motivair

AIR COOLED CHILLERS

Model: MPCA0005 – MPCA7200

INSTALLATION,

OPERATION, & MAINTENANCE

INSTRUCTIONS

Specializing Water Cooling Systems

Visit our website: www.motivaircorp.com

Operator's Responsibility

This equipment MUST be installed, maintained & operated by a person or persons qualified for this equipment. This chiller contains refrigeration, water circulation, and electrical components. The person most suited for this equipment is a qualified refrigeration technician with a valid refrigeration licence. Intervention by unauthorized or unqualified parties may invalidate the warranty.

WARNING

Operation of this system involves potentially lethal dangers (high voltage and high pressures). Therefore, all safety precautions and warnings described in this manual must be precisely observed. Otherwise, severe or fatal injury may be caused.

SAFETY INSTRUCTIONS

The installation, start-up and maintenance of these devices is dangerous, because:

- **high pressures are generated in the equipment**

- **electrical parts are energized**

- **the equipment contains hot pipes**

- **rotating parts (fans) can cause injury. The devices themselves may be installed in a dangerous position (e.g. roof, etc.) Fans can start without warning.**

For these reasons, the equipment must be installed and connected to the electricity/water installations by qualified companies only. **Start-up and maintenance must be conducted by a qualified refrigeration company only.**

Simple maintenance operations on the devices - without opening them - may be performed by the operator. **All other work must be performed by specially qualified personnel.**

Foundation

All chillers must be mounted on a solid, horizontal surface, suitable for the weight of the chiller. Note the chiller weight is increased by filling with water.

Installation site

Observe all local regulations.

Must be dry and protected against freezing. The room temperature must not be colder than 41°F. The system must be installed horizontally. The components are not suitable for exterior installation, without factory modification and approval. **Consult Motivair if chiller will be installed outdoors.**

Installation

Compliance with the following basic rules for the installation of chillers with axial fans will ensure problem-free operation and the rated refrigeration capacity.

Basic rules:
1. The condenser air is blown out vertically or horizontally.
2. Do not install the chiller close to heat sources. Heated air intake must be avoided.
3. The condenser fans are rated for ZERO external static pressure. They do not have the capacity to push air through ducting, which means that **NO DUCTS OR MUFFLERS** may be used on the inlet or outlet of the chillers.
4. No air short-circuit is permitted, i.e. the heated discharge air from the condenser fans must never be drawn back into the condenser inlet. This will occur if the chiller is too close to a wall, or a low ceiling, or other obstructions.

Structure-transmitted noise

It is possible that noise or vibration may be transmitted through the ground, or building structure. If this occurs, it may be necessary to install a vibration elimination device. **The construction specifications of the customer/engineering contractor regarding structure transmitted noise or vibration must be observed.**

Vibration

May be transmitted through the chilled water piping. This can be avoided by the use of flexible piping connections.

Clearances

Must be maintained for servicing and ventilation purposes. All removable side panels must be available for service.
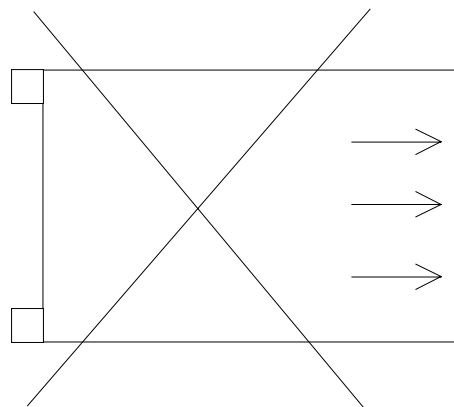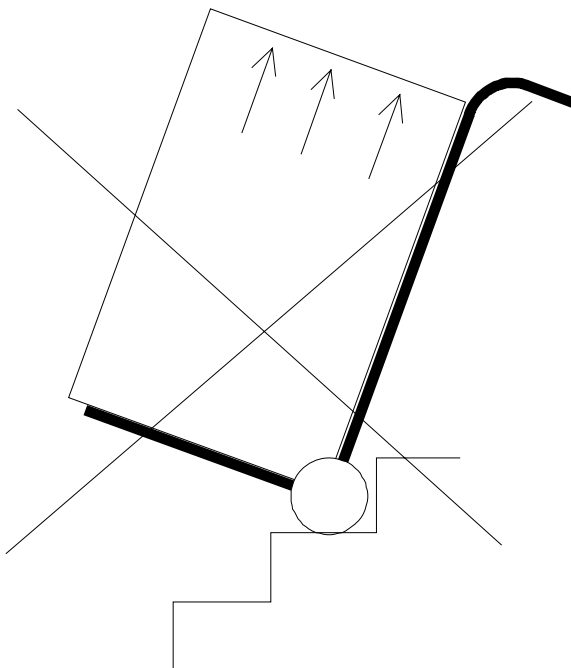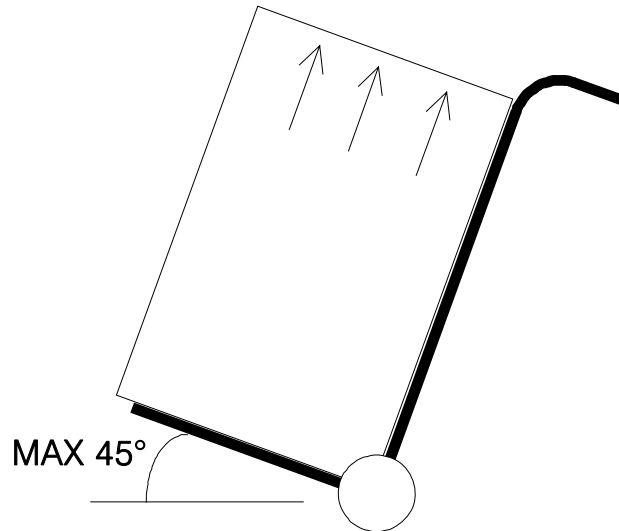
A minimum of 3 feet on all sides is required. Consult Motivair for irregular space requirements.

LIFTING - UNLOADING – POSITIONING	MANUFACTURER'S NOTE
Notices (symbols) –on device packing must be observed	**The chiller may be damaged by:**
Check the center of gravity of the chiller	Dropping or tipping it on the ground.
Use appropriate unloading equipment.	Pulling the chiller by cords, straps, etc.
Remove protective film from metal panels before use.	Lifting the chiller by its piping system.
	Excessive shaking by cranes
	Damage of this type is not covered by warranty.

MAX 45°

| **. LIFTING - UNLOADING – POSITIONING**	**MANUFACTURER'S NOTE**
Notices (symbols) –on device packing must be observed Check the center of gravity of the chiller Use appropriate unloading equipment. Remove protective film from metal panels before use.	**The chiller may be damaged by:** Dropping or tipping it on the ground. Pulling the chiller by cords, straps, etc. Lifting the chiller by its piping system. Excessive shaking by cranes **Damage of this type is not covered by warranty**

MOVING WITH A FORK LIFT TRUCK
If using a fork truck to position the chiller, the forks MUST be as long as the chiller. Use fork extensions if required, OR SERIOUS DAMAGE MAY RESULT.
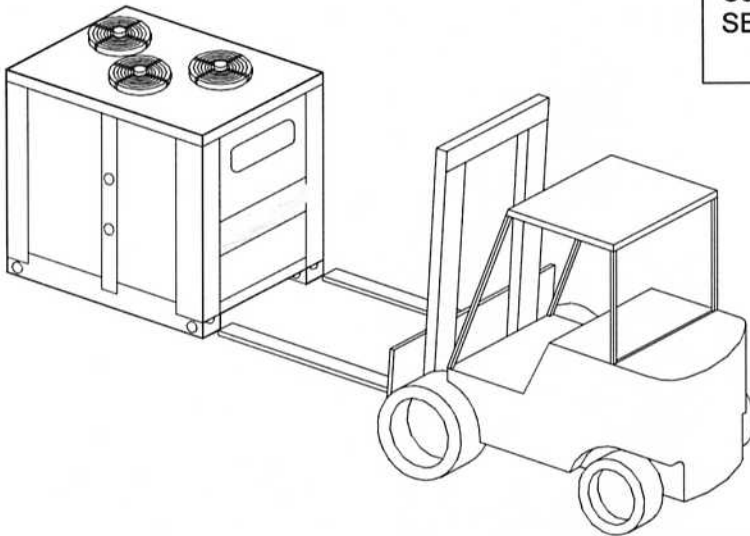
LIFTING WITH A CRANE
Use the holes in the bottom framework for lifting. To distribute the weight evenly place a strong L-shaped section between the belts and structure work. USE SPREADER BARS to prevent crushing.
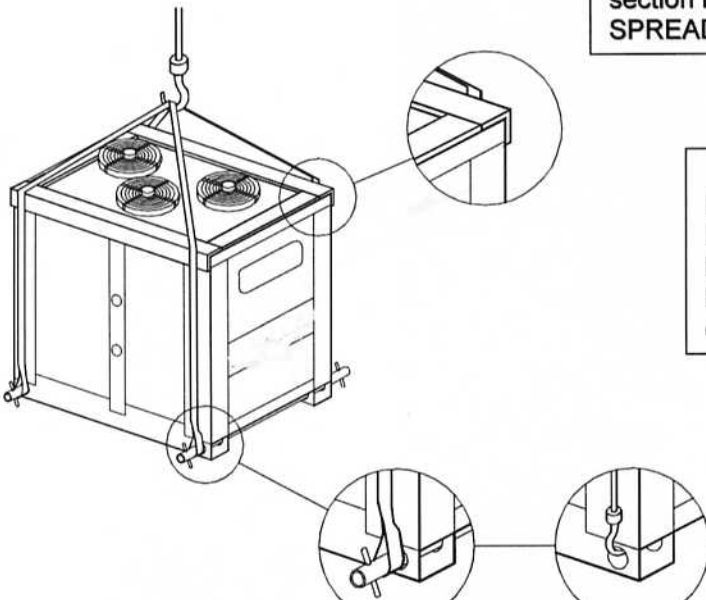
HOOKING TO THE STRUCTURE
Hook only to the points indicated by the LIFTING LABELS.
Make sure there is no possibility for the hooks to slip out due to swinging by the crane..

MAIN ELECTRICAL POWER CONNECTION

The connection of the chiller to the main electrical power supply must be carried out by a licensed electrician, and in strict accordance with Local Safety Standards and electrical codes.

> The manufacturer of the chiller accepts
> **NO LIABILITY**
> for the installation, or work performed by the customer or the installing contractor.

ELECTRICAL COMPONENTS

Factory-wired electrical panel
The control panel mounted in the chiller contains all necessary controls for the chiller
.
Additional wiring in the panel
Additional wiring is permitted but must not modify the original condition of the factory-installed wiring. All changes must be recorded in the original wiring diagram and must be available to the manufacturer.

MAIN VOLTAGE SUPPLY

MPC-A 0005 - 0010   230V/1/60 (3 wire)
MPC-A 0150- 7200   460V/3/60 (4 wire)

The permissible voltage tolerance is ±5%. These values are BINDING and COMPULSORY.

INFORMATION ON EXTERNAL WIRING

Main power feed
 If for local code or other reasons the cable size of the power supply is larger than the terminal size on the main disconnect switch or power block:
1. A junction box must be fitted to the chiller in compliance with local codes in order to reduce the cable cross-section, or
2. The main disconnect switch or power block of the chiller must be replaced (prior approval of the manufacturer is required).

WIRING DIAGRAM INSPECTION

Check that the wiring diagram supplied with the chiller is correct and complete:

1. System designation
2. Order number (see nameplate)
3. Electrical data on wiring diagram - cover sheet

MAX.RUNNING CURRENT FLA

MPCA0005	230V/60Hz/1~/PE	9 Amp
MPCA0010	230V/60Hz/1~/PE	11A
MPCA0150	460V/60Hz/3~/PE	9A
MPCA0200	460V/60Hz/3~/PE	11A
MPCA0300	460V/60Hz/3~/PE	15A
MPCA0500	460V/60Hz/3~/PE	19A
MPCA0800	460V/60Hz/3~/PE	28A
MPCA1000	460V/60Hz/3~/PE	33A
MPCA1200	460V/60Hz/3~/PE	40A
MPCA2200	460V/60Hz/3~/PE	64A
MPCA3000	460V/60Hz/3~/PE	76A
MPCA3500	460V/60Hz/3~/PE	92A
MPCA4000	460V/60Hz/3~/PE	108A
MPCA5000	460V/60Hz/3~/PE	126A
MPCA6000	460V/60Hz/3~/PE	148A
MPCA7200	460V/60Hz/3~/PE	150A

> **CAUTION – MANUFACTURER'S NOTICE**
> The main disconnect switch in the control panel must be switched OFF before any site wiring work,
>
> Do not switch on the control microprocessor until commissioning/start up has been successfully completed, or this may invalidate the manufacturer's warranty.

> **Model Information:**
> **REFER TO DATA ON PLAQUE FOR EACH MODEL**

CHILLED WATER/GLYCOL

MANUFACTURER'S SPECIFICATIONS
The chiller circuit must be 100% filled with water for opperation. If the cooling process causes a loss a water in the circuit, an automatic water make-up valve must be installed. Insufficient water content of the svstem will lead to

1. Safety devices
2. Controls, due to compressor fluctuations/ hunting (frequent switching)
3. Cooling capacity.

If the water content of the complete system is too low, an additional reservoir may be installed on the chilled water inlet side of the chiller.

Only operate the chiller with the flow switch (supplied), that switches off the chiller in the event of insufficient water or a faulty pump. If this condition is not satisfied:
ALL WARRANTY CLAIMS SHALL BE INVALID.
A flow meter and an automatic water make-up svstem can be purchased from the factorv.

COLD WATER PIPING

Water piping and connection to the chiller must conform with all generally accepted piping practices and local codes. All piping should be performed by a qualified person or company.
The following specifications are intended to prevent damage to the chiller.

1. Avoid unnecessary pressure drop by ensuring correct pipe sizes and routing.

2. Connect the chiller with vibration eliminators to avoid transmission of noise or vibration

3. Fit shut-off valves on both sides of the chiller so that maintenance and repair work can be performed without draining the piping system.
4. Fit a filter or Y-strainer (40 mesh) to the chiller inlet to protect the evaporator and pump from foreign particles**.**
5. **IMPORTANT: Filter/strainer must be installed, or blockage of the evaporator may occur**
6. Fit automatic vents at all local high points of the piping system to eliminate air locks. See chilled water system diagram for location.

6. Ensure that the water circuit is maintained at the correct pressure by installing an appropriately sized diaphragm expansion tank close to the inlet of the chiller. The return side of the chiller must be 5-10 psig when the pump is running.
7. Install temperature and pressure gauges at the inlet and outlet of the chiller and the heat load to insure easy inspection and maintenance
8. All chilled water lines should be insulated. Only insulate pipes AFTER testing the circuit for leaks.

NOTE: See Water Circuit Appendix A (pages 28-31) for additional information on how to install & vent a chilled water piping system.

