

Standard Chiller 1/4 compressors

Manual version: 1.4 - 18/10/96

Program code: **EP000ECH02**

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MAIN FEATURES

The MACROPLUS controller has been designed for the control of chillers with different configurations and WATER or AIR CONDENSATION.

Minimum configuration:

1 COMPRESSOR CHILLER

Maximum configuration:

4-COMPRESSOR CHILLER

The system consists of two main parts:

- a) CONTROL UNIT (USER INTERFACE)
- b) INPUT/OUTPUT UNIT

The User interface consists of 3 levels (masks), two of them protected by PASSWORD so as to avoid any data handling on the part of unauthorized personnel.

LEVEL 1 freely accessible (synoptic masks)

LEVEL 2 accessible to the User via PASSWORD (PROGRAMMING)

LEVEL 3 accessible to the Manufacturer via PASSWORD (INITIALIZATION of the unit)

HARDWARE

The main part of the system comprises:

- MACROPLUS control board
- INPUT / OUTPUT boards

Macroplus processes all data. It also represents the User interface since it ensures the easy communication between User and Unit.

The type and number of boards depend on the type of application and on the instruments required (COMPRESSORS and FANS).

The minimum configuration - 1 "large" board - allows you to manage:

- 1 COMPRESSOR
- 2 CONDENSER FANS
- 2 PUMPS
- 2 MODULATING OUTPUTS 0:10 Volts

The maximum configuration - 2 "large" boards plus 1 "additional" board plus 1 "small non-expandable" board - allows you to manage:

- 4 COMPRESSORS
- 12 CONDENSER FANS (3 per circuit)
- 2 PUMPS
- 2 ANALOG OUTPUTS 0:10 Volts

OPTIONS:

- CLOCK board, necessary to display DATE and TIME and to manage the time-bands of the chiller (timed ON/OFF routines) as well as daily time-bands with set-point variation;
- serial output RS422 for connection to a remote supervisor;
- serial output RS232;
- serial connection board to the printer, ALFAPANEL type;

- serial output RS232C for the modem.

FUNCTIONS OF THE SYSTEM

Macroplus controls and regulates the following conditions:

- water temperature (based on the evaporator inlet/outlet temperature);
- modality of intervention of each single component of the machine;
- protections of each single compressor and indication of any off-normal condition (either LOCAL indication or REMOTE signal via serial line);
- protection of each single refrigeration group;
- display:
 - programming data (**DISPLAY**)
 - ON status of the components (**LED indicators**)

PROTECTIONS

MACROPLUS ensures a series of protective actions against:

- high outlet pressure (pressurestat). It is also possible to combine the action of the pressurestat with a PRESSURE TRANSDUCER (DANFOSS or FANAL 4-20 mA) to continuously monitor the outlet pressure and signal any HIGH pressure condition within the circuit;
- suction low pressure (pressurestat);
- oil differential minimum pressure (pressurestat)
- max. absorption engine of the compressor (overload)
- max. absorption engine of the fans (overloads)
- max. absorption engine of the pumps (overloads);

The global protections are the following:

- antifrost protection (1 antifrost thermostat for 4 different circuits)
- protection in case of pumps starting failure (flow detectors any 2 pumps)
- protection in case of serious alarm (optional) (no. 2 digital inputs available to block the machine in case of serious alarms, eg: SMOKE/FIRE/FLOODING);

When the protections intervene, the controlled unit turns OFF and Macroplus informs the User of the OFF-normal condition via:

- BUZZER;
- energization of the change-over relay "ALARM RELAY" on the first interface board (to which a remote signal device can be connected for remote alarm indication);
- the 'AL' message (alarm) appears on the display.

Press the ALARM Button to display the exact type of alarm occurred:

Example of alarm mask:

Pressure switch HighPressure Comp.1
--

IMPORTANT:

All the alarms should be manually reset. They remain stored in the microprocessor until the User restores normal conditions by pressing the Button 'CLEAR'.

AUTODIAGNOSIS

There is a continuous exchange of information between the controller (main board) and its I/O interfaces (the peripheral parts of the system).

The I/O interfaces are constantly controlled and the unit is immediately blocked in case one of them should not work properly. Any OFF-normal condition will therefore be displayed.

Should the controller be blocked for any reason, there is a 40 seconds' interval meant to restore normal working conditions, after that the unit will automatically shift in STAND-BY (and the outputs will disenergize).

LIST OF CONTROL ACTIONS

- Regulation of water temperature at evaporator INLET/OUTLET (P or P+I regulation);
- Regulation based on a CENTRAL SET-POINT or a LATERAL ZONE;
- Automatic, periodic rotation of the compressors in order to balance the working hours of all the compressors;
- Timed ON/OFF routines of the compressors;
- Timed ON routines of different compressors to avoid simultaneous startings;
- Timed ON routines of the same compressor to limit the number of startings per hour;
- Possibility of selecting the minimum ON time of the compressors;
- Display of the working hours of the compressors and indication of exceeded threshold (maintenance is then required);
- No flow detectors action when the motor-driven pump starts working;
- No low pressure indication when the compressor starts working;
- Delay of the oil differential pressurestat indication;
- Optional PUMPDOWN procedure;
- PART WINDING of the compressors (1 second);
- (Optional) hourly rotation of the pumps and ON routine of the stand-by pump in case the current pump should not work properly;
- Weekly time-bands management of the chiller (ON/OFF routines);
- Daily time-bands management with variation of the SET-POINT for lower energy requirements;
- Possibility of forcing the ON routine of each compressor or of ignoring each of them for an easy maintenance, without intervention on the electrical control panel;
- Control of the parameters errors (selection of out-of-range limits).

USER INTERFACE: DISPLAY

The Liquid Crystal Display shows the values of the controlled parameters, the selected set-points, the alarm thresholds, the working hours of the compressors and, in general, any information relative to the components controlled by Macroplus.

DISPLAYs available:

4 rows x 20 characters, character dimension = 5mm

4 rows x 20 characters, character dimension = 8mm

LED INDICATORS

There are 18 LED indicators on the front panel of the chiller. They indicate the following conditions:

- L1 - yellow LED "POWER ON": indicates that the controller is being powered
- L2 - red LED "ALARM": indicates an OFF-normal condition
- 1 - green LED "COMP. 1 ON": indicates that compressor 1 is ON
- 2 - green LED "PART1 C1 ON": indicates that partialization 1 is active
- 3 - green LED "PART2 C1 ON": indicates that partialization 2 is active
- 4 - green LED "COMP. 2 ON": indicates that compressor 2 is ON
- 5 - green LED "PART1 C2 ON": indicates that partialization 1 is active
- 6 - green LED "PART2 C2 ON": indicates that partialization 2 is active
- 7 - green LED "COMP. 3 ON": indicates that compressor 3 is ON
- 8 - green LED "PART1 C3 ON": indicates that partialization 1 is active
- 9 - green LED "PART2 C3 ON": indicates that partialization 2 is active
- 10 - green LED "COMP. 4 ON": indicates that compressor 4 is ON
- 11 - green LED "PART1 C4 ON": indicates that partialization 1 is active

- 12 - green LED "PART2 C4 ON": indicates that partialization 2 is active
- 13 - green LED "PUMP 1 ON": indicates that pump 1 is ON
- 14 - green LED "PUMP 2 ON": indicates that pump 2 is ON

INPUTS / OUTPUTS

There are different configurations available, depending on the number of refrigeration circuits, cooling steps, digital inputs and outputs.

The I/O configuration allows not just the management of a 'small' configuration (based on 1 compressor) but also of a 'large' configuration (based on 4 compressors).

The configurations indicated below will be useful when adjusting the connections of the electric control panel.

