

SERVICE MANUAL

Condenserless water chillers.



HE

0011 ÷ 0121



Section B INSTALLATION, USE AND MAINTENANCE

Index	page
Installation	43
Hydraulic connections	44
Coolant connections	45
Dimensioning the coolant lines	46
Functional electrical connections	46
HE electrical diagram single phase	48
HE electrical diagram three phase	49
Optional electrical connections	50
Checking and starting the unit	52
Setting the operating parameters	54
Displaying alarms	56
Operating characteristics	56
Maintenance	58
Operating instructions	59



IMPORTANT

Before installation, pay scrupulous attention to the warnings below.

- read this manual carefully;
- all work should be carried out according to current legislation in the country concerned;
- respect the safety distance between the appliance and other equipment or structures. Ensure adequate space to access the unit for maintenance and/or service;
- power supply: the section of the electric cables must be adequate for the power of the unit and the supply voltage must correspond with that indicated for the respective appliances;
- all appliances must be earthed according to current legislation in the country concerned;
- to ensure correct operation, carry out the hydraulic connections according to the instructions;
- add glycol to the hydraulic circuit if the unit is not used during the winter or if the circuit is not drained;
- guarantee validity: the guarantee is invalidated if the above instructions are not respected or the unit is started up without the presence of authorised personnel (where specified in the supply contract) who should draw up a start-up report.
- handle the unit with extreme care (see weight distribution table on page 35). Avoid damage;
- the documentation provided with the unit must be consigned to the owner who should keep it carefully for consultation in the event of future maintenance or service.

CHECKING THE UNIT FOR DAMAGE

When the appliance is delivered by the carrier, check that the packaging and unit itself are complete and undamaged. In the event of damage or missing components, indicate this on the delivery note.

Send in a formal claim to the After Sales Service by fax or registered letter within eight days of receipt.

CHOICE OF INSTALLATION SITE

Before installing the unit, agree the site with the customer, paying particular attention to the following points:

- check that the surface on which the unit is to rest is adequate to support the weight;
- respect the safety distance between the unit and other equipment or structures to guarantee sufficient space for maintenance.

INSTALLING THE UNIT

Before handling the unit, always check the lifting capacity of the equipment used, respecting the indications on the packaging.

To move the machine in a horizontal direction, make appropriate use of lift trucks or similar, paying attention to the weight distribution of the units;

When positioning the unit, make sure it is level, adjusting the feet as necessary (screw adjustment in models 0071 to 0121). Check there is easy access to hydraulic and electrical components.

HYDRAULIC CONNECTIONS

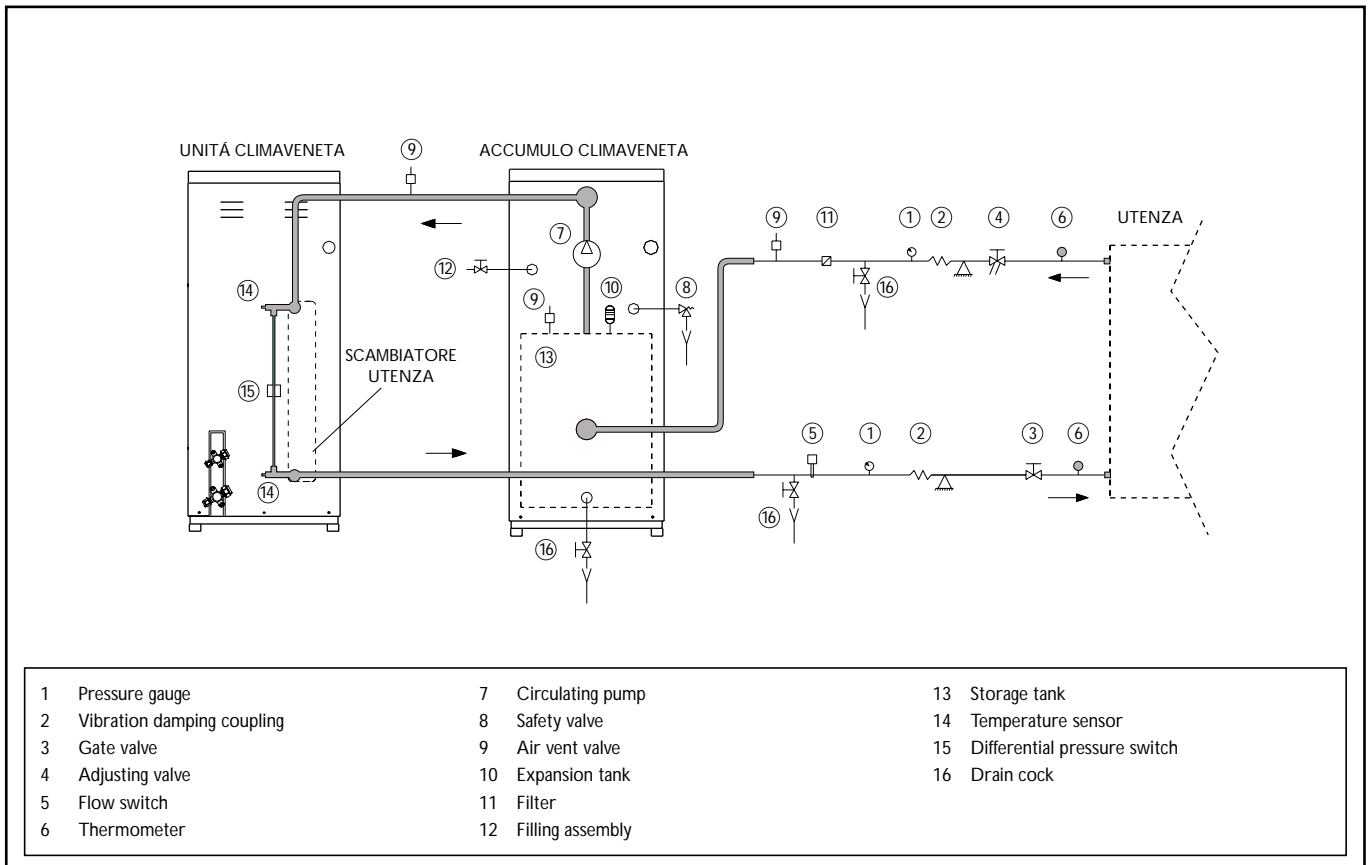
You are recommended to install the following instruments on the evaporator water circuit:

1. Two pressure gauges with appropriate scale (on inlet and outlet)
2. Two vibration damping couplings (on inlet and outlet)
3. Two gate valves (normal on inlet, adjusting on outlet)
4. One flow switch (on inlet)
5. Two thermometers (on inlet and outlet)
6. One inlet filter positioned as close as possible to the evaporator
7. Air vent valves

The water flow rate to the refrigerating unit must be within the range of values shown on page 37. The water flow rate must be kept constant during operation.

