Heos sistem

Waterloop controller

CAREL

ENG

User manual

Code: **OSSTDmWLCN**

LEGGI E CONSERVA QUESTE ISTRUZIONI

READ AND SAVE THESE INSTRUCTIONS

NO POWER & SIGNAL CABLES TOGETHER

READ CAREFULLY IN THE TEXT!

Integrated Control Solutions & Energy Savings

WARNINGS

CAREL bases the development of its products on decades of experience in HVAC, on the continuous investments in technological innovations to products, procedures and strict quality processes with in-circuit and functional testing on 100% of its products, and on the most innovative production technology available on the market. CAREL and its subsidiaries nonetheless cannot guarantee that all the aspects of the product and the software included with the product respond to the requirements of the final application, despite the product being developed according to start-of-the-art techniques. The customer (manufacturer, developer or installer of the final equipment) accepts all liability and risk relating to the configuration of the product in order to reach the expected results in relation to the specific final installation and/or equipment. CAREL may, based on specific agreements, acts as a consultant for the positive commissioning of the final unit/application, however in no case does it accept liability for the correct operation of the final equipment/system.

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In addition to observing any further warnings described in this manual, the following warnings must be heeded for all CAREL products:

- prevent the electronic circuits from getting wet. Rain, humidity and all types of liquids or condensate contain corrosive minerals that may damage the electronic circuits. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual.
- do not install the device in particularly hot environments. Too high temperatures may reduce the life of electronic devices, damage them and deform or melt the plastic parts. In any case, the product should be used or stored in environments that comply with the temperature and humidity limits specified in the manual.
- do not attempt to open the device in any way other than described in the manual.
- do not drop, hit or shake the device, as the internal circuits and mechanisms may be irreparably damaged.
- do not use corrosive chemicals, solvents or aggressive detergents to clean the device.
- do not use the product for applications other than those specified in the technical manual.

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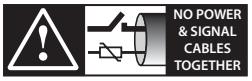
IMPORTANT



READ CAREFULLY IN THE TEXT!

Separate as much as possible the probe and digital input cables from the cables carrying inductive loads and power cables to avoid possible electromagnetic disturbance.
Never run power cables (including the electrical panel cables) and signal cables in the same conduits.

DISPOSAL

INFORMATION FOR USERS ON THE CORRECT HANDLING OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

In reference to European Union directive 2002/96/EC issued on 27 January 2003 and the related national legislation, please note that:

- WEEE cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
- the public or private waste collection systems defined by local legislation must be used. In addition, the equipment can be returned to the distributor at the end of its working life when buying new equipment;
- the equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
- the symbol (crossed-out wheeled bin) shown on the product or on the packaging and on the instruction sheet indicates that the equipment has been introduced onto the market after 13 August 2005 and that it must be disposed of separately;
- in the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.

Warranty on materials: 2 years (from the date of production, excluding the consumable parts.

Certification: the quality and safety of CAREL S.p.A. products are guaranteed by the ISO 9001 certified design and production system.

Content

1. INTRODUCTION

1.1 Main features

"Waterloop controller" guarantees control of water loops in the most-commonly used commercial refrigeration configurations, in which Heos manages the showcases. LThe control board features a built-in display for setting the parameters directly on the controller, and is ready for DIN rail mounting, while connection to the Carel boss is available for complete refrigeration system management/service.

Main features:
- Management of a drycooler, including evaporative cooling (ChillBooster)
- Use of tandem pumps, including with 0 to 10 Vdc analogue control
- Enable chiller operation for low temperature units
- Possibility of integration with PVpro/boss
- Management of time bands for chiller operation
- Management of two generic loops with analogue or digital outputs
- Digital control of one or two Cooling/Heating changeover valves

The main components in the system are shown below.

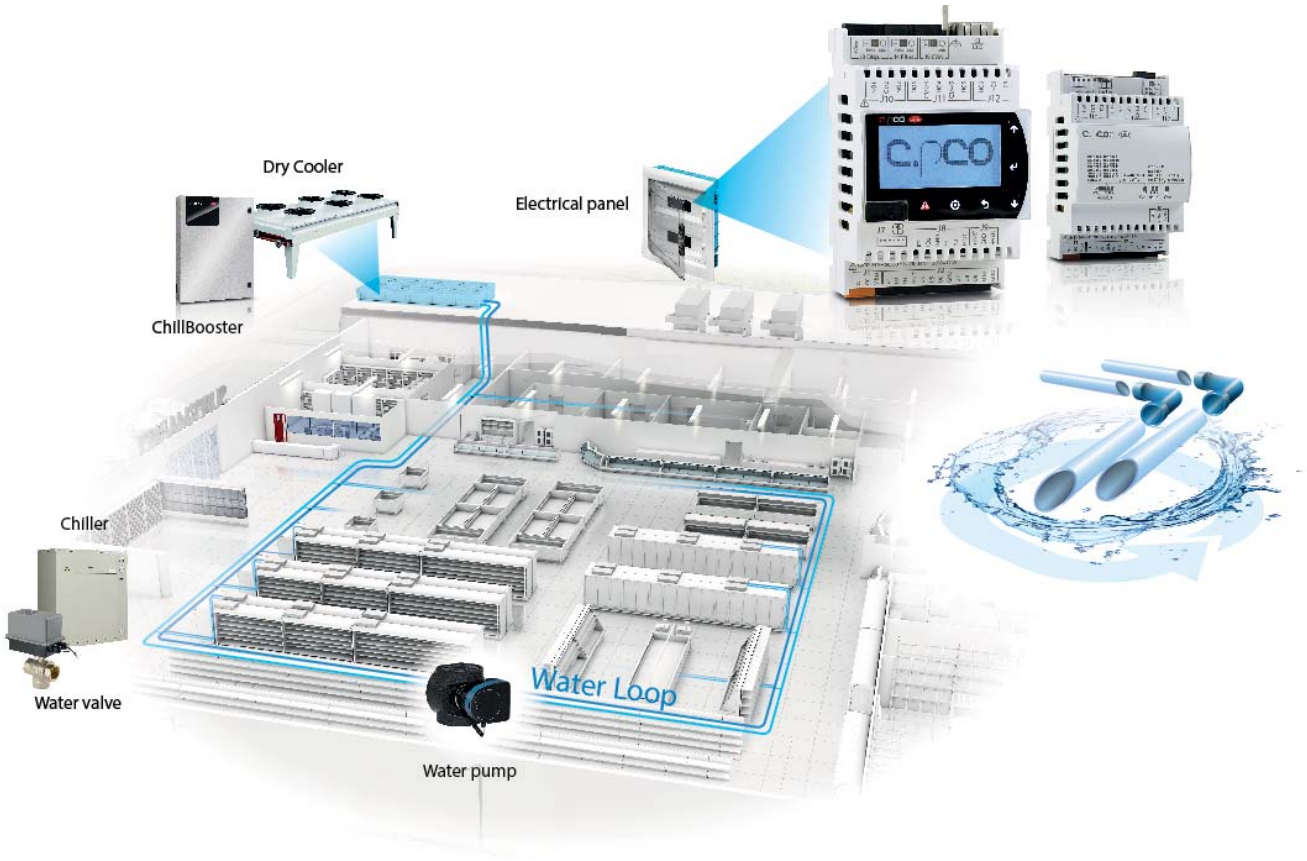


Fig. 1.a

1.2 Components and accessories

Code	Description
P+D000UE1DEF0	c.pco mini DIN Enhanced
P+D000NH1DEF0	c.pco mini DIN High-End
P+E0000000000	c.pcoe I/O expansion
P+D0CON0E0	cpco mini connector kit
P+D0CON0B0	cpcoe connector kit
PGDEH00FZ0	pGDE, for panel installation, with optional buzzer
S90CONN0S0	Cable for pGD evolution display, L= 1.5 m for cpco mini
NTC030HP00	NTC temp. probe, HP IP67, -50T50, 3 m long
SPKT0011C0	Stainless steel pressure probes, 4-20 mA, 0-10 bar
SPKT005310	Cable for pressure probes L=5 m
DPPC214000	Outside T+H sensor, serial -20T70°C - 0 to 100% rH
DPPC114000	Outside T+H sensor, serial -10T60°C - 10 to 90% rH
DWPC114000	Serial room T+H probe -10T60°C - 10 to 90% rH

Tab. 1.a

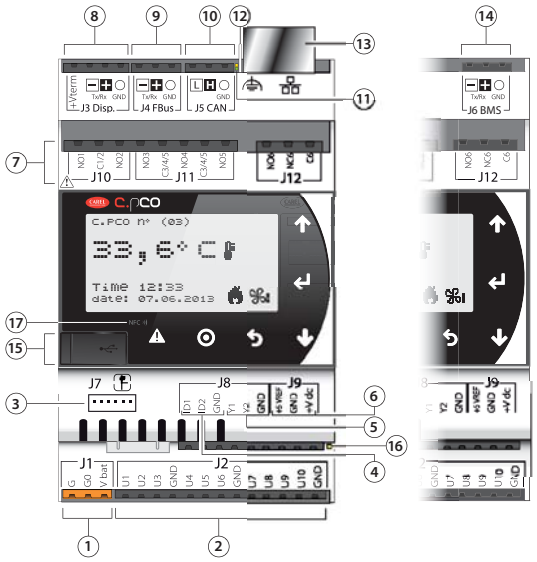
2. INSTALLATION

2.1 c.pCO mini

For further features, see the technical leaflet +050001590

High-end version

Enhanced version



c.pCOe

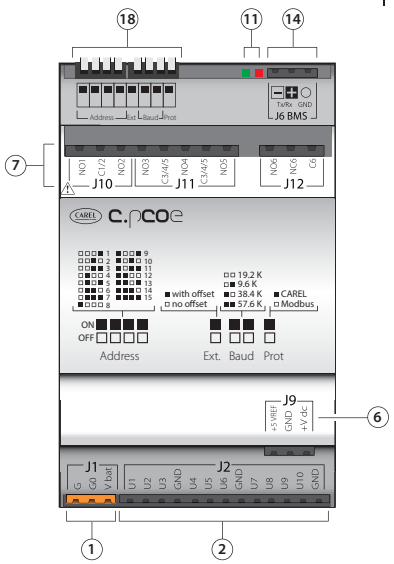


Fig. 2.a

Legende:

		High-end	Enhanced	c.pCOe
1	Power connector [G(+), G0(-), Vbat]	✓	✓	✓
2	Universal inputs/outputs	✓	✓	✓
3	Single-pole valve connectors	✓	✓	
4	DI: digital inputs with voltage-free contacts	✓	✓	
5	Analogue outputs	✓	✓	
6	+Vdc power supply for active probes +5V power supply for ratiometric probes	✓	✓	✓
7	Relay digital outputs	✓	✓	✓
8	External terminal connector +Vterm: terminal power supply	✓	✓	
9	FieldBus connector	✓	✓	
10	CANBus connector	✓		
11	Communication LED	✓		✓
12	Ethernet earth spade connector (Ethernet version only)	✓		
13	Ethernet connector (Ethernet version only)	✓		
14	BMS connector (BMS version only)		✓	✓
15	MicroUSB port	✓	✓	
16	Power LED	✓	✓	
17	NFC antenna	✓		
18	Configuration dipswitches			✓

Tab. 2.a

I/O Specification

Digital inputs

Type: digital inputs with voltage-free contacts
Number of digital inputs (DI): 2
Maximum current output: 5 mA
Maximum voltage with the contact open: 12 Vdc
Maximum connection cable length: less than 10 m

Analogue outputs

Type: 0 to 10 Vdc continuous, PWM 0/10 V 100 Hz synchronous with power supply to control phase-cutting module, PWM 0/10 V frequency 100 Hz, PWM 0/10 V frequency 2 kHz, selectable from application program
Number of analogue outputs (Y): 2
Maximum current output: 10 mA
PWM output duty cycle selectable from application program: operating range 0% - 10%...90% - 100% (values in the range 1..9% - 91..99% are not managed).
Precision of analogue outputs: ± 3% of full scale
Maximum connection cable length: less than 10 m

Universal channels

Analogue/digital conversion: 14-bit
Type of input selectable from application program: NTC, PT1000, PT500, PT100, 4 to 20 mA, 0 to 1 V, 0 to 5 V, 0 to 10 V, 0 to 2 kHz (risolution ± 1Hz) on/off or open collector digital input (Rpullup 2 kOhm)
Type of output selectable from application program: PWM 0/3.3 V 100 Hz, PWM 0/3.3 V 2 kHz, 0 to 10 V analogue output; Maximum current output 2 mA
Number of universal channels (U): 10
Precision of analogue input reading: ± 0.3% of full scale
Analogue output precision: ± 2% of full scale
Maximum connection cable length: less than 10 m

Digital outputs

Group 1 (R1, R2); Group 2 (R3, R4, R5): Switchable power: NO EN 60730-1: 2(1) A (50,000 cycles); UL60730: 5 A resistive, 250 Vac, 30k cycles, 105°C, Defined Purpose, 1FLA, 6LRA, 250 Vac, 30k cycles, 105°C, pilot duty C300, 250 Vac, 30k cycles, 105°C.
Group 3 (R6): Switchable power: NO EN 60730-1: 1(1) A (100,000 cycles)
Maximum switchable voltage: 250 Vac; UL 60730-1: 1 A resistive, 1 A FLA, 6 A LRA, 250 Vac, D300 pilot duty, 30,000 cycles.
Switchable power R2, R3 with SSR assembly: 15 VA 110/230 Vac or 15 VA 24 Vac according to the model purchased.
Between Group 1 and Group 2 there is basic insulation. Group 3 has reinforced insulation from the two other groups and consequently a different power supply can be used.
Maximum connection cable length: less than 30 m

Controller electrical and physical specifications

Power supply:

Power supply to the product between G and G0: 24 Vac +10%/-15% 50/60 Hz, 28 to 36 Vdc +10% to -15%;
Power supply to the product between G0 and Vbat: +18 Vdc only for power supply from the Ultracap module (EVD0000UC0).
NB: with Vdc power supply, forced closing of the ExV in the event of power failures is not managed.
Minimum product functioning when correctly operating connected to the Ultracap module: 60 seconds without forced valve closing, 40 seconds with forced valve closing
Maximum power consumption: 30 VA /12W (40 VA for power supply combined with Ultracap module). Reinforced insulation between main power supply and controller guaranteed by the safety power transformer.
Protection against short-circuits: external 2.5 AT fuse. The product does not have protection against short-circuits and overloads (IEC61558-2-6).
Maximum connector voltage (NO1…C6): 250 Vac;
Minimum size of digital output wires: 1.5 mm^2
Minimum size of all other connector wires: 0.5 mm^2

IMPORTANT: Use a transformer with G0 earthed (compulsory) in the version with ETHERNET communication port.
Power supply to the product must only be connected between G and G0.
The Vbat terminal is only used for connection to the Ultracap module as emergency power supply in the event of power failures

Power supplied by the product
Type: +Vdc for external probe, +5 Vref for external probe; +Vterm for terminals
Rated voltage +Vdc: 12 Vdc ±8%
Max current available +Vdc: 50 mA, protected against short-circuits
Rated voltage +5Vref: 5 Vdc ±3%
Max. current available (+5 Vref): 50 mA, protected against short-circuits
Rated voltage +Vterm: from 24 to 36 Vdc ±5% according to product power supply voltage.
Max. current available 100 mA, suitable for powering the CAREL pGD1, pLDPRO and thTUNE terminals, protected against short-circuits
Max. connection cable length: less than 10 m

Internal clock specifications

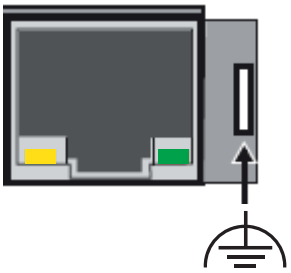
Internal clock precision: 50 ppm
Removable battery specifications: lithium button battery, BR2032, 3 Vdc
Battery life: minimum 5 years in normal operating conditions
Instructions for replacing the battery: do not replace the battery, contact Carel for replacement
Battery use: the battery is only used for correct operation of the clock when the product is not powered. Using the product at the limits of operating temperature reduces battery life.
Have the battery replaced if the time is not updated when restarting the product.

