

**TECHNICAL HANDBOOK**  
**INSTALLATION**  
**USE**  
**MAINTAINANCE**



**QUASAR** ❄️  
**PULSAR** ❄️

**Single phase Models 021 - 026 - 031**  
**Three-phase Model 041**



**m.a1ch.**



**TONONFORTY**   
the perfect climate

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**1.0 GENERAL INFORMATION**

**CHILLERS** - Quasar  
**HEAT PUMPS** - Pulsar

The Quasar and Pulsar units are both available in 4 models, three single-phase and one threephase.

All the units are fitted with a single sealed Scroll compressor, and are dimensioned for using R22 refrigerant or, on request, R407C.

These units are ideal for either home use or for business premises, with special attention paid to overall size and noise emissions, offering a series of accessories to make installation and maintenance easier.

All the units are supplied complete with wiring and ready for connection to the customer's supply network. Before delivery, each machine is tested when running, checking that all the safety devices work correctly.

The range is divided between coolers (just cooled water) and heat pumps (cooled or heated water).

Available models:

**Quasar:** Water coolers complete with pump and inertial storage.

**Pulsar:** Heat pump complete with pump and inertial storage.

All the units have the following hydraulic devices:

- water circulation pump
- compact system interface module
- water circulation safety flow-limit switch
- expansion tank (except for QUASAR models)
- 3-bar safety valve

Both the versions are supplied completely wired and fitted in a panelled single block.

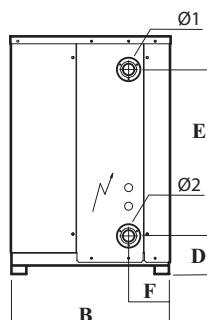
**1.1 FEATURES OF THE MAIN ELEMENT**

- **Compressor** sealed Scroll, primary brand, especially suitable for home air conditioning, able to guarantee high efficiency levels and very low noise and vibration emissions.

- **Condensing coil** with copper pipes mechanically expanded into aluminium fins and galvanised steel heat-exchanger supporting frame. On request, the fins can be supplied in copper or pre-painted aluminium for installation in very aggressive atmospheres.

- **Compact system interface module** with brazed plate evaporator in Aisi 316 stainless steel, immersed in the storage tank. The module is made by a welding process, controlled in each phase, and tested on both the cooling and the water side. This module improves heat exchange efficiency, by reducing heat dispersion.

- **Fan section**, with axial fan with rotating stator blades, each fan has a protection grid for accident prevention in painted galvanised steel.



**WORKING LIMITS**

**Cooling cycle:**  
 Outside air temperature B.S. 10°C÷42°C  
 Cooled water temperature 4°C÷ 15°C  
**Heating cycle:**  
 Outside air temperature B.S. -10°C÷20°C  
 Hot water temperature 35°C÷ 50°C

- **Refrigeration circuit** completely wired with copper pipe fittings, including:

°**Quasar** dehydration filter, thermostatic valve with external equalisation, safety pressure switches on the high and low pressure sides, pressure tubes for filling and empty-ing the refrigerant and connection for control pressure gauges. The low-pressure side is isolated by thick foam anti-condensation padding.

°**Pulsar** dehydrator filter, thermostatic valve with external equalisation, cooling cycle inversion solenoid, check valve, liquid receiver, safety pressure switches on the low and high pressure side, pressure tubes for filling and emptying the refrigerant and connection to the control pressure gauges. The entire circuit is isolated by thick foam padding.

- **Electric control panel**, completely wired inside a sealed steel box, made in conformity with the strictest European standards. The power circuit is set for 230/1/50 or 400/3/50 V/ph/Hz supply, depending on the model, and includes the hour meter and magnetothermal protection for the compressor.

Microprocessor regulation and controls coupled to the safety devices on board the unit or connected externally.

The working parameters are programmed and set directly on the display module in the electric control panel, which is accessible from the outside through the inspection flap on the front panel of the unit.

**1.2 MAIN FUNCTIONS OF THE CONTROLLER**

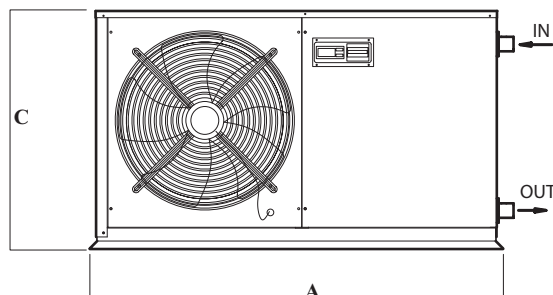


Controls compressor start depending on the return water temperature (temperature usually shown on the display).

Signal of triggered alarms on the display.

ON/OFF control of the circulation pump.

Direct control of fan speed by the air exchanger temperature probe. Timing count for compressor and pump working.



Modello	A	B	C	D	E	F	Ø1	Ø2
021 / 026	1112	428	604,5	102,5	448	110	3/4"	3/4"
031 / 041	1112	428	1113	102,5	448	110	3/4"	3/4"

- Storage of programming data as protection in the case of power failure.
- Storage of alarm list up to 50
- compressor activity control according to external temperature (dynamic set-point)
- defrost function jointly controlled by temperature / pressure

**1.3 ACCESSORIES AVAILABLE ON REQUEST**

- \* MHL: high pressure and low pressure
- \* RAE: Evaporator anti-freeze heating element
- \* SAB: Supporting vibration reducer feet
- \* KRC Base: remote control kit with on-off, summer/winter controls and alarm cut in.
- \* KRC Top - complete remote control kit
- \* DCP: Pressure control device
- \* V-Kit-Top: adapter for remote touch pad
- \* KRI: kit of additional heating element
- \* KRS485: TTL/rs485 output, serial communication protocol ModBus

**\* All these accessories are supplied separately for installation on site.**

**2.0 INSTALLATION**

**2.1 GENERAL INFORMATION**

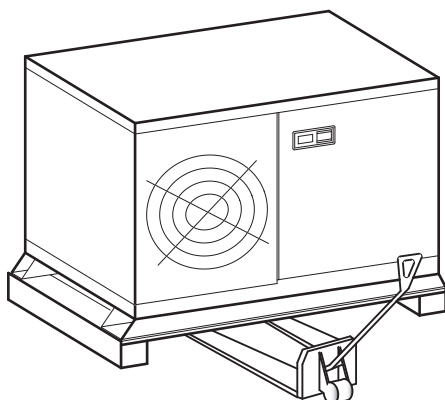
All installation and maintenance work must be performed by qualified personnel, following the indications given in this handbook and on board the unit. If these standards are not applied, hazardous situations could arise for people, animals and property, for which the manufacturer accepts no responsibility. The unit must be turned off at the mains by turning off the automatic switch that is fitted near the unit, before beginning any maintenance work on the unit. All the units are manufactured for installation on the outside, and no special protection is required against atmospheric agents.

**2.2 INSPECTION, HANDLING AND POSITIONING**

**INSPECTION**

Once the unit reaches its final destination, it must be carefully checked visibly for any signs of damage that occurred during transport.

The haulier must be immediately informed of any imperfections or obvious signs of damage, and they must be noted on the shipping note, TONON S.p.A. or your local agent must be informed in writing as soon as possible.



**HANDLING**

We advise handling the unit inside its original packing, which should only be removed when it is in the final installation position.

It can be handled on a normal transpallet or by lifting, using suspended cables that are sufficiently long to avoid the top of the packing being crushed.

**2.3 TECHNICAL FEATURES**

MODEL	QUASAR				PULSAR				
	021	026	031	041	021	026	031	041	
Cooling capacity	kW	5,0	5,9	8,6	10,8	5,0	5,9	8,6	10,8
Heating capacity	kW	-	-	-	-	5,5	6,9	9,7	11,5
Scroll compressors	n°	1	1	1	1	1	1	1	1
Cooling circuits	n°	1	1	1	1	1	1	1	1
Shutter steps	%	0-100	0-100	0-100	0-100	0-100	0-100	0-100	0-100
Supply voltage	V/Hz/Ph	.....230/50/1.....		400/50/3		.....230/50/1.....		400/50/3	
Sound pressure LPS (1)	dB(A)	41,7	41,7	43	43,5	41,7	41,7	43	44,5
<b>COMPRESSOR</b>									
Nominal output	kW	1,6	1,9	2,6	3,2	1,6	1,9	2,6	3,2
Nominal current	A	7,5	9,3	13,5	6,3	7,5	9,3	13,5	6,3
Max. current	A	11,4	13,6	18,7	10,0	11,4	13,6	18,7	10,0
Take off current	A	47,0	61,0	100,0	50,0	47,0	61,0	100,0	50,0
<b>FAN SECTION</b>									
Fans	n°	1	1	1	1	1	1	1	2
Air capacity	m³/s	0,97	0,97	1,15	1,15	0,97	0,97	1,15	1,83
Rotation speed	min -1	900	900	900	900	900	900	900	900
Power intake	kW	0,16	0,16	0,16	0,16	0,16	0,16	0,16	0,16
Current intake	A	0,71	0,71	0,71	0,71	0,71	0,71	0,71	0,71
<b>COMPACT SYSTEM INTERFACE MODULE</b>									
Storage tank	l	20	20	36	36	20	20	36	36
Heat pump	n°	1	1	1	1	1	1	1	1
External head	kPa	41	38	45	33	41	38	45	33
Pump absorption	kW	0,09	0,09	0,24	0,24	0,09	0,09	0,24	0,24
Pump absorption	A	0,45	0,45	1,1	1,1	0,45	0,45	1,1	1,1
Plate evaporator	n°	1	1	1	1	1	1	1	1
Water capacity	l/s	0,23	0,28	0,41	0,52	0,23	0,28	0,41	0,52
<b>POWER INTAKE</b>									
Nominal output	KW	1,85	2,15	3,00	3,60	1,85	2,15	3,00	3,76
Nominal current	A	8,7	10,5	15,3	8,1	8,7	10,5	15,3	8,8
Max. current	A	12,5	14,8	20,5	11,8	12,5	14,8	20,5	12,5
Start up current	A	50,0	64,0	103,5	55,0	50,0	64,0	103,5	56,8
Supply lead section	n°xmm²	3 x 2,5	3 x 2,5	3 x 4	5 x 2,5	3 x 2,5	3 x 2,5	3 x 4	5 x 2,5
<b>SIZE AND WEIGHTS</b>									
Length	mm	1080	1080	1080	1080	1080	1080	1080	1080
Width	mm	430	430	430	430	430	430	430	430
Height	mm	640	640	1113	1113	640	640	1113	1113
Weight	Kg	113	116	160	172	119	122	166	186

The above data refers to the following working conditions:

Cooling: outside air temperature 35 °C - water temperature 12-7 °C

Heat pump: outside air temperature 6 °C BU - water temperature 39 - 45 °C

(1) At a distance of 10 m in free field

**2.4 POSITIONING**

The position for the unit must be clearly defined, taking into account the following precautions:

- The refrigerator must be installed on the outside, on any flat horizontal surface, that can support its weight (ground, terrace, roof, etc.)
- If it is installed on the roof or a terrace, rubber padding should be placed between the unit and the surface, or special anti-vibration supports (available as accessories) to prevent any vibrations being transmitted to the building structure.
- Install away from windows or openings that communicate with the adjacent buildings.
- Avoid installation near chimneys, flues, fans or air extractors, to avoid the unit being exposed to hot or polluted air flows.
- All the models in the Quasar - Pulsar series have the fan section fitted with horizontal air outlet.
- It is important that there are no obstacles to the airflow, which could cause the air to recirculate between the suction and delivery circuits.
- Insufficient air circulation or recirculation through the fin condenser means the unit does not work properly and could block it completely.

**3.0 HYDRAULIC CONNECTIONS**

**PIPING**

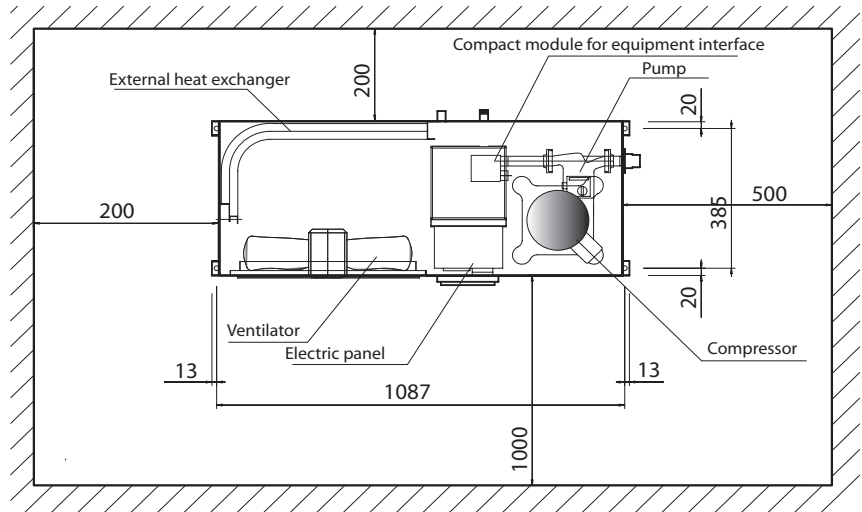
The piping can be in steel, galvanised steel, polyethylene or PVC. All the units have threaded hydraulic attachments.

The units are supplied complete with circulating unit, to guarantee an effective head as given in the enclosed table.

The pipes must be dimensioned on the basis of the pump output, taking into account the pressure drop in the system.

All the piping must be correctly insulated to avoid heat storage (cause a fall in system performance) and the formation of condensation on the outside surface. Use 10-mm thick foam insulating material. To avoid vibration transmission from the unit to the main system, and to compensate heat expansion, elastic joints should be fitted to the hydraulic attachments on the unit.

The installation must be prepared in conformity with local Standards or those of the Country of Installation.



**3.1 POSITIONING AND SERVICE AREAS**

The unit must be positioned respecting the recommended service spaces. This way the unit will work correctly, and all the parts are easy to reach for maintenance purposes.