The water content of the system must be such as to avoid unbalanced operation of the chilling circuits. Refer to the values shown on page 37. If there are two units on the same water circuit, the minimum content of the system will be equal to the sum of the minimum content of the individual units.

EXAMPLE OF CONNECTION WITH PUMPING UNIT AND STORAGE TANK

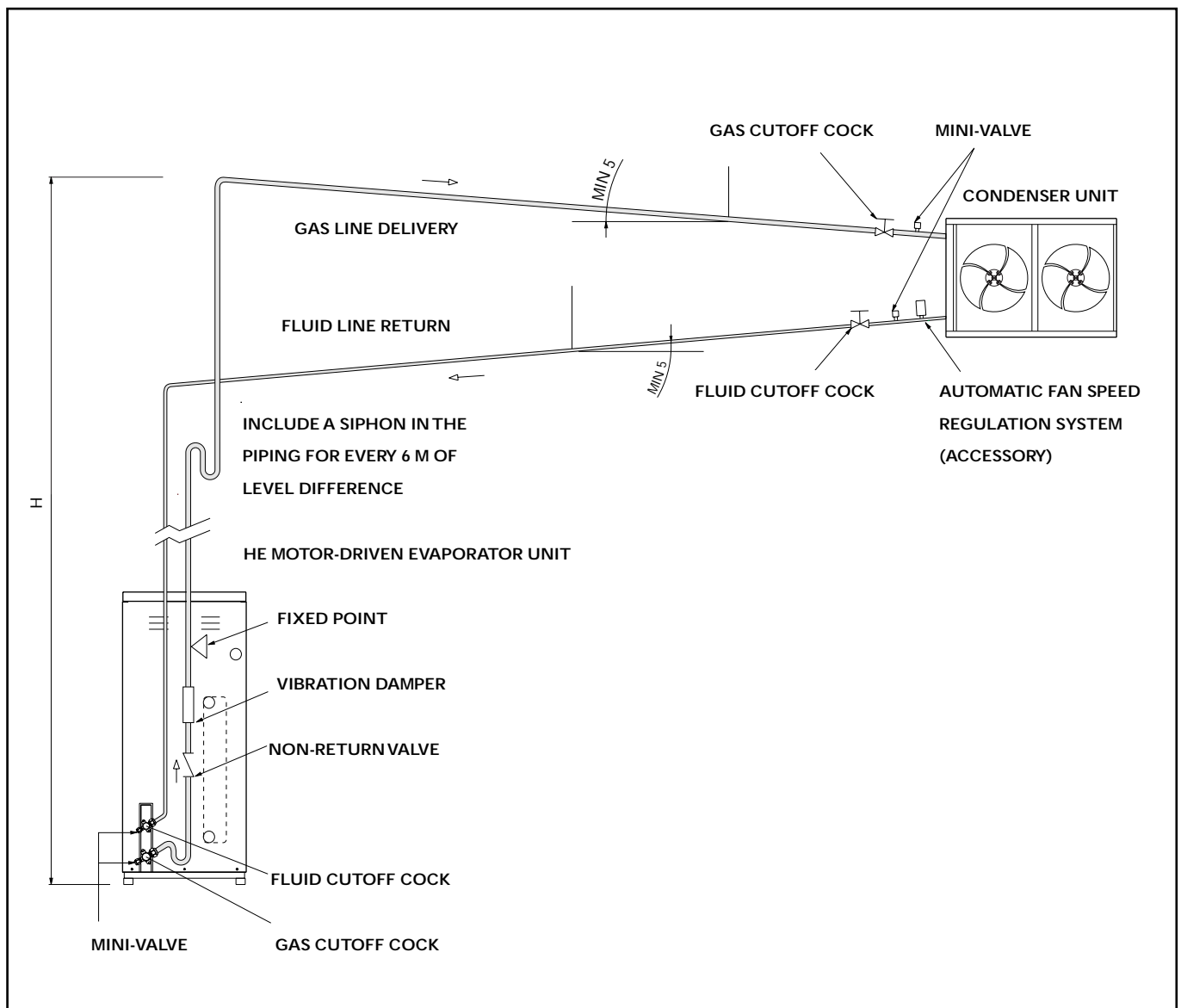


If discharge heads greater than those obtained by a pumping unit and storage tank are required, an additional circulating pump should be installed on the machine.

IMPORTANT

Before installation, pay scrupulous attention to the warnings below.

- use copper tubing suitable for coolant;
- before installing the remote condenser, read the installation instructions supplied with the unit;
- when installing piping, refer to the diagram;
- respect the pipe diameters given in the following table according to the distance between the motor-driven evaporator and the remote condenser (the maximum distances indicated are expressed in metres equivalent. When calculating the piping, all pressure drops must therefore be subtracted);
- where the difference in level is greater than or a multiple of 6 m, include a siphon on the gas line between the motor-driven evaporator and the remote condenser;
- the connection between the two units must be carried out to a high standard (gas and fluid-tight connections, clean piping, exhaust and check the seal of the circuit);
- the fan and remote condenser electrical connections must be carried out in accordance with current legislation;
- guarantee validity: the guarantee is invalidated if the above instructions are not respected or the unit is started up without the presence of authorised personnel (where specified in the supply contract) who should draw up a start-up report