The **ANALOG INPUTS** are common to all versions:

logic no. - terminal - probe type

(1 I/O "**large**" board)

- 1 - B1 - M - WATER TEMP. PROBE AT EVAPORATOR OUTLET
- 2 - B2 - M - WATER TEMP. PROBE AT EVAPORATOR INLET
- 3 - B3 - M - AMBIENT AIR TEMPERATURE PROBE
- 4 - B4 - M - FREE COOLING TEMPERATURE PROBE
(water temperature at machine inlet)
- 5 - B5 - M - HIGH PRESSURE TRANSDUCER CIRCUIT 1
- 6 - B6 - M - HIGH PRESSURE TRANSDUCER CIRCUIT 2

(1 I/O "**additional**" board)

- 7 - B7 - M - REMOTE SET-POINT
- 8 - B8 - M - non-connected
- 9 - B9 - M - non-connected
- 10 - B10 - M - non-connected
- 11 - B11 - M - non-connected
- 12 - B12 - M - non-connected
- 13 - B13 - M - HIGH PRESSURE TRANSDUCER CIRCUIT 3
- 14 - B14 - M - HIGH PRESSURE TRANSDUCER CIRCUIT 4

In case one of the above mentioned probes is not used, it is recommended to ground its corresponding analog input.

ANALOG OUTPUTS

Common to all versions and active only when the freecooling function has been selected.

(1 I/O "**large**" board)

- 1 - Y1 - G0 - 3-WAY FREECOOLING VALVE
- 2 - Y2 - G0 - INVERTER

SINGLE COMPRESSOR VERSION

1 "LARGE" BOARD

DIGITAL INPUTS:

(1 I/O "**large**" board)

- 1 REMOTE START / STOP ROUTINES
- 2 ANTIFREEZE WATER THERMOSTAT
- 3 WATER FLOW DETECTOR
- 4 MOTOR-DRIVEN PUMP 1 OVERLOAD
- 5 MOTOR-DRIVEN PUMP 2 OVERLOAD
- 6 EXTERNAL INTERBLOCK no. 1 (alarm: machine lockout)
- 7 HIGH PRESSURE PRESSURESTAT COMPRESSOR 1
- 8 HIGH PRESSURE PRESSURESTAT COMPRESSOR 1 (limit control)
- 9 LOW PRESSURE PRESSURESTAT COMPRESSOR 1

- 10 HIGH TEMPERATURE WINDING COMPRESSOR 1
- 11 COMPRESSOR 1 OVERLOAD
- 12 PRESSURESTAT OIL DIFFERENTIAL FOR COMPRESSOR 1
- 13 FAN 1 OVERLOAD
- 14 FAN 2 OVERLOAD
- 15 FAN 3 OVERLOAD

DIGITAL OUTPUTS:

(1 I/O "large" board)

- 1 MOTOR-DRIVEN PUMP 1
- 2 MOTOR-DRIVEN PUMP 2
- 3 CONTACTOR WINDING A COMPRESSOR 1
- 4 CONTACTOR WINDING B COMPRESSOR 1
- 5 SOLENOID LIQUID OF COMPRESSOR 1
- 6 SOLENOID PARTIALIZATION 1 COMPRESSOR 1
- 7 SOLENOID PARTIALIZATION 2 COMPRESSOR 1
- 8 FAN 1
- 9 FAN 2
- RA ALARM RELAY

WARNING: If you change the set-point via analogic input (B7) you have to connect an additional board to the large one.

2-COMPRESSOR VERSION

1 "LARGE" BOARD

DIGITAL INPUTS:

(1 I/O "large" board)

- 1 REMOTE START / STOP ROUTINES
- 2 ANTIFROST THERMOSTAT
- 3 WATER FLOW DETECTOR
- 4 MOTOR-DRIVEN PUMP 1 OVERLOAD
- 5 MOTOR-DRIVEN PUMP 2 OVERLOAD
- 6 EXTERNAL INTERBLOCK no. 1 (alarm: machine lockout)
- 7 HIGH PRESSURE PRESSURESTAT COMPRESSOR 1
- 8 HIGH PRESSURE PRESSURESTAT COMPRESSOR 1 (limit control)
- 9 LOW PRESSURE PRESSURESTAT COMPRESSOR 1
- 10 HIGH TEMPERATURE WINDING COMPRESSOR 1
- 11 COMPRESSOR 1 OVERLOAD
- 12 PRESSURESTAT OIL DIFFERENTIAL FOR COMPRESSOR 1
- 13 FAN 1 OVERLOAD
- 14 FAN 2 OVERLOAD
- 15 FAN 3 OVERLOAD
- 16 HIGH PRESSURE PRESSURESTAT COMPRESSOR 2
- 17 HIGH PRESSURE PRESSURESTAT COMPRESSOR 2 (limit control)
- 18 LOW PRESSURE PRESSURESTAT COMPRESSOR 2
- 19 HIGH TEMPERATURE WINDING COMPRESSOR 2
- 20 COMPRESSOR 2 OVERLOAD
- 21 PRESSURESTAT OIL DIFFERENTIAL FOR COMPRESSOR 2
- 22 FAN 4 OVERLOAD
- 23 FAN 5 OVERLOAD
- 24 PUMP FUNCTIONING IN REFRIG: START/STOP ROUTINES OF THE PUMP

DIGITAL OUTPUTS:

(1 I/O "large" board)

- 1 MOTOR-DRIVEN PUMP 1
- 2 MOTOR-DRIVEN PUMP 2
- 3 CONTACTOR WINDING A COMPRESSOR 1

- 4 CONTACTOR WINDING B COMPRESSOR 1
- 5 SOLENOID LIQUID OF COMPRESSOR 1
- 6 SOLENOID PARTIALIZATION 1 COMPRESSOR 1
- 7 SOLENOID PARTIALIZATION 2 COMPRESSOR 1
- 8 FAN 1
- 9 FAN 2
- 10 FAN 4
- 11 FAN 5
- 12 CONTACTOR WINDING A COMPRESSOR 2
- 13 CONTACTOR WINDING B COMPRESSOR 2
- 14 SOLENOID LIQUID OF COMPRESSOR 2
- 15 SOLENOID PARTIALIZATION 1 COMPRESSOR 2
- 16 SOLENOID PARTIALIZATION 2 COMPRESSOR 2
- RA ALARM RELAY

WARNING: If you change the set-point via analogic input (B7) you have to connect an additional board to the large one.

3-COMPRESSOR VERSION

- 1 "LARGE" BOARD
- 1 "ADDITIONAL" BOARD

DIGITAL INPUTS:

(1 I/O "**large**" board)

- 1 REMOTE START / STOP ROUTINES
- 2 ANTIFROST THERMOSTAT
- 3 WATER FLOW DETECTOR
- 4 MOTOR-DRIVEN PUMP 1 OVERLOAD
- 5 MOTOR-DRIVEN PUMP 2 OVERLOAD
- 6 EXTERNAL INTERBLOCK no. 1 (alarm: machine lockout)
- 7 HIGH PRESSURE PRESSURESTAT COMPRESSOR 1
- 8 HIGH PRESSURE PRESSURESTAT COMPRESSOR 1 (limit control)
- 9 LOW PRESSURE PRESSURESTAT COMPRESSOR 1
- 10 HIGH TEMPERATURE WINDING COMPRESSOR 1
- 11 COMPRESSOR 1 OVERLOAD
- 12 PRESSURESTAT OIL DIFFERENTIAL FOR COMPRESSOR 1
- 13 FAN 1 OVERLOAD
- 14 FAN 2 OVERLOAD
- 15 FAN 3 OVERLOAD
- 16 HIGH PRESSURE PRESSURESTAT COMPRESSOR 2
- 17 HIGH PRESSURE PRESSURESTAT COMPRESSOR 2 (limit control)
- 18 LOW PRESSURE PRESSURESTAT COMPRESSOR 2
- 19 HIGH TEMPERATURE WINDING COMPRESSOR 2
- 20 COMPRESSOR 2 OVERLOAD
- 21 PRESSURESTAT OIL DIFFERENTIAL FOR COMPRESSOR 2
- 22 FAN 4 OVERLOAD
- 23 FAN 5 OVERLOAD
- 24 PUMP FUNCTIONING IN REFRIG: START/STOP ROUTINES OF THE PUMP