In any case, we recommend installing the following devices to guarantee correct use and maintenance:

- Elastic anti-vibration joints
- Cut off valves
- Housing for the water temperature probes.
- Wiring net filter
- Air bleeding device
- Automatic filling unit
- Discharge valve
- Expansion tank (in the Pulsar models this is supplied as standard).

For correct working and performance to be guaranteed, each unit needs a constant nominal water capacity, as given in table 1 on page 2.

If there is a lower water capacity, the unit could have working problems with serious consequences and damage to some of the main components, such as the compressor.

**3.2 USE OF ANTI-FREEZE LIQUIDS**

If water is not emptied from the hydraulic circuit during winter months, an anti-freeze must be added to the water in the correct percentage parts.

The use of anti-freeze liquids (table 2) reduces the cooling capacity slightly, but gives a considerable variation in the water capacity levels and pressure drop in the system.

In these cases, it is important to check the pump performance carefully, to avoid any working problems or any damage that could be caused if there is not the required water capacity.

**IMPORTANT:** the current pumps can work with a maximum rate of glycol of 30%. To use the equipment with a higher mix, please contact **TONON FORTY S.p.a.**

Winter outside air temperature (machine turned off)	°C	5	2	-3	-10	-15
Recommended percentage of ethylene glycol (in weight)	%	0	10	20	30	40
Coefficient of cooling capacity current *	-	1	0.97	0.95	0.93	0.9
Coefficient of intake power current *	-	1	0.99	0.98	0.97	0.96
Coefficient of water capacity current	-	1	1.02	1.1	1.14	1.3
Coefficient of evaporator pressure drop	-	1	1.08	1.3	1.39	1.6
Mixture freezing point	°C	0	-3	-8	-15	-23
* for normal working conditions (outside air temperature 35°C / cooled water temperature 7°C)						



**DEPENDING ON THE MODELS AND THE USER'S PLANT LAYOUT, THE MACHINES MUST BE FITTED WITH A SERIES OF COMPONENTS, THAT HAVE ALREADY BEEN LISTED, TO GUARANTEE THE BEST OPERATIONS FROM THE SYSTEM.**

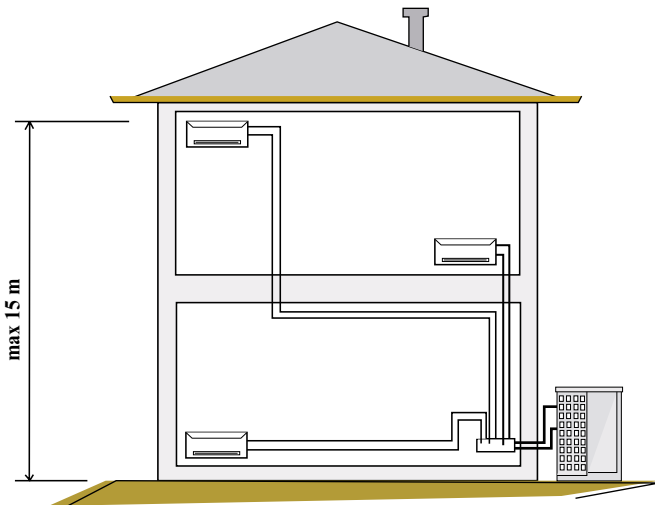
**HOWEVER, THESE COMPONENTS MUST BE PERIODICALLY CHECKED TO ENSURE THEY ARE STILL OPERATING CORRECTLY.**

**\*PERIODICALLY CHECK THE SAFETY FLOW SWITCH TRIGGERS.**

**\*CHECK THE READING ON THE ANTIFREEZE PROBE, AND COMPARE IT WITH A CERTIFIED INSTRUMENT. IF THE READING IS INCORRECT, THEN THE PROBE MUST BE GAUGED.**

**\*PERIODICALLY CLEAN THE MESH FILTER AT THE ENTRANCE TO THE MACHINE HEATEXCHANGER.**

**\*CHECK THE PRESSURE IN THE HYDRAULIC PLANT IS WITH IN THE SAFETY LIMITS (MAX 3 bar). IN NORMAL CONDITIONS, THE HYDRAULIC PRESSURE CAN VARY BETWEEN 0.8 ÷ 1.2 bar. DIFFERENCE IN LEVEL BETWEEN THE CHILLING UNIT AND THE HIGHEST POINT IN THE SYSTEM.**



**4.0 ELECTRIC CONNECTIONS**

**4.1 GENERAL INDICATIONS**

All the units in the Quasar - Pulsar series are supplied with an electric control panel with all the elements required for running the unit and controlling the fitted safety devices.

Electric connections must be performed in conformity with current CEI national standards or those relative to the country where it is installed, following the indications given in the enclosed wiring diagrams. Ensure the unit is turned off before beginning any work on the internal or external electric parts.

Dimension the power lead section on the basis of the total maximum power intake. The Technical Data table in this manual shows the recommended sections for installation, when a thermomagnetic - differential automatic switch is fitted near the unit (table 1). Ensure there is adequate earth connection as required by law, using the corresponding terminal inside the electric control panel.

The power voltage must conform to the data of the unit (voltage/frequency/ number of phases/neutral conductor); no variations can be accepted +-5%, with unbalance between the phases (for three-phase supply) less than 2%.

The use of incorrect power supply as requested by the manufacturer, can compromise working and integrity of the machine and the guarantee will be cancelled.

**All the data for dimensioning the power circuit and the choice of electric protections (lead section and power intake) are given in table 1 on page 2.**

**4.2 ELECTRIC CONNECTIONS**

The electric connections to be made by the user are reported in the electric diagram and are summed up as follows:

**• Connections to the mains supply**

**Number on terminal block in the electric panel**

**Models 021 026 031 L-N-PE**

**Models 041 L1-L2-L3-N-PE**

All the units are dimensioned to be supplied with a neutral lead for auxiliary circuits.

**• On/Off remote control :  
blocks in the electric panel 4-5**

**USE A CLEAN CONTACT THAT IS NOT LIVE**

**Parameter CF16=0**

Logic: - closed contact : working disactivated  
- open contact: working activated

You may invert the working logic of the digital on/off input, by changing parameter CF16 in the user's menu (see page 16, par. 10.3).

**IMPORTANT: from keyboard you can switch the unit on / off only from a disactivated input (priority from remote control).**

**• Summer / Winter remote activation:**

**Blocks in electric board: 4-6**

-Function active only in EPA heat pump models. It allows you to control the section chiller / heat pump from a remote touch pad.

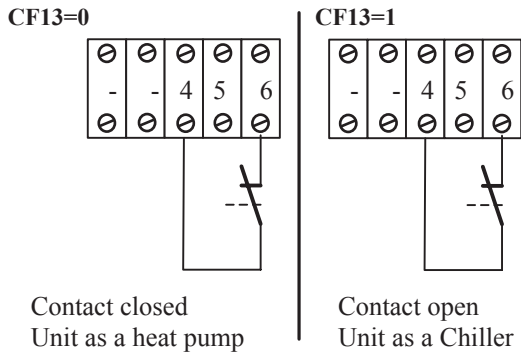
**USE A CLEAN CONTACT THAT IS NOT LIVE**

Working logic:

With parameter CF13=1 (standard configuration) and remote contact "open", the equipments works as a heat pump. When the contact is closed, it works as a chiller.

With parameter CF13=0 and remote contact "open", it forces the equipment to work as a chiller. When the contact is closed, it works as a heat pump.

**Numbers on the terminal block in the electric board**



To use the Summer/Winter remote activation you have to set parameter CF28 on, in the user's menu (CF28=1). Once this parameter is active, the selection priority is from remote control (see page 15).

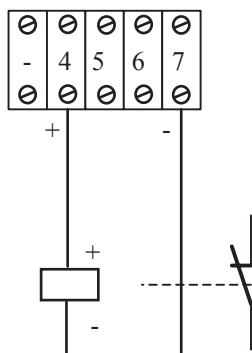
- Alarm signal from remote position:

**Blocks** 4 - 7 ---  
(open collector output to control a 12V /40mA relay)

-Permette di riportare a distanza un segnale di "allarme intervenuto". Blocks 4-7 are directly connected to an open collector output, that can control a 12VDC/40mA relay. The output switches from 0 to 12Vdc, as soon as an alarm managed by the microprocessor starts.

**The relay is optional**

**Before connecting the relay, please respect the following connections:**

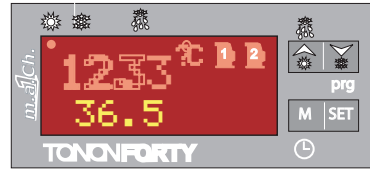


**IMPORTANT:** The output signal from connector 7 (-12Vdc) directly controls the red LED "Allarme" on the base remote control (KRC Base), when a KRC Base is supplied as an accessory.

**5.0 USE OF THE MICROPROCESSOR CONTROLLER**



All the units mount a microprocessor controller by which you can set all the typical parameters regulating the working of the equipment.



**5.1 USER INTERFACE**

The instrument display is divided into three areas.

**Left Upper Area:** Evaporator. It shows user system water IN / OUT temperature.

IN - inlet water temperature (return from user system)

OUT - outlet water temperature (delivery to user system)

**Left Lower Area:** It shows condensation temperature / pressure or the active time (function activated on call as an accessory).

**Right Area:** Signalling icons.

**Display Icons**

The display icons give you all information on the state of the unit.

**Celsius degrees °C**

the value shown on the display is a temperature value (in the user's menu as well)

**Bar**

the value shown on the display is a pressure value (in the user's menu as well)

**Compressor**

The icon shows the compressor state:

Blinking: the compressor is needed. A temporization is in progress

Lit: the compressor is active

**Unit in Stand-by**

The stand-by mode is active every time the unit is turned off from a chiller or a heat pump state. It is signalled by the lit icon

**Even in stand-by mode you can:**

- 1) Visualize the detected temperature
- 2) Manage the alarm situation by visualizing and signalling them
- 3) Activate the heating element as antifreeze safety.

**General Alarm**

it signals the presence of one or more alarms. In case of auto-resetting alarm, access the M key function menu and select the "AlrM" function.

**High pressure alarm**

it signals that an alarm has been triggered by the high pressure safety pressure switch. The safety device is connected to ID3 digital input (see the applicable wiring diagram).



**Low Pressure Alarm** 

it signals that an alarm has been triggered by the low pressure safety pressure switch. The safety device is connected to ID4 digital input. (see the applicable wiring diagram).

**Antifreeze heating element** 

Indica lo stato delle resistenze elettriche antigelo.

**Flow switch alarm** **Flow I**

it signals that an alarm has been triggered by the safety water flow switch. The safety device is connected to ID1 digital input. (see the applicable wiring diagram).

**Clock / Counter** 




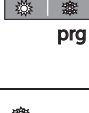
**Maintenance needed** 

The compressors or the plant pump need maintenance for exceeding working hours

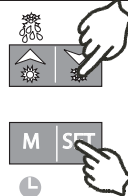
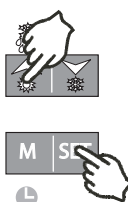
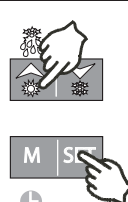
**Menu** **Menu**

It signals that "Function Menu" has been accessed







**5.2 FUNCTIONS OF THE KEYS**

	The <b>M</b> key allows to access function menu and time set-up.
	The <b>SET</b> key allows to display or change the set point value. In programming mode, it selects a parameter or confirms a value
	Keeping this key pressed for 5 sec will start or stop the unit in <b>cooling</b> (chiller) mode of operation. It selects water IN/OUT temperatures on the upper display. In programming mode, it scrolls through parameters codes or increases their value.
	Keeping this key pressed for 5 sec will start the unit in <b>heating</b> (pdc) mode of operation. It selects outside air temperature / defrost display. In programming mode, it scrolls through parameters codes or increases their value.

**5.3 COMBINED KEY FUNCTIONS**

	To access programming mode
	To exit programming mode
	Pressing and holding these keys for more than 5 sec will start a manual defrost cycle

**SYMBOLS AND LEDS ON THE FRONT PANEL**

Simbolo	Led	Funzione
	On	Unit ON in chiller mode
	On	Unit ON in heat pump mode
	Blinking	During programming phase (it blinks together with LED  )
	Blinking	Defrost Start Delay Time
	On	Defrost active
	Off	Defrost disabled or finished
		Clock setting

**6.0 VISUALIZATION**  
**VISUALIZATION IN NORMAL CONDITION**



Under normal working conditions, the instrument displays:

**Upper Display:**

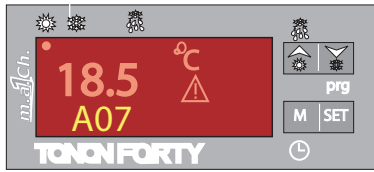
Evaporator water inlet/outlet temperature (EWA EPA EWE EWR air/water units, EWH EPH water/water units).

**Lower Display:**

Condensation temperature/pressure or evaporator water anti-freeze temperature (pdc water/water units), with their units of measurements.

Active time (optional).

**6.1 DISPLAY DURING ALARMS**

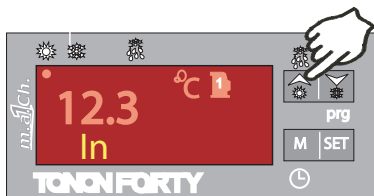
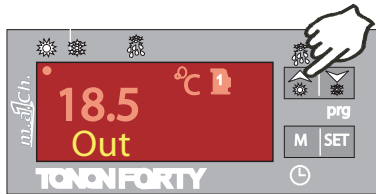


Varying from a normal condition (no alarm active), as soon as an alarm condition is detected, the instrument alternately shows blinking alarm code and respective icon, and temperature / pressure on the lower display (example given in the fig.: presence of alarm high pressure).

