

klimatix

User Manual

CPM Mini Precision Air Conditioner

Rev. 03 | August. 2022




Review History			
First Edition	Date	Elaborated by	Approval
New Version	8/31/2021	GOG	AFS
Revision Description	Date	Change	Approval
Addition of instructions regarding Modbus communication, troubleshooting table and images from PDG1 and PGDX HMI	2/23/2022	CPJ	GOG
Addition of instructions to access the factory menu, diagnostics and alarms history in HMI	3/14/2022	CPJ	GOG
Addition of external interconnections, HMI shutdown screen, replacement of air filters, oil charge, minimum thermal load, image update. Change in refrigeration installation table and identification plate	31/08/2022	CPJ	GOG

ABOUT THE MANUAL

This manual is intended to provide sufficient information needed for installation, operation and maintenance for the CP line of Precision air conditioners to ensure the best performance and long life of the equipment for the design conditions.

Considering that technological advances will occur, Mecalor reserves the right to change this manual and the design of the equipments without prior warning, according to the same models specified.

Words like DANGER, ATTENTION and INFORMATION are used in the course of the manual to show warning situations as shown below:

	DANGER	Warns about immediate danger that may cause serious injuries or death.
	ATTENTION	Warns about unsafe practices, which if not avoided, may cause personal damages or death.
	INFORMATION	Relevant information about the equipment or recommendation about good working practices.

MANUFACTURER

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	INFORMATION	Keep this manual in a place that is accessible to the user to consult in case of doubts. This manual cannot be reproduced whole or in part without the prior authorization from Mecalor.
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	INFORMATION	Do not perform any procedure on the equipment in case of doubts after reading this manual. This manual serves as a guide to operate the equipment safely and it does not have the purpose of informing all the variables of the system. Contact the technical support of Mecalor in case of doubts.
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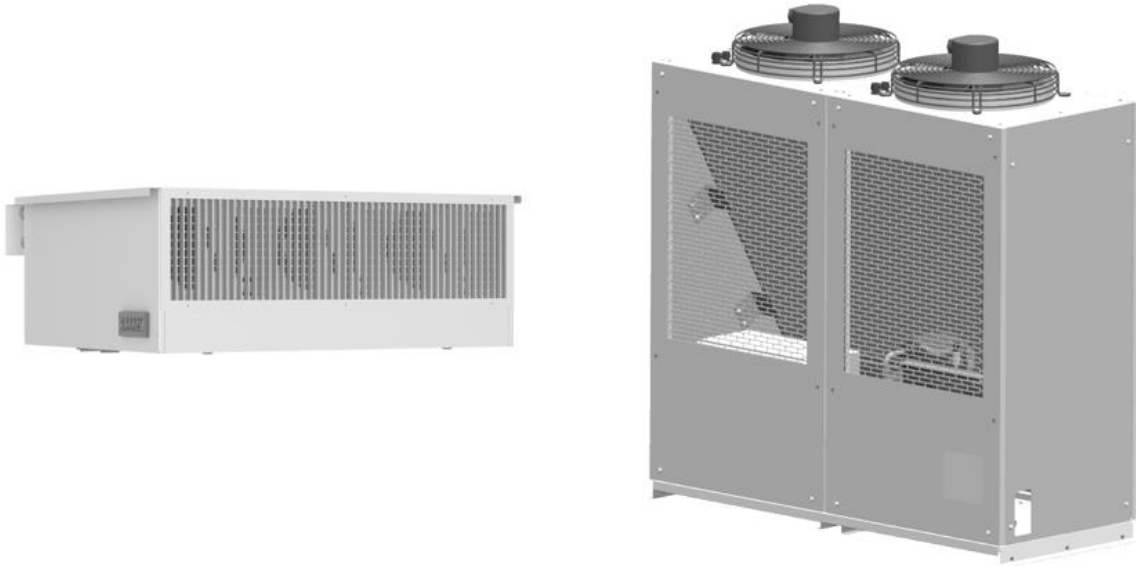
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1. General Description of the Product

1.1. Equipment Description




Klimatix mini precision air conditioners are equipment intended for heat removal in confined environments with high thermal dissipation rate, such as small Data Centers, UPS rooms and telecommunication rooms. In these environments, heat is predominantly generated by the electrical and electronic components and the main function of the equipment is to stabilize the temperature and relative humidity conditions, even in lower capacity systems that share these same requirements.

Maintenance of the temperature and relative humidity conditions within the defined range is essential to ensure proper operating conditions, as well as reliability of the data and transmission equipment, and to guarantee the life expectancy of the electrical and electronic components.

Precision air conditioners are designed for high performance or high sensible heat ratio (SHR) conditions for applications where the sensible heat dissipation rate is predominant (Higher than 90% sensible heat compared to the total heat load).

With structure manufactured in minimized galvanized steel (Finishing Z180) painted by an electrostatic process and polyester-based powder paint in RAL 9003 white, heat exchanger with copper tubes and aluminum fins, EC radial fans, and cooling and humidity control systems according to the equipment configuration.

	ATTENTION	It is not allowed to tamper with original installed components of the equipment. This practice may put at risk the safety of the operator, the functioning of the equipment and losing the warranty.
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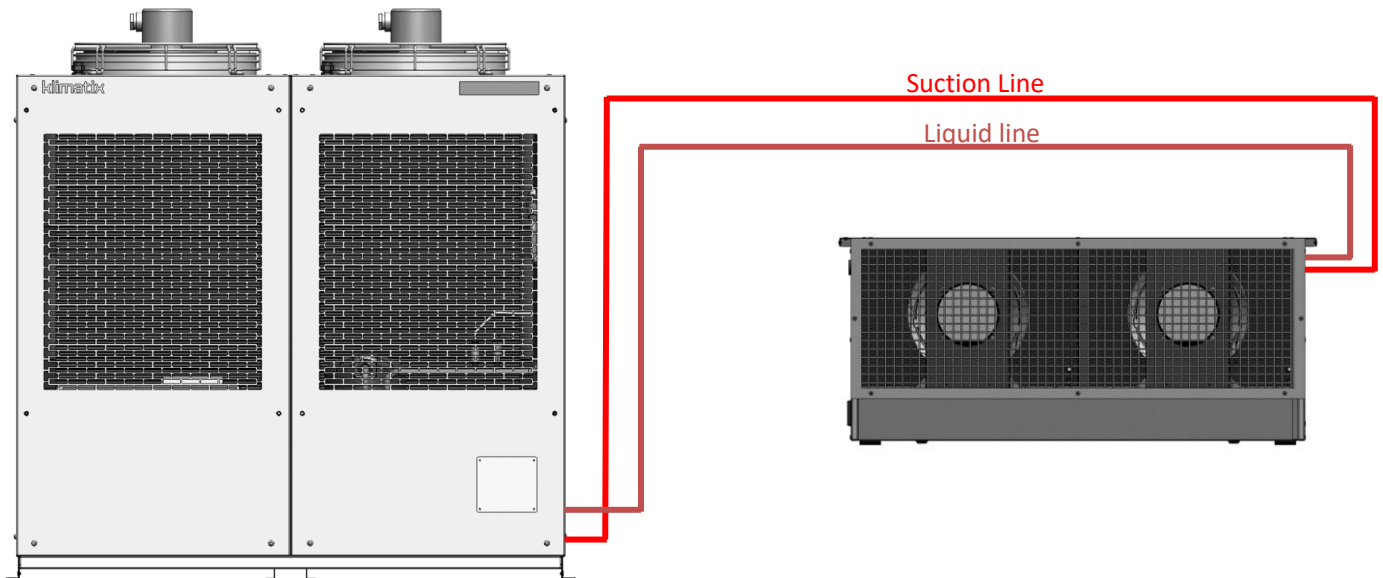
1.2. CPM - Direct Expansion Mini Precision Air Conditioner

This precision air conditioner has its evaporator unit (CPM) installed in the room it is to condition, and is a direct expansion unit, so it operates with a remote condensing unit (UR) to dissipate the heat absorbed in the cooling system to the room.

The CPM is usually installed indoors and in a confined environment, where the racks with the electrical and electronic components of the UPS, telecommunication or data center rooms are located, while the UR must be installed outdoors and in a well-ventilated environment. For this reason the CPM and its respective UR (Remote condensing unit) are interconnected by two refrigerant piping lines called:

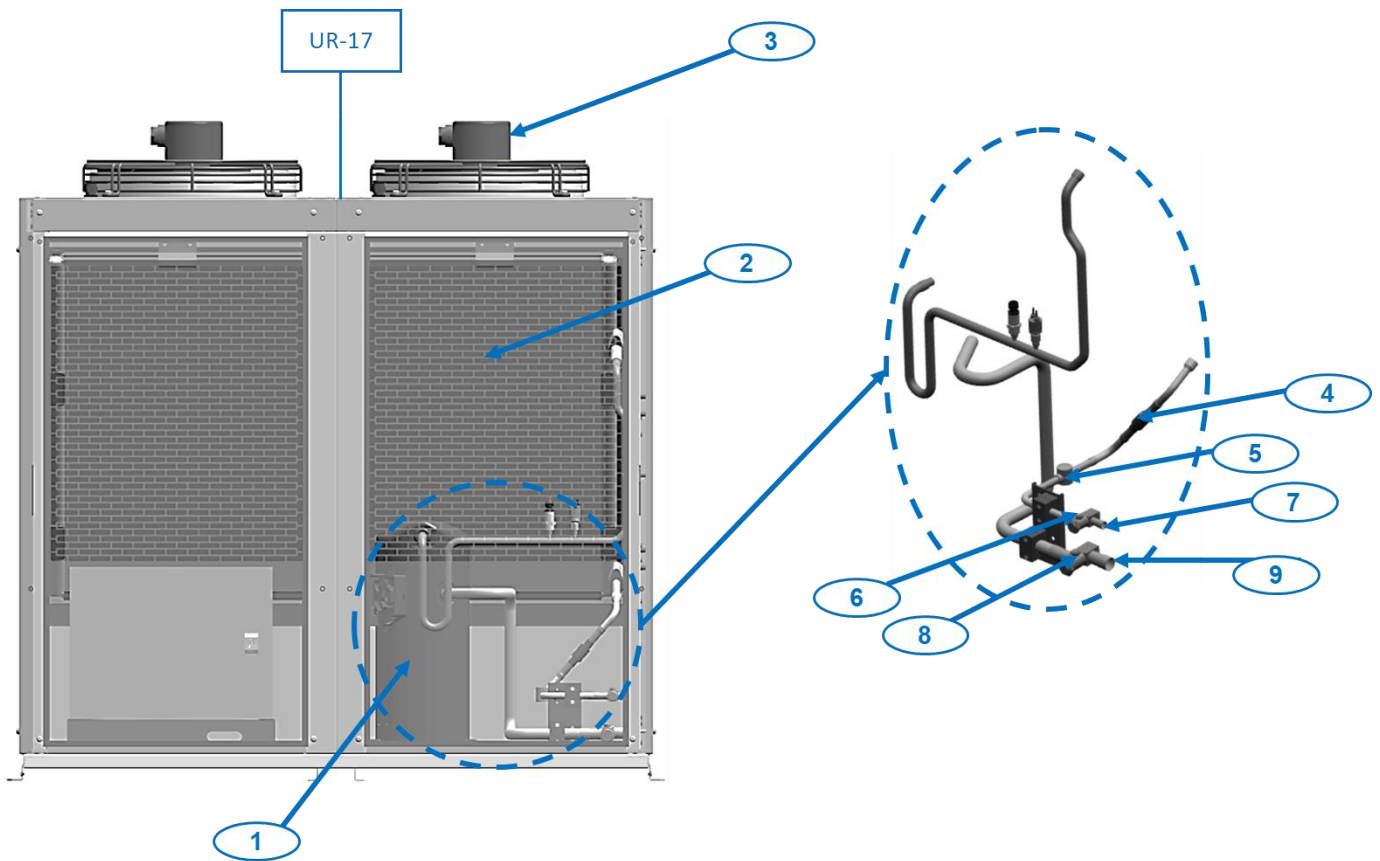
- Suction line: conducts refrigerant in the superheated steam state at low pressure and temperature, coming from the evaporation process in the equipment evaporator, directing the flow to the compressor located in the UR.
- Liquid line: conducts the refrigerant in the liquid state at high pressure, originating from the condensation process to the expansion device located in the CPM.

The figure below shows the connection points and identifies the cooling lines in an illustrative way to help with the interconnection of the system. Proper cooling interconnection requires the adoption of the good practices and requirements described section 4.5 of this manual.



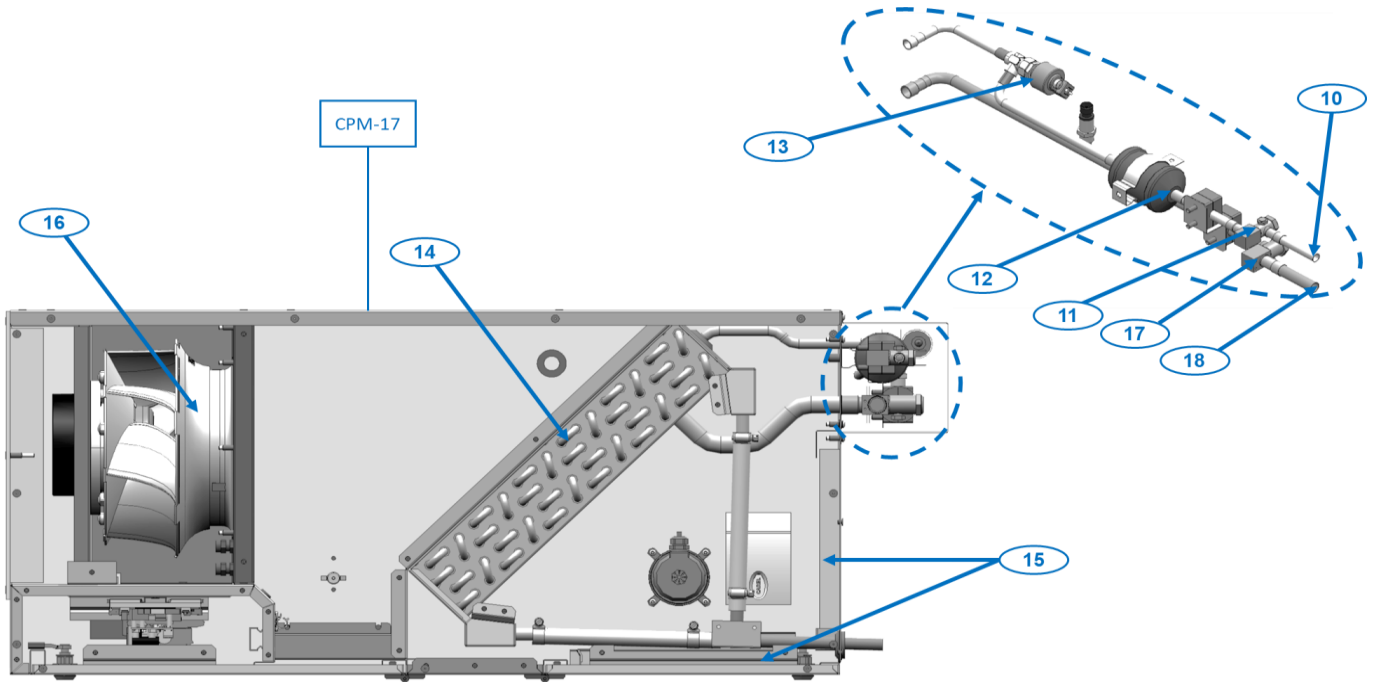
The following are the main components of the evaporator (CPM) and condenser (UR) units as well as their remote panel.

1.2.1. UR main components



Item	Description
1	Hermetic Scroll Compressor
2	Microchannel Condenser
3	Axial Fan
4	Check valve
5	Liquid display
6	Block valve: liquid line
7	UR liquid line connection
8	Block valve: suction line
9	UR suction line connection

1.2.2. CPM main components



Item	Description
10	CPM liquid line connection
11	Block valve: liquid line
12	Filter Drier
13	Electronic expansion valve
14	Evaporator - Copper tubes and aluminum fins
15	Air Filter G4 (Optionally M5)
16	EC Radial Fan
17	Shut-off valve: Suction line
18	CPM suction line connection

1.2.3. Operating Principle

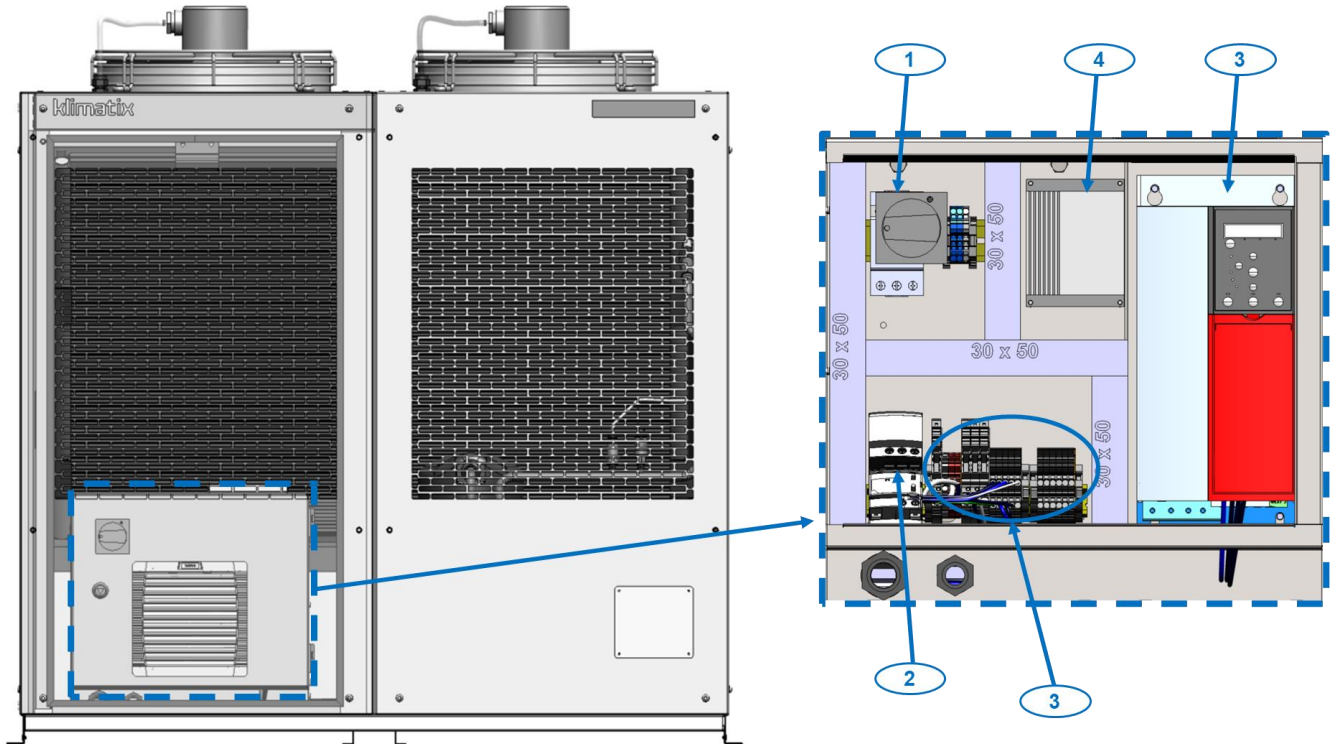
The refrigeration system of the set consisting of the CPM evaporator and UR Condensing Unit is made up of a hermetic scroll compressor (1) which is responsible for moving the refrigerant fluid in the system, directing the flow in the form of hot gas to the micro channel condenser (2) for dissipation to the external environment. The condenser in turn is cooled through the forced passage of air by one or more axial fans (3), the air is heated and returned to the environment.

After passing through the condenser of the UR, the refrigerant fluid containing the system heat reaches the state of sub cooled liquid and its flow is conducted again to the evaporator unit (CPM) passing through a check valve (4), optionally through a liquid tank, and then through a liquid display (5) responsible for visually indicating the fluid situation inside the pipe, following to the outlet connection through the liquid line block valve (6) and lastly to the UR liquid line connection (7).

The refrigerant fluid in the sub cooled liquid condition passes through the liquid piping and enters the evaporator (CPM) through its liquid line connection (10), passes through a block valve (11), and goes to a filter drier (12), which is responsible for eliminating impurities and moisture present in the system. When passing through the expansion valve (13) the refrigerant suffers a pressure drop, entering in the form of saturated liquid in the evaporator (14). Inside the evaporator the refrigerant fluid receives heat from the process fluid by means of forced air passage through the evaporator, after a G4 air filter (15), by an EC radial fan (16), and therefore, as it absorbs this energy it undergoes a state transition from saturated liquid to superheated steam, condition in which it can enter the compressor and restart the cooling cycle, moving again to the UR passing through the block valve (17) and suction connection of the CPM (18), bypassing the suction line of the installation and accessing the equipment through the suction connection and block valve installed in the UR.

