

pCO compact

electronic controller

CAREL



 Technical leaflet

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**READ AND SAVE
THESE INSTRUCTIONS**

Integrated Control Solutions & Energy Savings

1. INTRODUCTION

The new pCO compact series is the result of the need for a controller than can manage considerable information flows.

This feature adds to the numerous advantages of a programmable controller.

pCO compact is compatible with the pCO family at both a hardware and software level, the controller has been developed by CAREL in compliance with the European RoHS directive. Ideal as system coordinator, the simultaneous access to one supervisory systems and master functions make it versatile for all types of applications and requirements in the HVAC/R sector. The application program can be downloaded to the flash memory using the smart key PCOS00AKY0, or from a PC using the CVSTDUTLF0 USB-485 adapter and the pCO manager, or 1 tool program, or directly by USB connection in the provided models. The pCO compact can also execute a control program, and is fitted with a set of terminals for connection to devices such as probes, compressors, fans, etc.

The fast digital input can be used to directly read energy meters.

The program and the parameters are saved to FLASH memory and EEPROM, meaning the data is stored even in the event of power failures and without the need for a backup battery.

The program can be loaded from a PC (28.8 kbps and 115.2 kbps) or using the special programming key called the Smart Key. The optional connection to the supervisor-telemaintenance serial line using the CAREL or Modbus® communication protocol, over the RS485 standard, is made by fitting the pCO compact with one optional serial cards. Other optional cards can be used to connect to a supervisor over standards other than RS485 (communicating via BACnet, LON, SNMP, HTTP, e-mail, Konnex).

pCO compact has 3 serial interfaces, specifically:

- one BMS serial interfaces for serial cards
- one opto-isolated Field-Bus serial interface (alternatively can be used for the tLAN)
- one pLAN serial interface for acquiring or sharing data.

The built-in user interface consists of a White positivo LCD, with 132x64 pixel resolution and a six-button membrane keypad.

1.1 Versions available

The controller is available in two models: TYPE A and TYPE B, yet a different only maximum number of I/Os available.

Models	Description	Carel code
TYPE A	BASIC (RELAY)	PCOX000AA0
	BASIC (2 SSR)	PCOX002AA0
	+ BUILT-IN DISPLAY (RELAY)	PCOX000BA0
	+ BUILT-IN DISPLAY (2 SSR)	PCOX002BA0
	+ USB (RELAY)	PCOX000CA0
	+ USB + BUILT-IN DISPLAY (RELAY)	PCOX000DA0
TYPE B	BASIC (RELAY)	PCOX000AB0
	BASIC (2 SSR)	PCOX002AB0
	+ BUILT-IN DISPLAY (RELAY)	PCOX000BB0
	+ BUILT-IN DISPLAY (2 SSR)	PCOX002BB0
	+ USB (RELAY)	PCOX000CB0
	+ USE + BUILT-IN DISPLAY (RELAY)	PCOX000DB0

Tab. 1.a

1.2 Installation

Mechanical fastening

The pCO compact is installed on a DIN rail. To fasten the unit to the DIN rail, press it lightly 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.

1.3 Power supply

The power supply is connected between G and G0, with G0 clamp connected to earth (PE). For AC installation, use a 30 VA class II safety transformer, output voltage 24 Vac, supplying one pCO compact controller only.

If supplying multiple pCO compact controllers with the same transformer, the rated power of the latter must be $n \times 30$ VA, where "n" is the number of controllers being supplied by the transformer, regardless of the version of controller.

- The power supply to the pCO compact controller and terminal (or series of pCO compact controllers and terminals) should be separate from the power supply to the other electrical devices (contactors and other electromechanical components) inside the electrical panel.
- A 250 V (5x20) 800 mA T fuse must be installed in the power supply line of the controller and a 50 mA T - 250 V (5x20) must be installed in the power supply of SYNC clamp (only for 48 Vdc power supply). The power supply is functionally insulated from the rest of the I/O circuit, including the serial connections.
- The power cable should be wound twice around a ferrite (i.e. KITAGAWA part no. RI 18-28-10 - CAREL code 0907877AXX).
- The synchronicity line (SYNC) must be supplied by a class 2 safety transformer with 24 Vac output using the two pins on terminal "J2" called SYNC.

