

# humiFog multizone

pumping unit

# CAREL



## **ENG** User manual

**LEGGI E CONSERVA  
QUESTE ISTRUZIONI!**  
→ **READ AND SAVE  
THESE INSTRUCTIONS** ←

  **NO POWER  
& SIGNAL  
CABLES  
TOGETHER**  
READ CAREFULLY IN THE TEXT!



WARNINGS



CAREL INDUSTRIES Hq humidifiers are advanced products, whose operation is specified in the technical documentation supplied with the product or can be downloaded, even prior to purchase, from the website [www.carel.com](http://www.carel.com). Each CAREL INDUSTRIES Hq product, in relation to its advanced level of technology, requires setup/configuration/programming/commissioning to be able to operate in the best possible way for the specific application. The failure to complete such operations, which are required/indicated in the user manual, may cause the final product to malfunction; CAREL INDUSTRIES Hq accepts no liability in such cases.

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 INDUSTRIES Hq may, based on specific agreements, act as a consultant for the installation/commissioning/use of the unit, however in no case does it accept liability for the correct operation of the humidifier and the final installation if the warnings or suggestions provided in this manual or in other product technical documents are not heeded. In addition to observing the above warnings and suggestions, the following warnings must be heeded for the correct use of the product:

- **DANGER OF ELECTRIC SHOCK**  
The humidifier contains live electrical components. Disconnect the mains power supply before accessing inside parts or during maintenance and installation;
- **DANGER OF WATER LEAKS**  
The humidifier automatically and constantly fills/drains certain quantities of water. Malfunctions in the connections or in the humidifier may cause leaks;
- **For isothermal humidifiers: DANGER OF BURNS**  
The humidifier contains high temperature components (100°C/212°F);
- **For gas-fired isothermal humidifiers: DANGER OF GAS LEAKS**  
The humidifier is connected to the gas mains. Malfunctions in the connections or inside the humidifier may cause gas leaks.
- The installation of the product must include an earth connection, using the special yellow-green terminal available in the humidifier.
- The environmental and power supply conditions must conform to the values specified on the product rating labels.
- The product is designed exclusively to humidify rooms either directly or through distribution systems (ducts). In addition, for adiabatic-water spray-pressure humidifiers, humidification also occurs through the atomisation rack.
- Only qualified personnel who are aware of the necessary precautions and able to perform the required operations correctly may install, operate or carry out technical service on the product.
- Only water with the characteristics indicated in this manual must be used for steam or water vapour production.
- Warning, demineralised drinking water must be used for adiabatic-water spray-pressure humidifiers (as specified in the manual). In addition, the particles of water not absorbed by the air must be removed into the droplet collection tank (in the humidification section) and by the droplet separator (at the end of the humidification section).
- All operations on the product must be carried out according to the instructions provided in this manual and on the labels applied to the product. Any uses or modifications that are not authorised by the manufacturer are considered improper. CAREL INDUSTRIES Hq declines all liability for any such unauthorised use.
- Do not attempt to open the humidifier in ways other than those specified in the manual.
- Observe the standards in force in the place where the humidifier is installed.
- Keep the humidifier out of the reach of children and animals.
- Do not install and use the product near objects that may be damaged when in contact with water (or condensate). CAREL INDUSTRIES Hq declines all liability for direct or indirect damage following water leaks from the humidifier.
- Do not use corrosive chemicals, solvents or aggressive detergents to clean the inside and outside parts of the humidifier, unless specifically indicated in the user manual.
- Do not drop, hit or shake the humidifier, as the inside parts and the linings may be irreparably damaged.
- For adiabatic-water spray-pressure humidifiers: the atomised water must be distributed using a special atomising 'rack' or through distribution systems specified by CAREL INDUSTRIES Hq
- For isothermal appliances: these are designed to produce steam at atmospheric pressure, and not pressurised steam. CAREL INDUSTRIES Hq does not recommend and waives all liability for the use of distribution devices other than those specified.

CAREL INDUSTRIES Hq adopts a policy of continual development. Consequently, CAREL reserves the right to make changes and improvements to any product described in this document without prior warning. The technical specifications shown in the manual may be changed without prior warning.

The liability of CAREL INDUSTRIES Hq in relation to its products is specified in the CAREL INDUSTRIES Hq general contract conditions, available on the website [www.carel.com](http://www.carel.com) and/or by specific agreements with customers; specifically, to the extent where allowed by applicable legislation, in no case will CAREL INDUSTRIES Hq, its employees or subsidiaries be liable for any lost earnings or sales, losses of data and information, costs of replacement goods or services, damage to things or people, downtime or any direct, indirect, incidental, actual, punitive, exemplary, special or consequential damage of any kind whatsoever, whether contractual, extra-contractual or due to negligence, or any other liabilities deriving from the installation, use or impossibility to use the product, even if CAREL INDUSTRIES Hq or its subsidiaries are warned of the possibility of such damage.

DISPOSAL



The humidifier is made up of metal parts and plastic parts. In reference to European Union directive 2002/96/EC issued on 27 January 2003 and the related national legislation, please note that:

1. WEEE cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
2. 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;
3. 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;
4. 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;
5. in the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.

**Warranty on the materials:** 2 years (from the date of production, excluding consumables).

**Approval:** the quality and safety of CAREL INDUSTRIES Hq products are guaranteed by the ISO 9001 certified design and production system, as well as by the following marks.

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

NO POWER  
& SIGNAL  
CABLES  
TOGETHER

READ CAREFULLY IN THE TEXT!



# Content

<b>1. INTRODUCTION AND ASSEMBLY</b>	<b>7</b>
1.1 Description of humiFog.....	7
1.2 Components in the system.....	7
1.3 humiFog system configurations.....	7
1.4 Dimensions and weights.....	8
1.5 Components (master/slave).....	9
1.6 Electrical specifications.....	10
1.7 Opening the packaging.....	10
1.8 Positioning the cabinet.....	10
1.9 Opening the cabinet door.....	11
1.10 Components and accessories.....	11
<b>2. WATER CIRCUIT CONNECTIONS</b>	<b>12</b>
2.1 Water circuit installation: instructions.....	12
2.2 Supply water characteristics.....	12
2.3 Water circuit installation: checklist.....	
<b>3. ELECTRICAL CONNECTIONS</b>	<b>14</b>
3.1 Power supply.....	15
3.2 Remote ON/OFF.....	15
3.3 Control signals from external voltage-free contact (humidistat).....	15
3.4 Modulating control signal (J2).....	15
3.5 Solenoid valve connection for distribution system.....	17
3.6 Water treatment system control.....	18
3.7 Cumulative alarm relay (J15).....	18
3.8 Alarm inputs from external devices.....	18
3.9 Master-slave connection.....	18
3.10 Supervisor network.....	19
<b>4. PUMPING UNITS</b>	<b>20</b>
4.1 Pumping unit with flow control configuration.....	20
4.2 Pumping unit with constant pressure control.....	20
<b>5. DISTRIBUTION SYSTEM</b>	<b>21</b>
5.1 Air handling unit: distribution, atomisation system and droplet separator.....	21
5.2 Direct humidification into the room: distribution and atomisation system.....	21
<b>6. APPLICATIONS</b>	<b>22</b>
6.1 Main advantages of humiFog multizone.....	22
<b>7. CONTROL</b>	<b>23</b>
<b>8. SINGLE ZONE AND MULTIZONE CONFIGURATION</b>	<b>25</b>
8.1 Single zone.....	25
8.2 Multizone application in AHU or room.....	26
8.3 Indirect adiabatic cooling applications.....	27
8.4 System operation.....	28
8.5 Constant pressure systems: notes on capacity control.....	28
<b>9. STARTING AND USER INTERFACE</b>	<b>30</b>
9.1 Starting.....	30
9.2 Stopping.....	30
9.3 First start-up (setting the language).....	30
9.4 Keypad.....	30
9.5 "Main" screen.....	30
9.6 "INFO" screens.....	31
9.7 "SET" screen.....	31

9.8 "Warnings" screen.....	31
9.9 Main menu.....	32
9.10 User menu.....	34
<b>10. TABLE OF ALARMS</b>	<b>41</b>
<b>11. WIRING DIAGRAMS</b>	<b>44</b>
11.1 Electric panel humiFog multizone - Master - CE.....	44
11.2 Electric panel humiFog multizone - Slave - CE.....	46



# 1. INTRODUCTION AND ASSEMBLY

## 1.1 Description of humiFog

humiFog is a humidifier and adiabatic cooler that atomises demineralised water into very fine droplets that evaporate spontaneously in the air, which is humidified and cooled.

humiFog uses a volumetric pump to pressurise the water, which is atomised by special stainless steel nozzles.

The sophisticated control system combines the action of an inverter, which controls the speed and consequently the flow-rate of the pump, with a series of solenoid valves that activate only the nozzles that are necessary, allowing the system to always operate at the ideal pressure to atomise the water, across a wide range of flow-rates.

The effect of cooling the air is due to the spontaneous evaporation of the droplets of water: the change in state from liquid to steam occurs by subtracting energy from the air that, as a consequence, is cooled. Each kilogram of water evaporated absorbs 0.69 kWh of heat from the air.

humiFog is a complete humidification and/or adiabatic cooling system that can be used both in AHUs (air handling units) and to humidify or cool industrial environments by spraying water directly into the environments. The term zone refers to both AHUs and industrial environments.

## 1.2 Components in the system

humiFog is made up of:

- a pumping unit that delivers the water at high pressure (25-70 bars). It also contains the electronic controller that completely manages the pumping unit, controlling the temperature/humidity in a zone (either AHU or environment) and managing any other zones connected to the pumping unit;
- The pumping unit can be set to operate:
  - with flow control (maximum precision, minimum energy and water consumption, single zone applications);
  - at constant pressure (suitable for multizone applications where one pumping unit supplies the humidification and/or cooling system in different zones);
- distribution and atomisation system: system of pipes carrying the pressurised water that house the atomisation nozzles and, in general, the capacity-control solenoid valves and drain solenoid valves;
- droplet separator (only when installed in an AHU);
- temperature and/or humidity probes (if necessary);
- water treatment system: typically this is a reverse osmosis demineraliser that supplies water with a low mineral salt content to the humiFog.

## 1.3 humiFog system configurations

The humiFog system can be used in the following configurations:

- single zone: for humidification and/or cooling applications in a AHU or an industrial environment;
- multizone: for applications where one pumping unit (master) is used to supply multiple zones with pressurised water. The master will control one zone, in the sense that in relation to the zone probe readings or the external controller, it will activate and control the distribution and atomisation system so as to maintain the humidity or temperature level. All other zones will have a controller (slave electrical panel) that communicates with the master, and in relation to the zone probe readings or the external controller will activate and control the distribution atomisation system so as to maintain the humidity or temperature level.

One important configuration is for indirect adiabatic cooling applications: a pumping unit can be used to humidify the air in winter and to cool the discharged air in summer before it enters a heat recovery unit. This

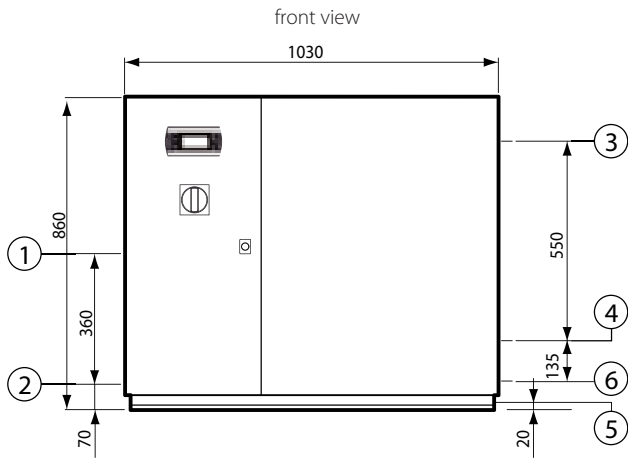
configuration is explained in detail in the chapters below.

humiFog humidifiers are available for:

- maximum flow-rates respectively of 100 l/h,(UA100..) 200 l/h (UA200..), 320 l/h (UA320..), 460 l/h (UA460..), 600 l/h (UA600..);
- type of cabinet: H=single zone master; Z=multizone master; S=slave cabinet;
- power supply voltage: D= 230 V 50 Hz; U= 208 V 60 Hz;
- version: 0=without damper ; 1=with damper (only versions with 100 and 200 l/h flow-rate)
- features of the pump and circuits: 0= brass; 1=stainless steel; 2= stainless steel, silicon free

### 1.4 Dimensions and weights

#### Humifog master



detail of cabinet, water inlet/outlet side view

electrical connection side view

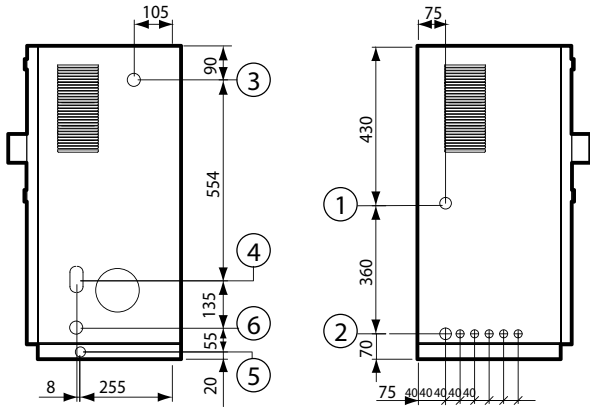


Fig. 1a

**Key:**

- 1. power supply inlet;
- 2. terminal block inlet;
- 3. water inlet;
- 4. water outlet;
- 5. drain
- 6. drain bypass..

**N.B.:** inlets for electrical connections ready to be cut out, opening and cable gland installation to be performed by the installer

Packaging dimensions:

- height (H): 1020 mm (40.16 inch);
- width (W) 1100 mm (43.30 inch);
- depth (D) 455 mm (17.50 inch).

Weight of packaged humidifier:

- models UA(100,200)(H,Z)3\*\*:
- models UA(320,460)(H,Z)3\*\*:
- models UA600(H,Z)3\*\*:

Weight of installed humidifier:

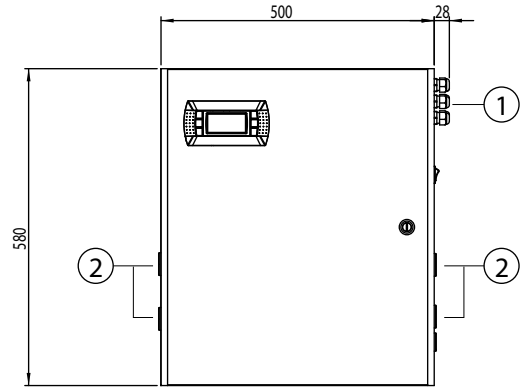
- models UA(100,200)(H,Z)3\*\*:
- models UA(320,460)(H,Z)3\*\*:
- models UA600(H,Z)3\*\*:

Mechanical specifications:

- Installation: floor standing;
- IP20; (enclosure type 1).
- cabinet operating conditions: 1 to 40 °C (34 to 104 °F) <80 % RH non-condensing;
- storage conditions: 1 to 50 °C (34 to 122 °F) <80 % RH non-condensing

#### Humifog slave

front view



detail of cabinet, air & water inlet side view

detail of cabinet, outlet side view (to nozzles)

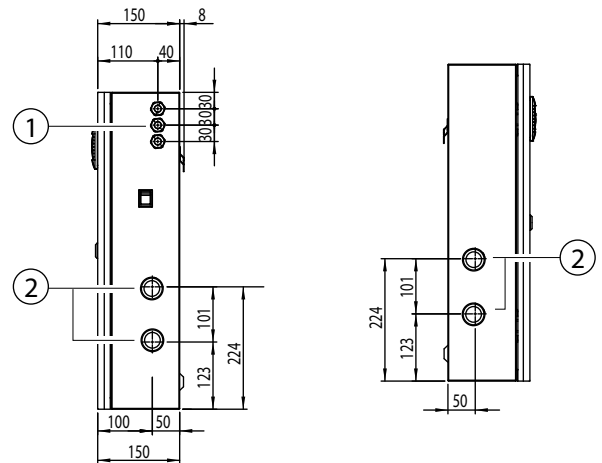


Fig. 1.b

**N.B.:** inlets for electrical connections ready to be cut out, opening and cable gland installation to be performed by the installer

Packaging dimensions:

- height (H): 770 mm (30.14 inch);
- width (W) 605 mm (23.82 inch);
- depth (D) 255 mm (10.00 inch).

Weight of packaged humidifier:

- models UA000S(D,U)300: 21 kg (46.3 lb);

Weight of installed humidifier:

- models UA000S(D,U)300: 19.5 kg (43 lb);

Mechanical specifications:

- Installation: wall mounted;
- IP20; (enclosure type 1)
- cabinet operating conditions: 1 to 40 °C (34 to 104 °F) <80 % RH non-condensing;
- storage conditions: 1 to 50 °C (34 to 122 °F) <80 % RH non-condensing

1.5 Components (master/slave)

Electrical components

Master cabinet

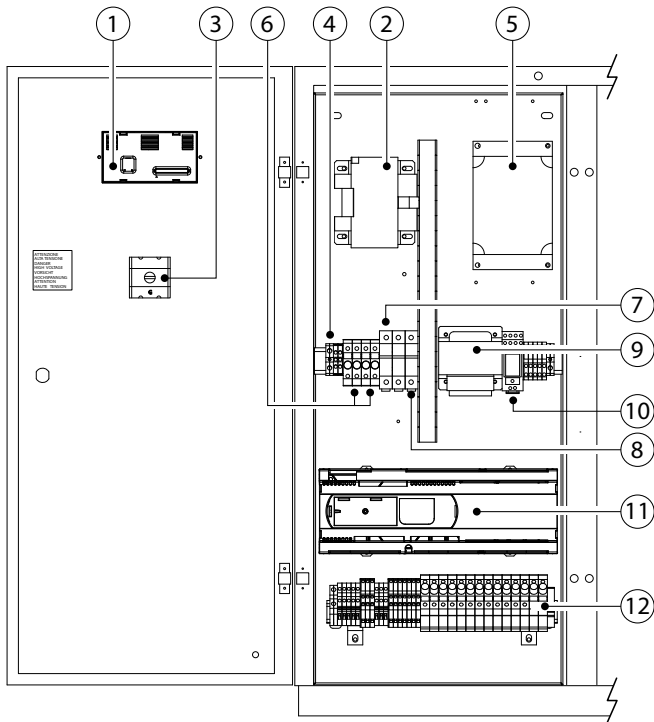


Fig. 1.c

Slave cabinet

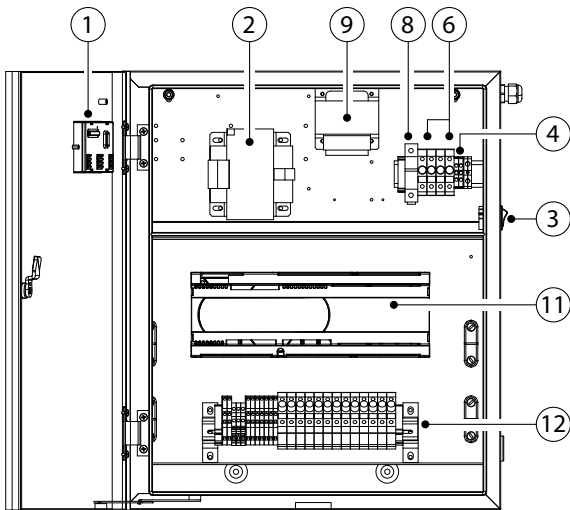


Fig. 1.d

Key:

- 1. terminal rear view.
- 2. transformer B.
- 3. main switch G.
- 4. power supply terminal block.
- 5. VFD inverter.
- 6. transformer primary fuse carrier (TRA: F1,F2; TRB:F3,F4).
- 7. inverter fuse carrier (F6, F7).
- 8. transformer B secondary fuse carrier (F8).
- 9. transformer A.
- 10. start relay K.
- 11. electronic controller;
- 12. control terminal block plus fuses

Water circuit components

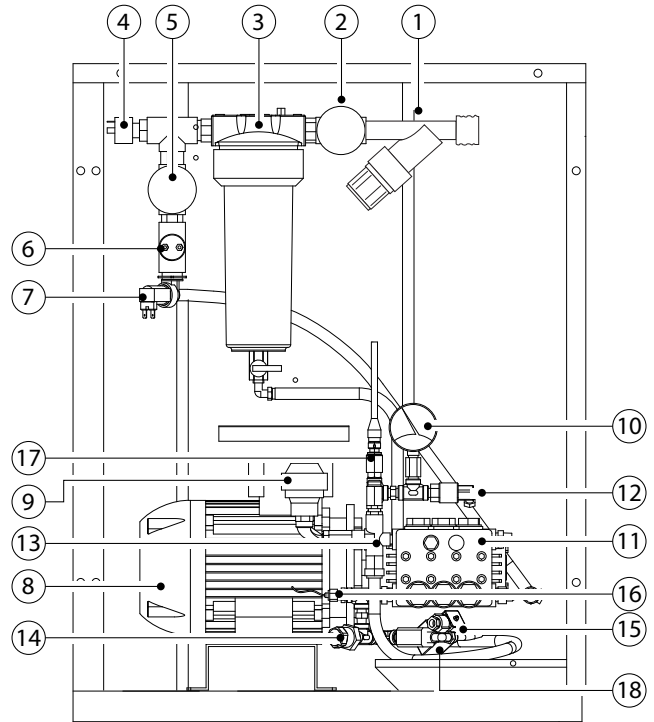


Fig. 1.e

Key:

- 1. inlet water pressure reducer with filter;
- 2. 1st pressure gauge, inlet;
- 3. water filter;
- 4. minimum pressure switch (1 bar);
- 5. 2nd pressure gauge, downstream of the water filter;
- 6. conductivity sensor;
- 7. water supply solenoid valve;
- 8. motor;
- 9. pulsation damper;
- 10. outlet pressure gauge, high pressure side;
- 11. piston pump;
- 12. maximum pressure switch (95 bars);
- 13. high pressure control valve;
- 14. thermostat (70 °);
- 15. bypass solenoid valve;
- 16. temperature probe;
- 17. pressure transducer
- 18. drain bypass.