GLYCOL IN CIRCUIT

Glycol mixture
The following basic rules must be observed:

1. The freezing point of the mixture must be lower than the minimum evaporation temperature, or the lowest outside piping temperature, whichever is the lower.
2. See correction factors for glycol concentration on back page of chiller brochure.
3. Use only an industrial-grade inhibited ethylene glycol or food-grade propylene glycol solution. DO NOT use auto antifreeze.
4. Check the pH-value of the solution. It should be about 9 and must never be less than 7.5.
5. Check the pH-value regularly (maintenance).
6. DO NOT use galvanized piping or fittings

IMPORTANT: _NEVER_ change the antifreeze alarm on chiller without written authorization from factory. **WARRANTY WILL BE VOID**

WARNING!
The glycol/water mixture must not be discharged into the normal water drainage system. It must be collected in suitable containers and disposed of in accordance with legal regulations.
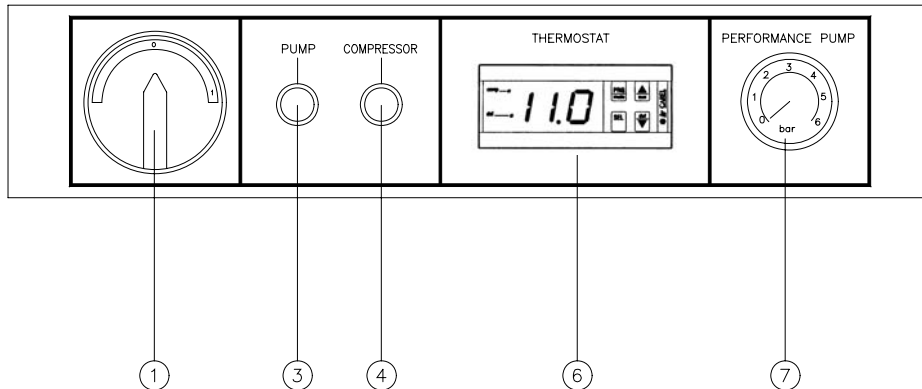
1. MAIN SWITCH

Function   Disconnects the power supply of device

Activation   starts and stops the chiller

O   power supply is OFF

I   power supply is ON

WARNING
High voltage – Danger of fatal injury
Do not open the control panel before isolating the incoming power supply; the power supply of input terminal remains ON.

INDICATORS FUNCTION ON

3. PUMP   Pump is on

4. COMPRESSOR   Compressor is on

6. ELECTRONIC THERMOSTAT

This system is controlled by an electronic thermostat. The essential operating data and information are shown by the display.

DISPLAY – Normal Mode:
XX.X   **actual temperature of the chilled water** in the chiller tank.

DISPLAY ON – CHILLER IS OPERATING, SEE DIXEL CONTROL DESCRIPTION (included).

KEYS:

SET   pressed for more 5 sec.
To view the factory SET POINT

∧ (UP)   increases the displayed value

(DOWN)   decreases the displayed value

Comp___(*)   indicates compressor ON

7. PUMP GAUGE Indicates the external pressure of the water pump

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N.B.
MPCA0005 has only main switch (1) and mechanical thermostat (6) for regulation.

CAUTION
PUMP PRESSURE 15 – 35 PSIG
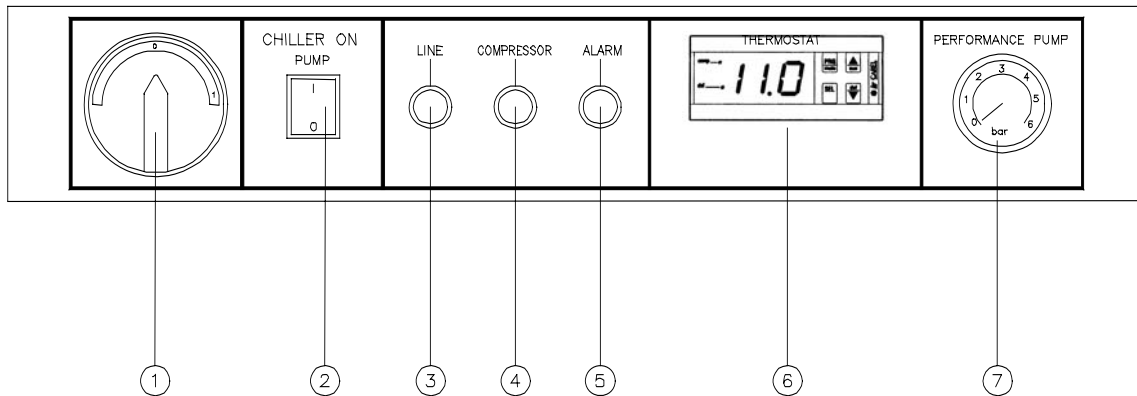
1. MAIN SWITCH

Function   Disconnects the power supply of chiller

2, WORKING SWITCH

Activation   Only for starting and stoping the chiller circulation pump. Switch must be on to start chiller opperaion.

O   power supply is OFF

I   power supply is ON

WARNING
High voltage – Danger of fatal injury
Do not open the control panel before isolating the incoming power supply; the power supply of input terminal remains ON.

INDICATORS FUNCTION (ON)

3. LINE   electric circuit is on

4. COMPRESSOR   Compressor is working

5. ALARM   Intervention of protection device

6. ELECTRONIC THERMOSTAT

This system is controlled by an electronic thermostat. The essential operating data and information are displayed by the display.

DISPLAY – Normal Mode:
XX.X   actual temperature of the chilled water inside the storage tank.

DISPLAY ON – CHILLER IS WORKING, SEE DIXEL DESCRIPTION (included).

KEYS:

SET   pressed for more 5 sec.
To view the factory SET POINT

∧ (UP)   pressed increases the displayed value

∨ (DOWN)   pressed decreases the displayed value

Comp___● (∗)   indicates compressor ON

7. PUMP PRESSURE GAUGE

Indicates the pressure of the water pump

CAUTION
PUMP PRESSURE 15 – 35 PSIG

Single Stage Thermostat

XR10C

Contents

GENERAL WARNING

⚠️ **Please read before using this manual**

- This manual is part of the product and should be kept near the instrument for easy and quick reference.
- The instrument shall not be used for purposes different from those described hereunder. It cannot be used as a safety device.

⚠️ **Safety Precautions**

- Check the supply voltage is correct before connecting the instrument.
- Do not expose to water or moisture: use the controller only within the operating limits avoiding sudden temperature changes with high atmospheric humidity to prevent formation of condensation
- Warning: disconnect all electrical connections before any kind of maintenance.
- The instrument must not be opened.
- Fit the probe where it is not accessible by the end user.
- In case of failure or faulty operation send the instrument back to the distributor or to "Dixell s.r.l." (see address) with a detailed description of the fault.
- Consider the maximum current which can be applied to each relay (see Technical Data).
- Ensure that the wires for probes, loads and the power supply are separated and far enough from each other, without crossing or intertwining.
- In case of applications in industrial environments, the use of mains filters (our mod. FT1) in parallel with inductive loads could be useful.

General description

Model **XR10C**, 32 x 74 mm format, is a single stage temperature controller suitable for applications in the field of refrigeration or heating.
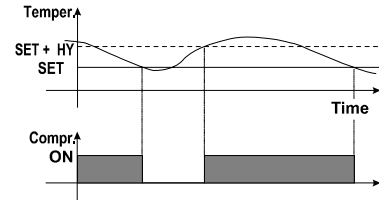
Controlling loads

The regulation output

The regulation is performed according to the temperature measured by the probe.
The instruments are provided with the **CH** programmable parameter which enables the user to set the regulation both for heating or cooling applications:
- CH = CL: cooling applications
- CH = Ht: heating applications

CH = CL: cooling applications.

The Hy value is automatically set above the Set Point. If the temperature increases and reaches set point plus differential the compressor is started and then turned off when the temperature reaches the set point value again.

CH = ht: heating application.
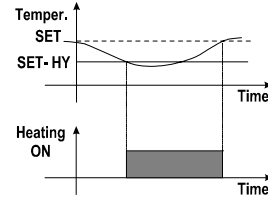
The Hy value is automatically set under the Set Point. If the temperature decreases and reaches set point minus differential the regulation output is activated and then turned off when the temperature reaches the set point value again.

Front panel commands
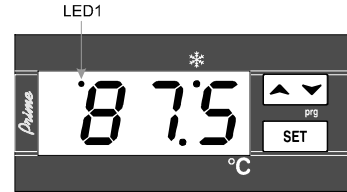
SET: To display target set point, In programming mode it selects a parameter or confirm an operation.

è (UP): To see the max stored temperature; in programming mode it browses the parameter codes or increases the displayed value.

à (DOWN): To see the min stored temperature; in programming mode it browses the parameter codes or increases the displayed value.

KEY COMBINATIONS:

è + à To lock & unlock the keyboard.
SET + à To enter in programming mode.
SET + è To return to the room temperature display.

MEANING of LEDS

Each LED function is described in the following table.

LED	MODE	FUNCTION
❄	ON	Output enabled
❄	Flashing	-Programming Phase (flashing with **LED1**) - Anti-short cycle delay enabled
LED1	Flashing	Programming Phase (flashing with ❄)

HOW TO SEE THE MIN TEMPERATURE
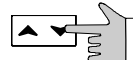
1. Press and release the **à** key.
2. The "Lo" message will be displayed followed by the minimum temperature recorded.
3. By pressing the **à** key again or by waiting 5s the normal display will be restored.

HOW TO SEE THE MAX TEMPERATURE
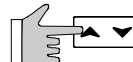
1. Press and release the **è** key.
2. The "Hi" message will be displayed followed by the maximum

temperature recorded.

3. By pressing the **è** key again or by waiting 5s the normal display will be restored.

HOW TO RESET THE max OR min TEMPERATURE RECORDED

1. Hold press the SET key for more than 3s, while the max. or min temperature is displayed. (rSt message will be displayed)
2. To confirm the operation the "rSt" message starts blinking and the normal temperature will be displayed.

HOW TO SEE THE SETPOINT
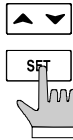
1) Push and immediately release the **SET** key: the display will show the Set point value;

2) Push and immediately release the **SET** key or wait for 5 seconds to display the probe value again.

HOW TO CHANGE THE SETPOINT
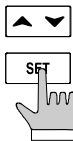
1) Push the **SET** key for more than 2 seconds to change the Set point value;
2) The value of the set point will be displayed and the ❄ LED starts blinking;
3) To change the Set value use the **è** or **à** arrows within 10s.
4) To memorise the new set point value push the **SET** key again or wait 10s.

Changing a parameter's value

To change the parameter's value operate as follows:
1. Enter the Programming mode by pressing the Set and DOWN key for 3s (LED 1 and ❄ start blinking).
2. Select the required parameter.
3. Press the "**SET**" key to display its value (Now only the ❄ LED is blinking).
4. Use **è** or **à** to change its value.
5. Press "**SET**" to store the new value and move to the following parameter.

To exit: Press **SET** + **è** or wait 15s without pressing a key.
NOTE: the set value is stored even when the procedure is exited by waiting the time-out to expire.

THE HIDDEN MENU

The hidden menu Includes all the parameters of the instrument.

HOW TO ENTER THE HIDDEN MENU

1. Enter the Programming mode by pressing the Set + **à** key for 3s (LED 1 and ❄ start blinking).

2. When a parameter is displayed keep pressed the Set+**à** for more than 7s. The Pr2 label will be displayed immediately followed from the HY parameter.

NOW YOU ARE IN THE HIDDEN MENU.

3. Select the required parameter.
4. Press the "**SET**" key to display its value (Now only the ❄ LED is blinking).
5. Use **è** or **à** to change its value.
6. Press "**SET**" to store the new value and move to the following parameter.

To exit: Press **SET** + **è** or wait 15s without pressing a key.
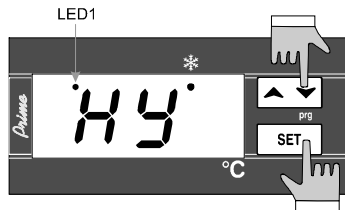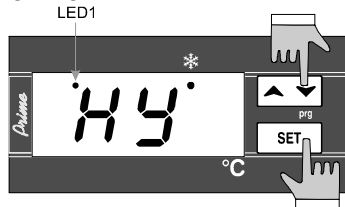**NOTE**: the set value is stored even when the procedure is exited by waiting the time-out to expire.

HOW TO MOVE A PARAMETER FROM THE HIDDEN MENU TO THE FIRST LEVEL AND VICEVERSA.

Each parameter present in the HIDDEN MENU can be removed or put into "THE FIRST LEVEL" (user level) by pressing **"SET + à"**.
In HIDDEN MENU when a parameter is present in Fisrt Level the decimal point is on.

HOW TO LOCK THE KEYBOARD
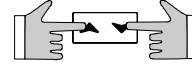
1. Keep pressed for more than 3 s the **è** and **à** keys.
2. The "POF" message will be displayed and the keyboard will be locked. At this point it will be possible only to see the set point or the MAX o Min temperature stored
3. If a key is pressed more than 3s the "POF" message will be displayed.

TO UNLOCK THE KEYBOARD

Keep pressed together for more than 3s the UP and DOWN keys.

List of Parameters

NOTE: the parameters preceded by dots are only in the Hidden Menu.

REGULATION

Hy Differential: (0,1 ÷ 25,5°C / 1÷255 °F) Intervention differential for set point.
    Cooling: Compressor Cut IN is Set Point Plus Differential (Hy). Compressor Cut OUT is when the temperature reaches the set point.
    Heating: Compressor Cut IN is Set Point minus Differential (Hy). Compressor Cut OUT is when the temperature reaches the set point.

- *LS Minimum set point*: (- 50°C÷SET / -58°F÷SET): Sets the minimum acceptable value for the set point.
- *US Maximum set point*: (SET÷ 150°C / SET÷302°F). Set the maximum acceptable value for set point.

Ot Thermostat probe calibration: (-12.0÷12.0°C; -120÷120°F) allows to adjust possible offset of the thermostat probe.

- *OdS Outputs activation delay at start up:* (0÷255min) This function is enabled at the initial start up of the instrument and inhibits any output activation for the period of time set in the parameter.

AC Anti-short cycle delay: (0÷50 min) minimum interval between the compressor stop and the following restart.

- *COn Compressor ON time with faulty probe:* (0÷255 min) time during which the compressor is active in case of faulty thermostat probe. With COn=0 compressor is always OFF.
- *COF Compressor OFF time with faulty probe:* (0÷255 min) time during which the compressor is OFF in case of faulty thermostat probe. With COF=0 compressor is always active.

CH Type of action: CL = cooling; Ht = heating.

DISPLAY

- *CF Temperature measurement unit*: °C = Celsius; °F= Fahrenheit. *WARNING: When the measurement unit is changed the SET point and the values of the parameters Hy, LS, US, Ot, ALU and ALL have to be checked and modified)*

rES Resolution (for °C): (in = 1°C; dE = 0.1 °C) allows decimal point display.

ALARMS

- *ALC Temperature alarms configuration*: (Ab; rE)
  (*Ab*= absolute temperature: alarm temperature is given by the ALL or ALU values.
  rE = temperature alarms are referred to the set point. Temperature alarm is enabled when the temperature exceeds the "SET+ALU" or "SET-ALL" values.

ALU MAXIMUM temperature alarm: (ALL÷150°C; ALL÷302°F) when this temperature is reached the alarm is enabled, after the "Ald" delay time.

ALL Minimum temperature alarm: (-50.0 °C ÷ ALU; -58°F ÷ALU) when this temperature is reached the alarm is enabled, after the "Ald" delay time.