(1I/O "**additional**" board)

- 25 HIGH PRESSURE PRESSURESTAT COMPRESSOR 3
- 26 HIGH PRESSURE PRESSURESTAT COMPRESSOR 3 (limit control)
- 27 LOW PRESSURE PRESSURESTAT COMPRESSOR 3
- 28 HIGH TEMPERATURE WINDING COMPRESSOR 3
- 29 COMPRESSOR 3 OVERLOAD
- 30 PRESSURESTAT OIL DIFFERENTIAL FOR COMPRESSOR 3
- 31 FAN 7 OVERLOAD
- 32 FAN 8 OVERLOAD

DIGITAL OUTPUTS:

(1 I/O "**large**" board)

1	MOTOR-DRIVEN PUMP 1
2	MOTOR-DRIVEN PUMP 2
3	CONTACTOR WINDING A COMPRESSOR 1
4	CONTACTOR WINDING B COMPRESSOR 1
5	SOLENOID LIQUID OF COMPRESSOR 1
6	SOLENOID PARTIALIZATION 1 COMPRESSOR 1
7	SOLENOID PARTIALIZATION 2 COMPRESSOR 1
8	FAN 1
9	FAN 2
10	FAN 4
11	FAN 5
12	CONTACTOR WINDING A COMPRESSOR 2
13	CONTACTOR WINDING B COMPRESSOR 2
14	SOLENOID LIQUID OF COMPRESSOR 2
15	SOLENOID PARTIALIZATION 1 COMPRESSOR 2
16	SOLENOID PARTIALIZATION 2 COMPRESSOR 2
RA	ALARM RELAY

(1 I/O "**additional**" board)

17	FAN 3
18	CONTACTOR WINDING A COMPRESSOR 3
19	CONTACTOR WINDING B COMPRESSOR 3
20	SOLENOID LIQUID OF COMPRESSOR 3
21	SOLENOID PARTIALIZATION 1 COMPRESSOR 3
22	SOLENOID PARTIALIZATION 2 COMPRESSOR 3
23	FAN 7
24	FAN 8

4-COMPRESSOR VERSION

- 1 "LARGE" BOARD
- 1 "ADDITIONAL" BOARD
- 1 "SMALL NON-EXPANDABLE" BOARD

DIGITAL INPUTS:

(1 I/O "**large**" board)

1	REMOTE START/STOP ROUTINES
2	ANTIFROST THERMOSTAT
3	WATER FLOW DETECTOR
4	MOTOR-DRIVEN PUMP 1 OVERLOAD
5	MOTOR-DRIVEN PUMP 2 OVERLOAD
6	EXTERNAL INTERBLOCK no. 1 (alarm: machine lockout)
7	HIGH PRESSURE PRESSURESTAT COMPRESSOR 1
8	HIGH PRESSURE PRESSURESTAT COMPRESSOR 1 (limit control)
9	LOW PRESSURE PRESSURESTAT COMPRESSOR 1
10	HIGH TEMPERATURE WINDING COMPRESSOR 1
11	COMPRESSOR 1 OVERLOAD
12	PRESSURESTAT OIL DIFFERENTIAL FOR COMPRESSOR 1
13	FAN 1 OVERLOAD
14	FAN 2 OVERLOAD
15	FAN 3 OVERLOAD
16	HIGH PRESSURE PRESSURESTAT COMPRESSOR 2
17	HIGH PRESSURE PRESSURESTAT COMPRESSOR 2 (limit control)
18	LOW PRESSURE PRESSURESTAT COMPRESSOR 2
19	HIGH TEMPERATURE WINDING COMPRESSOR 2
20	COMPRESSOR 2 OVERLOAD
21	PRESSURESTAT OIL DIFFERENTIAL FOR COMPRESSOR 2
22	FAN 4 OVERLOAD

- 23 FAN 5 OVERLOAD
- 24 PUMP FUNCTIONING IN REFRIG: START/STOP ROUTINES OF THE PUMP

(1 I/O "**additional**" board)

- 25 HIGH PRESSURE PRESSURESTAT COMPRESSOR 3
- 26 PRESSURE PRESSURESTAT COMPRESSOR 3 (limit control)
- 27 LOW PRESSURE PRESSURESTAT COMPRESSOR 3
- 28 HIGH TEMPERATURE WINDING COMPRESSOR 3
- 29 COMPRESSOR 3 OVERLOAD
- 30 PRESSURESTAT OIL DIFFERENTIAL FOR COMPRESSOR 3
- 31 FAN 7 OVERLOAD
- 32 FAN 8 OVERLOAD

(1 I/O "**small non-expandable**" board)

- 1 FAN 6 OVERLOAD
- 2 FAN 9 OVERLOAD
- 3 HIGH PRESSURE PRESSURESTAT COMPRESSOR 4
- 4 HIGH PRESSURE PRESSURESTAT COMPRESSOR 4 (limit control)
- 5 LOW PRESSURE PRESSURESTAT COMPRESSOR 4
- 6 HIGH TEMPERATURE WINDING COMPRESSOR 4
- 7 COMPRESSOR 4 OVERLOAD
- 8 PRESSURESTAT OIL DIFFERENTIAL FOR COMPRESSOR 4
- 9 FAN 10 OVERLOAD
- 10 FAN 11 OVERLOAD
- 11 FAN 12 OVERLOAD
- 12 EXTERNAL INTERBLOCK no. 2 (alarm: machine lockout)
- 13 to be bridged to the COMMON contact

DIGITAL OUTPUTS:

(1 I/O "**large**" board)

- 1 MOTOR-DRIVEN PUMP 1
- 2 MOTOR-DRIVEN PUMP 2
- 3 CONTACTOR WINDING A COMPRESSOR 1
- 4 CONTACTOR WINDING B COMPRESSOR 1
- 5 SOLENOID LIQUID OF COMPRESSOR 1
- 6 SOLENOID PARTIALIZATION 1 COMPRESSOR 1
- 7 SOLENOID PARTIALIZATION 2 COMPRESSOR 1
- 8 FAN 1
- 9 FAN 2
- 10 FAN 4
- 11 FAN 5
- 12 CONTACTOR WINDING A COMPRESSOR 2
- 13 CONTACTOR WINDING B COMPRESSOR 2
- 14 SOLENOID LIQUID OF COMPRESSOR 2
- 15 SOLENOID PARTIALIZATION 1 COMPRESSOR 2
- 16 SOLENOID PARTIALIZATION 2 COMPRESSOR 2
- RA ALARM RELAY

(1 I/O "**additional**" board)

- 17 FAN 3
- 18 CONTACTOR WINDING A COMPRESSOR 3
- 19 CONTACTOR WINDING B COMPRESSOR 3
- 20 SOLENOID LIQUID OF COMPRESSOR 3
- 21 SOLENOID PARTIALIZATION 1 COMPRESSOR 3
- 22 SOLENOID PARTIALIZATION 2 COMPRESSOR 3
- 23 FAN 7
- 24 FAN 8

(1 I/O "**small non-expandable**" board)

- 1 FAN 6

2	FAN 9
3	CONTACTOR WINDING A COMPRESSOR 4
4	CONTACTOR WINDING B COMPRESSOR 4
5	SOLENOID LIQUID OF COMPRESSOR 4
6	SOLENOID PARTIALIZATION 1 COMPRESSOR 4
7	SOLENOID PARTIALIZATION 2 COMPRESSOR 4
8	FAN 10
9	FAN 11
10	FAN 12

WARNING: all the digital inputs are *normally closed* contacts. Consequently, the alarm will be activated when the signal shifts from the low logic signal to the high one.