DIMENSIONING THE COOLANT LINES

EQUIVALENT LENGTH, 90° CURVE AND COMPLETE SIPHON

Pipe diameter	Øi / Øe	8/10	10/12	14/16	16/18	20/22	26/28	33/35	39/42
90° curve	m eq.	0.40	0.42	0.48	0.50	0.60	0.80	1.00	1.20
Siphon	m eq.	1.60	1.68	1.92	2.00	2.40	3.20	4.00	4.80

DIMENSIONING THE COOLANT LINES ACCORDING TO EQUIVALENT LENGTH

Model		0011	0021	0025	0031	0041	0051	0061	0071	0091	0101	0121
Line type	0-10 m eq.											
Delivery	Ø mm	12	12	16	16	18	18	18	22	22	22	22
Fluid	Ø mm	10	10	10	10	12	12	12	16	16	18	18
Line type	10-20 m eq.											
Delivery	Ø mm	16	16	16	16	18	18	18	22	22	28	28
Fluid	Ø mm	10	10	10	10	12	12	12	16	16	18	18
Line type	20-30 m eq.											
Delivery	Ø mm	-	-	16	16	18	22	22	28	28	28	28
Fluid	Ø mm	-	-	12	12	12	12	16	16	16	18	18
Line type	30-40 m eq.											
Delivery	Ø mm	-	-	-	18	22	22	22	28	28	28	28
Fluid	Ø mm	-	-	-	12	12	16	16	16	16	18	18
Line type	40-50 m eq.											
Delivery	Ø mm	-	-	-	-	22	22	22	28	28	35	35
Fluid	Ø mm	-	-	-	-	16	16	16	16	16	18	18

R22 CONTENT PER LINEAR METRE OF PIPING

Pipe diameter		10	12	16	18	22	28	35	42
Line type									
Delivery	gr/m	-	19	33	43,5	70	115	-	-
Fluid	gr/m	63	96	170	222	347	-	-	-

N.B.: Attention: the addition of gas implies an addition of lubrication oil corresponding to 10% of weight.

FUNCTIONAL ELECTRICAL CONNECTIONS

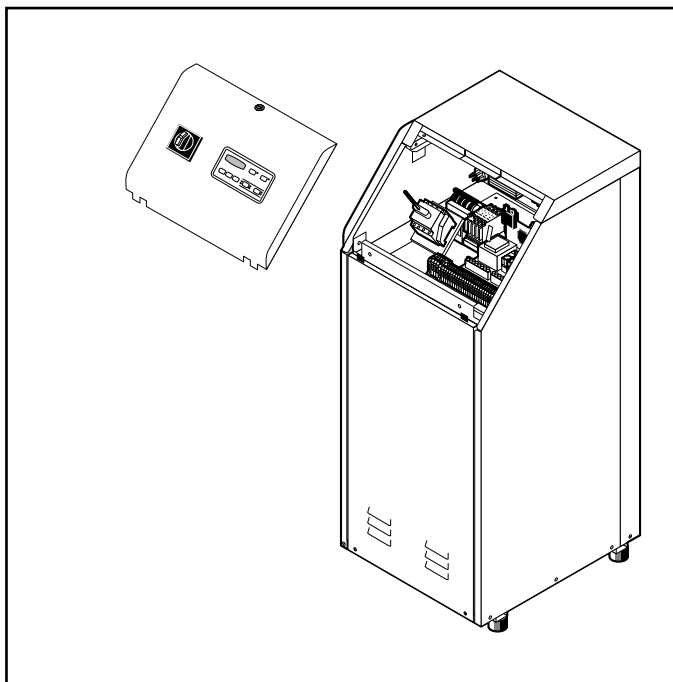
IMPORTANT:

- Power up the unit only when both hydraulic and electrical installation has been completed;
- Carry out all electrical connections as laid down by the relevant regulations current in the destination country;
- Comply with the instructions on live, neutral and earth lead connections;
- Ensure that the power line upstream of the unit is equipped with adequate protection against short-circuits to cut the system off from other power users;
- Voltage values must never exceed tolerances of $\pm 10\%$ of the unit's rated supply voltage.
If these parameters are exceeded, contact your local electricity company.

ACCESSING THE SWITCHBOARD

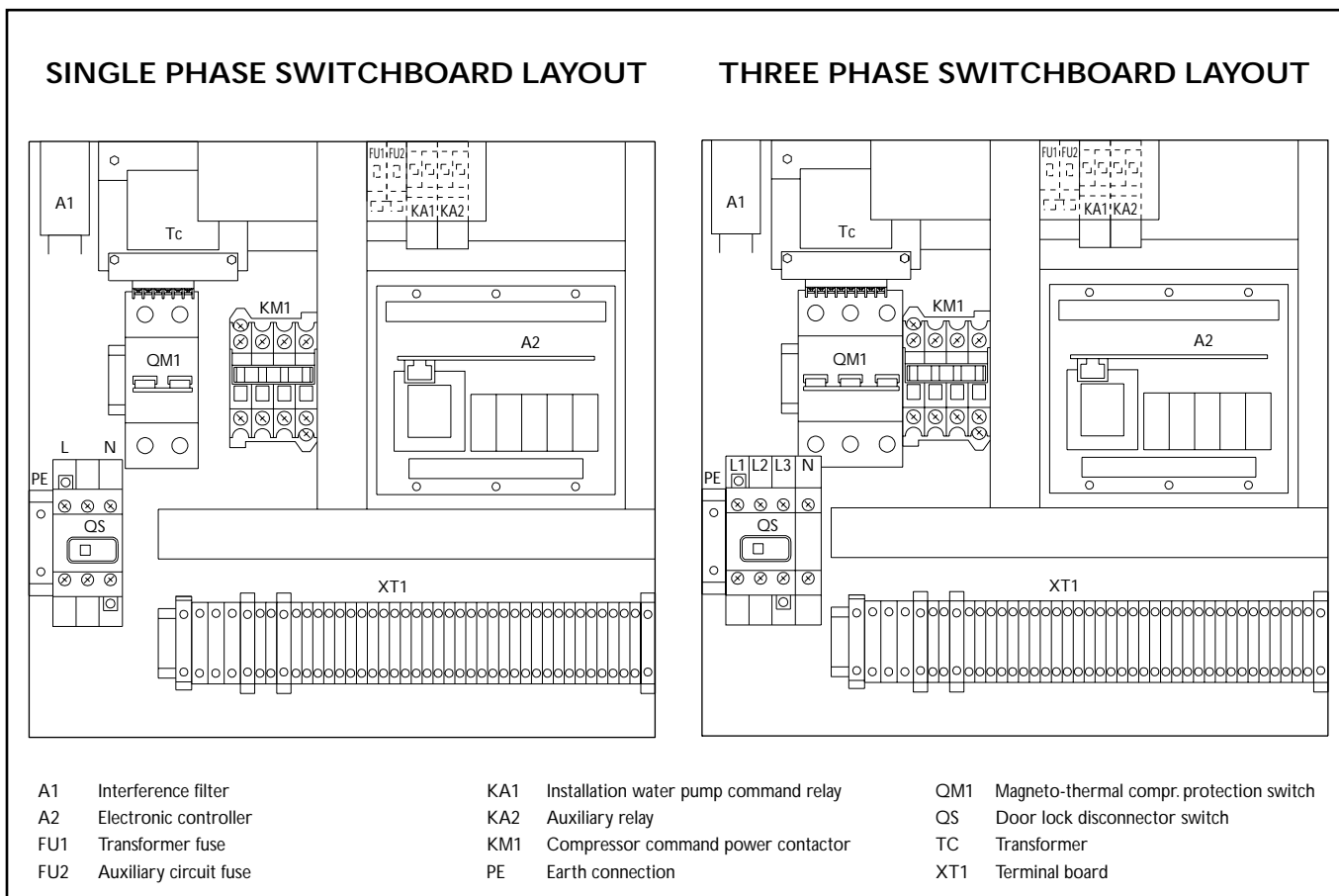
To access the electrical switchboard, proceed as follows:

- position the disconnecter switch to OFF;
- rotate the screw at the top of the panel through a half turn;
- lift the panel forwards.



POWER CONNECTIONS

For functional connection of the unit, bring the power supply cable to the electrical switchboard inside the unit and connect it to the disconnecter switch QS, respecting the live (L), neutral (N) and earth (PE) connections in the single phase version (230/1/50+N); or the three phases (L1/L2/L3), neutral (N) and earth (PE) in the case of the three-phase version (400/3/50+N).



OPTIONAL ELECTRICAL CONNECTIONS

All terminals referred to in the explanations below are part of the terminal strip in the electrical switchboard indicated with the abbreviation XTI in the diagrams.

REMOTE START-UP AND SHUT-DOWN

If required, a remote start-up and shut-down device may be provided by connecting a switch to terminals 15 and 16 of the electrical switchboard. If you wish to programme special times of operation, you can connect a daily or weekly timer to terminals 15 and 16.

IMPORTANT:

- If the unit fails to start up and the electrical switchboard control displays alarm E00, check the contact between terminals 15 and 16. If the above mentioned remote start-up and shut-down functions are not utilised, inspect the jumper between terminals 15 and 16.

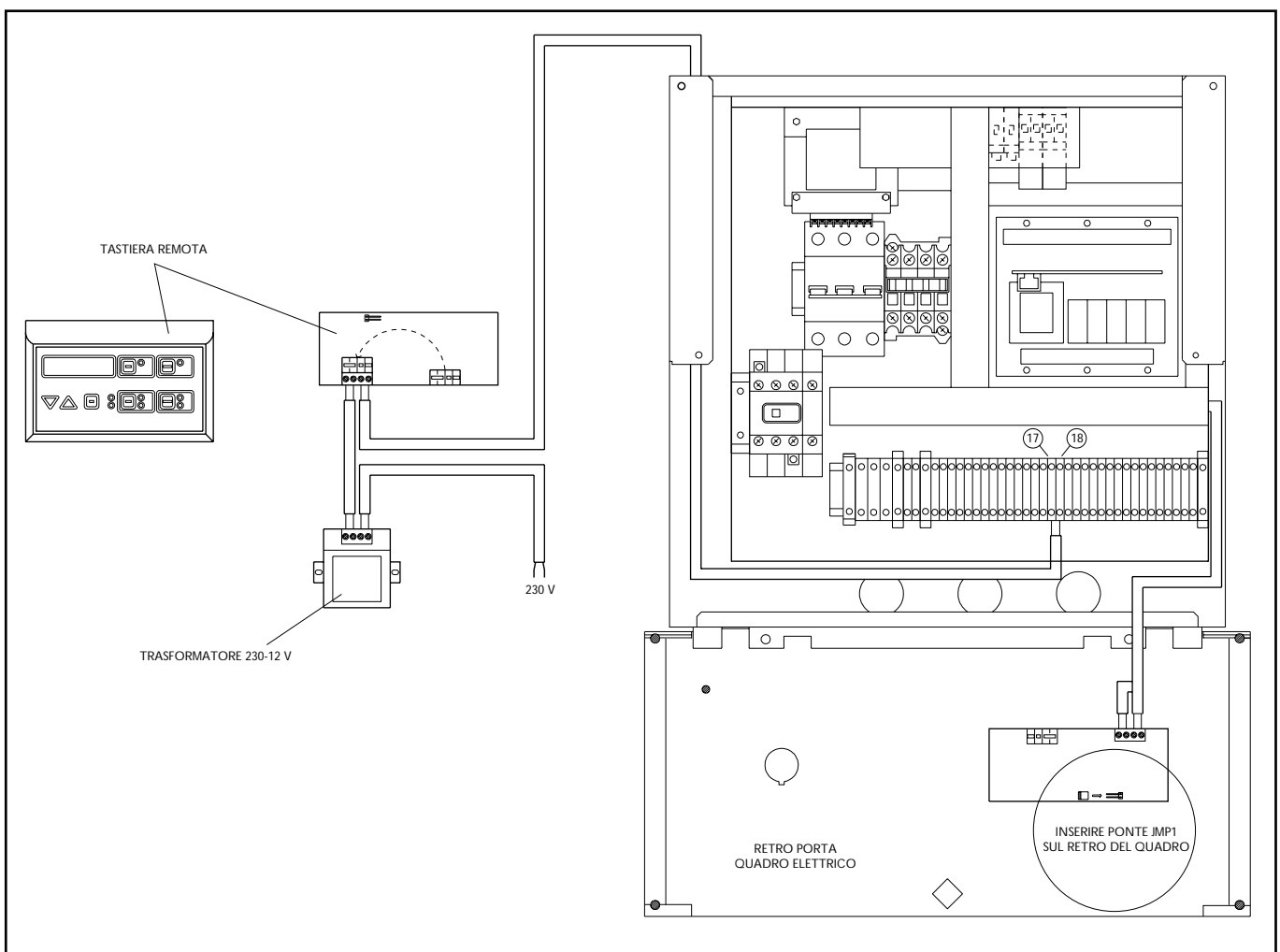
REMOTE ALARM

If you need a remote display of machine shut-down due to malfunction, a visual or acoustic alarm signalling device may be connected to terminals 13 and 14 (output from terminals 13 and 14: 230V - 50 Hz - 1A max. applicable load).

REMOTE KEYBOARD KIT