Optionally the CPM can be supplied with Steam generator and Reheating resistor, both acting in the humidity control, the former humidifying the air while the resistor ensures the reheating of the air generating enough thermal load to keep the refrigeration system operating, which with low evaporation temperatures ensures the occurrence of condensation in the evaporator, dehumidifying the air contained in the system. Furthermore, the system can also be supplied with optional variable capacity control using a frequency inverter and with G0 air filters for the condensing unit.

1.2.4. UR Electrical Components



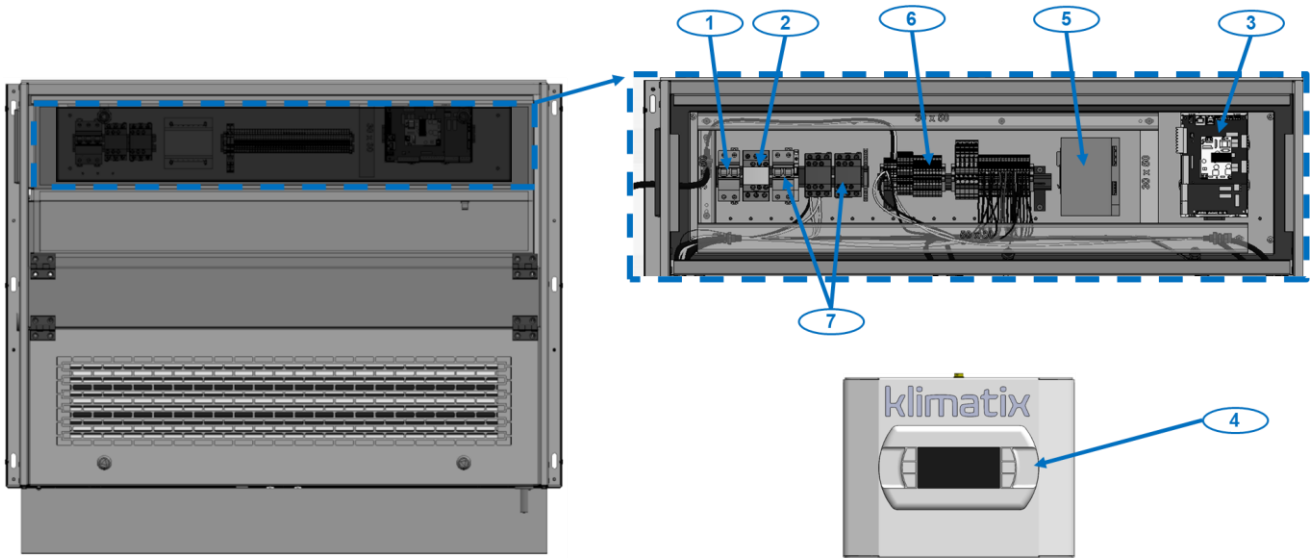
Item	Description
1	Main Circuit Breaker
2	Contactor
3	Frequency inverter (optional)
4	Fan speed regulator
5	Terminal Strip

The electric panel of the UR has components for switching, control and interconnection installed inside it. The electric supply to the components of the unit can be cut off by activating the main circuit breaker (1), enabling safe intervention during the equipment maintenance process. The system is controlled by a PLC installed in the CPM evaporator unit that by means of signals sent to the contactor (2) activates or turns off the system.

The system optionally has a frequency inverter (3) to drive and control compressor capacity, as well as a speed regulator (4) to control the rotation of the axial fans installed in the equipment.

For the instruments and the control system, the control connections are made through the terminal strip (5), directing all the necessary connections between instruments and controller, enabling the control logic operation of the system PLC as well as its interconnection with the evaporator.

1.2.5. CPM Electrical Components



Item	Description
1	Main Circuit Breaker
2	Contactor
3	PLC - Programmable Logic Controller
4	Remote Panel and HMI - Human Machine Interface
5	24 VDC Power Supply
6	Terminal Strip
7	Circuit Breaker and Resistor contactors (Optional)

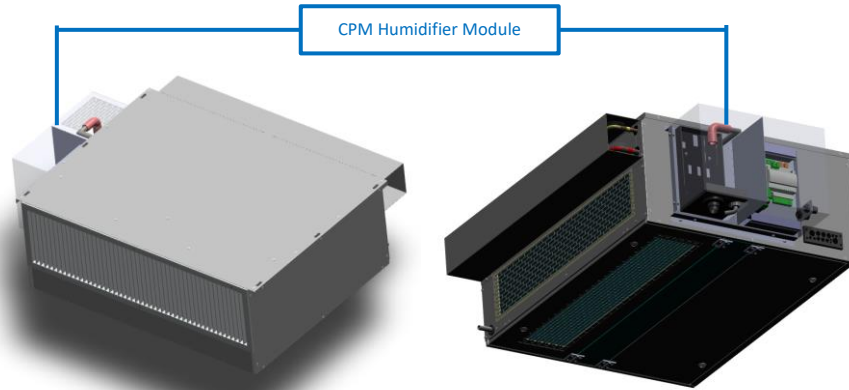
The CPM electric panel has components for switching, control and interconnection installed inside it. The electric supply to the components of the unit can be cut off by activating the main circuit breaker (1), enabling safe intervention during the equipment maintenance process. The system is controlled by a PLC (3) that uses signals received from the instruments installed in the equipment. The adjustment of the working conditions as well as the monitoring of the parameters is done through an HMI (4).

The system has a circuit breaker and contactor for the fans and, optionally, dedicated circuit breakers and contactors for the reheating resistor (7), these contactors are used to activate the component via PLC.

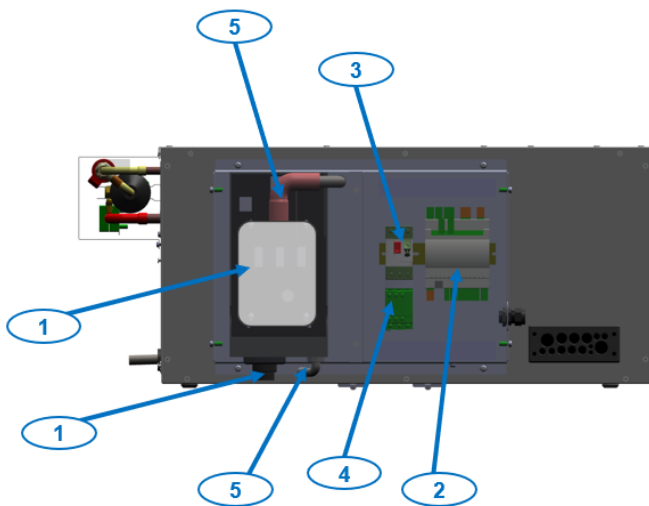
For the instruments and the control system, the power supply (5) converts the supply voltage into control voltage (24 VDC) for the controllers and instruments installed in the equipment. The control connections are made through the terminal strip (6), directing all necessary connections between instruments and controller, allowing the PLC control logic of the system to operate.

When the equipment configuration includes the steam generator, it is necessary to install its respective controller to drive and control it, based on signals received from the PLC for humidity control of the system. This humidification system is a plugin to the cabinet of the equipment, installed on its side, and will be better detailed separately. The equipment can optionally be supplied with touchscreen HMI, in this configuration the standard analog semi graphic PGD1 HMI is replaced by a 4.3" color touchscreen PGDX HMI.

1.2.6. CPM Humidification Module




Optionally the CPM can be supplied with a humidifier. For this, a module with the Carel steam generator and its electrical panel is installed on its side. The electrical power supply and control is made by the panel of the CPM, requiring only the connection of water replacement and drain. The main components are shown below:



Item	Description
1	Carel Steam Generator
2	Carel CPY Humidifier Controller
3	Circuit Breaker
4	Contactor
5	Steam Pipe
6	Replacement Pipe
7	Drain Pipe

1.3. Application Scope

The CPM line was designed for precision air conditioning of environments such as small data centers, UPS and telecommunication rooms, where there is a considerable rate of dissipation of heat, predominantly sensible heat, from electrical and electronic components. In these environments the equipment must ensure that the operating condition is maintained within the temperature and humidity ranges defined in these systems to maintain reliability and extend the useful life of these components.

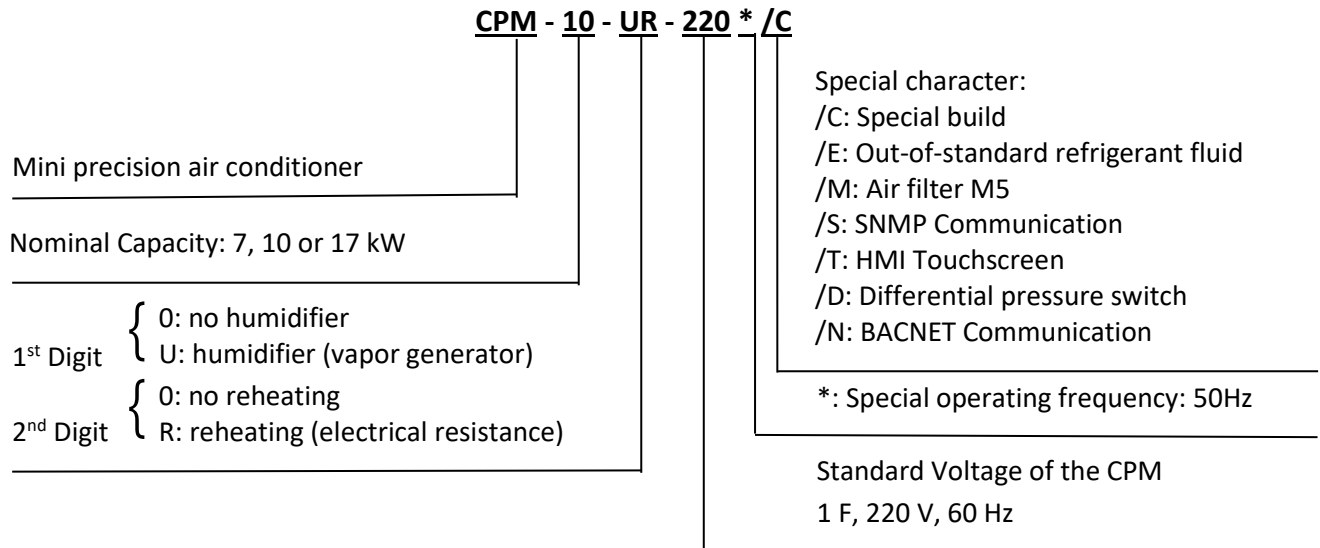
	ATTENTION	Applications different from those intended for the product may put at risk the safety of the operator, the equipment performance and even the breakage of a component of the equipment and the loss of warranty.
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1.4. Optional Items Installed at the Factory and on the Field

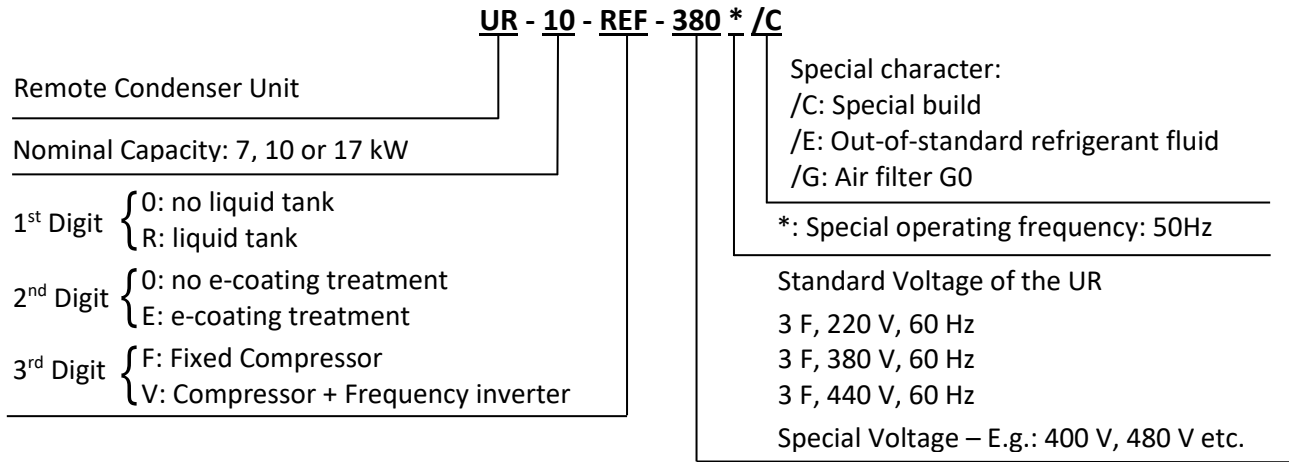
Item	CPM	RH	Installed in Factory	Installed on Field
Air filter M5	✓	⊘	✓	✓
SNMP Communication	✓	⊘	✓	✓
HMI Touchscreen	✓	✓	✓	⊘
G0 Air Filter	⊘	✓	✓	✓


2. Technical Features

2.1. Nomenclature CPM



2.2. Nomenclature UR



	INFORMATION	<p>Check the special documentation described in the annex of this manual for the equipment that has special character (/C).</p> <p>Some data in this manual such as electrical data may not apply to the equipment that has special character.</p>
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2.3. CPM/UR Data table

	Description	Unit	Model		
			CPM-7	CPM-10	CPM-17
Operating conditions	Evaporator unit				
	Total capacity (1)	kW	6.3	10.0	16.7
	Sensible capacity	kW	6.1	9.4	15.0
	Useful capacity	kW	5.8	9.4	15.0
	Efficiency EER (COM + UR)	-	2.4	2.4	2.7
	Sensible heat factor	-	0.97	0.94	0.90
	Direction of air insufflation	-	Horizontal / Vertical		
	Nominal flow rate	m ³ /h	2000	3000	4000
	Maximum static pressure available	Pa	70	70	120
	Specific fan power (SFP) (1)	W/(m ³ /s)	605	605	506
	Cooling circuits	-	1	1	1
	Filtering class	-	G4		
	Sound pressure (2)	dBA	61	62	71
	Refrigerant load (1)	kg	0.6	1	1.6
Dimensional	Width	mm	860	1050	1075
	Depth	mm	940	940	1160
	Height	mm	385	385	480
	Occupied area	m ²	0.81	0.99	1.25
	Weight	kg	85	105	140
	Maintenance	-	Front / Rear / Bottom		
	Maintenance access	mm	600		
	Inlet connection diameter	in	3/8	1/2	1/2
	Outlet connection diameter	in	5/8	3/4	7/8
Condenser Unit			UR-7	UR10	UR-17
	Direction of air insufflation	-	Vertical		
Operating conditions	Nominal flow rate	m ³ /h	3250	3500	6500
	Maximum static pressure available	Pa	10	10	10
	Specific fan power (SFP) (1)	W/(m ³ /s)	443	387	443
	Sound pressure (2)	dBA	64	64	67
	Refrigerant load (1)	kg	0.5	0.9	1.1
	Dimensional	Width	mm	847	997
Depth		mm	510	510	510
Height		mm	1300	1300	1300
Weight		kg	110	140	185
Maintenance		-	Front		
Maintenance access		mm	600		
Inlet connection diameter		in	5/8"	3/4"	7/8"
Outlet connection diameter		in	3/8"	1/2"	1/2"
Refrigerated plant installation (5)	Maximum equivalent length (3)	m	30		
	Max. level difference (evaporator below condenser) (3)	m	17		
	Max. level difference (evaporator above condenser) (3)	m	5		
Power rating	Nominal evaporator power (1)	kW	0.6	0.7	0.8
	Nominal condenser power (1)	kW	2.1	3.5	5.5
	Maximum evaporator power (1)	kW	0.6	0.8	1.2
	Maximum condenser power (1)	kW	3.1	4.8	7.8
	Reheating resistor	kW	3.0	3.0	4.5
	Humidifier	kW	2.25	2.25	2.25

(1) Return temperature 24°C, relative humidity 45% and atmospheric pressure 101.3 kPa; Condensation temperature 35°C; Leq. 15 meters

(2) Sound pressure at 2 meters from the source

(3) Other measurements consult manufacturer

2.4. Minimum thermal load

To guarantee a stable operation and within the operation limits presented in item 2.5, it is important that the equipment meets the minimum ideal capacity condition for operation. Therefore, we recommend that the thermal load of the room to be acclimatized meet the minimum conditions indicated below:

Model	Compressor	Minimum thermal load
UR-7 (CPM-7)	Fixed compressor	5,8 kW
	Fixed compressor + frequency inverter	3,15 kW
UR-10 (CPM-10)	Fixed compressor	9,4 kW
	Fixed compressor + frequency inverter	5,0 kW
UR-17 (CPM-17)	Fixed compressor	15 kW
	Fixed compressor + frequency inverter	8,35 kW

2.5. Operating limits

Some operating limits are described below and must be observed for good performance and operation of the equipment:

- Maximum outdoor temperature of up to 45°C;
- Minimum outdoor temperature of -10°C.
- Operation with return temperature between 20°C and 26°C;
- Operation with relative humidity in the return between 40 and 50% RH;

2.6. Identification plate attached to the Precision Air Conditioner

Modelo Model / Modelo		Fabricação Manufacturing Date / Fabricación		Nº. de série Serial Number / Nº. de Serie	
A	Alimentação elétrica Power Supply / Alimentación Eléctrica	G	Potência instalada Installed Power / Potencia Instalada	L	Corrente nominal Rated Current / Corriente Nominal
B	Capacidade nominal Rated Capacity / Capacidad Nominal	H	Refrigerante Coolant / Refrigerante	M	Temp. de trabalho Working Temp. / Temp. de Operación
C	Condensação Condensation / Condensación	I	Temperatura Temperature / Temperatura	N	Vazão requerida Required Flow / Caudal Requerido
D	Bomba de processo Process Pump / Bomba de Proceso	J	Peso (kg) Weight / Peso	O	Aquecimento Heating / Calentamiento
E	Observações e dados complementares Remarks and Complementary Data / Observaciones y Datos Adicionales				P
F					

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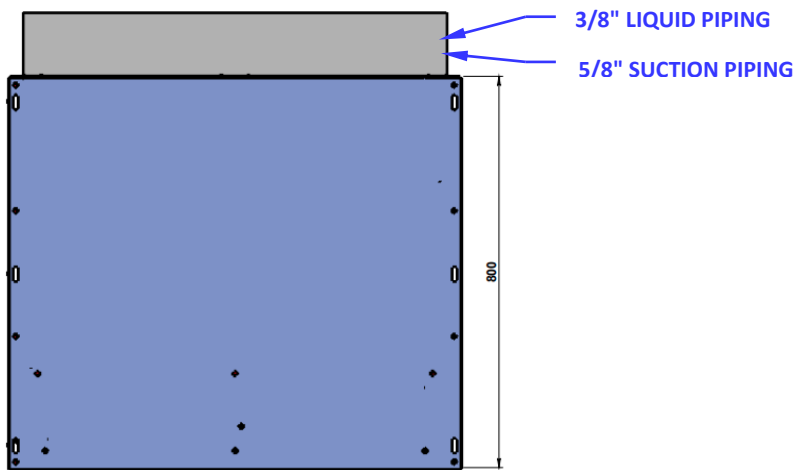
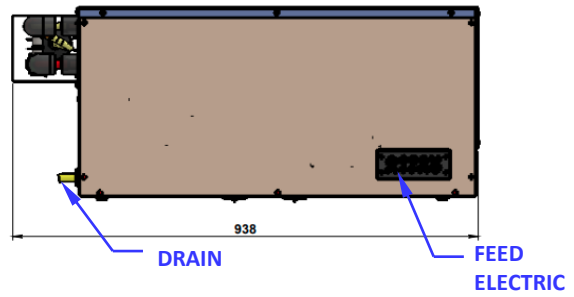
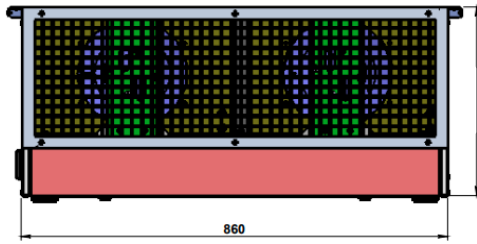
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- A Abbreviation of the model
- B Voltage (V), phases and frequency (Hz)
- C Cooling heat capacity (kW)
- D Type of condensation: air or water
- E Observations and complementary data of the equipment
- F Special characteristics
- G Month and year of manufacture
- H Maximum electrical demand at full load (kVA)