## 1.6 Electrical specifications

### MASTER 230 V 50 HZ

model	UA100*D3**	UA200*D3**	UA320*D3**	UA460*D3**	UA600*D3**
VAC	230 V	230 V	230 V	230 V	230 V
phases	1	1	1	1	1
Hz	50 Hz	50 Hz	50 Hz	50 Hz	50 Hz
power	0.955 kW	0.955 kW	1.150 kW	1.150 kW	1.95 kW
current	7.0 A	7.0 A	9.2 A	9.2 A	12.0 A

### MASTER 208 V 60 HZ

model	UA100*U3**	UA200*U3**	UA320*U3**	UA460*U3**	UA600*U3**
VAC	208 V	208 V	208 V	208 V	208 V
Phases	1	1	1	1	1
Hz	60 Hz	60 Hz	60 Hz	60 Hz	60 Hz
power	0.955 kW	0.955 kW	1.150 kW	1.150 kW	1.95 kW
current	8.00 A	8.00 A	10.20 A	10.20 A	13 A
FLA	1HP/8 A	1HP/8 A	2HP/12 A	2HP/12 A	3HP/17 A
SCCR	5KA	5KA	5KA	5KA	5KA

### SLAVE

model	UA000SD300	UA000SU300
VAC	230 V	208 V
phases	1	1
Hz	50 Hz	60 Hz
power	0.280 kW	0.280 kW
current	2.20 A	2.50 A
FLA	-	3/4HP
SCCR	-	5KA

**Important:** the maximum distance between the cabinet and rack/distribution system is 50 metres, for higher distances contact CAREL INDUSTRIES.

### Positioning procedure:

- after opening the packaging;
- position the cabinet in the final position;
- level the cabinet horizontally.

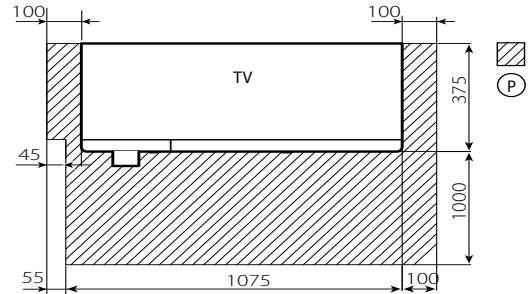


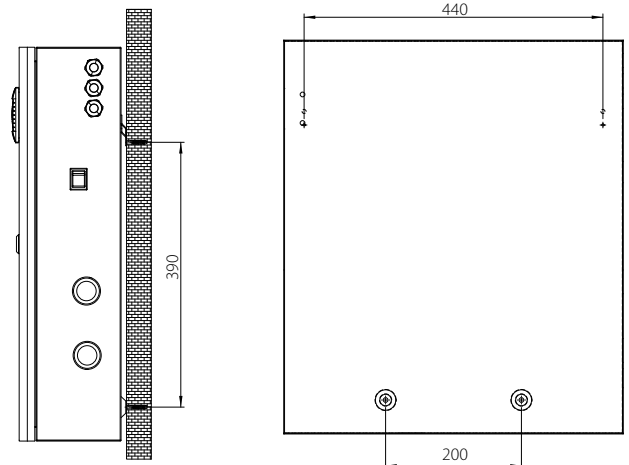
Fig. 1.f

### Slave cabinet

Fasten it to a solid support surface using the screws and bracket supplied.

Make sure there is enough space for the electrical power supply and control connections.

### rear of the cabinet



### drilling template

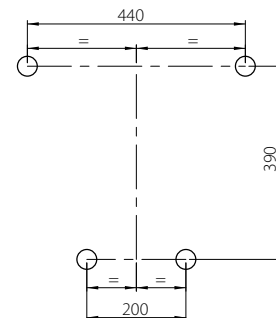


Fig. 1.g

## 1.7 Opening the packaging

- make sure the humidifier is intact upon delivery and immediately notify the transporter, in writing, of any damage that may be due to careless or improper transport;
- move the humidifier to the site of installation before removing from the packaging, grasping the neck from underneath;

for the master cabinet:

- position the cabinet near the site of installation (still packaged on the pallet);
- remove the packaging;
- unscrew the bolts and remove the pallet (the cabinet is secured to the bottom of the pallet using 4 bolts);

for the slave cabinet:

- open the cardboard box, remove the protective material and remove the humidifier, keeping it vertical at all times.

Keep the packaging in a cool and dry environment (cardboard box, pallet, 4 bolts used to secure the cabinet to the pallet) for reuse.

## 1.8 Positioning the cabinet

Both cabinets: master and slave, should be positioned so as to guarantee the following:

- read the values on the display;
- access the keypad on the display;
- open the front panels;
- access to the inside parts for checks and maintenance;
- connection of the water supply lines;
- connection to the water distribution lines;
- power and control connections;

in particular, for the Master cabinet:

It can be positioned wherever the following conditions are ensured:

- clearance for routine maintenance as described in Fig. 1.f
- humidity 20-80% rH non-condensing
- temperature 1-40 °C;

## 1.9 Opening the cabinet door

### Master cabinet

Opening Fig. 1.h:

1. Release the water circuit panel:
  - use a flat-head screwdriver (max. 8 mm);
  - turn anticlockwise until releasing the panel.
2. Remove the panel:
  - tilt the panel and lift it.

Closing Fig. 1.h:

3. Reposition the water circuit panel:
  - Important: insert the bottom pins of the panel in the corresponding holes (F).
4. Lock the panel:
  - use a flat-head screwdriver (max. 8 mm);
  - turn clockwise until the panel is secured

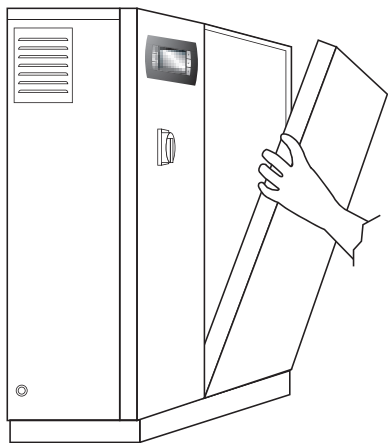
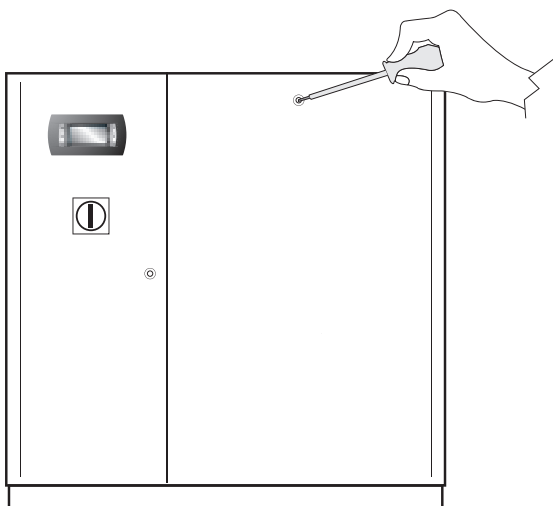


Fig. 1.h

### Slave cabinet

1. press and turn anticlockwise with a flat-head screwdriver (max 8 mm) until releasing the panel;
2. open the cabinet door by turning it to the left.

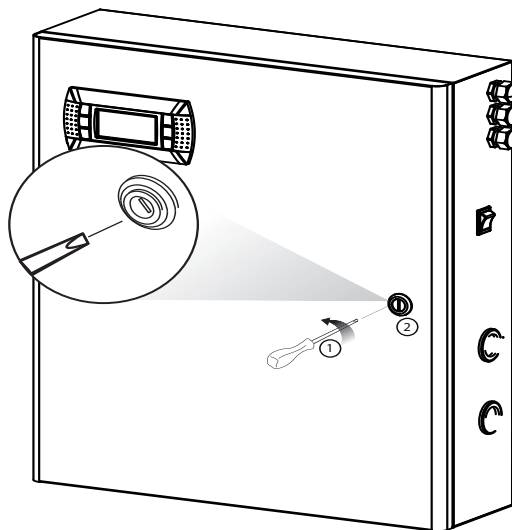


Fig. 1.i

## 1.10 Components and accessories

Once having opened the packaging and removed the front cover of the humidifier, make sure the following are included:

for master units:

- tool for opening the water inlet filter casing;
- PG13 and PG21 cable glands for the electrical connections (CE versions only).
- yellow/black pump motor oil cap, to replace the red cap on the pump.

for slave units

- kit of screws with plugs for wall-mounting;
- PG13 and PG21 cable glands for the electrical connections (CE versions only).

## 2. WATER CIRCUIT CONNECTIONS

### 2.1 Water circuit installation: instructions

#### The water connections are

- water inlet;
- high pressure water outlet to the rack (see "connecting the cabinet to the rack" in the distribution manual);
- water drain.

#### Water circuit installation: instructions

To simplify installation and maintenance, install a manual valve immediately before connecting the water inlet to the cabinet (this valve is not supplied by CAREL).

humifog only operates on demineralised water, preferably from a reverse osmosis system. The specifications and the limits of the water are described in detail in chap. 2.2.

1. open the water circuit (vedi par. Opening the cabinet door);
2. connect the water supply hose:
  - the supply hose connection fitting is G3/4" F (NPT3/4" F 208 V 60 Hz version).
  - the inside diameter of the supply hose must not be less than 10 mm.
  - run the water supply hose through hole "3" Fig. 1.a.

#### Water drain connection

1. connect the drain "5" Fig. 1.a to the drain system:
  - use a hose with inside diameter 10 mm, resistant to demineralised water.
  - connect the hose to the drain connection underneath the cabinet using a hose clamp.

**N.B.:** the hose and the clamp are not supplied by CAREL, to tighten clamp, lift the cabinet.

2. connect the drain bypass "6" Fig. 1.a to the drain system:
  - check the correct connection of the TFN8 pipe to the valve compression fitting
  - use TFN8 NYLON WHITE drain hose (1.5 m, supplied by CAREL).
  - run the hose through the hole "6" in Fig. 1.a.

**N.B.:** if the installation requires of a longer drain hose than the one supplied, replace this with a hose having the same features (TFN8 NYLON WHITE) but in the required length.

#### Replacing the top oil cap on the pump

1. replace the top oil cap on the pump:
  - replace the TOP oil cap ( Fig. 2.a, A), used for transport only, with the CAP WITH THE VENT HOLE ( Fig. 2.a, B) used in normal operation;
  - keep closed cap for future transport.
2. reposition the front panel on the water circuit and close it.



Fig. 2.a

#### CE versions

model	UA100*D3**	UA200*D3**	UA320*D3**	UA460*D3**	UA600*D3**
maximum	100	200	320	460	600
flow-rate (l/h ;lb/h;Gd)	220 634	441 1268	705 2028	1014 2916	1323 3805
inlet press. (Mpa,Bar,PSI)	0.3 to 0.8 Mpa 3 to 8 Bars 40 to 100 PSI				
temperature inlet	1T40 °C / 34T104 °F				
Adapter outlet (pump)	G3/4" F				
drain	M16.5m DIN 2353 (G3/8" F)				
drain	Stainless steel pipe OD 10 mm/ 0.4 inch				

#### UL versions

model	UD100*U3**	UD200*U3**	UD320*U3**	UD460*U3**	UD600*U3**
maximum	100	200	320	460	600
flow-rate (l/h ;lb/h;Gd)	220 634	441 1268	705 2028	1014 2916	1323 3805
inlet press. (Mpa,Bar,PSI)	0.3 to 0.8 Mpa 3 to 8 Bars 40 to 100 PSI				
temperature inlet	1T40 °C / 34T104 °F				
Adapter outlet (pump)	NPT3/4F				
drain	NPT3/8F				
drain	Stainless steel pipe OD 10 mm/ 0.4 inch				

### 2.2 Supply water characteristics

#### Why does humiFog require demineralised water?

Humifog only works with demineralised water, to ensure:

- minimum maintenance;
- no blockage of the nozzles;
- no dust (the droplets that evaporate do not leave mineral salts in the AHU/environment);
- more hygiene.

To ensure the supply water has the correct characteristics, reverse osmosis systems are recommended; these eliminate almost all the minerals, require minimum maintenance and feature low power consumption.

The use of demineralised water is also required by standards such as UNI8883 , VDI6022, VDI3803.

humifog must only be supplied with treated water, based on the limit values listed below. In normal circumstances, this means that the water must be treated using a reverse osmosis system.

recommended supply water characteristics	unit of measure	limits	
			max.
pH (**)		6.5	8.5
Specific conductivity at 20°C (**) (σR, 20 °C)	µS/cm	0	50
Total hardness (**) (TH)	mg/l CaCO3	0	25
Temporary hardness	mg/l CaCO3	0	15
Total quantity of dissolved solids (cR)	mg/l	(*)	(*)
Dry residue at 180° (R180°C)	mg/l	(*)	(*)
Iron + Manganese	mg/l Fe+Mn	0	0
Chlorides	ppm Cl	0	10
Silicon dioxide	mg/l SiO2	0	1
Chlorine ions	mg/l Cl-	0	0
Calcium sulphate	mg/l CaSO4	0	5

(\*)= values depend on the specific conductivity; in general:

$$C_R \cong 0,65 * \sigma_{R, 20^\circ C}; R_{180} \cong 0,93 * \sigma_{R, 20^\circ C}$$

\*\*.: main values to keep in consideration for every type installation.

**Important:** If the specific conductivity is less than 30 µS/cm, the

stainless steel pump should be used.

**⚠ Important:** (\*\*) for conductivity values around "0", contact CAREL INDUSTRIES for operating suggestions.

### **2.3 Water circuit installation: checklist**

---

humiFog system name: \_\_\_\_\_



Description / notes

- Cabinet level
- Distance between cabinet-rack/water distribution system: ≤50 m.
- Water supply connection
- Water inlet pressure ≥3 bars (0.3 MPa, 40 PSI)
- Filters filled with water
- Drain connected to the water drain system
- drain bypass: TFN8x10 NYLON WHITE hose connected to the water drain
- Pump: oil cap replaced with the cap featuring the vent
- Supply water within the limit values See the section on "Supply water characteristics"

Date: \_\_\_\_\_

Signature: \_\_\_\_\_

### 3. ELECTRICAL CONNECTIONS

Master version

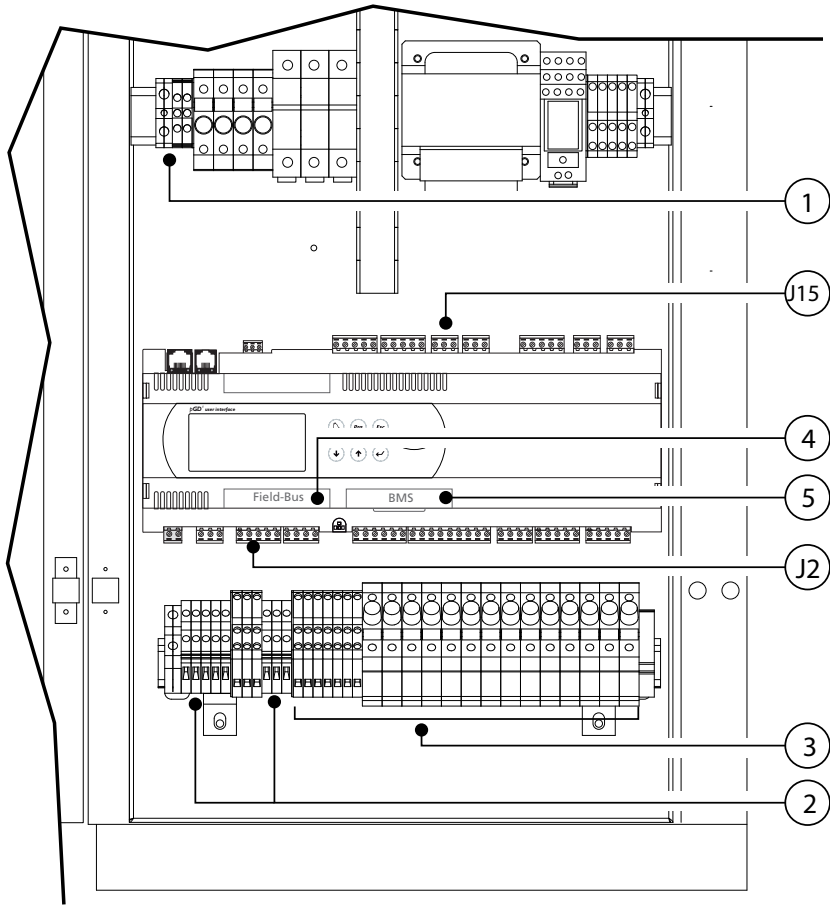


Fig. 3.a

Slave version

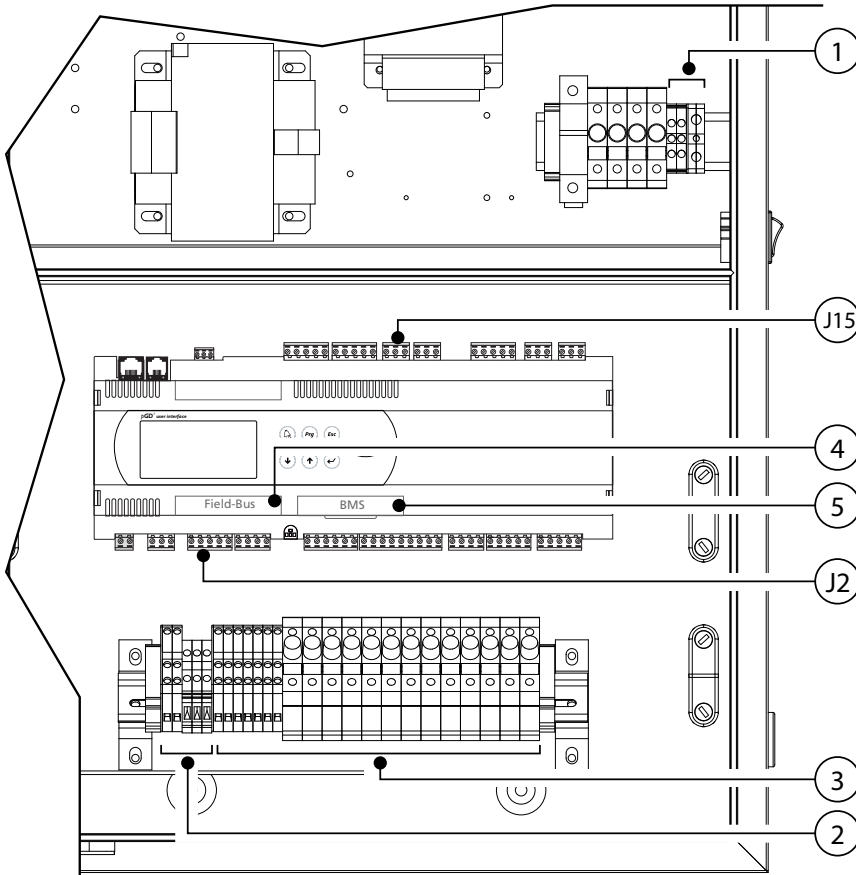



Fig. 3.b

Key:

1	L/N/GR	Power supply Important • make sure that the cable glands are fitted • do not run the control and signal cables through this cable gland.
J2	B1	Main humidity/temperature probe
	B2	Limit humidity/temperature probe
	B3	AUX probe (temperature display only)
J15	NO8	Cumulative alarm relay
2	PEN/G0A	Pumping unit remote enabling signal
	ROAL/G0A	Water treatment system alarm signal
	BKUP/G0A	Backup cabinet signal
	ROEN/COM	Water treatment system control
	ON-OFF/G0A	Control signals from external voltage-free contact, i.e. ON/OFF humidistat
	RKEN/G0A	Enable RACK production
	FLUX/G0A	Air flow switch
3	NC1=NC6/GOB	Capacity-control solenoid valves, step
	NO1=NO6/GOB	Drain solenoid valves, step
	NOL	Line drain solenoid valve
	NOV	Vent solenoid valve (rack)
4	Field card	Field card input for Master Slave connection
5	Serial Card	Serial card input for BMS (Building Management Systems)

 N.B.: feature adequate protection on all activation outputs to external devices.

### 3.1 Power supply

Depending on the model:

- UA\*\*\*\*D3\*\* voltage 230V 1~ 50Hz
- UA\*\*\*\*U3\*\* voltage 208V 1~ 60Hz

**Important:** The cables must conform to local standards. Install a power switch outside the humidifier to completely isolate the mains power supply, with earth fault protection (30 mA).

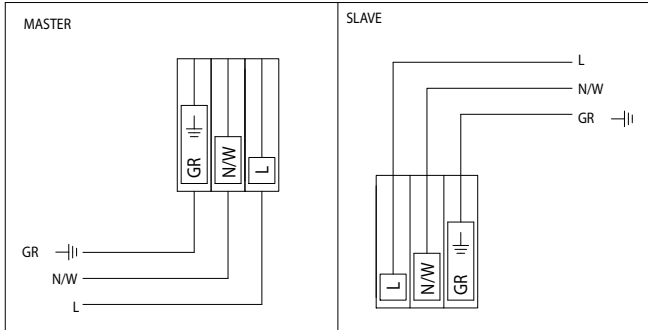


Fig. 3.c

#### CONNECTIONS

Master - slave cabinet	Power cable
L	L/F (phase)
N	N/W (neutral)
GR	GR/PE (earth)

### 3.2 Remote ON/OFF

Cables	• up to 30 m: two-wire cable AWG20/22
electrical specifications of the contact:	voltage-free contact

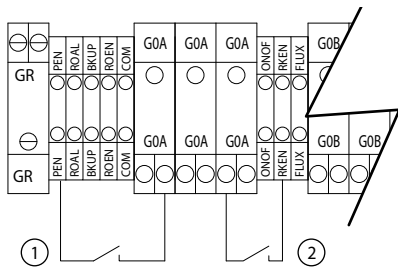


Fig. 3.d

Key:

1. Pump remote ON/OFF
2. Zone remote ON/OFF

#### CONNECTIONS

humifog Master cabinet	Remote ON/OFF
PEN (enable pump)	NC/NO
RKEN (enable master rack)	NC/NO
G0A	COM

humifog Slave cabinet	Remote ON/OFF
RKEN (enable slave rack)	NC/NO
G0A	COM

**N.B.:** the Master unit is supplied with contacts PEN-G0A and RKEN-G0A jumpered, the Slave unit is supplied with contact RKEN-G0A jumpered

### 3.3 Control signals from external voltage-free contact (humidistat)

#### a) ON/OFF (C control)

Cables	<ul style="list-style-type: none"> <li>• up to 30 m: two-wire cables cross-section 0.5 mm<sup>2</sup> (AWG20)</li> <li>• greater than 30 m: shielded cables cross-section 1.5 mm<sup>2</sup> (AWG15)</li> </ul>
electrical specifications of the contact	voltage-free contact

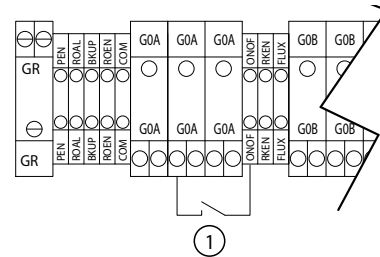


Fig. 3.e

Contact open: humiFog deactivated  
Contact closed: humiFog activated

humifog Master cabinet	ON/OFF humidistat thermostat
ON/OFF	NC/NO
G0A	COM

#### b) ON/OFF and limit probe (CH/CT control)

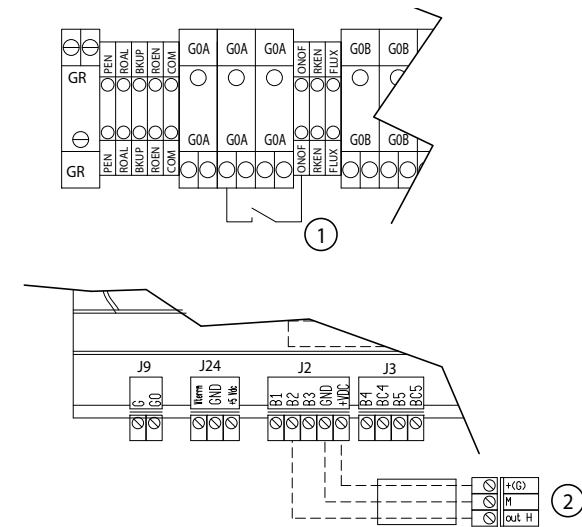


Fig. 3.f

Key:

1. ON/OFF humidistat thermostat
2. limit humidity/temperature probe

### 3.4 Modulating control signal (J2)

The control signal input connections depend on the control algorithm activated.

Cables	<ul style="list-style-type: none"> <li>up to 30 m: two-wire cables cross-section 0.5 mm<sup>2</sup> (AWG20)</li> </ul>
the signal may come from	<ul style="list-style-type: none"> <li>modulating control with external controller</li> <li>modulating control with ambient humidity probe</li> <li>external controller and limit humidity probe</li> <li>ambient humidity probe and limit humidity probe</li> <li>modulating control with temperature control</li> <li>modulating control with temperature control and limit probe</li> </ul>

To set the type of operation, control and signal: "installer menu > type of control (see chap. 9.11 Installer menu)"

**N.B.:** shielded cables should be used. The cables must not run near the 230 V/208 V power cables nor near the contactor cables: this avoids measurement errors due to electromagnetic disturbance.

#### a. Modulating control with external controller (P control)

0 to 1 V; 0 to 10 V; 2 to 10 V; 0 to 20 mA; 4 to 20 mA.

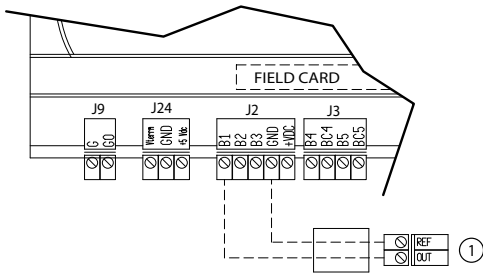


Fig. 3.g

**Key:**  
1. external controller

**Connections:**

	humifog cabinet	External controller
J2	B1	OUT
	GND	Reference, shield

#### b. Modulating control with ambient humidity probe (H control)

0 to 1 V; 0 to 10 V; 2 to 10 V; 0 to 20 mA; 4 to 20 mA

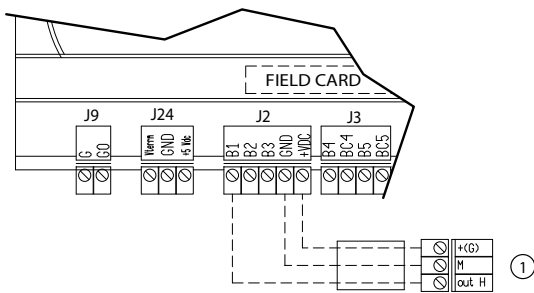


Fig. 3.h

**Key:**  
1. humidity sensor

**Connections:**

	humifog cabinet	Ambient humidity probe
J2	B1	OUT H
	+Vdc	+ (G)
	GND	M

#### c. Modulating control with controller and limit probe (PH/PT control)

0 to 1 V; 0 to 10 V; 2 to 10 V; 0 to 20 mA; 4 to 20 mA

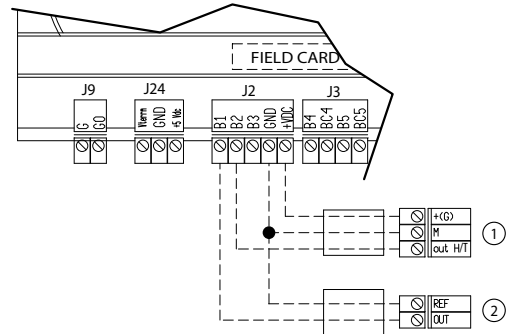


Fig. 3.i

**Key:**  
1. limit humidity/temperature probe;  
2. external controller.

**Connections:**

	humifog cabinet	External controller	Limit humidity probe
J2	B1	OUT	
	B2		OUT H/T
	+Vdc		+ (G)
	GND	Reference	M

#### d. Modulating control with ambient humidity probe and limit humidity and temperature probe (HH/HT control)

0 to 1 V; 0 to 10 V; 2 to 10 V; 0 to 20 mA; 4 to 20 mA

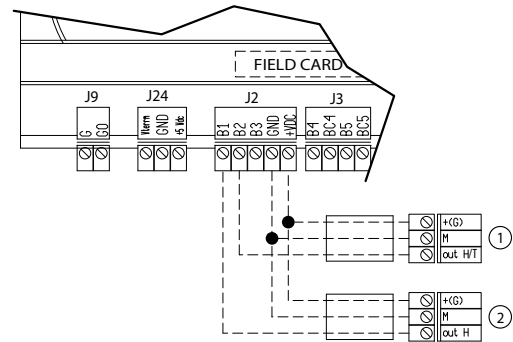


Fig. 3.j

**Key:**  
1. limit humidity/temperature probe;  
2. ambient humidity probe.

**Connections:**

	humifog cabinet	External controller	limit humidity probe
J2	B1	OUT H	
	B2		OUT H/T
	+Vdc	+ (G)	+ (G)
	GND	M	M

e. Modulating control with temperature control (T control)  
0 to 1 V; 0 to 10 V; 2 to 10 V; 0 to 20 mA; 4 to 20 mA

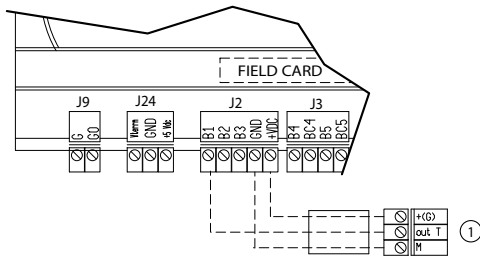


Fig. 3.k

Key:  
1. ambient temperature probe;

Connections:

	humifog cabinet	Ambient temperature probe
J2	B1	OUT T
	+Vdc	+(G)
	GND	M

f. Modulating control with temperature control using NTC probe (T control)

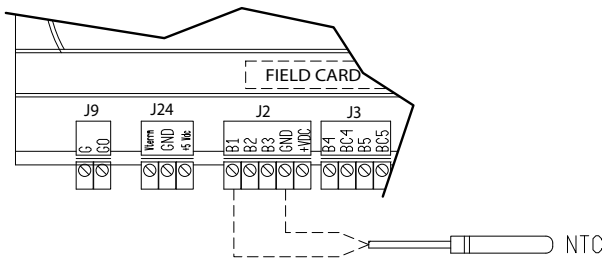


Fig. 3.l

Connections:

	humifog cabinet	NTC probe
J2	B1	NTC
	GND	NTC

g. Modulating control with temperature control and limit humidity probe (TH control)  
0 to 1 V; 0 to 10 V; 2 to 10 V; 0 to 20 mA; 4 to 20 mA

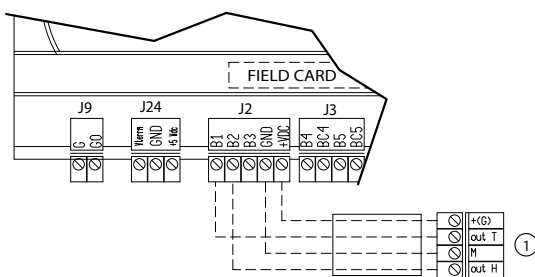


Fig. 3.m

Key:  
1. ambient temperature probe and limit humidity probe;

Connections:

	humifog cabinet	Ambient temperature probe + limit humidity probe
J2	B1	OUT T (main)
	B2	OUT H (limit)
	+Vdc	+(G)
	GND	M

h. Modulating control with temperature control and limit humidity and temperature probe (TT/TH control)  
0 to 1 V; 0 to 10 V; 2 to 10 V; 0 to 20 mA; 4 to 20 mA

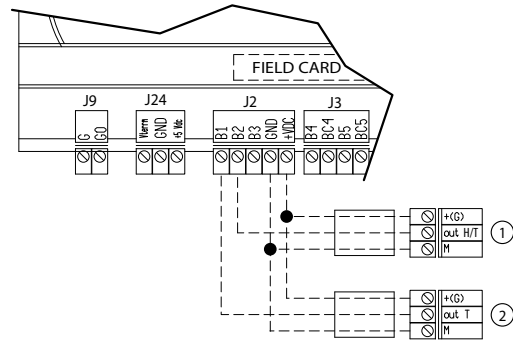


Fig. 3.n

Key:  
1. limit humidity/temperature probe;  
2. ambient temperature probe.

Connections:

	humifog cabinet	Ambient temperature probe	limit probe
J2	B1	OUT T	
	B2		OUT T/H
	+Vdc	+(G)	+(G)
	GND	M	M

### 3.5 Solenoid valve connection for distribution system

For the management of the distribution system, the cabinet controls four types of solenoid valves:

- normally closed "NC" for capacity-control of the manifolds.
- normally open "NO" for draining the manifolds.
- normally open vent valves.
- normally open line drain valves.

Recommended connection cables: two-wire plus earth AWG 13 (1.5mm<sup>2</sup>), maximum length 100 m.

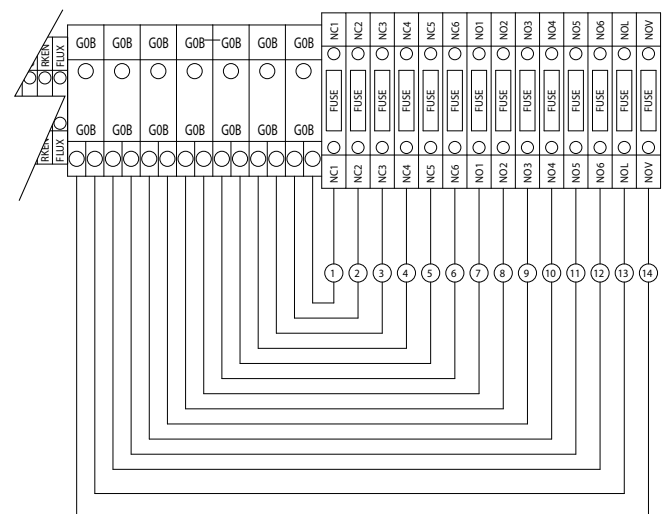


Fig. 3.o

Ref.	Cabinet terminal block	Solenoid valve connector	description	Max. no. of solenoid valves per step.
1	NC1 – G0B	1-2	Capacity-control sol. valves 1st step	6
2	NC2 – G0B	1-2	Capacity-control sol. valves 2nd step	6
3	NC3 – G0B	1-2	Capacity-control sol. valves 3rd step	4
4	NC4 – G0B	1-2	Capacity-control sol. valves 4th step	2
5	NC5 – G0B	1-2	Capacity-control sol. valves 5th step	2
6	NC6 – G0B	1-2	Capacity-control sol. valves 6th step	2
7	NO1 – G0B	1-2	Drain solenoid valves 1st step	6
8	NO2 – G0B	1-2	Drain solenoid valves 2nd step	6
9	NO3 – G0B	1-2	Drain solenoid valves 3rd step	4
10	NO4 – G0B	1-2	Drain solenoid valves 4th step	2
11	NO5 – G0B	1-2	Drain solenoid valves 5th step	2
12	NO6 – G0B	1-2	Drain solenoid valves 6th step	2
13	NOL – G0B	1-2	Line drain solenoid valves	2
14	NOV – G0B	1-2	Vent drain solenoid valves	1

**N.B.:** using the solenoid valves supplied by Carel SpA, each individual cabinet can power up to 22 solenoid valves, divided as follows:

- 10 NC capacity-control solenoid valves
- 10 NO manifold drain solenoid valves.
- 1 line drain solenoid valve.
- 1 vent drain solenoid valve.