The remote keyboard kit allows you to check all unit functions and access the electronic board parameters at a considerable distance from the unit.

The kit consists of a remote control module and transformer.



To install, proceed as follows:

- Turn off power (using the disconnecter switch QS) then access the inside of the switchboard;
- Remove the jumper between terminals 17 and 18;
- Connect the remote control module to terminals 17 and 18 of terminal strip XTI:
terminal 17 to the IN terminal of the module
terminal 18 to the OUT terminal of the module
- Connect the transformer supplied with the control module to terminals 12 - 12V;
- Insert jumper JMP1 into the rear of the unit keyboard.

IMPORTANT:

- To prevent disturbances due to magnetic fields you are recommended to use screened cable;
- The cable must not be more than 100m long.

PERSONAL COMPUTER INTERFACE

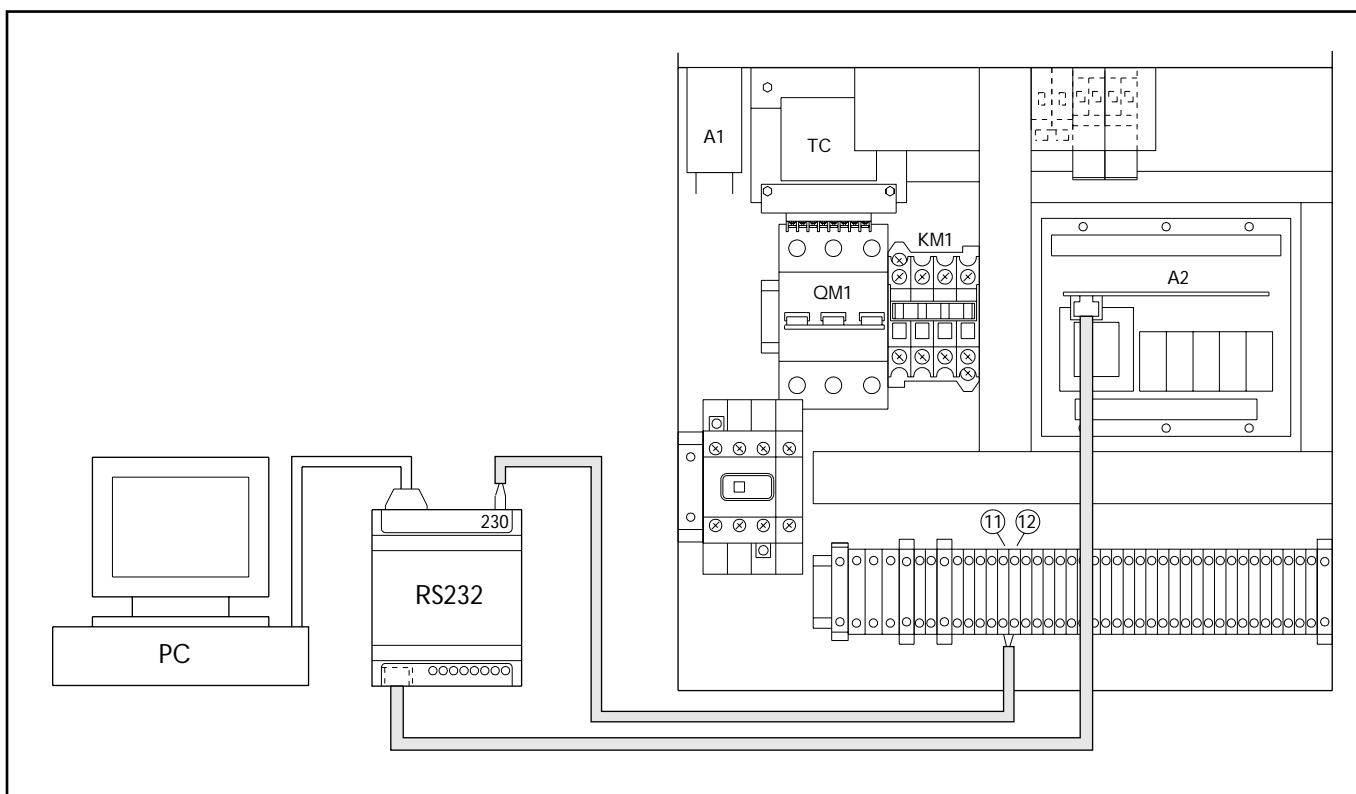
The personal computer interface kit allows you to connect a normal computer to the electronic board. This allows you to monitor correct operation of the unit and to redefine board parameters.

The kit comprises:

- one RS232 module
- one 8-pin connection cable
- one RS232 module power supply cable

To interface computer and electronic board, proceed as follows:

1. Access the interior of the electrical switchboard
2. Insert one end of the 8-pin cable into the connector on the switchboard;
3. Connect the other end to the RS232 module connector;
4. Use the serial cable (not supplied in the kit) to interface the RS232 serial module with the computer (serial port COM1);
5. Connect the RS232 module power supply cable to terminals 11 and 12 on the same module and to terminals 11 and 12 on the electrical switchboard.