- *ALd Temperature alarm delay*: *(0÷255 min) time interval between the detection of an alarm condition and alarm signalling.*
- *dAO Exclusion of temperature alarm at startup*: *(from 0.0 min to 23.5h) time interval between the detection of the temperature alarm condition after instrument power on and alarm signalling.*

OTHER

PbC Probe selection: (Ptc=PTC probe; ntc=NTC probe). It allows to select the kind of probe.

Installation and mounting

Instrument **XR10C** shall be mounted on panel, in a 29x71 mm hole, and fixed using the special bracket supplied.
The ambient temperature range allowed for correct operation is 0 - 60 °C.
Avoid places subject to strong vibrations, corrosive gases, excessive dirt or humidity. The same recommendations apply to probes. Let air circulate by the cooling holes.

Electrical connections

The instrument are provided with screw terminal block to connect cables with a cross section up to 2,5 mm^2. Before connecting cables make sure the power supply complies with the instrument's requirements. Separate the probe cables from the power supply cables, from the outputs and the power connections.
Do not exceed the maximum current allowed on each relay, in case of heavier loads use a suitable external relay.

Probe connection
The probes shall be mounted with the bulb upwards to prevent damages due to casual liquid infiltration. It is recommended to place probe away from air streams to correctly measure the average room temperature.

ALARM SIGNALS

Message	Cause	Outputs
"EE"	Memory failure	
"P1"	Room probe failure	Compressor output according to par. "Con" and "COF"
"HA"	Maximum temperature alarm	Outputs unchanged.
"LA"	Minimum temperature alarm	Outputs unchanged.

Alarm "EE"
The instrument is provided with an internal check verifying memory integrity.
Alarm "EE" flashes when a failure in the internal memory is detected. In such case call the service.

Alarm recovery
Probe alarm "P1", starts some seconds after the fault in the probe; it automatically stops some seconds after the probe restarts normal operation.
Check connections before replacing the probe.
Temperature alarms "HA" and "LA" automatically stop as soon as the thermostat temperature returns to normal values.

technical data

Housing: self extinguishing ABS.
Case: frontal 32x74 mm; depth 60mm;
Mounting: panel mounting in a 71x29 mm panel cut-out
Frontal protection: IP65
Connections: Screw terminal block ≤ 2,5 mm^2 wiring.
Power supply: 12Vac/dc, ±10%
         (optional 230, 110, ± 10%, 50/60Hz)
Power absorption: 3VA max.
Display: 3 digits, red LED, 14,2 mm high.
Inputs: 1 PTC probe or NTC probe
Relay outputs
    compressor
         SPDT relay 8(3) A, 250Vac or

SPST relay 20(8)A; 250Vac
Data storing: on the non-volatile memory (EEPROM).
Operating temperature: 0÷60 °C.
Storage temperature: -30÷85 °C.
Relative humidity: 20÷85% (no condensing)
Measuring and regulation range:
    PTC probe: -50÷150°C (-58÷302°F)
    NTC probe: -40÷110°C (-58÷230°F)
Resolution: 0,1 °C or 1°C or 1 °F (selectable).
Accuracy (ambient temp. 25°C): ±0,7 °C ±1 digit

Connections

XR10C: 12Vac/dc; COMPRESS. 8a
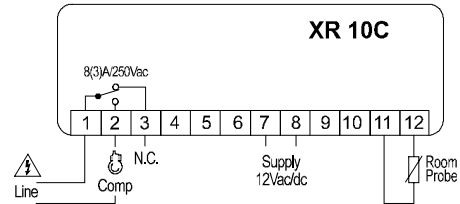
XR10C: 12Vac/dc; COMPRESS.
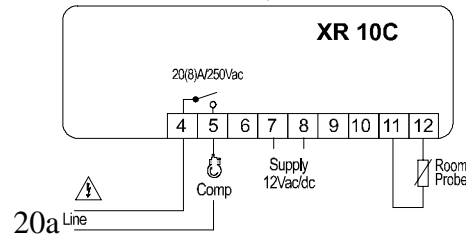
XR10C: 230Vac; COMPRESS. 8a
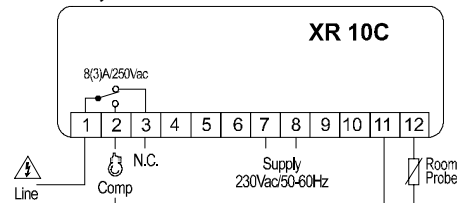
XR10C: 230Vac; COMPRESS. 20a
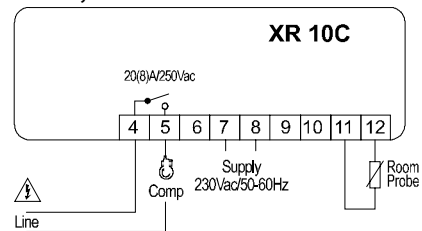
default setting values

abel	Name	Range	Cooling °C/°F	Heating °C/°F
Set	Set point	LS÷US	5/41	5/41
Hy	Differential	0,1÷25.5°C/ 1÷ 255°F	2/4	2/4
LS	Minimum set point	-50°C÷SET/ -58°F÷SET	-50/-58	-50/-58
US	Maximum set point	SET÷150°C/ SET ÷ 302°F	150/302	150/302
Ot	Thermostat probe calibration	-12÷ 12°C / -120 ÷ 120°F	0/0	0/0
OdS	Outputs delay at start up	0÷255 min	0	0
AC	Anti-short cycle delay	0 ÷ 50 min	1	0
COn	Compressor ON time with faulty probe	0 ÷ 255 min	30	0
COF	Compressor OFF time with faulty probe	0 ÷ 255 min	30	5
CH	Type of action (cooling, heating)	CL , Ht	CL	Ht
CF	Temperature measurement unit	°C ÷ °F	°C/°F	°C/°F
rES	Resolution	in ÷ dE	dE/-	dE/-
ALc	Temperat. alarms configuration	rE; Ab	Ab	Ab
ALU	MAXIMUM temperature alarm	ALL÷150.0°C ALL÷302°F	150/302	150/302
ALL	Minimum temperature alarm	-50.0°C÷ALU/ -58°F ÷ ALU	-50/-58	-50/-58
ALd	Temperature alarm delay	0 ÷ 255 min	15	5
dAO	Delay of temperature alarm at start up	0 ÷ 23h e 50'	1.0	0.3
PbC	Probe selection	Ptc ÷ ntc	Ptc/ntc	Ptc/ntc

Hidden parameters

GENERAL DISPLAY PANEL:

Description electric components from model. **MPCA0500 to model .MPCA7200**
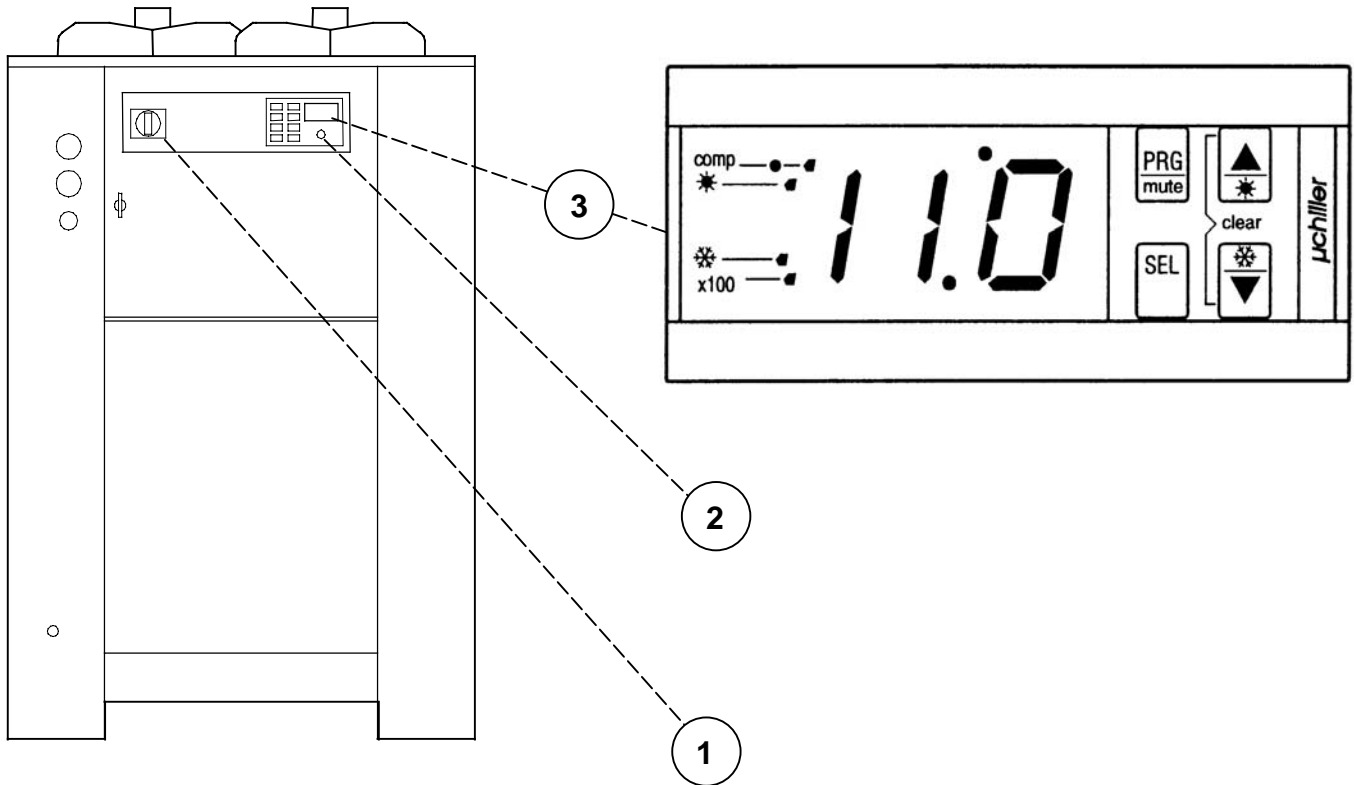
1   **MAIN POWER SWITCH -**   turn on this switch to position **I** for 24 hours before starting chiller

ON/OFF SWITCH -   turn this switch to position **I** (on) after 24 hours to start the chiller. (Not all models)

2   **CONTROL PANEL -**   **A**larm codes of microprocessor control printed on fascia panel

3   **MICROPROCESSOR** -   Used to display set points / alarms and to adjust chiller opperating parameters. Contoller has user accesable set points and factory only acccesable set points.

1. INTRODUCTION

1.1 General description

The µC² is a new compact CAREL electronic controller, the same size as a normal thermostat, for the complete management of chillers and heat pumps: it can control air-air, air-water, water-water and condensing units.

1.1.1 Main functions
- control of the water inlet and evaporator outlet temperature;
- defrost management by time and/or by temperature or pressure;
- fan speed control;
- complete alarm management;
- connection to serial line for supervision/telemaintenance;
- elimination of the expansion vessel.

- Driver function
- Management of electronic expansion valves.

1.1.2 Controlled devices
- compressor;
- condenser fans;
- reversing valve;
- water pumps for evaporator and/or condenser, and outlet fan (air-air);
- antifreeze heater;
- alarm signal device.

1.1.3 Programming
CAREL offers the possibility to configure all the unit parameters not only from the keypad on the front panel, but also using:
- a hardware key;
- a serial line.

1.2 User interface

1.2.1 Display
The display features 3 digits, with the display of the decimal point between -99.9 and 99.9.
Outside of this range of measurement, the value is automatically displayed without the decimal (even if internally the unit still operates considering the decimal part).
In normal operation, the value displayed corresponds to the temperature read by probe B1, that is, the evaporator water inlet temperature (for water chillers) or the ambient air temperature for direct expansion units.
Fig. 1.a show the symbols present on the display and on the keypad and their meanings.

1.2.2 Symbols on the display
Display with 3 green digits (plus sign and decimal point), amber symbols and red alarm symbols.

symbol	colour	meaning		reference refrigerant circuit
		with LED ON	con LED lampeggiante	
1; 2	amber	compressor 1 and/or 2 ON	start up request	1
1; 3	amber	compressor 3 and/or 3 ON	start up request	2
A	amber	at least one compressor ON		1/2
B	amber	pump/air outlet fan ON	start up request	1/2
C	amber	condenser fan ON		1/2
D	amber	defrost active	defrost request	1/2
E	amber	heater ON		1/2
F	red	alarm active		1/2
G	amber	heat pump mode (P6=0)	heat pump mode request (P6=0)	1/2
H	amber	chiller mode (P6=0)	chiller mode request (P6=0)	1/2

Table 1.a
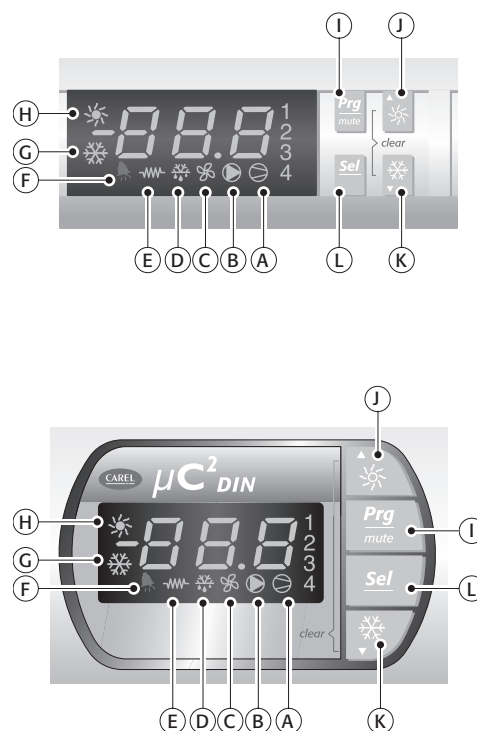
Fig. 1.a

1.2.3 Funzioni associate ai tasti

tasto	stato della macchina	modalità pressione
I	Loading default values	press at power ON
	Go up a sub-group inside the programming area, until exiting (saving changes to EEPROM)	press once
	In the event of alarms, mute the buzzer (if present) and deactivate the alarm relay	press once
L	Access the direct parameters	press for 5 s
	Select item inside the programming area and display value of direct parameters/confirm the changes to the parameters	press once
I + L	Program parameters afters entering password	press for 5 s
J	Select top item inside the programming area	press once or press and hold
	Increase value	press once or press and hold
	Switch from standby to chiller mode (P6=) and vice versa	press for 5 s
K	Select bottom item inside the programming area	press once or press and hold
	Decrease value	press once or press and hold
	Switch from standby to heat pump mode (P6=0) and vice versa	press for 5 s
J + K	Manual alarm reset	press for 5 s
	Immediately reset the hour counter (inside the programming area)	press for 5 s
L + J	Force manual defrost on both circuits	press for 5 s

Table 1.b

1.2.4 Programming and saving the parameters

1. press "$\frac{Prg}{mute}$" and "Sel" for 5 seconds;
2. the heating and cooling symbol and the figure "00" are displayed;
3. use "☀" and "❄" to set the password (page 28) and confirm by pressing "Sel";
4. use "☀" and "❄" to select the parameter menu (S-P) or levels (L-P) and then press "Sel";
5. use "☀" and "❄" to select the parameter group and then press "Sel";
6. use "☀" and "❄" to select the parameter and then press "Sel";
7. after making the changes to the parameter, press "Sel" to confirm or "$\frac{Prg}{mute}$" to cancel the changes;
8. press "$\frac{Prg}{mute}$" to return to the previous menu;
9. to save the modifications, press "$\frac{Prg}{mute}$" repeatedly until reaching the main menu.