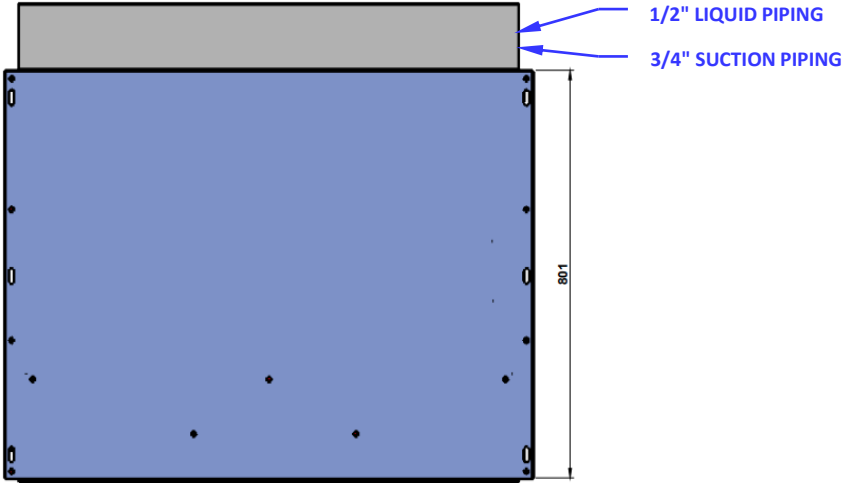
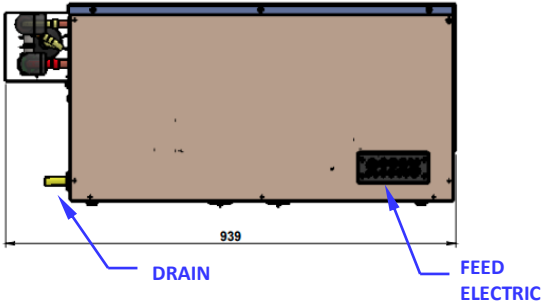
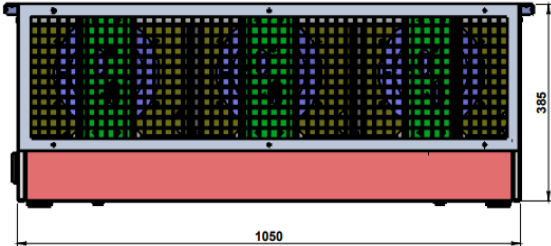
- I Cooling fluid
- J Maximum room temperature
- K Weight (kg)
- L Tracking number
- M Maximum current consumed (A)
- N Working temperature of the process fluid
- O Air flow of the condensers
- P Heating capacity, when applicable

2.7. CPM External Dimensions

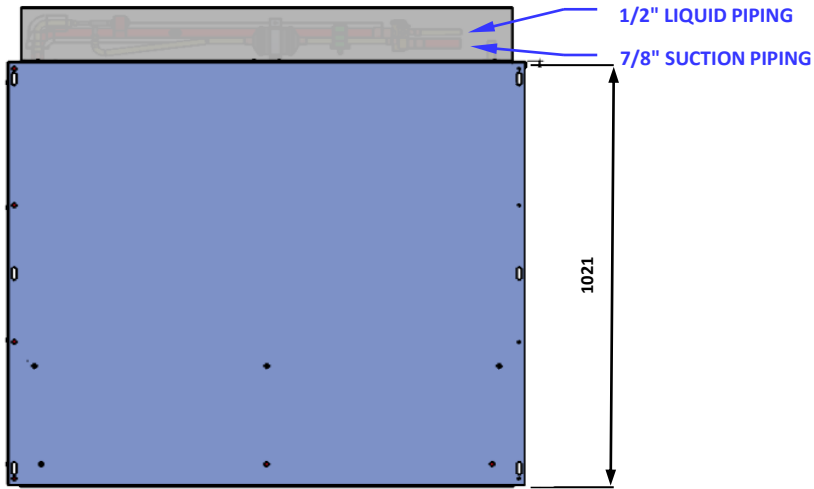
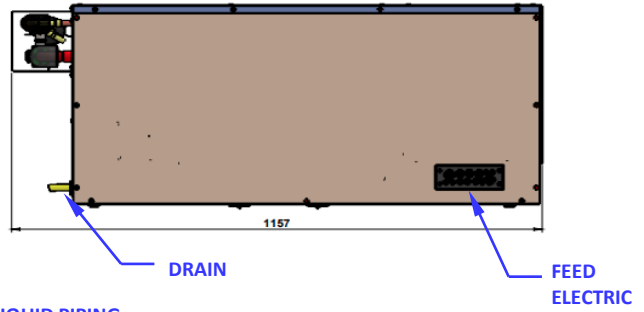
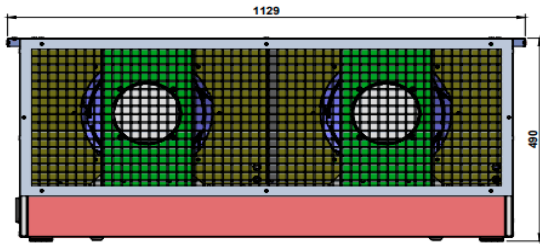
2.7.1. CPM-7



2.7.2. CPM-10



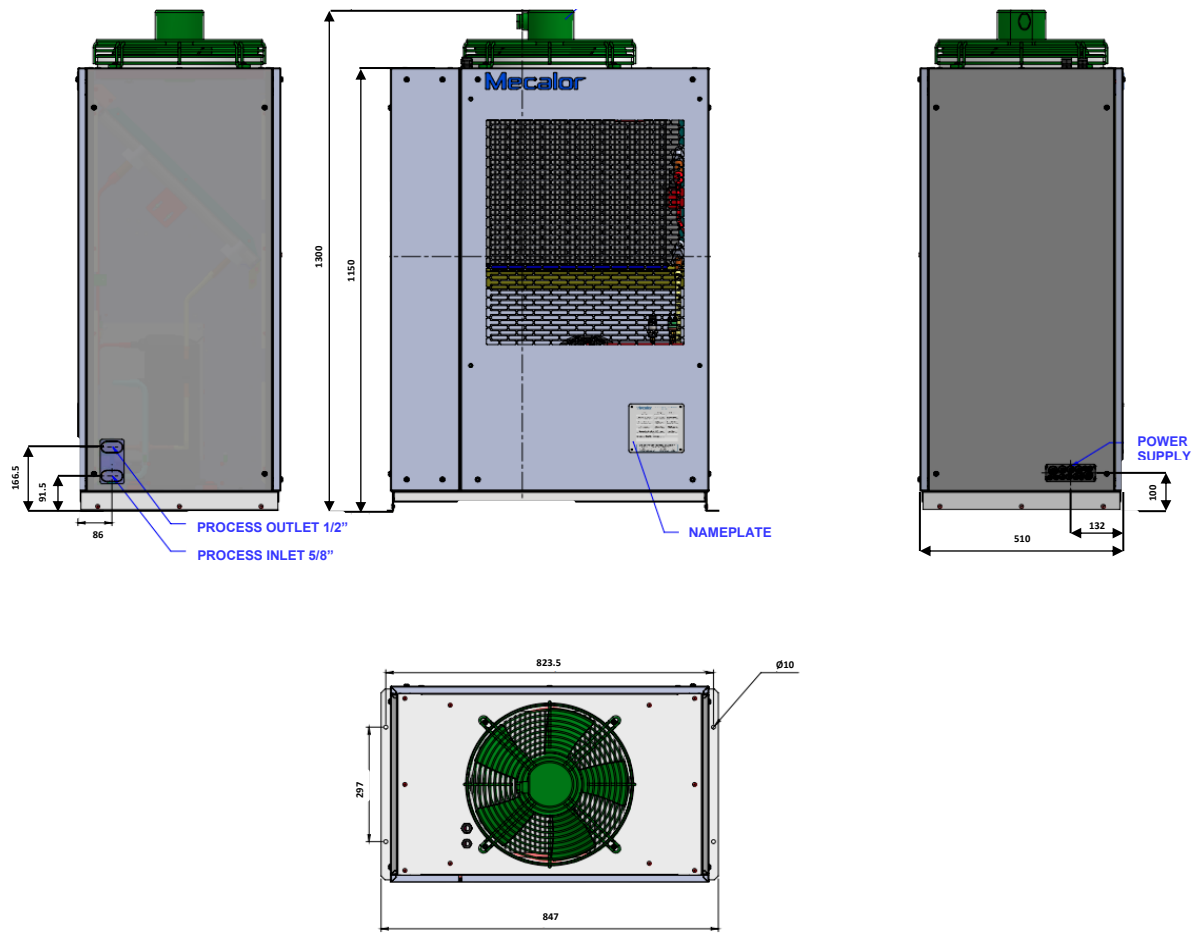
2.7.3. CPM-17



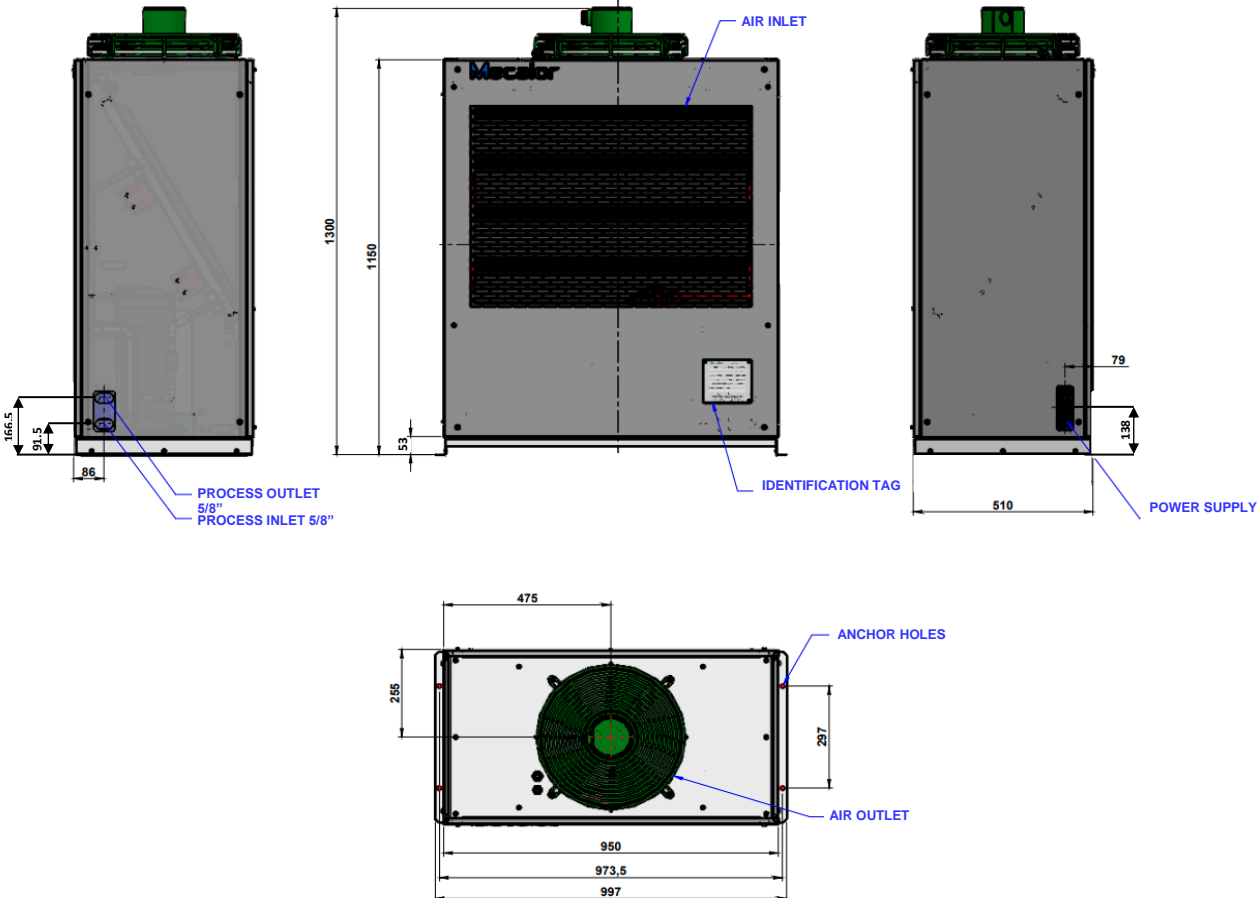
*For more details and connection positions in each CPM configuration, see the dimensions attached to the equipment documentation.

2.8. UR External Dimensions

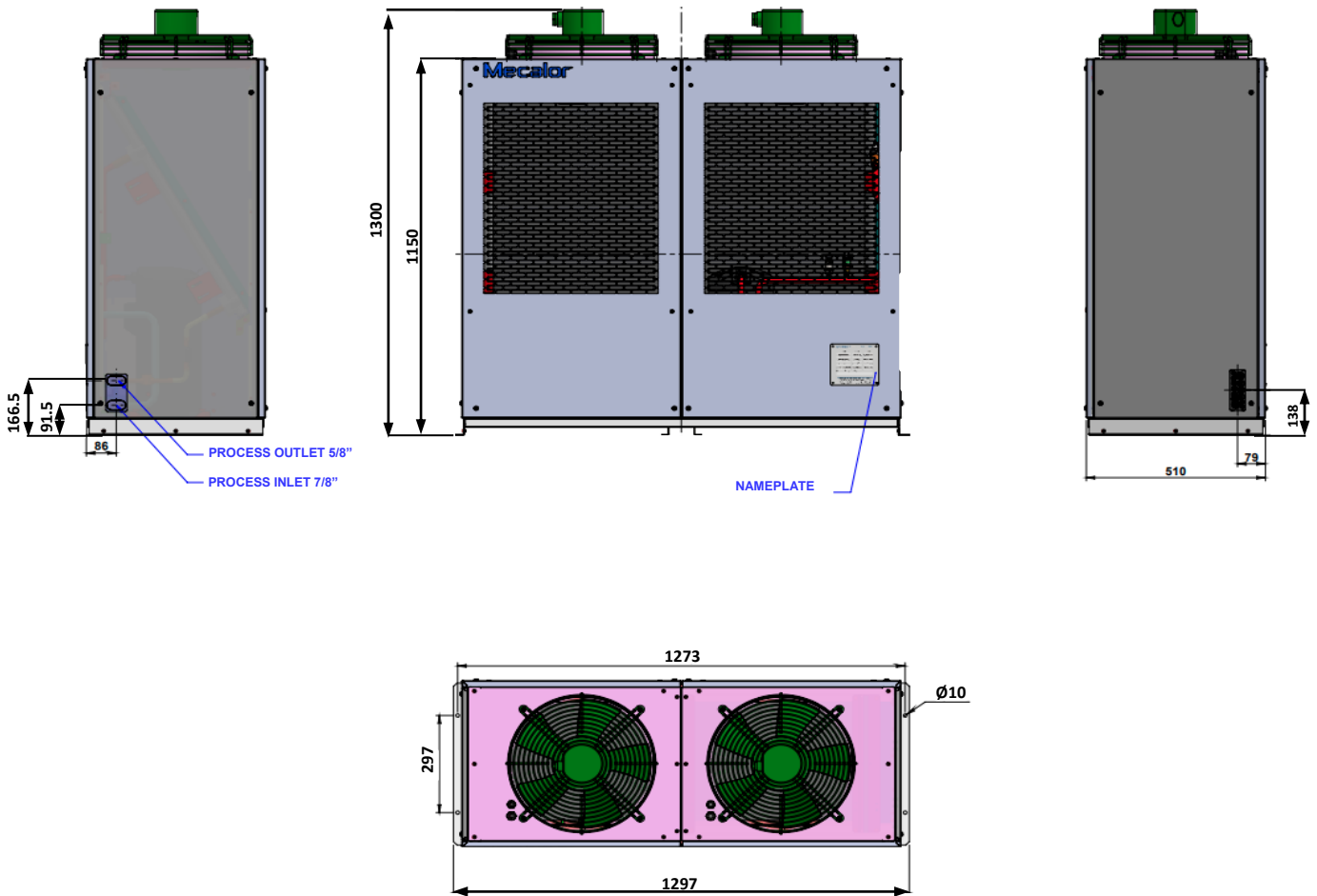
2.8.1. UR-7



2.8.2. UR-10



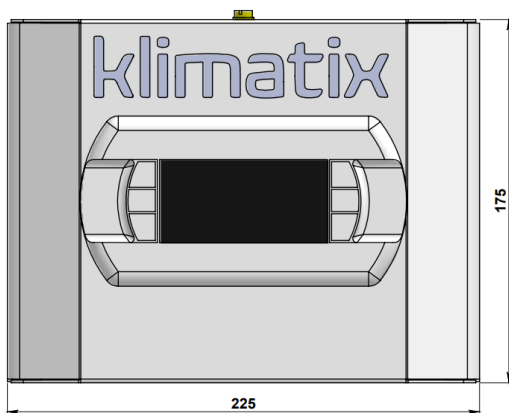
2.8.3. UR-17



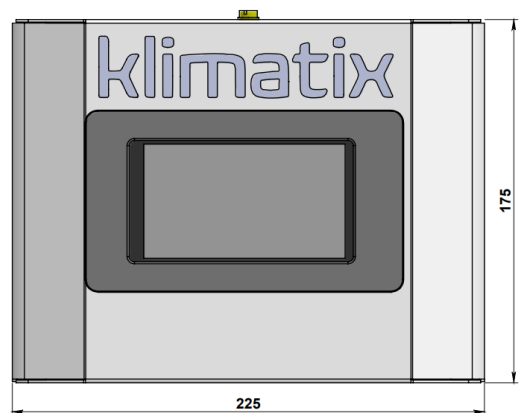
*For more details and connection positions in each UR configuration, see the dimensions attached to the equipment documentation.

2.9. Remote Panel External Dimensions

PGD1 HMI - Analog
Standard CPM







PGDX HMI - 4.3" color touchscreen
Optional




2.10. Electrical Data

The customer is responsible for laying the electric cable up to the equipment and it must be performed by a qualified person.

Check the electrical features of the CPM/UR on the identification plate attached to the equipment. The network voltage must comply with the CPM voltage and must be within the acceptable limits of $\pm 10\%$ (Voltage variations with a tolerance of $\pm 10\%$: 220 V (198 ~242V); 380V (342 ~412V); 440 V (396 ~484V). The electrical data of the equipment will be presented below.

	<p>INFORMATION</p>	<p>A power supply point is not necessary for the command/control circuit, because it is powered by the internal transformer of the equipment.</p>
	<p>INFORMATION</p>	<p>Command/control circuit voltage of 24V according to standards NR10 and NR12. Components installed on the equipment door does not represent the risk of electric shock to the operator.</p>
	<p>ATTENTION</p>	<p>DO NOT USE the electrical data of the previous table to size the power supply point in CP models that have special characters (/C, /E and /T) Check the special documentation described in the annex of this manual for CP with special character.</p>
	<p>ATTENTION</p>	<p>The maximum power informed on the electrical data table should be used to size the protections and cables. DO NOT USE the power in regime that was calculated based on the nominal operating condition of the equipment.</p>

2.10.1. CPM/UR Electrical Data

	<p>ATTENTION</p>	<p>Consult the standards applicable to the electrical installation at the site so as to ensure that the installation of the CP is according to the specified standards and prerequisites. For installations in Brazil, consult standard NBR5410 "Low Voltage Electrical Installations"</p>
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Equip. ⁽¹⁾	Voltage ⁽²⁾ (V)	Configuration ⁽³⁾							
		Standard (00)		With Humidification (U0)		With Reheating (OR)		Humidification and Reheating (UR)	
		Maximum Current (A)	Cable ⁽⁴⁾ (mm ²)	Maximum Current (A)	Cable ⁽⁴⁾ (mm ²)	Maximum Current (A)	Cable ⁽⁴⁾ (mm ²)	Maximum Current (A)	Cable ⁽⁴⁾ (mm ²)
CPM-7	220, 1F	3.4	2.5	14.2	2.5	17.2	4	28	10
UR-7	220, 1F	13.7	2.5	13.7	2.5	13.7	2.5	13.7	2.5
	220, 3F	9.7	1.5	9.7	1.5	9.7	1.5	9.7	1.5
	380, 3F	6.1	1.5	6.1	1.5	6.1	1.5	6.1	1.5
	440, 3F	6.1	1.5	6.1	1.5	6.1	1.5	6.1	1.5
CPM-10	220, 1F	5.1	2.5	15.9	2.5	18.9	4	29.7	10
UR-10	220, 3F	14.2	2.5	14.2	2.5	14.2	2.5	14.2	2.5
	380, 3F	8.3	1.5	8.3	1.5	8.3	1.5	8.3	1.5
	440, 3F	8.3	1.5	8.3	1.5	8.3	1.5	8.3	1.5
CPM-17	220, 1F	5.2	2.5	16	2.5	25.9	6	36.7	10
UR-17	220, 3F	23.9	6	23.9	6	23.9	6	23.9	6
	380, 3F	15.9	4	15.9	4	15.9	4	15.9	4
	440, 3F	13.9	2.5	13.9	2.5	13.9	2.5	13.9	2.5

(1) Standard equipment.