Communication port specifications

Type: all pGD1, pLDPRO, thTUNE and pGDTouch terminals. On DISPLAY PORT
Maximum length of the connection cables:
- 2 m with unshielded cable;
- 50 m with AWG24 shielded cable, earthed at both ends.

Maximum number of terminals connectable:
- one pGD1 family or one pLDPRO terminal if powered by c.pCOMini, maximum three if powered externally.
- one thTune terminal if supplied by c.pCOMini, maximum eight if powered externally.
- one pGDTouch terminal, always supplied externally.

Communication lines available
No. and type of lines available:
- 1 Master RS485 line, not opto-isolated for FieldBus (depending on the model)
- 1 Slave RS485 line, not opto-isolated for BMS (depending on the model)
- 1 Slave RS485 line, not opto-isolated for Display
- 1 CANbus line, not opto-isolated for CAN; (depending on the model) [CAN-ready only]. NB: For correct operation, install two 120Ω terminating resistors at the ends of the CANbus network
- 1 shielded RJ45 Ethernet line (depending on the model). To the Ethernet port only one circuit type SEL CIRCUIT can be connected.



Maximum serial port connection cable length: 2 m with unshielded cable for FieldBus and Display port, 500 m with AWG24 shielded cable earthed at both ends.
For the BMS port, always use shielded cable earthed at both ends.

Maximum Ethernet port connection cable length (according to the model purchased): 100 m CAT-5 STP
Earth with 6.3 mm female spade as shown in the figure below. Use a spade without plastic cap

Built-in terminal (according to the model purchased):
132x64 pixels with 6-button backlit keypad

NFC TAG (on models where featured): used to exchange information with external devices featuring this technology.

Operating conditions

Version without LCD
Storage: -40T70 °C, 90% rH non-condensing
Operation: -40T70 °C, 90% rH non-condensing.

Version with LCD
Storage: -30T70 °C, 90% rH non-condensing
Operation: -20T60 °C, 90% rH non-condensing.

Physical specifications

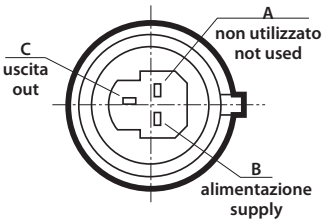
Dimensions: 4 DIN modules = 70 x 110 x 63 mm; panel = 147.3 x 81.3 x 70.5 mm
DIN mounting: fitted on DIN rail in accordance with DIN 43880, CEI EN 50022

Other specifications

Environmental pollution: level II
Front panel ingress protection (with USB port closed):
DIN version = IP40; panel version = IP65
Class of protection against electric shock: to be integrated into Class I and/or II appliances (for Basic/Enhanced) - Class I (High-End)
Material: technopolymer
Flammability: V2 (UL94) and 850 °C (in accordance with IEC 60695)
PTI of the PCB insulating materials: PTI250; Insulating material: PTI 175
Colour: white RAL 9016
Ball pressure test temperature 125 °C
Period of stress across the insulating parts: long
Type of action: 1C; 1Y for SSR versions
Type of disconnection or microswitching: microswitching
Heat and fire resistance category: category D (UL94 - V2)
Overvoltage category: category II
Software class and structure: Class A
Do not touch or tamper with the device when powered.

Note: The versions with LCD feature an auto-off function after 30 minutes of no activity. This time can be changed in the application program, but MUST NOT BE disabled

2.2 Pressure probes (SPKT00**C0)



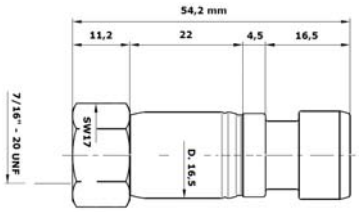


Fig. 2.b

General features

CAREL electronic pressure probes have been developed for applications in the refrigeration and air-conditioning sectors. The output is a current signal (4 to 20 mA), and the probe must be powered with direct current (8-28 Vdc).

Description of codes and models

Code	Pressure psi		Pressure bar		Material	over range		Pressure burst	
	4 mA	20 mA	4 mA	20 mA		psi	bar	psi	bar
SPKT0021C0	-8	100	-0,5	7	316L st. steel	210	15	7680	530
SPKT0011C0	0	145	0	10	316L st. steel	290	20	7680	530

Tab. 2.b

Technical specifications

power supply	8 to 28 Vdc, ±20%
output	4 to 20 mA
male connection thread	7/16" 20 UNF
female connection thread	7/16" 20 UNF
operating conditions	-40T135°C female
storage conditions	-40T135°C
fluid temperature (average)	-40T135°C
linearity	typical +/- 0,5% FS, max +/- 1% FS
total precision	typical +/- 1% FS, max +/- 2% FS (0T50°C), max +/- 4% FS (-20T80°C)
index of protection	IP67
shock	20 g* sinusoidal, 11 msec
vibrations	5 to 2000 Hz/10 g in directions x - y - z
pollution	Normal
tightening force	12 to 16 Nm
Compatible with all types of refrigerants	

Tab. 2.c

Note: FS=MAX output – MIN output

2.3 Temperature/Humidity serials probes

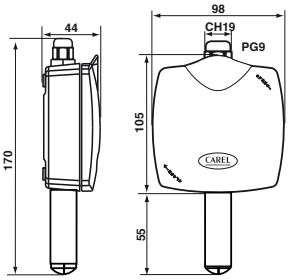


Fig. 2.c

Part numbers and models

P/N	Description	Range
DPPC114000	temperature and humidity probe for industrial environments with optically-isolated RS485 serial output -10T60 °C	10...90% rH
DPPC214000	temperature and humidity probe for industrial environments with optically-isolated RS485 serial output -20T70 °C	0...100% rH

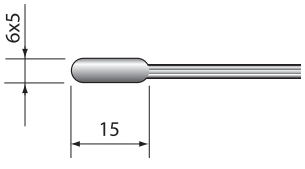
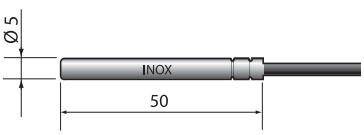
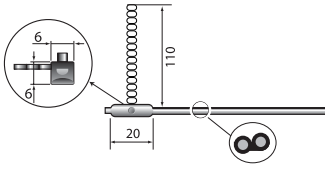
Tab. 2.d

Technical specifications

Power supply	12 to 24 Vac +/-10% or 8-32 Vdc (min-max)
Current draw	Direct serial version typ-max: 5 to 12 mA @ 12 Vdc power supply, 4 to 8 mA @ 24 Vdc power supply
	Optically-isolated serial version typ-max: 14 to 20 mA @ 12 Vdc power supply, 9 to 13 mA @ 24 Vdc power supply
Operating range	Temperature from -10 °C to +60 °C or -20°C to +70°C
	Humidity from 00 to 100%RH or 10 to 90 % RH
Precision	Temperature +/-0.5°C at 25°C, +/-0.9°C -10T60 °C (*)
	+/-0.5°C at 25°C, +/-1.0°C -20T70 °C
	Humidity' +/-3%RH at 25°C/50%RH, +/-5%RH -10T60 °C (*)
	+/-2%RH at 25°C/50%RH, +/-5%RH -20T70 °C
Storage	-20T70 °C; 20 to 90%RH non-condensing
Operating limits	-20T70 °C; 0 to 100%RH non-condensing
Temperature/humidity sensor	NTC 10Kohm at 25°C 1% - Capacitive sensor
Output signal	RS485 serial
	Temperature and humidity measurement transmission protocol: CAREL supervisor or Modbus (Table 1)
	Temperature: Reference range -30.0°C to 70.0°C
	Humidity: Reference range 0.0% to 99.9% RH
Terminal block	screw terminals for 0.2 to 1.5 mm² wires
Case ingress protection	IP55
Sensor element ingress protection	IP40/IP55 sintered
Stable temperature time constant	Temperature: 300 s in still air - 60 s in moving air (3 m/s)
	Note: a delay of 30-60 seconds must be added due to digital filtering of the measurement
Time constant	Humidity: 60 s in still air - 20 s in moving air (3m/s)
	Note: a delay of 30-60 seconds must be added due to digital filtering of the measurement

Tab. 2.e

2.4 Temperature probes

Models	NTC***HP00	NTC***HT41	NTC***HF01
Reference technical docs	+030220655	+030220655	+030220655
Operating range	-50T105 °C in air - -50T50 °C in fluid	-30T150 °C in air	-50T105 °C
Connections	Stripped ends, dimensions: 5±1 mm	Stripped ends, dimensions 6±1mm	Stripped ends, dimensions 6±1mm
Sensor	NTC 10 kΩ ±1% a 25 °C Beta 3435	R(25 °C)= 50 kOhm 1%; Beta (25/85)3977±1%	R(25 °C)= 10 kOhm 1%; Beta 3435
Dissipation factor (in air)	ca. 3 mW/°C	ca. / approx. 3 mW	3 mW
Thermal constant over time (in air)	ca. / approx. 25 s	ca. / approx. 30 s	approx. 50 s
Sensitive element index of protection	IP67	IP67	IP67
Sensitive element housing	Polyolefin	High temperature polyester dim. 20x5 mm	Thermoplastic with fastening clamp
Classification according to protection against electric shock	Basic insulation for 250 Vac	Basic insulation for 250 Vac	Basic insulation for 250 Vac
Category of resistance to heat and fire	Flame retardant	In accordance with CEI 20-35	UL/HB cable
			

Tab. 2.f

2.5 General connection diagram

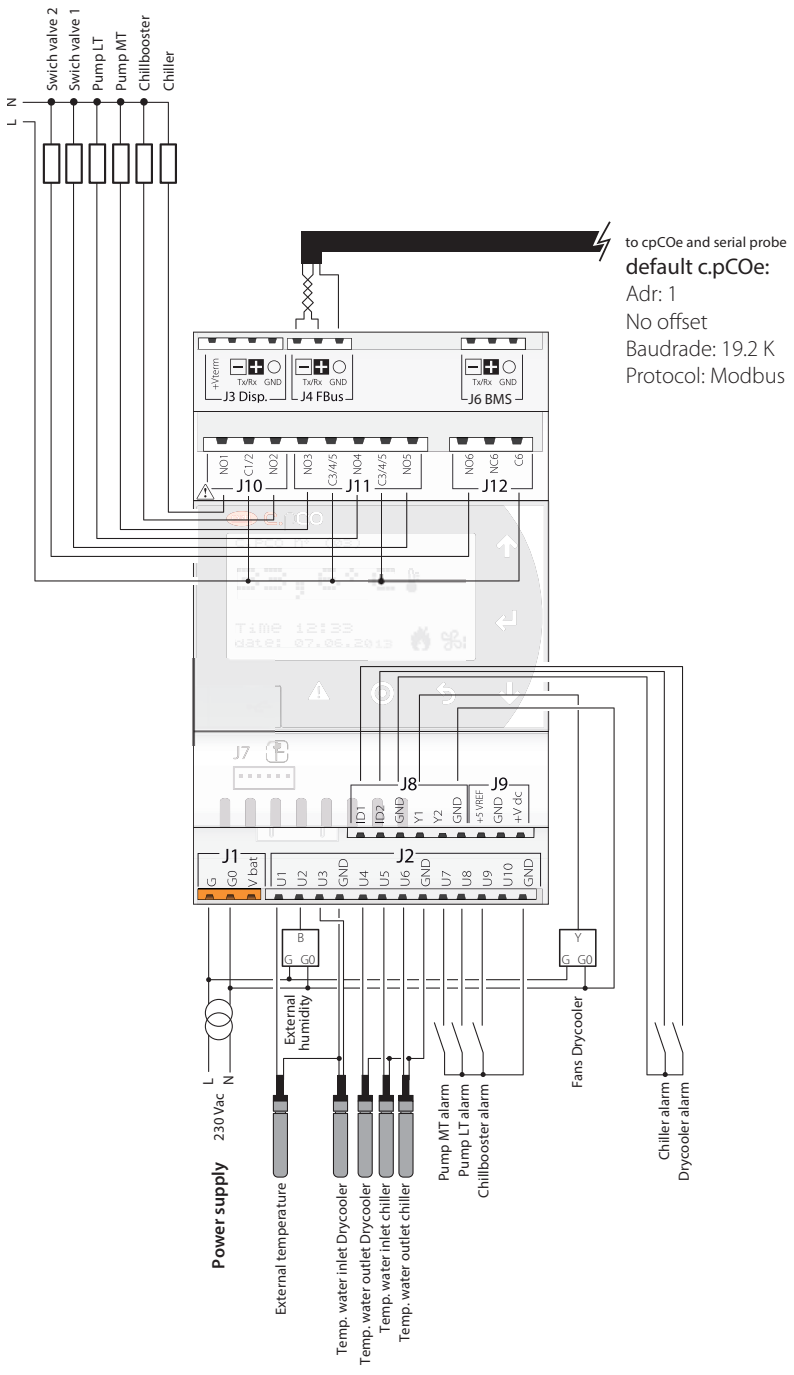


Fig. 2.d

WATERLOOP I/O list

Digital Inputs
Remote ON/OFF
Summer/Winter
General Alarm
Drycooler Alarm
MT Pump Alarm (single pump)
MT Pump 1 Overload Alarm
MT Pump 2 Overload Alarm
LT Pump Alarm (single pump)
LT Pump 1 Overload Alarm
LT Pump 2 Overload Alarm
MT Pump Flow Alarm
LT Pump Flow Alarm
Chillbooster alarm
LT Chiller alarm

Analog Inputs
External Temperature
External Humidity
Drycooler Water Inlet Temperature
Drycooler Water Outlet Temperature
MT Inlet Pressure
MT Outlet Pressure
LT Chiller Water Inlet Temperature
LT Chiller Water Outlet Temperature
LT Inlet Pressure
LT Outlet Pressure
Ambient Temperature
Ambient Humidity
Generic Temperature
Generic Temperature 2
After Bypass Temperature
MT Inlet Temperature
MT Outlet Temperature
LT Inlet Temperature
LT Outlet Temperature

Digital Outputs
Drycooler Bypass on-off
MT Pump Start Command (single pump)
MT Pump 1 Start Command
MT Pump 2 Start Command
LT Pump Start Command (single pump)
LT Pump 1 Start Command
LT Pump 2 Start Command
ChillBooster Start Command
LT Chiller Start Command
AC System Command
Switch Valve 1
Switch Valve 2
Generic Function Digital Output
Generic Function 2 Digital Output

Analog Outputs
Drycooler Bypass
Drycooler Fan
MT Pump Output
LT Pump Output
Generic Function Output
Generic Function 2 Output

I/O selection tables

I/O	Universal Inputs Description
U01	External Temperature
U02	External Humidity
U03	Drycooler Water Input
U04	Drycooler Water Output
U05	LT Chiller Water Input
U06	LT Chiller Water Output
U07	Digital Alarm pump to MT
U08	Digital Alarm pump to LT
U09	Digital Alarm Chillbooster
U10	

I/O	Digital Inputs Description
ID1	Drycooler Alarm
ID2	LT Chiller Alarm

I/O	Analog Output Description
Y1	Drycooler Fans
Y2	

I/O	Digital Output Description
NO1	LT Chiller Command
NO2	Chillbooster Command
NO3	Pompa MT Command
NO4	Pompa LT Command
NO5	Switching valve 1
NO6	Switching valve 2

2.6 Functional diagrams

There are two main system configurations. The first uses a drycooler for managing a water loop, for both the low temperature and medium temperature units. The second uses a chiller for managing the low temperature units. Both can be controlled using a simple switching valve.