CHECKING AND STARTING THE UNIT

IMPORTANT:

- Before starting the unit, check it as indicated in the relevant paragraph;
- The technical support centre (if its presence is specified in the sale contract) will not start up the machine if the installer has not carried out all the checks and inspections described below;
- Power up the unit only after completing the checks.

CHECKING THE COOLANT CIRCUIT

- Check there are no gas leaks at the junctions between the unit and the remote condenser;
- Check that the cocks on the motor-driven evaporator are open,

CHECKING THE HYDRAULIC CIRCUIT

- Fill the hydraulic circuit and bring it up to pressure;
- Ensure there is no air in the circuit; if necessary bleed air using the air vent valves;
- Ensure that the temperature of the fluid does not exceed the unit operating range;
- Check operation of unit circulating pump by turning on separately;
- Ensure all gate valves are open;
- Check water flow to the plate heat exchangers.

CHECKING THE ELECTRICAL CIRCUIT

- Voltage should be within a tolerance of 10% of the unit's rated supply voltage: 230 \pm 10% / 400 \pm 10%;
- Inspect power supply lead connections;
- Inspect earthing connections;
- Inspect the connections of the safety devices installed in the hydraulic circuit;
- Inspect remote control and remote keyboard kit connections (if installed);
- Check that the condenser fans are connected to the unit switchboard or the mains power supply.

IMPORTANT:

- Initial start-up must take place using the standard settings; you should change the operating set point values only after having tested the unit;
- Before starting, power up the unit for at least eight hours with the disconnect switch in the ON position in order to allow the compressor sump oil to heat up.

STARTING THE UNIT

Close the door lock disconnect switch by turning the knob to the ON position.

Turn the unit on using the ON/OFF button on the keyboard.

Choose the chill/heat mode of operation with the MODE key on the keyboard.

If a pressure regulating valve is fitted (accessory), check that the capillary tube is connected correctly and bled (see diagram on page 17). Open the valve completely (release the spring) via the adjusting pin. Start up the unit in summer mode.

With stable flow conditions, close the valve (compress the spring) via the adjusting pin until the condensing pressure equals 12.5 bars.

Turn the unit off and check that the flow of water is interrupted by closure of the valve. If this is not the case, adjust the valve to a slightly higher pressure.

Operating limits: condensing pressure: 12 bars min - 23 bars max.

IMPORTANT:

If the following should be displayed during this initial phase, proceed as follows:

- E00 check the connections to terminals 15 and 16
- E41 check water flow rate and flow meter connection (flow meter not included)

CHECKING THE COMPRESSOR (IN OPERATION)

Check that the noise level of the compressor does not exceed the normal value and that compressor output pressure is greater than input pressure. If these conditions are not respected check the sequence of power supply lead phase connections L1-L2-L3 (incorrect rotation direction).

Ensure that the voltage value is within the established limits and that the unbalance between the three phases (three-phase voltage) does not exceed 3%.

Check that compressor current absorption is lower than the values shown in the Electrical Data table on page 2.

CHECKING THE HYDRAULIC CIRCUIT

Check the water flow rate through the difference in temperature between plate exchanger input and output water:

$$Q \text{ [l/h]} = (\text{kW} \times 860) / \Delta T$$

Q : water flow rate

kW : output power with reference to unit operating conditions

ΔT : difference in temperature between plate exchanger input and output water

$\Delta T < 5^\circ\text{C}$ implies a flow rate higher than the rated value

$\Delta T > 5^\circ\text{C}$ implies a flow rate lower than the rated value

Units are designed to have a ΔT of 5°C for proper operation.

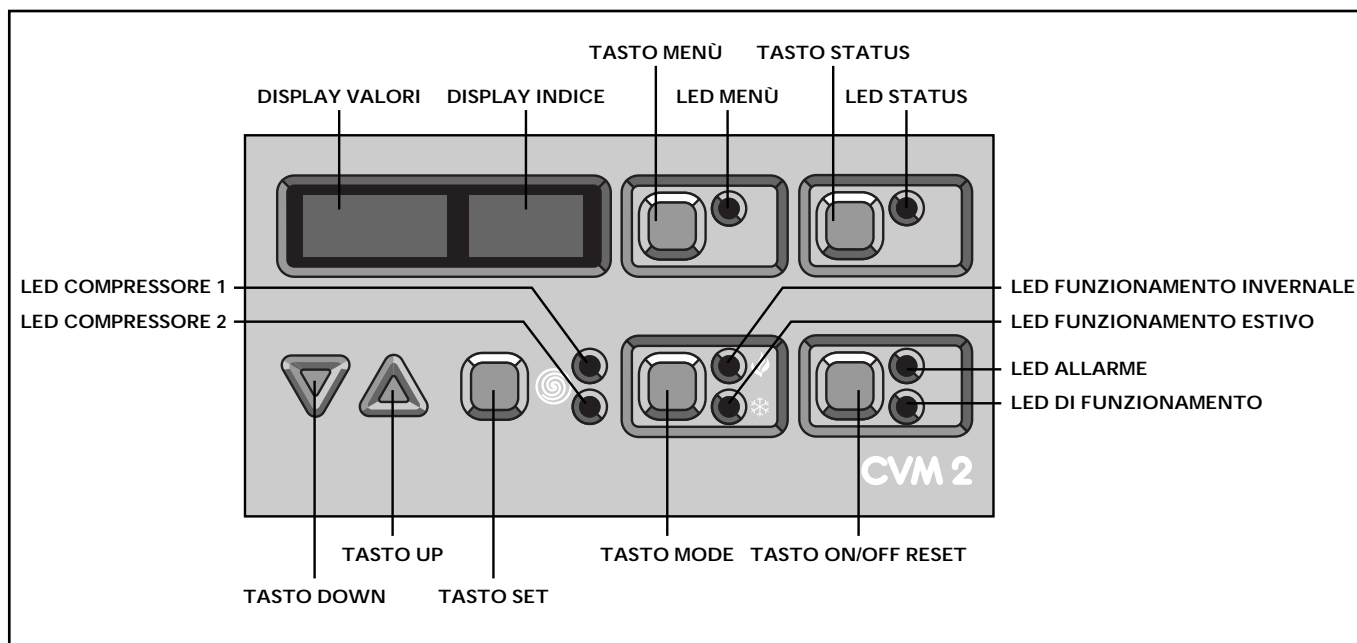
FILLING OUT THE MACHINE LOGBOOK

When you have completed all tests fill out the machine logbook with all the required information together with the warranty which must be sent to our After-Sales Service within **7 days** of commissioning the unit. Failure to compile the machine logbook and warranty **invalidates the warranty immediately**.