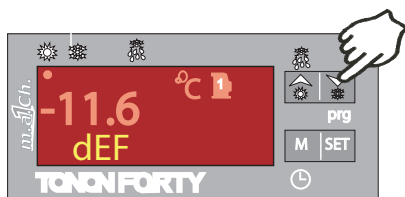
**6.2 QUICK DISPLAY OF MAIN INFORMATION**

**In order to help user during the machine test-and-check phase, the procedure for displaying main information without accessing selection menu has been simplified.**

- Pressing the key UP will display in rotation system delivery and return temperatures. This function helps to check the actual evaporator inlet/outlet thermal head, which should corresponds approximately to 5°C in normal working conditions.



- Pressing the DOWN key will display in rotation outside air temperatures (probe available as optional) / and condensation or defrost temperatures (pdc unit).



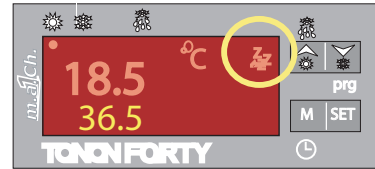
**6.3 UNIT IN STAND-BY**

Stand-by mode is enabled any time the unit is turned off, either in chiller or in p.d.c. mode of operation. When the unit is stand-by mode, the icon will light up.

**Also in stand-by mode, the controller allows to:**

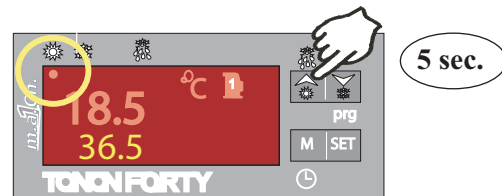
- 1) Display the detected measurements
- 2) Manage alarm events by displaying and signalling them.
- 3) Activate heating elements as evaporator anti-freeze safety device depending on thermoregulator.

Only by switching the unit off you can change from chiller to heat pump.



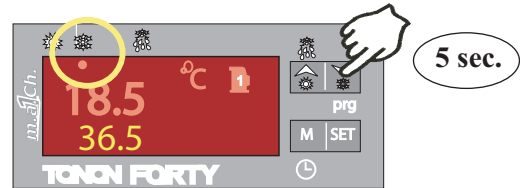
**6.4 ACTIVATING / DISACTIVATING CHILLER MODE (SUMMER MODE)**

By pressing 5 seconds UP key , the unit changes from stand-by to chiller mode or viceversa. After the delay timing, if no alarm is active, the compressor starts. During the start the "STAND-BY" icone turns off, while the SUN icone referring to "Chiller" mode blinks. In "Chiller" mode only the related set-point ("StC" Set Chiller) can be changed; otherwise you can visualize the dynamic set-point ("StD") if it is active.



**6.5 ACTIVATING / DISACTIVATING HEATING MODE (WINTER MODE)**

By pressing 5 seconds DOWN key , the unit changes from stand-by to heat pump mode or viceversa. After the delay timing, if no alarm is active, the compressor starts. During the start the "STAND-BY" icone turns off, while the "SNOW" icon related to "heat pump" mode. In heat pump mode only the related set-point ("StH" Set Heat pump) can be changed; otherwise you can visualize the dynamic set-point ("StD") if it is active.



**6.6 ACTIVATION / DISACTIVATION FROM DIGITAL INPUT**

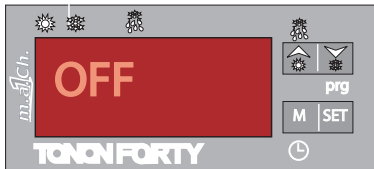
This function is used if the unit on/off is remote controlled (i.e. by a timer, see par. 4.2, p. 4).

**USE A CLEAN CONTACT THAT IS NOT LIVE**

- 1) It takes the precedence to the keyboard
- 2) You can turn the unit on/off, only when the digital input is deactivated

3. When the digital input is inactive, the controller goes back to the mode prior to the activation. The upper part of the display shows "OFF" and the LED of the decimals blinks.

IMPORTANT: you can invert the polarity of input "id5", so when the signal is active the unit is on. The parameter controlling this function is CF16=1, and it can be modified by the user (see par. Access to user's menu)



### 6.7 CONTROLLING THE CHILLER / HEAT PUMP WORKING MODE FROM DIGITAL INPUT

To use the summer / winter remote control you have to activate parameter CF28, in the user's menu (CF28=1). Once this parameter is active, the selection priority is from remote control.

When CF28=1, if the unit is on in Chiller or Heat pump mode and the working mode is changed, the controller turns all the outputs (compressor, pump...) off, and it waits the fixed delay time, signalled by the blinking LEDs of the Chiller or of the Heat pump. The blinking state indicates the working state when the unit is turned on again, waiting for the protection time of the compressors.

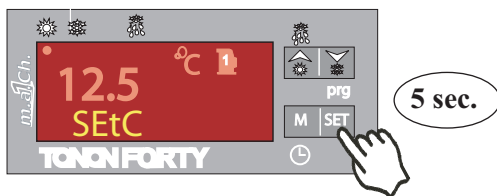
## 7.0 ADJUSTING THE "SET POINT"



### 7.1 Set.C Set point Chiller 12,5°C

By pushing the SET key when the unit is in stand-by or chiller mode you can display the set value. To change the set value just push key SET about 5 seconds; the displayed value starts blinking. Use the UP or DOWN keys to modify the value within the limits set up in factory.

ST05	10°C	minimum Summer set
ST06	18°C	maximum Summer set



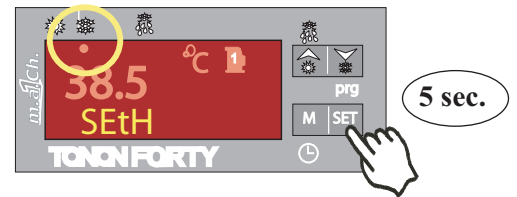
The value blinks, use the cursor to modify the value.

Press SET key to save the change

### 7.2 Set.H Set point Heat pump 38,5°C

When the unit is in stand-by or in heat pump mode, press SET key to visualize the set value. To change the value, just press SET key about 5 seconds; the value then starts blinking. Use the UP or DOWN keys to modify the value within the limits set up in factory.

ST07	36°C	minimum Winter set
ST08	43°C	maximum Winter set



The value blinks, use the cursor to modify the value.



Press SET key to save the change

### 7.3 Set.D Dynamic Set point (Optional on request)

It allows to change the working set point according to the temperature detected by pb4 probe, supplied as an accessory. This function increases the compressor output C.O.P., favoring energy saving

When the dynamic set point is on, press SET key twice to visualize on the lower part of the display "Set.D" (dynamic set), and on the upper part the actual working value of the set.

The label SETd is on only if the dynamic set point is a activated. The parameters controlling the dynamic setpoint of chiller and heat pump are directly set in the user's menu, taking care of the following relations:

#### • Working Logic Set.D Summer (Chiller)

If $pB4 \geq Sd04$	$Set.D = Set.C$
If $pB4 \leq Sd04 - Sd06$	$Set.D = Set.C + Sd02$



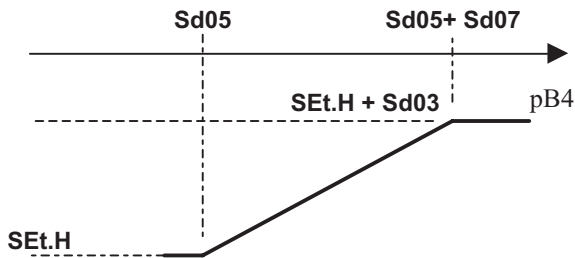
**Sd02** Summer dynamic set point max offset. It establishes the maximum variation for the set-point in chiller mode.

**Sd04** Set external air temperature, dynamic set point in chiller mode.

**Sd06** Temperature difference between external air and dynamic set-point in chiller mode.

• winter functioning logic (heat pump)

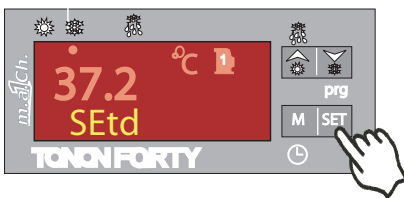
With  $pB4 \geq Sd05$                        $SEt.D = SEt.H$   
 With  $pB4 < Sd05 + Sd07$             $SEt.D = SEt.H + Sd03$ .



**Sd03** Increase maximum dynamic set-point in heat pump function. Establishes the maximum variation for the set-point in heat pump mode

**Sd05** Set external air temperature, dynamic set point in heat-pump mode

**Sd07** Dynamic set point outside air temperature differential in heat pump mode of operation.



7.4 SEt.S Energy saving (Optional su richiesta)

Energy Saving function allows to run two different working set points in both chiller / p.d.c. modes of operation.

It could be programmed daily or weekly by time bands (version with on-board time clock, on-request accessory), or run by external contact. During an Energy Saving cycle, the set point is increased by the value set in ES10 / ES12, so that the working set point will become SET+ES10 in chiller mode of operation, or SET+ES12 in heat pump mode of operation. The referring differential for thermoregulation with active energy saving will correspond to the value of S11 parameter in chiller mode of operation, ES13 parameter in heat pump mode of operation.

• E.S. Daily Programming

Only for models with on-board time clock. (Optional on request)

Set the energy saving parameter relating to the day to 1. E.g.: ES03 = 1 (energy saving active on Monday, 24 hour a day). Set parameters from ES04 to ES09 to 1 to enable energy saving during all the other days of the week.

• E.S. Time Band Programming

(Only for models with on-board time clock. Optional on request)

Set the parameter ES01 (Energy Saving cycle start time), ES02 (Energy Saving cycle stop time). E.g.: ES01 = 8.0 ES02 = 10.0 energy saving active 8÷10.0 all days of the week.

E.g.: ES01 = 23.0 ES02 = 8.0 energy saving active from 11.00 P.M. to 8.00 A.M. of the following day, all days of the week.

**IMPORTANT: The time band function will be prohibited if parameters ES01 / ES02 are set to the same time or to 0.**

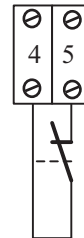
• Running E.S. from External Contact

The E.S. function can always be run directly from id5 external contact( CONNECTORS 4-5). To enable this function, set the parameter CF10=8.

This operation uses the same digital input normally used as a remote on/off (see par.4.2 p. 4).

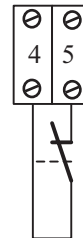
**IMPORTANT: depending on parameter CF16 the working logic is inverted.**

Example  
CF16=0



Closed contact  
Energy saving active

CF16=1



Closed contact  
Energy saving inactive

USE A CLEAN CONTACT THAT IS NOT LIVE

• Parametri Energy Saving

- ES01 Energy saving start time
- ES02 Energy saving stop time
- ES03 Monday      0 = disabled      1= enabled
- ES04 Tuesday     0 = disabled      1= enabled
- ES05 Wednesday   0 = disabled      1= enabled
- ES06 Thursday     0 = disabled      1= enabled
- ES07 Friday        0 = disabled      1= enabled
- ES08 Saturday     0 = disabled      1= enabled
- ES09 Sunday        0 = disabled      1= enabled
- ES10 Energy saving setting increase in chiller mode of operation
- ES11 Energy saving differential in chiller mode of operation
- ES12 Energy saving setting increase in heat pump mode of operation
- ES13 Energy saving differential in heat pump mode of operation

7.5 AUTOMATIC CHANGE-OVER (OPTIONAL ON REQUEST)

It automatically changes the unit state of functioning (chiller / heat pump) according to programming and external climatic conditions.

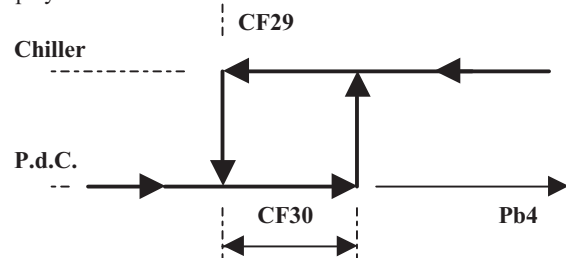
This function works only with heat pump EPA supplied with an optional PB4 environmental temperature sensor.

Parameters governing the change over function:

**CF29** It allows to set the change over set point, which is the value of the PB4-detected temperature below which the instrument will force a p.d.c. mode of operation.

**CF30** It allows to set the change over differential, which is the temperature differential depending on which the instrument will force a chiller mode of operation.

In order to help user set up the change over set point, pressing and releasing the DOWN key will display the temperature of PB4 probe for 5sec on the upper display, while the lower display will show the Et label.



For temperatures within the CF30 differential, change over via keypad is allowed.

### 8.0 BASE REMOTE CONTROL PANEL BASE KRC BASE (Optional on request)

This touch pad allows the on/off control of all the Quasar and Pulsar units. With reversible Pulsar heat pumps you can switch from chiller to heat pump and viceversa. Moreover, a red LED signals the state of an active alarm. After completing the electric wirings as described below, check that the jumper on the right hand of the electric block is closed (supply 12Vac).

**A wrong setting of the jumper may damage the remote control.**

**IMPORTANT:** Please, change CF16 = 1 parameter, so that the activation logic respects that of the remote control. You can change the parameter in the "User's menu", see par. 10.3 p. 16.