(2) Electrical voltage at 60 Hz frequency, with an allowable variation of $\pm 10\%$.

(3) Equipment configuration according to its accessories

(4) Diameter indication for cable per phase, for power supply of the main switch of the equipment. For distances greater than 50 meters, the cable should be resized.


3. Receiving


The receiving and moving of the equipment should be performed by the customer. In this stage, the following points should be checked:

- The data informed on the identification tag of the equipment should correspond to the information of the purchase order;
- The presence of all items, according to the order and invoice, and immediately inform the manufacturer in case of divergence or lack of items;

3.1. Packaging


For transports carried out in the country, the shipping of the CPM and UR is performed in a crate of wood wrapped in high resistance plastic. For export, the shipping is carried out in a closed fumigated wooden package. Both packages were designed to be transported exactly the way they are shipped.


	INFORMATION	<p>The CPM package was designed to ensure the integrity of the equipment during transport.</p> <p>Changes in the design of the package may result in damages on the equipment and loss of warranty</p>
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	ATTENTION	<p>Do not pile boxes or deposit other volumes over the CPM package.</p>
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3.2. Unloading, Moving and Storage

As soon as the unit is received and before unloading, check to see if the package of the CPM does not have any damages caused during transport.

	INFORMATION	<p>Check the general condition of the equipment IMMEDIATELY after opening the package. In case any damage is observed, take a picture and send it to the shipping company.</p>
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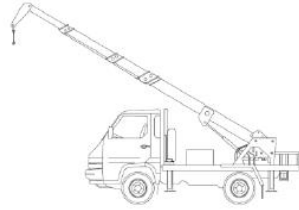
	INFORMATION	<p>It is recommended to store the CPM packaged in a dry place sheltered against dirt and bad weather in case the equipment remains unused for a long period of time before its installation and operation.</p>
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	INFORMATION	<p>It is recommended to move the CPM to the installation site or near the installation site with the original package.</p>
---	--------------------	--

Use a forklift or a pallet jack to unload. Check the weight of the equipment to define the capacity of the forklift that will be used to unload the equipment. Perform the transport with the equipment only in the vertical position. Transport the volume to the installation site or near it and unpack it.



In some cases, it is impossible to use the forklift, because the installation site is inaccessible, requiring the use of a munck truck or hoisting with a crane.



	ATTENTION	Use canvas belts appropriate for the weight of the equipment to lift it. Unsafe practices may cause accidents, therefore, this process should be carried out by qualified people and with the suitable safety equipments.
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4. Installation

The CPM was designed thinking of efficiency, durability and safety of the operator; however, the safety should be ensured by the correct installation, preventive maintenance performed periodically and the operation within the design conditions.

	ATTENTION	It is recommended for the installation of the equipment to be performed by Mecalor or by a qualified person. It is imperative for the installer to have a knowledge of local installation codes and regulations in order to ensure that the best mounting and safety practices are used.
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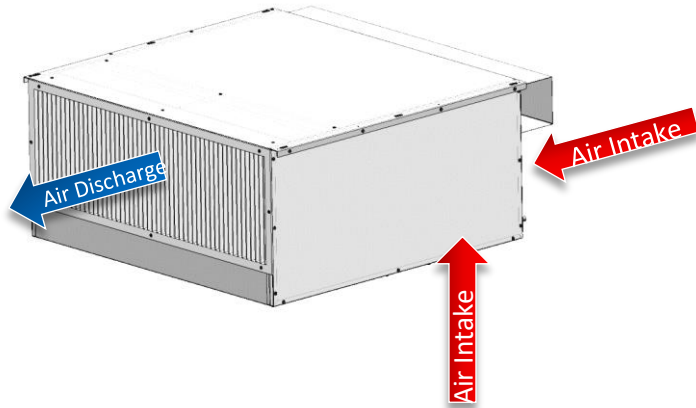
	DANGER	The CPM was not designed to work in an area classified as risk of explosion. If the use in these conditions is detected, the equipment will lose its warranty.
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4.1. Airflow

Direct expansion mini precision air conditioners (CPM) have the following airflow configurations.

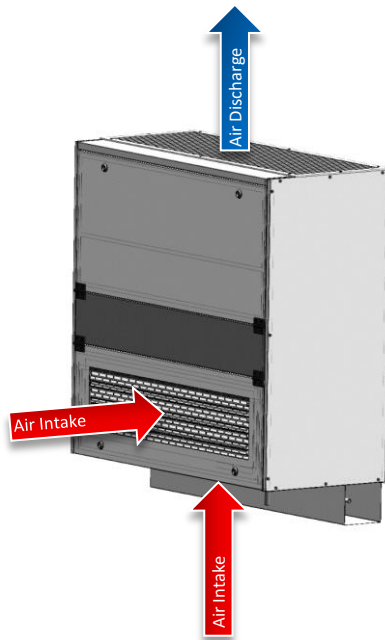
4.1.1. CPM horizontal mounting

When the CPM is mounted attached to the ceiling or tie rod in its horizontal position, the air is captured and accesses the equipment through the rear and bottom part, and is directed to the evaporator for temperature and humidity control, driven by the radial fan and returned to the room through the front part, directing the flow to the room in the direction it is installed, as shown in the image below:



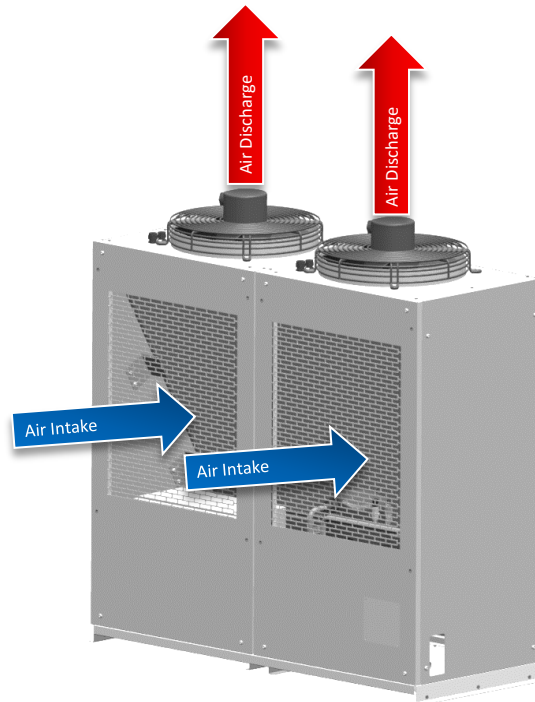
4.1.2. CPM vertical mounting

The CPM can also be mounted attached to the wall in its vertical position, and in this configuration the air is captured and accesses the equipment through the rear and bottom part, and is directed to the evaporator for temperature and humidity control, driven by the radial fan and returned to the room through the top part, directing the flow to the room where it is installed, as shown in the image below:



4.1.3. UR - Remote condensing unit

The UR has a unique installation configuration, operating with vertical upflow with front intake, accessing the equipment from the front through the condenser, where the air is heated due to the energy dissipated by the cooling system and is driven into the environment by the axial fan installed on top of the equipment.



4.2. Installation Site

The CPM is designed for installation in small data center rooms, UPS rooms or telephone centers. The equipment may be installed in the horizontal position, attached to the ceiling by means of a threaded bar or anchor, or in the vertical position.

The condenser of the UR must be installed in an open and ventilated place as close as possible to the served evaporating unit, respecting the distances indicated in the following table.

Position between condenser unit and evaporator unit	Equivalent Length*	Maximum of 30 m
	Height	-5 to 17 meters
Siphon in the suction line	Vertical upward	Every 6 meters

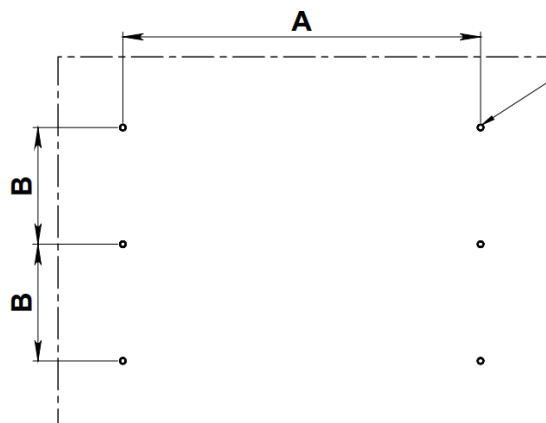
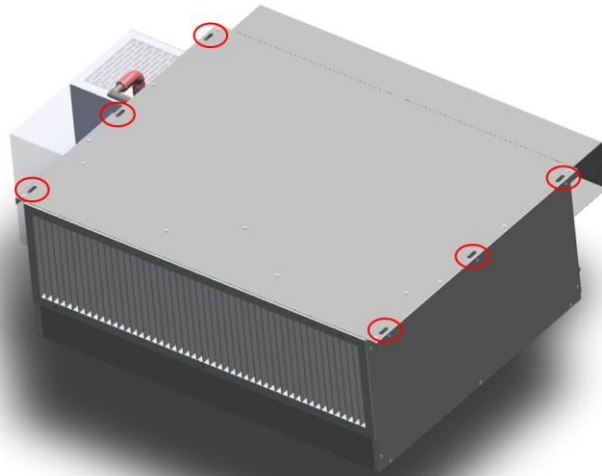
** The length indicated in the table refers to the equivalent length of piping that comprises the distance between the evaporator and condenser units plus the equivalent length of connections and accessories. The limitation of this parameter has the purpose of limiting the load loss in the system in order to ensure nominal capacity of the equipment.*

**ATTENTION**

Never block the air inlet and outlet flow.

4.3. Positioning of the Evaporator Unit (CPM)

The installation of the CPM is simple. The evaporator unit model CPM has 6 fastening points located on the top plate of the equipment. These points allow the equipment to be attached to the ceiling with the use of rods, or even to a wall with the use of anchors. For fastening with anchors, expandable anchors with 3/8" x 2.1/2" CB bolts can be used. The hole for installation has a diameter of 14mm (9/16").

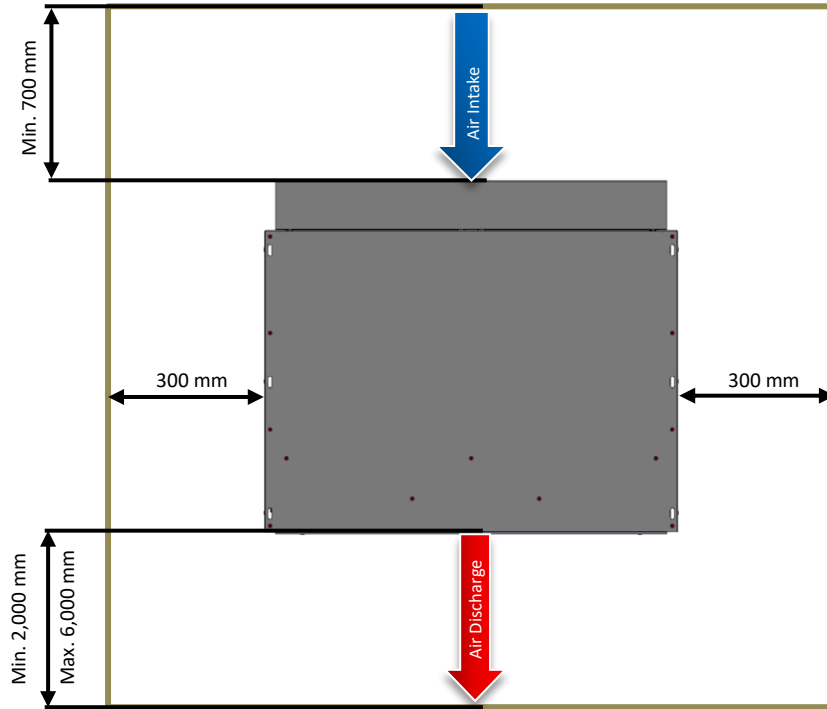


EXPANSION ANCHOR BOLT - CB BOLT 3/8" X 2.1/2"
INSTALLATION HOLE 9/16" (Ø14MM)



Model	A (mm)	B (mm)
CPM-7	885	350
CPM-10	1.075	350
CPM-17	1.100	470

The installation of the equipment must be considered respecting some minimum dimensions to ensure proper maintenance and ventilation conditions for the equipment, as indicated in the image below:

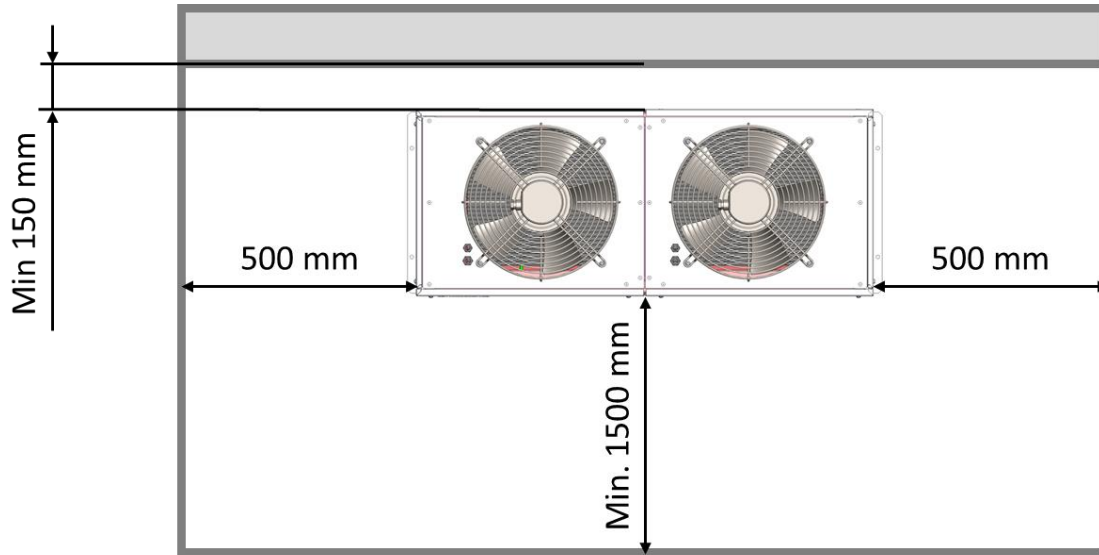


In addition to these dimensions, considering the equipment positioned on the ceiling, 500 mm must be considered to allow the opening of the access doors to the electrical panel/resistor and to the air filters of the equipment.

4.4. Positioning of the Condensing Unit (UR)

The condensing unit, in turn, must be in an external and well-ventilated environment. Once the installation site is defined, the leveling of the equipment in position must be ensured; considering the leveled floor, the base of the equipment has holes to allow it to be attached to the floor. If necessary, if the site is uneven, levelers can be installed on the equipment for level compensation. The equipment is not supplied with anchors or levelers.

For positioning of the UR, some minimum dimensions must be respected to ensure proper maintenance and ventilation conditions for the equipment, as indicated in the image below:



There should be no restrictions on the top of the equipment, to avoid recirculation of hot air. When there is no proper ventilation a duct should be installed to exhaust hot air from the equipment to the outside environment.

The following recommendations should be considered in order to correctly size the air exhaust duct:

- Maximum load loss in the duct: 20 Pa
- The length of the duct should not exceed 2.5 m
- The duct should be placed between the roof/wall in order not to overload the structure of the UR
- There should be a flexible canvas placed between the duct and the upper part of the fan in order to avoid the transmission of vibration to the roof/wall and enable maintenance of the fan
- The highest load loss of a duct is mostly on the very short radius curve ($\ll D/2$). Curves of bigger radiuses or close to $D/2$ avoid turbulent flow and excess load loss.

	INFORMATION	<p>During installation, it is recommended to protect the CPM and UR to prevent dirt from surrounding works from settling in the equipment cabinet. It is recommended to carry out general cleaning after installing the equipment.</p>
	INFORMATION	<p>The UR is equipped with an axial fan, which is not designed to be ducted. The exhaust duct to be installed is a grille and must have the smallest length possible in order to not cause excess load loss and consequently deactivate the equipment due to high pressure.</p>
	INFORMATION	<p>In case of doubts, consult Mecalor or the ASHRAE criteria for the correct size of the hot air exhaust duct.</p>

**INFORMATION**

Never restrict the air duct in the hot air outlet, this practice may cause the increase of load loss in the duct and deactivate the UR due to high pressure.

4.5. Electrical installation

The electrical installation between the main power point to the terminals of the main disconnecter of the CPM Precision Air Conditioner and the UR Remote condensing unit is the responsibility of the customer or the installer hired by him. The electric power supply of the equipment is independent

**ATTENTION**

Use blockades and warnings like *Equipment Under Maintenance* when the installation or intervention is occurring on the CPM.
Consult standard NR12 and local references for the correct signal of the equipment in case of installation or maintenance.

**DANGER**

Keep the main switch of the equipment always switched off at the time of installation or maintenance of the CPM or UR. The noncompliance of this practice may cause personal damage or even death.

**DANGER**

High voltage in the connection boxes of the electrical panel, compressor, fan, reheating electric resistor and steam generator. Risk of injury or death.
Only qualified personal with suitable safety equipment can handle these components and with the prior authorization from Mecalor.


The breaker and the power cable must comply with the electrical power requirements of the equipment, voltage and power described in the electrical data table in section 2.10 of this manual and support the current informed in it.

**ATTENTION**

The customer is responsible for the sizing and selection of the exclusive disconnection device of the CPM. Unsuitable sizing or out of the local regulations may put at risk the safety of the installation, causes damages to the equipment and loss of warranty.

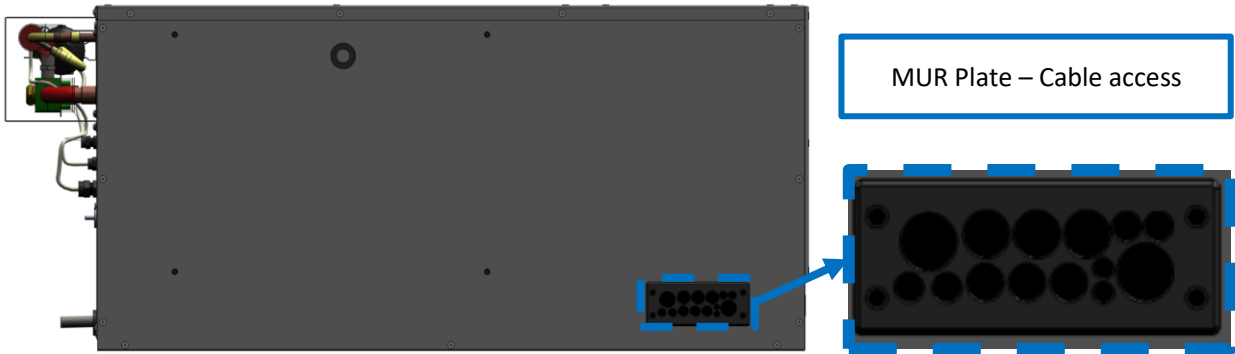
**ATTENTION**

DO NOT USE the power in regime to size the circuit breaker and power cable.
The electric safety devices should always be sized according to the installed/maximum power of the CP.

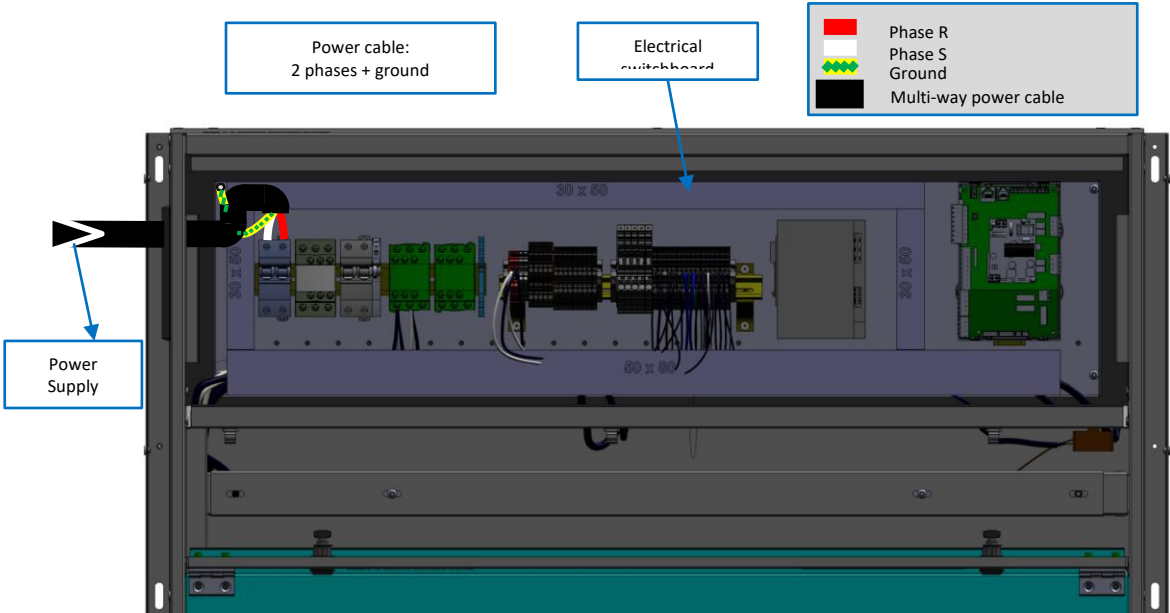
	ATTENTION	<p>Consult the standards applicable to the electrical installation at the site so as to ensure that the installation of the CP is according to the specified standards and prerequisites.</p> <p>For installations in Brazil, consult standard NBR5410 “Low Voltage Electrical Installations”</p>
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4.5.1. CPM Electric power supply

The power supply cable must enter the electric panel of the equipment, accessing the cabinet from the side through a MUR plate installed in the equipment.