If the controller has a 24 Vac power supply, this can also be used to supply the SYNC signal. It is necessary to follow exactly the wiring connection in fig. 4.b.

If, on the other hand, the controller has a DC power supply 48 Vdc (36 Vmin. .. 72 Vmax), the SYNC connection must be supplied by a special transformer (at least 1 VA) connecting the 24 Vac output to the two SYNC pin. In this case, it must be protected by a 250 V 50 mA T fuse (follow the Fig. 4.c).

- To make the power supply connection to terminal J1, use a cable with a minimum cross-section of 1mm².

1.4 BMS serial options

	item	code	description
1	Modbus®/CAREL RS485	PCOS004850	opto-isolated RS485 serial
2	LON	PCO1000F0	LON FTT10 serial
3	Ethernet™ BACnet™ / SNMP / Modbus®	PCO1000WB0	Ethernet™ serial
4	BACnet™ RS485	PCO1000BD0	BACnet™ MS/TP 485 serial
5	RS232	PCO100MDM0	RS232 serial
6	CANbus	PCOS00HBB0	CANbus for slave serial port (BMS)
7	KONNEX	PCOS00KXB0	KONNEX serial BMS port

Tab. 1.b

1.5 Connectors

Electrical specifications of the plug-in connectors used

Step: 5.08 mm; Rated voltage: 250 V; Rated current: 12 A; Cable size: 0.25 mm² - 2.5 mm² (AWG: 24 to 12); Stripping length: 7 mm; Screw thread size: M3; Tightening torque: 0.5- 0.6 Nm
 Step: 3.81 mm; Rated voltage: 160 V; Rated current: 8 A; Cable size: 0.25 mm² - 1.5 mm² (AWG: 28 to 16); Stripping length: 7 mm; Screw thread size: M2; Tightening torque: 0.22- 0.25 Nm.

1.6 Installation warnings - operating environments and connections

Avoid assembling the boards in environments with the following characteristics:

- relative humidity greater than 90%;
- strong vibrations or knocks;
- exposure to continuous water sprays;
- exposure to corrosive or pollutant gases (e.g. sulphur or ammonia fumes, saline mist, smoke) so as to avoid corrosion and oxidation;
- strong magnetic and/or radio interference (therefore avoid installing the unit near transmitting antennae);
- exposure of the pCO compact to direct sunlight or the elements in general;
- large and rapid fluctuations in ambient temperature;
- environments where explosives or mixes of flammable gases are present;
- exposure to dust (formation of corrosive patina with possible oxidation and reduction of insulation).



For connection, the following warnings must be observed:

- provide a power supply switch in accordance with the local disposal legislation;
- using a different power supply from the one specified may seriously damage the system;
- use cable ends suitable for the terminals. Loosen each screw and insert the cable ends, then tighten the screws. When completed, lightly tug the cables to check that they are tight;
- separate as much as possible the probe and digital input signal cables from the cables carrying inductive loads and power cables to avoid possible electromagnetic disturbance. Never run power cables (including the electrical cables) and probe signal cables in the same conduits. Do not install the probe cables in the immediate vicinity of power devices (contactors, circuit breakers or similar);
- reduce the path of the probe cables as much as possible, and avoid spiral paths that enclose power devices;
- avoid touching or nearly touching the electronic components fitted on the boards, so as to avoid electrostatic discharges (extremely dangerous) from the operator to the components;
- separate the power supply to the digital outputs from the power supply to the pCO compact;
- when tightening the cables to the terminals do not exert excessive pressure on the screwdriver, to avoid damaging the pCO compact;
- disconnect the controller from the power supply before performing any maintenance or assembly operations;
- the controller has to be integrated inside an instrument panel and it has not to be reachable in order to avoid strokes and impacts;
- if the device is used in a manner not specified by the manufacturer, the rated protection of the device may be compromised.
- in case of failure of the control and of optional boards, please only refer to CAREL service;
- install optional boards and connectors only supplied by CAREL.