SETTING THE OPERATING PARAMETERS

IMPORTANT:

- The minimum Set Point value is 12°C for chill.
- The maximum Set Point value is 20°C for chill.
- The frost protection Set Point is factory-set to 3°C. To change this preset value apply to a specialist maintenance company.



DEFINING THE SET POINT

The Set Point as set in the factory is: 13.5° for chill.

To change the Set Point proceed as follows:

- Press the ON/OFF key;
- Press the MENU key;

The following values appear on the display: 13.5 - 02;

- Press SET: the values display begins to flash (parameter "02");
- To adjust the heating Set Point press the UP/DOWN keys, select parameter "03" and press SET; as the Values Display value begins to flash, programme the new Set Point with the UP/DOWN keys.
- Press SET followed by MENU.

The set up procedure is complete.

LIST OF ACCESSIBLE PARAMETERS

Parameter	Description	Unit of measure	Factory setting
2	Summer Set Point	°C	13.5
92	Password	units	0

SETTING THE SERVICE PARAMETERS

To check or vary the parameters set on the microprocessor, a higher level must be accessed by entering a password. To do this, apply to a specialist maintenance company.

The instructions are as follows:

- Press ON/OFF
- Press MENU

The following values are displayed: 13.5 - 02

- Press SET: the value on the index display begins to flash (parameter "02")
- Press UP/DOWN, choose parameter "92" and press SET. As the values display begins to flash, set the password using the UP/DOWN keys
- Press SET
- Press the UP/DOWN keys to display all the parameters
- Press SET to change a parameter setting
- Set the new value using the UP/DOWN keys, and press SET to go to the next parameter or press MENU to exit.

IMPORTANT:

- Press SET to store the new value
- When both displays blink, the setting is incorrect and has not been stored
- Press MENU to exit from the list of parameters

DISPLAYING OPERATING STATUS

To display unit operating status, proceed as follows:

- Press ON/OFF
- Press STATUS
- Press the UP/DOWN keys to choose the parameter that matches the unit operation you want to display.

MEANING OF STATUS CODES			
Index display	Component	Values display	Meaning
01	Compressor	01	In operation
		04	Timing
		06	Inactive
02	Compressor	No. hours / 100	Hours of operation since last reset
04	Defrosting	06	Inactive
40	BT1 temp. sensor	value	Value in tenths of a degree
	Plate exchanger input	EER	Sensor error
41	Remote On/Off	On or Off	Remote On/Off input status
42	BT2 frost protection sensor plate exchanger output	value	Value in tenths of a degree
		EER	Sensor error
46	Circulating pump	01	Active
		06	Inactive
47	Circulating pump	No. hours / 100	Total number of hours of operation
48	Frost protection heater	04	Heater inactive

DISPLAYING ALARMS

IMPORTANT:

- Before resetting the unit, remove the cause of the malfunction; failure to do so will invalidate the warranty immediately
- If the same malfunction occurs again, call the specialist maintenance company.

Unit operation is controlled by a microprocessor that also triggers a series of alarms. When an alarm is triggered, a code will flash on the keyboard values display.

The table below shows the various error conditions indicated by the alarm.

LIST OF ALARM CODES			
Code	Malfunction	Cause	Reset
E00	Remote off	Check connection between terminals 15 and 16	Automatic
E01	High pressure alarm	Check air flow at condenser Check that the pressure side chiller circuit is not obstructed (cocks, coolant lines and remote condenser)	Manual
E02	Low pressure alarm	Check fluid flow rate to heat exchanger Check gas content (*)	Automatic
E03	Compress. 1 thermal relay light	Possible compressor breakdown (*)	Manual
E05	Frost protection alarm	Check water flow rate to plate heat exchanger Check Set Point setting (parameters: 2, 58, 59) (*)	Manual
E06	BT2 sensor malfunction	Check connector connection terminals 29 and 30 (*) Sensor malfunction	Automatic
E040	BT1 sensor malfunction	Check connector connection terminals 27 and 28 (*) Sensor malfunction	Automatic
E041	Differential pressure switch Optional flow switch	Irregular water circuit flow rate (installation side or well side) and/or air bubbles present. Possible flow switch breakdown	Automatic

(*) Contact a specialist maintenance company

OPERATING CHARACTERISTICS

START-UP AND SHUT-DOWN

Start up and shut down the unit using the QS door lock disconnect switch.

This supplies power to the compressor sump heater and the electronic board in stand-by.

To start the unit set the required mode on the keyboard (chill) with the ON/OFF and MODE keys. Compressor operation is regulated by the temperature of water coming from the plate exchanger.

For example: Chill Set Point (factory-set) = 13.5°C, hysteresis = +- 1.5°C

Compressor starts if water temperature exceeds 13.5°C + 1.5°C (15°C)

Compressor switches off if water temperature is below 13.5°C - 1.5°C (12°C)

When you restore power to the unit after a brief interruption, the mode set is retained in the memory.

COMPRESSOR START-UP DELAY

To prevent compressor restarts too close to one another, a special function has been provided to prevent the compressor being restarted unless a given time has elapsed since the last switch-off. The function also defines a maximum number of restarts possible in one hour.

CIRCULATING PUMP

The electronic board has only one output to control the circulating pump. This is activated 60 seconds before compressor start-up and is turned off 60 seconds after compressor shut-down.

After the first 30 seconds of pump operation when the water flow rate is steady, the water flow rate alarm functions are enabled (differential pressure switch and flow switch if installed).

FROST PROTECTION ALARM

To prevent damage to the plate exchanger due to the internal formation of ice, the microprocessor shuts down the compressor if the temperature measured by the exchanger outlet temperature sensor is less than +3°C.