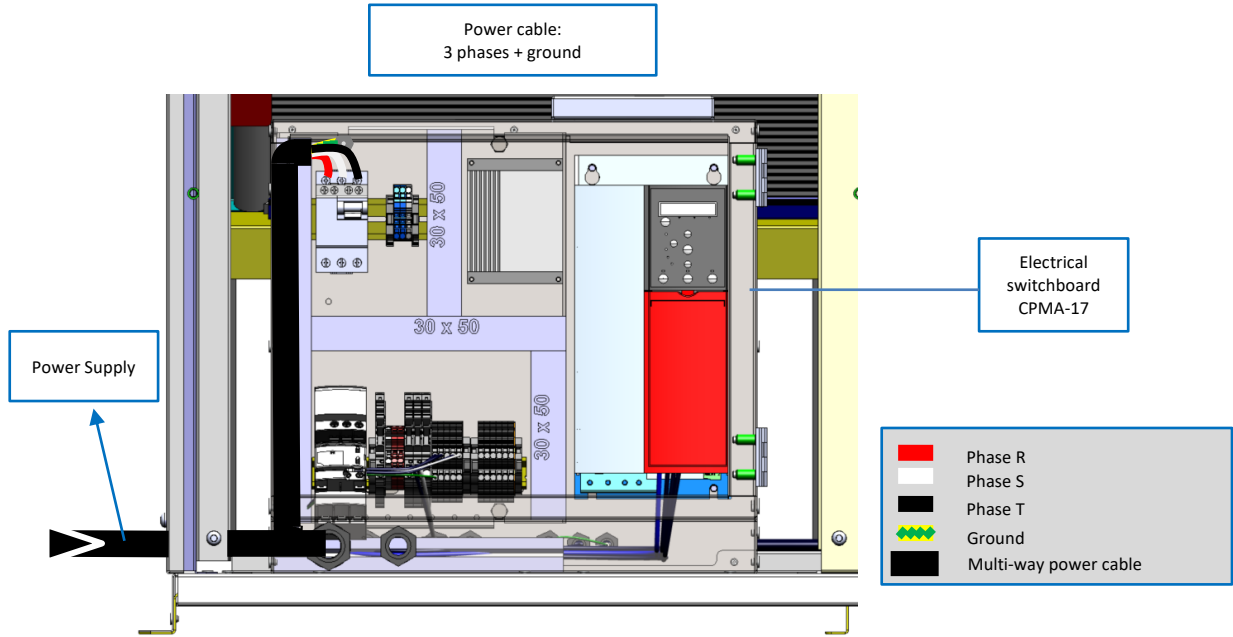






Phases R and S should be connected to the main switch and the ground cable attached to the panel as indicated below:



4.5.2. UR Electric power supply

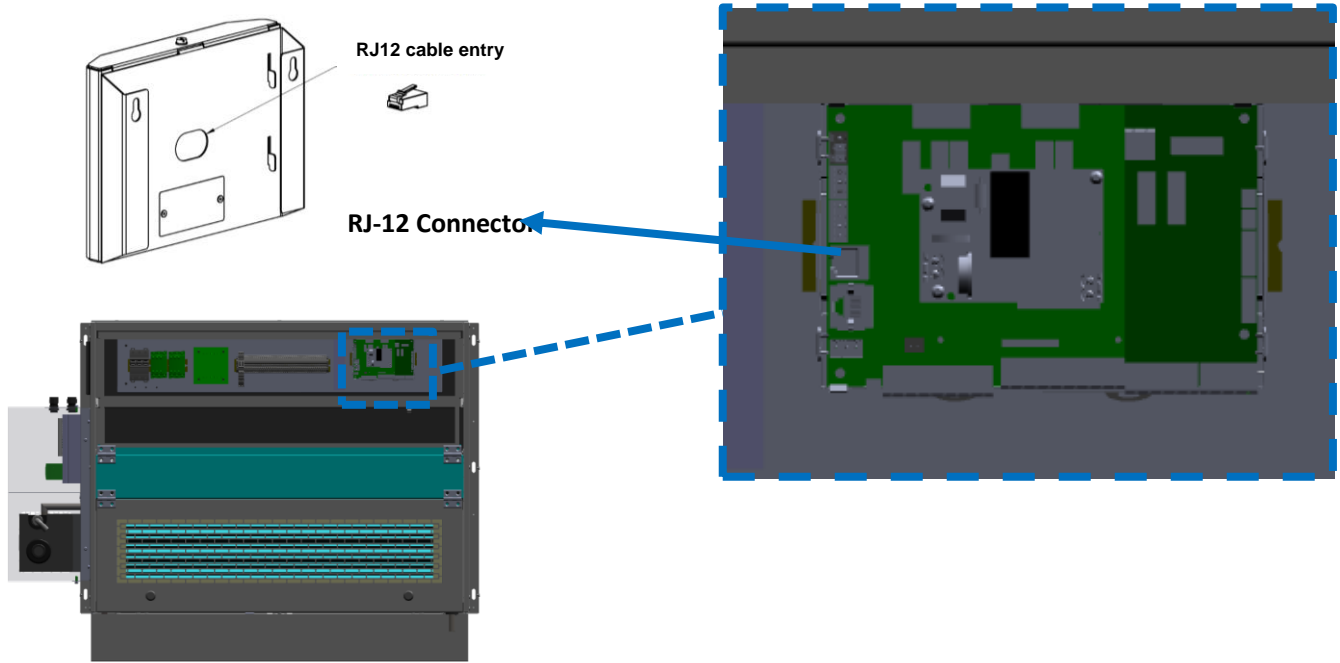
The electric power cable must enter through the electrical panel of the equipment, accessing the UR structure through the opening on the side of the equipment. Phases R, S and T should be connected to the main switch and the ground cable attached to the panel as indicated below:



	INFORMATION	In case of power supply failure with the CPM in operation and if the main disconnector is in the “ON” position, in normalization, the equipment will start operating automatically. Therefore, no action should be taken by the operator in this case.
	INFORMATION	The piping for routing the power cable must be planned according to the installation. The wiring described in the figure are only an example general electrical installation and it does not consider the installation variables of the customer. The electrical pipe should comply with the applicable local codes.
	DANGER	Use non-tinned cables and with terminals at the points where the terminals are to be installed. Stripped cables can overheat, cause damage to equipment, personal injury and even death.
	DANGER	The CPM or UR cabinet can be electrically charged. The non-grounding of the equipment may cause electric shocks, short circuits, personal damages and even death. Ground the equipment in the grounding grid. Location according to NBR-5410/NBR-5419.

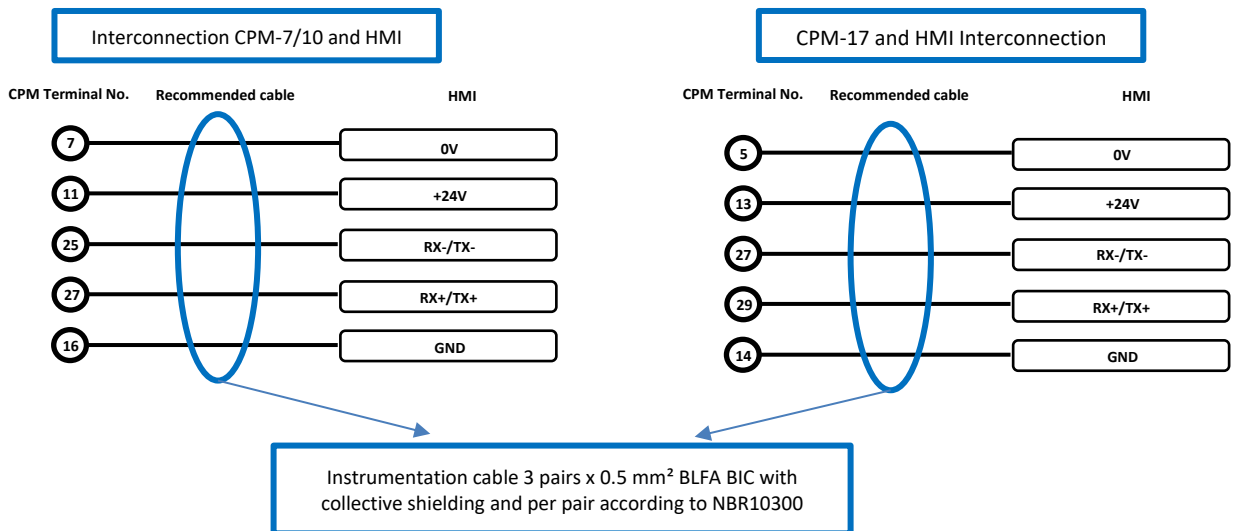
4.5.3. Remote Panel Interconnection

The standard PGD1 Analog Semi Graphic HMI is powered by the PLC installed in the electrical panel of the CPM evaporator unit through an RJ-12 cable. The HMI connector is available at the rear part of the remote panel as illustrated below:



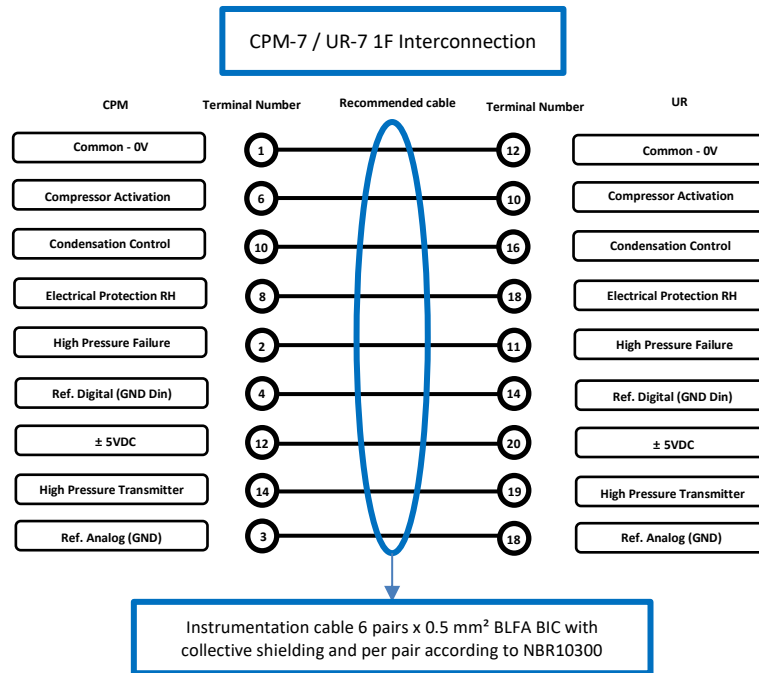
	ATTENTION	The crimping of the cables must be done in parallel to ensure the correct operation of the HMI.
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If the equipment is supplied with the 4.3" Touchscreen PGDX HMI, the connection is made differently, between the terminals indicated and the HMI connection points, as shown in the following image

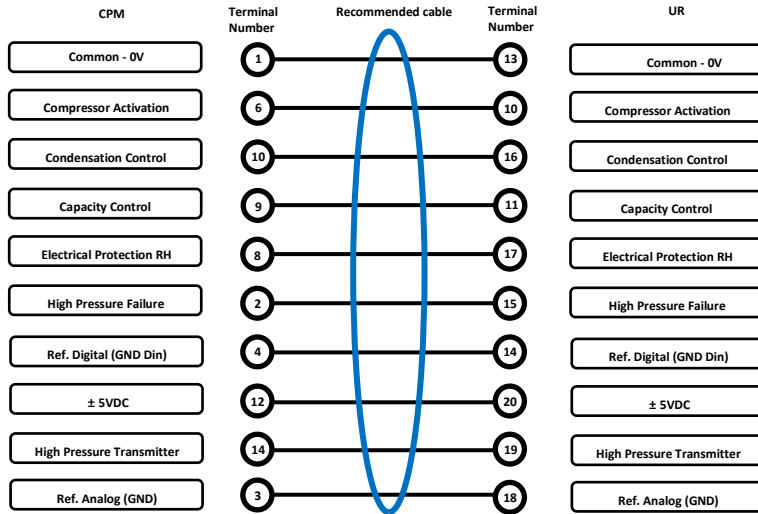


4.5.4. Interconnection between CPM and UR

The interconnection between CPM and UR is made for control between the PLC installed in the evaporator and the components and instruments installed in the condenser. For this connection it is recommended to use a 6 pairs x 0.5 mm² BLFA BIC instrumentation cable according to NBR 10300 with collective shielding and per pair. The terminals and function for connection in each equipment of the line are indicated below.

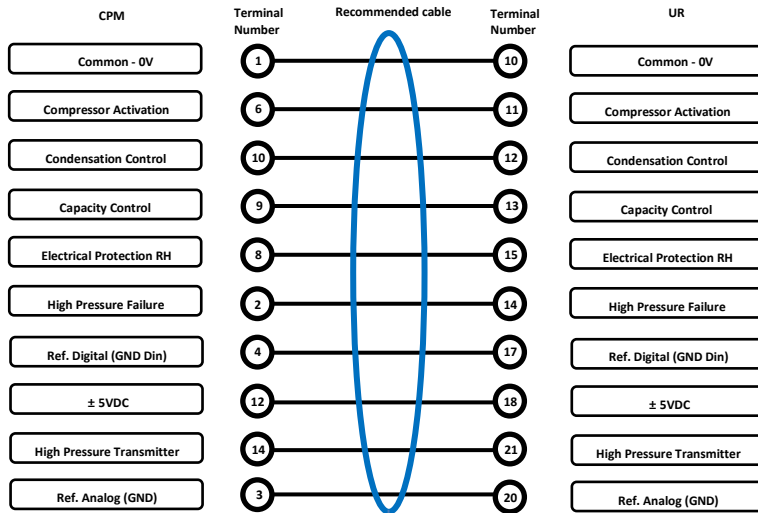


CPM-7 / UR-7 3F Interconnection

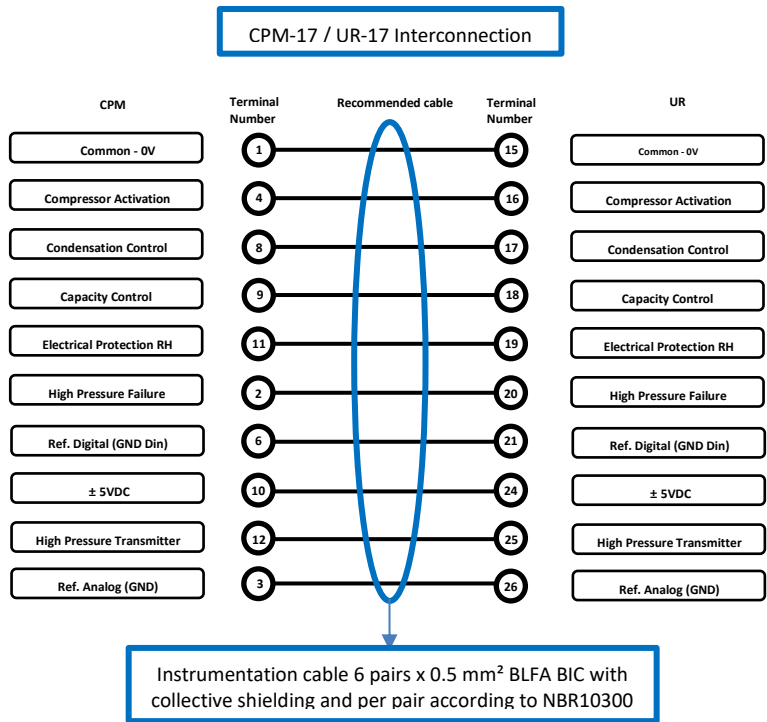


Instrumentation cable 6 pairs x 0.5 mm² BLFA BIC with collective shielding and per pair according to NBR10300

CPM-10 / UR-10 Interconnection

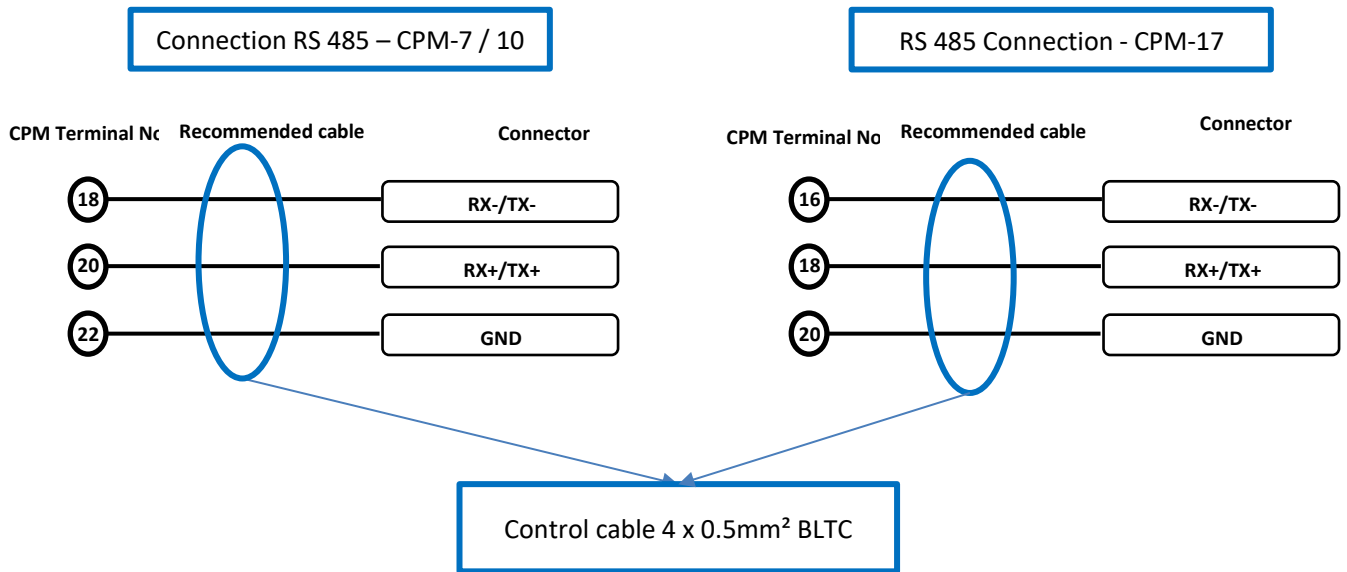


Instrumentation cable 6 pairs x 0.5 mm² BLFA BIC with collective shielding and per pair according to NBR10300



4.5.5. Interconnection via Modbus network

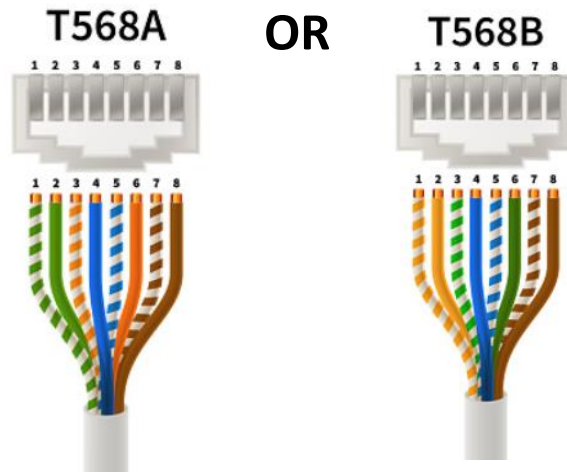
To connect the system via Modbus RTU via RS485 we must use a 4 x 0.5 mm² BLTC control cable according to NBR 7289. The connection must be made through the following points:



4.5.6. Interconnection via Ethernet network

CAT5 cable must be used for interconnection between equipment and network and between pieces of equipment. The connection should be made through a switch for which the customer is responsible.