1.7 Maintenance



- Disconnect the device (turn OFF) before accessing inside parts or during maintenance;
- all service and/or maintenance operations must be performed by specialist and qualified personnel, in accordance with the safety standards and legislation in force.

2. TECHNICAL SPECIFICATIONS

2.1 Mechanical specifications

dimensions	available in 6 DIN module format 105x115x60 mm
assembly	DIN rail

2.2 Plastic case

- Fitted on DIN rail as per DIN 43880 and IEC EN 50022
- Material: technopolymer
- Flame retardance: V2 (UL94) and 960 °C (IEC 695)
- Ball pressure test 125 °C
- Resistance to creeping current ≥ 250 V
- Colour grey RAL7035

2.3 Electrical specifications

Isolated power supply	DC power supply: 48 Vdc (36 V min to 72 V max)
	AC power supply: 24 Vac +10% to -15 %, 50/60 Hz
CPU	Maximum power input: MEDIUM ver. P=6W, P=8VA, I _{max} =400mA LARGE ver. P=11W, P=14VA, I _{max} =700mA
	H8SX/1651 32-bit, 50 MHz
FLASH program memory	2+2 Mbytes
SRAM data memory	512 Kbytes, 16-bit
EEPROM parameter data memory	13 Kbytes + 32 kB
NAND FLASH memory	32 MByte
Duration of working cycle	0.2 s typical (applications of average complexity)
Clock	Available as standard and integrated on main board

Tab. 2.a

Battery specifications

The battery used inside the pCO compact is a "button" sized lithium battery, code CR2430, 3 Vdc, dimensions 24 mm x 3 mm.

2.4 SERIAL specifications

Item	Type	Reference	Main specifications			
Serial ZERO	PLAN	J4, J5	<ul style="list-style-type: none"> • Integrated on main board • Not opto-isolated • HW driver: RS485 • Connectors: Telephone jack + 3-pin plug-in p. 3.81 			
			CABLE LENGHT			
			Connector	Shielded cable type	Lmax (m)	Power supply
			J4	Telephone	50	given by pCO compact (150 mA)
			J4	AWG24	200	given by pCO compact (150 mA)
J4	AWG20/22	500	separated by TCONN6J000			
J5	AWG20/22	500	-			
Serial ONE	BMS 1	Serial Card 1	<ul style="list-style-type: none"> • Not integrated on main • HW driver: not featured • Allows all the pCO family optional BMS cards to be used • Maximum cable lenght: refer to technical leaflet of the serial card 			
Serial TWO	Opto-isolated FIELD Bus	J8	<ul style="list-style-type: none"> • Integrated on main board • Opto-isolated serial • HW driver: opto-isolated RS485 • 3-pin plug-in connector p. 3.81 • Maximum lenght of shielded cable AWG20/22: 500 m: 			
	tLAN	J6/J7	<p><u>Instead of the FieldBus serial, the following can be used:</u></p> <ul style="list-style-type: none"> • tLAN serial available on a 2-pin connector, p. 3.81 (J7) • connection to a PLD terminal available via special 4-pin connector (J6) • J7: maximum lenght of shielded cable (2 wires + shield) AWG20/22: 30 m • J6: maximum lenght of 4-wires cable (see accessories table): 2 m for domestic application, 10 m for residential application 			

Tab. 2.b

Note:

Use only STP or S/UTP cable with both extremity of shield connected to PE (see par. "Electrical connections").

- The serial 2 has been designed to be MASTER. This implicates that possible pCO compact SLAVES, can not be connected using his own serial 2. Nevertheless it is possible connect only one pCO compact using his own serial 2.

2.5 pLAN network/user terminal connection

Type	Asynchronous half duplex RS485
Transmission speed	62.5 Kbps or 115.2 Kbps selected via software
Maximum number of units connectable	Maximum 32 units allowed
Connector for terminal	6-pin shielded telephone (J4)
Connector for pLAN network, Graphic terminal, Aria terminal	3-pin plug-in connector, pitch 3.81 mm (J5)

Tab. 2.c

Note:

- J4 can only be connected to one terminal (pCOT, pCOI, pGD0 and pGD1) or two terminals without using the backlighting for the display.
- The Graphic terminal and Aria terminal must be always powered with separate power supplies.