This frost protection set point temperature can only be changed by a specialist company and only after having checked that the water circuit contains an anti-freeze solution.

WATER FLOW RATE ALARM

The microprocessor includes an alarm triggered by water flow rate outside the unit: the flow switch.

This type of safety device may be triggered after the first 30 seconds of pump operation when the water flow rate is steady.

The alarm shuts down the compressor but not the pump which remains active for some time.

To resume normal operation, the alarm contact must be deactivated for at least 5 seconds.

IMPORTANT:

- before carrying out maintenance on the unit, disconnect from the power supply;
- clean the well side water filter regularly to guarantee correct unit operation;
- clean the installation side filter annually to ensure correct unit operation;
- you are recommended to check all unit functions at the start of each season and have the unit checked at least once a year by an authorised service centre.

HYDRAULIC CIRCUIT

When you start up the unit after a period of inactivity, check the pump for correct operation. If the impeller is jammed, release it by removing the screw on the pump head and rotating the impeller with a screwdriver.

Be sure there are no leaks in the water circuit.

Check the water flow rate by measuring the ΔT at exchanger inlet and outlet.

Clean the water filter installed in the water mains.

ELECTRICAL CIRCUIT

Inspect the unit power supply cables.

Check that the connection clamps of power and signal interface cables are tight (this should be done by a specialist maintenance company).

Ensure voltage values are within the values recommended by the manufacturer.

CHECKING FUNCTIONS AND ALARMS (FOR SPECIALIST COMPANY ONLY)

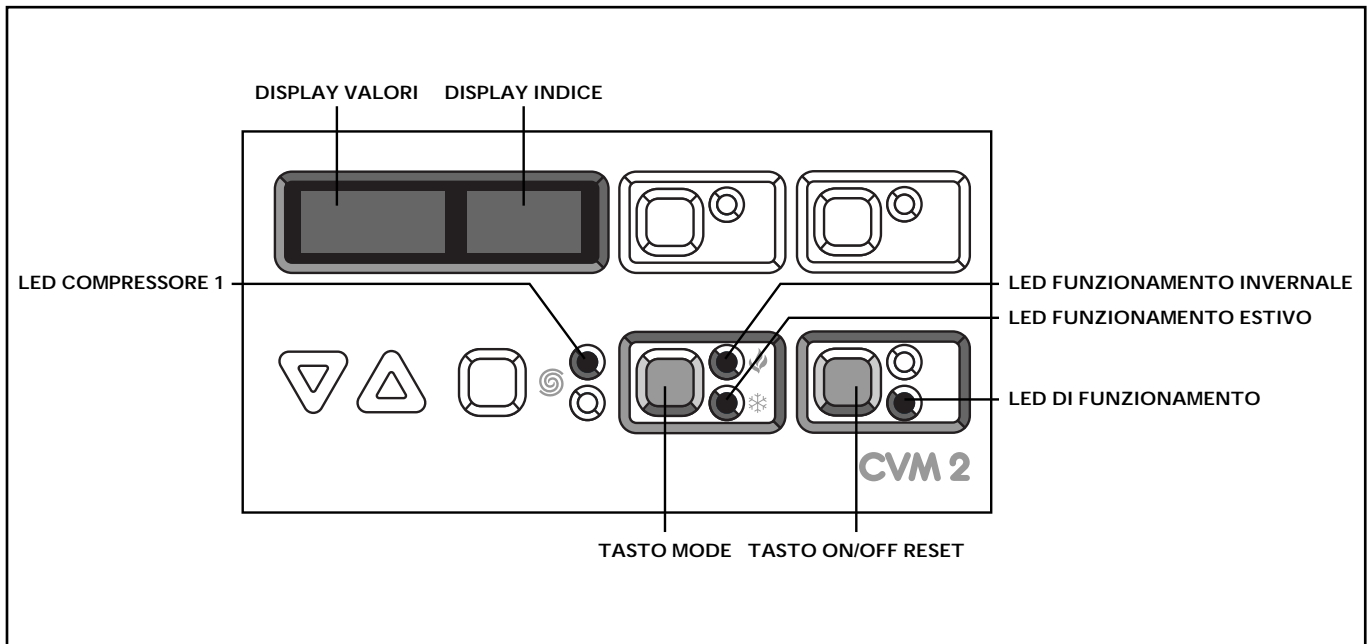
Check that the pressure transducer reading matches the pressure measured by the gauge; if necessary, adjust.

Check that the temperature sensor reading matches the thermometer reading; if necessary, adjust.

Check flow switch operation.

Check operation of the differential pressure and flow switches (if installed) by closing the hydraulic circuit gate valves.

Via the chiller circuit liquid flow indicator light, check that no coolant is flowing in a gaseous state.



STARTING THE UNIT FROM THE QS KEYBOARD

Set the door lock disconnecter switch to ON and leave the unit on for at least eight hours in order to allow the compressor sump oil to heat up.

- Press the ON/OFF key on the keyboard to turn the unit on. The values display shows the temperature of water entering the exchanger.
- Press MODE on the keyboard to choose the chill/heat mode of operation. Compressor 1 LED begins to flash to indicate wait status due to compressor timing. At the end of this phase, the compressor 1 LED will remain on to indicate that the unit has started up and is in operation.
- Press the MODE key once more to change the operating mode. After a new timing phase the unit will change the chill/heat operating mode accordingly.

SWITCHING OFF THE UNIT

- Press the ON/OFF key on the keyboard to set the unit to stand-by status until the next start-up.
- Position the QS disconnecter switch to OFF to deactivate the unit completely.

STARTING THE UNIT BY REMOTE SWITCH

- Set the remote switch to ON
- Switch on the unit with the ON/OFF key on the electrical switchboard keyboard.
- Choose the operating mode by pressing MODE on the keyboard as explained above.
- To turn off, set the remote switch to OFF. The values display will flash the signal E00.
- When the remote switch is turned back to the ON position, the message E00 will appear on the values display along with the water temperature. The unit will start up in the set mode;
- Set the QS disconnecter switch to OFF to deactivate the unit completely.