With drycooler for all units

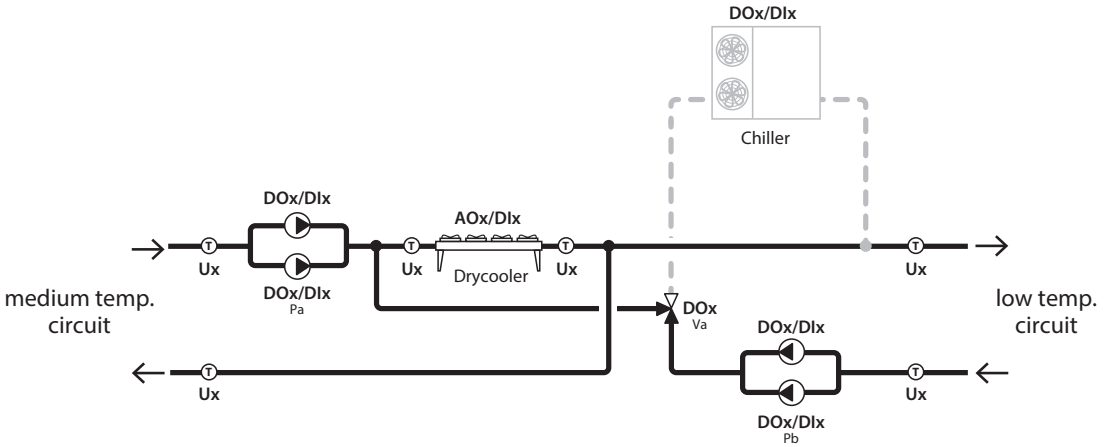


Fig. 2.e

With drycooler for the medium temperature units and air-cooled chiller for the low temperature units

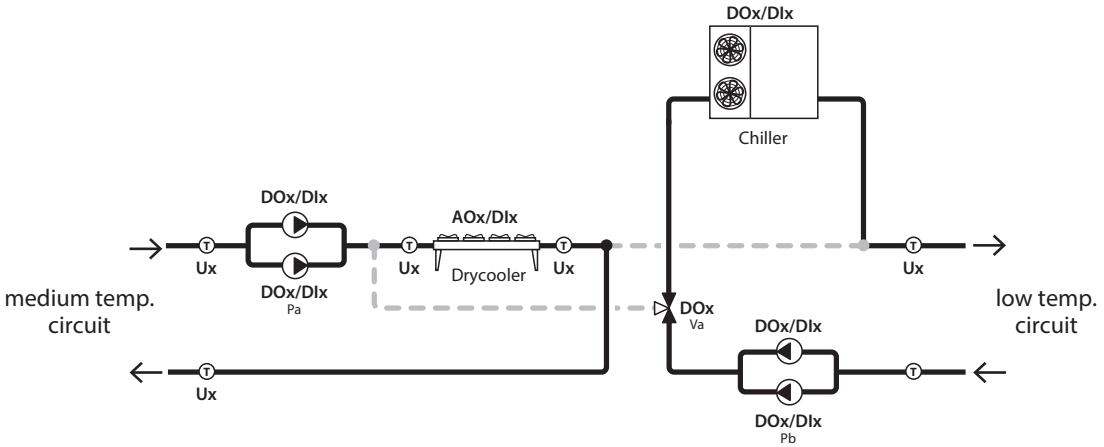


Fig. 2.f

Legende (Fig. 2.e, 2.f, 2.g):

Pa	Medium temperature circuit pump
Pb	Low temperature circuit pump
Va	Switching valve
Vb	Valve

With drycooler for the medium temperature units and water-cooled chiller for the low temperature units

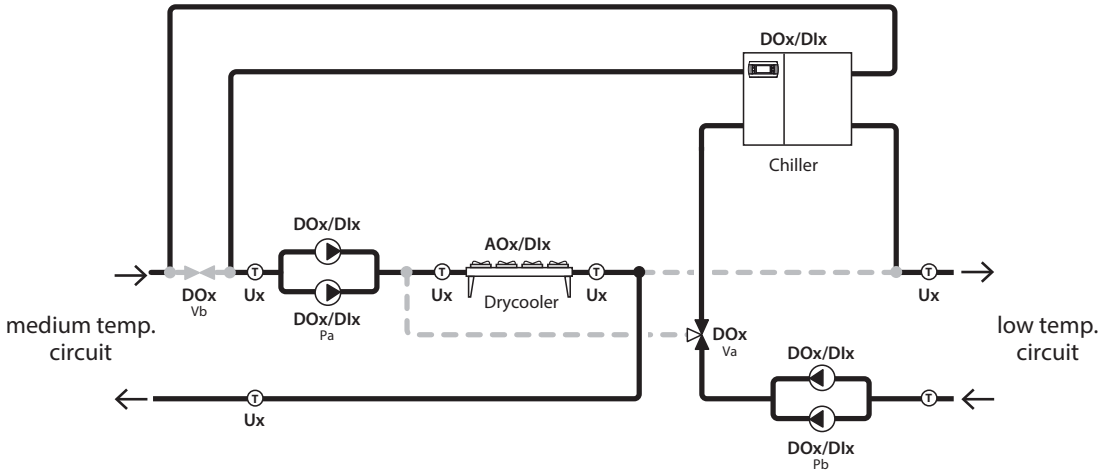


Fig. 2.g

2.7 Installation

For installation, proceed as follows, with reference to the wiring diagrams:

- before performing any operations on the control board, disconnect the main power supply by turning the main switch in the electrical panel OFF.
- avoid touching the control board with bare hands, as any electrostatic discharges may damage the electronic components;
- suitable electrical protection must be ensured by the manufacturer of the showcase or by appropriate installation of the controller;
- connect any digital inputs, Lmax=10 m;
- connect the temperature and pressure probe, Lmax=10 m;
- connect the optional PGDe terminal
- program the controller using the guided commissioning procedure: see the chapter on Commissioning".
- if present, connect the cpCOe expansion between connectors J4 (controller) and J6 (cpCOe). For connection, use a shielded cable and make sure that the maximum distance between consecutive controllers is 100 m (minimum cable size AWG22);
- connect the electrical loads to the relay outputs only after having programmed the controller. Always carefully evaluate the maximum capacity of the output relays, as specified in the Technical specifications;
- connect the supervisor serial line to the card inserted on connector J13.

Important: avoid installing the controllers in environments with the following characteristics:

- relative humidity greater than 90% or with condensation;
- strong vibrations or knocks;
- exposure to water sprays;
- exposure to aggressive and polluting atmospheres (e.g.: sulphur and ammonia fumes, saline mist, smoke) to avoid corrosion and/or oxidation;
- strong magnetic and/or radio frequency interference (therefore avoid installing the devices near transmitting antennae);
- exposure of the controllers to direct sunlight and to the elements in general.

Important: the following warnings must be observed when connecting the controllers:

- incorrect power connections may seriously damage the controller;
- use cable ends suitable for the corresponding terminals. Loosen each screw and insert the cable ends, then tighten the screws and gently tug the cables to check they are sufficiently tight;
- separate as much as possible the probe and digital input cables from cables to inductive loads and power cables, so as to avoid possible electromagnetic disturbance. Never run power cables (including the electrical panel cables) and probe signal cables in the same conduits;
- do not run probe signal cables in the immediate vicinity of power devices (contactors, circuit breakers, etc.);
- reduce the path of probe cables as much as possible, and avoid spiral paths that enclose power devices.

Important: Class A software: the safety devices providing overload and high pressure protection must control the compressor directly, and consequently need to be wired in series with compressor contactor control signal.

Note: when connecting the serial network:

- connect the shield to the GND terminals on all controllers;
- do not earth the shield on the electrical panel;
- use a shielded twisted cable AWG20-22 (es. Belden 8761);
- For the supervisor serial network (J13): connect a 120 Ω terminating resistor between the Tx/Rx+ and Tx/Rx- terminals on the last controller in the network (the one furthest away from the supervisor).

3. USER INTERFACE

Heos sistema allows the display on the control board to be replicated on the pGDe remote display. The latter display can be used for commissioning and/or to access all the control parameters.

Note: all the parameters can also be set from the supervisory system.

3.1 Built-in keypad

Fig. 3.a

Button		Function
	Alarm	displays the list of active alarms
	Prg	used to enter the main menu tree
	Esc	returns to the higher level screen
	Up	scrolls a list upwards or increases the value highlighted by the cursor
		from the "main" screen, accesses the Quick menu
	Down	scrolls a list downwards or decreases the value highlighted by the cursor
		from the "main" screen, accesses the Quick menu
	Enter	enters the selected submenu or confirms the set value
		from the main screen, accesses the "DIRECT COMMANDS" screens

Tab. 3.a

3.2 "Main" mask

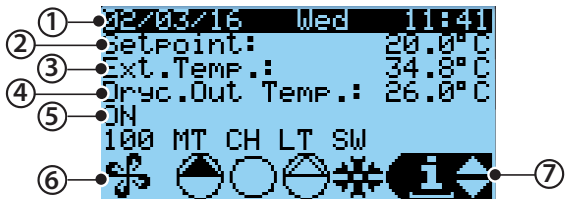
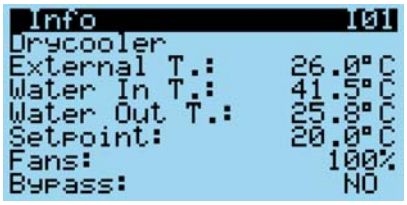


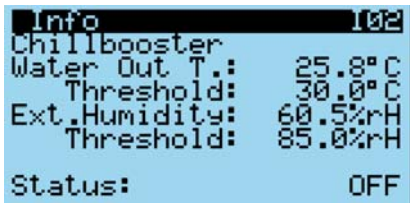
Fig. 3.b

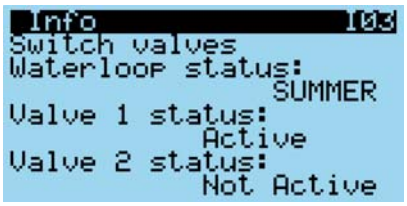
Rif.	Function
1	Status bar with date and time
2	Drycooler set point
3	Outside temperature
4	Drycooler outlet temperature
5	Unit status
6	Actuator status
7	Quick access menu and info

Tab. 3.b

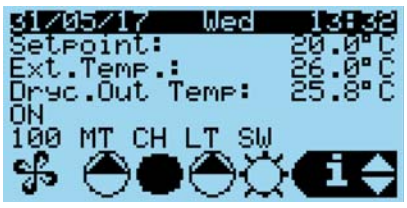
Below are some examples of the INFO screens, directly accessible from the main screen:







From the main screen, the system can also be switched ON or OFF:



Pressing when the on/off symbol is selected opens screen A01

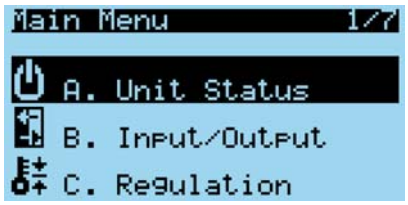
where unit status can be switched.

4. MENU DESCRIPTION

4.1 Main menu

To access the menu tree, press from the main screen; the "enter password" screen is displayed.

Once having entered the correct password (default value 1234), the first main menu screen will be displayed.



Important:
- the password **U**ser; **S**ervice; **M**anufacturer
- if no button is pressed while navigating the menu tree, after 5 minutes the main screen is automatically displayed again.

To navigate inside the menu tree, use the following buttons:
- and : navigate around the submenus, screens and change values and settings;
- : confirm and save the changes made;
- : to return to the previous menu

	A.Unit status			A01-02	U
	B.I/O config.	a.I/O configuration		Ba01-15	S
				Bb01-08	S
	C.Control			C01-03	S
	D.Devices	a.Drycooler	a.Control	Daa01-02	S
			b.Configuration	Dab01-14	S
			c.Bypass	Dac01-05	S
		b.Pumps	a.Control	Dba01-04	S
			b.Configuration	Dbb01-22	S
		c.LT Chiller	a.Control	Dca01-03	S
			b.Configuration	Dcb01-04	S
			c.Scheduler	Dcc01-03	S
		d.Other		Dd01-08	S
	E.Configuration	a.Date/time		Ea01-02	U
		b.Languages		Eb01	U
		c.Serial ports		Ec01-02	S
		d.Change password		Ed01	S
		e.Initialisation		Ee01-04	S
		f.Unit configuration		Ef01-03	S
	F.Alarms	a.Log		Record01-64	U
		b.Temperature		Fb01-03	S
	G.Diagnostics	Info		G01-11	U

Tab. 4.a

5. START-UP

5.1 System configuration

The main systems that can be configured are shown in the functional diagrams (Chap. 2.6); if the configuration features just one pump for the water circuit, with a drycooler, only the basic controller (c.pCOmini) will be needed. If a second pump is needed for the water circuits, in this case the I/O expansion (c.pCOe) will also be required.
There are also many possible configurations of the various devices, using the I/O settings as described in the "Functions" chapter.

5.2 System settings

In branch `E.Configuration` a series of settings are available, including:

```
a.Date/time
b.Languages
c.Serial ports
d.Change password
e.Initialisation
f.Unit configuration
```

Date/time

The water loop controller features an internal clock with standby battery that stores the time and date for all functions where these data are required. The screen used to make the settings is shown below.

The following date formats can be set:
- day, month, year (dd/mm/yy)
- month, day, year (mm/dd/yy)
- year, month, day (yy/mm/dd)

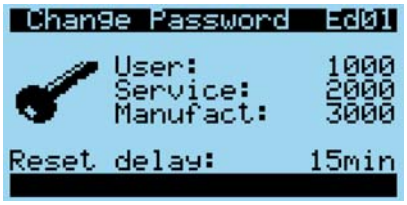
In addition, the changeover to daylight saving time and time zone can be enabled.

Serial ports

The Fieldbus serial port parameters can be set for connecting the c.pCOe and/or serial probes, as illustrated in the figure below..

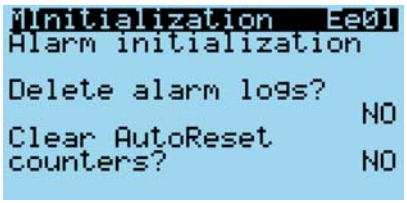
Change password

If the manufacturer password is used to access the system, as well as the user and service parameters, the manufacturer parameters can also be set.



Initialisation

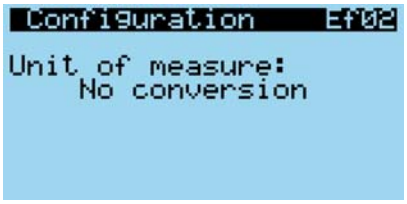
This screen is used to delete the log and the hour counter.



The following screen is used to save and set the parameter configuration files.

Unit configuration

Ef01 displays the type of password used to login. Pressing ENTER logs out of the system, allowing login with a different password.



Ef02 selects the unit of measure. The options are:
- NO conversion;
- US system.

In the first case, the International System is used, the temperatures are expressed in °C and pressures in barg. In the second case, the imperial system is used and the units of measure are °F and psig.

6. FUNCTIONS

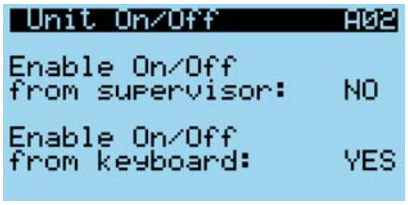
The configurations are set partly in the Devices branch (D.Device) and partly in the "I/O configuration" menu (B.Input/Output).

6.1 Unit On-Off

The unit can be switched on and off from:
- User terminal
- Supervisor
- Digital input

On-off from the user terminal and the configuration parameters are available under the main menu, branch A.c, and are differentiated based on the access level; the User password allows display only.

On-off from the supervisor and from the digital input and start-up after a blackout must be enabled using screen A02.



On-off from the digital input is equivalent to an enabling signal, that is, if the digital input is Off the unit cannot be switched on in any other way, while if is On, the unit can be switched on or off in any other way, with the same priority (the most recent control has precedence, whatever the origin), as shown in the figure:

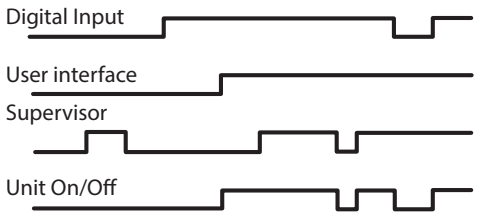
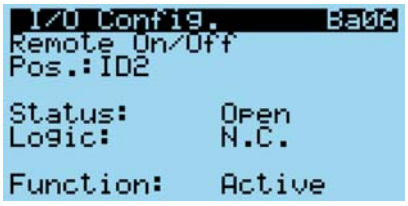


Fig. 6.a

The remote ON/OFF configuration is set using the screen below.