**CONTROLS**

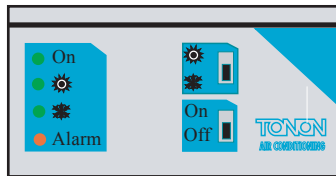
1. ON/OFF key
2. Summer / Winter key

**VISUALIZATION**

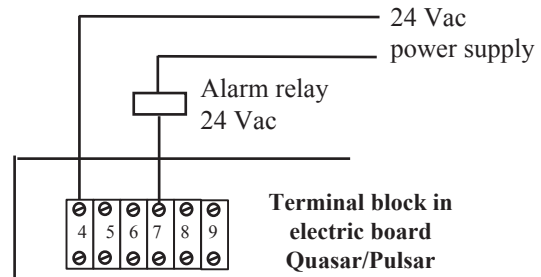
- 3 Green Led On
- 4 Green Led Summer
- 5 Green Led Winter
- 6 Red Led Alarm

**SIZE**

-120 x 70 x 28.7 mm



### 8.1.1 CONNECTION TO AN EXTERNAL ALARM RELAY

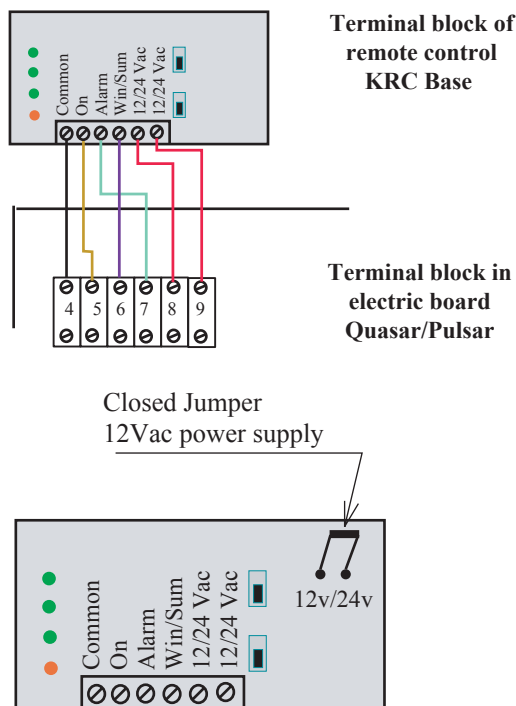


### 8.2 TOP REMOTE CONTROL PANEL KRC TOP (Optional on request)



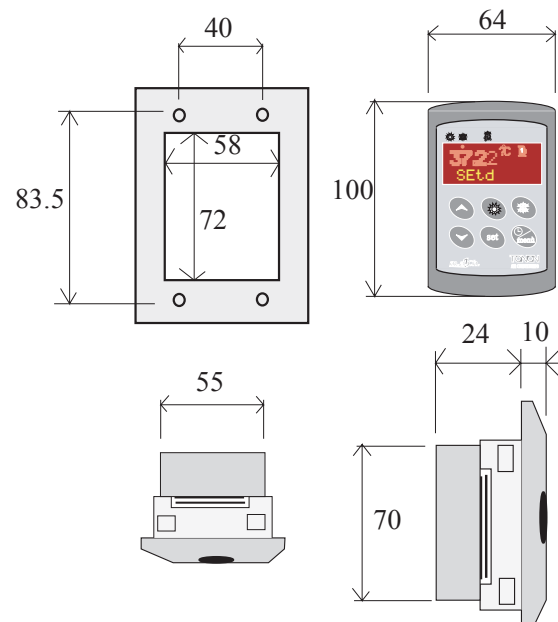
### 8.1 ELECTRIC CONNECTIONS FOR THE BASIC REMOTE CONTROL PANEL KRC BASE

The electric connections between the remote control panel and the electric control board on the unit must be made on site, using a 6-pole cable with a minimum section of 0.5 sq.mm. The maximum recommended length must no exceed **150 meters**. The electric connections to the remote control panel are the following:

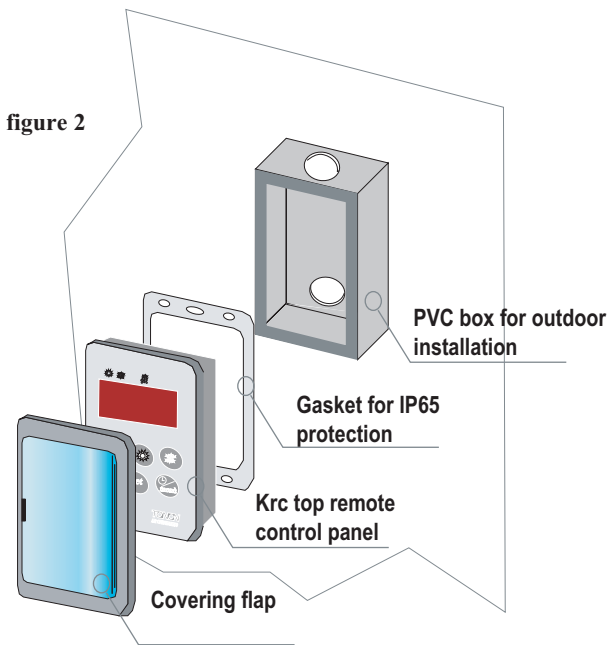


Rear view of the remote control panel

Supplied as an on-request accessory, this kit allows to display and run all control parameters displayed as from machine controller. The keypad size enables the device to be installed within the very common (3 modules) wall boxes used in civil electrical systems. The remote terminal must be mounted on the panel, or on a 72x56 mm hole, and fixed using screws.



To obtain a IP65 front protection, use the front protection rubber, mod. RGW-V (optional). For external fixing on wall, a V-KIT vertical keypad adapter, as the one shown in figure 2, is available.



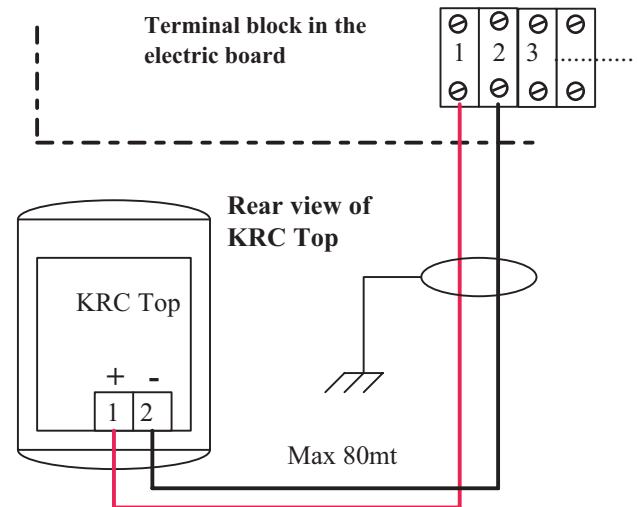
**FUNZIONE DEI TASTI KRC Top**

	The M key allows to access function menu and time set-up.
	The SET key allows to display or change the set point value. In programming mode, it selects a parameter or confirms a value.
	This key allows to select water IN/OUT temperatures, on the upper display. In programming mode, it scrolls through parameter codes or increase their values.
	This key allows to display outside air defrost temperature. In programming mode, it scrolls through parameter codes or decrease their values.
	Keeping this key pressed for 5 sec will start or stop the unit in either chiller or heat pump mode of operation.
	Keeping this key pressed for 5 sec will start or stop the unit in either chiller or heat pump mode of operation

**8.3 ELECTRICAL CONNECTIONS KRC Top**

The electric connection between the unit switchboard and the remote control panel has to be done on site using a 2 wire shielded cable 0,5 mmq size. The Max suggested length is 80 m. With connections exceeding this length the wire size has to be increased up to 1,5 mmq for a 150 m max length.

**Connection cables are NOT included in the KRC accessory kit.**



**IMPORTANT: Respect polarity as shown in the scheme below:**

**block in electric board 1 +                      block in krc 1+**  
**block in electric board 2-                      block in krc 2-**

**If wrong connected, the remote display does not lightup. The keyboard is still protected, and if wrongly connected, all you have to do is invert polarity**

**9.0 “ M KEY ” FUNCTION MENU**

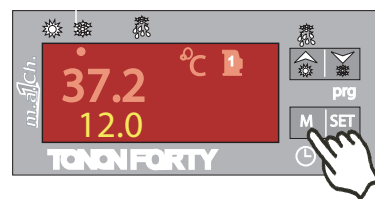
**Accessing the function menu will allow you to:**

- 1) Display and reset triggered alarms
- 2) Display and reset controlled load working hours
- 3) Enable the control via infrared transmission (supplied as an accessory)
- 4) Display alarm history
- 5) Delete alarm history

**While the function menu is displayed, the “menu” icon is lit up**

**9.1 ACCESS TO THE “M” FUNCTION MENU**

Press and release the M (menu) key. The “menu” icon will appear.



**9.2 EXIT FROM THE FUNCTION MENU**



Press and release the M key or wait for time-out (15s). The “menu” icon will disappear.



9.3 DISPLAYING ALARMS

The system runs about 30 alarm codes. The most important are displayed by means of icons at the sides of the two displays. All the alarms can be identified through a code, and stored, up to 50, in time wise order. Tutti gli allarmi sono identificabili tramite codice, e memorizzati fino ad un massimo di 50 in ordine temporale.

Access function menu:

- 1) By using the UP or DOWN KEYS  select the "ALrM" function.
- 2) Press and release the SET key.
- 3) By using the UP or DOWN keys  scroll through all the alarms. To exit, press the menu key or wait 15s for time-out.

9.4 RESETTING AN ALARM

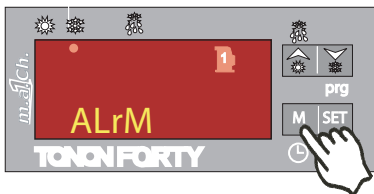
In case of a serious alarm, such as high pressure, evaporator antifreeze, etc., the system must be manually reset.


All the arisen alarm codes (manual and auto reset) are recorded in the Eprom, to allow an alarm diagnosis even long time later.

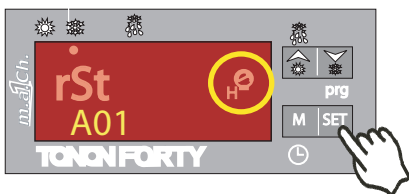
**IMPORTANT: If the alarm continues, call the TONON Authorized Service Centre.**

Procedure to manually reset the alarms

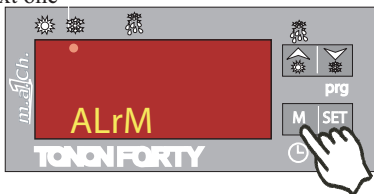
- 1) Access the Functions Menu
- 2) Select the "ALrM" function



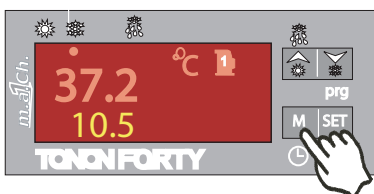
- 3) By pressing SET the lower display will show the alarm code
- 4) Upper display: rSt label if the alarm is resettable, e l'allarme e resettabile, label NO label if it is not resettable. Scroll through all available alarms by using the  keys.



- 5) Press SET next to the rSt label to reset the alarm and move to the next one



- 6) To exit, press the menu key or wait for the 15seconds' timeout.

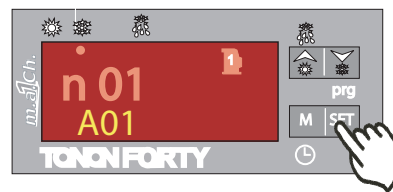


9.5 HOW TO DISPLAY THE ALARM HISTORY

- 1) Access the function menu
- 2) By using the UP or DOWN keys select the ALoG function



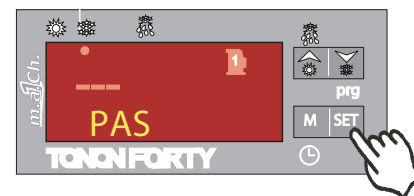
- 3) Press SET: the lower display will show a label indicating an alarm code, the upper display the "n" label indicating a progressive number



- 4) By using the the UP or DOWN keys  scroll through all the available alarms.



- 5) To exit ALoG function and revert to standard display, press the M key or wait for time-out (15 sec) to expire. The memory can store up to 50 alarms; any new detected alarm exceeding that number will automatically delete the oldest alarm from the memory (alarms are displayed from the oldest to the most recent).



**IMPORTANT: The alarm history can be deleted only through the maintenance password.**

## 9.6 ALARM CODES AND FUNCTIONS

Code	Meaning	Cause	Action	Reset
<b>P1</b>	Alarm PB1 probe	Faulty probe or resistive value out of range	It activates the alarm relay output It activates the buzzer The general alarm icon blinks Code on the display	Automatic if the value returns within the set range
<b>P2</b>	Alarm PB2 probe	Faulty probe or resistive value out of range	It activates the alarm relay output It activates the buzzer The general alarm icon blinks Code on the display	Automatic if the value returns within the set range
<b>P3</b>	Alarm PB3 probe	Faulty probe or resistive / current value out of range	It activates the alarm relay output It activates the buzzer The general alarm icon blinks Code on the display	Automatic if the value returns within the set range
<b>P4</b>	Alarm PB4 probe	Faulty probe or resistive value out of range	It activates the alarm relay output It activates the buzzer The general alarm icon blinks Code on the display	Automatic if the value returns within the set range
<b>A01</b>	Alarm high pressure switch	The Hp1 high-pressure gauge triggers	Open-collector / alarm relay activated Buzzer activated “High Pressure Alarm” icon blinking Code displayed	Manual Return to the pressure range plus reset procedure at point 9.4
<b>A02</b>	Alarm Low pressure switch	The Lp1 low-pressure gauge triggers	Open-collector / alarm relay activated Buzzer activated “LowPressure Alarm” icon blinking Code displayed	Automatic, it becomes manual after 2 triggers in one hour Manual Return to the pressure range plus reset procedure at point 9.4
<b>A05</b>	High temperature High pressure	AL11 limit exceeded by PB3 probe (condensation control)	Open-collector / alarm relay activated Buzzer activated “Alarm High Pressure” icon blinking Code displayed	Manual Return to the pressure range plus reset procedure at point 9.4
<b>A06</b>	Low temperature Low pressure	AL13 limit exceeded by PB3 probe defrosting control)	Open-collector / alarm relay activated Buzzer activated “Alarm Low Pressure” icon blinking Code displayed	Automatic, it becomes manual after 2 triggers in one hour Manual Return to the pressure range plus reset procedure at point 9.4
<b>A07</b>	Alarm anti-freezing	AR03 limit exceeded set antifreeze alarm by pB2 probe on the evaporator (delivery temperature)	Open-collector / alarm relay activated Buzzer activated “Generic Alarm” icon blinking Code displayed	Manual Return to the pressure range plus reset procedure at point 9.4
<b>A08</b>	Flow switch alarm	Safety device triggers on the evaporator water delivery (FL)	Open-collector / alarm relay activated Buzzer activated “Flow switch Alarm” icon blinking Code displayed	Automatic, it becomes manual after 2 triggers in one hour Manual Return to the pressure range plus reset procedure at point 9.4
<b>A09</b>	Alarm compressor 1, thermal relay	Digital input activated by the magnetothermal switch on compressor 1	Open-collector / alarm relay activated Buzzer activated “Generic Alarm” icon blinking Code displayed	Reset the safety device plus reset procedure at point 9.4.
<b>A10</b>	Alarm compressor 2, thermal relay	Digital input activated by the magnetothermal switch on compressor 2	Open-collector / alarm relay activated Buzzer activated “Generic Alarm” icon blinking Code displayed	Reset the safety device plus reset procedure at point 9.4.