Note:
a. the parameters that have been modified without being confirmed using the "Sel" button return to the previous value;
b. if no operations are performed on the keypad for 60 seconds, the controller exits the parameter modification menu by timeout and the changes are cancelled.

1.2.5. Keypad
The keypad is used to set the unit operating values (see Parameters/alarms - Keypad combinations)

2. CONNECTIONS

2.1 General diagram

tLAN

EVD*40*: driver for electronic expansion valve

MCH200002*: I/O expansion board for µ²SE

EVD*40*: driver for electronic expansion valve

µ**C**²

Optional board

CONVONOFF*: PWM/digital converter

CONV0/10A0*: PWM/analogic converter

MCHRTFA0:** fan speed regulator

NTC: temperature probes

SPKT: trasduttori di pressione 0...5 V

PSOPZKEY*: programming key

MCH200485*: RS485 serial card

PW/Modbus® RTU CAREL Supervisory

MCH2*T*: terminal

MCH2*TSV*: adapter

PW/Modbus® RTU CAREL Supervisory

Fig. 2.a

2.2 Network layout

PWM

µ**C**²

tLAN

EV driver

RS485

Fig. 2.b

RS485

PWM

µ**C**²

PWM

tLAN

tLAN

EV driver

µ**C**²**DIN**

EV driver

Fig. 2.c

4.1 General parameters

The parameters are divided into 4 different types, according to their level of access by the user (password) and their function.

For each level, only the access to the parameters of the same or lower level can be set.

This means that through "factory" password, acessing the menù "levels" (L-P), it is possible to set the desired level for each parameter.

- **Factory parameters:** Accessible with the 66 "Factory" password, allow the configuration of all the unit parameters.

- **Super User parameters:** Accessible with the 11 "Super User" password, allow the configuration of the Super User, User and Direct parameters.

- **User parameters:** Accessible with password 22, allow the configuration of the parameters that typically can be set by the user (User parameters) and the Direct parameters, consequently relating to the options.

- **Direct parameters:** Accessible without password, this are used to read the probe measurements and any data, by any user, without compromising the operation of the unit.

N.B.: The modifications to the parameters regarding the configuration of the unit (type, number of compressors,…) must be performed with the controller in Standby.

4.2 Menu structure
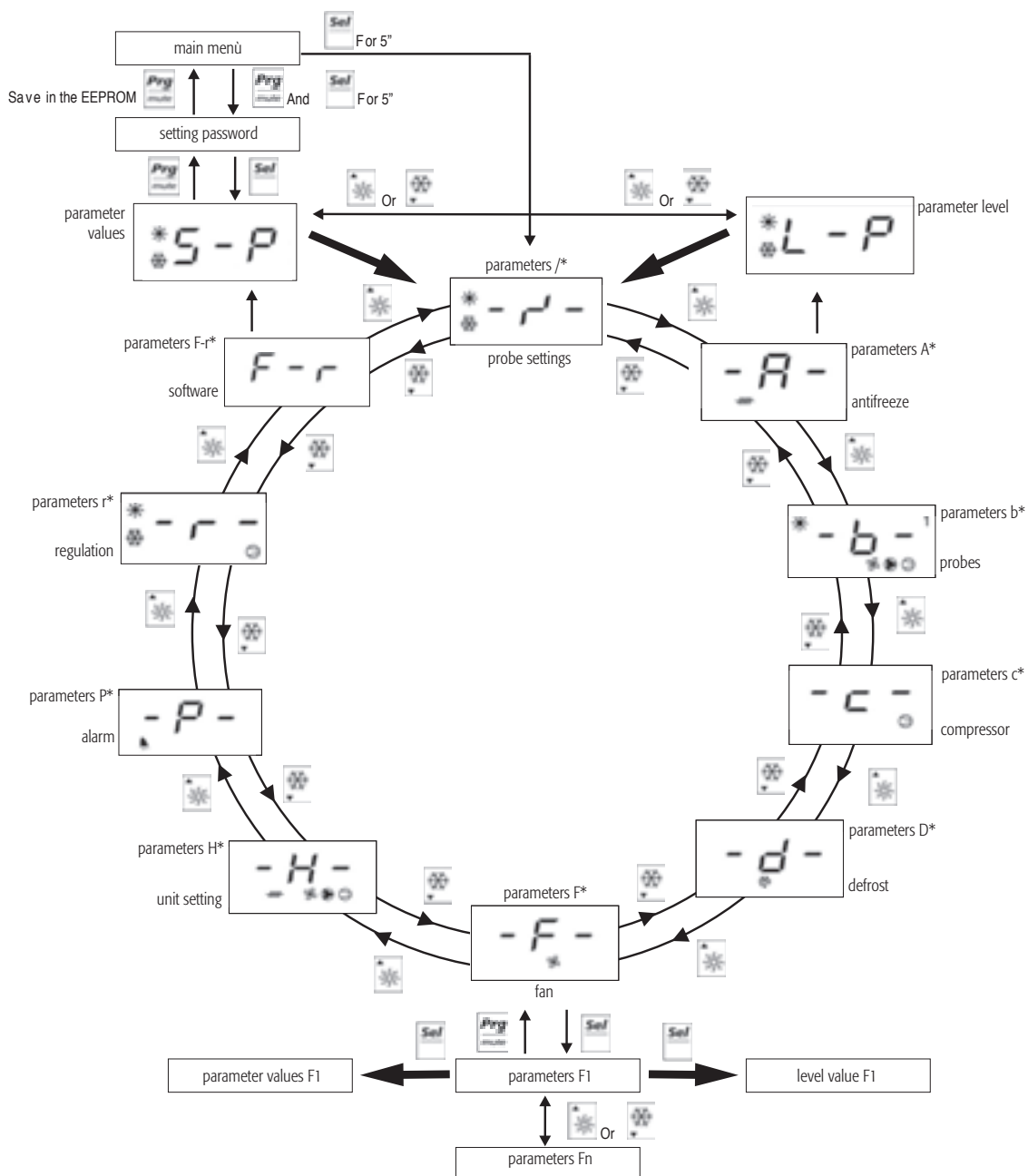
Fig. 4.a

4.3 Parameter tables

The following tables show of the parameters divided by type/family (e. g. compressor, probes, fans etc.).

• Key to the parameter tables
   Level (default)
   S= super user
   F= factory
   D= direct

Visibility:
The visibility of some groups depends on the type of controller and the value of the parameters.
   D= defrost (if D01=1)
   F= fan (if F01=1)
   N= NTC probe (if /04-/08=2)
   P= pressure (if /04-/08=3)
   V= driver (if H08 =1-3)
   X= expansion (if H08=2-3)
   - = always present

Supervisor variables:
   R/W = supervisor read/write parameter
   R= supervisor read-only parameter

4.3.1 Probe setting parameters: (/*)

display indicat.	parameter and description		default level	min.	max.	U.O.M.	variat.	default	visibility	supervis. variable	Modbus	variabile type
/01	Probe type B1	0= not present 1= present	F	0	1	Flag	1	1	-	1 (R/W)	1	Digital
/02	Probe type B2	0= not present 1= present	F	0	1	Flag	1	0	-	2 (R/W)	2	Digital
/03	Probe type B3	0= not present 1= NTC Cond. Probe 2= NTC Out. Probe	F	0	2	flag	1	0	-	14 (R/W)	142	Integer
/04	Probe type B4	0= not present 1= ON/OFF (D.I) 2= NTC Out. Probe 3= ratiometric cond. Probe, 5 Vdc	F	0	3	flag	1	0	-	15 (R/W)	143	Integer
/05	Probe type B5	0= not present 1= present	F	0	1	Flag	1	0	X	3 (R/W)	3	Digital
/06	Probe type B6	0= not present 1= present	F	0	1	Flag	1	0	X	4 (R/W)	4	Digital
/07	Probe type B7	0= not present 1= NTC Cond. Probe 2= NTC Out. Probe	F	0	2	flag	1	0	X	16 (R/W)	144	Integer
/08	Probe type B8 (expansion)	0= not present 1= ON/OFF 2= NTC Out. Probe 3= ratiometric cond. Probe, 5 Vdc	F	0	4	int	1	0	X	17 (R/W)	145	Integer
/09	Min. value voltage input		F	0	/10	0.01 Vdc	1	50	P	18 (R/W)	146	Integer
/10	Max. value voltage input		F	/09	500	0.01 Vdc	1	450	P	19 (R/W)	147	Integer
/11	Pressure min. value		F	0	/12	bar	1	0	P	1 (R/W)	1	Analog
/12	Pressure max. value		F	/11	99.9	bar	1	34.5	P	2 (R/W)	2	Analog
/13	Probe B1 calibration		F	-12.0	12.0	°C/°F	0.1	0.0	-	3 (R/W)	3	Analog
/14	Probe B2 calibration		F	-12.0	12.0	°C/°F	0.1	0.0	-	4 (R/W)	4	Analog
/15	Probe B3 calibration		F	-12.0	12.0	°C/°F	0.1	0.0	-	5 (R/W)	5	Analog
/16	Probe B4 calibration		F	-12.0	12.0	°C/bar/°F	0.1	0.0	-	6 (R/W)	6	Analog
/17	Probe B5 calibration		F	-12.0	12.0	°C/°F	0.1	0.0	X	7 (R/W)	7	Analog
/18	Probe B6 calibration		F	-12.0	12.0	°C/°F	0.1	0.0	X	8 (R/W)	8	Analog
/19	Probe B7 calibration		F	-12.0	12.0	°C/°F	0.1	0.0	X	9 (R/W)	9	Analog
/20	Probe B8 calibration		F	-12.0	12.0	°C/bar/°F	0.1	0.0	X	10 (R/W)	10	Analog
/21	Digital filter		U	1	15	-	1	4	-	20 (R/W)	148	Integer
/22	Input limitation		U	1	15	-	1	8	-	21 (R/W)	149	Integer
/23	Unit of measure	0= °C 1= °F	U	0	1	Flag	1	0	-	5 (R/W)	5	Digital

Table 4.a

4.3.2 Antifreeze/auxiliary heater setting parameters (A*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variat.	default	visibility	supervis. variable	Modbus	variabile type
A01	Antifreeze/low ambient temp. (air/air) alarm set point	U	A07	A04	°C/°F	0.1	3.0	-	11 (R/W)	11	Analog
A02	Differential for antifreeze/low ambient temperature alarm	U	0.3	122.0	°C °F	0.1	5.0	-	12 (R/W)	12	Analog
A03	Bypass time for antifreeze alarm/low ambient temp. when turning on the unit in heating mode	U	0	150	S	1	0	-	22 (R/W)	150	Integer
A04	Set point for the activation of antifreeze heater/auxiliary heater	U	A01	r16	°C/°F	0.1	5.0	-	13 (R/W)	13	Analog
A05	Diff. for antifreeze heater/auxiliary heater	U	0.3	50.0	°C/°F	0.1	1.0	-	14 (R/W)	14	Analog
A06	Auxiliary heater probe 0= Control probe see (Table 5.a) 1= Antifreeze probe see (Table 5.a)	F	0	1	Flag	1	0	-	6 (R/W)	6	Digital
A07	Antifreeze alarm set point limit	F	-40.0	176.0	°C °F	0.1	-40.0	-	15 (R/W)	15	Analog
A08	Auxiliary heater set point in heating mode	U	A01	r16	°C °F	0.1	25.0	-	16 (R/W)	16	Analog
A09	Auxiliary heater differential in heating mode	U	0.3	50.0	°C/°F	0.1	3.0	-	17 (R/W)	17	Analog
A10	Antifreeze automatic start up 0= disabled function 1= Heaters and pump on at the same time on A4/A8 2= Heaters and pump on indipendently on A4/A8 3= Heaters ON on A4/A8	U	0	3	Flag	1	0	-	23 (R/W)	151	Integer

Table 4.b

4.3.3 Probe reading parameters (B*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variat.	default	visibility	supervis. variable	Modbus	variabile type
b00	Config. of probe to be shown on the display 0= probe B1 1= probe B2 2= probe B3 3= probe B4 4= probe B5 5= probe B6 6= probe B7 7= probe B8 8= set point without compensation 9= dynamic set point with possible compensation 10= remote ON/OFF digital input status	U	0	10	Flag	1	0	-	24 (R/W)	152	integer
b01	Value read by probe B1	D	-	-	°C /°F	-	-	-	70 (R)	70	Analog
b02	Value read by probe B2	D	-	-	°C /°F	-	-	-	71 (R)	71	Analog
b03	Value read by probe B3	D	-	-	°C /°F	-	-	-	72 (R)	72	Analog
b04	Value read by probe B4	D	-	-	°C /°F/bar	-	-	-	73 (R)	73	Analog
b05	Value read by probe B5	D	-	-	°C /°F	-	-	X	74 (R)	74	Analog
b06	Value read by probe B6	D	-	-	°C /°F	-	-	X	75 (R)	75	Analog
b07	Value read by probe B7	D	-	-	°C /°F	-	-	X	76 (R)	76	Analog
b08	Value read by probe B8	D	-	-	°C /°F bar	-	-	X	77 (R)	77	Analog
b09	Driver 1 evaporator temperature	D	-	-	°C /°F	-	-	V	78 (R)	78	Analog
b10	Driver 1 evaporator pressure	D	-	-	bar	-	-	V	79 (R)	79	Analog
b11	Driver 1 superheating	D	-	-	°C /°F	-	-	V	80 (R)	80	Analog
b12	Driver 1 saturation temperature	D	-	-	°C /°F	-	-	V	81 (R)	81	Analog
b13	Driver 1 valve position	D	0	100.0	%	-	-	V	82 (R)	82	Analog
b14	Driver 2 evaporator temperature	D	-	-	°C /°F	-	-	XV	83 (R)	83	Analog
b15	Driver 2 evaporator pressure	D	-	-	bar	-	-	XV	84 (R)	84	Analog
b16	Driver 2 superheating	D	-	-	°C /°F	-	-	XV	85 (R)	85	Analog
b17	Driver 2 saturation temperature	D	-	-	°C /°F	-	-	XV	86 (R)	86	Analog
b18	Driver 2 valve position	D	0	100.0	%	-	-	XV	87 (R)	87	Analog
b19	Temp. probe at the outlet of the external coil c1	D	-	-	°C /°F	-	-	V	88 (R)	88	Analog
b20	Temp. probe at the outlet of the external coil c12	D	-	-	°C /°F	-	-	XV	89 (R)	89	Analog