Note:
- OFF from digital input has priority over the keypad or supervisor.
- The devices (pumps, fans, drycooler, etc.) must be configured with the unit OFF.

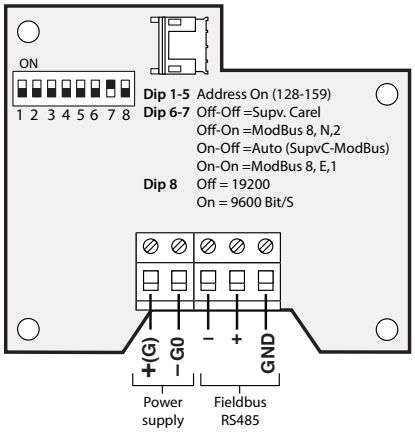
6.2 I/O configuration

From the I/O menu, the following inputs can be configured:
- type of outside probe (local or serial);
- remote ON/OFF;
- cooling/heating changeover;
- output for alarm signals.

6.2.1 Outside sensor (local or serial)

The water loop controller features 10 universal analogue inputs on the main controller plus 10 more on the pCOe (U1, U2, … U10), which can all be configured.
In the I/O branch, the first setting is the outside sensor, which can be local or serial. In the latter case, the value is sent by the probe to the controller via the Fieldbus serial port using the Modbus protocol.
The configuration of the dipswitches to set the probe to the default configuration (address 128, Modbus protocol, baud rate 19.2, no parity, 2 stop bits) is shown in the following figure.

Note: the 24 Vac power supply to the probe can be the same used for the c.pComini, respecting the polarity of G, G0.



Below are the screens used to configure the type of local humidity/ temperature probe (i.e. connected to the analogue inputs).

6.2.2 Cooling/heating changeover

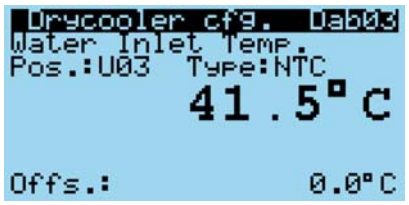
Cooling/heating changeover can be managed using a digital input, set on screen B07, or alternatively based on the drycooler water outlet set point or the outside temperature.
The type of changeover depends on the type of system being developed. For example, if only the drycooler is managed, changeover will be set based on outside temperature, while if the air-conditioning systems are also managed, it is better to select the digital input.

6.3 Drycooler management

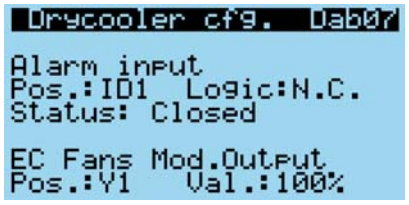
6.3.1 Configuration

Branch Dab is used to set the I/Os for managing the drycooler and the minimum and maximum fan speed, for example:

- water inlet temperature;



- alarm input and the corresponding fan analogue output;



- minimum and maximum fan speed;

6.3.2 Control

Waterloop controller can manage two types of control:

- Proportional only (P)
- Proportional + integral (P+ I)

The type of control depends on the unit being controlled.
In general, for condensers it is preferable to use P+I control, however in this case the integral constant should be evaluated according to the system being controlled.

The two types of control are described below:

Proportional and P+I control

The operating principle is normal proportional control, with a central control set point, as schematised in the following figure:

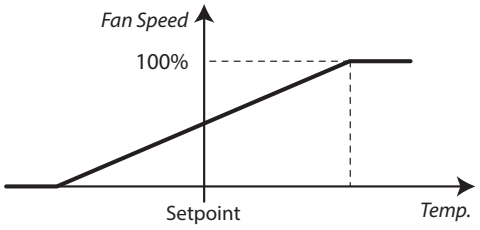


Fig. 6.b

Note: if 0-10V fan control is selected instead of serial control, a 100% control signal will correspond to a 10V analogue output, and 0% will correspond to a 0V output.

With P+I control, added to the effect of the proportional action described above is the integral action, used to achieve a null control error in steady operation, as shown in the figure:

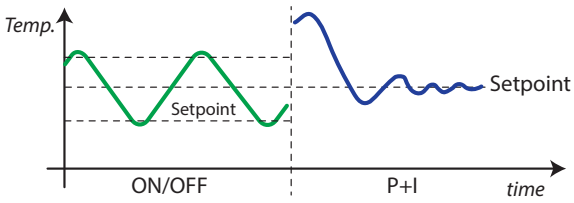


Fig. 6.c

The integral action depends on the time and the deviation from the set point. It modifies the control request when the controlled value remains for some time away from the set point.

The value of the integration time setting represents how quickly integral control is implemented:

- Low values mean a fast and intense control response
- High values give slower response and more stable control

It is recommended to not set a value that is too low for the integral time, to avoid instability.

Setting the control parameters

On the screen shown in the figure, the set point and related parameters Kp (proportional gain) and tI (integral time) can be set.

To select P+I control, set tI≠0.
Kp represents the percentage of increase in cooling request according to the deviation from the set point [%/°C], tI represents the time interval to evaluate the variation and the trend in the integral error. High values of Kp lead to higher variations in request for the same variation in control temperature (Treg), high values of tI lead to smaller variations in request over time.

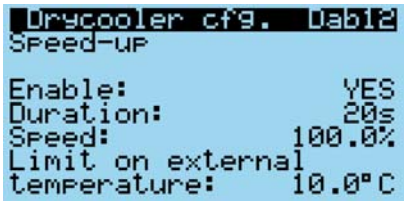
6.3.3 Fan parameters

Waterloop controller manages a series of parameters specifically related to the
fans, herewith listed:

- speed-up
- cut-off function
- kick function

Speed-up

To ensure the fans start correctly, when these are restarted (after being stopped by the controller or external control signal), a time can be set during which maximum speed is applied, called speed-up, which helps the fans overcome inertia on starting. The function is enabled on screen Dab12.



When speed-up is enabled, the time that the fans work at 100% speed can be set. If the outside temperature probe is fitted, an additional threshold can be set below which speed-up is disabled, so as to avoid drastically lowering the temperature at start-up.

Cut-off

Waterloop controller manages a fan control cut-off; the function can be enabled and the related parameters set in main menu branch Dab14.

The operating principle of the cut-off function is shown in the figure:

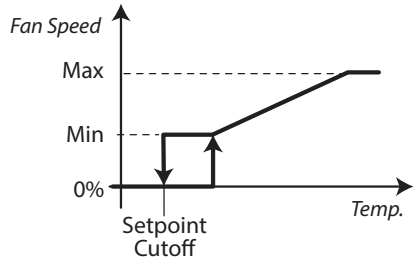


Fig. 6.d

When the control request reaches the set cut-off value, this value is kept constant until the control value falls below the cut-off set point, after which it falls to 0 % and remains there until the request exceeds the cut-off value again.

Kick function

To ensure correct operation even when the fans are off for an extended period, Waterloop controller can activate the fans for a certain time at a certain interval, set in branch Dab13.

Note: this function is also enabled when the unit is OFF from the

6.3.4 Floating set point

In branch Daa01, the floating set point function can be enabled, allowing for adjustments based on variations in outside temperature.

The floating set point will be based on the outside temperature. Its value is determined by adding a programmable constant value to the outside temperature and limiting the resulting value between a minimum and maximum, settable on Daa02

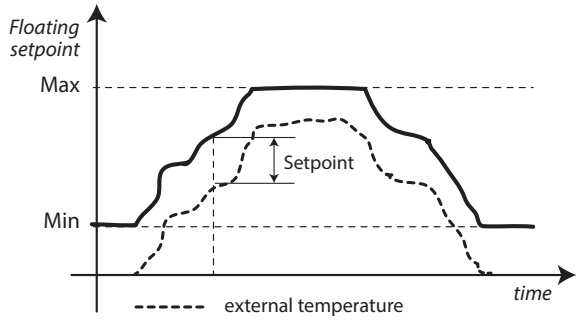
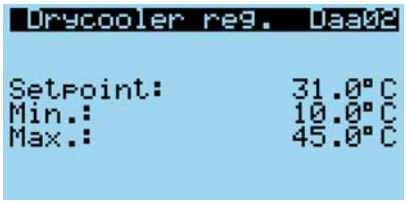


Fig. 6.e



6.3.5 Drycooler bypass

On branch Dac01 (Bypass), the output for managing the bypass can be set.

Then on screens Dac02, the probe for activation (Drycooler water outlet temperature or Outside temperature) and corresponding set point can be selected. The same applies for the deactivation logic (Dac03)

If an anlogue output is used for the bypass, the configuration screens will be:

6.4 Pump control loops

In general, control refers to "electronically controlled pumps", that is, pumps with on-board control and corresponding sensors, and a permanent magnet motor to improve pumping system efficiency. Typically with systems featuring a low pressure drop, constant pressure operation is used, while in systems with high pressure drop, "proportional pressure" is preferred.

The settings are normally made directly on the pumps, which receive the activation signal from the "Heos sistema" controller. If the lines are particularly long, pressure sensors can be installed on the load at the end of the line and the pumps can be managed with proportional control (0 to 10 V); in this case, the control parameters are set directly on the "Heos sistema" controller.

These settings are available under Devices>Pumps.

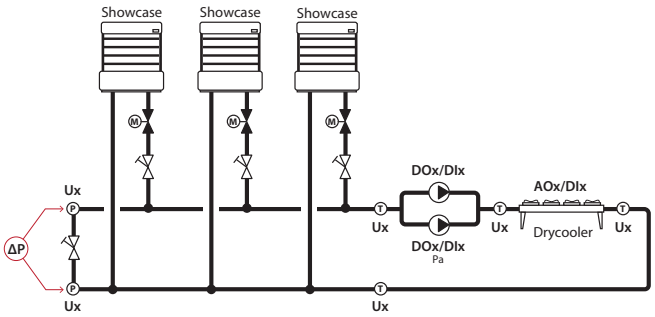


Fig. 6.f

Pump loops

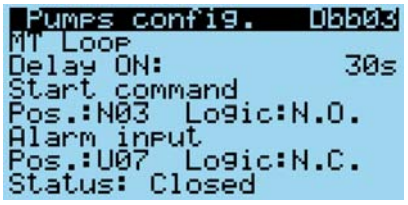
There are two pump control loops:

- medium temperature (MT);
- low temperature (LT).

Two types of control are available for each loop:

- independent;
- controlled (by temperature or pressure).

In the first case, control is managed independently by the pumps themselves. On screen Dbb03 set the control output and the corresponding alarm input for the MT circuit.



In the second case, control can be managed based on pressure or temperature, and with 0 to 10 V proportional outputs. The configuration screens relating to the MT circuit are shown below.

Again with reference to the MT circuit, on screen Dba02 the control set point and corresponding PID parameters can be set.

PID control

The operating principle is classic proportional plus integral and derivative control; operation in temperature control mode is illustrated in the following figure:

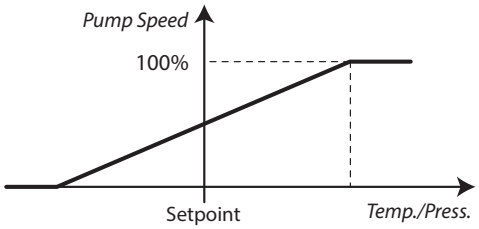


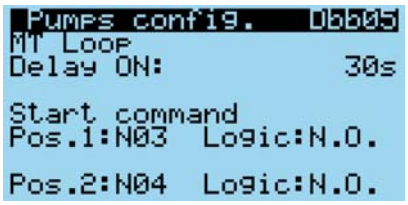
Fig. 6.g

Note: for 0 to 10 V control, 100% corresponds to an analogue output value of 10 V, while 0% corresponds to 0 V.

Control can be either based on temperature (inlet, outlet or the difference for the circuit in question) or pressure (inlet, outlet or the difference for the circuit in question). In the latter case, control will be reverse, while in temperature control mode it will be direct

ON/OFF logic with two pumps

On screens Dbb05_06, the I/Os used to manage the pumps in the medium temperature circuit can be set, specifically the control outputs and the corresponding overload alarms.
This same logic applies to the low temperature circuit, using screens Dbb12_13.

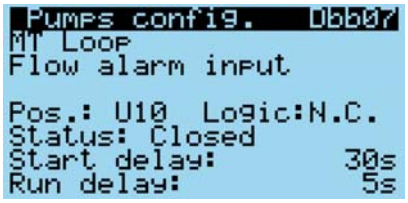


The time of pump rotation can be selected for both the MT circuit and the LT circuit on screen Dbb16 While screen Dbb15 is used to select the type of reset for the various thermal overloads (automatic or manual).

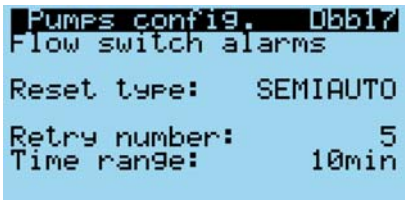
Note: if two pumps are configured, in the event of an overload alarm on one of the two, the other is automatically activated. The same is true for a flow alarm

Flow alarms

For both circuits, a flow alarm can be set, with different delays on pump activation and during normal operation. On Dbb07 the parameters are set corresponding to the MT flow switch (screen shown below), while the LT circuit settings are on screen Dbb14.

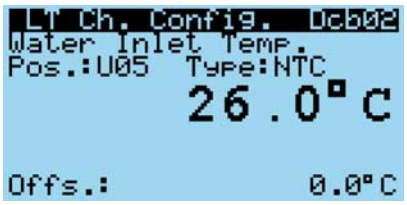


These alarms can have manual or automatic reset, as selected on screen Dbb17.



6.5 Chiller management

The chiller is used for the low temperature showcases, and is controlled so as to optimise condensing conditions and thus ensure high energy savings. Both water- and air-cooled chillers can be used; in the first case, the chiller condenser supply circuit is usually the same that supplies the medium temperature showcases, with connection guaranteed by opening a bypass valve (see Figure 2.o on p.13).
The controller is normally on the chiller and a digital input is used to connect to the "water loop controller" for starting and stopping; an additional digital input is used as feedback, to signals any chiller operating anomalies.
On the configuration screen the fundamental values for chiller operation are set, together with the corresponding I/Os.



Note: in the event of chiller alarms, the LT circuit switches to Heating mode to attempt to supply the showcases with water from the MT circuit and this keep the system active.

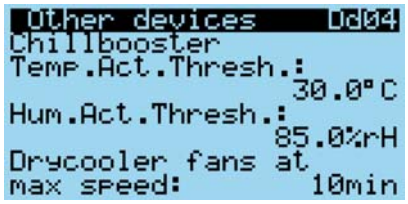
6.6 Other functions

6.6.1 Spray water system

Waterloop controller can control the Carel ChillBooster, an evaporative cooling
device that cools the air flowing through the Drycooler or condenser by enabling the corresponding parameters in the menu branch Dd02_04.

Spray water system is activated by WL when both of the following two conditions exist:

- the control temperature exceeds a set threshold
- the fan control request is at the maximum for at least a settable number of minutes;
- the outside humidity is lower than the set point.



The counting of the max request time starts every time the above conditions are not satisfied (the demand decreases). Spray water operation ends when the "cooling demand" falls below a set threshold. Waterloop controller can manage a digital alarm input from ChillBooster, which has the effect to deactivate the complete device.

Hygiene procedure

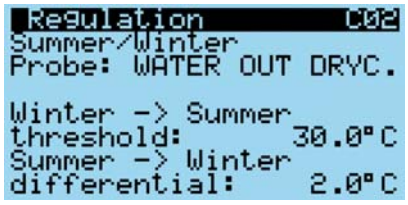
To avoid water stagnation in the pipes, a hygiene procedure can be enabled that activates Spray water system every day for a certain time and, if the outside temperature is greater than a threshold.