'0' indicates remote stop.

'1' remote start routine.

KEYPAD OF MACROPLUS

BUTTON ON



Places Macroplus in the operative status, leaving the stand-by status in which it normally is after power has been supplied.

In case of power failure, press this Button before power is restored in order to restart the unit automatically (the AUTOSTART procedure, however, must have been previously selected on the dedicated mask).

BUTTON OFF



Brings Macroplus back to a stand-by status.

It is still possible to read the mask tree, to change the working parameters and to read the values measured by the probes.

MENU BUTTON



It allows you to quickly come back to the main mask (MENU mask).

The Menu mask is a reference mask from where you can enter the various working fields.

CLEAR BUTTON



It allows you to silence the alarm buzzer and to reset any alarm condition (deletes the stored alarm messages).

Pressed once it silences the buzzer, turns OFF the alarm LED and acts on the relative relay placed on the interface board. The alarm remain stored (the "AL" message appears on the display).

After having removed the cause of the alarm, press CLEAR a second time to delete all the alarm messages stored in the controller.

WARNING: Once turned OFF, the buzzer will sound again whenever an alarm condition different from the previous one occurs.

ALARM BUTTON



It allows you to display any alarm message.

In case of different alarms, their relative masks can be displayed in sequence, by using the  and  buttons.

ENTER BUTTON



It allows you to confirm the parameters after having selected their values.

Position the cursor on the mask whose value has to be set or simply modified, then press ENTER a first time to start the selection phase. Increase or decrease the numeric variable by means of the  and  buttons. Then confirm by pressing ENTER a second time.

If the selected value overshoots the allowable range, the buzzer will briefly sound.

In case of binary parameter (yes/not, present/absent, etc.), when ENTER is pressed the cursor always positions itself on the value to be modified. Swap the value of the parameter by acting on the arrow Buttons.

BUTTON



It allows you to move upwards in the masks tree (both the main and the alarm tree).

When setting the value of a numeric variable, the  Button increases the value on which the cursor is positioned (see also ENTER Button).

BUTTON



It allows you to move downwards in the masks tree (both the main and the alarm tree).

When setting a numeric variable, it decreases the value of the parameter on which the cursor is positioned (see also ENTER Button).

RIGHT BUTTON



It allows you to move to the right in the masks tree and to display the masks which are at a level lower than the active one.

When setting a numeric variable, it moves to the right the cursor indicating the value to be modified.

LEFT BUTTON



It allows you to move to the left in the masks tree and to come back to the masks which are at a level higher than the active one.

When setting a numeric variable, it moves to the left the cursor indicating the value to be modified.

By pressing the **CLEAR and LEFT** Buttons simultaneously, you can regulate the contrast of the display.

ON/OFF ROUTINES

ON ROUTINE OF THE CHILLER

As soon as the unit starts working - by pressing the ON Button, by acting on the digital input for remote ON routine or simply by exiting a stand-by status (eg. following a time-bands procedure) - the first component to start is the MOTOR-DRIVEN PUMP.

Then, if necessary, Macroplus will activate the compressors.

***** IMPORTANT *****

THE MOTOR-DRIVEN PUMP FUNCTIONING HAS TOTAL PRIORITY.

SHOULD THE MOTOR-DRIVEN PUMP STOP BECAUSE OF ANY ALARM CONDITION, THE CONTROLLER WILL BE PLACED IN A STAND-BY STATUS.

***** IMPORTANT *****

IT IS POSSIBLE TO ENABLE THE AUTOSTART FUNCTION SO AS TO MAKE THE UNIT RESTART AUTOMATICALLY AFTER A CONDITION OF POWER FAILURE.

OFF ROUTINE OF THE CHILLER

After having pressed the 'OFF' Button, all devices connected to Macroplus will be turned OFF. If the pump-down cycle has been selected, the compressors will turn OFF only after the pump-down procedure has been carried out.

The OFF routine of the motor-driven pump will take place after a programmable time-delay (0:999 sec., default 20 sec.); this delay ensures the water flow in the evaporators during the pump-down cycle.

NOTE: it is possible to turn the chiller ON and OFF in the following ways:

- by pressing the START (or STOP) Button;
- via remote START (or STOP);
- via serial START (or STOP) (BOSS);
- via programmable START (or STOP);
(time-bands management of the unit).

It is therefore possible to turn the chiller ON by pressing the dedicated Button and turn it OFF via serial line.

REGULATION OF THE WATER TEMPERATURE

The regulation of the temperature is usually based on the values measured by the probe (**inlet** water temperature probe, default regulation). However, by acting on the dedicated mask protected by the 'Customer' password, you can decide to regulate the water temperature according to the values measured by the probe placed at the evaporator outlet (**outlet** water temperature probe).

TYPES OF CONTROL

It is possible to select the following control functioning modes:

- proportional control (P)
- proportional + integral control (P+I)

PROPORTIONAL CONTROL:

The control action aims at reaching the value of the SET-POINT (ideal working condition) in a proportional way - eg. proportionally to the distance of the set-point to be reached.

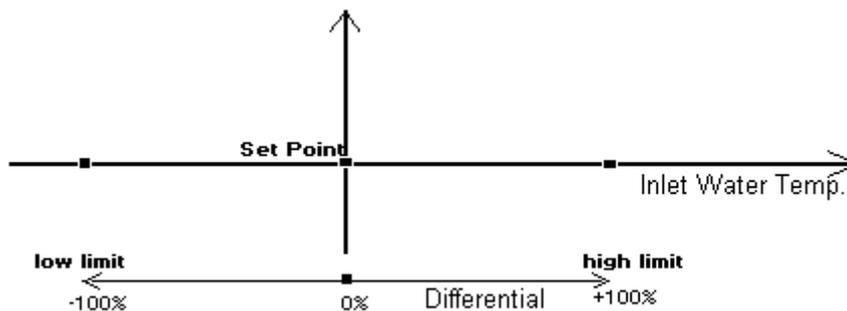
The selection of a PROPORTIONAL ZONE near the set-point will determine the action of the control that will be minimum in proximity of the set-point value and will increase as the distance to the set-point increases.

PROPORTIONAL + INTEGRAL CONTROL:

Besides the action described above, the proportional+integral control acts according to the difference between the selected temperature value (set-point) and the temperature value measured by the probe.

SET-POINT AND DIFFERENTIAL

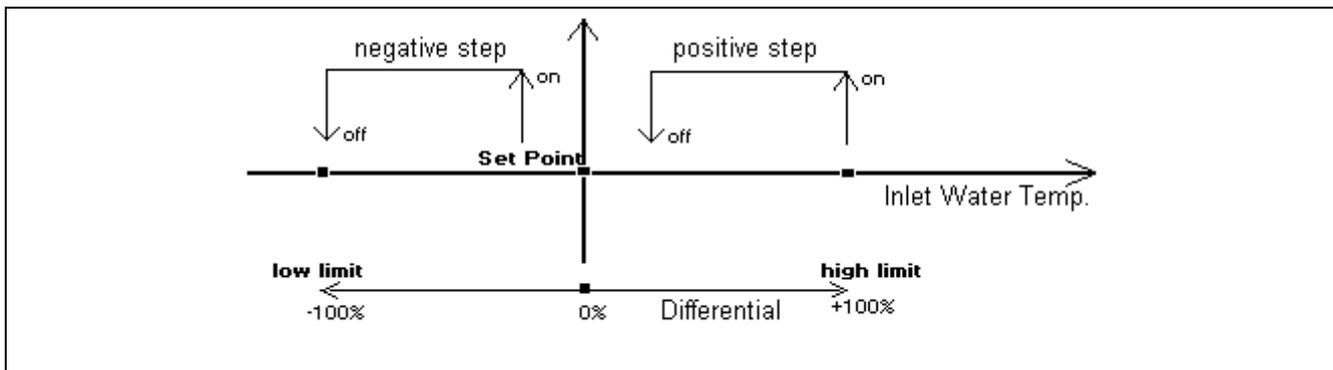
SETPOINT ==> selectable in °C; ideal working condition
 DIFFERENTIAL ZONE ==> selectable in °C; indicates the operating zone of the controller.