### 3.6 Water treatment system control

Cables	• up to 30 m: two-wire cable cross-section 0.5 mm <sup>2</sup> (AWG15)	
Electrical specifications of the contact:	• power 50 VA; • voltage 24 V; • current 0.5A resistive/ inductive	
Status of the contact according to master status	Master OFF or in standby Master ON	contact open contact closed

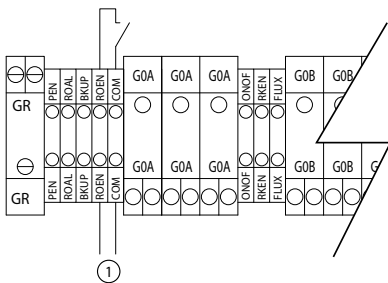


Fig. 3.p

- Key:
1. water treatment system control

### 3.7 Cumulative alarm relay (J15)

Activated when one or more alarms is detected via a contact/output that can be transferred to a supervisory system.

Cable	two-wire AWG 15/20	
Electrical specifications of the relay	power 500 VA; voltage 250 V; current 2 A resistive/ inductive	
Status and operation of the relay:	contact open contact closed	no alarm active active alarm/alarms

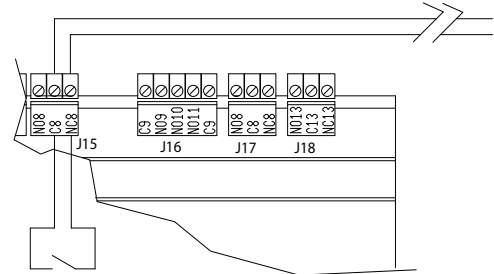


Fig. 3.q

#### Connections

humifog cabinet	terminal	
J15	NO8	normally open
	C8	COM

### 3.8 Alarm inputs from external devices

Cable	two-wire AWG 15/20	
Electrical specifications of the relay	voltage-free contact	
Status and operation of the relay:	contact open contact closed	no alarm active active alarm/alarms

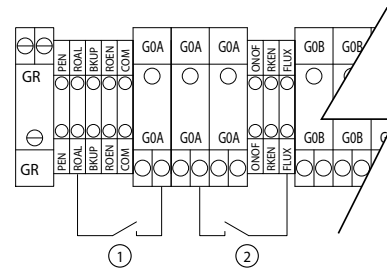


Fig. 3.r

- Key:
1. alarm input from water treatment system;
  2. alarm input from AHU pressure sensor (flow switch).

**N.B.:** the unit is supplied with contacts ROAL-G0A and FLUX-G0A jumpered.

### 3.9 Master-slave connection

The master-slave multizone configuration is a serial connection using the optically-isolated 485 FieldBus cards on the humiFog multizone master and slave units.

Cable cross-section use two-wire twisted cable with shield, AWG20/22, with cross-section at the terminals min. 0.2 - max. 2.5 mm<sup>2</sup>

**Connections**

humiFog master Fieldbus card	humiFog slave Fieldbus card
+	+
-	-
GND	GND

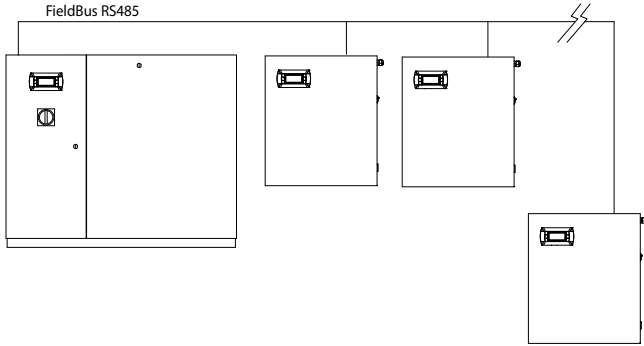


Fig. 3.s

**Note:** if the optional card is in the last position on the supervisor serial line and the line is longer than 100 m, connect the 120 Ω - 1/4 W line terminal resistors to the pins, as shown in the following figure.

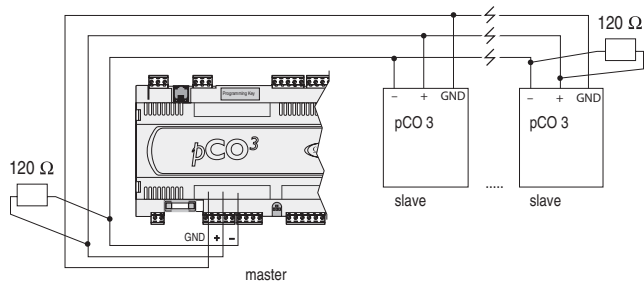


Fig. 3.t

### 3.10 Supervisor network

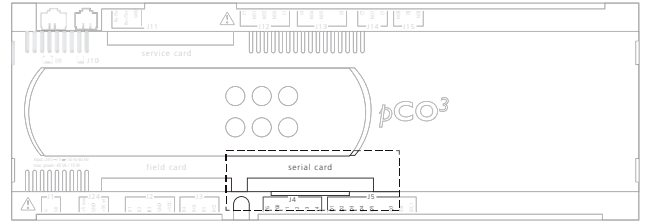


Fig. 3.u

**Optional CAREL cards**

	network/card	protocol supported
PCOS004850	RS485 (stand.)-	CAREL, Modbus®
PCO100MDM0	RS232 (external modem)	CAREL for remote connections
PCO1000WB0	Ethernet™	TCP/IP SNMP v1 &v2c BACnet™ Ethernet™ ISO8802-2/8802-3 BACnet/IP
PCO1000BA0	Ethernet™ (Modbus®)	BACnet™ MS/TP

**Important:** Follow the instructions shown on the optional cards for the technical specifications, connections and expansion boards.

Default: CAREL supervisor protocol.

All the new features are supplied as standard with the RS485 card, other cards and protocols are optional.

## 4. PUMPING UNITS

### 4.1 Pumping unit with flow control configuration

humiFog controls the humidification and/or cooling capacity by continuously controlling the atomised water flow-rate across a wide range of modulation.

This configuration is used in the following applications:

- humidification and/or adiabatic cooling (direct) in an AHU;
- humidification and indirect adiabatic cooling in an AHU with heat recovery unit (one atomisation system at a time atomises the water). In this case, a zone electrical panel will be required, see the next chapters for further information.

humiFog is fitted with an inverter to continuously and precisely control the speed of the pump and, consequently, the flow-rate.

The outlet pressure is kept within the optimum water atomisation limits by the range of modulation of the pump speed and control of the number of nozzles that atomise the water.

In detail, the nozzles must be supplied at a pressure in the range from 25 to 70 bars, to ensure that the droplets generated have an average equivalent diameter of 10-15 µm.

Based on the flow-rate of water to be atomised, humiFog will activate the number of nozzles that ensures the pressure is within the range indicated above.

It is clear that if the required flow-rate is low, just a few nozzles will be needed to atomise the water; if the request increases, the increase in flow-rate will cause an increase in pressure that, if it exceeds 70 bars, will activate other atomising nozzles, consequently decreasing the pressure and returning it within the range of optimum values. Similarly, if the humidification request decreases, the flow-rate and thus the pressure will decrease and, if the latter falls below 25 bars, some nozzles will be closed so that the pressure returns within the optimum atomisation range.

This is possible because the nozzles are assembled into groups of up to four, with different capacities; when suitably activated, these guarantee continuous modulation of the flow-rate across a wide range, nominally from 14 to 100% of the maximum flow-rate, with a pressure from 25 to 70 bars.

The groups of nozzles are normally configured when selecting the humiFog system, and the procedure is clearly described in the documents supplied with the water distribution system (rack).

The pumping unit in the flow control configuration can only be used for single-zone applications: one pumping unit supplies just one zone at a time. Multizone configurations are not possible.

The flow control configuration guarantees maximum humidification and adiabatic cooling precision as capacity is controlled continuously and across a wide range.

### 4.2 Pumping unit with constant pressure control

The humiFog controller manages the water pressure generated to ensure it remains at a constant level, typically 70 bars.

This configuration is used in the following applications:

- humidification and/or adiabatic cooling (direct) in an AHU (the flow control configuration is recommended);
- humidification and indirect adiabatic cooling in an AHU fitted with heat recovery unit (the two distribution systems can atomise water at the same time);
- humidification and/or adiabatic cooling (direct) in an industrial environment;
- humidification and/or adiabatic cooling (direct) in multiple zones, whether AHUs, AHUs fitted with heat recovery units, industrial environments, or any combination of these.

Note that in the case of humidification and/or cooling adiabatic directly into rooms, constant pressure control is preferred over flow control: as the droplets are atomised directly into the environment, to minimise the space required for evaporation, the smallest possible diameter should be achieved and therefore the water must be atomised at maximum pressure. This is represented by constant pressure control, which maintains the pressure at 70 bars.

humiFog is fitted with an inverter to control the speed of the pump and maintain the pressure at the rated value set by parameter, typically 70 bars.

The humiFog system will be made up of a pumping unit (master) that also controls its own zone, as well as a series of zone electrical panels (slaves) corresponding to the number of remaining zones.

Note that for humidification and indirect adiabatic cooling in an AHU fitted with heat recovery unit (the two distribution systems may atomise the water at the same time) a zone panel (slave) will be required.

The water distribution system/systems have nozzles organised into groups, called steps, which in general each have different capacities. Based on the flow-rate of water to be atomised in one or more zones, the humiFog system will activate the required steps until the nozzles atomise the required quantity of water. Each zone can have up to 6 modulation steps.

The groups of nozzles are normally configured when selecting the humiFog system, and the procedure is clearly described in the documents supplied with the water distribution system (rack or room distribution and atomisation system)

Constant pressure control rationalises operation of the humiFog pumping unit as, despite the lower precision, it can treat a number of zones at the same time without installing a pumping unit for each AHU or industrial environment.

## 5. DISTRIBUTION SYSTEM

This paragraph briefly describes the distribution and atomisation systems for AHUs (rack and droplet separator) and for rooms. These are described in detail in the “humiFog – distribution systems” manual.

### 5.1 Air handling unit: distribution, atomisation system and droplet separator

The rack is supplied made-to-measure based on the AHU/duct and is made up of various vertical manifolds with atomisation nozzles, each with activation and drain solenoid valves. Each rack is also fitted with a main drain solenoid valve installed at the lowest point of the piping that connects the rack to the pumping unit. In addition, it is fitted with a vent solenoid valve on the horizontal manifold so as to completely empty the pipelines. The manifolds house the required number of atomising stainless steel nozzles located in specific positions, calculated during the system configuration phase and described in the documents supplied with the rack.

The droplet separator has the purpose of trapping the droplets of water that are not completely evaporated, so as to prevent objects located downstream from getting wet. The droplet separator is supplied in standard modules that can be assembled on a support structure to cover the cross-section of the AHU. The structure is always in stainless steel, and guarantees fast and effective draining of the water trapped by the droplet separator. The modules are available with glass wool or stainless steel filters, the latter required for hygiene-certified installations, such as VDI6022, UNI8884, etc.

The width and the height of the rack and the droplet separator comes in 152 mm steps, with the following limits:

- width: 558 to 2826 mm;
- height: 508 to 2790 mm.

If the droplet separator does not exactly cover the cross-section of the AHU, the free spaces must be sealed to prevent air from bypassing the droplet separator.

Flexible or stainless steel hoses are supplied for connecting the pumping unit to the rack.

Note that a droplet collector tank with drain connection must also be fitted, containing the rack, droplet evaporation chamber and droplet separator. This tank is not supplied by CAREL.

### 5.2 Direct humidification into the room: distribution and atomisation system

This system consists of

- hoses and/or stainless steel pipes for the distribution of pressurised water;
- capacity-control solenoid valves to shut off the branches of the system that don't need to atomise water (on/off operation, N.C.);
- drain solenoid valves to empty the installation and prevent stagnation of water (on/off operation, N.O., opening pressure 13 bars);
- main drain solenoid valve installed on the lowest point of the piping that connects the rack to the pumping unit, so as to completely empty the system and avoid stagnation of water. The solenoid drain valves are also used to quickly discharge water pressure when the line stops atomising, avoiding dripping. In addition, the solenoid drain valves are used for the automatic periodical washing function managed by humiFog;
- stainless steel manifolds (pipes with holes) with atomising nozzles;
- blower units: compact units featuring manifolds with atomising nozzles, on-off solenoid and drain valve, plus a fan that creates a stream of air that carries the droplets and ensures they evaporate completely before falling in the environment.

The distribution and atomisation system can have up to 6 capacity modulation steps, where, obviously, each step can have a series of branches with pipes, manifolds and/or blower units.

Special attention must be paid to the position of the nozzles and the blower units inside the environment: observe the installation limits (minimum installation height and minimum horizontal distance from objects/machinery/people that must not be wetted), as shown in the “humiFog multizone: distribution system” manual.

## 6. APPLICATIONS

humiFog for AHU/ducts is suitable for all applications in which the air can be humidified and/or cooled adiabatically, atomising demineralised water. Below are some possible applications of humiFog:

- office buildings
- hotels and call centers
- printing and paper industries
- cleanrooms
- libraries and museums
- textiles industry
- food industry
- direct/indirect adiabatic cooling
- timber industry
- other industrial applications.

The possibility of using an atomising rack for indirect adiabatic cooling is especially interesting: the air to be discharged is cooled adiabatically (bringing it to saturation) and is then used to cool the fresh outside air using an air-air heat exchanger, as shown in the following figure.

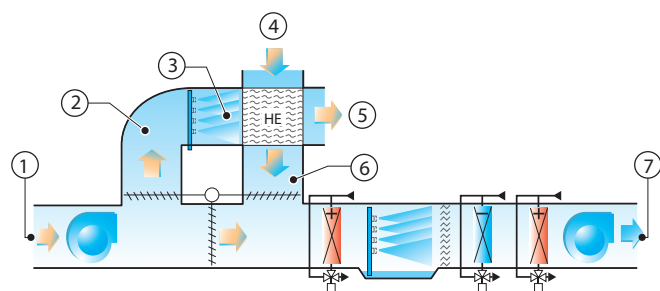


Fig. 6.a

**Key:**

1. recirculated air;
2. exhaust air;
3. saturated and cooled air;
4. outside air inlet;
5. heated exhaust air;
6. cooled outside air;
7. fresh air.

Further advantages of the humiFog system include:

- extremely low electricity consumption: around 4 Watts for each litre/hour of humidification capacity;
- high maximum capacity: 600 kg/h (customised versions are available with capacities up to 5000 kg/h);
- high precision, thanks to models with continuous modulation from 14% to 100% of maximum capacity;
- complete distribution rack, supplied already assembled and tested;
- extremely fine atomisation with consequently very little space required for evaporation, due to high water pressure (25 to 75 bars);
- optimum humidification and cooling effect in the AHU thanks to custom racks made to measure based on the cross-section of the AHU;
- very low maintenance requirements
- automatic washing and emptying cycles to avoid stagnation of water
- no dripping;
- silent nozzles
- modularity: one pumping unit can supply up to 6 zones
- connectivity: humiFog can be connected to external systems, for example BMS, using the MODBUS, TCP/IP protocols etc. (see paragraph 3.10).

### 6.1 Main advantages of humiFog multizone

The main characteristic of humiFog for AHUs is compliance with the European standards on air hygiene, as certified by the Institut für Lufthygiene in Berlin, which has declared it as compliant with the following standards:

Standard air-conditioning	Hospitals
VDI 6022, page 1 (04/06) ✓	DIN 1946, part 4 (01/94) ✓
VDI 3803 (10/02) ✓	ONORM H 6020 (02/07) ✓*
ONORM H 6021 (09/03) ✓	SWKI 99-3 (03/04) ✓
SWKI VA104-01 (04/06) ✓	
DIN EN 13779 (09/07) ✓	

\*: In accordance with H6020 (02/07), chapter 6.13.2 the use of steam humidifiers or equivalent humidification systems is required in Austria.

Please note:

- VDI6022/2006: "Hygiene requirements for ventilation and air-conditioning systems and units"
- DIN EN 13779: "Ventilation for non-residential buildings – Performance requirements for ventilation and room conditioning systems"
- DIN1946 - Ventilation and air conditioning - part 4: Ventilation in hospitals

## 7. CONTROL

The electronic controller fitted in the humiFog features different control algorithms, which can be selected from the installer menu.

**• HH control:**

modulates the capacity (water flow-rate) using two humidity probes, one control probe normally installed in the AHU in the return air, and one limit probe, usually installed downstream of the droplet separator.

**• HT control:**

modulates the capacity (water flow-rate) with two probes, one humidity control probe and one limit temperature probe. This configuration is recommended for systems in which a certain humidity level is required without however excessively cooling the air.

**• H control:**

like the HH algorithm but without the limit humidity probe;

Below is the diagram of operation using humidity control probes

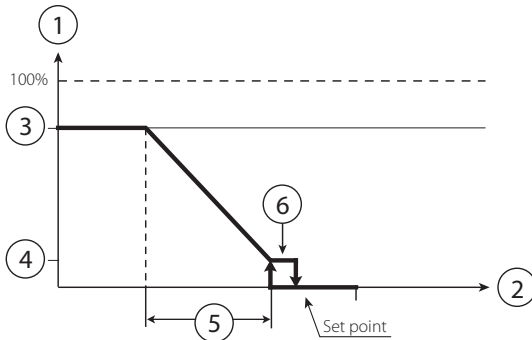


Fig. 7.a

**Key:**

- 1. production
- 2. humidity control probe
- 3. maximum production
- 4. minimum production
- 5. proportional band
- 6. hysteresis (10% of "5")

**• TH control:**

modulates the capacity (water flow-rate) with a temperature probe normally installed in the AHU in the return air, and a limit humidity probe, usually installed downstream of the droplet separator. In room applications, both probes are installed so that the temperature and relative humidity represent the average ambient values (for example, not near windows or the nozzles where the cooling and humidification effect do not correspond to the averages in the room)

**• TT control:**

modulates the capacity (water flow-rate) with a temperature control probe and a limit temperature probe. This configuration is recommended for adiabatic cooling systems in rooms where the control probe is usually installed in the centre of the room and the limit probe at another "critical" point where the temperature must absolutely not fall below a set limit value.

**• T control:**

like the TH algorithm, but without the limit humidity probe;

Below is the diagram of operation using temperature control probes

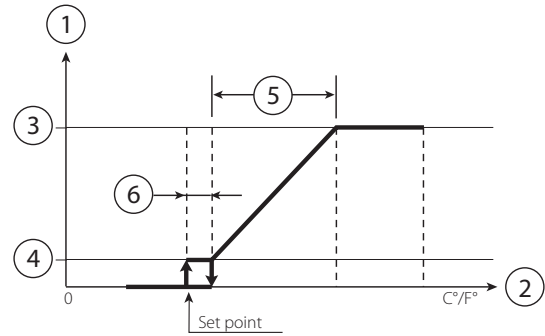


Fig. 7.b

**Key:**

- 1. production
- 2. probe control temperature
- 3. maximum production
- 4. minimum production
- 5. proportional band
- 6. hysteresis (10% of "5")

**• PH/PT control:**

capacity is modulated proportionally to an external control signal and is limited based on the value measured by the limit temperature or humidity probe. This is the typical configuration used in humiFog installations connected to a Building Management System that generates a control signal;

**• P control:**

like the PH/PT algorithm but without the limit humidity probe;

Below is the diagram of operation with proportional control.