Note: if the outside temperature probe is not configured or is configured but is not working, Spray water system operates based solely on the control request, and the hygiene procedure can still be activated.

6.6.2 Cooling and heating valve management

Cooling/heating changeover can be managed using one or two valves, depending on the type of circuit used; this for example allows separation between medium temperature and low temperature circuit. The outputs and corresponding logic are set on screen Dd01.

Changeover can be managed using a digital input, or based on the outside temperature or drycooler water outlet temperature (C01...C02).



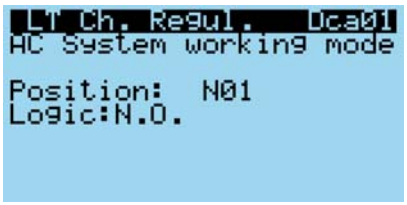
6.6.3 Auxiliary functions

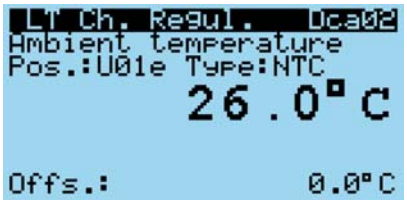
Management of a 0-10 V modulating valve or digital output with independent PID has been introduced as a generic function. The settings are made on screens Dd05_06.

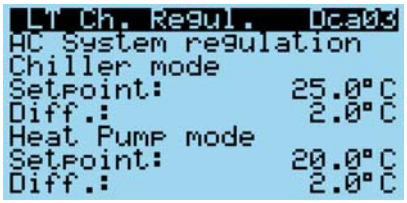
If managing a digital output, the following screen sets the position of the output.

Screen Dd07/08 is used to activate management of a second generic function, with the same features as the previous one.

Screen Dca01 is used to set a digital output with direct operation in Cooling and reverse in Heating, based on the room temperature (Dca02/Ba14).
The corresponding set points and differentials are selected on screen Dca03.







7. PARAMETER TABLE

Mask index": indicates the unique address of each screen and consequently the path needed to reach the parameters available on this screen; for example, to reach the parameters corresponding to the suction pressure probe with mask index Bab01, proceed as follows:


Main menu I/O B. In./Out. ➔

Below is the table of the parameters that can be displayed on the terminal. The values indicated with '---' are not significant or are not set, while the values indicated with '…' may vary according to the configuration, with the possible options visible on the user terminal. A row of '…' means that there are a series of parameters similar to the previous ones.

Note: not all the screens and parameters shown in the table are always visible or can be set, the screens and parameters that are visible or can be set depend on the configuration and the access level.

Mask Index	Variable Description	Default Value	UoM	Min	Max	Value Description	Type	Adr	R/W
A01	Unit On/Off by keyboard	0	--	0	1	0: OFF.bmp 1: ON.bmp	D		R/W
	Unit status		--	0	9	0: 1: ON 2: OFF BY ALARM 3: OFF BY BMS 4: OFF BY SCHED 5: OFF BY DI 6: OFF BY KEYBOARD 7: IN MANUAL MODE	I		R
A02	Enable Unit On/Off by BMS	0	--	0	1	0:NO 1:YES	D		R/W
	Enable On/Off from keyboard	1	--	0	1	0:NO 1:YES	D		R/W
Ba01	External probes connection type	0	--	0	1	0: LOCAL 1: SERIAL	D		R/W
Ba02	Address serial probe	128	--	128	159		I		R/W
	External Temperature		°C (°F)	--	--		A		R
	Offset Temperature serial probe	0.0 (0.0)	°C (°F)	-10,0 (-18.0)	10,0 (-18.0)		A		R/W
	External Humidity		%rH	--	--		A		R
	Offset Humidity serial probe	0,0	%rH	-10,0	10,0		A		R/W
	Dewpoint		°C (°F)	--	--		A		R
	State		--	0	1	0: Offline 1: Online	D		R
Ba03	Enables the cpCOe	0	--	0	1	0: NO 1: YES	D		R/W
	Device online status		--	0	1	0: Offline 1: Online	D		R
	Address cpCOe		--	0	128		I		R
	Protocol cpCOe Modbus		--			Modbus	I		R
Ba04	Position of External Temperature probe	1	--	0	20	0: --- 1:U01…10:U10 11: U01e ….20:U10e	I		R/W
	External temperature probe type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	External temperature probe value		°C (°F)	--	--		A		R
	External temperature probe offset	0.0 (0.0)	°C (°F)	-50,0 (-90.0)	50,0 (90,0)		A		R/W
Ba05	Position of External Humidity probe	2	--	0	20	0: --- 1…10:U01... U10 11...20: U01e...U10e	I		R/W
	External humidity probe type	2	--	0	2	0: 0-1V 1: 0-10V 2: 4-20mA	I		R/W
	External Humidity		%rH	0.0	100.0		A		R
	External Humidity minimum value	0.0	%rH	0.0	Max		A		R/W
	External Humidity maximum value	100.0	%rH	Min	100.0		A		R/W
	External humidity probe offset	0.0	%rH	-50,0	50,0		A		R/W
Ba06	Position of Remote On/Off digital input	0	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13…22: U01e...U10e	I		R/W
	Status of Remote On/Off digital input		--	0	1	0: Closed 1: Open	D		R
	Logic of Remote On/Off digital input	0	--	0	1	0: N.C. 1: N.O.	D		R/W
	Remote On/Off digital input (logic)		--	0	1	0: Not active 1: Active	D		R
Ba07	Position of Summer/Winter digital input	0	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13…22: U01e...U10e	I		R/W
	Status of Summer/Winter digital input		--	0	1	0: Closed 1: Open	D		R

Mask Index	Variable Description	Default Value	UoM	Min	Max	Value Description	Type	Adr	R/W
Ba07	Logic of Summer/Winter digital input	0	--	0	1	0: N.C. 1: N.O.	D		R/W
	Summer/Winter digital input (Function)		--	0	1	0: Not active 1: Active	D		R
Ba08	Position of General Alarm digital output	0	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	Logic of General Alarm digital output	0	--	0	1	0: N.C. 1: N.O.	D		R/W
	Status General Alarm digital output		--	0	1	0: Closed 1: Open	D		R
Ba09	Position of Generic Temperature	0	--	0	20	0: --- 1:U01…10:U10 11: U01e ….20:U10e	I		R/W
	Generic Temperature type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	Generic temperature value		°C (°F)	--	--		A		R
	Generic temperature offset	0.0 (0.0)	°C (°F)	-50,0 (-90.0)	50,0 (90,0)		A		R/W
Ba10	Position of Generic Temperature 2	0	--	0	20	0: --- 1:U01…10:U10 11: U01e ….20:U10e	I		R/W
	Generic temperature 2 type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	Generic temperature 2 value		°C (°F)	--	--		A		R
	Generic temperature 2 offset	0.0 (0.0)	°C (°F)	-50,0 (-90.0)	50,0 (90,0)		A		R/W
Ba11	Position of After Bypass Temperature	0	--	0	20	0: --- 1:U01…10:U10 11: U01e ….20:U10e	I		R/W
	After Bypass temperature type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	After Bypass temperature value		°C (°F)	--	--		A		R
	After Bypass temperature offset	0.0 (0.0)	°C (°F)	-50,0 (-90.0)	50,0 (90,0)		A		R/W
Ba12	Ambient probes connection type	0	--	0	1	0: LOCAL 1: SERIAL	D		R/W
Ba13	Address serial probe	128	--	128	159		I		R/W
	Ambient Temperature		°C (°F)	--	--		A		R
	Offset Temperature serial probe	0.0 (0.0)	°C (°F)	-10,0 (-18.0)	10,0 (-18.0)		A		R/W
	Ambient Humidity		%rH	--	--		A		R
	Offset Humidity serial probe		%rH	-10,0	10,0		A		R/W
	Dewpoint		°C (°F)	--	--		A		R
	State		--	0	1	0: Offline 1: Online	D		R
Ba14	Position of Ambient Temperature probe	0	--	0	20	0: --- 1:U01…10:U10 11: U01e ….20:U10e	I		R/W
	Ambient temperature probe type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	Ambient temperature probe value		°C (°F)	--	--		A		R
	Ambient temperature probe offset	0.0 (0.0)	°C (°F)	-50,0 (-90.0)	50,0 (90,0)		A		R/W
Ba15	Position of Ambient Humidity probe	0	--	0	20	0: --- 1…10:U01... U10 11...20: U01e...U10e	I		R/W
	Ambient humidity probe type	2	--	0	2	0: 0-1V 1: 0-10V 2: 4-20mA	I		R/W
	Ambient Humidity		%rH	0.0	100.0		A		R
	Ambient Humidity minimum value	0.0	%rH	0.0	Max		A		R/W
	Ambient Humidity maximum value	100.0	%rH	Min	100.0		A		R/W
	Ambient humidity probe offset	0.0	%rH	-50,0	50,0		A		R/W
Bb01	Enable outputs manual management	0	--	0	1	0: NO 1: YES	D		R/W
Bb02…8	Outputs Digital/Analogue Manual management	0	--	0 (0)	1 (100)	0: NO (0) 1: YES (1…100)	D/I		R/W
C01	Summer/Winter Selection	1	--	0	1	0: FROM D.I. 1: FROM REG.	D		R/W
C02	Summer/Winter Regulation temperature selection	0	--	0	1	0: WATER OUT DRYC. 1: EXTERNAL TEMP.	D		R/W
	Threshold Winter to Summer activation	30.0 (86,0)	°C (°F)	-50,0 (-58.0)	50,0 (122,0)		A		R/W
	Differential Summer to Winter activation	5.0 (9,0)	°C (°F)	0,1 (0,2)	20,0 (36,0)		A		R/W
C03	Minimum time in Summer or Winter status	5	min	0	99		I		R/W
Daa01	Drycooler regulation temperature selection	0	--	0	1	0: WATER OUTLET 1: DELTA ON EXT.TEMP.	D		R/W
	Regulation Setpoint for Drycooler management	20.0	°C (°F)	-50,0	100,0		A		R/W
	Delta between External and Drycooler ouput temperature, for fans management	5.0 (9,0)	°C (°F)	0,1 (0,2)	20,0 (36,0)		A		R/W
	Proportional coefficient for Drycooler management	10.0	%/°C (°F)	0,1	999,9		A		R/W
	Integral time for Drycooler management	120	s	0	999		I		R/W

Mask Index	Variable Description	Default Value	UoM	Min	Max	Value Description	Type	Adr	R/W
Daa02	Drycooler regulation setpoint		°C (°F)	--	--		A		R
	Minimum Setpoint value in case of Delta on Ext.Temp. regulation	10.0 (50,0)	°C (°F)	-50,0 (-58,0)	max		A		R/W
	Maximum Setpoint value in case of Delta on Ext.Temp. regulation	45.0 (113,0)	°C (°F)	min	50,0 (122,0)		A		R/W
Dab03	Position of Drycooler water inlet temperature probe	3	--	0	20	0: --- 1…10:U01...U10 11….20: U01e...U10e	I		R/W
	Drycooler Water Inlet temperature probe type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	Drycooler water inlet temperature value		°C (°F)	--	--		A		R
	Drycooler Water Inlet Temperature probe offset	0.0 (0.0)	°C (°F)	-50,0 (-90.0)	50,0 (90,0)		A		R/W
Dab04	Position of Drycooler water outlet temperature probe	4	--	0	20	0: --- 1…10:U01...U10 11….20: U01e...U10e	I		R/W
	Drycooler Water Outlet temperature probe type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	Drycooler water outlet temperature value	--	°C (°F)	--	--		A		R
	Drycooler water outlet temperature probe offset	0.0 (0.0)	°C (°F)	-50,0 (-90.0)	50,0 (90,0)		A		R/W
Dab07	Position of Drycooler alarm digital input	11	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13….22: U01e...U10e	I		R/W
	Logic of Drycooler Alarm digital input	0	--	0	1	0: N.C. 1: N.O.	D		R/W
	Status of Drycooler Alarm digital input		--	0	1	0: Closed 1: Open	D		R
	Position of Drycooler EC Fan 0-10 V analog output	11	--	0	22	0: --- 1…10: U01...U10 11: Y1 12: Y2 13….22: U01e...U10e	I		R/W
	Drycooler EC Fan 0-10V Value %		--	0	100		I		R
Dab08	Drycooler fans minimum speed [%]	0.0	%	0.0	Max		A		R/W
	Drycooler fans maximum speed [%]	100.0	%	Min	100.0		A		R/W
Dab12	Enable Speed-Up function for Drycooler fans	1	--	0	1	0:NO 1:YES	D		R/W
	Speed-Up duration for Drycooler fans	20	s	0	999		I		R/W
	Drycooler fans speed during Speed-Up	100.0	%	Min	Max		A		R/W
	Temperature limit for Drycooler Fans Speed-Up function	10.0 (50,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
Dab13	Enable Kick function for Drycooler fans	1	--	0	1	0:NO 1:YES	D		R/W
	Kick time threshold [h] for Drycooler fans	72	h	0	999		I		R/W
	Kick duration for Drycooler fans	1	min	0	999		I		R/W
	Drycooler fans speed during Kick function	80.0	%	Min	Max		A		R/W
Dab14	Enable Cut-Off function for Drycooler fans	1	--	0	1	0:NO 1:YES	D		R/W
	Drycooler Fans speed threshold for Cut-Off function	10.0	%	Min	Max		A		R/W
	Temperature setpoint for Cut-Off function	10.0 (50,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
Dac01	Type	0	--	0	1	0: DIGITAL 1: ANALOG	D		R/W
	Position of Drycooler Bypass analog output	0	--	0	22	0: --- 1…10: U01...U10 11: Y1 12: Y2 13….22: U01e...U10e	I		R/W
	Position of Drycooler Bypass digital output	0	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	Drycooler Bypass (ON/OFF) output logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	Drycooler Bypass Logic	0	--	0	1	0: DIRECT 1: REVERSE	D		R/W
Dac02	Drycooler Bypass activation probe selection	0	--	0	1	0: WATER OUT TEMP 1: EXTERNAL TEMP.	D		R/W
	Drycooler Bypass Temperature Activation Threshold	30.0 (86,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
	Drycooler Bypass activation delay	10	min	0	99		I		R/W
Dac03	Drycooler Bypass deactivation probe selection	0	--	0	1	0: WATER OUT TEMP 1: EXTERNAL TEMP.	D		R/W
	Drycooler Bypass deactivation threshold selection	0	--	0	1	0: MANUAL 1:EXT.TEMP.AUTOADAPT.	D		R/W
	Drycooler Bypass Temperature deactivation Threshold	0.0 (32,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
	Drycooler Bypass Temperature deactivation Offset	3,0 (5,4)	°C (°F)	0,1 (0,2)	20,0 (36,0)		A		R/W
	Drycooler Bypass deactivation delay	10	min	0	99		I		R/W