Table 4.c

4.3.4 Compressor setting parameters (c*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variat.	def.	visibility	supervis. variable	Modbus	variabile type
c01	Min. compressor ON time	U	0	999	s	1	60	-	25 (R/W)	153	Integer
c02	Min. OFF time compressor	U	0	999	s	1	60	-	26 (R/W)	154	Integer
c03	Delay between 2 starts of the same compressor	U	0	999	s	1	360	-	27 (R/W)	155	Integer
c04	Delay between starts of the 2 compressors	U	0	999	s	1	10	-	28 (R/W)	156	Integer
c05	Delay between 2 shut-downs of the 2 compressors	U	0	999	s	1	0	-	29 (R/W)	157	Integer
c06	Delay at start-up	U	0	999	s	1	0	-	30 (R/W)	158	Integer
c07	Delay in switching on the compressor after switching on the pump/inlet fan (air/air)	U	0	150	s	1	20	-	31 (R/W)	159	Integer
c08	Delay in switching OFF the compressor after switching OFF the pump/inlet fan (air/air)	U	0	150	min	1	1	-	32 (R/W)	160	Integer
c09	Maximum compressor operating time in tandem	U	0	60	min	1	0	-	33 (R/W)	161	Integer
c10	Compressor 1 timer	D	0	800.0	100 hours	0.1	0	-	90 (R)	90	Analog
c11	Compressor 2 timer	D	0	800.0	100 hours	0.1	0	-	91 (R)	91	Analog
c12	Compressor 3 timer	D	0	800.0	100 hours	0.1	0	-	92 (R)	92	Analog
c13	Compressor 4 timer	D	0	800.0	100 hours	0.1	0	-	93 (R)	93	Analog
c14	Operation timer threshold	U	0	100	100 hours	1	0	-	34 (R/W)	162	Integer
c15	Hour counter evaporator pump/fan 1	D	0	800.0	100 hours	0.1	0	-	94 (R)	94	Analog
c16	Hour counter condenser backup pump/fan 2	D	0	800.0	100 hours	0.1	0	-	95 (R)	95	Analog
c17	Minimum time between 2 pump starts	U	1	150	min	1	30	-	35 (R/W)	163	Integer
c18	Minimum pump ON time	U	1	15	min	1	3	-	36 (R/W)	164	Integer

Table 4.d

4.3.5 Defrost setting parameters (d*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variat.	def.	visibility	supervis. variable	Modbus	variabile type
d01	Defrosting cycle/Condenser antifreeze 0= no; 1= sì, con sbrinamento unificato yes, with shared defrosting	U	0	1	Flag	1	0	-	7 (R/W)	7	Digital
d02	Time or temp.- press. based defrosting 0= time 1= temp. - press 2= pressure start, temperature end	U	0	2	Flag	1	0	D	90 (R/W)	218	Integer
d03	Start defrosting temperature Condenser antifreeze alarm set point	U	-40.0	d04	°C/°F	0.1	-5.0	DN	19 (R/W)	19	Analog
	Start defrosting pressure		/11	d04	bar	0.1	3.5	DP	18 (R/W)	18	Analog
d04	End defrosting temperature	U	d03	176	°C	0.1	20.0	DN	21 (R/W)	21	Analog
	End defrosting pressure		d03	/12	bar	0.1	14.0	DP	20 (R/W)	20	Analog
d05	Min. time to start a defrosting cycle	U	10	150	s	1	10	D	37 (R/W)	165	Integer
d06	Min. duration of a defrosting cycle	U	0	150	s	1	0	D	38 (R/W)	166	Integer
d07	Max. duration of a defrosting cycle	U	1	150	min	1	5	D	39 (R/W)	167	Integer
d08	Delay between 2 defrosting cycle requests within the same circuit	U	10	150	min	1	30	D	40 (R/W)	168	Integer
d09	Defrosting delay between the 2 circuits	U	0	150	min	1	10	D	41 (R/W)	169	Integer
d10	Defrost by external contact 0= disables function 1= external contact start 2= external contact end 3= external contact start and end	F	0	3	Flag	1	0	D	42 (R/W)	170	Integer
d11	Antifreeze heaters activated while defrosting 0= Non presenti/Not present; 1= Presenti/Present	U	0	1	Flag	1	0	D	9 (R/W)	9	Digital
d12	Waiting time before defrosting	F	0	3	min	1	0	D	43 (R/W)	171	Integer
d13	Waiting time after defrosting	F	0	3	min	1	0	D	44 (R/W)	172	Integer
d14	End defrosting with 2 refrigerating circuits 0= Indipendent 1= If both at end defrost 2= If at least one at end defrost	F	0	2	Flag	1	0	D	45 (R/W)	173	Integer
d15	Start defrost with 2 circuits 0= Indipendent 1= If both at start defrost 2= If at least one at start defrost	F	0	2	Flag	1	0	D	46 (R/W)	174	Integer
d16	Forced ventilation time at the end of the defrosting	F	0	360	s	1	0	D	47 (R/W)	175	Integer
d17	Defrost with compressors OFF	F	0	80.0	°C/°F	0.1	0	D	22 (R/W)	22	Analog

Table 4.e

4.3.6 Fan setting parameters (F*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variat.	def.	visibility	supervis. variable	Modbus	variabile type
F01	Fan output 0= absent 1= present	F	0	1	Flag	1	0	-	10 (R/W)	10	Diigital
F02	Fan operating mode 0= always ON 1= depending ON the compressor (in parallel operation mode) 2= depending ON the compressors in ON/OFF control 3= depending ON the compressors in speed control mode	U	0	3	Flag	1	0	F	48 (R/W)	176	Integer
F03	Min. voltage threshold for Triac	F	0	F04	step	1	35	F	49 (R/W)	177	Integer
F04	Max. voltage threshold for Triac	F	F03	100	step	1	75	F	50 (R/W)	178	Integer
F05	Temp. value for min. speed Cooling	U	-40.0		°C	0.1	35.0	FN	24 (R/W)	24	Analog
	Pressure value for min. speed Cooling		/11	/12	bar	0.1	13.0	FP	23 (R/W)	23	Analog
F06	Differential value for max. speed Cooling	U	0	50.0	°C/°F	0.1	10.0	FN	26 (R/W)	26	Analog
	Pressure value for max. speed Cooling		0	50	bar	0.1	3.0	FP	25 (R/W)	25	Analog
F07	Fan shut-down differential in Cooling mode	U	0	50.0	°C/°F	0.1	15.0	FN	28 (R/W)	28	Analog
	Fan shut-down pressure in Cooling mode		0	F5	bar	0.1	5.0	FP	27 (R/W)	27	Analog
F08	Temperature value for max speed in Heating mode	U	-40.0		°C	0.1	35.0	FN	30 (R/W)	30	Analog
	Pressure value for max speed in Heating		/11	/12	bar	0.1	13.0	FP	29 (R/W)	29	Analog
F09	Temperature value for max. speed in Heating mode	U	0	50.0	°C/°F	0.1	5.0	FN	32 (R/W)	32	Analog
	Pressure value for max speed in Heating		0	F08	bar	0.1	4.0	FP	31 (R/W)	31	Analog
F10	Temp. to turn OFF the fan in Heating 0.1	U	0	F08	°C/°F	0.1	5.0	FN	34 (R/W)	34	Analog
	Pressure to turn OFF the fan in Heating		0	30.0	bar	0.1	3.0	FP	33 (R/W)	33	Analog
F11	Fan starting time	U	0	120	s	1	0	F	51 (R/W)	179	Integer
F12	Triac impulse duration (fan start)	F	0	10	s	1	2	F	52 (R/W)	180	Integer
F13	Fan management in defrost mode 0= Disabled fans 1= Fan in chiller mode 2= Max. speed after defrost	F	0	2	Flag	1	0	F	53 (R/W)	181	Integer
F14	Fan on time when starting in high condensing temperature	U	0	999	S	1	0	FN	91 (R/W)	219	Integer

Table 4.f

4.3.7 Unit setting parameters (H*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variat.	def.	visibility	supervis. variable	Modbus	variabile type
H01	Unit model 0= air_air unit 1= air_air heat pump 2= air_water chiller 3= air_water heat pump 4= water_water chiller 5= water_water heat pump with reversal on gas circuit 6= water_water heat pump with reversal on water circuit 7= condensing unit 8= reverse-cycle condensing unit 9= water-cooled condensing unit 10= reverse-cycle water-cooled condensing unit	F	0	10	Flag	1	2	-	54 (R/W)	182	Integer
H02	Number of condensers 0=1 circuit; 1=2 circuits	F	0	1	Flag	1	0	F	12 (R/W)	12	Digital
H03	Number of evaporators 0=1 evaporator 1=2 evaporators	F	0	1	Flag	1	0	-	13 (R/W)	13	Digital
H04	Number of compressors per circuit 0=1 comp. ON 1 circuit (single circuit) 1=2 comp. in tandem ON 1 circuit (single circuit) 2=1 comp. per circuit, 2 circuits (two circuits) 3=2 comp. in Tandem, 2 circuits (two circuits) 4=1 compressor and 1 Capacity step in one circuit 5=1 compressor and 1 capacity Step per circuit	F	0	5	Flag	1	0	-	55 (R/W)	183	Integer
H05	Pump/outlet fan (Air/Air) mode (output N2) 0= absent 1= always ON 2= ON upon request of the controller 3= ON upon request of the controller and for set time	F	0	5	Flag	1	1	-	56 (R/W)	184	Integer
H06	Cooling/Heating digital input 0= absent 1= present	U	0	1	Flag	1	0	-	14 (R/W)	14	Digital
H07	ON/OFF digital input 0= absent 1= present	U	0	1	Flag	1	0	-	15 (R/W)	15	Digital
H08	µC^2 network configuration 0= µC^2 only 1= µC^2 + valve 2= µC^2 + exp. 3= µC^2 +exp.+valve	F	0	3	Flag	1	0	-	57 (R/W)	185	Integer
H09	Lock keypad 0= disabled 1= enabled	U	0	1	Flag	1	1	-	16 (R/W)	16	Digital
H10	Serial address	U	1	200	-	1	1	-	58 (R/W)	186	Integer
H11	Output modes (see Table 5.3 and following pag. 56)	F	0	12	Flag	1	0	-	59 (R/W)	187	Integer
H12	Capacity- control logic valve and inversion valve 0= Both normally closed 1= Both normally open 2= Inversion valve normally open and capacity-control valve normally closed 3= Inversion valve normally closed and capacity-control valve normally open	F	0	3	Flag	1	1	-	60 (R/W)	188	Integer
H21	Second pump function 0= Disabled 1= Backup and weekly rotation 2= Backup and daily rotation 3= Condensing control on corresponding set point 4= Condensing control always on	F	0	4	int	1	0	-	62 (R/W)	269	Integer
H22	Disable load default values 0= Function disabled 1= Function enabled	F	0	1	Flag	1	0	-	18 (R)	18	Digital
H23	Enable Modbus protocol	F	0	1	Flag	1	0	-	11	11	Digital

Table 4.g

ENGLISH

4.3.8 Alarm setting parameters (P*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variat.	def.	visibility	supervis. variable	Modbus	variabile type
P01	Flow switch alarm delay when starting the pump	U	0	150	s	1	20	-	63 (R/W)	191	Integer
P02	Flow switch alarm delay during steady operation	U	0	120	s	1	5	-	64 (R/W)	192	Integer
P03	Low pressure alarm delay at start-up	U	0	200	s	1	40	-	65 (R/W)	193	Integer
P04	Enable part load in high pressure	U	0	3	int	1	0	P	66 (R/W)	194	Integer
P05	Alarm reset 0= HP1-2/LP1-2/A1-2/Lt manual 1= HP1-2/LP1-2/A1-2/Lt automatic 2= HP1-2/A1-2/Lt manual LP1-2 automatic 3= HP1-2 manual LP1-2/A1-2/Lt automatic 4= HP1-2/LP1-2 manual A1-2/Lt automatic 5= HP1-2/LP1-2 (thrice per hour) manual A1-2/Lt automatic 6= HP1-2/LP1-2 (thrice per hour) manual; A1-2/Lt manual	F	0	6	Int	1	0	-	67 (R/W)	195	Integer
P06	Cooling/heating logic 0=: ☼ Chiller, ❄ Heat pump 1=: ☼ Heat pump, ❄ Chiller	F	0	1	Flag	1	0	-	19 (R/W)	19	Digital
P07	Low pressure alarm from transducer 0= Disabled 1= Enabled	F	0	1	Flag	1	0	P	68 (R/W)	196	Integer
P08	Digital input 1 selection 0= N 1=FL man. 2=FL auto. 3=TP man. 4=TP auto 5= TC1 man. 6= TC1 auto. 7= TC2 man. 8= TC2 auto. 9= Cool/Heat. 10= Cool/Heat. Delayed 11= LA man. 12= LA auto. 13= 2° Set 14= 2° Set timer 15= stop defrost c. 1 16= stop defrost c. 2 17= start defrost c. 1 18= start defrost c. 2 19= step 1 20 = step 2 21= step 3 22= step 4	F	0	22	Flag	1	0	-	69 (R/W)	197	Integer
P09	Digital input 2 selection	F	0	22	Flag	1	0	-	70 (R/W)	198	Integer
P10	Digital input 6 selection	F	0	22	Flag	1	0	X	71 (R/W)	199	Integer
P11	Digital input 7 selection	F	0	22	Flag	1	0	X	72 (R/W)	200	Integer
P12	Digital input 10 selection	F	0	22	Flag	1	0	X	73 (R/W)	201	Integer
P13	Configuration of B4 as P8 if /4=1 (digital input)	F	0	22	Flag	1	0	-	74 (R/W)	202	Integer
P14	Configuration of B8 as /8=1 (digital input)	F	0	22	Flag	1	0	X	75 (R/W)	203	Integer
P15	low pressure alarm configuration L 0= not active with compressor OFF 1= active with compressor OFF	F	0	1	Flag	1	0	-	76 (R/W)	204	Integer
P16	High temperature alarm set	U	-40.0		°C	0.1	80.0	-	38 (R/W)	38	Analog
P17	High temperature alarm delay at start-up	U	0	250	min	1	30	-	77 (R/W)	205	Integer
P18	High pressure alarm set from transducer	F	0	99.9	bar	0.1	20.0	P	39 (R/W)	39	Analog
P19	System low temperature alarm set point	U	-40.0		°C	0.1	10.0	-	40 (R/W)	40	Analog
P20	Enable system start-up protection 0= Disabled 1= Enabled	U	0	1	Flag	1	0	-	20 (R/W)	20	Digital
P21	Alarm relay management 0= normally de-activated 1= normally activated	F	0	1	Flag	1	0	-	8 (R/W)	8	Digital

Table 4.h

4.3.9 Control setting parameters (r*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variat.	def.	visibility	supervis. variable	Modbus	variabile type
r01	Cooling set point	D	r13	r14	°C/°F	0.1	12.0	-	41 (R/W)	41	Analog
r02	Cooling differential	D	0.3	50.0	°C/°F	0.1	3.0	-	42 (R/W)	42	Analog
r03	Heating set point	D	r15	r16	°C/°F	0.1	40.0	-	43 (R/W)	43	Analog
r04	Heating differential	D	0.3	50.0	°C/°F	0.1	3.0	-	44 (R/W)	44	Analog
r05	Compressor rotation 0= disabled; 1= FIFO type 2= con controllo ore/hour control 3= direct relation between (D.I. and compressors D.O.)	F	0	3	flag	1	0	-	78 (R/W)	206	Integer
r06	Type of compressor control 0= proportional on inlet 1= proportional on inlet + dead zone 2= proportional on outlet 3= proportional on outlet + dead zone 4= time on outlet with dead zone	F	0	4	flag	1	0	-	79 (R/W)	207	Integer
r07	Dead zone differential	F	0.1	50.0	°C/°F	0.1	2.0	-	45 (R/W)	45	Analog
r08	Activation delay at lower limit of r07	F	0	999	s	1	120	-	80 (R/W)	208	Integer
r09	Activation delay at upper limit of r07	F	0	999	s	1	100	-	81 (R/W)	209	Integer
r10	Deactivation delay at lower limit of r12	F	0	999	s	1	120	-	82 (R/W)	210	Integer
r11	Deactivation delay at upper limit of r12	F	0	999	s	1	100	-	83 (R/W)	211	Integer
r12	Compressor deactivation differential	F	0	50.0	°C/°F	0.1	2.0	-	46 (R/W)	46	Analog
r13	Min. Cooling set point	U	-40.0	r14	°C/°F	0.1	-40.0	-	47 (R/W)	47	Analog
r14	Max. Cooling set point	U	r13		°C	0.1	80.0	-	48 (R/W)	48	Analog
r15	Min. Heating set point	U	-40.0	r16	°C/°F	0.1	-40.0	-	49 (R/W)	49	Analog
r16	Max. Heating set point	U	r15	176.0	°C	0.1	80.0	-	50 (R/W)	50	Analog