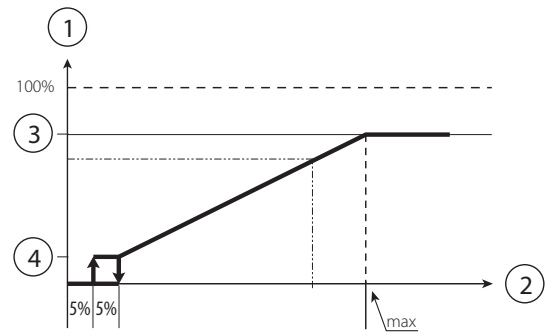


Fig. 7.c

**Key:**

- 1. production
- 2. external request
- 3. maximum production
- 4. minimum production

**• CH/CT control:**

operation in on/off mode, based on a voltage-free external contact (for example, a humidistat). The capacity will thus be either the maximum set or nothing, depending on the status of the external contact, and is limited based on the value measured by the limit probe.

• C control:

like the CH/CT algorithm but without the limit probe;

The HH and TH algorithms are the most commonly-used, and recommended for humiFog installations.

The limit humidity probe described above is usually set to high values, e.g. 80% rH, so as to limit the maximum moisture in the air introduced into the duct and into the room. This is especially recommended in installations where air flow-rate and operating, temperature and humidity conditions, may change over time and, consequently an additional safety system is required to prevent the humidifier from over-humidifying the air and, in the worse case scenario, condensing in the ducts downstream.

Below are the two diagrams of operation with humidity or temperature probes

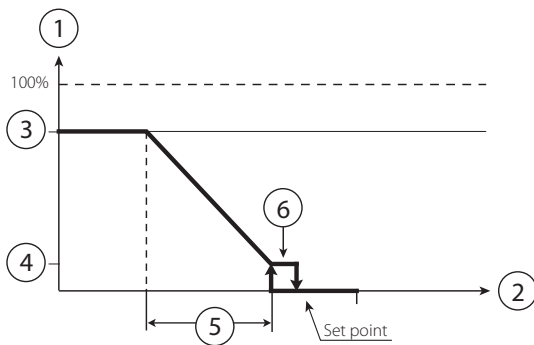


Fig. 7.d

Key:

- 1. production
- 2. limit probe
- 3. maximum production
- 4. minimum production
- 5. proportional band
- 6. hysteresis (10% of the set point)

➡ **N.B.:** for convenience, the diagrams show continuous modulation of the flow-rate while, depending on the model, control may be continuous or in steps.

## 8. SINGLE ZONE AND MULTIZONE CONFIGURATION

The humiFog system can be used in the following configurations:

### 8.1 Single zone

For humidification and/or cooling applications in AHUs or industrial environments. The pumping unit has just one distribution system, a rack in the case of AHUs or a room distribution system with simple manifolds and nozzles or blower units. The humiFog control system (single zone version UAxxxxxxx) controls both the pumping unit and the connected distribution system. In particular, it receives signals from the probes and/or the external control system, calculates the required humidification/cooling capacity, starts the pump to pressurise the water and manages the solenoid valves in the distribution system. In addition, it manages the filling, wash and drain cycles.

#### Single zone application in AHU

As can be seen in the figure, humiFog is a complete system for humidification/cooling in AHUs.

humiFog can be set for:

- **capacity/flow-rate control:**

As described in detail in the paragraph "humiFog with flow control", the humiFog controller manages the humidification and/or cooling capacity by controlling the water flow-rate atomised continuously across a wide range of modulation.

The outlet pressure is kept within the optimum water atomisation limits by the range of modulation of the pump speed and control of the number of nozzles that atomise the water.

For example, if low capacity is required, only the first group of nozzles is activated and the pump speed will be controlled to ensure the required capacity (Fig. 8.a point 1). If the request increases, the pump speed will increase and, as a consequence, the flow-rate and outlet pressure will increase. If the pressure exceeds the maximum limit (75 bars, settable) humiFog will activate a further group of nozzles (max 4 groups), Fig. 8.a point 2, so that, for the same flow-rate, the operating pressure will drop and fall within the limits (25-75 bars, settable). If the request increases further, the pump will increase the flow-rate and the pressure until activating a further, third, group of nozzles (Fig. 8.a point 3). The process is repeated until the maximum flow-rate is reached, corresponding to all the groups of nozzles being active and the pump operating at the maximum rack flow-rate (Fig. 8.a point 4). Similarly, the system will behave in reverse if the request decreases, reducing the speed and consequently the flow-rate of the pump and deactivating the groups of nozzles one after the other.

The groups of nozzles on the rack are configured automatically during humiFog system selection procedure using the "humiFog excel tool" and is described in detail in the documents supplied with the water distribution system (rack).

The flow control configuration guarantees maximum precision of humidification and adiabatic cooling as capacity is controlled continuously and across a wide range.

- **constant pressure control:**

As better described in the paragraph "humiFog with constant pressure", humiFog is fitted with an inverter to control the speed of the pump, so as to maintain the pressure at the rated value set by parameter, typically 70 bars.

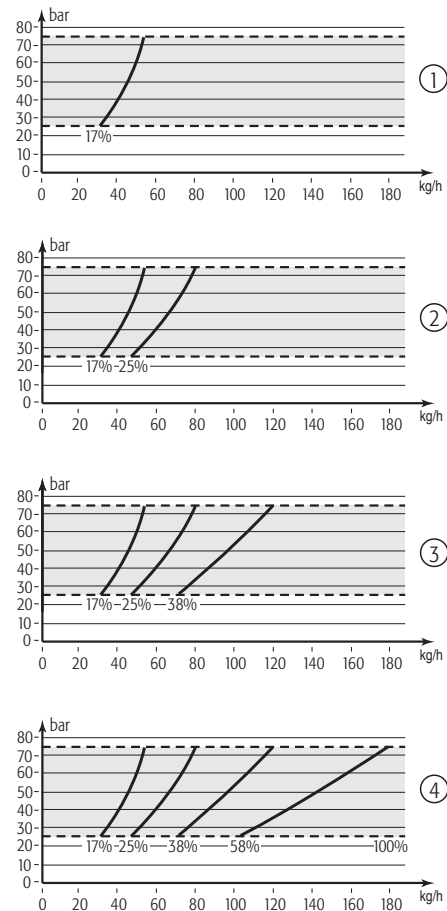


Fig. 8.a

The water distribution system/systems have nozzles organised into groups, called steps, which in general each have different capacities. Based on the flow-rate of water to be atomised in one or more zones, the humiFog system will activate the best combinations of steps until the nozzles atomise the required quantity of water. For example, if the system has three steps with the following capacities: step 1 - 30kg/h, step 2 - 30kg/h; step 3 - 20kg/h, and the request is 30 kg/h, then step 1 is activated, if the request is 50 kg/h then step 1 and step 3 are activated, while if the request is 60 kg/h then step 1 and step 2 will be activated.

In AHU applications, it is useful to suitably distribute the capacity of the steps so as to allow good resolution of capacity modulation. For example, a humiFog with a 180 kg/h rack, using 4 modulation steps and 4 kg/h nozzles, may have steps with the following capacities:

- step 1 96kg/h
- step 2 48kg/h
- step 3 24kg/h
- step 4 12kg/h

Note that the resolution is  $12/180=6.6\%$ , therefore very good, with just 4 modulation steps!

The technique involves assigning around half of the capacity to one step, half of this to the next step, half of the latter to the following step and so on, according to the following formula:

$$S = \frac{M \cdot 2^{T-1}}{2^N - 1}$$

With:

S= capacity of step T

M= rack capacity

T= index of the step, 1 to N

N= step number

⚠ N.B.: the maximum flow-rate of one step is 120 l/h.

Obviously, the capacity calculated above should be rounded off based on

the capacity of the nozzles (in this example, 4 kg/h), the number of nozzle manifolds that can be installed, etc.  
Each zone may have up to 6 modulation steps.

The groups of nozzles are normally configured when selecting the humiFog system, and the procedure is clearly described in the documents supplied with the water distribution system (rack or room distribution and atomisation system).

**Single AHU application**

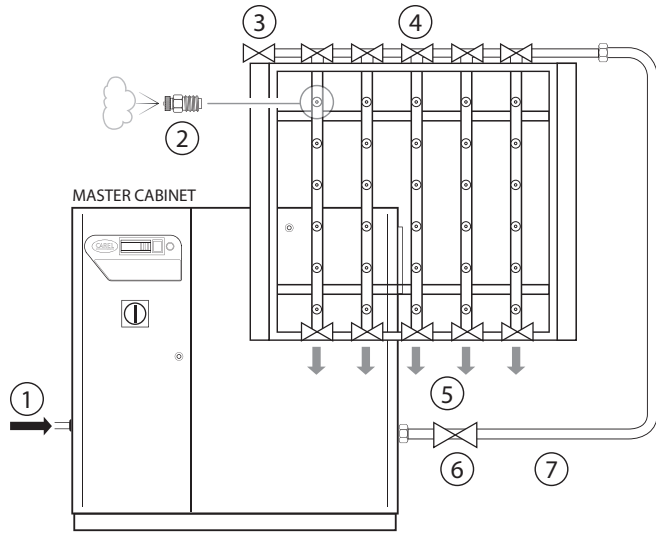


Fig. 8.b

- Key:**
- 1. water from REVERSE OSMOSIS system;
  - 2. atomising nozzles;
  - 3. vent valve;
  - 4. water fill valve;
  - 5. water drain;
  - 6. main drain valves;
  - 7. high pressure stainless steel or rubber hoses.

**Single room application**

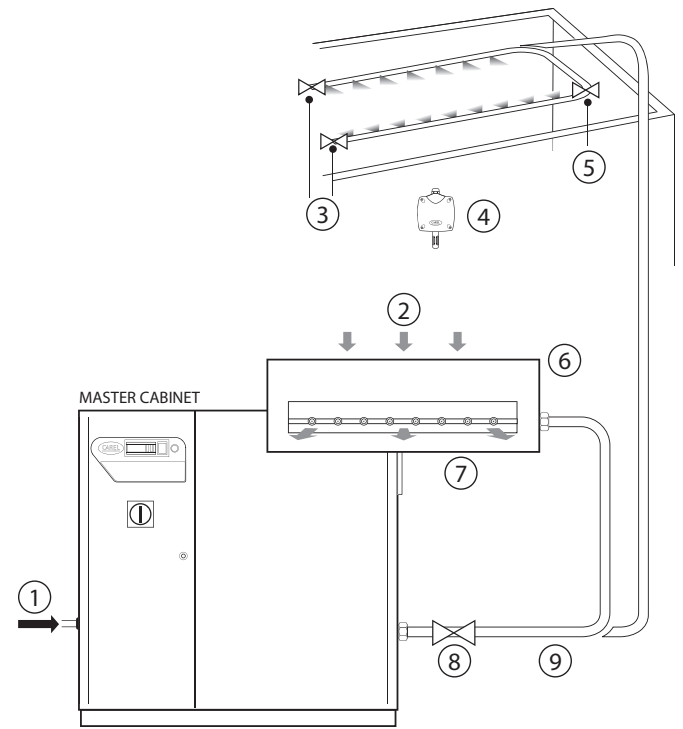


Fig. 8.c

- Key:**
- 1. water from REVERSE OSMOSIS system;
  - 2. air inlet;
  - 3. drain valves;
  - 4. ambient probe;
  - 5. fill valves;
  - 6. blower;
  - 7. main drain valves;
  - 8. high pressure stainless steel or rubber hoses.

**Single zone room applications**

As can be seen in the figure, humiFog is a complete system for humidification directly into rooms.

As better described in the paragraph on "humiFog with constant pressure", humiFog features an inverter to control the speed of the pump, so as to maintain the pressure at the rated value set by parameter, typically 70 bars.

Note that in the case of humidification and/or cooling adiabatic directly into rooms, constant pressure control is preferred over flow control: as the droplets are atomised directly into the environment, to minimise the space required for evaporation, the smallest possible diameter should be achieved and therefore the water must be atomised at maximum pressure. This is represented by constant pressure control, which maintains the pressure at 70 bars.

The water distribution system/systems have nozzles organised into groups, called steps, which in general each have different capacities. For simple installation and operation, however it is recommended to use steps of the same capacity. For example, a 100 kg/h system may have two 50 kg/h steps, where necessary made up of two or more lines with nozzles/blower units. Based on the flow-rate of water to be atomised, the humiFog system will activate the steps required for the nozzles to atomise the necessary quantity of water. The zones can have up to 6 modulation steps. humiFog also manages rotation of the lines, emptying, washing etc, better described in the following paragraphs.

The groups of nozzles are normally configured when selecting and sizing the humiFog system.

**8.2 Multizone application in AHU or room**

For standard humidification and/or cooling applications in AHUs or industrial environments.

The humiFog controller manages the water pressure generated so as to keep it at a constant level, typically 70 bars.

As illustrated in the following figure, the pumping unit has a distribution system, a rack in the case of AHUs or a room distribution system with simple manifolds and nozzles or blower units. The humiFog control system (multizone zone version UAxxxxxxx) controls both the pumping unit and the connected distribution system. All the other zones, whether an AHU or an industrial environment, has a zone control cabinet fitted with electronic controller that manages its own distribution system, a rack in the case of AHUs or a room distribution system with simple manifolds and nozzles or blower units. In addition, it communicates with the Master for all the common system procedures, such as washing, emptying, etc. Each cabinet, both Master and Slave, receives the signals from the probes and/or the external control system, calculates the required humidification/cooling capacity and, when the water has reached the rated pressure, manages the solenoid valves in the distribution system to generate the required capacity.

Constant pressure control rationalises operation of the humiFog pumping unit as, despite the lower precision of stepped modulation, it can treat a number of zones at the same time without installing a pumping unit for each AHU or industrial environment.

For the configuration of the steps, see the instructions provided in the previous paragraph "Single zone applications in AHUs – constant pressure control" and "Single zone applications in rooms"

Multi-AHU application

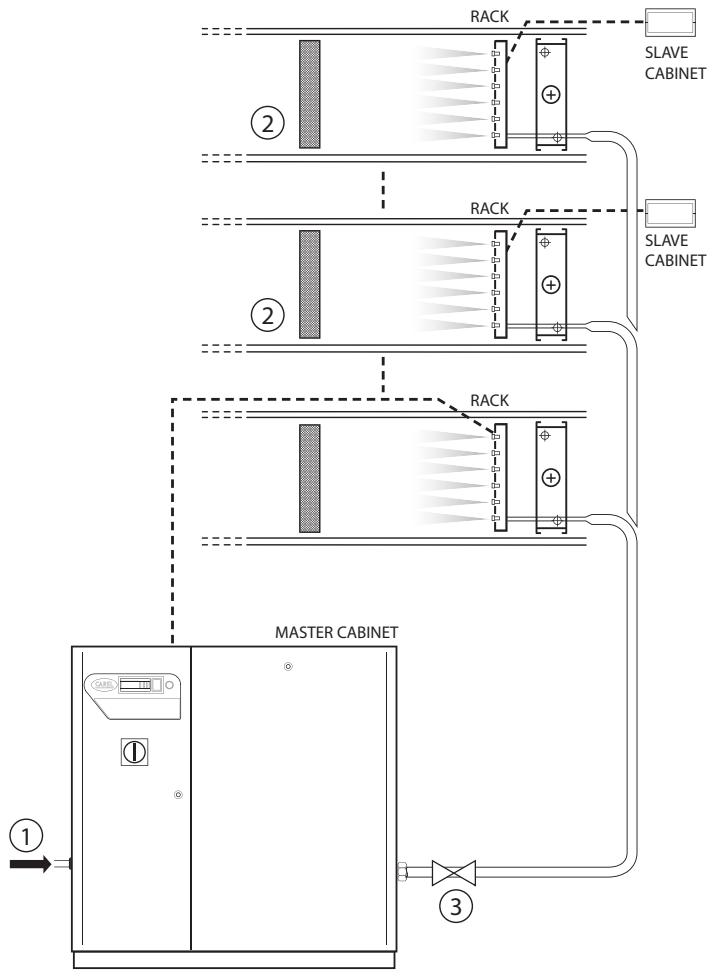


Fig. 8.d

- Key:
- 1. water from REVERSE OSMOSIS system;
  - 2. air handling unit;
  - 3. main drain valve

Multi-room application

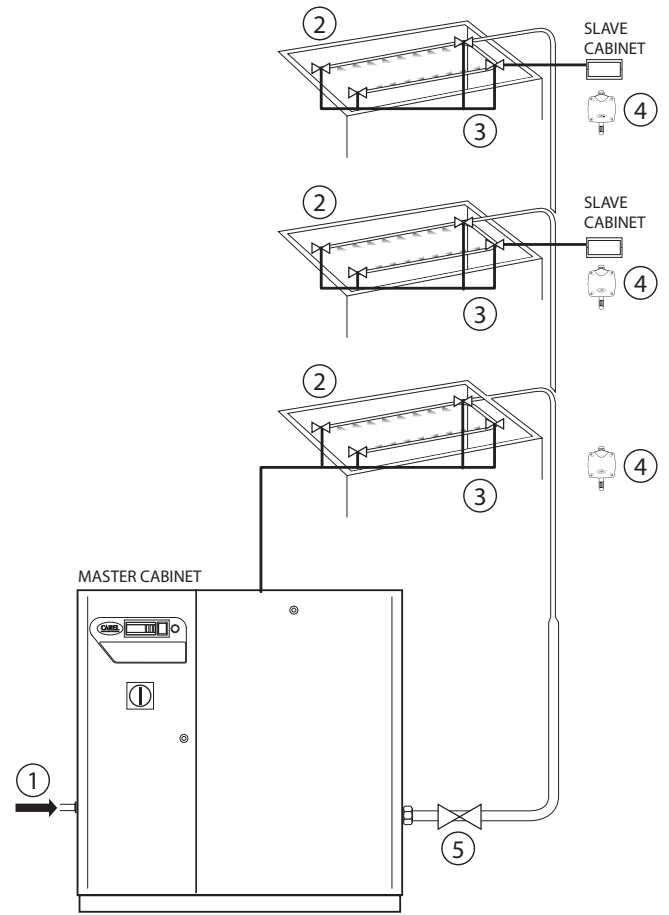


Fig. 8.d

- Key:
- 1. water from REVERSE OSMOSIS system;
  - 2. drain valves (one in each zone);
  - 3. fill valve;
  - 4. ambient probe;
  - 5. main drain valve.

installer

user

service

### 8.3 Indirect adiabatic cooling applications

One important function involves indirect adiabatic cooling applications (summer): a pumping unit can cool the exhaust air before it enters a heat recovery unit. This function is often complementary with the use of humiFog for air humidification in winter. The configuration in question is illustrated in the figure.

The system can be configured in two ways:

- **capacity/flow-rate control:** just one rack at a time atomises the water, with continuous system capacity control and consequently maximum precision. See paragraph "4.1 Pumping unit with flow control configuration" for further information on capacity control.
- **constant pressure control:** two racks can atomise the water at the same time or individually. This maximises energy saving by simultaneous indirect (cooling the air before the heat recovery unit) and direct adiabatic cooling (cooling the air before this is introduced into the environment), however with less precise control (stepped capacity modulation, see paragraph "4.2 Pumping unit with constant pressure control" for further information on capacity control).

For example, an indirect system with 100 kg/h of water sprayed can cool the exhaust air with an equivalent cooling capacity of 68 kW; this, in the heat exchanger/heat recovery unit, will cool the fresh air with an equivalent cooling capacity of 34 kW, for a power consumption of just 1.2 kW! In addition, this reduces the capacity required of the cooling coil and the chiller. For a detailed and complete description, see "Air humidification" by Lazzarin - Nalini, chapter 11.