Mask Index	Variable Description	Default Value	UoM	Min	Max	Value Description	Type	Adr	R/W
Dac04	Analog mode Bypass								
	Probe	4	-	0	8	0: GENERIC TEMP. 1: GENERIC TEMP. 2 2: A.BYPASS 3: EXTERNAL TEMP. 4: WATER OUT DRY 5: WATER IN DRY 6: WATER OUT CHILLER 7: WATER IN CHILLER 8: AMBIENT TEMP.	I		R/W
	Set point	20,0 (68,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
	Kp	10,0	%/°C (°F)	0	999,9		I		R/W
	Ti	100	s	0	999		I		R/W
	Td	0	s	0	999		I		R/W
Dac05	Low limit Analog Bypass	0	%	0	High		I		R/W
	High limit Analog Bypass	100	%	Low	100		I		R/W
Dba01	Pumps control type	0	--	0	1	0: INDEPENDENT 1: BY CONTROLLER	D		R/W
	MT Pump control type	0	--	0	1	0: ON/OFF 1: 0/10V	D		R/W
	Probe used for MT Pumps regulation	4	--	0	8	0: W. IN DRYCOOLER 1: W. OUT DRYCOOLER 2: W. DELTA TEMP. DRY 3: W. IN TEMP. MT 4: W. OUT TEMP. MT 5: W. DELTA TEMP. MT 6: W. IN PRESS. 7: W. OUT PRESS. 8: W. DELTA PRESS.	I		R/W
Dba02	MT Pump Regulation setpoint (in Pressure regulation)	5,0 (72,5)	barg (psig)	-1,0 (-14,5)	50,0 (725,0)		A		R/W
	MT Pump Regulation setpoint (in Temperature regulation)	20,0 (68,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
	Proportional coefficient for MT Pump 0/10V regulation	10,0	%/°C (°F)	0,1	999.9		A		R/W
	Integral time for MT Pump 0/10V regulation	120	s	0	999		I		R/W
	MT Pump Derivative time	5	s	0	999		I		R/W
Dba03	Pumps control type	0	--	0	1	0: INDEPENDENT 1: BY CONTROLLER	D		R/W
	LT Pump control type	0	--	0	1	0: ON/OFF 1: 0/10V	D		R/W
	Probe used for LT Pumps regulation	4	--	0	8	0: W. IN LT CHILLER 1: W. OUT LT CHILLER 2: W. DELTA TEMP. LT CHIL. 3: W. IN TEMP. LT 4: W. OUT TEMP. LT 5: W. DELTA TEMP. LT 6: W. IN PRESS. 7: W. OUT PRESS. 8: W. DELTA PRESS.	I		R/W
Dba04	LT Pump Regulation setpoint (in Pressure regulation)	5,0 (72,5)	barg (psig)	-1,0 (-14,5)	50,0 (725,0)		A		R/W
	LT Pump Regulation setpoint (in Temp. regulation)	20,0 (68,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
	Proportional coefficient for LT Pump 0/10V regulation	10,0	%/°C (°F)	0,1	999.9		A		R/W
	Integral time for LT Pump 0/10V regulation	120	s	0	999		I		R/W
	LT Pump Derivative time	5	s	0	999		I		R/W
Dbb01	Position of MT Loop Inlet pressure	0	--	0	20	0: --- 1…10:U01...U10 11….20: U01e...U10e	I		R/W
	MT Pump Inlet pressure probe type	0	--	0	2	0: 4-20mA 1: 0-5V 2: RAT 0-5V	I		R/W
	MT Loop inlet pressure		barg (psig)	--	--		A		R
	MT Pump maximum value inlet pressure probe	18,0 (261,0)	barg (psig)	min	50,0 (725,0)		A		R/W
	MT Pump minimum value inlet pressure probe	0,0 (0,0)	barg (psig)	-1,0 (-14,5)	max		A		R/W
	MT Inlet Pressure probe offset	0,0 (0,0)	barg (psig)	-10,0 (-145,0)	10,0 (145,0)		A		R/W
Dbb02	Position of MT Loop Outlet pressure	0	--	0	20	0: --- 1…10:U01...U10 11….20: U01e...U10e	I		R/W
	MT Pump Outlet pressure probe type	0	--	0	2	0: 4-20mA 1: 0-5V 2: RAT 0-5V	I		R/W
	MT Loop outlet pressure		barg (psig)	--	--		A		R
	MT Pump maximum value outlet pressure probe	18,0 (261,0)	barg (psig)	min	50,0 (725,0)		A		R/W
	MT Pump minimum value outlet pressure probe	0,0 (0,0)	barg (psig)	-1,0 (-14,5)	max		A		R/W
	MT Outlet Pressure probe offset	0,0 (0,0)	barg (psig)	-10,0 (-145,0)	10,0 (145,0)		A		R/W
Dbb03	MT Loop Pump delay ON	30	s	0	999		I		R/W
	Position of MT Loop pump start command digital output	3	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	MT Pump start command output logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	Position of MT Loop Pump alarm digital input	7	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13….22: U01e...U10e	I		R/W

Mask Index	Variable Description	Default Value	UoM	Min	Max	Value Description	Type	Adr	R/W
Dbb03	MT Pump alarm digital input logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	MT Pump alarm digital input status		--	0	1	0: Closed 1: Open	D		R
Dbb04	Position of MT Loop Pump Setpoint 0-10V analog output	0	--	0	22	0: --- 1…10: U01...U10 11: Y1 12: Y2 13….22: U01e..U10e	I		R/W
	MT pump status (AOUT)		%	0	100,0		A		R
Dbb05	MT Loop Pump delay ON	30	s	0	999		I		R/W
	Position of MT Loop pump 1 start command digital output	0	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	MT Pump 1 start command output logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	Position of MT Loop pump 2 start command digital output	0	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	MT Pump 2 start command output logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
Dbb06	Position of MT Loop Pump 1 overload alarm input	0	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13….22: U01e..U10e	I		R/W
	MT Pump 1 alarm digital input logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	MT Pump 1 alarm digital input status		--	0	1	0: Closed 1: Open	D		R
	Position of MT Loop Pump 2 overload alarm input	0	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13….22: U01e...U10e	I		R/W
	MT Pump 2 alarm digital input logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	MT Pump 2 alarm digital input status		--	0	1	0: Closed 1: Open	D		R
Dbb07	Position of MT Loop Pump Flow alarm digital input	0	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13….22: U01e...U10e	I		R/W
	MT Pump Flow alarm digital input logic	0	--	0	1	0: N.C 1: N.O.	D		R/W
	MT Pump Flow alarm digital input status		--	0	1	0: Closed 1: Open	D		R
	Source pump flow alarm startup delay	30	s	0	999		I		R/W
	Source pump flow alarm run delay	5	s	0	999		I		R/W
Dbb08	Position of LT Loop Inlet pressure	0	--	0	20	0: --- 1:U01 …10:U10 11: U01e ….20:U10e	I		R/W
	LT Pump Outlet pressure probe type	0	--	0	9	0: 4-20mA 1: 0-5V 2: RAT 0-5V	I		R/W
	LT Loop inlet pressure		barg (psig)	--	--		A		R
	LT Pump maximum value inlet pressure probe	18,0 (261,0)	barg (psig)	min	50,0 (725,0)		A		R/W
	LT Pump minimum value inlet pressure probe	0,0 (0,0)	barg (psig)	-1,0 (-14,5)	max		A		R/W
	LT Inlet Pressure probe offset	0,0 (0,0)	barg (psig)	-10,0 (-145,0)	10,0 (145,0)		A		R/W
Dbb09	Position of LT Loop Outlet pressure	0	--	0	20	0: --- 1…10:U01...U10 11….20: U01e..U10e	I		R/W
	LT Pump Outlet pressure probe type	0	--	0	9	0: 4-20mA 1: 0-5V 2: RAT 0-5V	I		R/W
	LT Loop outlet pressure		barg (psig)	--	--		A		R
	LT Pump maximum value outlet pressure probe	18,0 (261,0)	barg (psig)	min	50,0 (725,0)		A		R/W
	LT Pump minimum value outlet pressure probe	0,0 (0,0)	barg (psig)	-1,0 (-14,5)	max		A		R/W
	LT Outlet Pressure probe offset	0,0 (0,0)	barg (psig)	-10,0 (-145,0)	10,0 (145,0)		A		R/W
Dbb10	LT Loop Pump delay ON	30	s	0	999		I		R/W
	Position of LT Loop pump start command digital output	4	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	LT Pump start command output logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	Position of LT Loop Pump alarm digital input	8	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13….22: U01e...U10e	I		R/W
	LT Pump alarm digital input logic	0	--	0	1	0: N.C. 1: N.O.	D		R/W

Mask Index	Variable Description	Default Value	UoM	Min	Max	Value Description	Type	Adr	R/W
Dbb10	LT Pump alarm digital input status		--	0	1	0: Closed 1: Open	D		R
Dbb11	Position of LT Loop Pump Setpoint 0-10V analog output	0	--	0	22	0: --- 1…10: U01...U10 11: Y1 12: Y2 13….22: U01e...U10e	I		R/W
	LT Chiller pump status (AOUT)		--	0	100,0		A		R
Dbb12	LT Loop Pump delay ON	30	s	0	999		I		R/W
	Position of LT Loop pump 1 start command digital output	0	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	LT Pump 1 Start command logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	Position of LT Loop pump 2 start command digital output	0	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	LT Pump 2 Start command logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
Dbb13	Position of LT Loop Pump 1 overload alarm input	0	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13….22: U01e...U10e	I		R/W
	LT Pump 1 alarm digital input logic	0	--	0	1	0: N.C. 1: N.O.	D		R/W
	LT Pump 1 alarm digital input status		--	0	1	0: Closed 1: Open	D		R
	Position of LT Loop Pump 2 overload alarm input	0	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13….22: U01e...U10e	I		R/W
	LT Pump 2 alarm digital input logic	0	--	0	1	0: N.C. 1: N.O.	D		R/W
	LT Pump 2 alarm digital input status		--	0	1	0: Closed 1: Open	D		R
Dbb14	Position of LT Loop Pump Flow alarm digital input	0	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13….22: U01e...U10e	I		R/W
	LT Pump Flow alarm digital input logic	0	--	0	1	0: N.C. 1: N.O.	D		R/W
	LT Pump Flow alarm digital input status		--	0	1	0: Closed 1: Open	D		R
	Source pump flow alarm startup delay	30	s	0	999		I		R/W
	Source pump flow alarm run delay	5	s	0	999		I		R/W
Dbb15	Pumps Alarms reset type	0	--	0	1	0: AUTO 1: MAN	D		R/W
Dbb16	Time rotation loop pumps MT	24	h	0	999		I		R/W
	Time rotation loop pumps LT	24	h	0	999		I		R/W
Dbb17	Flow switch alarm	0	--	0	1	0: SEMIAUTO 1: MANUAL	D		R/W
	Retry Number	5	--	1	5		I		R/W
	To time range	10	min	0	999		I		R/W
Dbb18	ML Work hours threshold	0	h	0	999900		I		R/W
	LT Work hours threshold	0	h	0	999900		I		R/W
Dbb19	Position of temperature inlet MT	0	--	0	20	0: --- 1…10:U01...U10 11….20: U01e...U10e	I		R/W
	Temperature inlet MT type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	Temperature inlet MT value		°C (°F)	--	--		A		R
	Temperature inlet MT offset	0,0	°C (°F)	-50,0 (-90,0)	50,0 (90,0)		A		R/W
Dbb20	Position of temperature outlet MT	0	--	0	20	0: --- 1…10:U01...U10 11….20: U01e...U10e	I		R/W
	Temperature outlet MT type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	Temperature outlet MT value		°C (°F)	--	--		A		R
	Temperature outlet MT offset	0,0	°C (°F)	-50,0 (-90,0)	50,0 (90,0)		A		R/W
Dbb21	Position of temperature inlet LT	0	--	0	20	0: --- 1…10:U01...U10 11….20: U01e...U10e	I		R/W
	Temperature inlet LT type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	Temperature inlet LT value		°C (°F)	--	--		A		R
	Temperature inlet LT offset	0,0	°C (°F)	-50,0 (-90,0)	50,0 (90,0)		A		R/W

Mask Index	Variable Description	Default Value	UoM	Min	Max	Value Description	Type	Adr	R/W
Dbb22	Position of temperature outlet LT	0	--	0	20	0: --- 1…10:U01...U10 11….20: U01e...U10e	I		R/W
	Temperature outlet LT type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	Temperature outlet LT value		°C (°F)	--	--		A		R
	Temperature outlet LT offset	0,0 (0,0)	°C (°F)	-50,0 (-90,0)	50,0 (90,0)		A		R/W
Dca01	Position of AC System mode digital output	0	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	AC System mode output logic	0	--	0	1	0: N.O. (0:HP - 1:CH) 1: N.C. (0:CH - 1:HP)	D		R/W
Dca02	Position of Ambient temperature probe	0	--	0	20	0: --- 1…10:U01...U10 11….20: U01e...U10e	I		R/W
	Ambient temperature probe type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	Ambient temperature value		°C (°F)	--	--		A		R
	Ambient Temperature probe offset	0,0 (0,0)	°C (°F)	-50,0 (-90,0)	50,0 (90,0)		A		R/W
Dca03	Chiller mode activation setpoint	25,0 (77,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
	Chiller mode deactivation offset	2,0 (3,6)	°C (°F)	0,1 (0,2)	20,0 (36,0)		A		R/W
	Heat pump mode activation setpoint	20,0 (68,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
	Heat pump mode deactivation offset	2,0 (3,6)	°C (°F)	0,1 (0,2)	20,0 (36,0)		A		R/W
Dcb01	Enable LT Chiller management	0	--	0	1	0:NO 1:YES	D		R/W
	Position of LT Chiller start command digital output	1	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	LT Chiller start command output logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	Position of LT Chiller alarm digital input	12	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13….22: U01e...U10e	I		R/W
	LT Chiller alarm digital input logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	LT Chiller alarm digital input status		--	0	1	0: Closed 1: Open	D		R
Dcb02	Position of LT Chiller water inlet temperature probe	5	--	0	20	0: --- 1…10:U01...U10 11….20: U01e...U10e	I		R/W
	LT Chiller Water Inlet temperature probe type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	LT Chiller water intlet temperature value		°C (°F)	--	--		A		R
	LT Water inlet temperature probe offset	0,0 (0,0)	°C (°F)	-50,0 (-90,0)	50,0 (90,0)		A		R/W
Dcb03	Position of LT Chiller water outlet temperature probe	6	--	0	20	0: --- 1…10:U01...U10 11….20: U01e...U10e	I		R/W
	LT Chiller Water Outlet temperature probe type	0	--	0	2	0: NTC 1: PT1000 2: NTC-HT	I		R/W
	LT Chiller water outlet temperature value		°C (°F)	--	--		A		R
	LT Water outlet probe offset	0,0 (0,0)	°C (°F)	-50,0 (-90,0)	50,0 (90,0)		A		R/W
Dcb04	Chiller delay ON	30	s	0	999		I		R/W
Dcc01…3	LT Chiller Scheduler - TB1…7 Day	0	--	0	11	0: --- 1: MONDAY 2: TUESDAY 3: WEDNESDAY 4: THURSDAY 5: FRIDAY 6: SATURDAY 7: SUNDAY 8: MON-FRI 9: MON-SAT 10: WEEKEND 11: ALL DAYS	I		R/W
Dcc01…3	LT Chiller Scheduler - TB1…7 Start Hour	0	h	0	23		I		R/W
	LT Chiller Scheduler - TB1…7 Start Minute	0	min	0	59		I		R/W
	LT Chiller Scheduler - TB1…7 End Hour	0	h	0	23		I		R/W
	LT Chiller Scheduler - TB1…7 End Minute	0	min	0	59		I		R/W