In the application shown above, the set-point represents the CENTRAL point of the regulation zone.

POSITION OF THE STEPS

DEFINITION OF 'STEP'



on ==> STEP ON (active)
 off ==> STEP OFF

For each step it is possible to select the following values:

- **SETPOINT** of the step (% value of the regulation zone)
 - a) if the % value is **POSITIVE**, the step is positioned in the **POSITIVE PART** of the regulation zone
 - b) if the % value is **NEGATIVE**, the step is positioned in the **NEGATIVE** part of the regulation zone
- **HYSTERESIS** (as 1/2 of the total hysteresis of the step; its value is a % value of the regulation zone).

NUMBER OF STEPS

The number of compressors, hence of steps, depends on the type of chiller to be controlled. The number of steps necessary to activate the various components of the system depends on:

- the number of compressors;
- the number of capacity-controlled procedures (partializations).

The table below shows the relation between the different types of chillers and their relative number of compressors and steps:

TYPE OF CHILLER	number of COMPR.	number of STEPS	
		min	max
1 compressor	1	1	3
2 compressors	2	2	6
3 compressors	3	3	9
4 compressors	4	4	12

The minimum number of steps means no partialization procedures, viceversa the maximum number of steps indicates the activation of all partializations relative to each single compressor. The steps which activate compressors and partializations will be inserted when the temperature rises and disactivated when the temperature diminishes with respect to the set-point of the step itself. The consequence of their action consists in the variation of the working point of the unit to the left so as to reach the ideal working condition (set-point).

A series of masks allow you to change the values of the SET-POINT and the DIFFERENTIAL relative to each step, so as to generate:

- DEAD ZONES near the regulation SET-POINT;
- or OVERLAPPING STEPS, to start more than one compressor simultaneously.

STANDARD POSITION OF THE STEPS

During the initialization phase - after having cleared the back-up memory - a mask will appear on the display requiring the exact type of machine Macroplus has to control. On the basis of the type of unit selected - with 1, 2, 3 or 4 compressors - Macroplus will automatically set a series of factory-set parameters.

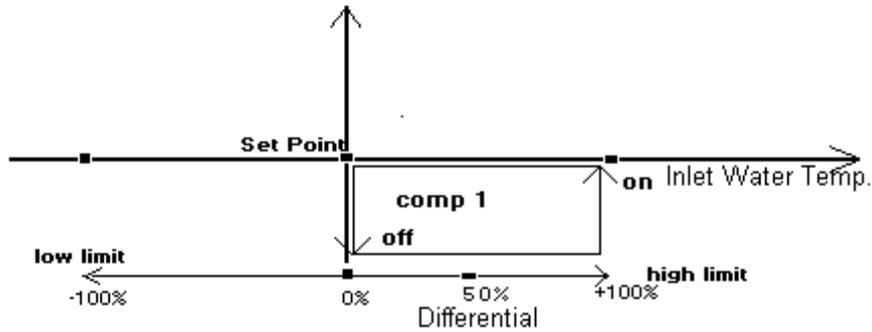
***** **IMPORTANT*******

The cooling steps for the activation of the compressors and relative to the temperature probe (inlet or outlet water) are positioned - in the standard configuration - in sequence and cover the entire POSITIVE REGULATION ZONE (from the set-point up to the HIGH LIMIT). All the steps have the same differential.

The ideal working condition (set-point) implies no activation of the cooling steps.

REGULATION

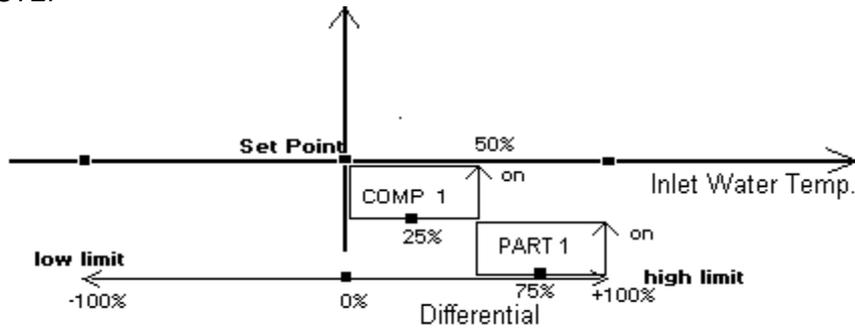
EXAMPLE OF STANDARD CONFIGURATION FOR SINGLE-COMPRESSOR CHILLERS WITH NO PARTIALIZATIONS



COMP1	setpoint	50%
	differential	50%

The % values refer to the selected regulation zone.

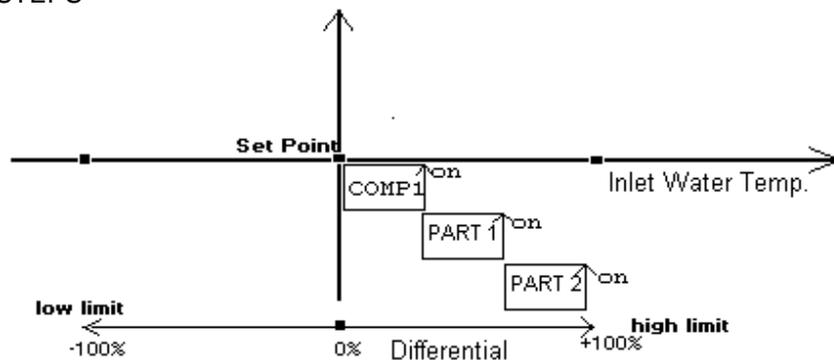
EXAMPLE OF STANDARD CONFIGURATION FOR SINGLE-COMPRESSOR CHILLERS WITH 1 PARTIALIZATION STEP



COMP1	setpoint	25%
	differential	25%
PART1	setpoint	75%
	differential	25%

The % values refer to the selected regulation zone.

EXAMPLE OF STANDARD CONFIGURATION FOR SINGLE-COMPRESSOR CHILLERS WITH 2 PARTIALIZATION STEPS

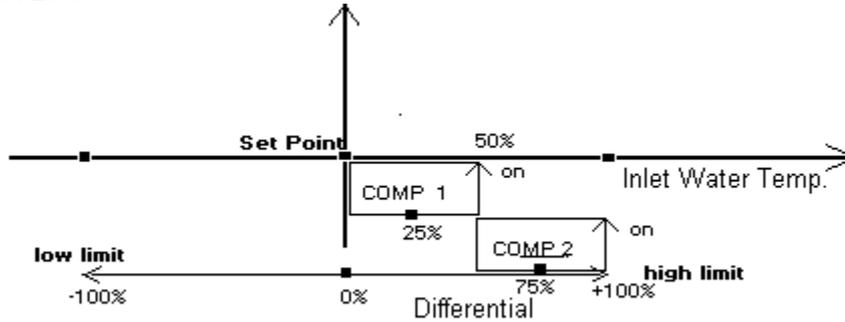


COMP1	setpoint	17.0 %
-------	----------	--------

	differential	16.0 %
PART1	setpoint	50.0 %
	differential	16.0 %
PART2	setpoint	83.0 %
	differential	16.0 %

The % values refer to the selected regulation zone.