## 000 ALARM CODES AND FUNCTIONS

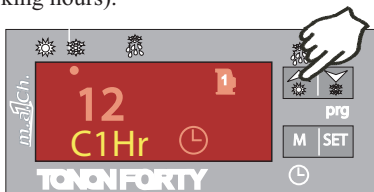
<b>A11</b>	<b>Alarm</b> Condensation fan	Digital input activated by the fan thermal switch (thermal and klixon)	Open-collector / alarm relay activated Buzzer activated "Alarm Generic" icon blinking Code displayed	Manual Reset the safety device plus reset procedure at point 9.4
<b>A12</b>	Defrost alarm error	End of defrosting for dF07 (maximum time)	Code displayed Only signalling	Automatic By a subsequent correct defrost Manual
<b>A13</b>	Alarm Compressor 1 Maintenance	Compressor 1 working hours exceeded	Open-collector / alarm relay activated Buzzer activated "Alarm Maintenance" icon blinking Code displayed	Manual Working hour reset point 9.8
<b>A14</b>	Alarm Compressor 2 Maintenance	Compressor 2 working hours exceeded	Open-collector / alarm relay activated Buzzer activated "Alarm Maintenance" icon blinking Code displayed	Manual Working hour reset point 9.8
<b>A15</b>	Alarm Water pump Maintenance	Working hours > CO16	Open-collector / alarm relay activated Buzzer activated "Alarm Maintenance" icon blinking Code displayed	Manual Working hour reset point 9.8
<b>rtC</b>	Alarm Time Clock	Time Clock to be set	Open-collector / alarm relay activated Buzzer activated "Generic Alarm" icon blinking Code displayed	Manual Clock setting plus reset procedure point 9.4
<b>rtF</b>	Alarm Time Clock	Time Clock fault Clock malfunctioning	Open-collector / alarm relay activated Buzzer activated "Generic Alarm" icon blinking Code displayed	Manual Reset procedure point 9.4 If after resetting the alarm re-occurs, change the clock
<b>EE</b>	Alarm Eprom error	Memory data loss	Open-collector / alarm relay activated Buzzer activated "Generic Alarm" icon blinking Code displayed	Manual Reset procedure point 9.4 If after resetting the alarm re-occurs, the equipment will remain blocked
<b>ACF 1</b>	Alarm Configuration	Unit configured as heat pump with non-configured reversal valve	Open-collector / alarm relay activated Buzzer activated "Generic Alarm" icon blinking Code displayed	Automatic By correct reprogramming
<b>ACF 2</b>	Alarm Configuration	Air/air air/water units without probe configured for condensation control	Open-collector / alarm relay activated Buzzer activated "Generic Alarm" icon blinking Code displayed	Automatic By correct reprogramming
<b>ACF 3</b>	Alarm Configuration	Two digital inputs having the same configuration	Open-collector / alarm relay activated Buzzer activated "Generic Alarm" icon blinking Code displayed	Automatic By correct reprogramming
<b>ACF 4</b>	Alarm Configuration	CF28= 1 and digital input non-configured or CF28=2 probe PB4 other than 3	Open-collector / alarm relay activated Buzzer activated "Generic Alarm" icon blinking Code displayed	Automatic By correct reprogramming
<b>AFr</b>	Alarm Mains supply frequency	Mains supply frequency out of range	Open-collector / alarm relay activated Buzzer activated "Generic Alarm" icon blinking Code displayed	Automatic When frequency returns within working range

9.7 OUTPUT BLOCK TABLE

Alarm Code	Alarm Description	Comp.1	Antifreeze heating element	Pump	Condenser fan	Boiler
P1	Probe PB1	OFF	Yes if Ar19 =0		OFF	OFF
P2	Probe PB2	OFF	Yes if Ar19 =0		OFF	OFF
P3	Probe PB3	OFF	Yes if Ar19 =0		OFF	OFF
P4	Probe PB4	OFF	Yes if Ar19 =0		OFF	OFF
A01	High pressure switch	OFF				
A02	Low pressure switch	OFF			OFF	
A05	High temperature, high pressure	OFF				
A06	Low temperature, low pressure	OFF			OFF	
A07	Antifreeze	OFF			OFF	
A08	Flow switch	OFF	Boiler heater OFF	OFF		OFF
A09	Compressor 1 thermal relay	OFF				
--						
A11	Condensation fan thermal relay	OFF			OFF	
A12	Defrost error					
A13	Compressor 1 maintenance					
--						
A15	Water pump maintenance					
rtC	Time clock Alarm					
RtF	Time clock Alarm					
EE	Eprom error	OFF	OFF	OFF	OFF	OFF
ACF1	Configuration Alarm	OFF	OFF	OFF	OFF	OFF
ACF2	Configuration Alarm	OFF	OFF	OFF	OFF	OFF
ACF3	Configuration Alarm	OFF	OFF	OFF	OFF	OFF
ACF4	Configuration Alarm	OFF	OFF	OFF	OFF	OFF
AFr	Net frequency alarm	OFF	OFF	OFF	OFF	OFF

9.8 DISPLAYING LOAD WORKING HOURS

- 1) Access function menu
- 2) Press the keys until the lower display shows the label of the single load; C1Hr (compressor 1 working hours), CHr2 (compressor 2 working hours), PFHr (system water pump working hours).

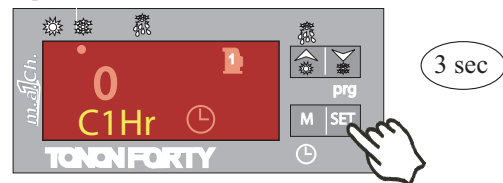


The upper display will show the working hours.

The icon is lit up.

9.9 RESETTING LOAD WORKING HOURS

- 1) Access function menu by pressing "M" key
- 2) Press the keys until the lower display shows the label of the single load (C1Hr, C2Hr, PFHr) and the upper display shows the working hours.
- 3) Keep the SET key pressed for 3 sec: **the upper display will show 0, which means the reset has been carried out correctly.**
- 4) Exit function menu by pressing the M key or waiting for exit time-out to expire (15s)
- 5) Repeat operations 1 to 4 for other loads.



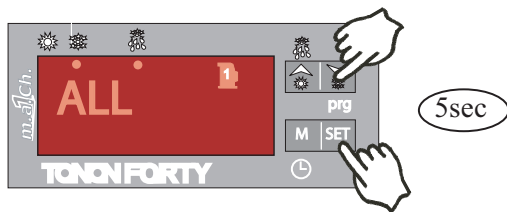
**Before resetting this Alarm code, contact the authorized Tonon Service for a check-up of the equipment in order to avoid further troubles**

**10.0 PROGRAMMING FROM THE KEYBOARD**

The controller parameters are managed under Family Labels. This system allows a quicker access to the required parameter.

LABEL	MEANING
ALL	Displays all the parameters
ST	Displays only thermoregulation parameters
CF	Displays only configuration parameters
SD	Displays only dynamic set point parameters
ES	Displays only energy saving parameters
CO	Displays only compressor parameters
FA	Displays only ventilation parameters
Ar	Displays only heating element parameters
DF	Displays only defrost parameters
AL	Displays only alarm parameters

**10.1 ACCESS TO “PR1” PARAMETERS (USER-LEVEL)**



- 1) Press SET and keys for a few seconds. The icons and start blinking.
- 2) Select the different families of parameters by using the keys
- 3) After selecting the family, by pressing the SET key, the instrument will display label and code of the first parameter included into the family in "Pr1" on the lower display, and its value on the upper display.

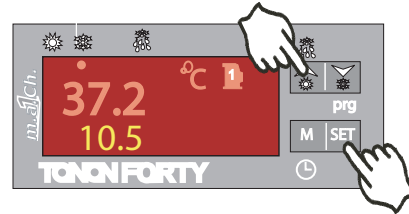
Now you can scroll and change only the parameters included into that family.

**10.2 TO CHANGE PARAMETER VALUES**

- 1) Access programming mode
- 2) Select the desired parameter
- 3) Press the SET key to allow the value to be changed
- 4) Change the value by using the keys
- 5) Press SET to store the new value and move to the next parameter

**6) TO LEAVE PROGRAMMING MODE:**

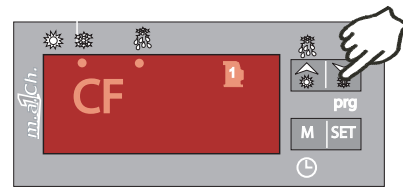
Press SET + when a parameter is displayed, or wait (15s) without pressing any key.



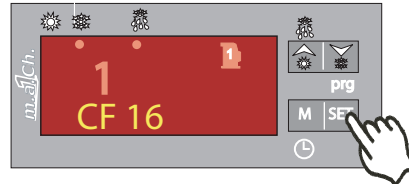
**IMPORTANT:** The new set value is stored also in case of time-out exit without pressing SET.

**10.3 KEY SEQUENCE TO CHANGE PARAMETERS**

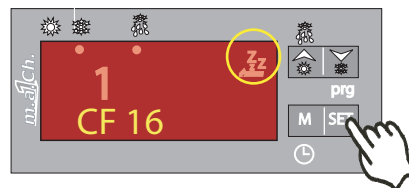
- 1) Press SET + arrow UP, to access the user menu "PR1"
- 2) Press the keys , select the range of parameters to display (e.g. CF is the configuration parameter)



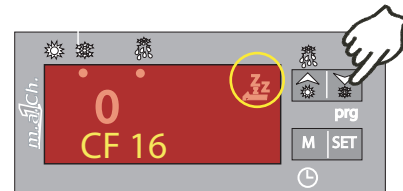
- 3) Press SET to access the parameters of the selected range.



- 4) Press SET to select the set value to be changed  
**IMPORTANT: this is only possible with the unit in stand-by**



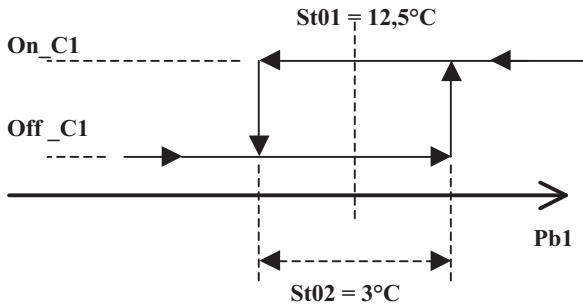
- 5) Press to change the parameter. Press SET to save the change.



### 11.0 COMPRESSOR ADJUSTMENT IN CHILLER OR HEAT PUMP MODE

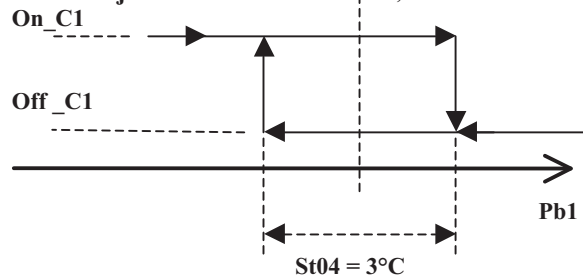
All the units are controlled depending on temperature detected by pB1 probe located at the evaporator inlet (temperature returning from user system). The compressors functioning is set out below:

- st01** Summerset point
- st02** Summer differential
- C1** Compressor 1
- Pb1** adjustment sensor



#### Single compressor units

- St03** Winter set-point (Heat pump)
- St04** Winter differential
- C1** Compressor 1
- Pb1** adjustment sensor **St03 = 38,5°C**



### 11.1 OPERATING MODE OF THE CIRCULATION PUMP

The plant circulation pump functions are controlled by the machine regulator

#### 11.2 TIMING

To guarantee a correct machine functioning and avoid untimely triggering of some safety devices during compressor starting and stopping phase. In the regulation system the following timings are active:

**CO02 360 sec.**

Minimum Off-time

It determines the time during which the compressor must remain deactivated even when there is a call for it to restart. During this phase, the LED relating to the compressor is blinking.

**CO05 60 sec**

Delay on-time meant as actual power supply to the control

It delays the activation of outputs in order to distribute mains electrical inputs and protect the compressor/s against repeated startings in case of frequent mains power supply failures.

**CO07 250 sec.**

The water pump will be stopped only as machine stops (unit in stand by).

### 11.3 FAN FUNCTIONS

All the unit mount a fan speed control. They may be adjusted according to a temperature or to a pressure sensor, which is supplied on request as an accessory (DCP).

**IMPORTANT: for units working with low outside air temperature in chiller function, we recommend using the DCP for a more reliable control.**

Ideal temperature ranges for control type:

#### WORKING IN CHILLER MODE

Outdoor temperature  $20 \div 35^\circ\text{C}$

Standard control temperature

Outdoor temperature  $-10 \div 35^\circ\text{C}$

DCP pressure control

As to Pulsar models with heat pump, the DCP gives better control for the defrosting function too.

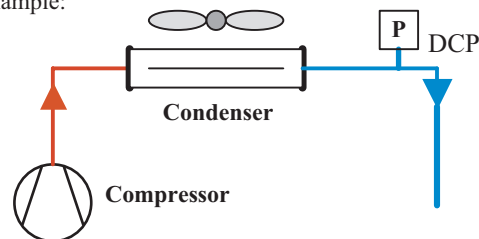
### 11.4 DCP PRESSURE CONTROL DEVICE

This type of control has a pressure probe with 4-20mA outlet signals. The regulation range for the probes goes from 0 to 30 bars. The device can also be installed on site, which besides the installation of a transducer also requires a series of changes to the control parameters. Therefore this operation must only be performed by **qualified TONON FORTY S.p.A, staff or by authorized service centres.**

#### QUASAR models with only "Chiller":

The position for the pressure test point for installing the pressure transducer is on the liquid pipe coming out of the condensation battery.