Mask Index	Variable Description	Default Value	UoM	Min	Max	Value Description	Type	Adr	R/W
Dd01	Position of Switch Valve 1 (Summer-Winter) digital output	5	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	Switch Valve 1 output logic	0	--	0	1	0: WIN:O - SUM:C 1: WIN:C - SUM:O	D		R/W
	Switch Valve 1 output status		--	0	1	0: Closed 1: Open	D		R
	Position of Switch Valve 2 (Summer-Winter) digital output	6	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	Switch Valve 2 output logic	0	--	0	1	0: WIN:O - SUM:C 1: WIN:C - SUM:O	D		R/W
	Switch Valve 2 output status		--	0	1	0: Closed 1: Open	D		R
Dd02	Chillbooster presence	1	--	0	1	0:NO 1:YES	D		R/W
	Position of Chillbooster start command digital output	2	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
	Chillbooster start command output logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	Position of Chillbooster alarm digital input	9	--	0	22	0: --- 1…10: U01...U10 11: ID1 12: ID2 13….22: U01e...U10e	I		R/W
	Chillbooster alarm digital input logic	0	--	0	1	0: N.O. 1: N.C.	D		R/W
	Chillbooster alarm digital input status		--	0	1	0: Closed 1: Open	D		R
Dd03	Chillbooster Sanitary procedure enable	0	--	0	1	0:NO 1:YES	D		R/W
	Sanitary procedure hour	23	h	0	23		I		R/W
	Sanitary procedure minute	0	min	0	59		I		R/W
	Sanitary procedure duration	5	min	0	99		I		R/W
	Sanitary temperature threshold for activation	10.0 (50,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
Dd04	Chillbooster temperature threshold for activation	35.0 (95,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
	Chillbooster humidity threshold for activation	85.0	%rH	0	100,0		A		R/W
	Time of fans at maximum speed for activating Chillbooster output	10	min	0	999		I		R/W
Dd05	Enable Generic Function	0	--	0	2	0:NO 1:YES DIRECT 2: YES REVERSE	I		R/W
	Probe Generic Function	0	--	0	12	0: GENERIC TEMP. 1: GENERIC TEMP. 2 2: A.BYPASS 3: EXTERNAL TEMP. 4: WATER OUT DRY 5: WATER IN DRY 6: WATER OUT CHILLER 7: WATER IN CHILLER 8: AMBIENT TEMP. 9: WATER IN MT 10: WATER OUT MT 11: WATER IN LT 12: WATER OUT LT	I		R/W
	Setpoint Generic function (PID)	20,0 (68,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
	Proportional Coefficient of Generic Function	10	%/°C (°F)	0.1	999.9		A		R/W
	Integral time of Generic Function	100	s	0	999		I		R/W
	Derivative time of Generic Function	0	s	0	999		I		R/W
Dd06	Type	0	--	0	1	0: DIGITAL 1: ANALOG	D		R/W
	Low limit of Generic Function (Analog output)	0	%	0	100		A		R/W
	High limit of Generic Function (Analog output)	100	%	0	100		A		R/W
	Position of Generic Function Analog output	0	--	0	22	0: --- 1…10: U01...U10 11: Y1 12: Y2 13….22: U01e...U10e	I		R/W
	Position of Generic Function Digital output	0	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W

Mask Index	Variable Description	Default Value	UoM	Min	Max	Value Description	Type	Adr	R/W
Dd07	Enable Generic Function 2	0	--	0	2	0:NO 1:YES DIRECT 2: YES REVERSE	I		R/W
	Probe Generic Function 2	1	--	0	12	0: GENERIC TEMP. 1: GENERIC TEMP. 2 2: A.BYPASS 3: EXTERNAL TEMP. 4: WATER OUT DRY 5: WATER IN DRY 6: WATER OUT CHILLER 7: WATER IN CHILLER 8: AMBIENT TEMP. 9: WATER IN MT 10: WATER OUT MT 11: WATER IN LT 12: WATER OUT LT	I		R/W
	Setpoint Generic function 2 (PID)	20,0 (68,0)	°C (°F)	-50,0 (-58,0)	100,0 (212,0)		A		R/W
	Proportional Coefficient of Generic Function 2	10,0	%/°C (°F)	0.1	999.9		A		R/W
	Integral time of Generic Function 2	100	s	0	999		I		R/W
	Derivative time of Generic Function 2	0	s	0	999		I		R/W
Dd08	Type	0	--	0	1	0: DIGITAL 1: ANALOG	D		R/W
	Low limit of Generic Function 2 (Analog output)	0	%	0	100		A		R/W
	High limit of Generic Function 2 (Analog output)	100	%	0	100		A		R/W
	Position of Generic Function 2 Analog output	0	--	0	22	0: --- 1…10: U01...U10 11: Y1 12: Y2 13….22: U01e...U10e	I		R/W
	Position of Generic Function 2 Digital output	0	--	0	12	0: --- 1…6: NO1...NO6 7…12: NO1e...NO6e	I		R/W
Ea01	Date format	0	--	0	2	0: DD/MM/YY 1: MM/DD/YY 2: YY/MM/DD	I		R/W
	Writing of new day value enabled by EnDate		--	1	31		I		R/W
	Writing of new month value enabled by EnDate		--	1	12		I		R/W
	Writing of new year value enabled by EnDate		--	0	99		I		R/W
	Writing of new Hour value enabled by EnDate		--	0	24		I		R/W
	Writing of new minute value enabled by EnDate		--	0	59		I		R/W
	Day of week		--	0	7	0: 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday 7: Sunday	I		R
Ea02	Current Time Zone	0	--	0	94	BERL/BUDUP/PARIS ...	I		R
	New Time Zone	0	--	0	94	BERL/BUDUP/PARIS ...	I		R/W
	Update Time Zone	0	--	0	1	0: NO 1...YES	I		R/W
Eb01	Change Language	0	-	0	1	0: INGLESE 1: ITALIANO	I		R/W
Ec01	ModBus Master Fieldbus Baudrate setting (bps)	1		0	2	0: 9600 1: 19200 2: 38400	I		R/W
	ModBus Master Fieldbus Stop Bits setting	2	--	0	2	0: 0 STOP BIT; 1: 1 STOP BIT; 2: 2 STOP BITS	I		R/W
	ModBus Master Fieldbus Parity setting	0	--	0	2	0: NONE; 1: ODD; 2: EVEN	I		R/W
Ec02	Port (only high end modul)	0	--	0	1	0: DISPLAY PORT 1: ETHERNET			
	Supervisor BMS Protocol	0	--	0	1	0: CAREL 1: MODBUS	I		R/W
	Address	1	--	0	247		I		R/W
	BMS Baudrate setting (bps)	1		0	2	0: 9600 1: 19200 2: 38400	I		R/W
	BMS Stop Bits setting	2	--	0	2	0: 0 STOP BIT; 1: 1 STOP BIT; 2: 2 STOP BITS	I		R/W
	BMS Parity setting	0	--	0	2	0: NONE; 1: ODD; 2: EVEN	I		R/W
Ed01	User password	0	--	0	9999		I		R/W
	Service password	1234	--	0	9999		I		R/W
	Manufacturer password	1234	--	0	9999		I		R/W
	Password reset delay	15	min	1	99		I		R/W

Mask Index	Variable Description	Default Value	UoM	Min	Max	Value Description	Type	Adr	R/W
Ee01	Delete alarm logs	0	--	0	1	0: NO 1: YES	D		R/W
	Clear AutoReset counters	0	--	0	1	0: NO 1: YES	D		R/W
Ee02	Import/Export file	0	--	0	1	0: IMPORT 1: EXPORT	D		R/W
	Drive type	0	--	0	1	0: INT FLASH MEMORY 1: USB	D		R/W
	Import/Export file name (EXPORT_XX)	0	--	0	99		I		R/W
	Confirm operation	0	--	0	1	0: NO 1: YES	I		R/W
Ee03	Default installation informations (info)	--	--	--	--	1: Press enter+alarm 2: Application 3: Wipe Retain			R
Ee04	Counter Reset	--	--	0	3	0: MT1 1: MT2 2: LT1 3: LT2	I		R/W
Ef01	Pess Enter to Logout	0	--	0	1		I		R/W
Ef02	Unit of measure selection	0	--	0	1	0: NO CONVERSION 1: U.S. SYSTEM	I		R/W
Ef03	Buzzer Einable	0	-	0	1	0: YES 1: NO	D		R/W
F00	Datalogger	0	-	0	64	-	-		R
Fb01	Temperature 1 selector	4	--	0	12	0: GENERIC TEMP. 1: GENERIC TEMP. 2 2: A.BYPASS 3: EXTERNAL TEMP. 4: WATER OUT DRY 5: WATER IN DRY 6: WATER OUT CHILLER 7: WATER IN CHILLER 8: AMBIENT TEMP. 9: WATER IN MT 10: WATER OUT MT 11: WATER IN LT 12: WATER OUT LT	I		R/W
	Temperature alarm 1 threshold type	1	--	0	1	0: RELATIVE 1: ABSOLUTE	D		R/W
	High Temperature Alarm 1 Threshold (Absolute)	50,0 (122,0)	°C (°F)	Low	100,0 (212,0)		A		R/W
	High Temperature Alarm 1 Threshold (Relative)	50,0 (90,0)	°C (°F)	0,0 (0,0)	50,0 (90,0)		A		R/W
	Low Temperature Alarm 1 Threshold (Absolute)	0,0 (32,0)	°C (°F)	-50,0 (-58,0)	High		A		R/W
	Low Temperature Alarm 1 Threshold (Relative)	50,0 (90,0)	°C (°F)	0,0 (0,0)	50,0 (90,0)		A		R/W
Fb02	Temperature 2 selector	5	--	0	12	0: GENERIC TEMP. 1: GENERIC TEMP. 2 2: A.BYPASS 3: EXTERNAL TEMP. 4: WATER OUT DRY 5: WATER IN DRY 6: WATER OUT CHILLER 7: WATER IN CHILLER 8: AMBIENT TEMP. 9: WATER IN MT 10: WATER OUT MT 11: WATER IN LT 12: WATER OUT LT	I		R/W
	Temperature alarm 2 threshold type	1	--	0	1	0: RELATIVE 1: ABSOLUTE	D		R/W
	High Temperature Alarm 2 Threshold (Absolute)	50,0 (122,0)	°C (°F)	Low	100,0 (212,0)		A		R/W
	High Temperature Alarm 2 Threshold (Relative)	50,0 (90,0)	°C (°F)	0,0 (0,0)	50,0 (90,0)		A		R/W
	Low Temperature Alarm 2 Threshold (Absolute)	0,0 (32,0)	°C (°F)	-50,0 (-58,0)	High		A		R/W
	Low Temperature Alarm 2 Threshold (Relative)	50,0 (90,0)	°C (°F)	0,0 (0,0)	50,0 (90,0)		A		R/W
Fb03	Differential OFF	2,0 (3,6)	°C (°F)	0,0 (0,0)	50,0 (90,0)		A		R/W
	Delay ON	120	min	0	240		I		R/W

8. SIGNALS AND ALARMS

Waterloop controller can manage both alarms relating to the status of the digital inputs and to system operation. For each alarm, the following are controlled:

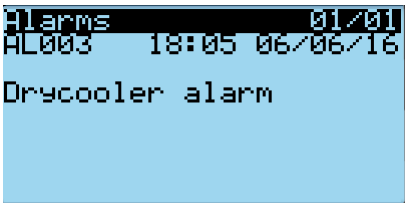
- actions on the devices, if required
- output alarm relay (if configured)
- red LED on the terminal and buzzer
- any activation delay

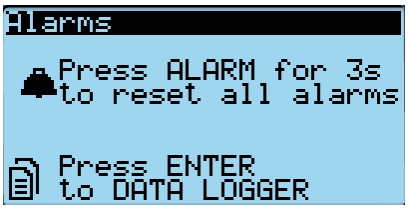
The complete list of alarms, with the related information as described above, is available in the "Alarm table".

8.1 Alarm management

All alarms feature the following behaviour:

- When an alarm is activated, the red LED flashes and the buzzer and alarm relay are activated (when configured)
- Pressing the button, the red LED stays on steady, the buzzer is muted and the alarm screen is shown
- If there is more than one active alarm, these can be scrolled using and
- Pressing the button again for at least 3 seconds manually resets the alarms, which are cleared from the display unless others are active (they are saved in the log)





Reset

Alarms can be reset manually or automatically:

- Manual: the alarm is reset by pressing the button twice, the first time displays the corresponding alarm screen and mutes the buzzer, the second (extended, for at least 3 seconds) cancels the alarm (which is saved in the log). If the alarm is still active, the reset has no effect and the signal is shown again.
- Automatic: when the alarm condition ceases, the alarm is automatically reset, the LED comes on steady and the corresponding screen remains displayed until the button is pressed and held; the alarm is saved in the log.

For manual reset, the functions associated with the alarm will not be reactivated until the alarm is reset, while for automatic reset, the functions are reactivated as soon as the alarm condition ceases.

Log/Events

The alarm log can be accessed:

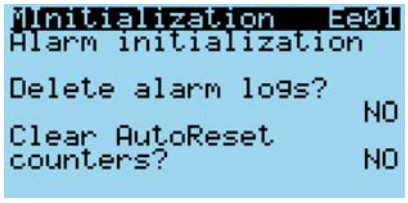
- from branch F of the main menu
- pressing and then when there are no active alarms

The alarm log screens show:

1. the chronological number of the event (no. 01 is the più recenti alarm)
2. time and date of the alarm
3. the alarm code (see the table in par. 8.5)
4. short description of the logged alarm
5. start and end of the event.

Note: A maximum of 64 alarms can be logged; after this limit any new events overwrite the oldest ones, which are therefore deleted.

In menu E (Initialisation), the log can be reset on screen Ee01. The same screen can also be used to reset the pump hour counters.



8.2 Temperature alarms

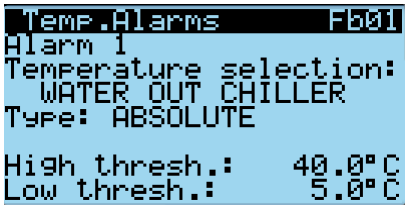
High and low temperature alarms

On screens Fb01 and Fb02, the probe used to detect the high and low temperature alarms can be set, based on two different temperatures.

The following probes can be set:

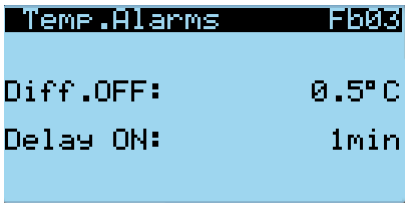
- drycooler outlet probe;
- drycooler inlet probe;
- chiller outlet probe;
- chiller inlet probe;
- ambient temperature probe
- generic probe;
- generic probe 2;
- bypass temperature probe;
- outside temperature probe;
- MT inlet temp. probe
- MT outlet temp. probe
- LT inlet temp. probe
- LT outlet temp. probe

The alarm thresholds can be absolute compared to the probe set point, or relative (see the note). The thresholds for high and low temperature alarms 1 are set on screen Fb01, while those for high and low temperature alarms 2 are set on Fb02.



Note: if a relative alarm is selected, this is fixed only in relation to the drycooler set point.

The reset differential, equal for all four thresholds, and the corresponding activation delay can be set on screen Fb03.



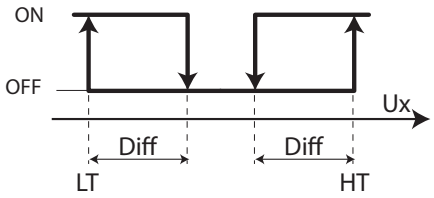


Fig. 8.a

Keys

LT	Low temperature alarm thresholds	Ux	Selected probe
HT	High temperature alarm thresholds		

8.3 Alarms table

Code	Description	Reset	Delay	Action
AL001	Error in the number of retain memory writings	Man	Imm.	
AL002	Error in retain memory writings	Man	Imm.	
AL003	Drycooler alarm	Auto	Imm.	Drycooler and Chillbooster OFF
AL004	MT Pump alarm	Auto	Imm.	
AL005	LT Pump alarm	Auto	Imm.	
AL006	Chillbooster alarm	Auto	Imm.	Chillbooster OFF
AL007	LT Chiller alarm	Auto	Imm.	LT Chiller OFF
AL008	AC System alarm	Auto	Imm.	AC System OFF
AL009	MT Pump 1 Overload alarm	Dbb15	Imm.	MT Pump 1 OFF
AL010	MT Pump 2 Overload alarm	Dbb15	Imm.	MT Pump 2 OFF
AL011	Source pump MT group alarm	Dbb15	Imm.	Analogue pump MT OFF
AL012	Flow Switch MT pump alarm	Dbb15	Dbb07	Analogue pump MT OFF
AL013	Device offline alarm	Auto	Imm.	
AL014	Wrong configuration on device	Auto	Imm.	
AL015	LT Pump 1 Overload alarm	Dbb15	Imm.	LT Pump 1 OFF
AL016	LT Pump 2 Overload alarm	Dbb15	Imm.	LT Pump 2 OFF
AL017	Source pump LT group alarm	Dbb15	Imm.	Analogue pump LT OFF
AL018	Flow Switch LT pump alarm	Dbb15	Dbb14	Analogue pump LT OFF
AL019	External temperature probe alarm	Auto	Fb03	
AL020	External humidity probe alarm	Auto	Fb03	
AL021	Drycooler inlet water temperature probe alarm	Auto	Imm.	
AL022	Drycooler outlet water temperature probe alarm	Auto	Imm.	
AL023	MT inlet pressure probe alarm	Auto	Imm.	
AL024	MT outlet pressure probe alarm	Auto	Imm.	
AL025	LT Chiller inlet water temperature probe alarm	Auto	Imm.	
AL026	LT Chiller outlet water temperature probe alarm	Auto	Imm.	
AL027	LT inlet pressure probe alarm	Auto	Imm.	
AL028	LT outlet pressure probe alarm	Auto	Imm.	
AL029	Low Temperature alarm 1	Auto	Fb03	
AL030	Low Temperature alarm 2	Auto	Fb03	
AL031	High Temperature alarm 1	Auto	Fb03	
AL032	High Temperature alarm 2	Auto	Fb03	
AL033	Serial Probe offline alarm	Auto	Fb03	
AL034	Temperature probe in serial broken	Auto	Fb03	
AL035	Humidity probe in serial broken	Auto	Fb03	
AL036	Ambient temperature probe alarm	Auto	Fb03	

Tab. 8.a

9. SOFTWARE UPDATE

9.1 Setting the controller's address

The controller's pLAN address set by default in the factory is 1. The controller's address can be set via a terminal connected in the pLAN network. The controller is assigned a private (Pr) or shared (Sh) terminal with address 32. The address of the external terminal can be set in the range between 0 and 32; addresses between 1 and 32 are used by the pLAN protocol, while address 0 identifies the Local terminal protocol, used for point-to-point connections and to configure the controller (this procedure is only possible with a pGD terminal and one pCO only).