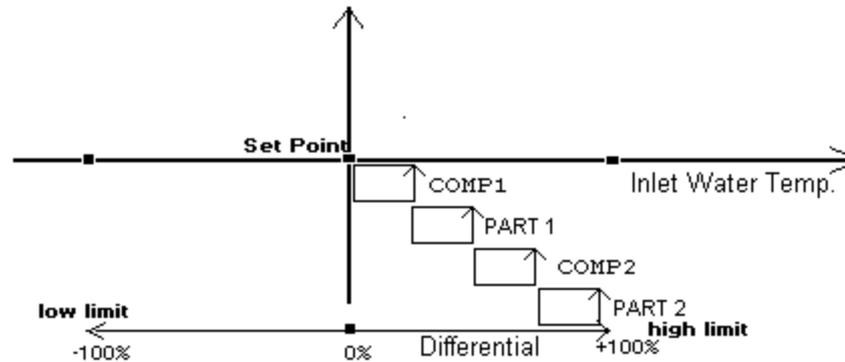
EXAMPLE OF STANDARD CONFIGURATION FOR TWO-COMPRESSOR CHILLERS WITH NO PARTIALIZATION STEPS



COMP1	setpoint	25%
	differential	25%
COMP2	setpoint	75%
	differential	25%

The % values refer to the selected regulation zone.

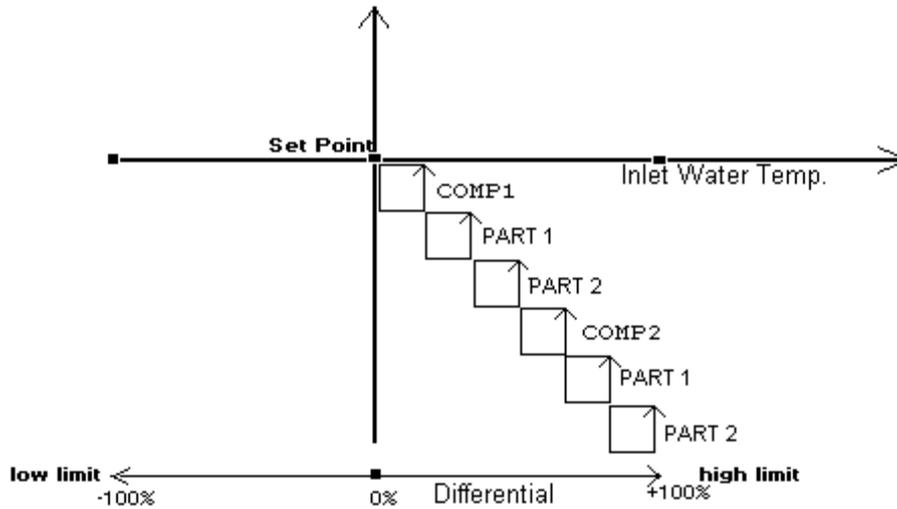
EXAMPLE OF STANDARD CONFIGURATION FOR TWO-COMPRESSOR CHILLERS WITH ONE PARTIALIZATION FOR EACH COMPRESSOR



COMP1	setpoint	13.0 %
	differential	12.0 %
PART1	setpoint	38.0 %
	differential	12.0 %
COMP2	setpoint	62.0 %
	differential	12.0 %
PART1	setpoint	86.0 %
	differential	12.0 %

The % values refer to the selected regulation zone.

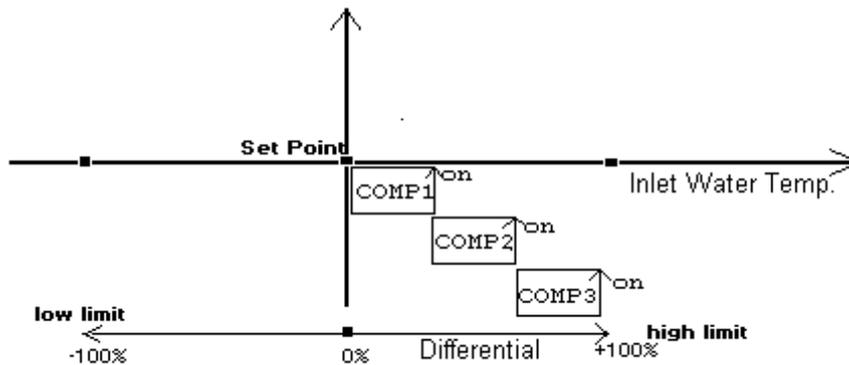
EXAMPLE OF STANDARD CONFIGURATION FOR TWO-COMPRESSOR CHILLERS WITH 2 PARTIALIZATIONS FOR EACH COMPRESSOR



COMP1	setpoint	8.0 %	
	differential		8.0 %
PART1	setpoint	24.0 %	
	differential		8.0 %
PART2	setpoint	40.0 %	
	differential		8.0 %
COMP2	setpoint	56.0 %	
	differential		8.0 %
PART1	setpoint	72.0 %	
	differential		8.0 %
PART2	setpoint	88.0 %	
	differential		8.0 %

The % values refer to the selected regulation zone.

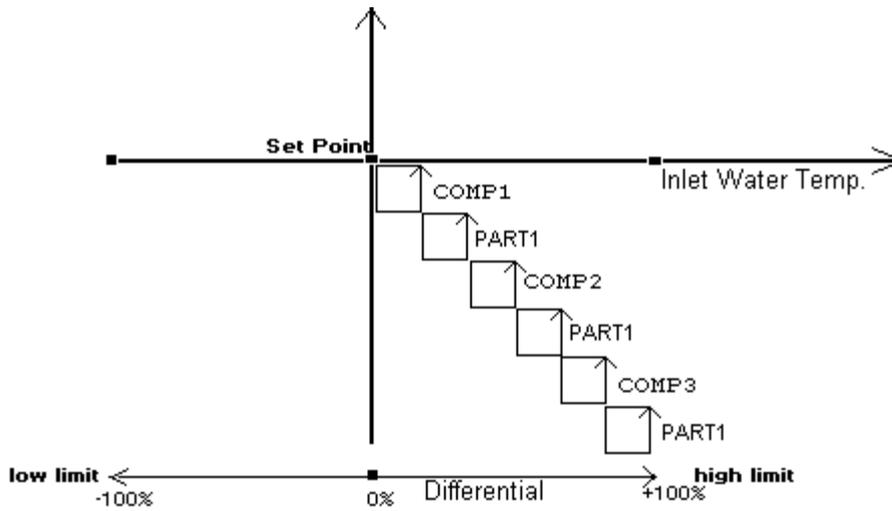
EXAMPLE OF STANDARD CONFIGURATION FOR THREE-COMPRESSOR CHILLERS WITH NO PARTIALIZATIONS



COMP1	setpoint	17.0 %	
	differential		16.0 %
COMP2	setpoint	50.0 %	
	differential		16.0 %
COMP3	setpoint	83.0 %	
	differential		16.0 %

The % values refer to the selected regulation zone.