Example:



#### PULSAR models "Chiller and heat pump"

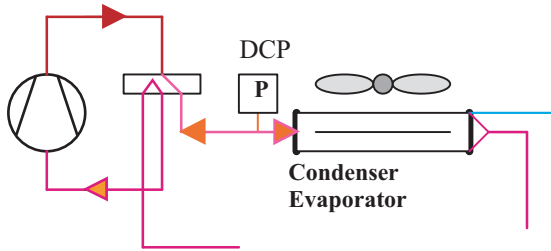
The position of the pressure test point to install the pressure transducer is on the delivery pipe coming out of the 4-way reverse valve, going into the finned battery (summer condenser / winter evaporator). This gives the following controls:

- Condensation pressure control in Chiller mode, to control the fan speed during summer functions.
- Evaporation pressure control in Heat pump mode, to control the fan speed during winter functions.
- Defrosting control with low pressure input and high pressure outlet (see par. 11.5 p. 18)



Example:

Compressor



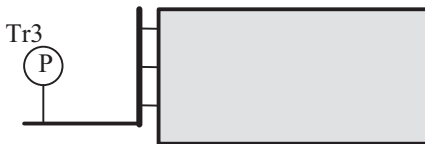
**11.5 DEFROSTING**

All the heat pump Pulsar model use a defrosting control by pressure sensor.

Working

When the defrosting temperature has been reached pB3 (par. DF03) the delay countdown begins. Once the delay is complete, a defrosting cycle is activated. The output starts according to the set (par. DF04), once the value of probe TR2 has been reached. If the defrosting time goes over the maximum value, the wrong defrosting is signalled on the display.

- Combined pressure control



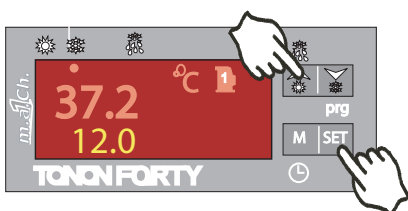
The probe is positioned as shown in the diagram:  
Tr3 defrosting control pressure probe

*N.B. during a defrosting phase the heating elements fitted in the battery pipes (if delivered as accessories) are turned on. In this way the lower part of the battery is warmed up to help dripping and preventing ice blocks.*

**11.6 MANUAL DEFROSTING**

The control also gives the possibility of forcing a manual defrosting cycle. This function is active if parameter dF05 is not 0. You may defrost with pressure lower than set dF19 for time dF05, even if time dF10 has not expired. If while time counting dF05 pressure goes over the sum of dF19 set and differential dF20, the function is cancelled and time dF05 is reloaded.

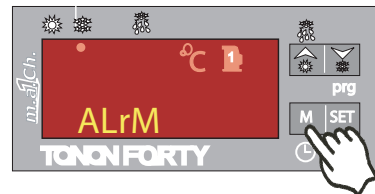
To start the manual function, press the SET+arrow up keys together for 5 seconds.



**11.7 DISPLAYING TIME LEFT TO COMPLETE DEFROSTING**

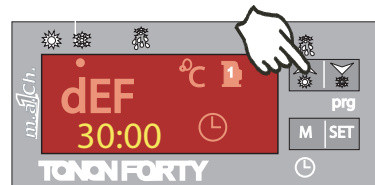
You can visualize on the display the time left to the start of a defrosting cycle. To access this visualization, press "M" key, then with the arrow keys scroll to label "dEF". On the lower part of the display you can read time, expressed in minutes and seconds.

- 1- Press "M" key to access the FunctionsMenu



- 2- Scroll through the menu to Label dEF. On the lower display the remaining time before a defrosting is shown.

**IMPORTANT: In the case of combined defrosting, once the delay time has expired, the defrosting function is only activated if the combined set point status is satisfied**



## 12.0 STARTING

### 12.1 PRELIMINARY CHECK

General checks are NECESSARY prior to starting the appliance in order to guarantee trouble-free operation of assembly.

- 1) Check that the water connections have been carried out correctly in accordance with the general diagrams enclosed with this manual.

Ensure that the user system return water pipe is connected to the fitting marked "COOLED WATER INLET", while the system water supply pipe is connected to the fitting "COOLED WATER OUTLET"

- 2) Bleed the water system properly with the pump switched off. Any air bubbles could cause malfunctioning and even ice in the cooler, with the possibility that this could break and pollute the refrigerant circuit.
- 3) Check that all the on/off valves in the system are open, that the system is up to pressure and that water circulation is normal.
- 4) Check the electrical connections and that the Sections of the wires and their raceways corresponds to what is indicated on the enclosed wiring diagram.
- 5) Check that the terminals are tight.
- 6) Check that the supply voltage corresponds to the indications given on the wiring diagram. Also check that the voltage is constant and does not deviate more than 5% from the required value.
- 7) All the units included in models 041 / 121 come with a three-phase compressor and are fitted with a cyclic phase connection control relay. If the connection is incorrect, the appliance cannot be activated.

**If the green LED on the relay lights up, this indicates that the connections and the phase sequence are correct. The LED goes out if phase connection is incorrect.**

In this case it is sufficient to invert the connection of two of the three phases to ensure the correct direction of rotation of the compressor.

- 8) All the units have a compressor oil heater (casing resistance), which should be activated at least 8 hours before starting the compressor. The casing resistance should be powered by switching on the power on/off switch without starting the compressor by the On/Off control on the display panel.
- 9) Ensure that airflow through the finned block condenser is not obstructed (presence of foreign objects, packing material, leaves, etc.).

**Do not use the on/off power circuit breaker to start or stop the unit**


### 12.2 START UP



Once all the above tests have been performed, the unit can be turned on.

**From the front panel on the machine, you can directly have access to the controller through the PVC flap.**

All the thermal switches on the QMI electric control board etc., must be turned on so that they power all the users.

*If the regulator display is not on, check that the phase control relay KA3 is active. Otherwise invert the phases on the line terminal board input (see the previous para-graph at point 7).*

The regulator display shows respectively the plant return temperature (plant water intake) and the bottom display shows the fan control temperature or pressure. The machine awaits a command, the stand-by icon  is lit.

To start the unit in summer mode (chiller) press the key  for 5 seconds, or  press key to activate the unit in Winter mode (Pulsar units only) see paragraph 7.1 or 7.2.

### 12.3 SUMMER MODE START UP

**The regulation device is set in the factory with the summer function set-point (chiller) at 12.5°C with a differential of 3°C.**

This shows that the unit is set to function when the recycle water temperature is above 14°C and will automatically stop when the temperature falls to 11°C.

Before starting the unit, we recommend checking the set-point value as follows:

- Press the SET key
- The bottom display shows the Set C code (summer set-point)
- The top display shows the set value 12.5

**To change the value refer to paragraph 8.0.**

### 12.4 WINTER MODE START UP

**The regulation device is set in the factory with the winter function set-point (heat-pump) at 38.5°C with a differential of 3°C.**

This shows that the unit is set to function when the recycle water temperature is lower than 37°C and will automatically stop when the temperature reaches 40°C.

Before starting the unit, we recommend checking the set-point value as follows:

- Press the SET key
- The bottom display shows the Set H code (Winter set-point)
- The top display shows the set value 38.5

**To change the value refer to paragraph 8.0.**

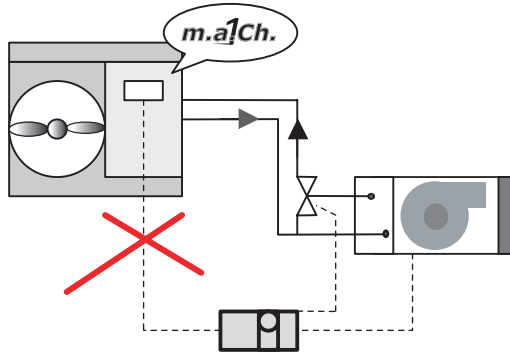
**IMPORTANT: if the unit is not started from a remote control, the top display shows the OFF label (see par. 7.3)**

**12.5 INTERFACE WITH THE USER’S SYSTEM**

TONON® chiller and heat pump units can be interfaced with various types of systems. However, certain hydraulic and electric requirements must be respected to avoid problems of varying entity during operations.

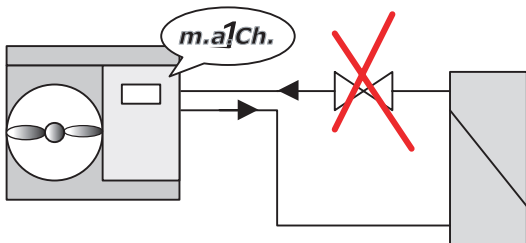
1) All the units are automatically heat-regulated. During the relative period, it is best if the unit is always on so that the water temperature is maintained in the user’s system.

**DO NOT USE THE ROOM THERMOSTAT AS THE ON/OFF SWITCH FOR THE MACHINE**



2) All the standard and AP units need a constant water flow to the heat exchanger. Therefore it is important that when the unit is running there is no variation in the flow.

**UNDER NO CIRCUMSTANCES MUST THE WATER DELIVERY AND RECYCLE LINES OF THE UNIT BE BLOCKED.**



3) All the units need a rated flow, refer to paragraph 3.0, which guarantees a thermal jump of around 5°C between entrance and exit to the exchanger. One of the simplest checks is to ensure there are no large pressure drops in the system.

**12.6 OPERATING CHECKS**

**GENERAL INDICATIONS**

All the appliances come with a condensate temperature / control device to allow operation even with low external air temperatures (min. -10°C).

This device activates the modulation of the fan speed of rotation in relation to the condensed refrigerant temperature. Upon starting the compressor, the fan starts immediately at maximum speed of rotation. After a few moments the control device automatically enables the modulation of the airflow in order to keep the temperature/condensation pressure constant within the set values in relation to the external air temperature.

The control device is set to prevent subsequent compressor start-ups at short intervals, which could cause damage. The following time settings are therefore active during a normal operating cycle: (see par.13.2).

**12.7 CHECKS**

*- Water temperature*

Once steady operating conditions have been reached, check the difference between the inlet and outlet water temperature. The inlet temperature is normally shown on the display. Pressing the key will display in rotation system delivery and return temperatures. The temperature difference should be between 4.5 - 5.5 °C. Greater differences indicate poor water circulation in the system (in this case, check pump specifications).

*- Working pressures*

After a few minutes operation, using the pressure gauges (supplied as accessory or to be connected in the field), check the condensation (high-pressure side) and evaporation temperature (low-pressure side).

High pressure side:

**Pressure Bar 17.5 - 19 kPa 1750 - 1900**

Low pressure side:

**Pressure Bar 4 - 4.7 kPa 400 - 470**

*- Refrigerant load*

The temporary presence of bubbles that can be seen through the liquid indicator (when included) is to be considered normal. Persistence of the bubbles indicates lack of refrigerant inside the cooling circuit. The refrigerant load is indicated on the adhesive identification plate on the appliance.

**- Presence of humidity**

After a few hours of operation, check the colour of the crown inside the liquid level indicator (when included):

-a somewhat yellow colour indicates the presence of humidity in the cooling circuit. In this case, have qualified personnel remove the moisture from the circuit.

**- Overheating temperature of the refrigerant gas**

This value corresponds to the difference between the temperature of the gas measured on the intake pipe and the temperature of evaporation measured on the pressure gauge. For optimal appliance performance, the values should be between 4°C and 10 °C.

**- Under-cooling temperature of the refrigerant liquid**

This value corresponds to the difference between the temperature of condensation measured on the pressure gauge and the temperature measured on the liquid pipe. For optimal appliance performance, the values should exceed 2-3 °C.

**- Electrical input**

Check that electrical input corresponds to the values given on the technical data sheet.

**13.0 CONTROL AND SAFETY DEVICES**

All the appliances are fitted with a control device and a series of safety components, as listed on the following pages. These devices are calibrated in the factory and checked during the final test prior to dispatch. Once the appliance has been installed and after a reasonable period of operation, it is a good rule to check the efficiency of the control/safety devices and the matching of the values given in the following tables.

**Safety devices**

safety device	Set-point	Differential
<b>Antifreeze thermostat</b>	<b>4°C</b>	<b>3°C</b>
- alarm activation temperature: set point		
- reenabling temperature: set point + differential		
<b>High pressure switch</b>	<b>28 bars 2800KPa</b>	<b>5 bars 500KPa</b>
- alarm activation temperature: set point		
- reenabling temperature: set point - differential		
<b>Low pressure switch</b>	<b>2 bars 200KPa</b>	<b>1 bar 100KPa</b>
- alarm activation temperature: set point		
- reenabling temperature: set point + differential		

**Overload compressor 1,33 x I nom. comp.**

The antifreeze alarm and high pressure, are manual resetting. Before resetting the unit after lock out (refer to paragraph 11.4), check the reason for the problem. If the alarm continues contact the **TONON® Authorised service centre** who will see to the necessary maintenance.

**13.1 GENERAL INFORMATION**

Before leaving the factory all the machines are carefully tested and left running for a sufficient period to ensure that all components work properly and that all the control and safety devices trigger correctly. After correct installation no further adjustments need to be made unless repairs are carried out or malfunctioning occurs.

It is, however, necessary to periodically check that the appliance is working correctly, especially after prolonged periods of idleness.

**This maintenance should be carried out by qualified TONON FORTY® personnel only, following the instructions given in this manual.**

The maintenance operations described on the following pages should be considered as a routine and are extremely important for the quality of operation and for long life of the appliance.

A troubleshooting list is given at the end of the chapter, in which possible troubles that could be encountered are listed, plus the corresponding causes and remedies.