9.2 Setting the terminal address and connecting the controller to the terminal

After setting the controller network address (see previous paragraph), to establish connections between the controller and the terminal, the terminal address needs to be set.

9.3 Uploading/updating the software

It is possible to load/update the application software of the c.pCO controllers family with the following methods:

- Update from computer by using c.factory (via USB or Ethernet connection
- Update via USB flash drive
- Update with file transfer via FTP
- Update via tERA cloud service

The c.factory software is part of the "c.suite", but it can be also installed individually, downloading it from http://ksa.carel.com under "Software & Support"->"c.suite".

Update from computer using c.factory

On all c.pCO family controllers, the application program can be uploaded by using the c.factory software, with direct connection to the controller via USB cable or Ethernet network. To upload the application program, proceed as follows:

a) Update from computer using c.factory via Ethernet connection:

Configure the computer and the c.pCO controller so that they belong to the same LAN (see paragraph 9.2).

1. Open c.factory and select the application program file compiled in c.strategy tool (".otr" file extension). The tool will list the configurations defined in c.design. Select the configuration to be loaded on the controller and click "next".

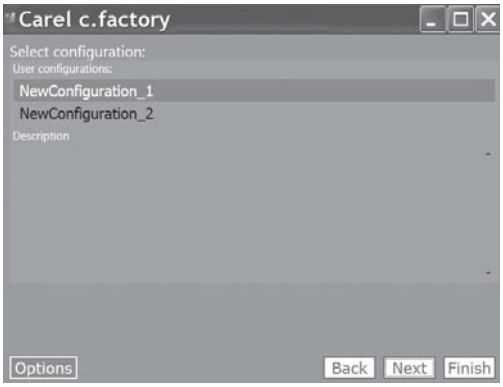


Fig. 9.a

2. Select the files to be loaded on the controller and "Ethernet Connection" type. By pressing "Discover" it is possible to list the c.pCO controllers available in the LAN. Select the MAC address of the c.pCO controller to be updated, and click "upload":

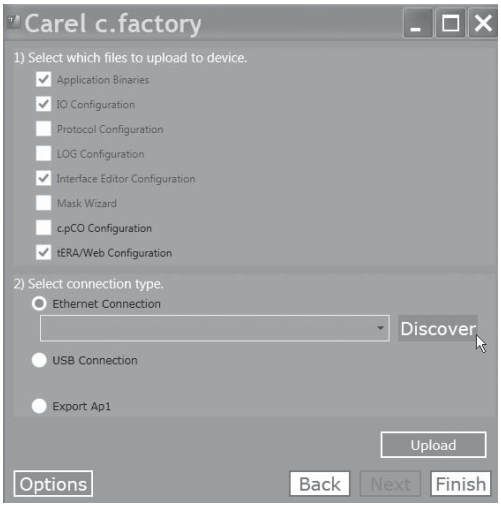


Fig. 9.b

Note: if the c.pCO controller contains an application program that is protected by a different password or digital signature than the new application program, a dialogue box will be shown prompting for the password. If the password entered is correct, the new application program can be uploaded.

3. At the end of the update procedure, the c.pCO controller restarts automatically with the new application program (or new configuration).

b) Update via USB connection:

Connect the computer to the c.pCO controller via USB cable using the device USB port.

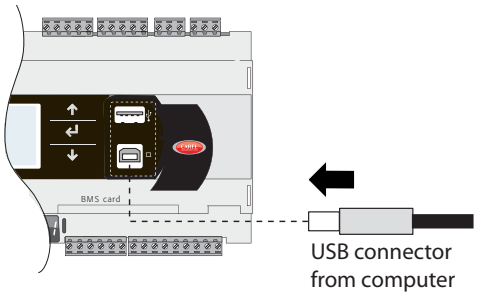


Fig. 9.c

1. Open c.factory and select the application program file compiled in c.suite (".otr" file extension). The tool will list the configurations defined in c.design. Select the configuration to be loaded on the controller and click "next".

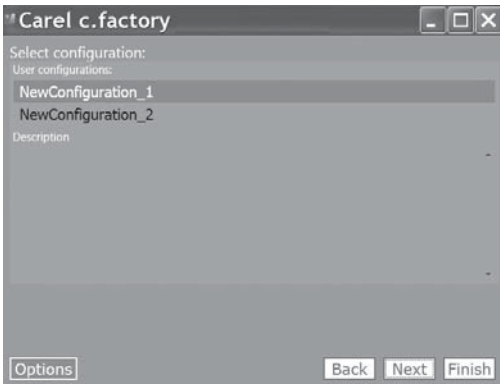


Fig. 9.d

2. Select the files to be loaded on the controller and "USB Connection" type. Select the serial port that the c.pCO controller is connected to via USB cable and click "upload":

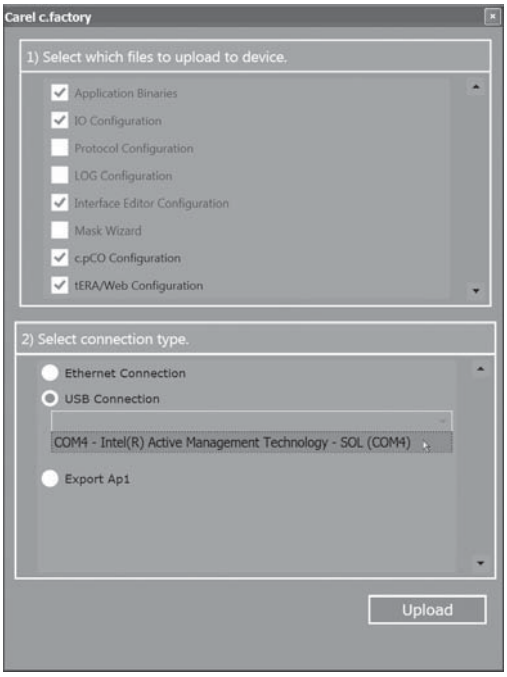


Fig. 9.e

Note: if the c.pCO controller contains an application program that is protected by a different password or digital signature than the new application program, a dialogue box will be shown prompting for the previous password. If the password entered is correct, the new application program can be uploaded.

3. At the end of the update procedure, the c.pCO controller restarts automatically with the new application program (or new configuration).

Important: before updating the c.pCO controller via USB connection, check in the system menu that the Device USB port is enabled (Settings --> USB Settings --> PC connection, see Chapter 7).

Update via USB flash drive

All models in the c.pCO family come with a host USB port that can be connected to a USB mass storage device (typically a USB flash drive or portable hard drive), from which an application program can be loaded onto the c.pCO programmable controller.
To update the controller, the application file with extension .ap1 needs to be created in c.factory and loaded onto the USB flash drive:

1. Open c.factory and select the application program file compiled in c.suite (".otr" file extension). The tool will list the configurations defined in c.design. Select the configuration to be loaded on the controller and click "next".

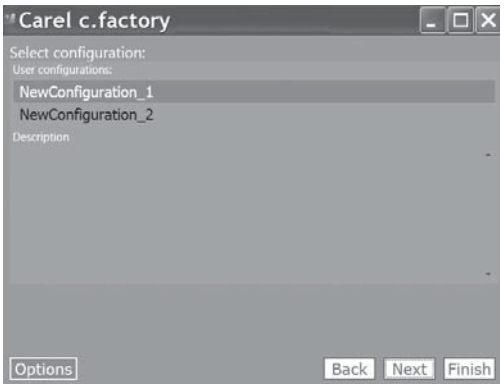


Fig. 9.f

2. Select the files to be loaded onto the controller and click "Export Ap1". In the application package it is possible to include also:
   - the Operating System, selecting the specific path;
   - the web pages for the c.pCO web server functionality (see Chapter 10).

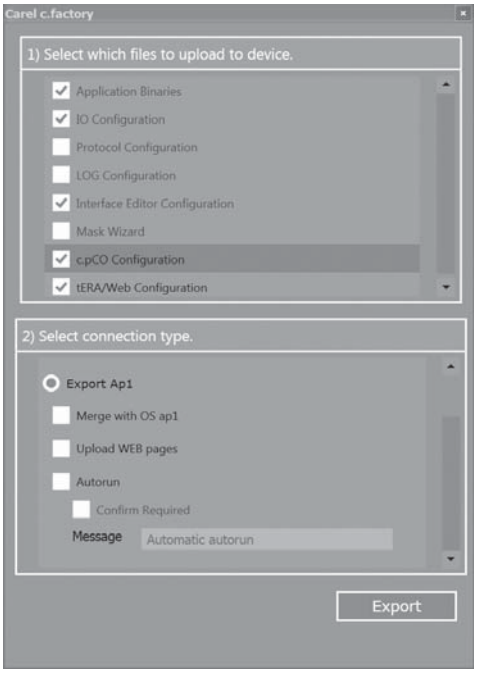


Fig. 9.g

3. Click "Export" and save the file to a flash drive, under a directory called "UPGRADE".
4. Plug the flash drive into the Host USB port and enter the system menu (see Chapter 7). On the screen, select UPGRADE and then the application program to be loaded and confirm by pressing enter.

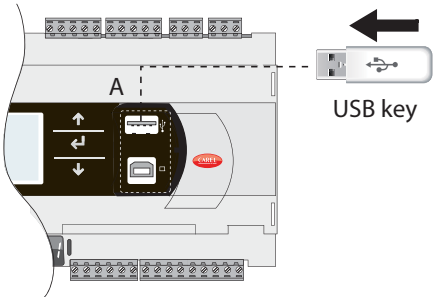
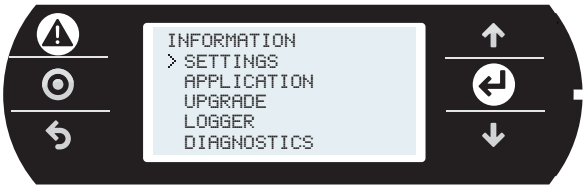
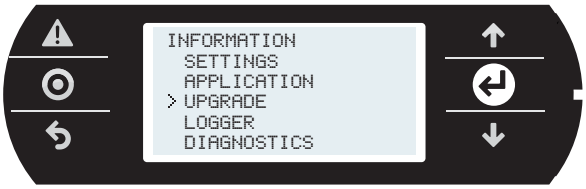


Fig. 9.h





Important:

- Before updating the c.pCO controller via USB connection, check in the system menu that the Host USB port is enabled (Settings --> USB Settings --> Pen drive, see Chapter 7).
- Only use flash drives with FAT file system.
- Do not use both USB ports on the controller at the same time.
- Do not use mass storage peripherals that have a current draw more than 500 mA.

Update with file transfer via FTP

The c.pCO family controllers fitted with Ethernet port include an FTP server that provides access to the public partition of the file system. Files and directories in this partition can be read, modified, created and deleted. FTP can also be used to transfer an .ap1 file, for example to update the image of the operating system or the application program. This is done using an FTP client, for example "FileZilla".

To protect the contents of the public file system against unauthorised access, different users can be created, assigning each a different access profile, dedicated to each service and adapted to the individual directory (see Chapter 9). To update via FTP:

1. Open an FTP client (e.g. FileZilla). Enter the IP address of the c.pCO controller and the access credentials (default user "anonymous", no password).
2. Drag & drop the software update file from the directory on the computer to the "UPGRADE" directory on the c.pCO controller.

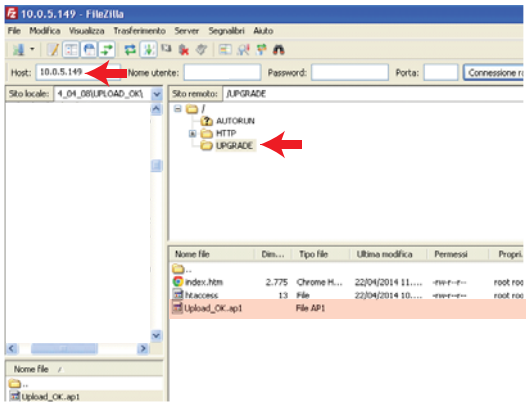
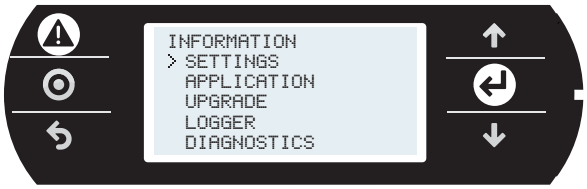


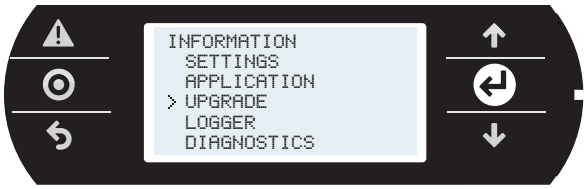
Fig. 9.i

Nota: Please use following settings in Filezilla:

- Edit->Settings->Connection-> set timeout in seconds = 0
- Edit -> Settings -> Transfers -> set maximum simultaneous transfers to 1

3. Access the system menu on the c.pCO and select "UPGRADE" (see Chapter 7).





Note: when having loaded the update file to the "UPGRADE" directory via FTP, the update procedure can also be started using the virtual terminal (see paragraph 10.3).

9.4 c.pCO connection to cloud tERA

The c.pCO controllers family can establish a remote secure connection to the Carel cloud server platform called tERA. Every c.pCO with built-in Ethernet interface is natively integrated into tERa cloud platform and can access to linked services. Every c.pCO is uniquely identified by the tERA cloud using its MAC address. It is possible to create a customized private portal according to the customers specifications. For further information on tERA services available, contact your local Carel sales network.

Fig. 9.j

c.pCO registration:
Activation and registration procedure and settings of the tERA services are described in the "tERA Quick start Guide" (document +030222141), that can be download from www.carel.com.
Following data are requested in order to register a c.pCO in tERA server:

- MAC address of the c.pCO
- c.pCO Hardware unique ID
- tERA password

Above data are reported in the c.pCO System menu at the following path: INFORMATION --> pCO INFORMATION (see figure below).

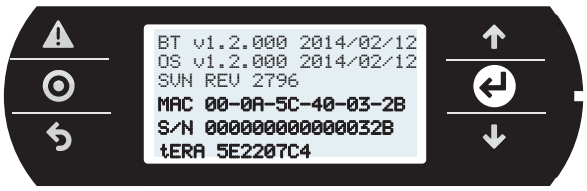


Fig. 9.k

c.pCO Update from tERA
From tERA portal, it is possible to update the application program and the Operating System of the c.pCO by remote. The controller should be already registered in the tERA portal.

Procedure is described in "tERA Quick start Guide" (document +030222141), that can be download from www.carel.com.

9.5 History of software revisions

- Version 1.1 = first official version

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