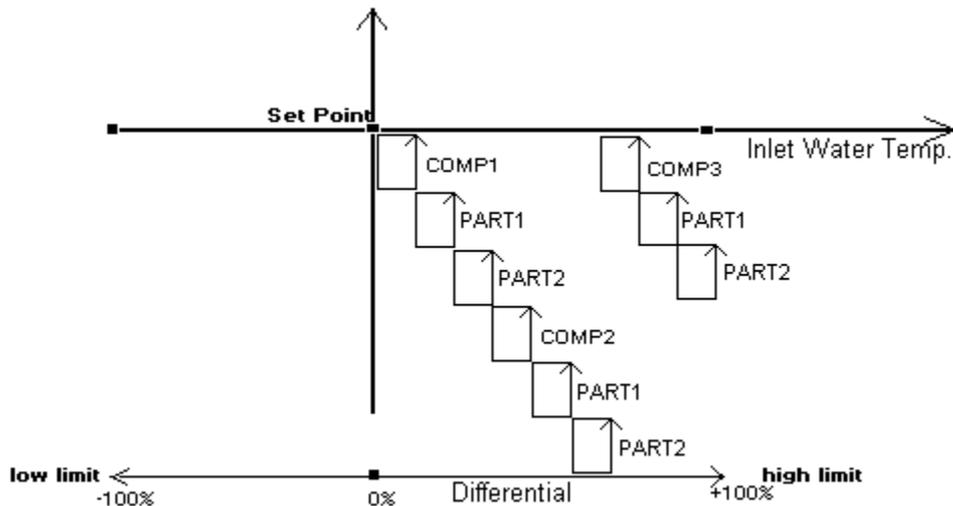
EXAMPLE OF STANDARD CONFIGURATION FOR THREE-COMPRESSOR CHILLERS WITH 1 PARTIALIZATION FOR EACH COMPRESSOR



COMP1	setpoint	8.0 %
	differential	8.0 %
PART1	setpoint	24.0 %
	differential	8.0 %
COMP2	setpoint	40.0 %
	differential	8.0 %
PART1	setpoint	56.0 %
	differential	8.0 %
COMP3	setpoint	72.0 %
	differential	8.0 %
PART1	setpoint	88.0 %
	differential	8.0 %

The % values refer to the selected regulation zone.

EXAMPLE OF STANDARD CONFIGURATION FOR THREE-COMPRESSOR CHILLERS WITH 2 PARTIALIZATIONS FOR EACH COMPRESSOR

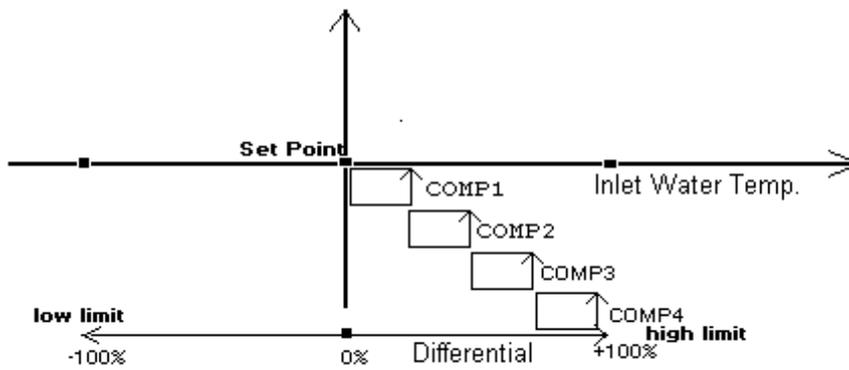


COMP1	setpoint	6.0 %
	differential	5.0 %
PART1	setpoint	18.0 %

	differential	5.0 %
PART2	setpoint	30.0 %
	differential	5.0 %
COMP2	setpoint	42.0 %
	differential	5.0 %
PART1	setpoint	54.0 %
	differential	5.0 %
PART2	setpoint	66.0 %
	differential	5.0 %
COMP3	setpoint	78.0 %
	differential	5.0 %
PART1	setpoint	90.0 %
	differential	5.0 %
PART2	setpoint	94.0 %
	differential	5.0 %

The % values refer to the selected regulation zone.

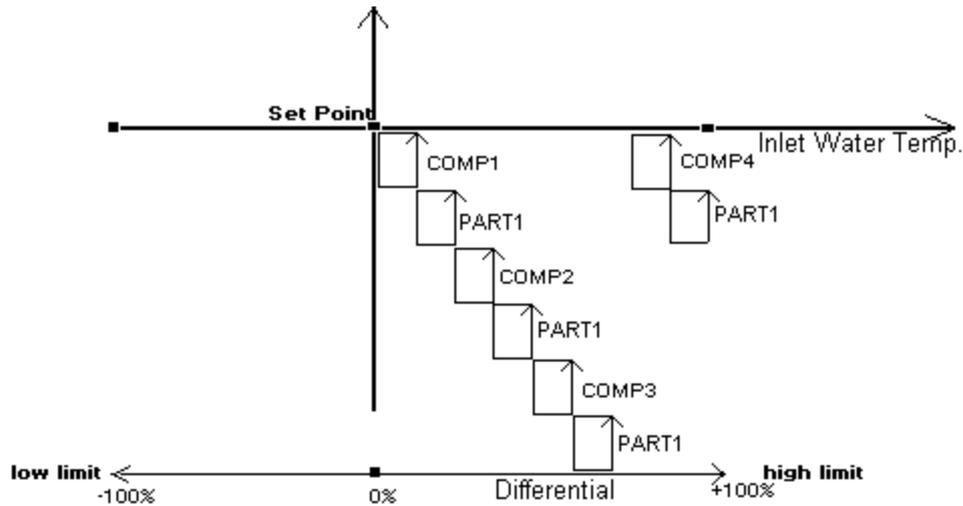
EXAMPLE OF STANDARD CONFIGURATION FOR 4-COMPRESSOR CHILLERS WITH NO PARTIALIZATIONS



COMP1	setpoint	13.0 %
	differential	12.0 %
COMP2	setpoint	38.0 %
	differential	12.0 %
COMP3	setpoint	62.0 %
	differential	12.0 %
COMP4	setpoint	86.0 %
	differential	12.0 %

The % values refer to the selected regulation zone.

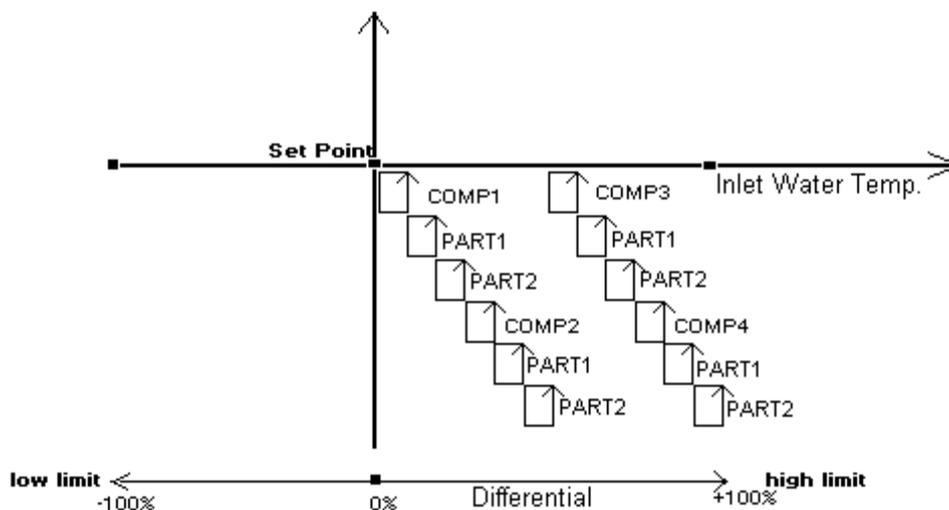
EXAMPLE OF STANDARD CONFIGURATION FOR 4-COMPRESSOR CHILLERS WITH 1 PARTIALIZATION FOR EACH COMPRESSOR



COMP1	setpoint	6.0 %
	differential	6.0 %
PART1	setpoint	18.0 %
	differential	6.0 %
COMP2	setpoint	30.0 %
	differential	6.0 %
PART1	setpoint	42.0 %
	differential	6.0 %
COMP3	setpoint	54.0 %
	differential	6.0 %
PART1	setpoint	66.0 %
	differential	6.0 %
COMP4	setpoint	78.0 %
	differential	6.0 %
PART1	setpoint	92.0 %
	differential	6.0 %

The % values refer to the selected regulation zone.