Parallel configuration must be used for terminal connection (the terminals must be crimped in an identical way in both terminals) and connection standard T568A or T568B can be followed, as shown in the figure below:

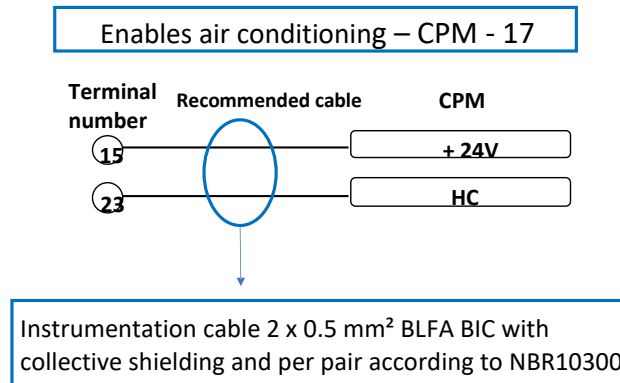
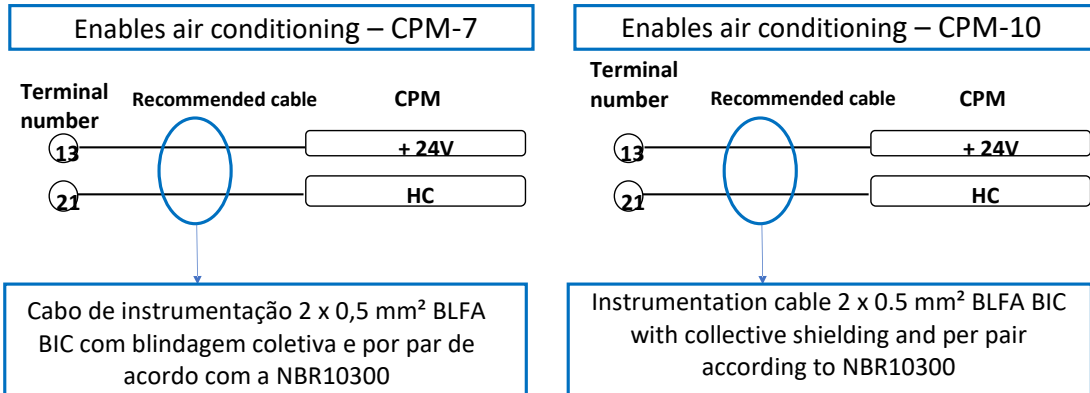


With the connection made correctly, the rotation condition between the equipment and the system connection with the WEB interface is guaranteed.

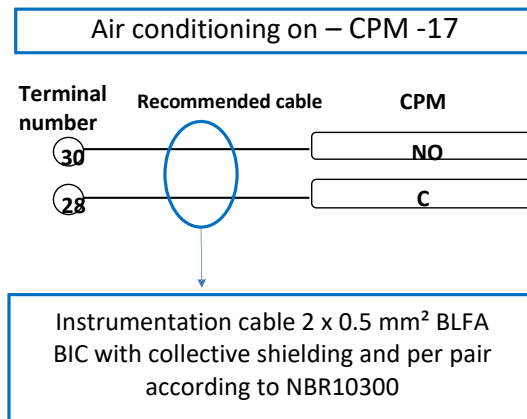
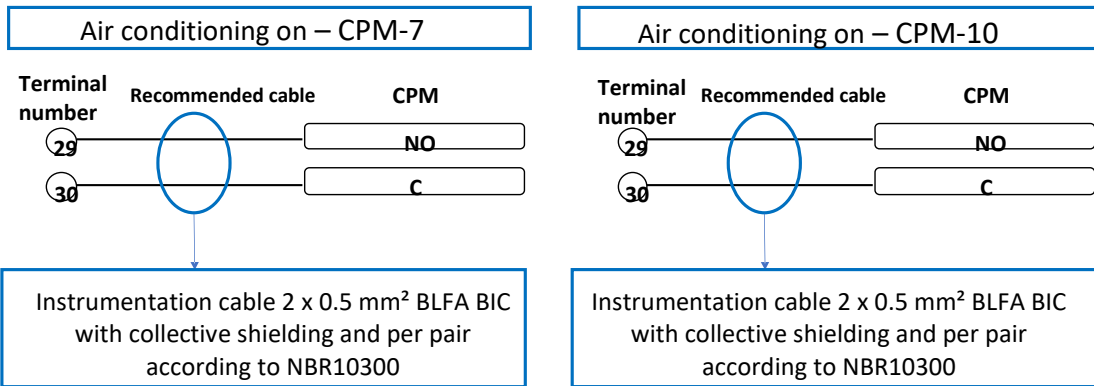
4.5.7. External interconnections.

The air conditioner has some contacts available for interaction with external interfaces, such as a contact for connecting an external push button (Enables air conditioning), a dry contact for signaling the moments in which the climate control is in operation (Air conditioning on) or a dry contact for signaling failures (Alarm Summary). The connection of the contacts should be done as follows for each model of equipment.

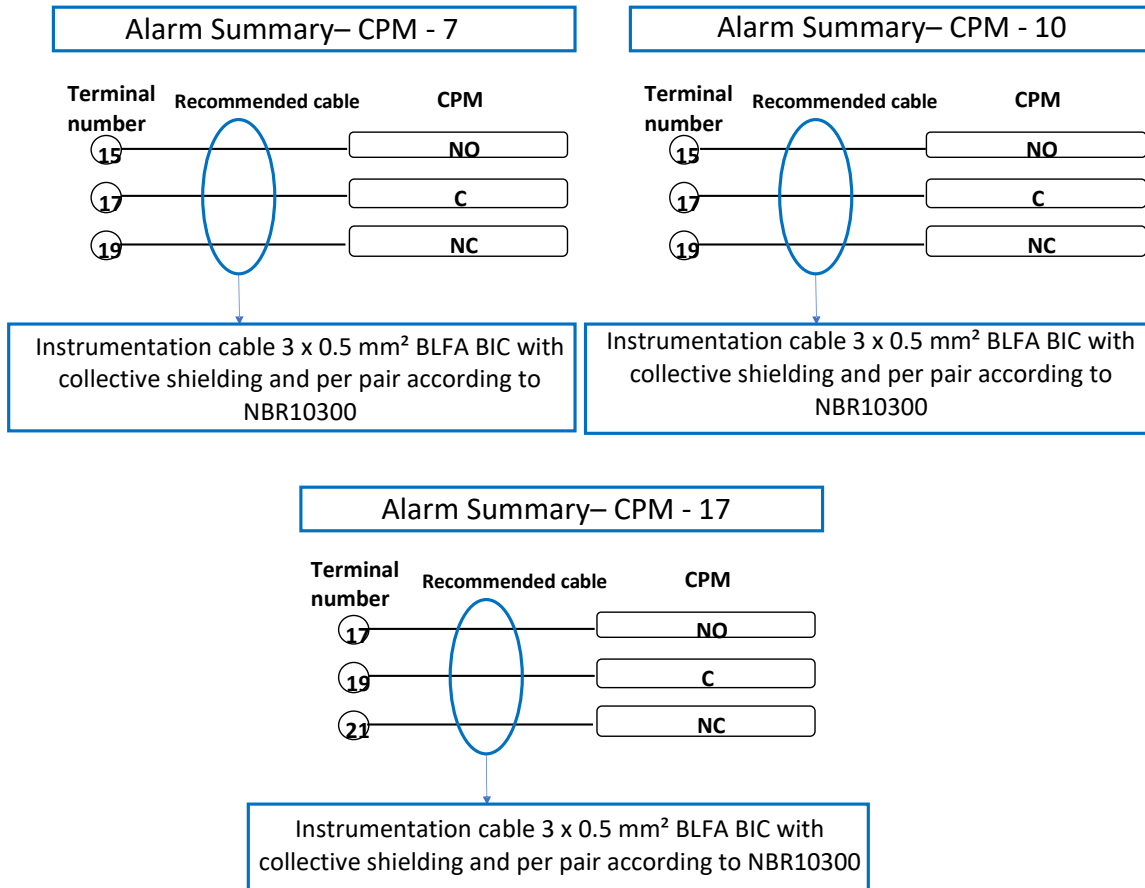
4.5.7.1. Enables air conditioning



4.5.7.2. Air conditioning on



4.5.7.3. Alarm Summary



4.5.8. Interconnection of units for rotation operation

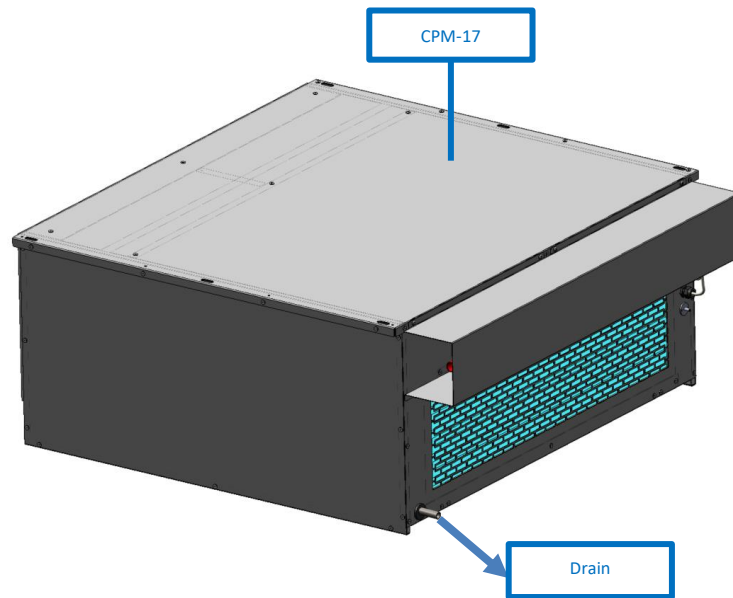
In an installation with more than one unit it is possible to perform network communication between the controllers to enable the rotation regime between the equipment, determining the time for relay between them and the number of equipment in simultaneous operation. To perform communication between the units, cables must be used according to the specifications of item 4.5.6 in addition to providing for the installation of a switch. After interconnecting the units, refer to the controller setup for setting up the "Multi Climas" and "Network Configuration" session within the driver settings menu.

To enable rotation regime, it is necessary to adjust the addressing of the controllers, since the controllers of the units are provided with the default addressing. Within the "Network Settings" menu, all the addressing parameters of the drives are located. Each unit must be adjusted to a unique IP range so that the drives do not fail. In the "Multi Climas" menu are the parameters for configuring the rotation regime of the units, such as the

number of equipment in the network, number of equipment operating simultaneously, time for rotation and identification address of each unit. You can configure up to 10 drives in the system.

4.6. Drain installation

The connection between the evaporator tray and the drain piping is part of the equipment and is delivered in AISI 304 stainless steel tube with 1/2" diameter. Connection through a flexible hose and a siphon is indicated, and it can be made from the same hose. The drain piping should be made using material that is not susceptible to corrosion and with a minimum inclination of 2° in the direction of flow.



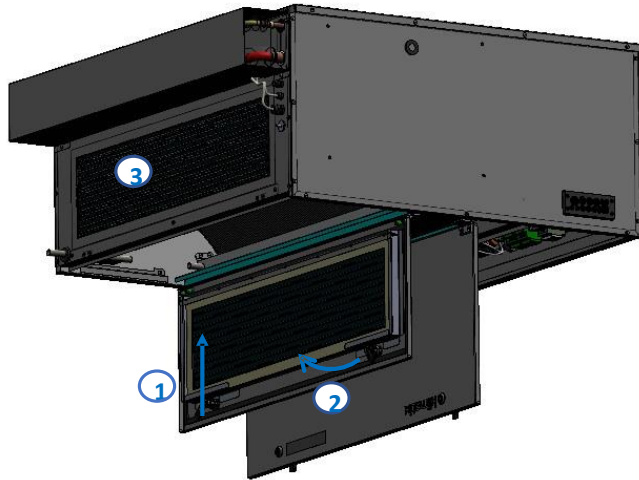
4.7. Replacement of the air filter

The CPM air conditioner by default is supplied with G4 air filters, with the possibility of purchasing the equipment with M5 filters according to ABNT NBR 16101:2012.

The filters are located in the rear region of the equipment and are accessed through the rear maintenance door. Both are fixed by ducts.

Over time, depending on the conditions of the installation environment, the filters will be saturated with dirt, requiring their replacement. Optionally the equipment can be supplied with a digital differential pressure switch, which measures the pressure drop in the input and output of the filter, indicating an alert in the HMI when the loss exceeds the pressure switch limits.

The replacement of the filters is very simple, with no tools required. Simply lift the filter until it reaches the top of the top mounting duct so that the bottom of the filter is free for removal, as shown in the illustration below:



1. Lift the filter to the top of the duct
2. Pull the bottom of the filter in the opposite direction to the door
3. The same procedure should be done to remove the rear filter

For this equipment we recommend the use of pleated filters that meet the following specifications:

CPM Model	Filter specifications					
	Filtration grade	Dimensions	Initial load loss	Final load loss	Filtering area	Speed
CPM-7	G4 (Standard)	710 x 200 x 25 mm	80 Pa	300 Pa	0,16 m ²	3,5 m/s
CPM-7	M5 (Optional)	710 x 200 x 25 mm	80 Pa	300 Pa	0,16 m ²	3,5 m/s
CPM-10	G4 (Standard)	900 x 200 x 25 mm	80 Pa	300 Pa	0,3 m ²	3,1 m/s
CPM-10	M5 (Optional)	900 x 200 x 25 mm	80 Pa	300 Pa	0,3 m ²	3,1 m/s
CPM-17	G4 (Standard)	925 x 250 x 25 mm	80 Pa	300 Pa	0,3 m ²	3,9 m/s
CPM-17	M5 (Optional)	925 x 250 x 25 mm	80 Pa	300 Pa	0,3 m ²	3,9 m/s

4.8. CPM cooling installation

The refrigeration interconnection between the evaporator unit (CPM) and remote condenser unit (UR) must be made with copper pipes, according to ASTM C12200 and connection diameters indicated in the table below:

CPM/UR Model	Connection dimensions			
	Suction line	Indicated thickness	Liquid line	Indicated thickness
CPM-7	5/8"	1/16"	3/8"	1/16"
CPM-10	3/4"	1/16"	1/2"	1/16"
CPM-17	7/8"	1/16"	1/2"	1/16"

The refrigeration circuit piping must be sized according to the installation conditions and must be limited according to the restrictions, recommendations and distances defined in section 4.2 of this manual, such as bends, reductions, valves and other accessories, maintaining the equivalent length and the positioning of the remote condenser can be done at the same level, above or below the evaporator unit. The tubes used for interconnection between evaporator and condenser units, as well as accessories, must be clean and free of moisture.


The connection between pipes and components should be made through spigots, never through butt weld, using a brazing process and filler material containing 15% silver according to DIN EN 1044.


To avoid the formation of oxide contaminants inside the tubes and accessories, the brazing process must be carried out with the injection of nitrogen.


The suction and liquid pipes must be at least 25mm apart and secured by supports at a distance of not more than 2 meters.

The table below shows some additional recommendations for assembly, considering the level of the remote condenser in relation to the evaporator unit.

Installation Settings		
UR above the CPM	UR at CPM level	UR below the CPM
<ul style="list-style-type: none"> The maximum level difference allowed between the units is 17 meters; A double siphon should be provided every 6 meters for the overheated vapor line (discharge); Inverted siphon should be predicted above at condenser level for levels greater than 2 m; The horizontal stretch should be designed with minimum inclination of 0.5% in the direction of the refrigerant flow. 	<ul style="list-style-type: none"> The horizontal stretch should be designed with minimum inclination of 0.5% in the direction of the refrigerant flow. 	<ul style="list-style-type: none"> The maximum level difference allowed between the units is 5 meters; The horizontal stretch should be designed with minimum inclination of 0.5% in the direction of the refrigerant flow.

	ATTENTION	The pipes must be cleaned before being connected to the evaporator unit and remote condenser, and only nitrogen should be used for this.
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	ATTENTION	The temperature of the discharge pipe can reach values over 90°C, so do not attach elements or components that may suffer damage or malfunction.
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	ATTENTION	Always use an inverted siphon in the inlet and outlet lines of the unit that must be at least 150 mm above the level of the condenser.
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4.8.1. Leak check

Perform the procedure to detect leak by pressurizing the refrigeration circuit with nitrogen. The system should be pressurized to maximum pressure of 4.0 MPa (40 bar).

After 1 hour check for any pressure variation and check for leak points in case variation is observed.

	ATTENTION	Do not apply pressure greater than 4.0 MPa (40 bar) in the refrigeration circuit.
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4.8.2. Vacuum

To ensure performance in air conditioner operation it is essential to remove the moisture contained in the refrigeration circuit through an evacuation process.

The procedure to be adopted is started by connecting the vacuum pump to the service valves, installed on the high and low pressure sides of the refrigeration circuit, followed by activating the pump. When the pressure in the refrigeration circuit reaches an absolute value of 40 Pa (300 mmHg) close the connections and switch off the pump.

Then follow the pressure rise, and if the pressure increases quickly, repeat the procedure to check for leaks, because the rapid pressure variation is an indication of a leak.

Three hours after switching off the pump, the value measured in a vacuum gauge must not be higher than 160 Pa (1200 mmHg), if the pressure is higher than specified, the leak check procedure must be performed.

4.8.3. Oil charge


Due to the length of the piping that interconnects the evaporator and condenser units, it is necessary to add lubricating oil to the system. The amount of oil to be added varies based on the length of the interconnection path of the units.


It is recommended to add 0.1 to 0.13 liters of oil for each Kg of coolant added to the refrigerant circuit.

4.8.4. Refrigerant load

With the refrigerant cylinder connected to the liquid tank, open the regulator and let the refrigerant in the liquid phase enter the system until the pressure reaches approximately 0.3 MPa.

The completion of the coolant load will be carried out with the equipment in operation. This requires connecting the cylinder with refrigerant to the suction line using a manifold, then opening the cylinder valve and slowly opening the manifold regulator. Allow the refrigerant to enter the system until there are no more bubbles in the liquid display. In this condition, the overheating should be between 5 and 6°C and sub-cooling should be between 6 and 9°C.

	ATTENTION	The refrigerant load should be executed exclusively in the liquid phase.
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	ATTENTION	Do not activate the compressor with a suction pressure below 0.05 Mpa. Operating the compressor in this situation for more than a few seconds can cause the compressor to overheat, causing irreversible damage.
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4.9. Installation of CPM Options

4.9.1. Air filter M5

It is possible to replace the G4 air filter supplied with the equipment to ensure a finer degree of filtration. The equipment has an optional M5 air filter supplied according to ABNT NBR 16101:2012. The filter can be supplied with the equipment or installed on site, and must be replaced when it is saturated.

4.9.2. SNMP Communication

The standard equipment has a Carel PLC and standard communication via MODBUS TCP/IP or MODBUS RTU RS-485, allowing the monitoring of parameters, remote on/off and setpoint adjustment. Optionally the system can be supplied with a plugin for SNMP communication, if necessary for compatibility with management or monitoring software of the plant where the equipment is installed.

4.9.3. HMI Touchscreen

In this configuration the equipment is supplied with a 4.3" color touchscreen PGDX HMI replacing the standard analog PGD1 HMI.

4.10. Installation of UR Options

4.10.1. Air filter G0

The standard remote condensing unit is supplied without air filters; however it is possible to include G0 grade filter screens according to ABNT NBR 16101:2012, in order to retain larger particles that may cause some obstruction in the equipment condenser. The filter can be installed in the factory or in the field and should be washed with a high pressure washer for sporadic cleaning, according to the need depending on the installation site.

5. Operation


Below is a set of instructions for the correct operation of the CPM, as well as the change of the control temperature and humidity of the equipment and access to the alarm screens.

The operating actions do not require the use of PPEs unless the environment where the CPM is located requires it. The customer is responsible for establishing which PPEs the operator must use. The customer must provide suitable lighting for the environment where the CPM is installed and where maintenance services will be performed, if necessary.

Before starting operation with equipment, we must:

- Check the position of the service valves of the CPM cooling circuit, which must be open;
- Check the electrical connections between the components, cables and terminals, tightening when necessary;
- Check the gauges and fittings of the electrical conductors;
- Check the gauges and fittings of the pipes;
- Check to see if the safety devices of the equipment and installation are not activated;
- Check the control fuses;
- Check the voltage and difference between the electric power supply phases;
- Check to see if the air flow of the unit is not blocked and if there is suitable ventilation in the equipment installation site.


The equipment control is done through the PLC installed in the Precision Air Conditioner, including all the functions related to the temperature and humidity control of the system, including, in the case of the system with direct expansion. For more information about alarms and faults, refer to the manual of the corresponding evaporator unit.