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variat.	def.	visibility	supervis. variable	Modbus	variabile type
r17	Cooling compensation constant	U	-5.0	+5.0	-	0.1	0.0	-	51 (R/W)	51	Analog
r18	Maximum distance from the set point	U	0.3	20.0	°C/°F	0.1	0.3	-	52 (R/W)	52	Analog
r19	Start compensation temperature in cooling mode	U	-40	176.0	°C/°F	0.1	30.0	-	53 (R/W)	53	Analog
r20	Start compensation temperature in heating mode	U	-40	176.0	°C/°F	0.1	0	-	54 (R/W)	54	Analog
r21	Second cooling set point from external contact	D	r13	r14	°C/°F	0.1	12.0	-	55 (R/W)	55	Analog
r22	Second heating set point from external contact	D	r15	r16	°C/°F	0.1	40.0	-	56 (R/W)	56	Analog
r27	Enable accumulation vessel suppression 0= Disabled 1= Enabled in cool 2= Enabled in Heat 3= Always enabled	F	0	3	flag	1	0	-	88 (R/W)	216	Integer
r28	Minimum time to determine low load conditions	F	0	999	s	1	60	-	89 (R/W)	217	Integer
r29	Low load differential in chiller mode	F	0.3	50.0	°C/°F	0.1	3.0	-	58 (R/W)	58	Analog
r30	Low load differential in heat pump mode	F	0.3	50.0	°C/°F	0.1	3.0	-	59 (R/W)	59	Analog
r31	Heating compensation constant	U	-5.0	+5.0	-	0.1	0.0	-	60 (R/W)	60	Analog

Table 4.i

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4.3.10 Firmware parameters (F-r*)

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variat.	def.	visibility	supervis. variable	Modbus	variabile type
H96	Software version Driver 2	D	0	999	flag			XV	4 (R)	132	Integer
H97	Software version Driver 1	D	0	999	flag			V	3 (R)	131	Integer
H98	Expansion software version	D	0	999	flag			X	2 (R)	130	Integer
H99	Software version (to be displayed after instrument start-up)	D	0	999	flag			-	1 (R)	129	Integer

Table 4.j

4.3.11 Supervisor only variables

display indicat.	parameter and description	default level	min.	max.	U.O.M.	variat.	def.	visibility	supervis. variable	Modbus	variabile type
-	Digital input 1	-	0	1	Flag	1	-	-	43 (R)	43	Digital
-	Digital input 2	-	0	1	Flag	1	-	-	44 (R)	44	Digital
-	Digital input 3	-	0	1	Flag	1	-	-	45 (R)	45	Digital
-	Digital input 4	-	0	1	Flag	1	-	-	46 (R)	46	Digital
-	Digital input 5	-	0	1	Flag	1	-	-	47 (R)	47	Digital
-	probe B4 digital input	-	0	1	Flag	1	-	-	48 (R)	48	Digital
-	Digital output 1	-	0	1	Flag	1	-	-	49 (R/W)	49	Digital
-	Digital output 2	-	0	1	Flag	1	-	-	50 (R/W)	50	Digital
-	Digital output 3	-	0	1	Flag	1	-	-	51 (R/W)	51	Digital
-	Digital output 4	-	0	1	Flag	1	-	-	52 (R/W)	52	Digital
-	Digital output 5	-	0	1	Flag	1	-	-	53 (R/W)	53	Digital
-	Unit status, 1= ON or 0= standby	-	0	1	Flag	1	0	-	54 (R/W)	54	Digital
-	1= Cooling or 0= Heating	-	0	1	Flag	1	1	-	55 (R/W)	55	Digital
-	Digital input 6, 2nd circuit	-	0	1	Flag	1	-	-	56 (R)	56	Digital
-	Digital input 7, 2nd circuit	-	0	1	Flag	1	-	-	57 (R)	57	Digital
-	Digital input 8, 2nd circuit	-	0	1	Flag	1	-	-	58 (R)	58	Digital
-	Digital input 9, 2nd circuit	-	0	1	Flag	1	-	-	59 (R)	59	Digital
-	Digital input 10, 2nd circuit	-	0	1	Flag	1	-	-	60 (R)	60	Digital
-	Probe B8 digital inputs, 2nd circuit	-	0	1	Flag	1	-	-	61 (R)	61	Digital
-	Digital output 6	-	0	1	Flag	1	-	-	62 (R/W)	62	Digital
-	Digital output 7	-	0	1	Flag	1	-	-	63 (R/W)	63	Digital
-	Digital output 8	-	0	1	Flag	1	-	-	64 (R/W)	64	Digital
-	Digital output 9	-	0	1	Flag	1	-	-	65 (R/W)	65	Digital
-	Digital output 10	-	0	1	Flag	1	-	-	66 (R/W)	66	Digital
-	Enable digital output from Supervisor	-	0	8000	Flag	1	-	-	13 (R)		Integer
-	Defrost status 0= no Defrost 1= Def. circuit 1 2= Def. circuit 2 3= Def. circuit 1 and 2 5= Fan Def. circuit 1 10= Fan Def. circuit 2 15= Fan Def. circuit 1 and 2	-	-	-	-	-	-	104 (R)	stato defrost		Integer

Table 4.l

Parameter Adjustment

The electronic controller allows the operator to adjust several parameters that determine how the chiller functions. These adjustable parameters are accessed and manipulated as follows:

- Display the first parameter code by pressing the "**SEL**" button for a minimum of 5 seconds.

- Scroll through the list of available parameters using the "UP" (Δ) and "DOWN" (∇) buttons.

- Pressing the "**SEL**" button while a parameter is displayed allows for its adjustment using the (Δ) & (∇) buttons.

- After adjustment, press the "**SEL**" again to modify other parameters.

- Press the "**PRG**" button to store all of the modified parameters and exit the programming mode.

- During programming the display will flash if no buttons are pressed after a few seconds.

- The controller will automatically exit the programming mode without data storage after 60 seconds of inactivity.

4.5 Control Parameters

The accessible control parameters and their codes are listed below:

Thermostat Control Parameters		Units	Default	Min / Max	Comment
r1	Cooling set point	°F	53	40 / 60	based on return water temperature
r2	Cooling differential	°F	7	0.1 / 11	based on return water temperature
r3	Heating set point	°F	n/a	n/a	not used on chiller units
r4	Heating differential	°F	n/a	n/a	not used on chiller units
r6	Water outlet temperature	°F	n/a	n/a	display only
r8	Condensing temperature	°F	n/a	n/a	not used

Compressor Control Parameters		Units	Default	Min / Max	Comment
c9	Compressor run time	hours	n/a	0 / 19900	Reset these timers by Pressing both the "UP" (Δ) and
cC	Pump run time	hours	n/a	0 / 19900	"DOWN" (∇) buttons together for a minimum of 5 seconds

To select either °F or °C as the display units:

- Press "**PRG**" for a minimum of 5 seconds.

- Use the "UP" (Δ) or "DOWN" (∇) buttons until the password "**22**" appears in the display, then press "**SEL**".

- Again, use the "UP" (Δ) and "DOWN" (∇) buttons until the parameter "**/d**" appears in the display, then press "**SEL**".

- Again, use the "UP" (Δ) and "DOWN" (∇) buttons to display either "**0**" for °C or "**1**" for °F, then press "**PRG**" to store this value.

4.6 Alarms

The electronic controller is equipped with various alarm indications devised to maintain safe operation and to assist in maintenance and troubleshooting efforts. In the event of an alarm the program responds as follows:

- The general alarm relay is energized.

- The displayed temperature value flashes.

- The specific alarm code flashes alternately with the temperature value on the display.

- If the alarm condition persists, the controller will repeat the above indications until the cause of the alarm is removed.

Pressing both the "UP" (Δ) and "DOWN" (∇) buttons together for a minimum of 5 seconds will reset alarms.

Alarm Descriptions

The specific alarm conditions and the corresponding display codes are detailed below:

Alarm Display	Alarm Description	Alarm Mode	Alarm Delay	Reset Type	Comment
H1	High refrigerant pressure	Open	0s	Manual	The compressor is de-energized (independent of its current status or of the current pump status) and the alarm relay and associated display functions are activated. Fans are energized at maximum speed for 60 seconds to reduce the pressure.
L1	Low refrigerant pressure	Open	40s	Manual	The corresponding compressor is de-energized (independent of the current pump status) and the alarm relay and associated display functions are activated. There is a 40-second delay between the low-pressure condition and the alarm intervention.
t1	Compressor overload	Open	0s	Auto.	The compressor, pump, & fan are de-energized and the alarm relay and associated display functions are activated.
FL	Low water flow	Open	20s / 5s	Manual	If pump is energized, this alarm will de-energize compressor, pump & fan and the alarm relay and associated display functions are activated. There is a 20-second delay at start-up & a 5-second delay at all other times.
A1	Freeze protection	Open	0s	Manual	The compressor & fan are de-energized and the alarm relay and associated display functions are activated.
EE, EP	Memory failure	Open	0s	n/a	No interruption of operation, but memory damage will result in lack of data storage when power is removed.
E1, E2	Sensor failure	Open	0s	Auto.	The compressor, pump, & fan are de-energized and the alarm relay and associated display functions are activated.
EU, EO	High or low input voltage	Open	0s	n/a	No interruption of operation, but proper chiller operation can not be assured.
EL	Power supply "noise"	Open	0s	Auto.	No interruption of operation, but will cause fan speed modulation control (if supplied) to function as ON/OFF.
Ht	High water temperature	Open	30 min	Auto.	No interruption of operation, but signals if return water temperature exceeds 70°F

COMMISSIONING

Check the water connections

1. Check the supply / return connection
2. If glycol solution:
   Take a water sample to check the ratio.

Visual inspection

1. Remove the access panels and visually check the condition of the system, especially if chilled water pipes have been installed by the customer/ contractor.
2. Check the system visually for:
   accessibility and service clearances
   Has the system been modifled, e.g. by fixing cable ducting or similar equipment?
   Check that there are no screws next to copper pipes or the air-cooled condenser.

Note: Record any deviations on the Commissioning Report, with customer signature.

Inspect control panel and electrical work.

> **WARNING!**
> Use only suitable tools and measuring equipment when inspecting the electrical installation.

1. Main switch to ZERO - Open the switch cabinet
2. Input terminals voltage?
   YES = Open the main fuse
3. Check the electrical connections. Although these connections are well-tightened at the factory, they may be loosened during transport. Retighten if necessary.
4. Check the external connections against the wiring diagram. Fit jumpers if necessary.
5. Check the customer's wiring up to the main switch for cable cross-section and correct GROUNDING.
6. Check the supply voltage: Close the main switch and apply voltage to input terminals. ± 5% voltage tolerance
7. Check the control voltages of 24 Vac - microprocessor supply voltage at the output terminals of the control transformer.

> **ALWAYS OBEY SAFETY INSTRUCTIONS**

> **WARNING - HIGH VOLTAGE**
> **RISK OF FATAL INJURY**
> Open the main fuse before reconnecting

Preparations at the control panel
1. Open the switch cabinet (main switch 0FF)

CHILLED WATER PUMP
Inspection of chilled water circuit
Preparations with the control panel OPEN

1. Switch main switch 0FF via extension.
2. OPEN both compressor fuses
   (interrupt power supply to compressors)
3. Switch main switch ON via extension

Note: The chilled water pump must start after a short delay.
4. Bleed the system of air again
5. Check the piping in the entire system.

Inspection of the chilled water pump
1. Measure the running amps of the pump and compare with the values in the wiring diagram. If the measured value is greater than the rating plate the extemal pressure drop (piping system) is incorrect.

> **MANUFACTURER'S NOTE**
> The settings of the overloads must not be adjusted. **Warranty may be VOIDED.**

Inspect the water piping (check filter/strainer is installed on inlet) and remedy any faults.
INSPECTION OF COMPRESSORS
Check each chiller circuit as follows:
1. Main switch 0FF
2. Controller 0FF by monitor pushbutton
3. Close opened fuse of circuit
4. Main switch ON
5. Controller ON by monitor pushbutton
6. Clear alarm messages on monitor
System status:
Chilled water pump running (or compressor does not start)
Fan(s) running.
Inspection of refrigeration circuit
Note: It is recommended to use refrigeration pressure gauges to monitor the system pressures. Operate the compressor at least 15 minutes at full load.

CERTIFICATE OF HANDOVER OF THE
TO THE OPERATOR

Correct handover by the qualified company to the operator or operator's personnel is a basic precondition for operation of the refrigeration system.

Safety Instructions
The operator has been familiarised with the specified safety instructions.

Operating Instructions
The operator has been:
– trained in system operation
– instructed in the function and operation of the installed microprocessor.
– instructed in simple maintenance and inspection work.

The following have been handed over
System documentation, consisting of:
(check where applicable)

Handover Report including
commissioning data _____

Installation, Operating and
Maintenance Specifications _____

Instructions for Use of the
microprocessor _____

Safety instructions _____

Electrical wiring diagram _____

Miscellaneous:

_____ _____

_____ _____

_____ _____

INSPECTION – MAINTENANCE
The operator has been informed in precise detail by the qualified company of the necessity for regular inspection and maintenance.
Regular inspection and maintenance are independent of all guarantee provisions.

MAINTENANCE INTERVALS
The list below contains recommendations based on practical experience.
These recommendations must be adapted to the actual operating time of the chiller system, e.g. for continuous operation

Weekly
Inspections by operator
Every 3 months
Maintenance by qualified company
Once a year
General service by qualified chiller maintenance company

If the system is shut down for a long period(winter months), a complete inspection and service must be performed before switching off and restarting.