2.6 tLAN network connection

Type	Asynchronous half duplex 0/5 Vdc, non-differential
Transmission speed	9.6 Kbps or 19.2 Kbps selected via software
Maximum number of units connectable	Maximum 5 units allowed
Connector for tLAN network	2-pin plug-in connector, pitch 3.81 mm (J7)

Tab. 2.d

Note:

- The tLAN serial (J7) can be used as an alternative to either the FieldBus serial available on the 3-pin connector p. 5.08 (J8); or to the PLD terminal connection available on the special 4-pin connector (J6).

2.7 Analogue inputs

Maximum lenght cable	10 m	
Analogue conversion	A/D converter, 10-bit CPU built-in	
Models	TYPE A	TYPE B
CAREL NTC -50T90 °C; R/T 10 kΩ at 25 °C or HT NTC 0T150 °C	B1, B2, B3, B4, B5, B6, B7, B8	B1, B2, B3, B4, B5, B6
Voltage, 0 to 1 Vdc	B1, B2, B3, B4, B5, B6	
Voltage, 0 to 5 Vdc ratiometric	B1, B2, B5, B6	
Voltage, 0 to 10 Vdc	B1, B2, B5, B6	
Current, 0 to 20 mA or 4 to 20 mA	B1, B2	
PT1000 -100T200 °C; R/T 1000 Ω at 0 °C	B3, B4	
Voltage-free digital input (5 mA)	B5, B6, B7, B8	B5, B6
Total	8	6

Tab. 2.e

Warning: for the power supply to any active probes, the +21 V available on the VDC terminal can be used, maximum current available $I_{max} = 60$ mA, protected against short-circuits. For the power supply to the 0 to 5 Vdc ratiometric probes, use the +5 VREF, maximum current available $I_{max} = 60$ mA, protected against short-circuits.

Specifications

Time constant	0.5 s
Precision	± 0.3 % of full scale
Classification of measuring circuits	Category 1 (IEC EN 61010-1)

Tab. 2.f

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

2.8 Digital inputs

Maximum lenght cable	10 m	
Type	Not optically isolated, voltage free contact	
Power supply	Internal	
Models	TYPE A	TYPE B
Multifunction analogue inputs (see note)	B5, B6, B7, B8	B5, B6
Fast digital input	ID1	ID1
Normal digital input	ID2	ID2
Total	6	4

Tab. 2.g

Note:

Multifunction analogue inputs: these analogue inputs can be programmed via software as digital inputs instead of analogue inputs. All the digital inputs refer to GND.

Specifications of the fast digital input (ID1)

The fast digital input (ID1) can be configured via software in two distinct operating modes, as follows:

- first mode: normal or standard digital input
- second mode: fast digital input

When configured as a fast digital input, ID1 can measure a signal with a maximum frequency of 2 KHz, resolution +/- 1 Hz. This is made possible by the BIOS, which provides the SW application with two variables that the count the number of times the input signal crosses zero and the corresponding frequency in Hz.

Specifications of the normal and fast digital input

The maximum current available to the digital input is 5 mA (consequently the rating of the external contact must be at least 5 mA).

2.9 Analogue outputs

Maximum lenght cable	10 m	
Type	Not optically isolated	
Power supply	Internal	
Models	TYPE A	TYPE B
0 to 10 Vdc analogue output	Y2	Y2, Y3, Y4
PWM analogue output with 5 Vdc pulse of programmable duration	Y1	Y1
Total	2	4

Tab. 2.h

Specifications

Resolution	8 bit
Precision	± 2% of full scale on Y2
Settling time	2 s
Maximum load	1 k Ω (10 mA) for Y2.0 to 10 V, 470 Ω (10 mA) for Y1 PWM

Tab. 2.i

2.10 Digital outputs

pCO compact TYPE A has 7 digital outputs, while pCO compact TYPE B has 6 digital outputs with electromechanical relays or Solid state relay (SSR). To simplify assembly, the common terminals of some relays have been grouped together based on the insulation distance.