	<p>ATTENTION</p>	<p>It is recommended for the operator to go through training before operating the equipment. The CPM is easy to operate, but the operator must be qualified and have the minimum knowledge to operate the equipment safely.</p>
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5.1. Start-up

After performing the electrical installation, change the position of the main disconnecter to the 'ON' position. The equipment will be energized.

With the equipment energized the HMI must be started to activate the equipment. In case the HMI does not start operating, check to see if voltage is reaching the inlet of the Main Switch and if there is no phase inversion failure. If a fault occurs, correct the phase sequence by inverting the RS phases.

	<p>INFORMATION</p>	<p>The equipment should not be switched on without prior authorization from Mecalor, under the penalty of suspension of the warranty.</p>
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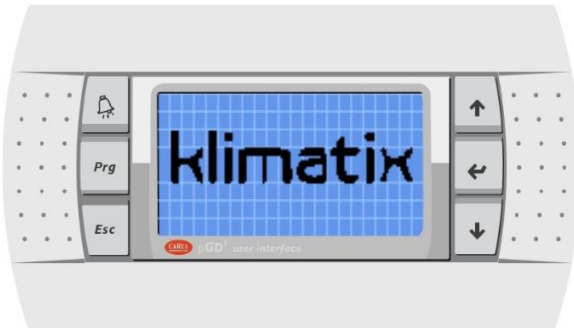
	<p>INFORMATION</p>	<p>Fill out the “Final inspection checklist of the installation before Start-up” before contacting Mecalor’s Technical Support for startup of the CPM/UR</p>
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	<p>INFORMATION</p>	<p>Use the main switch only to turn off the CP power in cases of maintenance. The main switch should not be used to switch the equipment on and off routinely. For this, use the HMI. The control panel monitors the CPM variables and must be powered.</p>
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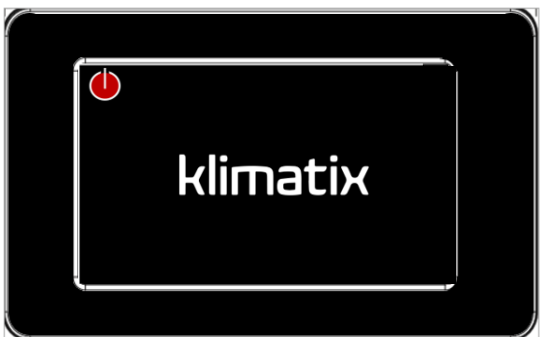
5.2. Control panel

The CP is supplied with a remote control panel consisting of an analog PGD1 HMI in its standard mounting, or can optionally be supplied with a 4.3" color touchscreen PGDX HMI.

**Main Screen – PGD1 HMI
Standard**



**Home Screen - PGDX HMI
Optional**

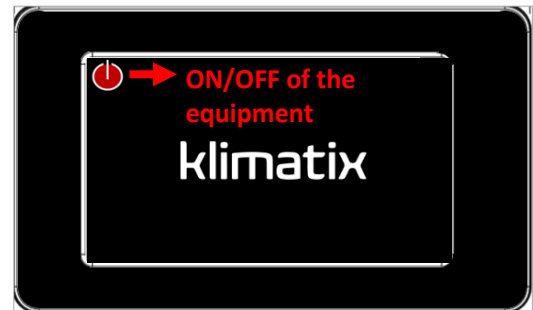


To turn on the equipment, after powering the control panel, in the PGD1 HMI (standard mounting) press the ↑ and ↓ buttons to display the activation screen of the CP unit. As for the PGDX HMI (optional mounting), the button for activating the CP unit is located in the upper left corner, as indicated below:

**On/Off – IHM PGD1
Standard**



**On/Off – IHM PGDX
Optional**

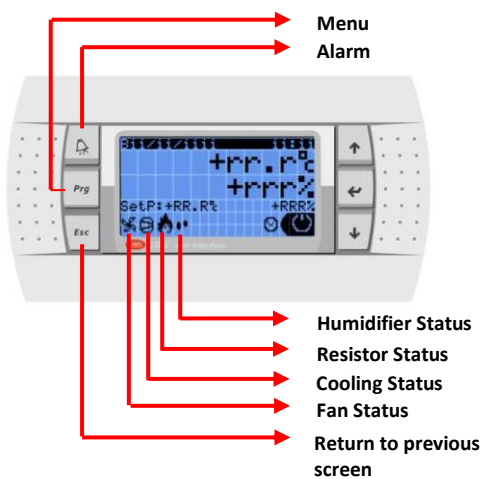


To turn on the equipment:

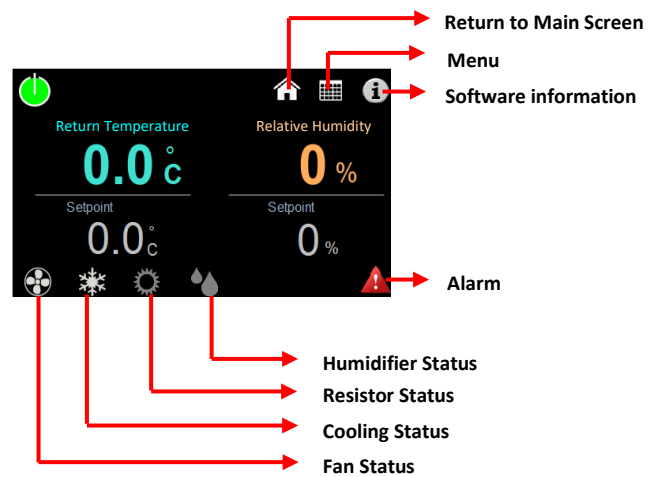
1. Press Prg + Esc
2. Select the On option using the ↑ and ↓ buttons
3. Press ←

The HMI will display its main screen after the activation.

**Main Screen - PGD1 HMI
Standard**

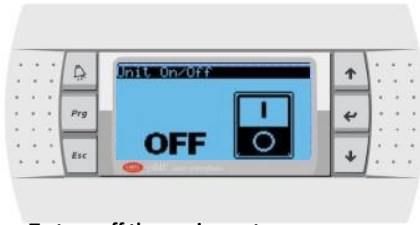


**Main Screen - PGDX HMI
Optional**



To turn off the equipment you will be asked for the access password:

On/Off – IHM PGD1 Padrão



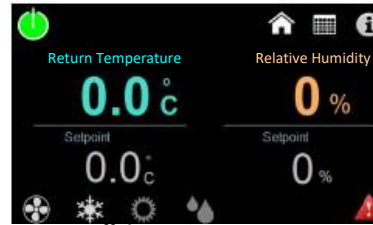
To turn off the equipment:

1. Press Prg and Esc
2. Select the Off option
3. Press ←↓
4. The password fill-in screen will be displayed



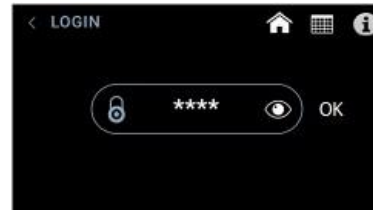
5. Press ↑ and ☺ to enter the value in each field
6. Press ←↓ to navigate between fields and confirm

On/Off – IHM PGDX Optional



To turn off the equipment:

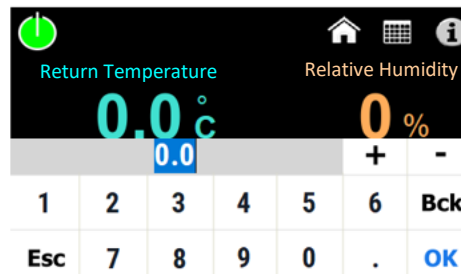
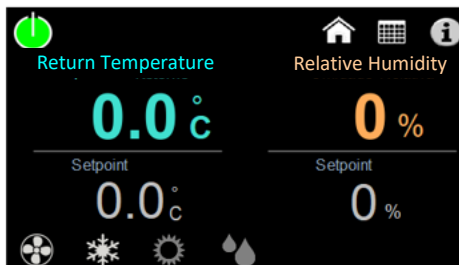
1. Press the On/Off button
2. The password fill screen will be displayed



3. Tap on the password field to view the virtual keyboard
4. Enter the password and confirm

To change the setpoint of the return temperature or relative humidity:

- PGDX HMI (Optional) - Touch the screen and then the setpoint value of the parameter, a virtual keyboard will appear, type the desired value and confirm.



- PGD1 IHM (Standard):



To change the Temperature/Humidity setpoint:

1. Press ←↵
2. The cursor will start to blink over the first digit of the temperature setpoint
3. Press ↑ and ↓ to change the value
4. Press ←↵ to confirm the change and the cursor will move to the next digit

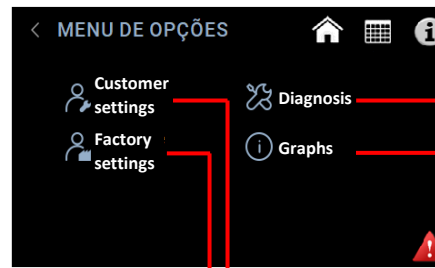
Menu – PGD1 HMI Standard



To access the menu:

1. Press Prg
2. Press ↑ and ↓ to browse the list of options
3. Press ←↵ to access the desired menu

Menu – IHM PGDX Optional

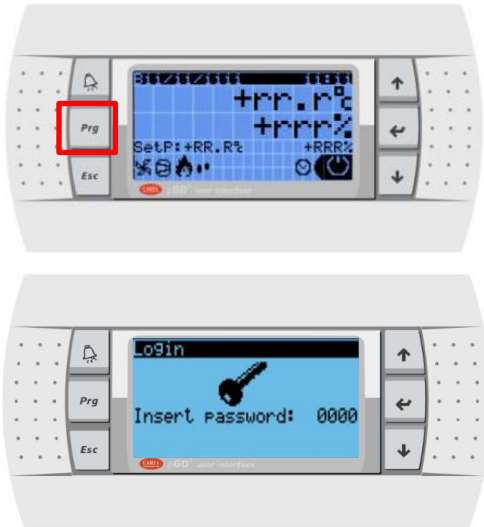


Diagnosis: Parameters and Status
Temperature and HR graphs

Customer settings
Factory settings

The Settings screens allow access to the configurations of the system and its components, as well as PID parameters, operating parameters, operating modes, activation of optional features (when applicable), and reading of variables. The menu displayed in PGD1 HMI (standard) does not have the same division between customer and factory level as the one displayed in PGDX HMI (optional). The access level is set by entering the password before accessing the menu. All options are displayed when the factory level password is inserted, while only the user level feature options are displayed when the user level password is inserted.

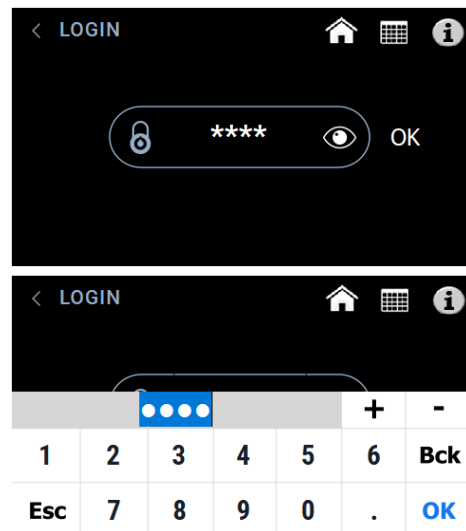
Menu Access - PGD1 HMI Standard



To insert the access password in the Menu:

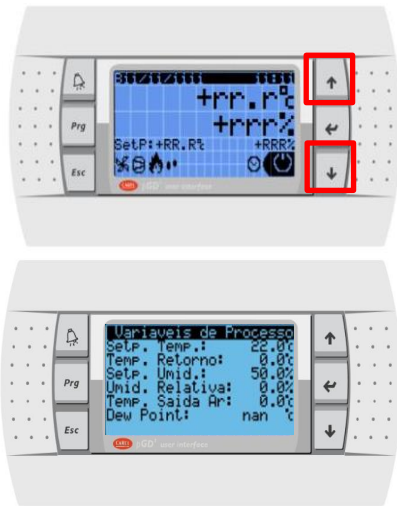
1. Press Prg
2. The cursor will start to blink over the first digit of the "Insert password"
3. Press ↑ and ↓ to change the value
4. Press ← to confirm the change and the cursor will move to the next digit

Menu Access – IHM PGDX Optional



The "Diagnostics" screen allows visualization of the process variables, equipment status, operating hours of the equipment, components, and alarms history. In case of alarm occurrence, after the fault has been solved, reset the equipment so that it is possible to resume the operation.

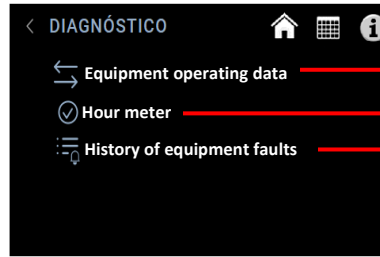
Diagnostics – PGD1 HMI Standard



To access Diagnostics:

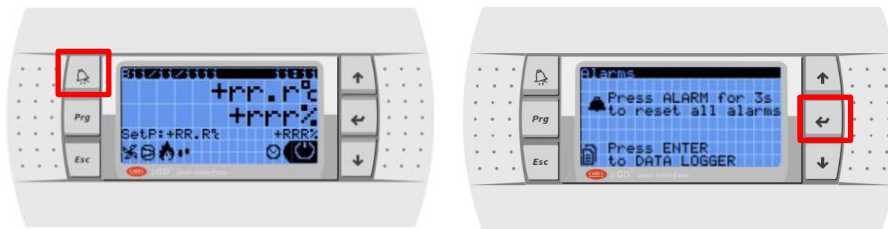
1. On the home screen, press \uparrow or \downarrow to browse between screens containing the operating and hour meter data

Diagnostics – IHM PGDX Optional



- Equipment operating data
- Hour meter of the equipment and its components
- History of equipment faults and alarms

In the case of PGD1 HMI, the alarm history is accessed through the screen displayed by pressing the alarm button.



To access the alarm history:

1. Press the alarm button
2. In the active alarm screen, press enter


	<p>DANGER</p>	<p>It is not allowed to change the software, parameters or operating conditions on the MMI screen in the factory menu. This practice can put at risk the operator and the operation of the equipment, able to cause loss of control of the process, breakage of the equipment and physical damages to the operator, in addition to loss of warranty.</p>
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6. Maintenance

Carrying out the maintenance procedures at the recommended intervals will ensure the proper functioning of the equipment within the conditions for which it was designed and manufactured.


The maintenance activity must be carried out only by technical specialists who must observe and respect the safety rules in any type of intervention on the equipment.

It is recommended to record and control the maintenances performed.

	DANGER	Never perform any type of maintenance while the equipment is energized. This practice can put at risk the operator and the operation of the equipment, able to cause loss of control of the process, breakage of the equipment and physical damages to the operator, in addition to loss of warranty.
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6.1. Corrective maintenance

All CPM faults are indicated on the HMI alarm screen. The failures of the CPM are divided into two types: Warnings and Alarms. In case a failure occurs on the CP, before applying the procedures described below, check the failure log as described in the previous session. When the fault is an Alert, it is only recorded in the fault history; however, in alarm conditions, the alarm icon is displayed on the HMI and the red LED on the left side of the Interface is activated, as shown in section 5.2 of this manual.

	ATTENTION	The procedures described below can only be performed by qualified people who have the knowledge on the operation of the equipment. Procedures performed by the layman may result in injuries or breakage of a component.
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6.2. Fault indication

All equipment faults are recorded in the HMI fault history, however, the alert signal is only issued when there are active alerts. Some alarms stop the operation of the equipment partially or completely and depending on the situation require an immediate diagnosis and solution.

When an alarm is identified, it is recommended to check the fault history to identify previously registered alerts, complementing the information for an accurate diagnosis.

The following table contains all the faults that can be indicated on the HMI of the CP, the causes and the procedures to be adopted when they are indicated. In case the failure cannot be corrected by following the indicated procedure, contact the Technical Support of Mecalor.

Description of the fault	Component		Consequence	Type		Rearm		Probable cause	Procedure
	TAG	Description		Alert	Alarm	Manual	Automatic		
Control turned off		Enables climate (Customer interface)	Alert	X				External contact responsible for activating the open HC contact.	Check for poor contact or anomaly in the activation contact of the unit present in the customer interface.
Electrical protection of the remote unit	RH	Remote unit	Turns off the cooling system		X	X	X	Remote unit fan thermal relay disarm	Check if the fan of the remote unit is operating with current within the specifications of the electrical data table. If it is identified that the current is above the nominal value of the fan operation, check if the supply voltage is correct or if there is poor contact in the electrical connection of the remote unit.
								Remote unit circuit breaker disarm	Check to see if the supply voltage to the remote unit and the compressor are within the specifications in the electrical data table or if there is poor contact in the electrical connection.
Cooling pressure fault	PHL	High pressure switch (Remote Unit)	Turns off the cooling system		X	X	X	High pressure switch disarm	Check the cleaning conditions of the condenser and the existence of hot air recirculation in the installation room of the remote unit.

Electrical protections of the circulation fan	CF	Circulation fan	Turns off the cooling system		X	X	X	Circulation fan thermal relay disarm	Check if the circulation fan is operating with current within the specifications in the electrical data table. If it is identified that the current is above the nominal value of the fan operation, check if the supply voltage is correct or if there is poor contact in the electrical connection. Also check if the fan is presenting any malfunction.
Clogged filter	F	Air filter	Alert	X		X	X	Dirt accumulation in the air filter	Replace the air filter
Alarm for the presence of water on the floor.	CNBE1	Low Level Switch of the external tray (Optional)			X	X	X	Water accumulation in the external tray	Check for possible clogging in the external tray drain
High Water Level in Tray Alert			Alert	X					
Electrical protections - Resistor	Q2	Resistor circuit breaker (Optional)						Disarm the circuit breaker	Try to reset the circuit-breaker and check if the voltage and current of the resistor are as specified in the electrical data table.
	TRBW1	Resistor safety thermostat (Optional)	Disable heating resistor		X	X	X	Operating current of the resistor is above nominal	Check to see if the operating current of the resistor is according to the electrical data table of the equipment. If abnormalities in the operation current are identified, check for poor contact in the electrical connection or discrepancy in the supply voltage to the resistor.

Fault in the Suction temperature sensor – System 1	PTS1	Suction temperature sensor of the compressor	Shutdown the equipment		X	X	X	Poor contact or defect in the suction temperature sensor of the compressor	Check for contact or fault in the temperature sensor reading
High suction temperature – System 1	PTS1	Suction temperature sensor of the compressor	Alert	X				Temperature above the limit established in the equipment setup	Check if the temperature sensor is reading the correct temperature and if it is positioned correctly in the piping. If it is, check to see if the compressor is functioning within the operating limits.
Low suction temperature – System 1								Temperature below the limit established in the equipment setup	
Fault in the sensor - Humidity Of the air return	TTH1 (Optional)	Temperature and humidity sensor	Turn off the humidifier and heating resistor		X	X	X	Humidity not within sensor reading range	Check to see if the sensor is properly in the equipment
High/low humidity in the air return			Alert	X				Bad sensor connection contact	Check to see if the electrical connection of the sensor is according to the electrical diagram.
			Alert	X				Humidity not within setpoint	Check for the existence of other alerts/alarms that are preventing the operation of the Humidifier.
Fault in the sensor – Air return temperature	TTH1 (Optional)	Temperature and humidity sensor	Disable cooling circuit, humidifier and resistor		X	X	X	Temperature not within sensor reading range	Check to see if the sensor is properly in the equipment.
High/low temperature in the air return			Alert	X				Bad sensor connection contact	Check to see if the electrical connection of the sensor is according to the electrical diagram.
Fault in the sensor – Air outlet temperature	TS2	Air outlet temperature sensor	Disable cooling circuit, humidifier and resistor		X	X	X	Temperature not within sensor reading range	Check to see if the sensor is properly in the equipment.
								Bad sensor connection contact	Check to see if the electrical connection of the sensor is according to the electrical diagram.

High/low temperature in the air outlet	TS2	Air outlet temperature sensor	Alert	X				Temperature not within setpoint	Check for the existence of other alerts/alarms that are preventing the operation of the equipment.
Fault in the sensor – High pressure of system 1	HP	Discharge pressure transmitter (Remote Unit)	Disable cooling circuit, humidifier and resistor		X	X	X	Pressure not within transmitter reading range	Check to see if the sensor is properly in the equipment.
								Poor contact in the transmitter connection	Check to see if the electrical connection of the sensor is according to the electrical diagram.
High/low condensation temperature – System 1	HP	Discharge pressure transmitter (Remote Unit)	Alert	X				Pressure not within limits established in the PLC setup	Check for the existence of other alerts/alarms that are preventing the operation of the equipment. Check the cleaning conditions of the condenser and the existence of hot air recirculation in the installation room of the remote unit.
Fault in the sensor – Low pressure of system 1	HP	Discharge pressure transmitter (Remote Unit)	Disable cooling circuit, humidifier and resistor		X	X	X	Pressure not within transmitter reading range	Check to see if the sensor is properly in the equipment.
								Poor contact in the transmitter connection	Check to see if the electrical connection of the sensor is according to the electrical diagram.
High/low evaporation temperature – System 1	HP	Discharge pressure transmitter (Remote Unit)	Alert	X				Pressure not within limits established in the PLC setup	Check for the existence of other alerts/alarms that are preventing the operation of the equipment. Check for bubbles in the liquid display during compressor operation, symptom of possible lack/leakage of refrigerant fluid in the system.