#### Indirect and direct adiabatic cooling

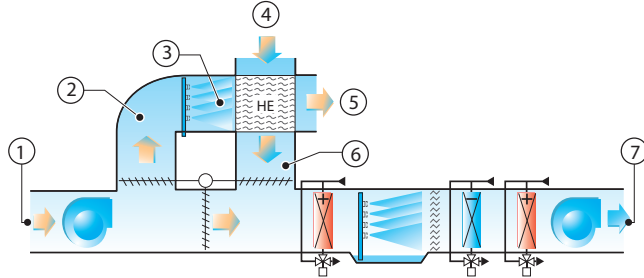


Fig. 8.e

**Key:**

1. recirculated air;
2. exhaust air;
3. saturated and cooled air;
4. outside air inlet;
5. heated exhaust air;
6. cooled outside air;
7. fresh air.

### 8.4 System operation

humiFog multizone independently manages the production of pressurised water, the distribution and filling, drain and wash cycles. This paragraph illustrates the latter functions.

**Filling:** before starting the production/atomisation phase, the piping must be filled with water and, then, vented of air. This ensures correct pressurisation of the lines and minimises the possibility of pressure swings due to air trapped in the piping. The system is empty when first started and following draining due to extended inactivity (see the rest of the paragraph for further information). Before starting production, the system is filled by starting the pump, which generates the rated capacity of the pumping unit and fills the piping with water for a time set by parameter. This time must be established by trial and error when starting the system. When filling, all the capacity-control and drain valves in all the zones are open, while the vent and main drain valves are closed. The distribution system must be sized so that, in these conditions, the water pressure does not exceed 5 bars, thus avoiding situations where the nozzles atomise/spray water (each nozzle contains a valve that prevents

atomisation at pressures below 7 bars).

**Washing:** this is performed periodically and involves flushing water through the piping for a time set on the menu. The purpose is to completely wash the system and avoid stagnation of water. It is performed in the same way as filling, but lasts longer: the time should be set so that the water used for washing is at least 3 times the volume of water contained in the complete installation. The wash cycle is performed every day at the same time (e.g. every day at 4 in the morning) or periodically at an interval set by parameter. At the end of the first wash cycle, the system remains full, while, starting from the second consecutive wash cycle without operation, the installation will be left empty. In addition, a wash cycle is also performed at start-up.

If the wash cycle is disabled, then the system will be left empty after a period, set by parameter, during which it has remained full and without operation.

**Pressure relief:** this last function is used to save water and limit the filling and emptying cycles, without affecting the hygiene features of the system, nor its performance.

The pressure relief function, when a branch (piping with nozzles or blower units) is disabled (stops atomising), the capacity-control valve is obviously closed and the drain valve is opened. The latter, however, will be closed again a few seconds later so that the pressure falls below 7 bars (and then the nozzles no longer spray) however the branch remains almost completely full of water. This avoids emptying the branch (saving water) and having to fill the system when production is required again in the branch. Note that opening the drain valve is required to achieve a rapid decrease in pressure from 70 bars to virtually 0, preventing the nozzles from spraying water at intermediate pressure values and generating large droplets that would wet the AHU/room.

Clearly, it is recommended to enable pressure relief. Indeed, thanks to the emptying procedure described above, in this case too there will not be stagnation of water in the piping for a time greater than the set value.

**Rotation** (only if "Pressure relief" is enabled): in constant pressure systems, humiFog periodically "rotates" the branches (piping with nozzles or blower units) that atomise the water. For example, if the zone has four branches and only two are in production, then the first and the third will be activated, for example, for 20 seconds, and then deactivated; at the same time, branches two and four will be activated. After a further 20 s, branches two and four will be deactivated (with pressure relief), and one and three will be activated simultaneously. The example in the diagram with six branches gives a better idea: this shows an activation sequence where each configuration (row) lasts 20 s. "A" indicates the active branch, "d" the inactive branch:

t=0	A	d	d	A	d	d
t=20s	d	A	d	d	A	d
t=40s	d	d	A	d	d	A
t=60s	A	d	d	A	d	d
t=80s	d	A	d	d	A	d
t=100s	d	d	A	d	d	A

Rotation is feasible if system operates with constant pressure and all the branches have the same rated capacity. Obviously, pressure relief must be enabled, otherwise each rotation would require a filling cycle.

## 8.5 Constant pressure systems: notes on capacity control

In constant pressure systems, humiFog keeps the pressure at the desired value when the required capacity changes (that is, the sum of the capacities required by each zone).

**Capacity required increases:** whenever a zone requires an increase in capacity, the pumping unit does not respond immediately: the flow-rate/capacity of the pump is modified to generate the required capacity and only then is the signal sent to the zone, which suitably controls the solenoid valves (overboost cycle). For example, if a zone has 4 branches, 25 kg/h in each branch, two branches are active and the request increases to 75 kg/h, then the zone controller sends the request to the pumping unit, which increases the flow-rate to 75 kg/h and, only when this has been reached, sends the signal to the zone to activate the third branch and consequently spray 75 kg/h. In the delay until the signal is received, the water pressure rises above the pressure set point, however this guarantees that, when the third branch is activated, the pressure will not fall below the required value and cause the nozzles to spray coarse droplets. During this transient period, the excess water is recirculated by the bypass valve. Subsequently, when the zone is in the final status (solenoid valves suitably activated, third branch open, as in the example) the water pressure drops for a few seconds to around 60 bars, to ensure complete closing of the bypass solenoid valve (underboost cycle).

**Capacity required decreases:** in this case, the pumping unit responds immediately to the request from any one of the zones to decrease the capacity. As a consequence of the reduction in atomised water in the zone/zones, the pressure will increase and the bypass valve may be activated. There will also be a reduction in the pump rotation speed (to reduce the flow-rate to the new value required by the zone) and, if the bypass valve has been activated, an underboost cycle will be performed (see the description above).

In the general case where there are multiple zones that require variations in capacity, these will be satisfied one at a time, in order, and only at the end of the last variation will the underboost cycle be performed, if necessary.

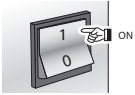
## 9. STARTING AND USER INTERFACE

installer

Before starting the humidifier check:

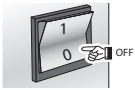
- 
- water and air connections (chap. 2). In the event of water leaks do not start the humidifier before having resolved the problem;
- electrical connections (cap. 3)

### 9.1 Starting



user

### 9.2 Stopping



**Note:** if the system is stopped for an extended time, open the valve at the end of the water line to assist drainage. If the system is fitted with drain solenoid valves at the end of the line (optional), this is done automatically.

service

### 9.3 First start-up (setting the language)

On power-up, the following screen is displayed:

Select language:	
1.	English
2.	Italiano
3.	Deutsch
4.	Francais
5.	Espaniol

Press ENTER to go the list of languages, then UP to select the desired language and ENTER to confirm. This screen remains displayed for 60 seconds.

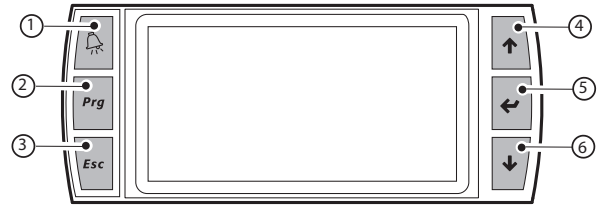
Subsequently, the following screen will be displayed:

Show language selection screen at start-up...Yes/no

- YES: the screen for choosing the language will be displayed when the humidifier is next started;
- NO: the screen for choosing the language will no longer be displayed on power-up.

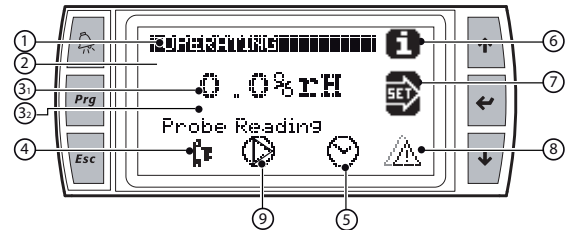
**Note:** The language can also be changed from the maintenance menu (maintenance menu > system info > language).

### 9.4 Keypad



button	function
1	alarm list active alarms and reset any alarms present
2	PRG return to the "main" screen from the "main" screen access the main menu
3	ESC return to the previous screen/display
4	UP circular navigation inside the menus, the screens, the parameters and the values of the parameters from the "main" screen, access an "INFO menu"
5	ENTER select and confirm (like the "Enter" key on a computer keyboard) from the main menu, access the "SET" screen
6	DOWN circular navigation inside the menus, the screens, the parameters and the values of the parameters from the main screen, access the warning screens

### 9.5 "Main" screen



button	function
1	description of zone status (*)
2	empty line
3 <sub>1</sub>	value read according to the type of signal connected (control value)
3 <sub>2</sub>	limit probe reading
4	status of the atomising nozzles: • atomising nozzles operating; • atomising nozzles off; • zone disabled
5	scheduler set
6	access "INFO" screen (UP button)
7	access "SET" screen (ENTER button)
8	access the "Warnings" screen that contains the reset alarm messages (DOWN button)
9	Display: • pump on (the triangle in the centre of the icon flashes); • pump off (the triangle in the centre of the icon does not flash, empty)

(\*) Types of descriptions:

1. < OFF FROM SCHEDULER / OFF FROM REMOTE / OFF FROM KEYPAD / OFF SUPERVISOR / OFF FLOW SWITCH / PUMP DISABLED / OTHER ZONE PUMP (only in flow-rate mode, the pump is atomising in the other zone) / FILLING / WASHING / EMPTYING / NO REQUEST / OPERATING / SHUTDOWN ALARM >

### 9.6 "INFO" screens

Series of read-only screens for displaying the main humidifier status values. To access, press UP from the "Main" screen. There are four "INFO" screens; to move from one screen to the next, press UP or DOWN. Press ESC to return to the "Main" screen.

Info shown on the display	Value and notes	Unit of measure
Zone info 1/3	Heading (screen 1 of 3)	
Request	Capacity request	kg/h
Production	Current humidifier capacity	kg/h
Aux probe	Display value read by auxiliary probe (not control, display only)	%rH or °C/°F
1 2 3 4 5 6 V	See note below (*)	
F	See note below (*)	
D	See note below (*)	
Date and time	Date and time	

(\*) The display shows a table where the columns represent the 6 capacity modulation steps and the rows contain the following information:  
 Row F - the symbol "→" is displayed if the branch is atomising, otherwise "-" is shown  
 Row D - the symbol "↓" is displayed if the branch is draining (valve open), the symbol "↓R" if the branch is draining with pressure relief, otherwise "-" is displayed if the drain valve is closed  
 Column v the symbol "↑" is displayed if the vent valve is open (and consequently also the main drain valve is open), otherwise "-" is displayed.

For example, the table may be as follows:

	1	2	3	4	5	6	V
F	-	→	-	→	-	→	-
D	-	-	-	-	-	-	-

This indicates that branches 2, 4 and 6 are active (on-off valves 2, 4 and 6 open, all drain valves closed, vent valve closed)

In another example, the table may be as follows:

	1	2	3	4	5	6	V
F	-	-	-	-	-	-	-
D	-	↓	-	↓	-	↓	-

This indicates that the branches are not atomising and branches 2, 4 and 6 are not draining (on-off valves 2, 4 and 6 closed, drain valves 2, 4 and 6 open, vent valve closed)

Info shown on the display	Value and notes	Unit of measure
Remote zone info 2/3	Heading (screen 2 of 4)	
Zone2 <status>	Status of the zone (example, Off from flow switch, in production, no request, etc.)	
Zone3 <status>	Status of the zone (example, Off from flow switch, in production, no request, etc.)	
Zone4 <status>	Status of the zone (example, Off from flow switch, in production, no request, etc.)	
Zone5 <status>	Status of the zone (example, Off from flow switch, in production, no request, etc.)	
Zone6 <status>	Status of the zone (example, Off from flow switch, in production, no request, etc.)	

Info shown on the display	Value and notes	Unit of measure
Unit info 3/3	Heading (screen 3 of 4)	
Request	Capacity request (sum of all the capacities required by the zones)	kg/h

Pump press.	Water pressure generated by the pump	bar
Conductivity	Conductivity of the humiFog inlet water	µS/cm
Hour counter	Operating hours since last hour counter reset	hours
Bypass temp.	Water temperature in the pump	°C/°F
Main drain valve	Status of main drain valve (open/closed)	

### 9.7 "SET" screen

Used to set the main values for the humidifier. From the main screen press:

- ENTER to access the menu;
- ENTER to move from one value to another;
- UP and DOWN to modify the selected value;
- ENTER to confirm and go to the next value.

Info shown on the display	Value and notes	Default	Unit of measure
SET	Heading		
Set point	Temperature or humidity set point	50%rH or 28°C / 82°F	°C/°F or %RH
Operation	Auto (in control) or OFF	Auto	
Max prod.	Maximum capacity available as percentage of rated capacity	100	%
Prop. band	Proportional band (modulation)	5	%
Lim set point	Limit temperature or humidity (limit probe)	90%rH or 20°C / 70°F	°C/°F or %RH
Lim. band prop.	Proportional band for limit probe (modulation)	5	%
Enable pump	Enable pump /Yes/no	Yes	

### 9.8 "Warnings" screen

The warning screen spontaneously displays messages generated by fixed events. One typical example is a lack of supply water, which generates an alarm but that, when supply pressure returns, is automatically reset and humiFog resumes operation: the reset alarm message will appear on the warning screen.

### 9.9 Main menu

To access press PRG from the main screen

Buttons:

- UP and DOWN: navigation inside the submenus, screens, and range of values and settings;
- ENTER: confirm and save the changes made;
- ESC: to go back (pressed more than once returns to the "Main" screen)

Menu tree (the headings have a grey background)

<b>1. User</b>	<b>1. Alarm threshold</b>	<b>Main probe thresholds</b>	
		High alarm	
		Low alarm	
		<b>Limit probe thresholds</b>	
		Alarm threshold	
		Alarm delay	
	<b>2. Clock</b>	Time	
		Day	
		Month	
		Year	
		Format	
		Weekday	
	<b>3. Enable scheduler</b>	Scheduler on/off	
		Variable set point	
		Off and delay time	
	<b>4. Set scheduler</b>	P1-1	
		P1-2	
		P2	
		P3	
		P4	
	<b>5. Weekly scheduler</b>	Monday	
		Tuesday	
		Wednesday	
		Thursday	
		Friday	
		Saturday	
		Sunday	
	<b>6. Scheduled set point</b>	Z1	
		Z2	
		Z3	
		Z4	
<b>2. Installer (password 77)</b>	<b>1. Pump setting</b>	<b>1. Pump setting (i)</b>	Operating mode: fow control High press. Low press.
		<b>2. Pump setting (ii)</b>	Operating mode: constant pressure Pressure setting <b>Low pressure measurement</b>
		<b>3. Supply water</b>	Delay at startup Delay in steady operation <b>Conductivity setting</b> Warning threshold Alarm threshold
		<b>4. Special pump functions</b>	<b>Filling</b> Mode< empty only / daily wash / periodical wash > Time of day / period Duration <b>Automatic wash</b> Enable Duration
	<b>2. Zone (controlled by Master)</b>	<b>1. Conf g. inputs 1/2</b>	Type of operation  Aux probe (%rH, °C/°F, No) <b>Control signal</b> Type of signal Min            Max Offset
		<b>1. Conf g. Inputs 2/2</b>	<b>Limit signal</b> Type of signal Min            Max Offset Aux signal Type of signal Min            Max Offset Min value of prop control signal

installer

user

service

		2. Special zone functions 1/2	Alarm relay logic
			Flow switch logic
			Language
			Show language selection at start-up
		2. Special zone functions 2/2	Pressure relief
			Enable
			Duration
			Rotation
			Enable
			Time
		3. Distribution system (note i)	Number of branches
			Rating
			Minimum flow-rate
		3. Distribution system (note ii)	Step 1:       xx.x kg/h
			Step 2:       xx.x kg/h
			Step 3:       xx.x kg/h
			Step 4:       xx.x kg/h
			Step 5:       xx.x kg/h
			Step 6:       xx.x kg/h
		4. Supervisor	BMS address
			Com speed
			Type of protocol
			On/off from supervisor
		5. External alarms	Water treatment alarm logic
	3. Remote zone setting	1. Remote zone setting	Zone 2: Yes/no add:
			Zone 3: Yes/no add:
			Zone 4: Yes/no add:
			Zone 5: Yes/no add:
			Zone 6: Yes/no add:

Tab. 9.a

(i) (ii) Either screen (i) or (ii) will be displayed, depending on whether flow control or constant pressure mode has been selected

Maintenance (password 77)	1. Reset conf.	Save configuration	
		Load configuration	
		Reset default	
		Set model	
	2. System info	Model	
		SW code	
		Version	
		Date	
		Bios	
		Boot	
	3. Instant readings	External signal	
		On/off input (control)	
		Main signal	
		Limit signal	
		Aux probe	
	4. Manual procedure	System prod request	
		Manual control all I/O	
	5. System status info	System status	
		Pump status	
	6. Hour counter	Pump hours	
		Reset hours	
		Reset date	
	7. Alarm log	No. xxx time date	Sequence of screens that contain the two rows displayed on the left
		Alarm message	
		Messaggio di alarm	

Tab. 9.b

### 9.10 User menu

From the main screen press:

- PROG to access the main menu;
- ENTER to select and access the selected menu;
- UP/DOWN to move between the submenus;
- ENTER to enter the submenus
- ENTER to select the parameter and move between the parameters;
- UP/DOWN to modify the parameter;
- ENTER to confirm selected parameter and go to the next parameter;
- ESC to return to the previous menu.

To navigate inside the screens:

- UP or DOWN to modify the value (within the options/range),
- ENTER to confirm and move the cursor to the next value
- ESC to return to the installer menu.

User menu screens:

1. User	1. Alarm threshold
	2. Clock
	3. Enable scheduler
	4. Set scheduler
	5. Weekly scheduler
	6. Scheduled set point

Tab. 9.c

Submenu: 1. Alarm threshold

Display	description	range	default	unit
Main thresholds probe	heading			
High alarm	High humidity or temperature alarm threshold	0 to 100 or -20 to 70	100 or 70	RH or °C
Low alarm	Low humidity or temperature alarm threshold	0 to 100 or -20 to 70	0 or -20	RH or °C
Limit thresholds probe	Heading			
Alarm threshold	High limit humidity or temperature alarm threshold	0 to 100 or -20 to 70	100 or 70	RH or °C
Alarm delay	Low limit humidity or temperature alarm threshold	0 to 100 or -20 to 70	0 or -20	RH or °C

Tab. 9.d

Submenu: 2. Clock

Display	description	range
Time	Internal clock time setting	
Day	Internal clock day setting	
Month	Internal clock month setting	
Year	Internal clock year setting	
Format	Date format setting	dd/mm/yy - mm/dd/yy
Weekday	Day setting of the week	Monday to Sunday

Tab. 9.e

Submenu: 3. Enable scheduler

Display	description	range	default	unit
Enable scheduler	Heading			
Scheduler on/off	Enable scheduler	ON/OFF	off	
Variable set point	Enable variable set point based on time of day	ON/OFF	off	
Off and delay time	Temporarily stop humiFog and automatically restart after ___ hours	On / off	off	

Tab. 9.f

Submenu: 4. Set scheduler

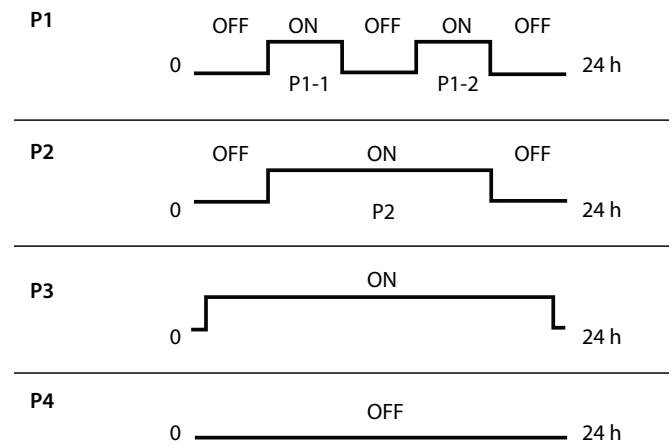
Note: this screen is visible if "scheduler ON/OFF" has been enabled (see the enable scheduler screen).