MACHINE DATA

System type _____

Serial number _____

Year of manufacture _____

Refrigerant _____

Qualified Company (Stamp) - Signature

Operator (Stamp) – Signature

Date: _____

Copy to qualified company and operator

The system was commissioned under the following conditions

Ambient air temperature	°F
Chilled water inlet temperature	°F
Chilled water outlet temperature	°F
Glycol solution	%
Type of glycol Name.	
Water flow rate	GPM
Pressure drop	PSI

Refrig. circuit 1 - Compressor 1

Power consumption,compressor	L1/A
Power consumption$_1$compressor	L2/A
Power consumption$_1$compressor	L3/A
Overcurrent release$_1$ winding 1	A
Overcurrent release,winding 2	A
High pressure	PSIG
Low pressure	PSIG
Oil pressure (semi hermetic only)	PSIG
Suction gas temperature	°F
Superheat	K
Safety devices – Settings	
Highpressure SDBK	PSIG
High pressure DBK	PSIG
Oil pressure OFF/SEC	PSIG
Low pressure OFF/ON	PSIG

Refrig. Circuit 1 - Compressor 2

Power consumption,compressor	L1/A
Power consumption$_1$compressor	L2/A
Power consumption$_1$compressor	L3/A
Overcurrent release$_1$ winding 1	A
Overcurrent release,winding 2	A
High pressure	PSIG
Low pressure	PSIG
Oil pressure (semi hermetic)	PSIG
Intake gas temperature	°F
Overheating	K
Safety devices – Settings	
Highpressure SDBK	PSIG
High pressure DBK	PSIG
Oil pressure OFF/SEC	PSIG
Low pressure OFF/ON	PSIG

Pump 1

Power consumption	L1/A
Power consumption	L2/A
Power consumption	L3/A
Overcurrent release	A
Pressure gauge, intake	PSIG
Pressure gauge, delivery	PSIG

Pump 2

Power consumption	L1/A
Power consumption	L2/A
Power consumption	L3/A
Overcurrent release	A
Pressure gauge, intake	PSIG
Pressure gauge, delivery	PSIG

Inspection of safety system

Antifreeze cut-off temperature	°F
Flow meter switch point	Mark

Control settings

Return temperature	°F
Supply temperature	°F
Setpoint	°F
Values read by the probes	

System ID

Model
Series/Year of manufacture
Customer Job No
Supplier Order No
Refrigerant Type: Lbs. circ.1
                                       Lbs. circ.2
Operator/installation site:

_____
Start up company

_____
The system was commissioned without deficiency. The listed values were measured at full load.

_____
Date/Place

_____
System operator

_____
Contact person of performing company:

_____
Servicing – Technical

_____
Comments:

WARNING
OBEY ALL SAFETY INSTRUCTIONS

WARNING
Only qualified service and
Maintenance personnel may carry out repairs to the system. During operation,potentially fatal pressures and voltages are generated in the system.
All safety precautions and warnings contained in these documents must be strictly observed.

Possible malfunctions to the chiller may occur due to the following factors:

1. Changes in operating conditions
2. Insufficient maintenance and inspection
3. External environmental factors
4. Internal machine factors
5. System factors
6. Operating errors

CAUSES OF MALFUNCTIONS

These causes can be divided into three groups:

1. **Faults due to the water circuit**
   The operator can generally remedy this type of problem.

2. **Electrical faults**
   With the aid of a qualified electrician, the operator can partially remedy this type of fault.

3. **Faults in the refrigerant circuit.**
   This type of problem can only be remedied by a qualified refrigeration company.

The table that follows lists a large proportion of the fault causes that can occur in practice.
These descriptions are intended for information only and must not be considered as a repair manual.
Often, the cause of a failure is due to a variety of factors.
However, these factors can only be evaluated by a qualified refrigeration company with precise knowledge of the functional interactions.

IMPORTANT
A large proportion of the functions, faults and operating states of the system are signalled by the microprocessor.
The microprocessor monitors all the function areas of the system.
Therefore, this information is also essential in defining faults.

CHANGES IN OPERATING CONDITIONS
Significant changes in the operating conditions of the liquid chiller may cause faults, because individual components important to the operation of the system will not be tuned to the new operating mode.
Inform the MANUFACTURER of any intended change and obtain prior consent.
NOTE: CANCELLATION OF WARRANTY MAY OCCUR.

TROUBLESHOOTING

FAULTS,

possible CAUSES

and possible REMEDIES

A) FAULT: COMPRESSOR DOES NOT START

Symptom	Cause	Possible Solution
1. **No voltage at power terminals of motor starter?**	Power Failure	Check the fuses and wiring
2. **No voltage at power terminals of motor starter.?**	Over load opened	Determine the cause. If all is 0k, close the overload.
3. **Voltage on but not applied down stream of fuse?**	Fuse Blown	Change fuse **Call customer service** - to identify the fault.
4. **Measure voltage value low?**	Voltage too low	Inform the electricity company
5. **Motor does not start, but full voltage applied at terminals?**	Motor burned out	Replace motor. **Call customer service**
6. **Damadged contacts or burnt solenoid coil?**	Defective starter	Repair or replace.
7. **Motor relay does not close?**	Control circui interupted	Identify the open safety switch and determine cause
8. **Compressor not running?**	Internal mechanical parts defective or compressor ceased.	Compressor must be replaced. **Call customer service.**
9. **High pressure switch open?**	High ambient. Lack of cooling to condenser.	see "High Pressure"

B) FAULT: COMPRESSOR NOISE - TOO LOUD. STOP THE COMPRESSOR

1. **Compressor knocking /banging**	Internal parts of compressor broken	Compressor must be replaced **Call customer service**
2. **Compressor knocking and intake line exceptionally cold?**	Expansion valve not closing	Check the expansion valve **Call customer service**

C) FAULT: COMPRESSOR LOSING OIL - STOP THE COMPRESSOR

1. **Lack of oil in compressor?**	Oil level too low	Oil must be topped up **Call customer service**
2. **Oil level falling?**	Clogged filter dryer	Change the filter dryer
3. **Compressor turning on/off too often?**	Compressor hunting	**Call customer service** See below, compressor hunting
4. **Reduced compressor power?**	Oil in sight glass black and containing dirt particles.	Possible winding damage **Call customer service**

D) FAULT: COMPRESSOR "HUNTING" – Customer service MUST be called

SYMPTOM	CAUSE	POSSIBLE SOLUTION
1. Normal opperation conditions but low pressure switch tripping? Bubbles in sight glass?	Unit low on refrigerant.	Repair possible leak in the circuit Top up with refrigerant. **Call customer service**
2. Compressor turning on/off too frequently?	Loose contact in control circuit	Repair or replace the defective switch. Tighten connections. (Electrician)
3. Ref. Suction pressure too low? Ice on the top of compressor?	Filter dryer plugged	Replace dryer **Call customer service**
4. Liquid line solenoid valve hisses when closing? Outlet colder than inlet?	Liquid line solenoid valve leaking.	Repair or replace **Call customer service**

E) FAULT: INSUFFICIENT COOLING CAPACITY

1. Expansion valve hissing?	Low on refrigerant	Top un refrigerant **Call customer service**
2. Temperature difference up/down stream of filter dryer or solenoid valve?	Dryer or solenoid valve colgged	Clean valve or replace dryer **Call customer service**
3. Frequent chiller cycling?	Expansion valved seized or clogged.	Repair or replace **Call customer service**
4. High water temperature?	Low flow across evaporator. Excessive pressure drop in evaporator.	Ensure good water flow. Check expansion valve. **Call customer service**
5. Wrong water temp. outlet	Adjust superheat	Check superheat and adjust **Call customer service**
6. Reduced water flow	Flow in water piping resticted or blocked	Remedy cause/obstruction

F) FAULT: SUCTION PRESSURE TOO LOW

1. Bubbles in sight glass	Low on refrigerant	Possible leaks or insufficient refrigerant **Call customer service**
2. Compressor hunting	Compressor hunting	See D) above: Compressor hunting **Call customer service**
3. Temperature difference up/down stream of solenoid valve?	Clogged filter dryer	Replace the dryer **Call customer service**
4. No refrigerant flow through expansion valve?	Power bulb of expansion valve has lost freon charge.	Replace the power bulb or expansion valve.
5. Expansion valve clogged?	Power loss	**Call customer service**
6. Water pressure loss?	Volume of flowing water too low	Measure volumetric water flow – clean filter

G) FAULT: CONDENSING PRESSURE TOO HIGH

SYMPTOM	CAUSE	POSSIBLE SOLUTION
1. **Normal opperation; high pressure switch activated?**	Too much refrigerant in system	Possibly overfilled with refrigerant. Check the level. **Call customer service.**
2. **Condenser pressure very high?**	Insufficint cooling air to condenser(s).	Clean the condenser coil. Check the operating mode of the motor and fans.
3. **Condenser pressure very high?**	Fans not delivering enough air. Check fan rotation. Check if fan motor has failed.	Change phase order on main power cord or change fan motor. **Call customer service.**
4. **High water temperature?**	Heat load into water circuit too large.	Check cooling load. **Call customer service.**

H) FAULT: CONDENSING PRESSURE TOO LOW

1. **Suction and discharge pressure equalize after pump down?**	High pressure valves broken or leaky.	Check the cylinder heads and valves. **Call customer service**
2. **Visable bubbles in sight glass?**	Low on refrigerant	Possible leak or insufficient rerigerant. **Call customer service**

I) FAULT: AXIAL FANS !

1. **Fan or chiller vibration?**	Fan out of balance	Inspect the bearings and visually check for damage.
2. **No air flow or some fans not running?**	Fan fuse blown	Check the voltage. Check the speed regulator (if fitted) and measure the amp. values. Check the motor(s) amp rating(s).

L) FAULT: CHILLED-WATER PUMP

1. **Large temperature rise from water out to water in.**	Not enough flow through system	Pressure drop in process cooling circuit is too high. Check the pump pressure gauge.
2. **Water leaking from pump**	Pumps seal failure	Change pump seal. **Call customer service**
3. **Pump does not run although cooling is required**	Pump mechanically defective or circuit breaker has tripped	Check pump pressure gauge. External pressure loss may be too high causing high amp draw. Check amp draw of pump.

MAINTENANCE
Before carrying out any maintenance work, the service technician must be made thoroughly familiar with the following safety precautions and provisions.

GENERAL

WARNING
High voltage - Risk of fatal injury
Disconnect the unit from the power supply before opening the doors or removing the chiller panels.

WARNING
High voltage - Risk of fatal injury
After opening the main switch, voltage is applied at input terminals L1, L2, L3
Open the main fuse

WARNING
Before carrying out any work in the control cabinet, make sure that the main switch is set to the 0FF position.

CAUTION
Use only the appropriate tools and measuring equipment to check the electrical system.

CAUTION
Risk of burns
Exposed copper pipes may be hot.

CAUTION
Danger of suffocation
When working with refrigerants, make sure of good ventilation. **Do not smoke.**

CAUTION
REFRIGERANT must never be discharged into the environment. It must be collected in a collecting container for reuse or for return to the manufacturer.

CAUTION
Risk of burns
Do not undo any coolant connections until the system is depressurised!

CAUTION
Protective goggles and rubber gloves must be worn when handling refrigerant.

CAUTION
Avoid any skin contact with gas or refrigerating oils. Severe burns may be caused. Always wear rubber gloves when handling dirty parts.

CAUTION
Risk of injury
If it is necessary to carry out work inside the system with the fans running, make sure that no parts of the body or clothing are caught in the fan blades or other moving parts.

MANuFACTURER'S SPECIFICATION

The safety devices installed in the system
such as flow meters, pressure switches etc. must not be bypassed.
CAUTION: WARRANTY MAY BE CANCELLED.

Microprocessor
Changes to the programming domain protected by password may only be made after checking with the manufacturer.
CAUTION: WARRANTY MAY BE CANCELLED.

Modifications in the control panel
The panel wiring may only be changed with the consent of the manufacturer.
Additional wiring is possible.
Any changes to the wiring must be marked in the wiring diagrams and made available to the operator.

PREVENTIVE MAINTENANCE
Maintenance Intervals
Note: *The maintenance intervals specified here are based on experience. Depending on individual conditions at any job site, required manitinance intervals may need to be performed more or less frequently than reccomended within this manual.*

WARNING
STRICTLY OBEY THE SAFETY INSTRUCTIONS

WARNING
Maintenance must be carried out exclusively by qualified service and maintenance technician. During operation, potentially lethal high voltages are generated in the system.
All safety precautions and warnings given in these documents must be precisely observed. Otherwise, severe or fatal injuries may be caused.

MANUFACTURER'S NOTE
The instruments and displays must be read at full load and under the normal system operating conditions.

Service protocol required every 3 months:

1. A general inspection of the machine opperation.

2. Carry out weekly inspections.

3. Check the settings of all safety devices against the Commissioning Report.

4. **Preventive maintenance,** as follows:
   − Check the fans are running
   − Check the refrigerant pipes for leaks
   − Check the water/glycol pipes for leaks
   − Check the cold water pumps
   − Check the condenser for dirt build up
   − Check the control cabinet
   − Check the compressor(s) amp draw(s)

5. Carry out any maintenance interventions required.

Enter all values in the Maintenance Report and obtain confirmation (countersignature) by the operator. Present a copy to the operator.

Servicing tasks required every 6 months

1. Repeat the 3-month service

2. **Preventive maintenance** – additional
   − Check superheat
   − Check the glycol/water mixture for good freeze protection

3. **Commissioning** operations, as follows:
   − Check the cold water pumps
   − Check the flow meters
   − Check the safety devices
   − Check the antifreeze protection devices

Enter all values in the Maintenance Report and obtain confirmation (countersignature) by the operator. Present a copy to the operator.

Note: *The recomendations and specifications given here are based on experience. The type and scope of maintenance depends on the actual application of the system. More frequent and more comprehensive inspections may be necessary in the event of more adverse conditions, e. g.:*
   − *Higher or lower ambient temperature*
   − *Power fluctuations*
   − *Dusty/dirty installation conditions*

Checking the glycol solution
If the system is operated with a water/glycol mixture, the mixed percentage must be regularly checked.

Recommendation: every 6 months
Only a correct mixture can guarantee correct operation. Use a portable spectrometer.
Excess glycol concentration: reduced cooling power. Insufficient glycol concentration: risk of freezing.
The water sample should also be checked for signs of corrosion.
Note: Improper use of water treatment agents can cause major problems. Obtain information from the manufacturer on suitable inhibitors.

WARNING
The glycol/water mixture must not be discharged into the normal water drains. It must be collected in suitable containers and disposed of in accordance with the local requirements.

Preventive Maintenance

IMPORTANT NOTE
The maintenance operations are described below. All operations must be performed step by step and must be completely finished.

CAUTION
High voltage - Risk of fatal injury
Disconnect the unit from the power supply before opening the doors or removing the chiller panels.

Risk of burns
Exposed copper pipes may be hot.

Checking the refrigerant pipes
1. Check the refrigerant piping as far as possible for faults, damage and oil leaks.
2. Check the piping for chafing points, especially where the pipes are routed very close to the frame work or along internal components of the unit.
3. Check the pipe insulation and repair if necessary.
4. Check the pipes for vibration. Check the pipe mounting clips and retighten the screws if necessary.

Checking the water or glycol lines
1. Check all pipes for vibration.
2. Check the mounting clips and tighten if necessary.
3. Check for leaks at screwed and welded joints and and repair if necessary.
4. Squeeze the insulation to determine whether it has filled with water. **If so**:
   Locate the leak and repair.
5. Check the insulation and reinsulate or reglue any damaged points.

Note: Condensation may form due to inadequately insulated chilled water pipes.

CARE
High voltage - risk of fatal injury
Disconnect the unit from the power supply

Checking the chilled water pump

1. Check for leaks arround the pump. If leaking, pump seal might need to be changed. Tighten connections if necessary.
2. Check the motor for loose electrical connections. If necessary, retighten the connections. Reclose the terminai boxes.
3. Check the externally mounted water filter/strainer and clean if necessary.

WARNING - RISK OF INJURY
Risk of cuts due to the condenser fins. Do not touch, or wear gloves.

RISK OF INJURY
If it is necessary to carry out work inside the system with the fans running, make sure that no parts of the body or clothing are caught in the fan blades or other moving parts.