**13.2 PERIODICAL PERIODIC MAINTENANCE AND CHECKS****Monthly checks.**

- Check the working pressures on the high and low pressure side using a common pressure gauge unit or, if provided, the pressure gauges installed on the appliance

**Rated working pressures**

<b>External air temperature:</b>		<b>35°C</b>
<b>High pressure side</b>	<b>Bars</b>	<b>18.5</b>
	<b>KPa</b>	<b>185</b>
<b>Water temperature</b>		<b>12°C-7°C</b>
<b>Low pressure side</b>	<b>Bars</b>	<b>4.2</b>
	<b>KPa</b>	<b>420</b>

- Check the safety devices work correctly, and that the set trigger levels correspond as given in paragraph 13.0.
- Check the refrigerant load through the liquid indicator installed on all the appliances. If bubbles can be seen through the indicator under steady operating conditions, this indicates possible lack of refrigerant.
- Check the colour of the crown inside the liquid indicator. Any tendency towards yellow indicates the presence of moisture or humidity and therefore the filter should be replaced. If the problem persists, dehydrate the cooling circuit.
- Check the total consumptions correspond to the levels given on the electrical data table.
- Check that the liquid circuit is properly filled, carefully bleeding the circuit through suitable air valves to eliminate any remaining air bubbles.
- Check that the electric terminals inside the electric control board and on the external user devices are tight.

**Six-monthly maintenance checks**

Carry out all maintenance operations scheduled at monthly intervals. Check that the condenser unit is clean. If necessary clean the fins using compressed air blown in the opposite direction to the airflow or, if there is concentrated clogging, a jet of water at moderate pressure. Check that the noise and vibration levels of the moving parts (compressor/fan/pump) are within normal limits.

### 13.3 STOPPING FOR THE SEASON

The Quasar and Pulsar range chillers and heat pumps are normally used in civil type air-conditioning systems which remain idle during Winter.

**If the appliance is installed in areas where there is the possibility of freezing during winter, the system must be drained of water or the latter mixed with anti-freeze solutions in suitable percentage parts. In this case appliance efficiency may be slightly affected and the size of the pump should be calculated taking into consideration the variation in the parameters of water flow rate and loss of head of the cooler (see table par. 2.3).**

**IMPORTANT: FOR UNITS WITH EVAPORATOR ANTIFREEZE ELEMENTS, DO NOT TURN THE POWER OFF TO THE UNIT TO AVOID THE SAFETY DEVICE BEING TURNED OFF DURING COLD PERIODS**

The antifreeze elements are active even when the unit is on stand-by.

### 13.4 SAFETY INFORMATION

All maintenance, repairs and replacement operations to any component, adding refrigerant gas, dismantling the unit, must all be done by qualified personnel trained in air conditioning units.

#### Electric connections

Fit a differential automatic switch near to the unit, with adequate capacity for the electric intake. Connect the unit to earth, checking it is efficient ( $80 \Omega$ ).

#### Refrigerant fluids

The type of refrigerant to use is given on the technical data plate on the hydraulic attachment side of the unit. The lubrication oil to be used is given on the compressor plate.

#### Warnings

If the refrigerant gas accidentally leaks, take the following precautions:

- if the refrigerant gas comes into contact with skin or eyes, it can cause frostbite. Therefore, use protective gloves and clothing, and protect the face and eyes.

Prolonged inhalation of refrigerant gas can cause unconsciousness or heart disorders. Elevated concentrations can cause asphyxia due to the lack of oxygen in the surrounding atmosphere.

- Never use open flames, which due to combustion can cause toxic substances.

### 13.5 DEMOLISHING THE MACHINE AND DISPOSAL OF TOXIC SUBSTANCES

Demolition and processing of the substances used in the machine must be entrusted to authorised persons, in accordance with legislation in force. Harmful substances like compressor oil and refrigerant, must not be emptied directly into the atmosphere, but collected in special containers and delivered to the special disposal centres. All the identification plates and technical documents must be destroyed.

## 14.0 FAILURE SOLVER

FAILURE	SIGN	POSSIBLE CAUSE	RECOMMENDED REMEDY
<b>The machine does not start</b>	Display panel does not light up	Power supply failure	Check electric connections to the mains supply terminals and the tension values. Check the fuses on the secondary circuit of the auxiliary transformer
		Phses inverted. Relay KA3 does not give an impuls. The related LED is not active (only mod. 041)	Change the input phases in the terminal block in the electric panel
	The display panel is lit but the machine does not start	Unit in STAND_BY mode	See par. 6.3 to start the equipment
	Writing OFF on the display	No external consent	Check connections to terminals 2-3 for external
	The machine does not start and the compressor LED blinks on the display panel	Timing in progress	Wait for timing to finish (max. 360 sec.);then the compressor should start
	The low part of the display blinks with one or more alphanumeric codes and alternates with the temperature level	One or more satefy devices is in alarm status	Check which safety device has triggered, remove the cause for the alarm and rearm the safety device (see par. 9.6)
<b>The compressor continuously starts and stops</b>	Normal working, too frequent stops and starts due to low pressure	Too little refrigerant	Trace and remove the refrigerant leak and fill up
	Suction pressure too low and frost	Liquid line filter blocked	Replace the filter
<b>The compressor runs and never stops</b>	Temperature too high in the room being conditioned	Excessive heat charge	Check infiltrations and insulation
	Temperature too low in the room being conditioned	The thermostat starts at too low temperature	Reset or repair the thermostat
	Bubbles on the refrigerant passage indicator	Too little refrigerant	Trace and repair the refrigerant leakage and fill up
<b>Noisy compressor</b>	The compressor is noisy, or delivery pressure too low and suction pressure too high	Worn or broken compression coils in the compressor	Service the compressor
	The compressor knocks in the head. The suction pipe is abnormally cold	Broken parts inside the compressor	Service the compressor
		Liquid return	Check overheating and the bulb position in the expansion valve
		Expansion valve blocked in open position	Repair or replace the expansion valve



FAILURE	SIGN	POSSIBLE CAUSE	RECOMMENDED REMEDY
<b>System performance is lower than normal</b>	Thermostatic valve whistles	The liquid refrigerant vaporises	Add refrigerant
	Temperature difference in the refrigerant pipe on a level with the filter or expansion valve	Blocked filter or solenoid	Clean or replace
	Intermittent or uninterrupted running	Blocked or obstructed expansion valve	Repair or replace
	Excessive overheating	Overheating not correctly adjusted	Adjust the expansion valve and check
Excessive pressure drop in evaporator		Check overheating and reset the expansion valve	
<b>Delivery pressure too high</b>	Condensator outlet air too hot	Poor condensation air flow	Check the fan condition and any obstacles in the air flow
		Dirty condenser	Remove anything that is blocking the condenser (leaves, paper, etc)
	Condenser outlet air cold	Too much refrigerant in the circuit, condenser flooded	Empty the refrigerant from the condenser
<b>Suction pressure too high</b>	Compressor runs without stopping	Excessive load to the evaporator	Check there are no excessive outside air infiltrations into the conditioned room
	Suction pipes too cold Liquid return to the compressor	Expansion valve overloaded	Set the overheating level and check the bulb position
		Expansion valve blocked in the open position	Repair or replace the valve
	Noisy compressor	Broken compression coils in the compressor	Service the compressor

**15.0 GENERAL HYDRAULIC DIAGRAM**

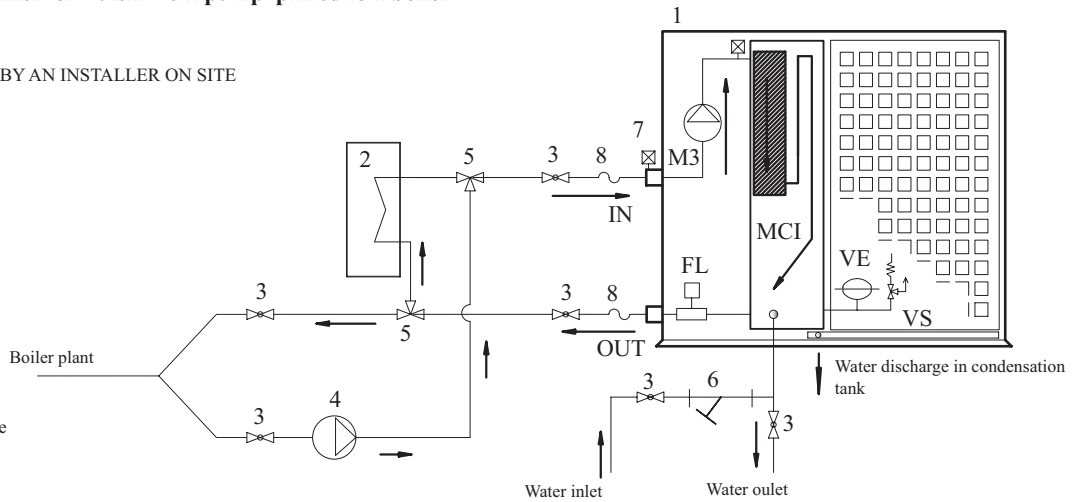
General plant of a Quasar chiller or Pulsar heat pump paired to a boiler

COMPONENTS TO BE INSTALLED BY AN INSTALLER ON SITE

1. Quasar / Pulsar
2. User's system
3. Cock
4. Circulation pump
5. 3-way valve
6. Net filter
7. Manual air blow valve
8. Vibration damping coupling

MAIN HYDRAULIC COMPONENTS

- MCI Plant interface compact module
- VS Safety valve
- VE Expansion tank
- FL Flow switch
- M3 Circulation pump



**16.0 COOLING CIRCUIT DIAGRAM**

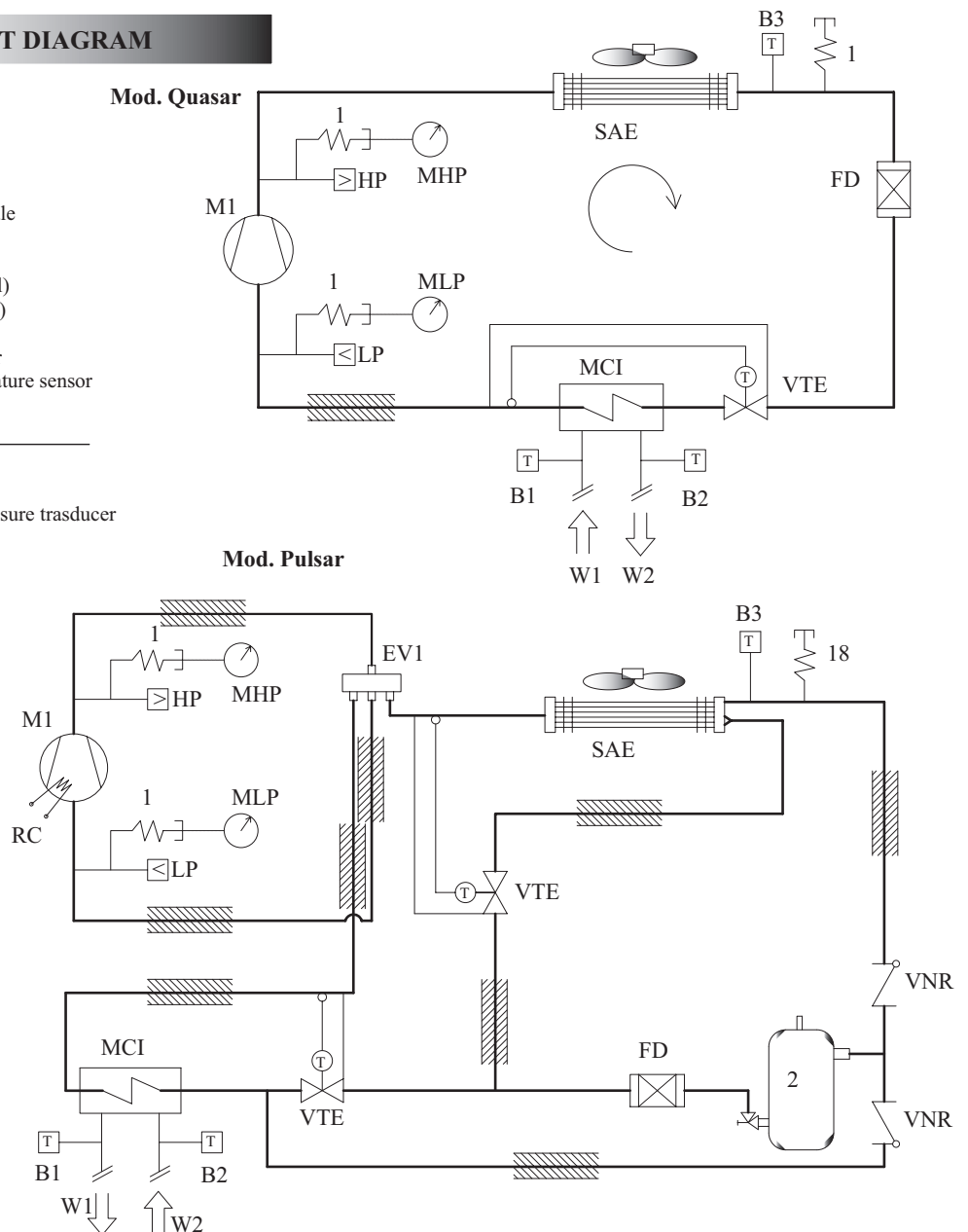
LEGEND

- M1 \* Compressor
- SAE \* External air exchanger
- FD \* Filtro deidratatore
- VTE \* Thermostatic valve
- MCI \* Plant interface compact module
- HP \* High pressure safety switch
- LP \* Low pressure safety switch
- MHP \* High pressure gauge (optional)
- MLP \* Low pressure gauge (optional)
- B1 \* Working temperature sensor
- B2 \* Antifreeze temperature sensor
- B3 \* Condensation control temperature sensor
- EV1 \*\* Cycle inversion valve
- VNR \*\* Non-return valve

- 1 - \* Pressure connection
- 2 - \*\* Tank for liquid
- 3 - \* Pressure connection for pressure trasducer