Setting of the intervals for the operation of the humidifier over one day (24h):

Display	description	ON time	OFF time
P1-1	First interval of band P1	9:00	13:00
P1-2	Second interval of band P1	14:00	21:00
P2	Interval of band P2	8:00	18:00
P3	Band always ON	Always ON	
P4	Band always OFF	Always OFF	

Tab. 9.g

Parameters P1 to P4 can be used set how many times atomised water production is enabled/disabled over a 24h period:



P1	Two daily ON time bands
P2	Individual ON time band
P3	Always ON
P4	Always OFF

Submenu: **5. Weekly scheduler**

Note: this screen is visible if "scheduler ON/OFF" has been enabled (see the enable scheduler screen).

Setting of the weekly operation of the humidifier, using parameters P1 to P4 (configured in the previous screen)

Display	range
Monday	P1 to P4
Tuesday	P1 to P4
Wednesday	P1 to P4
Thursday	P1 to P4
Friday	P1 to P4
Saturday	P1 to P4
Sunday	P1 to P4

Tab. 9.h

Submenu: **6. Scheduled set points**

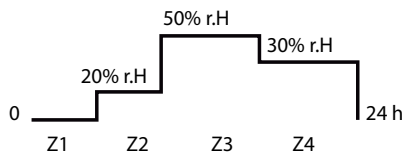
Note: this screen is visible if "variable set point" has been enabled (see the enable scheduler screen).

Parameters Z1 to Z4 are used to configure up to 4 different humidity set points that vary throughout the day (parameters Z1, Z2, Z3, Z4).

Display	description	Activation time	Set point value
Z1	Time setting for activating the specified set point	00:00	0 %rH
Z2	Time setting for activating the specified set point	00:00	0 %rH
Z3	Time setting for activating the specified set point	00:00	0 %rH
Z4	Time setting for activating the specified set point	00:00	0 %rH

Tab. 9.i

For example, the parameters described above can be set to change the set point throughout the day, as follows:



Note:

- during the "OFF" time band, the humidifier is NOT actually off, but rather atomised water production is temporarily disabled, even when setting manually;
- the "daily" time bands have priority over the "variable set point" bands. For example, setting P4 each Monday (humidifier off), parameters Z1, Z2, Z3, Z4 (different set point values) will not be observed, as the humidifier is not programmed to operate on that day.

**9.11 Installer menu**

From the main screen press:

- PRG to access the main menu;
- DOWN to move to the installer menu;
- ENTER to move to the password;
- UP/DOWN to enter the password "77"
- ENTER to access the selected menu;
- UP/DOWN to move between the submenus;
- ENTER to select the parameter and move between the parameters;
- UP/DOWN to modify the parameter;
- ENTER to confirm the selected parameter and go to the next parameter;
- ESC to return to the previous menu.

To navigate inside the screens:

- UP or DOWN to modify the value (within the options/range),
- ENTER to confirm and move the cursor to the next value
- ESC to return to the installer menu.

The installer menu is divided into four submenus:

Installer menu screens:

Display	description
<b>1. Pump setting</b>	Contains the submenus with the installer parameters corresponding to the pumping unit
<b>2. Zone</b>	Contains the submenus with the installer parameters corresponding to the controlled zone (rack or room distribution system)
<b>3. Remote zone settings</b>	Contains the submenus with the installer parameters corresponding to the remote zones, controlled by the slaves. This is only displayed on the master humiFog

Tab. 9.j

Submenu **1. Pump setting - 1. Pump setting**

Contains the submenu with the installer parameters corresponding to the pumping unit

One of the two following screens is displayed, depending on the setting of the "Operating mode" parameter between the two possible values.

Display	description	range	def.	unit
<b>Pump setting</b>	heading			
Operating mode: <b>flow control</b>	humifog operating mode setting	"Flow-rate control" or "constant pressure"		
High press.	Value for activating the next branch on the rack	20 to 80	70	bar
Low press.	Value for deactivating the branch on the rack	20 to 80	25	bar
<b>Pump setting</b>				
Operating mode: <b>constant pressure</b>	humifog operating mode setting	"Flow-rate control" or "constant pressure"		
Pressure setting	Pressure set point value	20 to 80	70	bar

Tab. 9.k

Submenu 1. Pump setting - 2. Supply water

Contains the submenus with the installer parameters corresponding to the demineralised water supply

Display	description	range	default	unit
Supply water	heading			
Low pressure measurement	Heading			
Delay at startup	Low pressure alarm delay time when starting the pump	1 to 999	15	seconds
Delay in steady operation	Low pressure alarm delay time with pump operating	1 to 999	15	seconds
Conductivity setting	Heading			
Warning threshold	Warning threshold (high conductivity warning)	1 to 2000	100	µS
Alarm threshold	High conductivity alarm threshold	1 to 2000	200	µS

Tab. 9.l

Submenu 1. Pump setting - 3.FSpecial pump functions

Display	description	range	default	unit
Special pump functions	Heading			
Filling	Heading			
Enable	Enable the function for filling the system	On / off	On	
Duration	Duration of the fill cycle	1 to 60	5	Min
Automatic washing Mode	Enable automatic washing or emptying	Emptying only = emptying due to inactivity when the time indicated below has elapsed Daily wash = wash every day at the time set below Periodical wash = wash for period set below (irrespective of operation or inactivity of the system)	Periodical wash	
Time of day / period	Time or period of time, as described for the previous parameter	1 to 168	48	h
Duration	Duration of the washing cycle	1 to 60	5	min

Tab. 9.m

(\*) setting wash to OFF, the system will simply be emptied the when the "Timeout" has elapsed, during which time the system remains full of water without atomising.

installer

user

service

Submenu 2. Zone – 1. Config. inputs

This contains two screens with the following parameters:

Display	description	range	default	unit
Config. inputs 1/2	First screen heading			
Type of operation	Set type of operation	Humidity control, Humid+Limit Humid control, Humid+Limit Temp control, Temperature control, Temp+Limit Humid control, Temp+Limit Temp control, External signal, Ext signal + Lim Humid, Ext signal + Lim Temp, External ON/OFF, Ext ON/OFF + Lim Humid, Ext ON/OFF + Lim Temp.	Humidity control	
Aux probe (°rH, °C/°F, No)	Enable display on Info screen of the value measured by the Aux probe	On/off	Off	
Control signal	Heading			
Type of signal	Type of signal generated by the probe	NTC, 0 to 135oh, 0-1V, 0-10V, 4-20mA, 0-20mA	0-1V	Various
Min Max	Min. and max. probe values	0 to 100	0, 100	%
Offset	Probe offset	0 to 100	0, 100	%
Config. inputs 2/2	Second screen heading			
Limit signal	Heading			
Type of signal	Type of signal generated by the probe	NTC, 0 to 135oh, 0-1V, 0-10V, 4-20mA, 0-20mA	0-1V	Various
Min Max	Min. and max. probe values	0 to 100	0, 100	%
Offset	Probe offset	0 to 100	0, 100	%
Aux signal	Heading			
Type of signal	Type of signal generated by the probe	NTC, 0 to 135oh, 0-1V, 0-10V, 4-20mA, 0-20mA	0-1V	Various
Min Max	Min. and max. probe values	0 to 100	0, 100	%
Offset	Probe offset	0 to 100	0, 100	%

Tab. 9.n

Only the parameters corresponding to the probes used for the type of operation set will be displayed.

Submenu 2. Zone – 2. Special functions

This contains two screens with the following parameters:

Display	description	range	default	unit
Special zone functions 1/2	Heading			
Alarm relay logic	Cumulative alarm relay logic setting	N.O. = (normally open) when connecting as described in the previous paragraphs, the output will be open when no alarms are active or N.C. = (normally closed) when connecting as described in the previous paragraphs, the output will be closed when no alarms are active		
Flow switch logic	Flow switch input logic setting	N.O. = (normally open) when connecting as described in the previous paragraphs, humiFog is activated only if the flow switch is closed or N.C. = (normally closed) when connecting as described in the previous paragraphs, humiFog is activated only if the flow switch is open		
Language	User interface language setting	Italian, English, French, German, Spanish (if available)	Italian	
Show language selection at start-up	Activation of prompt to set the language whenever starting humiFog	Enabled / disabled	Enabled	
Min value of prop control signal	Minimum value of proportional control signal. Input signals less than this threshold do not generate the production of atomised water	5 to 80	5	%
Special zone functions 2/2	Heading			
Pressure relief	Heading			
Enable	Enable pressure relief	Enabled / disabled	Disabled	
Duration	Pressure relief duration	1 to 999	3	Seconds
Rotation	Heading			
Enable	Enable atomising line/manifold rotation	Enabled / disabled	Enabled / disabled	

Display	description	range	default	unit
Time	Atomising line/manifold activation time	1 to 999	30	seconds

Tab. 9.o

(\*) humiFog is supplied with the flow switch input jumpered, consequently the unit is enabled.

Submenu 2. Zone – 3. Distribution system

One of the two following screens is displayed, depending on the setting of the “Operating mode” parameter to “Flow control” or “Constant pressure” in the “Pump setting” menu.

“Operating mode” set to “Flow control”

Display	Description	range	default	unit
Distribution system	heading			
Number of branches	Number branches on the rack	1 to 4	4	
Rating	Rated setting of the RACK (not to be confused with the rating of the pumping unit!). This value is shown in the documents supplied with the rack.	10 to 600	10	kg/h
Minimum flow-rate	Minimum flow-rate setting for the RACK (not to be confused with the flow-rate of the pumping unit!). This value is shown in the documents supplied with the rack and ensures that, at the minimum flow-rate, the water pressure does not fall below 20 bars and cause a shutdown alarm.	From the theoretical minimum calculated based on the “Rating” and the “Number of branches” up to 80% of the “Rating”	Theoretical minimum calculated based on the “Rating” and the “Number of branches”	kg/h

Tab. 9.p

“Operating mode” set to “Constant pressure”

Display	Description	range	default	unit
Distribution system	heading			
Step 1: xxx.x kg/h	Capacity setting for the first step of the system	0 to 120	0	kg/h
Step 2: xxx.x kg/h	Capacity setting for the second step of the system	0 to 120	0	kg/h
Step 3: xxx.x kg/h	Capacity setting for the third step of the system	0 to 120	0	kg/h
Step 4: xxx.x kg/h	Capacity setting for the fourth step of the system	0 to 120	0	kg/h
Step 5: xxx.x kg/h	Capacity setting for the fifth step of the system	0 to 120	0	kg/h
Step 6: xxx.x kg/h	Capacity setting for the sixth step of the system	0 to 120	0	kg/h

Tab. 9.q

Submenu 2. Zone – 4. Supervisor

Display	description	range	default	unit
Supervisor	Heading			
BMS address	Identifier for BMS network	0 to 200	1	
Com speed	Communication speed	1200, 2400, 4800, 9600, 19200	19200	bps
Type of protocol	Communication protocol setting	Carel, Modbus, RS232, to	Modbus	
On/off from supervisor	Enable ON/OFF from BMS	Yes, No	No	

Tab. 9.r

Submenu 2. Zone – 5. External alarms

Display	description	range	default	unit
External alarms	Heading			
Water treatment alarm logic	External water treatment alarm logic setting	N.O. = (normally open) when connecting as described in the previous paragraphs, humiFog will show the Water treatment alarm if the connection is interrupted or N.C. = (normally closed) when connecting as described in the previous paragraphs, humiFog will show the Water treatment alarm if the connection is not interrupted (contact closed)		

Tab. 9.s

(\*) humiFog is supplied with the water treatment alarm input jumpered, consequently the unit is enabled.

Submenu 3. Remote zone setting

Display	description	range	default
Remote zone setting	Heading		
Zone 2: Yes/no add:	remote zone activation and network address setting	Yes / no 1 to 32	no
Zone 3: Yes/no add:	remote zone activation and network address setting	Yes / no 1 to 32	no
Zone 4: Yes/no add:	remote zone activation and network address setting	Yes / no 1 to 32	no
Zone 5: Yes/no add:	remote zone activation and network address setting	Yes / no 1 to 32	no
Zone 6: Yes/no add:	remote zone activation and network address setting	Yes / no 1 to 32	no

Tab. 9.t

### 9.12 Maintenance menu

Important: the operations described in this menu must only be carried out by qualified personnel.

- From the main screen press:
- PRG to access the main menu;
- DOWN to move to the maintenance menu;
- ENTER to move to the password;
- UP/DOWN to enter the password "77"
- ENTER to access the selected menu;
- UP or DOWN to move between the submenus;
- ENTER to select the parameter and move between the parameters;
- UP/DOWN to modify the parameter;
- ENTER to confirm the selected parameter and go to the next parameter;
- ESC to return to the previous menu.

Maintenance menu screens:

Display
1. Reset conf
2. System info
3. Instant readings
4. Manual procedure
5. System status info
6. Hour counter
7. Alarm log

Submenu 1. Reset conf

Display	description	range	default
Reset conf	Heading		
Save configuration	Save a copy of the current parameter configuration	Yes / No	No
Load configuration	Load the copy of the parameter configuration saved previously using the above parameter	Yes / No	No
Reset default	Reset all parameters to the default values	Yes / No	No
Set model	Set the model of humiFog	All models available	

Tab. 9.u

Submenu 2. System info

Display	description
System info	heading
Model	Display humiFog model
SW code	Software code loaded
Version	Software version loaded
Date	Software date loaded
Bios	System BIOS version
Boot	System BOOT version

Tab. 9.v

Submenu 3. Instant readings

Display	description	range	unit
Instant readings	heading		
External signal	Display value of external proportional control signal	0 to 100	%
On/off input	Display status of on/off control input (not to be confused with the remote on/off enabling signal!)	On / off	
Main signal	Display value of the signal read by the main probe		Ohm, mA or Volt
Limit signal	Display value of the signal read by the limit probe		Ohm, mA or Volt
Aux probe	Display value of the signal read by the Aux probe		Ohm, mA or Volt

Tab. 9.w

The signals that are not connected are highlighted by the message "not present" on the screen.

Submenu 4. Manual procedure

Used to manually set the humiFog outputs, one at a time. The parameters displayed correspond to the humiFog terminal labels. In addition, the capacity to be generated can be set for a zone or the entire system.

Display	description	range	unit
Manual procedure	heading		
System prod request	Capacity that the system must generate. e.g. setting this to 30%, all the zones will generate 30% of maximum capacity.	0 to 100	%
Zone prod request	Capacity that the zone must generate. e.g. setting this to 30%, the zone will generate 30% of maximum capacity.	0 to 100	%
Manual control all I/O	Manual setting of all the humiFog inputs and outputs		

Tab. 9.x

Submenu **5. System status info**

Displays detailed information on the humiFog

Display	description	range
System status info	heading	
System status	Display system status	StandbyEmpty / StandbyFull / Filling / Washing / Emptying / Production
Pump status	Display pump status	Standby / Increase prod / Close bypass / Pressure for filling / Pressure for wash / Drain reduce (decrease prod ramp to reach flow-rate of just one drain SV) / Close drain cycles / steady operation (production and emptying)

Tab. 9.y

Submenu **6. Hour counter**

Display	description	range
Hour counter	heading	
Pump hours	Display the value of the hour counter since the last reset	
Reset hours	Reset hour counter	Yes / No
Reset data	Display date of last reset	

Submenu **7. Alarm log**

Display	description
Alarm log	heading
No. xxx time date	Sequence of screens that contain the two rows displayed on the left: alarm message number, alarm time, alarm date and alarm message.
Alarm message	

Tab. 9.z

The log contains 200 alarms, after which the next alarms overwrite the oldest ones.

## 10. TABLE OF ALARMS

When an alarm is activated, the alarm button starts flashing.

In these conditions, pressing the alarm button once displays the type of alarm.

In the case of potentially dangerous alarms, the controller automatically stops production. For some alarm events, the alarm relay is also activated at the same time as the signal (see the table below).