Within a group, the outputs have single insulation between them and thus must be powered at the same voltage (generally 24Vac or 110-230Vac). Between the groups there is reinforced insulation, thus the groups can be powered at different voltages.

Output technical specification	Insulation group	Connector	Models			
			Type A	Type A (2 SSR)	Type B	Type B (2 SSR)
SPDT relay: UL873: 2,5 A res., 2 A FLA, 12 A LRA, 250 Vac, C300 pilot duty (30.000 cycles) EN60730-1: 2 A res., 2 A inductive $\cos(\phi)=0,6$, 2 (2) A (100.000 cycles)	1	J3	1	-	1	-
	2	J10	1	-	1	-
relè SPST: UL873: 1 A res., 1 A FLA, 6 A LRA, 250 Vac, D300 pilot duty (30.000 cycles) EN60730-1: 1 A res., 1 A inductive, $\cos(\phi)=0,6$, 1 (1) A (100.000 cycles)	3	J11	5	5	2	2
	4	J12	-	-	2	2
Relè Power MOSFET Photovoltaic Operation voltage: 24 Vac/Vdc Maximum power: 10 W	1	J3	-	1	-	1
	2	J10	-	1	-	1
	3	J11	-	-	-	-
	4	J12	-	-	-	-
Outputs total			7	7	6	6

Tab. 2.j

2.11 USB Port



The USB connections have to be used only during commission and maintenance action.

Removing the cover from the front of the pCO compact devices fitted of USB port, there are 2 types of USB port; one of these has the function of USB SLAVE (USB standard type B connector) and the other USB HOST (USB standard type A connector).

The two connectors cannot be used at the same time.

The USB link can be used to download and upload the BIOS and applications, as well as carry out the commissioning operations.

Configurations available:

Hardware configuration	Type	Upload FW		Download FW		Commissioning
		USB HOST	USB DEVICE	USB HOST	USB DEVICE	
TYPE A	+ USB	with external PGD0/1 terminal only	●	with external PGD0/1 terminal only	logs and parameters only	●
	+ USB+BUILT-IN DISPLAY	●	●	●	logs and parameters only	●
TYPE B	+ USB	with external PGD0/1 terminal only	●	with external PGD0/1 terminal only	logs and parameters only	●
	+ USB+BUILT-IN DISPLAY	●	●	●	slogs and parameters only	●

Note: FW = BIOS and/or Application.

The USB HOST can be used, for example, to connect a memory key; the USB SLAVE can be connected to a PC.

2.12 Summary tables

Hardware configurations available

Models	PWM output	0...10 V output	Analogue inputs	Digital inputs	Group 1 output	Group 2 output	Group 3 output	Group 4 output	
TYPE A	Y1	Y2	B1, B2		NO1: - relay (1) - SSR (3)	NO2: - relay (1) - SSR (3)	NO3, NO4, NO5, NO6, NO7: - Relay (2)	-	
			B3, B4						
			B5, B6						
			B7, B8						
				ID1 (veloce)					
				ID2					
				Max 8					Max 6
TYPE B	Y1	Y2, Y3, Y4	B1, B2		NO1: - relè (1) - SSR (3)	NO2: - relè (1) - SSR (3)	NO3, NO4: - Relay (2)	NO5, NO6: - Relay (2)	
			B3, B4						
			B5, B6						
				ID1 (veloce)					
				ID2					
				Max 6					Max 4

Tab. 2.k

(1) Note: the relay is present instead of the SSR in the models not designed for having SSR.

Relay specifications:

UL873: 2,5 A res., 2 A FLA, 12 A LRA, 250 Vac, C300 pilot duty (30.000 cycles)

EN60730-1: 2 A res., 2 A inductives, $\cos(\phi)=0,6$, 2 (2) A (100.000 cycles)

(2) Note: the relay is present instead of the SSR in the models not designed for having SSR.

Relay specifications:

UL873: 1 A res., 1 A FLA, 6 A LRA, 250 Vac, D300 pilot duty (30.000 cycles)

EN60730-1: 1 A res., 1 A inductives, $\cos(\phi)=0,6$, 1 (1) A (100.000 cycles)

(3) Note: the SSR is present instead of the relay in the models designed for having 2 SSR.

SSR specification:

Relay Power MOSFET Photovoltaic, Operation voltage: 24 Vac/Vdc, Maximum power: 10 W

SSR specification:

Relay Power MOSFET Photovoltaic, Operation voltage: 24 Vac/Vdc, Maximum power: 10 W

Types of analogue/digital inputs

All the analogue inputs are can be configured via software, according to the following table, in the models TYPE A and TYPE B.

Symbol	NTC	ID	PT1000	4 to 20 mA	0 to 5 V	0 to 1 V	0 to 10 V
B1, B2	•			•	•	•	•
B3, B4	•		•			•	
B5, B6	•	•			•	•	•
B7, B8	•	•					

Tab. 2.o

2.13 Table of accessories

	code	description
1	PCOXCON0A0	plug-in screw connector kit for pCO compact MEDIUM type A
2	PCOXCON0B0	plug-in screw connector kit for pCO compact LARGE type B
3	PCOS00AKY0	pCO sistema smart key
4	0907877AXX	external ferrite for pCO compact power cable
5	PSTCON01B0	pLD terminal connection cable L= 1.5 m
6	PSTCON03B0	pLD terminal connection cable L= 3 m
7	PSTCON05B0	pLD terminal connection cable L= 5 m
8	S90CONN002	pGD terminal connection cable L= 0.8 m
9	S90CONN000	pGD terminal connection cable L=1.5 m
10	S90CONN001	pGD terminal connection cable L= 3 m

Tab. 2.p

2.14 Other specifications

Operating conditions	-10T60 °C, 90% rH non-condensing
Storage and transport conditions	-20T70 °C, 90% rH non-condensing
Index of protection	IP40 front panel only
Environmental pollution	2
Classification according to protection against electric shock	to be integrated into Class 1 and/or 2 appliances
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 2
Ageing characteristic (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 against surges	Category 3 (IEC EN 61000-4-5)

Tab. 2.q

The device is not designed to be hand-held

3. MECHANICAL DIMENSIONS

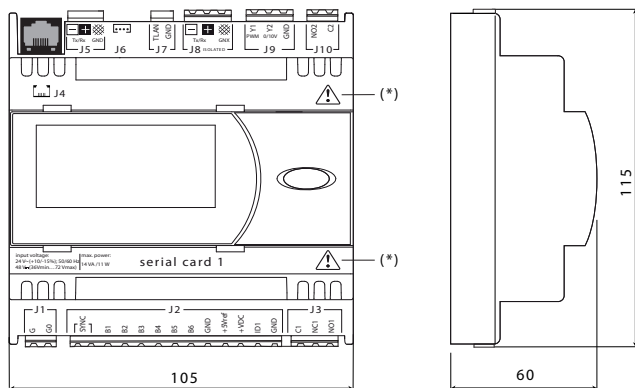
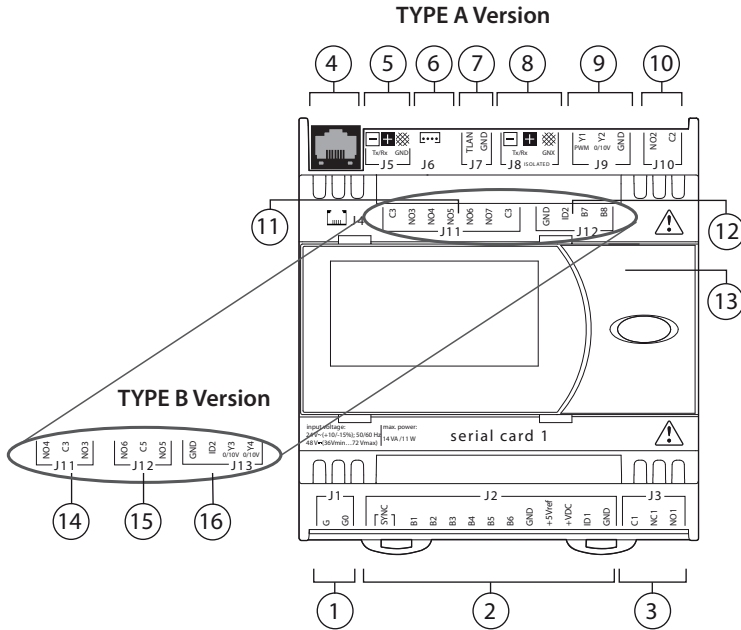


Fig. 3.a

(*) The icon  means to refer to this technical leaflet, during the electrical installation.

4. DESCRIPTION OF THE TERMINALS

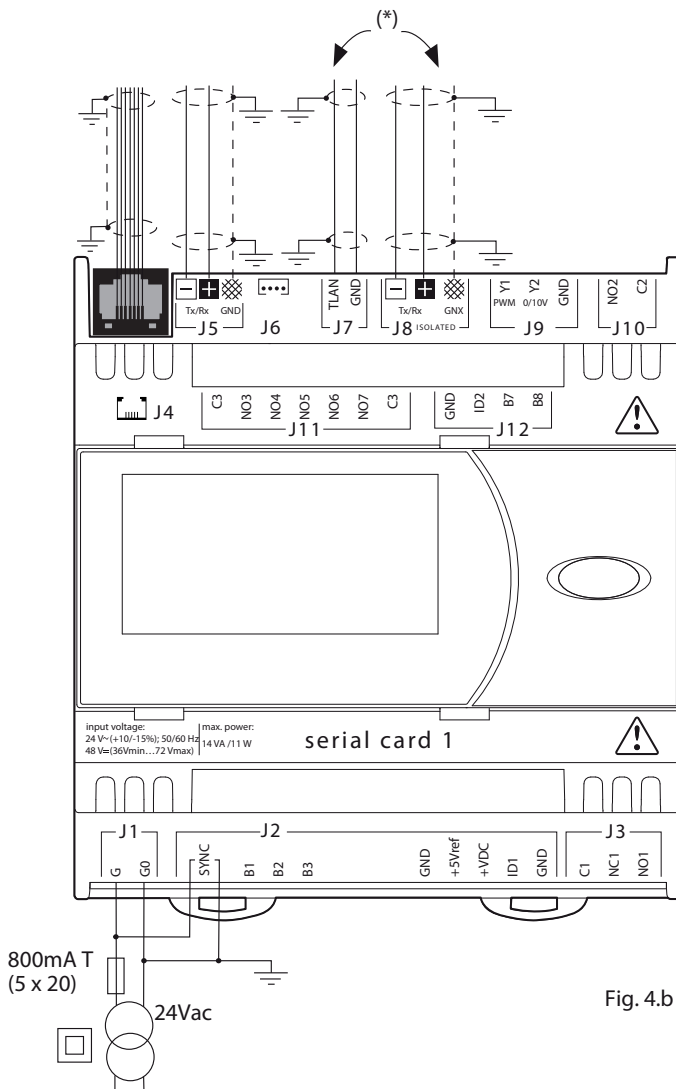


Legenda:

- | | |
|----|---|
| 1 | power supply connector
(G, GO) 24 Vac or 48 vdc (36 Vdc min...72 Vdc max) |
| 2 | "SYNC" synchronicity inputs for phase control and NTC, 0...1 V, 0 to 5 V, 0 to 20 mA, 4 to 20 mA +5 Vref for probe power supply, 5 V ratiometric and +VDC (+21 Vdc) for active probes |
| 3 | digital output |
| 4 | connector for all pCO series standard terminals and downloading the application program |
| 5 | pLAN connector |
| 6 | pLD terminal connector |
| 7 | tLAN connector |
| 8 | opto-isolated "Field-Bus" serial connector |
| 9 | 0 to 10 V and PWM (phase control) analogue outputs |
| 10 | digital output |
| 11 | digital outputs (Type A) |
| 12 | NTC analogue inputs and digital inputs (Type A) |
| 13 | removable door to access the USB ports |
| 14 | digital outputs (Type B) |
| 15 | digital outputs (Type B) |
| 16 | digital input and analogue outputs 0 to 10 V (Type B) |

4.1 Electrical connections

AC power supply



COMMON power supply for controller & SYNC

(*) the use of tLAN port excluded the use of Field Bus port and vice versa.