Checking the air-cooled condenser
1. Check the condenser coil and clean CAREFULLY if necessary with compressed air. DO NOT USE BRUSH OR SCRAPER OR COIL WILL BE PERMANENTLY DAMAGED
2. Straighten bent fins with a fin comb set for the correct fins per inch.

CAUTION
After changing fan or fan blades, insure balance is correct.

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1. Check the fan mounting and, if necessary, tighten the securing screws.
2. Check the electrical terminal box.
3. Check rotation of fans is in correct direction

After completing these operations, replace the access panels and tighten panel screws.

Note and report any faults detected during

NOTE ON CHLORINE - FREE REFRIGERANTS

The compressors designed for operation with chlorine-free refrigerants are factory-filled with ester oils approved by the compressor manufacturer and are marked accordingly.

Compared to single-substance refrigerants and azeotropic and quasi-azeotropic mixtures, the zeotropic refrigerant mixtures are characterised by a wider temperature variation. Specific effects on system maintenance and repairs must therefore be taken into account.

Due to the fact that zeotropic mixtures can have different compositions in the liquid and gas phases, it is especially important that these refrigerants are only ever charged into the system **in the liquid state.**
Therefore: strictly follow the filling instructions of the refrigerant manufacturer.

In the event of a leak, the change in mixture composition leads to reduced superheat after the thermostatic expansion valve and ultimately to liquid hammering in the compressor.

Another aspect of the mixture change is sudden 'hunting' of the expansion valve.

Tests by refrigerant manufacturers and the past experience of users have shown that this situation can be stabilized by recovering the complete charge and re-filling the system. Before replacing the entire circulating refrigerant, a mixture concentration analysis is recommended.

The use of polyester oils ("POE"s) is necessary for operation with chlorine-free refrigerants.

Compared to minerai oils, POEs have high hygroscopicity (moisture absorption).

If POE is exposed for only a short time to the ambient air, it absorbs so much moisture that it is no longer acceptable for use in refrigeration circuits.

Since a POE binds moisture more firmly than mineral oil, the moisture is more difficult to remove from the system by vacuum.

Consequently, we recommend filling the system with a POE containing less than 50ppm moisture particles. With the use of appropriately sized filter dryers, the moisture content in the system can be kept below 50 ppm.

If the moisture level rises to unacceptable levels, corrosion and copper-plating can occur.

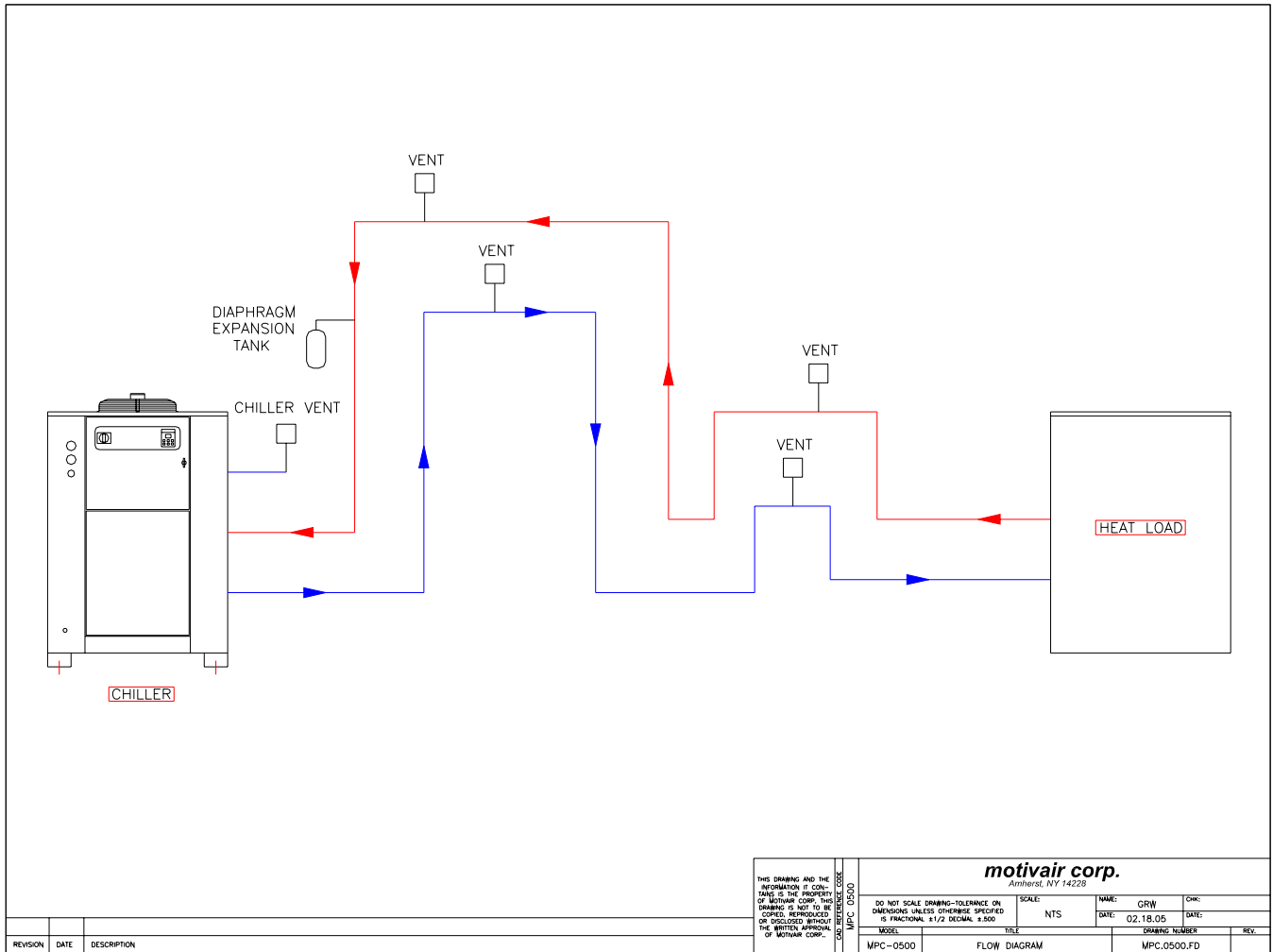By perfect evacuation, the residual moisture can be reduced to 10 ppm.

The system must be evacuated to 0.3 mbar. In the event of any doubt regarding the moisture level in the system, an oil sample should be taken and analysed for water content.

The installed indicator sight glass can be used for the new refrigerants and oils, but they do not show the actual moisture content, which may be higher than shown in the sight glass due to the high hygroscopicity.

The display in the sight glass only gives the moisture content of the refrigerant.

To determine the real moisture level, an oil sample must be taken from the system and analyzed.

NOTE: VENTS ARE REQUIRED AT ALL "LOCAL" HIGH POINTS IN SUPPLY & RETURN

PIPING INSTALLATION

This section is intended as a guide for the correct installation of the chilled water piping system, including this chiller. However, the chiller manufacturer accepts no responsibility whatsoever for the installation of the chiller or the associated piping.

All piping must be installed only by a licensed plumbing contractor, and in compliance with local codes. DO NOT USE GALVANIZED PIPING IF GLYCOL IS TO BE USED IN THE CHIILED WATER SYSTEM. Chemical reaction between the glycol and the galvanized piping (galvanic action) can be detrimental to the cooling system, the glycol and the chiller. Piping material may be copper, plastic, carbon or stainless steel, depending on the requirements of each installation.

It is the responsibility of the engineer and/or the piping contractor to insure that the piping is correctly sized in relation to the installation, and the available dynamic head of the pump installed inside the chiller. The chilled water pipe connections on the chiller are not necessarily the appropriate size for the system piping. As a general guide, the chiller pipe connections should be considered as the _minimum_ pipe size required for the installation. Drastic reductions in pipe sizing (small hoses, etc.) will reduce the chilled water flow and may cause a low flow alarm, or freezing damage in the evaporator. Note: installations with low water flow/high water temperature rise should always have a full-ported by-pass installed between the chiller inlet and outlet connections, with a manually adjustable gate valve in the by-pass line. Correctly adjusted, this blended return water will maintain an adequate flow through the chiller, at an acceptable return temperature.

Always install a pressure gauge in the return piping close to the chiller. This is essential for monitoring system pressure and pump performance.

It is good piping practice, especially on systems with short piping runs and/or low system pressure loss, to install a gate valve in the **DISCHARGE** line from the chiller for throttling purposes. This allows the operator to maintain optimum pump performance by adding resistance to the system. **NEVER** throttle the water flow on the return line to the chiller. This will cause cavitation and over-heating of the pump.

AUTOMATIC WATER MAKE-UP

If the chilled water cooling system is expected to lose water during normal operation (mold-changing, etc.) an automatic water make-up system should be installed, or can be supplied as a factory option. The auto make-up system must include a water pressure regulator and pressure gauge**. CAUTION:** The tank inside the chiller has a maximum pressure rating of 40 PSIG. Do not discharge city water (which can be as high as 60-80 PSIG) directly into the chiller. Instantaneous pressurization can cause the tank to rupture before the pressure relief valve opens. **NOTE:** Do not use an automatic water make-up system if glycol is installed for anti-freeze protection. The glycol will become diluted and the freeze protection will be lost. Some critical applications require the installation of emergency city water and drain solenoid valves, in the event of a chiller failure. In this case, the chiller MUST be isolated from the city water pressure to avoid damage. After operation of the emergency city water system, the glycol concentration must be carefully checked using a spectrometer. Add glycol to maintain the correct antifreeze concentration if required.

EXPANSION TANK

There is a small air space provided inside the top of the insulated reservoir of the chiller. This is designed to act as a compression chamber, in order to absorb moderate hydraulic expansion of the water, during operation. For systems with extensive piping, or large system chilled water volumes it is recommended to install a closed diaphragm expansion tank in the return chilled water line, close to the chiller. The tank should be sized using the appropriate calculations for the volume of water in the system, and the maximum expected temperature fluctuation of the water in the piping system, under any conditions. The purpose of the expansion tank is to absorb hydraulic expansion of the water in the system, which can cause damage to the chiller, piping and/or equipment to be cooled. The expansion tank should be connected to the side of a vertical pipe or the bottom of the horizontal return piping so that trapped air circulating in the chilled water does not become trapped in the expansion tank. Expansion tanks are typically factory pre-charged with compressed air to approximately 12-20 psig. After installation, filling & venting of the entire system, the pressure of the expansion tank should be set to provide a pressure of 5-10 PSIG on the return side of the chiller, **_with the chiller in operation_**. Air pressure can be added or removed from the diaphragm tank via the Schraeder valve.

NOTE: Vertical piping immediately connected to and from the chiller will impose a static (or standing) head pressure, which can be read on the pump discharge gauge of the chiller, and the gauge installed on the return line to the chiller, when the system is not operating. For example, if the supply and/or return piping from the chiller rises 15 feet before running above a ceiling, etc. this will show a gauge static pressure of approximately 6-7 PSIG on the gauges (feet x .424 = PSIG). This is simply the weight of the water in the vertical piping at that location, and does not indicate an overall **_system_** pressure.

SYSTEM VENTING

The single most common problem in chiller piping installations is lack of chilled water flow caused by poor piping practices and/or inadequate venting of the system. The symptom is a repeated flow alarm, when the flow switch installed in the return line inside the chiller opens the control circuit, stops the chiller and sets the alarm.

This chiller is a CLOSED CIRCUIT system and is not open to atmosphere. This means that air will remain in **_all_** local high points of the system when it is initially filled with water.

NOTE: A **_local_** high point is **_any_** point in the piping, which can be described as an inverted "U" section. More clearly defined, if the piping rises vertically ANYWHERE, AND AT ANY ELEVATION IN THE SYSTEM, travels horizontally, then drops again vertically, this inverted "U" section of piping **_is a permanent air lock_** AND MUST BE VENTED. Venting is required AT ALL LOCAL HIGH POINTS, and is required on both the supply and return pipes. Vents can be either manual, or automatic. Automatic vents should always be installed with an isolation valve for future service access, repair or replacement. Automatic vents are particularly susceptible to drawing air into the return chilled water piping if this line is allowed to fall into a vacuum.

```
┌────────────────────────────────────────────────────────────────────────┐
│  CAUTION:                                                                │
│                                                                          │
│  A FILTER/STRAINER MUST BE INSTALLED ON THE INLET TO THE CHILLER,        │
│  IN ORDER TO PREVENT PARTICULATES (RUST, DIRT, INSTALLATION              │
│  DEBRIS) FROM BLOCKING THE EVAPORATOR.                                   │
│  Blockage will severely impair chiller performance and is NOT covered by │
│  warranty.                                                               │
└────────────────────────────────────────────────────────────────────────┘
```

POSITIVE PRESSURIZATION OF THE SYSTEM

There are two (2) reasons for positive pressure in a closed loop, pumped piping system:

1. Prevention of air being drawn into the system at vent locations close to the chiller, caused by the pump drawing a vacuum in the return line.
2. Optimizing pump performance by providing a net positive suction head (N.P.S.H.) to the pump.

Positive system pressure can be imposed by ***carefully & slowly*** introducing city water pressure, via a hose connection anywhere in the system. After the system has been completely filled & vented, note the gauge pressure at the supply & return of the chiller. If there is no significant vertical piping connected directly to the chiller, the gauges should be at zero. If a pre-pressurized expansion tank is installed in the system, the initial system pressure should be approximately that of the expansion tank. Start the chiller and observe the operating pressure on both the return and discharge water pressure gauges. The return line to the chiller (while operating) should be approximately 5-10 PSIG, confirmed by the return line pressure gauge. The discharge gauge on the chiller should be approximately 30-40 PSIG, depending on the piping and system pressure losses of each installation.

The return (or suction) pressure can be raised or lowered by ***carefully*** using city water pressure via a hose connection, or by adjusting the diaphragm pressure of the expansion tank, or a combination of both.

NOTE: The expansion tank should not normally be pressurized to more than 20 PSIG, measured when the system is not operating. The final discharge pump pressure should **NEVER** be allowed to exceed the maximum pump rating pressure (normally around 35-50 PSIG).
CAUTION: Supercharging the pump with city water pressure higher than the nominal rating of the pump, can damage the mechanical pump seals, or cause damage to the chiller, piping system or customer equipment. This damage is not covered by the chiller warranty.

WATER/GLYCOL FILLING

If glycol is required for antifreeze protection, **ALWAYS** use an industrial inhibited ethylene glycol, or propylene (food-grade) glycol. **DO NOT** use automobile antifreeze. Suitable glycols are manufactured by the Dow Chemical Company for this purpose, and available nationwide. There are other glycol suppliers available, but always exercise great caution in the selection of a glycol supplier, and always confirm the freeze protection after installation, using a spectrometer. Damage caused by freezing is not covered under warranty.

Glycol can be pre-mixed with water to the correct concentration, then pumped into the system, or pumped in separately from the water, provided the system capacity is calculated accurately.
The most common method for filling the system is to pump the water/glycol into the fill or drain connection of the chiller, ***with all system vents open***. There is a manual vent located at the back of the chiller for initial filling/venting purposes, in addition to the high point piping vents. NOTE: The system should be filled slowly and carefully, allowing all the air to escape. The system can only be filled as fast as the air can escape. Be patient, and do not over-pressurize the system. After initial operation, check all air is vented from the system.