Message displayed	Cause	Solution	Reset	Alarm relay status	Action	Bell symbol	Note
Water treatment system alarm	Dig. input Idxx-COMx open, check for water treatment unit faults	jumper dig. input Idxx-COMx, if the alarm disappears check water treatment system; if the alarm persists, replace the controller	automatic	active	stop production	on	
Inlet line low pressure alarm	low water inlet pressure	check supply circuit and water supply pressure	automatic	not active	stop production	on	check inlet pressure three times before generating the next alarm
Inlet line low pressure alarm	low water inlet pressure	check supply circuit and water supply pressure	automatic	active	stop production	on	
Conductivity warning	water inlet conductivity over the warning threshold	check water treatment system	manual	not active	signal only	on	first alarm threshold signal only
Conductivity alarm	water inlet conductivity over the alarm threshold	check water treatment system	manual	active	stop production	on	second alarm threshold, stop production
High bypass temperature alarm	excess water recirculation in bypass	check operating temperature (surrounding ambient air and water); check that the pressurised water distribution system is not blocked so as to cause water recirculation in the pump	automatic	active	signal only	on	
Inverter alarm	inverter fault	check the inverter and replace if necessary	NB*	active	stop production	on	*: automatic reset on inverter control depends on the type of alarm see chapter 7 inverter manual
High bypass temperature alarm from thermostat	excess water recirculation in bypass	check operating temperature (surrounding ambient air and water); check that the pressurised water distribution system is not blocked so as to cause water recirculation in the pump	automatic	active	stop production	on	
Low pump cabinet temperature alarm	water inlet temperature less than 5 °C	heat supply water or the cabinet with a suitably rated heater	automatic	active	stop production	on	
High pressure alarm from pressure switch	outlet pressure greater than 90 bars	Contact CAREL for the instructions to check operation of the bypass valve	manual	active	stop production	on	
High pressure alarm from pressure probe	outlet pressure greater than 22% of rated pressure (85.5 bars)	Contact CAREL for the instructions to check operation of the bypass valve	automatic	active	signal only	on	
Low pressure alarm from pressure probe	outlet pressure less than 25 bars*	check tightness of water circuit at outlet	manual	active	stop production	on	*threshold settable by parameter
Remote zone 2-3-4-5-6 alarm Device offline	Slave unit not connected to the FieldBus network	check: connection, network cable, FieldBus card	automatic	active	signal only	on	
Pumping unit alarm Device offline	Master unit not connected to the FieldBus network	check: connection, network cable, FieldBus card	automatic	active	signal only	on	
Conductivity meter faulty or disconnected alarm	conductivity sensor fault or disconnected; problems from pCO (H)	check connection and operation of the conductivity sensor or the pCO board (H)	manual	active	stop production	on	
Pressure probe faulty or disconnected alarm	pressure probe faulty or disconnected	check connection and operation of the pressure probe	manual	active	stop production	on	
Main probe broken or disconnected alarm	main probe disconnected or broken	check connection and operation of the main probe	manual	active	stop production	on	

installer

user

service

Message displayed	Cause	Solution	Reset	Alarm relay status	Action	Bell symbol	Note
Secondary probe faulty or disconnected alarm	secondary probe disconnected or broken	check connection and operation of the secondary probe	manual	active	stop production	on	
Auxiliary probe faulty or disconnected alarm	auxiliary probe disconnected or broken	check connection and operation of the auxiliary probe	manual	active	signal only	on	
Clock fault alarm	backup battery completely discharged or general clock fault	replace/repair electronic controller	Note*	not active	stop production	off	* switch the unit off to repair or replace the electronic controller
Temperature bypass probe faulty or disconnected alarm	bypass temperature probe disconnected or broken	check connection and operation of the probe	manual	active	stop production	on	
High humidity alarm	value measured by the main probe greater than the humidity alarm threshold	check the parameter setting	manual	not active	signal only	on	
Low humidity alarm	value measured by the main probe less than the humidity alarm threshold	check the parameter setting	manual	not active	signal only	on	
Limit probe high humidity alarm	value measured by the limit probe greater than the humidity alarm threshold	check the parameter setting	manual	not active	signal only	on	



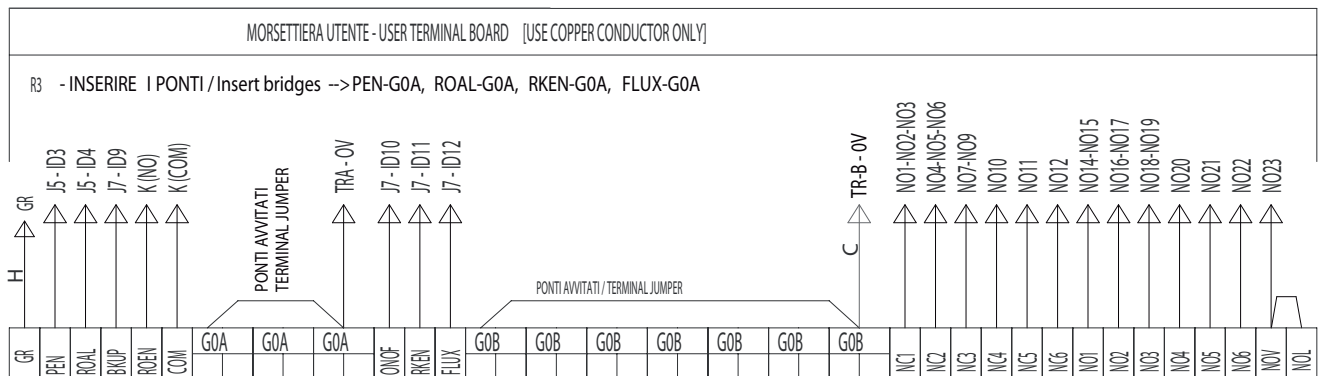
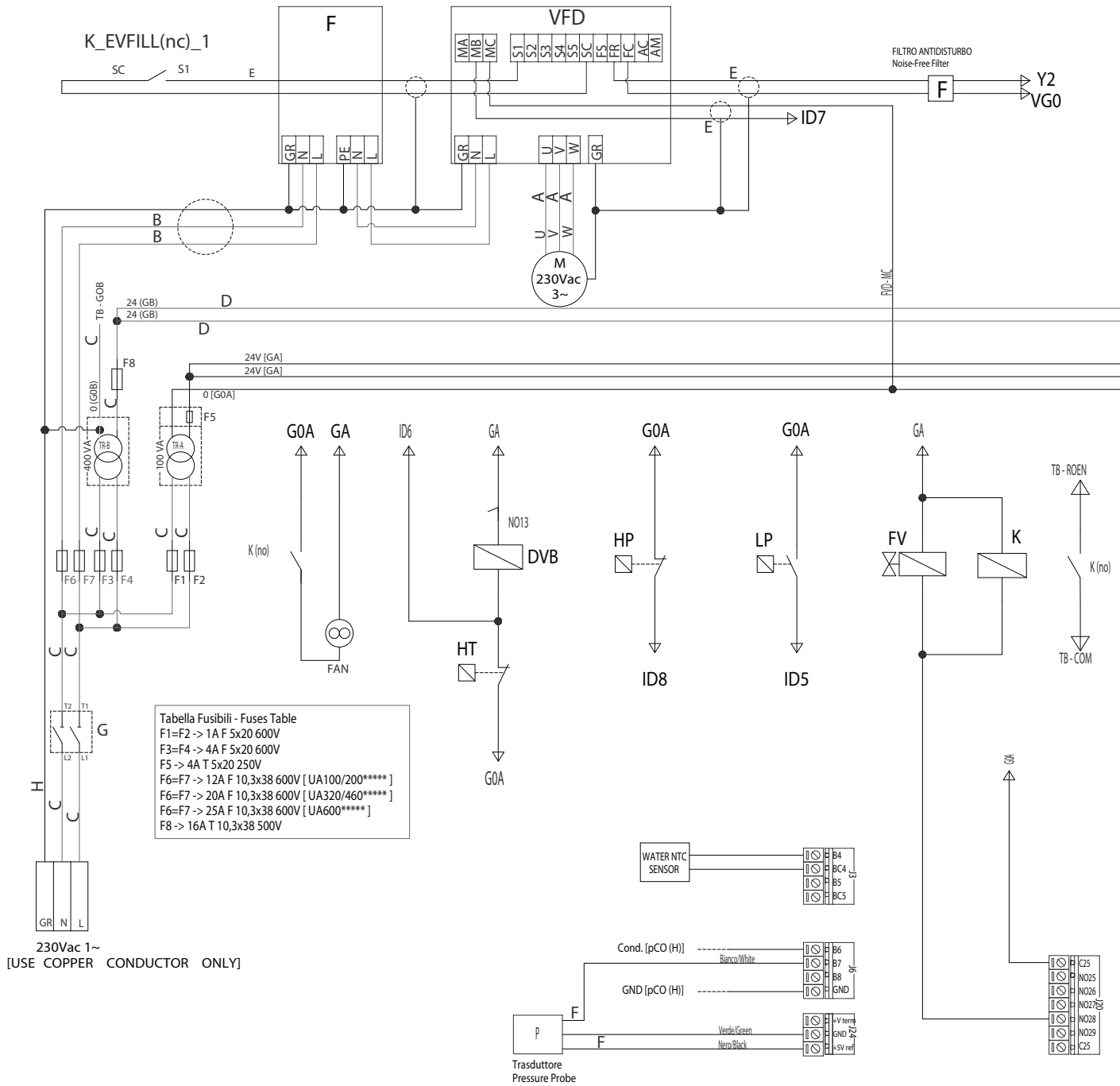
# 11. WIRING DIAGRAMS

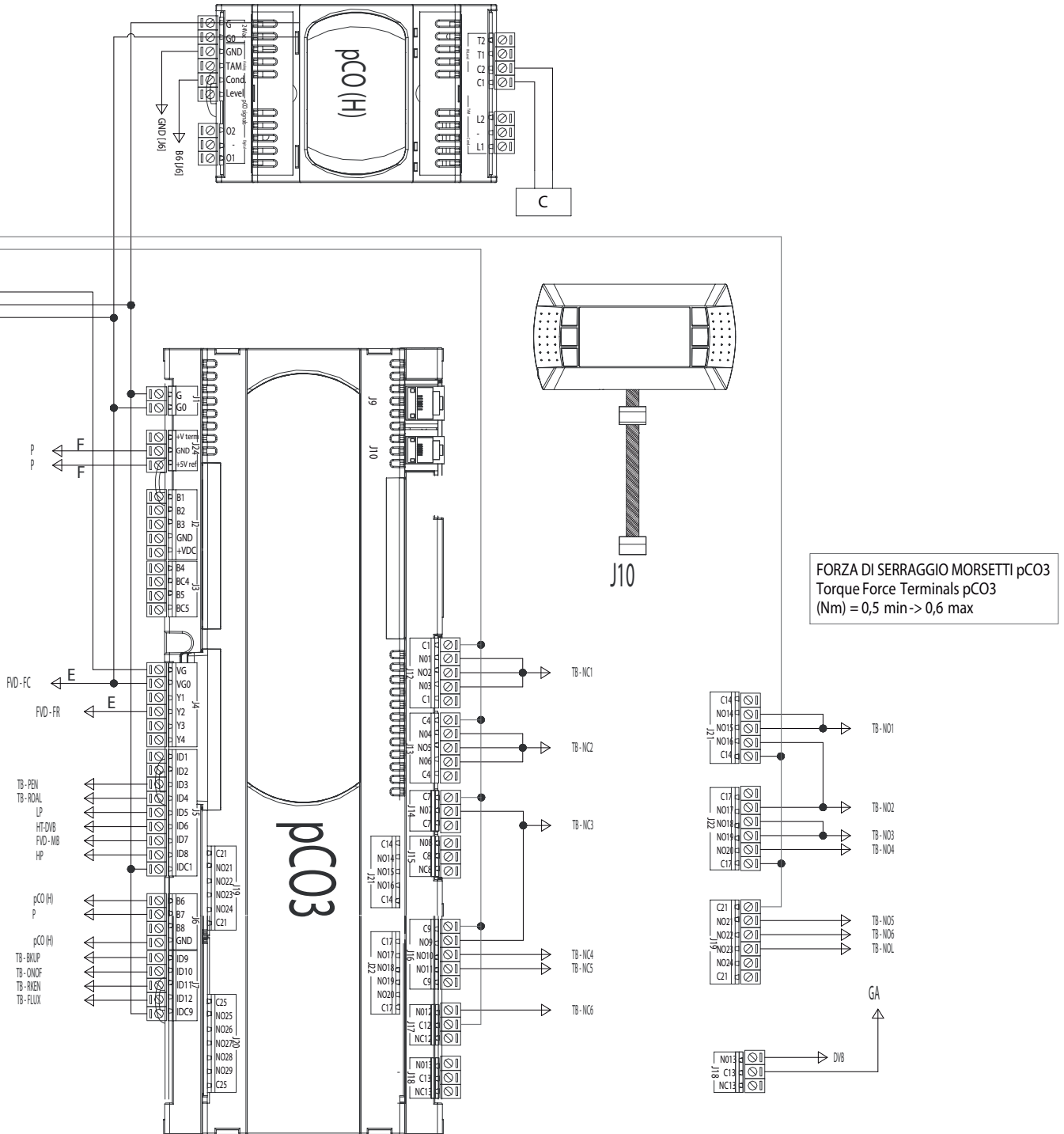
## 11.1 Electric panel humiFog multizona - Master - CE

installer

user

service





TORQUE FORCE TERMINALS (Nm)  
 SINGLE TERMINAL: 0,6 min -> 0,8 max  
 DOUBLE TERMINAL: 0,6 min -> 0,8 max  
 TERMINAL WITH FUSE: 1,5 min -> 1,8 max  
 GROUND TERMINAL: 1,5 min -> 1,8 max

11.2 Electric panel humiFog multizona - Slave - CE

installer

user

service

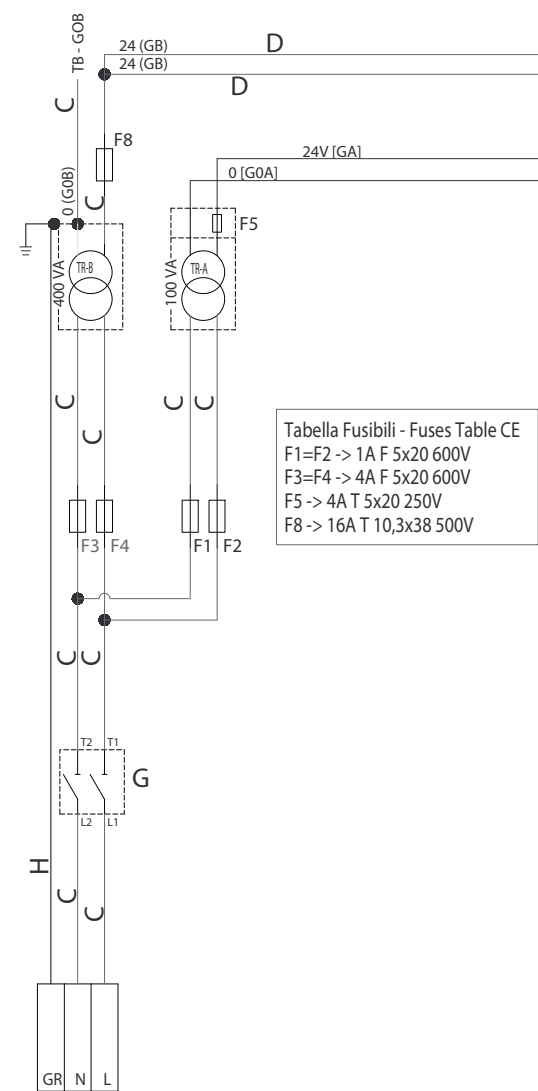


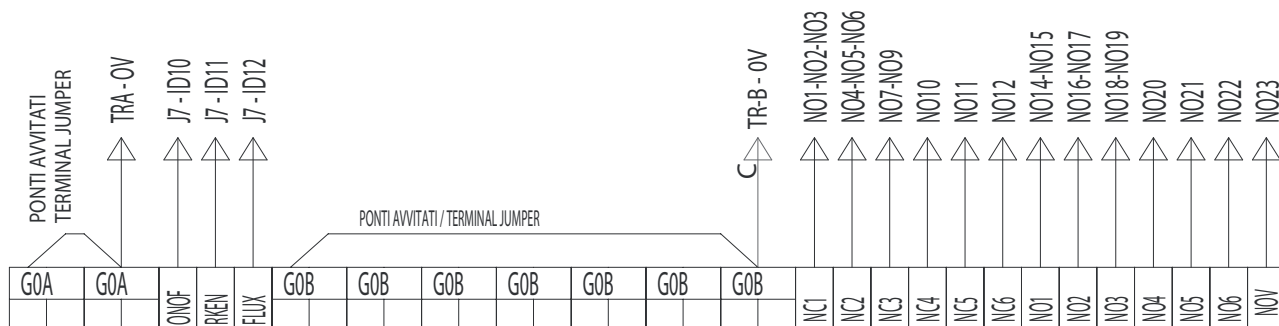
Tabella Fusibili - Fuses Table CE

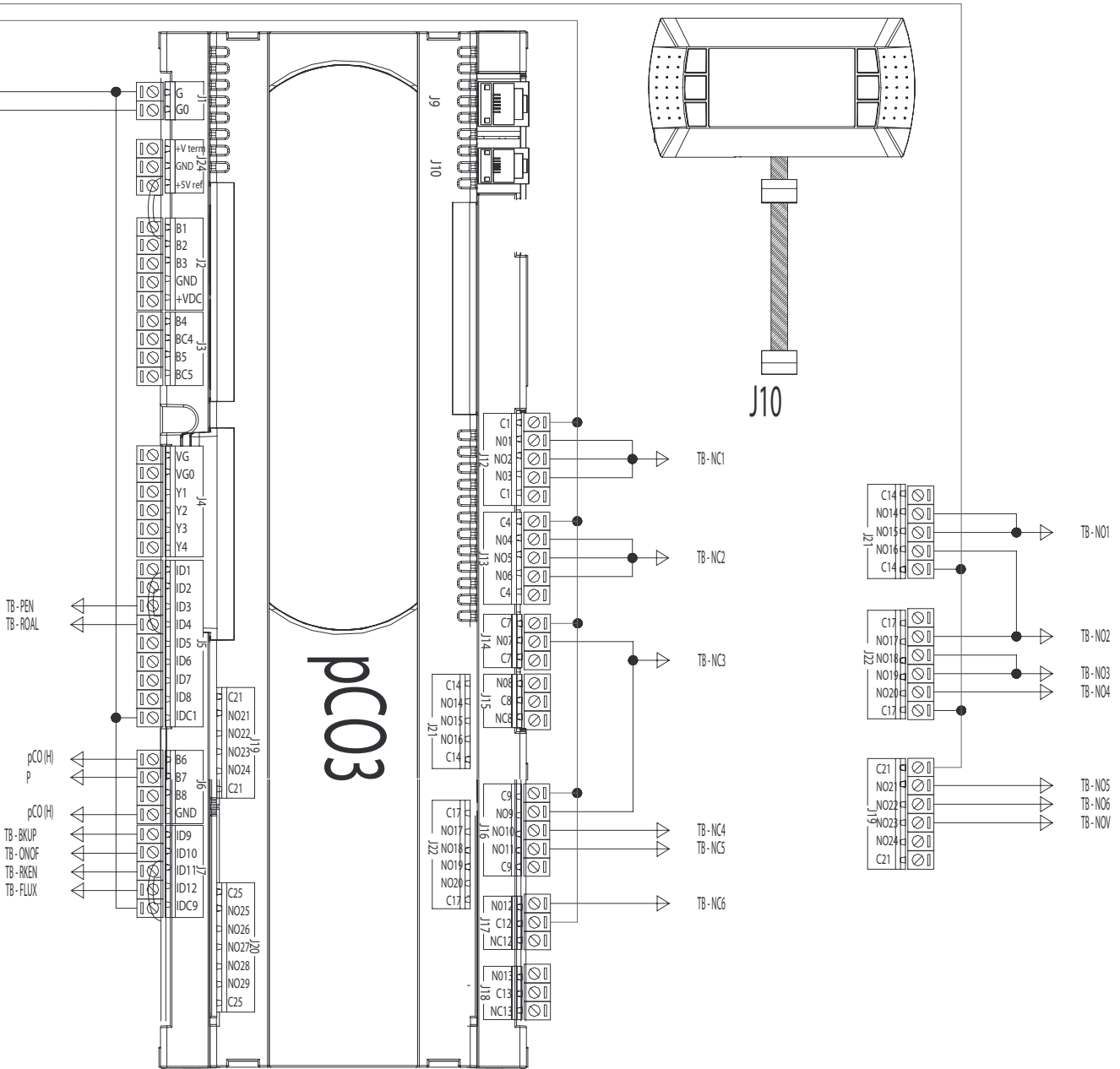
F1=F2	-> 1A F 5x20 600V
F3=F4	-> 4A F 5x20 600V
F5	-> 4A T 5x20 250V
F8	-> 16A T 10,3x38 500V

230Vac 1~  
[USE COPPER CONDUCTOR ONLY]

MORSETTIERA UTENTE - USER TERMINAL BOARD [USE COPPER CONDUCTOR ONLY]

R3 - INSERIRE I PONTI / Insert bridges --> RKEN-G0A, FLUX-G0A





FORZA DI SERRAGGIO MORSETTI pCO3  
 Torque Force Terminals pCO3  
 (Nm) = 0,5 min -> 0,6 max

TORQUE FORCE TERMINALS (Nm)  
 SINGLE TERMINAL: 0,6 min -> 0,8 max  
 DOUBLE TERMINAL: 0,6 min -> 0,8 max  
 TERMINAL WITH FUSE: 1,5 min -> 1,8 max  
 GROUND TERMINAL: 1,5 min -> 1,8 max









# CAREL

CAREL INDUSTRIES - Headquarters  
Via dell'Industria, 11 - 35020 Brugine - Padova (Italy)  
Tel. (+39) 049.9716611 - Fax (+39) 049.9716600  
e-mail: carel@carel.com - www.carel.com

Agenzia / Agency: