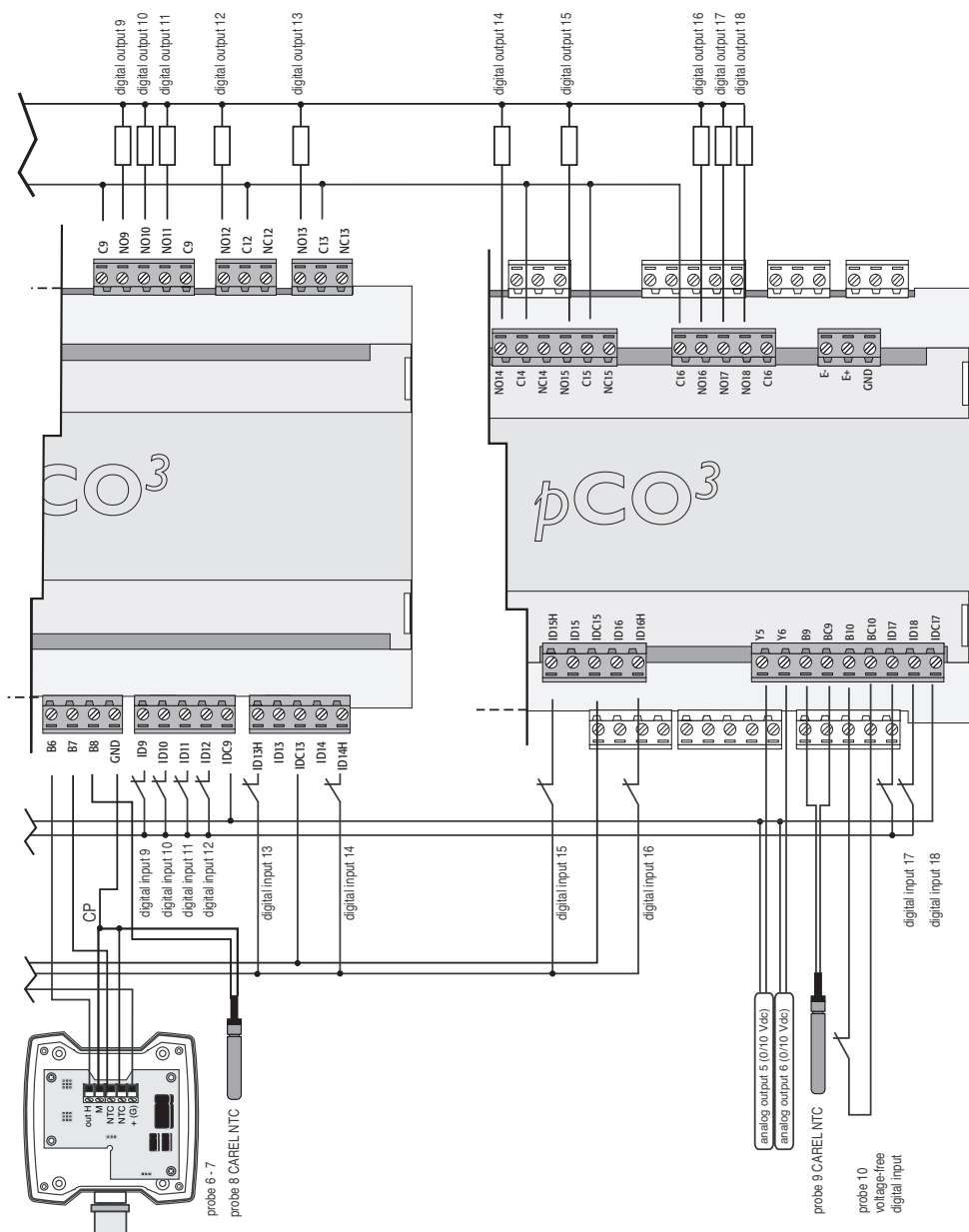
EXAMPLE GENERAL DIAGRAM OF THE ELECTRICAL CONNECTIONS

SMALL



MEDIUM

LARGE



CAREL

Technology & Evolution

CAREL S.p.A.

Via dell'Industria, 11 - 35020 Brugine - Padova (Italy)

Tel. (+39) 049.9716611 - Fax (+39) 049.9716600

e-mail: CAREL@CAREL.com - www.CAREL.com

Agenzia / Agency:

+050003290 - 1.4 - 28.09.2006