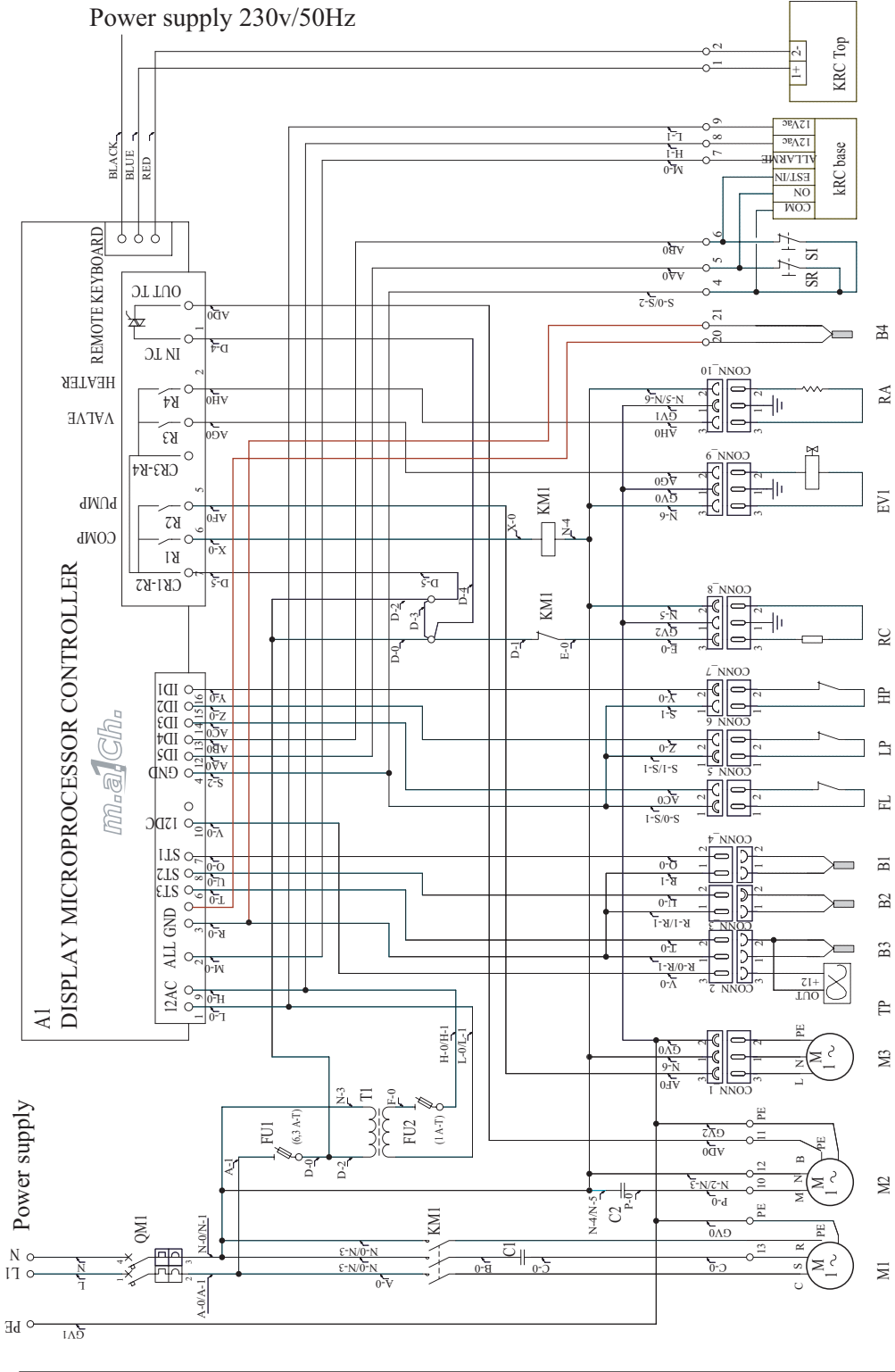
- W1- water back from the plant
- W2- water to the plant

- \* Quasar e Pulsar
- \*\* Pulsar



17.0 ELECTRIC DIAGRAM MODELS Quasar/Pulsar 021-026-031

Power supply 230v/50Hz



LEGEND

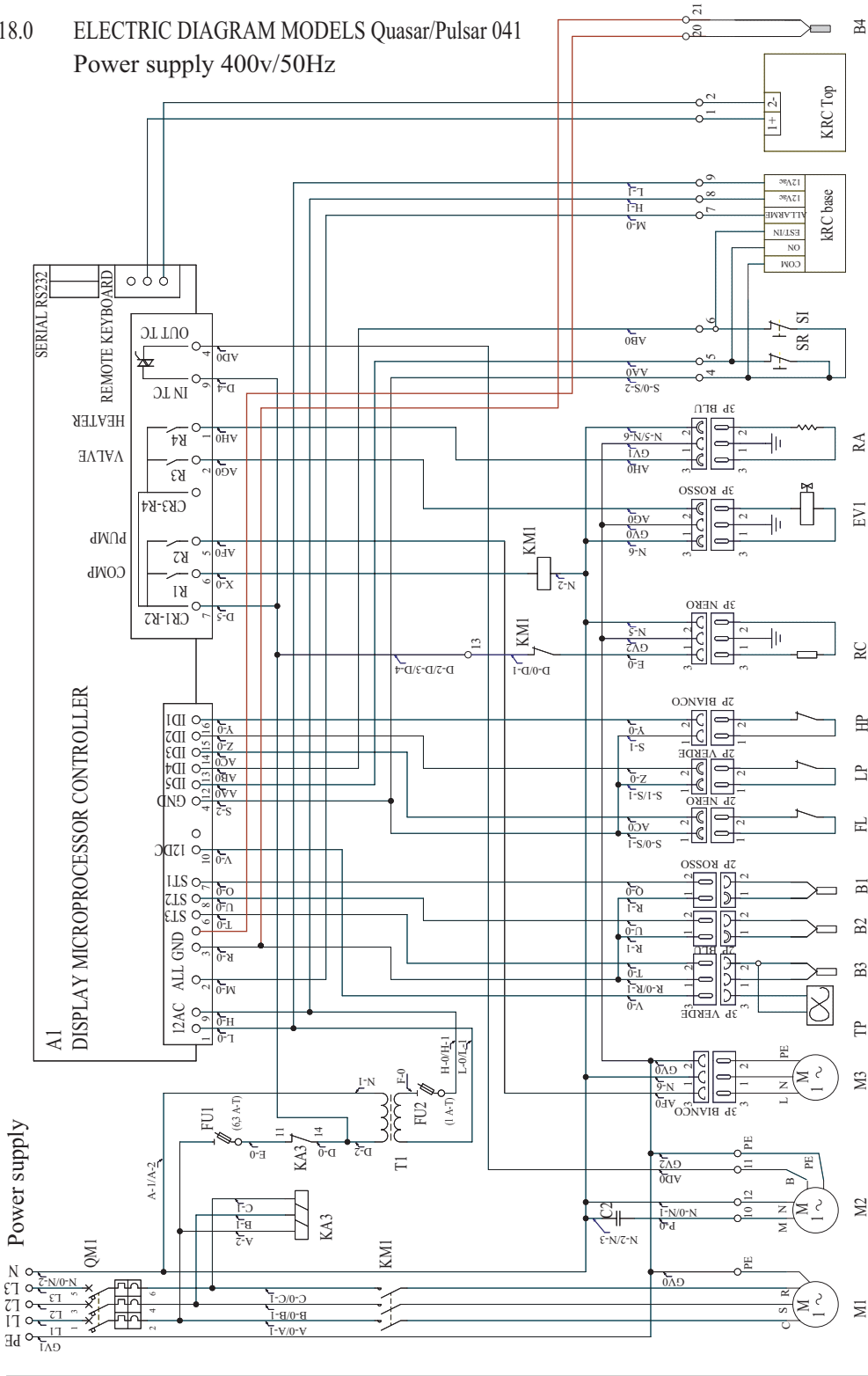
- A1 Microprocessor controller
- B1 Main sensor
- B2 Anti-freeze sensor
- B3 Condensation control sensor
- B4 External air temperature sensor (Optional on request)
- C1 Compressor capacitor
- C2 Ventilator capacitor
- EV1 Reverse cycle solenoid
- FL Flow switch (water flow safety)
- FU1 Auxiliary circuits fuse 230V
- FU2 Auxiliary circuits fuse 24V
- HP High pressure switch
- LP Low pressure switch
- M1 Compressor motor
- M2 Ventilator motor
- M3 Pump motor
- QM1 Main switch
- RA Anti-freeze heater
- RC Housing heater
- TP Pressure trasducer
- KRC BASE Connection kit for remote control
- KRC Top Connection kit for remote control
- SR On/Off remote control
- SI Summer/winter remote control

CONNECTOR LIST

No.	TYPE	LOAD	INITIALS	COLOUR	STANDARD	OPTIONAL
1	3 poles 230V	Circulation pump	M3	White	Yes	No
2	3 poles 12V	Condensation control sensor	B3	Green	Yes	No
3	3 poles 12V	Condensation control trasducer	TP	Green	No	Yes
4	2 poles 12V	Frost protection sensor	B2	Red	Yes	No
5	2 poles 12V	Main sensor	B1	Blue	Yes	No
6	2 poles 12V	Flow switch	FL	Black	Yes	No
7	2 poles 12V	Low pressure switch	LP	Green	Yes	No
8	2 poles 12V	High pressure switch	HP	White	Yes	No
9	3 poles 230V	Compressor housing heater	RC	Black	*Yes	Yes
10	3 poles 230V	Cold cycle inversion solenoid	EV1	Red	*Yes	No
		Anti-freeze heater	RA	Blue	No	Yes

\* Pulsar models

18.0 ELECTRIC DIAGRAM MODELS Quasar/Pulsar 041  
Power supply 400v/50Hz



Power supply

LEGEND

- A1 Microprocessor controller
- B1 Main sensor
- B2 Anti-freeze sensor
- B3 Condensation control sensor
- B4 External air temperature sensor (Optional on request)
- C1 Compressor capacitor
- C2 Ventilator capacitor
- EV1 Reverse cycle solenoid
- FL Flow switch (water flow safety)
- FU1 Auxiliary circuits fuse 230V
- FU2 Auxiliary circuits fuse 24V
- HP High pressure switch
- LP Low pressure switch
- M1 Compressor motor
- M2 Ventilator motor
- M3 Pump motor
- QM1 Main switch
- RA Anti-freeze heater
- RC Housing heater
- TP Pressure transducer
- KRC BASE Connection kit for remote control
- KRC Top Connection kit for remote control
- SR On/Off remote control
- SI Summer/winter remote control

CONNECTOR LIST

No.	TYPE	LOAD	INITIALS	COLOUR	STANDARD	OPTIONAL
1	3 poles 230V	Circulation pump	M3	White	Yes	No
2	3 poles 12V	Condensation control sensor	B3	Green	Yes	No
3	3 poles 12V	Condensation control trasducer	TP	Green	No	Yes
4	2 poles 12V	Frost protection sensor	B2	Red	Yes	No
5	2 poles 12V	Main sensor	B1	Blue	Yes	No
6	2 poles 12V	Flow switch	FL	Black	Yes	No
7	2 poles 12V	Low pressure switch	LP	Green	Yes	No
8	2 poles 12V	High pressure switch	HP	White	Yes	No
9	3 poles 230V	Compressor housing heater	RC	Black	*Yes	Yes
10	3 poles 230V	Cold cycle inversion solenoid	EV1	Red	*Yes	No
		Anti-freeze heater	RA	Blue	No	Yes

\* Pulsar models

<b>SPARE PARTS LIST</b>											
MARK	DESCRIPTION	CODE	Quasar				Pulsar				
			021	026	031	041	021	026	031	041	
A1	Microprocessor controller with display mach_1	735000980	1	1	1	1	1	1	1	1	
***A1	Microprocessor controller with display mach_1 with integrated clock (optional)	735000990	optional on all the units								
B1	Work probe	735000830	1	1	1	1	1	1	1	1	
B2	Anti-freeze probe	735000830	1	1	1	1	1	1	1	1	
B3	Condensation probe	735000830	1	1	1	1	1	1	1	1	
C1	Compressor condenser	714000020	1				1				
		714000030		1				1			
		714000040			1					1	
C2	Fan condenser	730000200	1	1	1	1	1	1	1	2	
EV1	Reverse cycle splenoid	418500010					1	1			
		418500020							1	1	
	Coil + cable 230V	721300010					1	1	1	1	
FD	Dehydrator filter to be welded	435100170	1	1	1	1	1	1	1	1	
FL	Flow switch 3/4"	282006000	1	1	1	1	1	1	1	1	
HP	28bar High pressure switch	720100230	1	1	1	1	1	1	1	1	
LP	Low pressure switch	720100180	1	1	1	1	1	1	1	1	
KA3	Phase sequence control relay	720100130					1			1	
KM1	Compressor contactor 4kW-AC3 Compressor contactor 5,5 kW-AC3	721000240	1	1		1	1	1		1	
		721000210			1					1	
		728100210	1				1				
M1	Scroll Compressor	728100220		1				1			
		728100230			1					1	
		728100510				1					1
M2	Axial fan	730000180	1	1	1	1	1	1	1	2	
M3	Circulating pump motor	731000030	1	1			1	1			
		731000080			1	1				1	1
MCI	Compatto module for plant interface	670103340	1	1			1	1			
		670103350			1	1				1	1
QM1	Mains Magnetothermal protection 2P 16A	710001110	1	1			1	1			
	Mains Magnetothermal protection 2P 20A	710001130			1					1	
	Mains Magnetothermal protection 3P 10A	710001100				1				1	
	Overload cut-out	710000700									
RC	Compressor oil sump heating element	729000010					1	1	1	1	
SAE	External battery	425100940	1	1							
		425101030			1	1					
		425100950					1	1			
		425101041								1	1
T1	Auxiliary circuit transformer 230/12V 5VA	451350270	1	1	1	1	1	1	1	1	
VE	Expansion tank	426000050					1	1	1	1	
VS	3 bar safety valve	428200010	1	1	1	1	1	1	1	1	
VNR	Check valve	418300150					2	2	2	2	
VTE	Thermostat valve	435300320	1	1	1		2	2	2		
		435300340				1					2