DC power supply

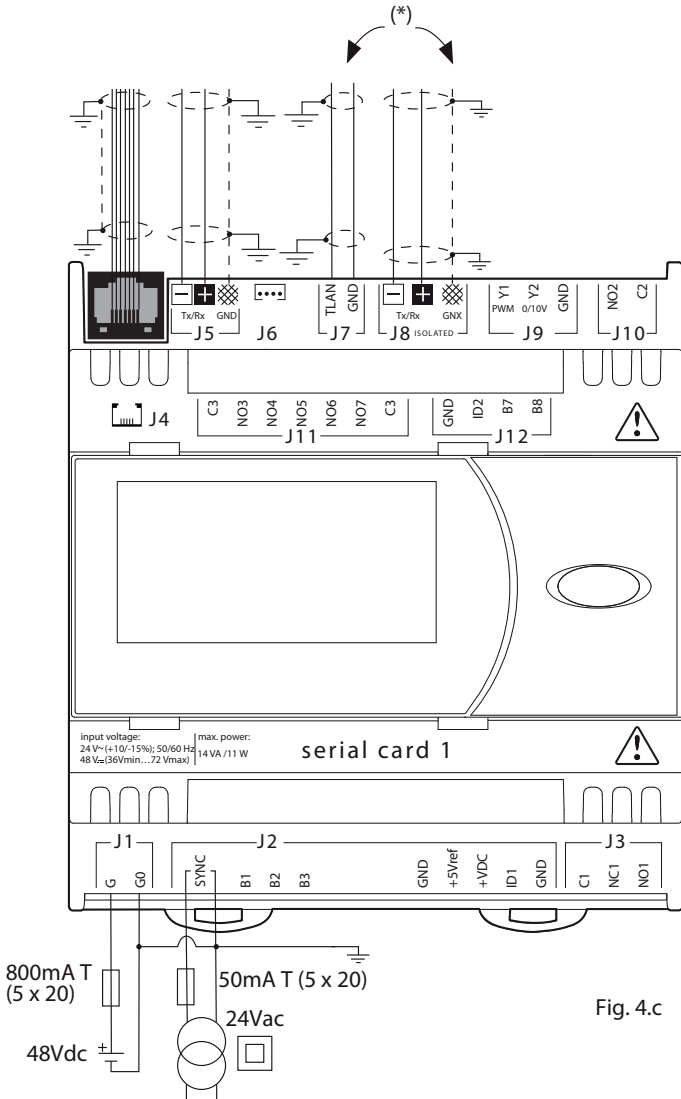


Fig. 4.c

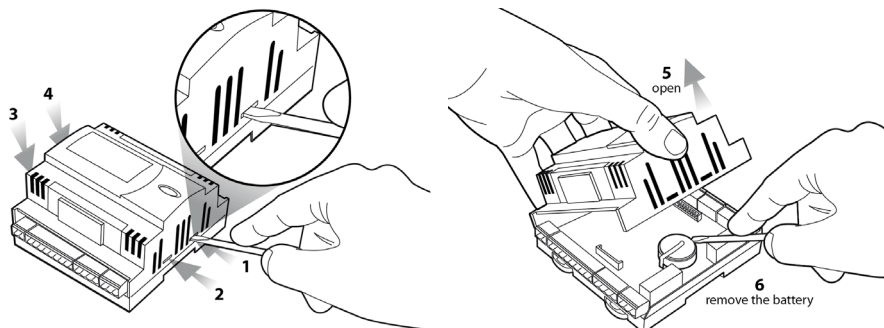
Fig. 4.c

SEPARATE power supply for controller & SYNC

(*) the use of tLAN port excluded the use of Field Bus port and vice versa.

Guidelines for disposal

- Do not dispose of the product as municipal waste; it must be disposed of through specialist waste disposal centres.
- The product contains a battery that must be removed and separated from the rest of the product according to the instructions provided, before disposing of the product.
- Improper use or incorrect disposal of the product may have negative effects on human health and on the environment.
- The public or private waste collection systems defined by local legislation must be used for disposal.
- In the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.



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

CAREL

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