Protection – Suction Sensor of system 1	PTS1	Suction temperature sensor of the compressor	Disable the cooling system		X	X	X	Temperature not within sensor reading range	Check to see if the sensor is properly in the equipment.
								Bad sensor connection contact	Check to see if the electrical connection of the sensor is according to the electrical diagram.
Protection – Air return temperature sensor	TTH1 (Optional)	Temperature and humidity sensor	Alert	X				Temperature not within sensor reading range	Check to see if the sensor is properly in the equipment.
								Bad sensor connection contact	Check to see if the electrical connection of the sensor is according to the electrical diagram.
Protection – Air outlet temperature sensor	TS2	Temperature sensor	Alert	X				Temperature not within sensor reading range	Check to see if the sensor is properly in the equipment.
								Bad sensor connection contact	Check to see if the electrical connection of the sensor is according to the electrical diagram.
Protection – Low air outlet temperature	TS2	Temperature sensor	Alert	X				Temperature not within sensor reading range	Check to see if the sensor is properly in the equipment.
								Bad sensor connection contact	Check to see if the electrical connection of the sensor is according to the electrical diagram.
Protection – Condensation pressure sensor of system 1	HP	Discharge pressure transmitter (Remote Unit)	Alert	X				Pressure not within transmitter reading range	Check to see if the transmitter is properly positioned in the equipment.
								Poor contact in the transmitter connection	Check to see if the electrical connection of the transmitter is according to the electrical diagram.
Protection - High/low condensation temperature of system 1	HP	Discharge pressure transmitter (Remote Unit)	Alert	X				Pressure not within transmitter reading range	Check to see if the transmitter is properly positioned in the equipment.
								Poor contact in the transmitter connection	Check to see if the electrical connection of the transmitter is according to the electrical diagram.

Protection - Low evaporation temperature of system 1	HP	Suction pressure transmitter	Alert	X				Pressure not within transmitter reading range	Check to see if the transmitter is properly positioned in the equipment.
								Poor contact in the transmitter connection	Check to see if the electrical connection of the transmitter is according to the electrical diagram.
Low SH protection of system 1	NV1	Electronic expansion valve	Alert – Expansion valve will perform modulations to adjust the SH. If the problem persists, the system will give off an alarm	X				Low superheating	Call a refrigeration technician to check the operation of the cooling system.
								Reading error in the pressure sensors/transmitters	Check to see if the temperature sensors and pressure transmitters are making the correct reading. In case of abnormalities, check to see if the connection of the component is according to the electrical diagram.
Low SH alarm in system 1	NV1	Electronic expansion valve	Disable the cooling system		X	X	X	Low superheating	Call a refrigeration technician to check the operation of the cooling system.
								Reading error in the pressure sensors/transmitters	Check to see if the temperature sensors and pressure transmitters are making the correct reading. In case of abnormalities, check to see if the connection of the component is according to the electrical diagram.

LOP Protection of system 1	NV1	Electronic expansion valve	Alert – Expansion valve will perform modulations to adjust the LOP. If the problem persists, the system will give off an alarm	X				Low pressure	Call a refrigeration technician to check the operation of the cooling system.
								Reading error in the pressure sensors/transmitters	Check to see if the temperature sensors and pressure transmitters are making the correct reading. In case of abnormalities, check to see if the connection of the component is according to the electrical diagram.
LOP Alarm of system 1	NV1	Electronic expansion valve	Disable the cooling system		X	X	X	Low pressure	Call a refrigeration technician to check the operation of the cooling system.
								Reading error in the pressure sensors/transmitters	Check to see if the temperature sensors and pressure transmitters are making the correct reading. In case of abnormalities, check to see if the connection of the component is according to the electrical diagram.
MOP Protection of system 1	NV1	Electronic expansion valve	Alert – Expansion valve will perform modulations to adjust the MOP. If the problem persists, the system will give off an alarm	X				High pressure	Check the cleaning conditions of the condenser and the existence of hot air recirculation in the installation room of the remote unit.
								Reading error in the pressure sensors/transmitters	Check to see if the temperature sensors and pressure transmitters are making the correct reading. In case of abnormalities, check to see if the connection of the component is according to the electrical diagram

MOP Alarm of system 1	NV1	Electronic expansion valve	Disable the cooling system	X		X	X	High pressure	Check the cleaning conditions of the condenser and the existence of hot air recirculation in the installation room of the remote unit.
								Reading error in the pressure sensors/transmitters	Check to see if the temperature sensors and pressure transmitters are making the correct reading. In case of abnormalities, check to see if the connection of the component is according to the electrical diagram
Fault in humidifier control thermal relay	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Disarm the humidifier thermal relay	Check to see if the power voltage of the humidifier is correct.
Required replacement of the cylinder								Humidifier cylinder life exhausted	Replace humidifier cylinder
High conductivity in the humidifier water	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Bad quality of the supply water of the humidifier	Carry out cleaning of the cylinder of the humidifier and the electrodes of the conductivity sensor. If the problem persists, install a demineralization system for the supply water of the humidifier.
Configuration error	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Incorrect parameterization	Check to see if the parameters of the controller are according to the setup.
Humidity controller memory error	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Damaged controller	Check to see if the parameters of the controller are according to the setup. If the fault persists, contact technical support.
High current in the electrode of the humidifier	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Very high conductivity	Drain part of the water and reset the alarm.
								High water level	Check to see if the drain valve is okay.
								Fault in the electrode	Search for leaks on the water supply valve.

Low steam production in the humidifier	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Water conductivity not within the limits	Check the quality of the water used in the humidifier supply.
								Excessive dirt in the humidifier cylinder	Clean the cylinder and replace the water.
								Incorrect parameterization	Check to see if the parameters of the controller are according to the setup.
High level of water in the humidifier	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Excessive water in the humidifier cylinder	Check to see if the drain valve is okay.
External signal not connected	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Incorrect parameterization	Check to see if the parameters of the controller are according to the setup.
								Poor contact	Check to see if all connections of the humidifier controller are according to the electrical diagram.
Fault in the filling of the humidifier	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Lack of supply water of humidifier cylinder	Check for possible lack of water in the supply system of the humidifier or clogging in the hydraulic circuit.
Fault in humidifier drainage	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Fault in the drainage valve	Check to see if the electric power supply of the drainage valve is correct. Also check for possible clogging in the drainage system.
Cleaning in the humidifier is required	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Dirt accumulation in the humidifier cylinder	Clean the humidifier cylinder and replace the water.
Foam in the cylinder	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Foam accumulation in the humidifier cylinder	Check for chemical products in the supply water of the humidifier. Clean the cylinder and replace the water.

Salt accumulation in the humidifier	HU1 (Optional)	Humidifier	Disable the humidifier	X		X	X	Bad quality of the supply water of the humidifier	Clean the cylinder and replace the supply water. Install a water demineralization system if the problem persists.
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6.3. Preventive Maintenance

The correct Preventive Maintenance of the equipment may avoid future breakdowns and shutdowns of the equipment. For this, we recommend the procedures described below.

Preventive Maintenance – General			
Item	Frequency	Procedure	Notes
Painting Structure	Monthly	Check the general condition of the cabinet painting and retouch if necessary	Cabinet color specifications: white color: RAL 9003 black color: RAL 9005
Insulation of the pipe	Every six months	Check the insulation conditions of the pipes and replace damaged insulations	Damaged insulations or insulations with excess moisture should be replaced.
Vibration	Every six months	Check for excess vibration in the equipment.	Check for possible cracks on welded points.
		Place your hand on the body of the compressor and visually check the pipe; this procedure is necessary to obtain a reference standard in relation to the normal vibration of the equipment	
Fixation of components	Every six months	Check the engine fittings: fan and compressor	Retighten loose bolts.
Air filter	Monthly	Check the condition of the air filters	Replace if saturated or damaged.
Equipment door	Monthly	Open and close the door	The door should be aligned and closed without difficulty.
Equipment door locks	Monthly	Close the door, lock it and then unlock it	There should be no interferences between the lock and the door. The door should be pressed against the rubber seal and not allow gaps.
Alignment and closing of the set of plates	Monthly	Check the alignment of the closing plates of the cabinet	They should be aligned and must not have any fixation bolts.
Insulation of the electrical panel	Monthly	Check the fastening of the seal and possible damages to the seal of the panel.	Carry out the replacement of the electrical panel seal.

Preventive Maintenance - Mechanical			
Item	Frequency	Procedure	Notes
Fan	Monthly	Check for excess vibration in the fan	Retighten the bolts
		Check cleaning of the fan	Clean the fan
Evaporator	Every six months	Check to see if it is necessary to clean the evaporator fins.	Clean the blades of the condensers with compressed air at low pressure (be careful not to bend the exchanger fins)
		Check for signs of encrustation on the fins of the heat exchanger	In case of signs of encrustation, call for technical support to assess and eventually carry out technical cleaning of the exchanger.
Compressor	Monthly	Check the oil level in compressors with oil display	With the compressor switched off, the oil level should at least be 1/4 and at most 3/4 of the display
Proportional Valve	Quarterly	Check for leaks, fastening and tightening the terminals	Review fastening, retighten terminals and remake the connections of the valve, if necessary
		Check manual operation of the valve	In case of damages, call technical support to assess the need to replace the valve
Refrigeration piping	Monthly	After 2 minutes of operation, check to see if the liquid display indicates the dark color and no bubbles	If the display indicates a light color, there is moisture in the system. If it shows bubbles, there is refrigerant leak
		Check for signs of oil leak in the pipe	The fluid leak should be corrected as soon as possible. Complete the refrigerant gas and oil load of the compressor, if necessary

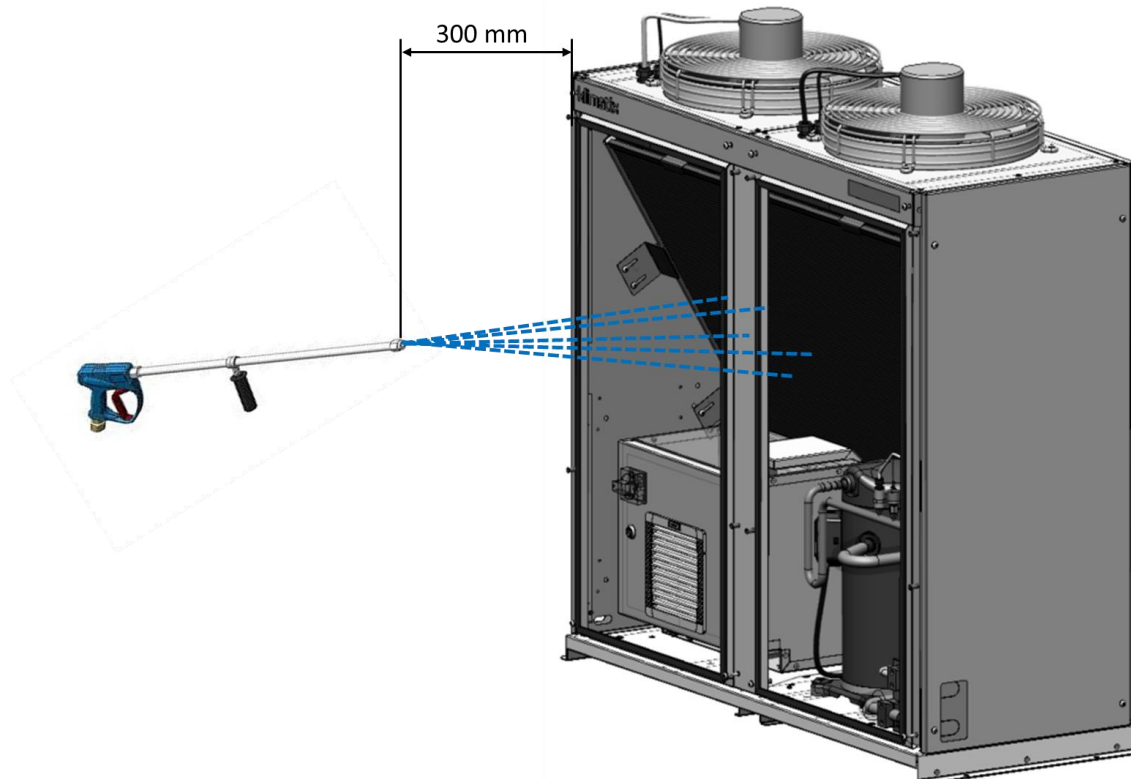
Preventive Maintenance – Electrical			
Item	Frequency	Procedure	Notes
Electrical Panel	Every six months	Check for any loose components of the electrical panel	Retighten the terminals or bolts
		Measure the fan currents and compare them to the current specified in the equipment checklist	Motor operation should be checked when currents are above specified
Engine switch box	Every six months	Check to see if the junction box terminals of the engines are coming loose	Retighten the terminals or bolts
Temperature sensors	Monthly	Check the calibration of the temperature sensors	Compare the outlet and return air temperatures with a calibrated standard thermometer
Clean the electrical panel	Every six months	Clean inside the electrical panel	The electrical panel should be clean, without dust and fillings
Terminal strips	Every six months	Check to see if all the electric cables are connected to their respective terminals	There should be no loose wires or "jumpers" inside the electrical panel
Electrical Resistance	Quarterly	Check fastening, cleaning and tightening the terminals	Carry out cleaning and retighten terminals and bolts
		Measure the current of phases R, S and T	Compare the currents indicated in the electrical data of the equipment
		Check the voltage variation between phases	It should not exceed 10%

Fan	Monthly	Measure the current of phases R, S and T	Compare the currents indicated in the electrical data of the equipment
		Check the voltage variation between phases	It should not exceed 10%
Compressor	Monthly	Measure the current of phases R, S and T	Compare the currents indicated in the electrical data of the equipment
		Check the voltage variation between phases	It should not exceed 10%

6.4. Cleaning procedure of the microchannel condenser

It is extremely important for the cleaning of the microchannel condenser to be carried out periodically. This process, in addition to extending the life of the condenser, prevents equipment breakdowns from occurring due to obstructions caused by dirt and dust. The following precautions should be taken when cleaning the condenser:

- I. Open the door where the fan is installed and which gives access to the condenser;
- II. Use a high pressure washer with spray nozzle to wash the condensers with clean water;
- III. The jet of water from the spray nozzle should be in the form of a fan and directed perpendicular to the surface of the condenser to prevent the fins from being dented.
- IV. The jet of water cannot be applied on a direct point of the surface of the condenser;
- V. Keep a distance of 300 mm between the spray nozzle and the surface of the condenser



7. Technical Services

In addition to quality products, Mecalor offers its customers customized service through a specialized team up to date with the technological innovations and prepared to suggest suitable solutions for each issue. Contact the technical support team for further information.

7.1. Start-Up

Despite being a very simple procedure, it is important for the customer to contact Mecalor in order for the installation conditions to be checked and for the start-up to be authorized.

7.2. Preventive Maintenance Agreements

With aim to prevent failures, Mecalor offers customized preventive maintenance agreements. The agreements consist of the periodic visits of technicians who check, gauge and test the condition and performance of the equipments.

The Mecalor Preventive Maintenance Plan ensures a longer service life of the equipment and reduces the possibility of shutdowns due to failure.

7.3. Retrofitting (Reform of Equipments)

In many cases an equipment with outdated technology may be technologically updated through the application of modern techniques developed by Mecalor.

Mecalor Retrofitting Service consists of:

- Study of the current conditions of the equipment, evaluating whether retrofitting is worthwhile;
- Study of the adaptability of the equipment to the new technology;
- Execution of the scope;
- Try-out;
- Project Documentation.

7.4. Training

Mecalor conducts specific training to meet the most diverse preparation needs of the maintenance and operation teams. The trainings are provided according to the specific needs of each customer.

8. Disposal and the environment

The CPM should be disposed at the end of its service life so as to reduce any negative impact on the environment. The following are recommended for such:

- Dismount the equipment according to all the safety recommendations applicable in the execution of the maintenance services.
- Reuse its components by their application in other machines or in the production process, for example: reuse the CP fans, or their electric engines, the frequency inverter, etc.

- Separate materials that can be recycled and send them for recycling; for example: recycle aluminum, stainless steel, bronze, plastics of the CP.

- Separate non-reusable materials and components and dispose of them, observing the effective legal recommendations. Special attention should be given to batteries, lubricant oil and cooling gas.

In case cooling fluid leakage is detected in the equipment, the maintenance of the leak should be requested urgently.

Any mechanical or electric component that is replaced due to failure or upgrade should be disposed according to the recommendations and effective rules.

9. Warranty Term

1. OBJECT AND VALIDITY

- 1.1. The warranty includes repair and/or replacement of any faulty component, as long as it is due to fabrication defect.
- 1.2. The validity of the warranty of the equipments manufactured by Mecalor is 365 days counted from the date of issuance of the sales invoice of the product, of which there are 90 consecutive days of legal warranty and 275 consecutive days of complementary warranty, the latter provided by Mecalor as an additional benefit to the customer.
- 1.3. In case the equipment is purchased with extended warranty, this should be recorded in the official business proposal issued by Mecalor and it exclusively consists of the increase of the complementary warranty, being that the legal warranty will always be 90 consecutive days.
- 1.4. This warranty term is valid only for products sold and used in Brazil.

2. WARRANTY VALIDATION

- 2.1. The customer should inform Mecalor technical support in writing immediately after identification of the possible manufacturing defect.
- 2.2. Once the information of the possible defect is received, the technical support team of Mecalor should evaluate the possible causes and issue a technical opinion.
- 2.3. In case the manufacturing defect is confirmed, Mecalor must provide the replacement or repair of the defective component within the shortest period of time possible.
- 2.4. The Warranty period offered by Mecalor covers the costs for repair and replacement of parts with manufacturing defect, including expenses with the transport of technicians and tools, equipment freight or expenses with shipping of parts and components to the billing address of the equipment.
- 2.5. It is mandatory for the customer to return the defective components to Mecalor to confirm the failure at the supplier (if applicable), under the penalty of bearing the costs involved.
- 2.6. The warranty establishes the execution of services during business hours, with additional charge for extra hours of services provided outside this period and transport fee for services performed on the installations of third parties.

3. LOSS OF WARRANTY

- 3.1. The warranty will lose its validity in case it is confirmed through technical evaluation that the defect is as a result of failures during transport, installation, startup, maintenance or improper use by the customer or third parties.
- 3.2. Start-up of the equipment can only be performed by the customer with the written authorization form the technical support of Mecalor or with the presence of our authorized technicians, when this optional service is part of the Mecalor scope of supply, under the penalty of loss of warranty.
- 3.3. Incompatibility caused by products purchased from third parties and installed with Mecalor products or application in noncompliance with the information established in our technical and business proposal.
- 3.4. The warranty will lose its validity if the contracting party fails to comply with purchase and sales agreement, even if the agreement is tacit, including regarding the compliance of the equipment purchased.


4. GENERAL EXCLUSIONS AND LIMITATIONS

- 4.1. Once Mecalor provides technical support in warranty within the limits established by law and by the good service practices, we shall not be held responsible for direct or indirect costs or loss of revenue eventually supported by the customer as a result of eventual equipment defect.
- 4.2. The customer will be responsible for the expenses with eventual shipping of the equipment to the factory or to any authorized technical representative of Mecalor to carry out technical support.
- 4.3. The replacement of components due to use or natural wear of the equipment, such as seals, sensors, engines, contactors, circuit breakers, among others.
- 4.4. Normal operating adjustments, maintenance and application of the equipment, such as sending of technicians to check the safety alarms, parameterization and technical assistance to optimize the performance of the product.

Customer	Serial number	Warranty period

10. Attachments

The documents that complement this manual are described below and may be different from standardized documents. In case the nomenclature of the CPM or UR has a special character, consult the specific documentation applied to the equipment.

	INFORMATION	Consult the special documents in case the nomenclature of the CPM or UR has a special character as described in the <i>nomenclature</i> section in the <i>technical characteristics</i> chapter of this manual.
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Complementary documents of this manual:

1. Engineering design, containing:
 - Dimensional;
 - Electrical Data;
 - Layout of the electrical panel;
 - Wiring diagram;
 - Flowchart;
 - List of Components.
2. Fan Operation Curve;
3. Equipment setup.
4. Modbus and SNMP addressing table