EXAMPLE OF STANDARD CONFIGURATION FOR 4-COMPRESSOR CHILLERS WITH 2 PARTIALIZATIONS FOR EACH COMPRESSOR



COMP1	setpoint	4.0 %
-------	----------	-------

	differential	4.0 %
PART1	setpoint differential	12.0 % 4.0 %
PART2	setpoint differential	20.0 % 4.0 %
COMP2	setpoint differential	28.0 % 4.0 %
PART1	setpoint differential	36.0 % 4.0 %
PART2	setpoint differential	44.0 % 4.0 %
COMP3	setpoint differential	52.0 % 4.0 %
PART1	setpoint differential	60.0 % 4.0 %
PART2	setpoint differential	68.0 % 4.0 %
COMP4	setpoint differential	76.0 % 4.0 %
PART1	setpoint differential	84.0 % 4.0 %
PART2	setpoint differential	95.0 % 4.0 %

The % values refer to the selected regulation zone.

FREECOOLING

The freecooling function ensures the production of cold water with very low energy requirements since the water is cooled by the low ambient temperature.

The water, contained in a finned pack exchanger placed near the condenser, is cooled by the condenser fans. The water flows within the circuit through a 3-way valve.

The freecooling function can be selected via dedicated mask (under 'Manufacturer' password). The necessary components to enable the freecooling are:

- EXTERNAL TEMPERATURE PROBE
- INLET WATER TEMPERATURE PROBE
(freecooling probe placed before the 3-way valve)
- 3-WAY VALVE TO MIX THE WATER IN THE EXTERNAL COOLER
WITH THE WATER IN THE CIRCUIT

The freecooling procedure is activated when:

Inlet temperature probe - external temperature > DELTA Temp.

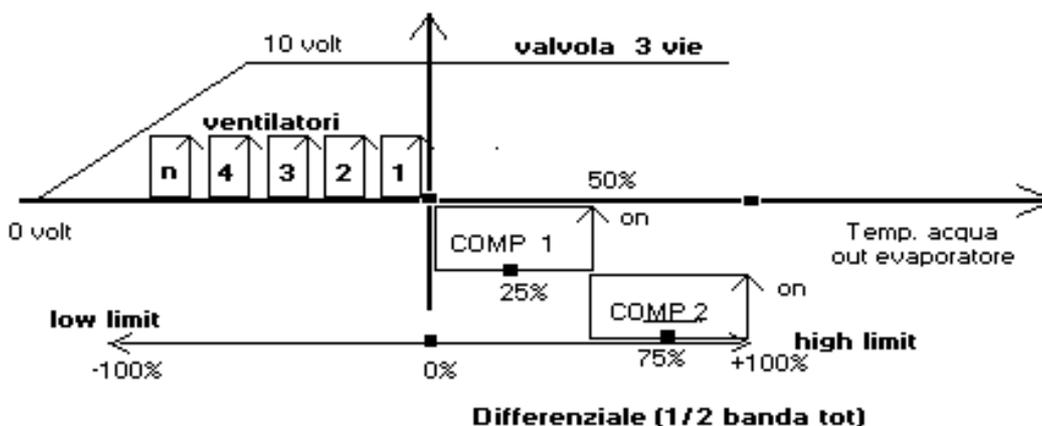
The "**DELTA Temp.**" value can be selected by the User (dedicated mask under 'Manufacturer' password, default 2°C, range 1_20°C).

During the freecooling procedure the normally closed 3-way valve opens to allow the cold water of the exchanger to mix with the inlet evaporator water in order to reach the temperature set-point. This procedure implies the minimum activation of devices involved in the production of cold water.

The ideal condition consists in producing cold water at the desired temperature just by modulating the 3-way valve.

FREECOOLING FUNCTION

(Unit with 2 alternative compressors)



SELECTABLE PARAMETERS:

- SET POINT WHEN THE FREECOOLING VALVE BEGINS TO OPEN (in $^{\circ}\text{C}$)
- SET-POINT WHEN THE FREECOOLING VALVE IS COMPLETELY OPEN (in $^{\circ}\text{C}$)
- TEMPERATURE REGULATING THE ON/OFF ROUTINES OF THE FANS ($^{\circ}\text{C}$)
BASED ON THE VALUE MEASURED BY THE PROBE AT THE EVAPORATOR INLET

When the freecooling function has been selected, the condenser fans will be activated according to a step control action based on the values measured by the inlet water temperature probe or when at least one compressor is working.

MODIFICATION OF THE VALUES MEASURED BY THE PROBES

By entering the OFFSET mask, it is possible to 'adjust' the values read by the water temperature probes (at evaporator inlet/outlet). Enter the OFFSET mask by pressing the MENU and  buttons simultaneously. After that, it will be possible to select a constant to be added or subtracted to the value measured by the probes. Press the MENU Button again to come back to the control mask.

MOTOR-DRIVEN PUMPS

FUNCTIONING

The motor-driven pump is the first device to start since its functioning has complete priority on all the other components of the unit.

Should an alarm condition block the pumps, the chiller is forced in stand-by.

Before turning OFF, the compressors will carry out the pump-down procedure (if previously selected).

Should the water temperature go below the safety values allowable during the pump-down procedure, and the pump be OFF, the relative antifrost thermostat will force the compressors to stop even if the pump-down procedure has not been completed.

The motor-driven pumps can be activated on the basis of the following functioning modes:

- 1) CONDITIONING LOGIC
- 2) REFRIGERATION LOGIC

CONDITIONING:

THE MOTOR-DRIVEN PUMPS WORK ACCORDING TO THE STATUS OF THE UNIT: IF THE UNIT IS 'ON', THE PUMP IS ON, IF THE UNIT IS 'OFF', THE PUMP STOPS WORKING AFTER A SELECTABLE TIME-DELAY.

REFRIGERATION:**THE MOTOR-DRIVEN PUMPS WORK AS FOLLOWS:**

- THE PUMP THAT IS CURRENTLY WORKING STOPS AS SOON AS THE SET-POINT VALUE IS REACHED (all compressors OFF)
- ALTHOUGH IN STAND-BY, THE PUMP CAN BE FORCED TO WORK BY ACTING ON THE DIGITAL INPUT no. 31:
 - * when input 31 is OPEN, then the pump will start working;
 - * when input 31 is CLOSED, the pump will remain in an OFF status.

Remember, however, that the pump will start working when one of the compressors starts working. When the temperature set-point value is reached and the input no. 31 is open, the pump goes on working. The time-delay before the OFF routine of the pump is always respected (both in the refrigeration and conditioning functioning modes).

For safety reasons there are two pumps in the cold water circuit. Consequently, should a pump break down, the chiller will not be blocked.

In normal conditions, only one pump will work. The second one will be activated following a request for pump rotation or in case the first pump does not work correctly (alarm condition).

*****ALARMS*****

The pump can be blocked due to the following alarms:

- MOTOR-DRIVEN PUMP OVERLOAD
ACTION: the pump stops immediately
RESET: manual
- WATER FLOW DETECTOR
This alarm is ignored when the pump starts working for a selectable 'T' time (RANGE: 1_300 sec., default 10 sec.)
ACTION: the currently working pump stops and the stand-by pump is activated
RESET: manual.

ROTATION OF THE MOTOR-DRIVEN PUMPS

The rotation of the pumps depends on the working hours of each pump.

FUNCTIONING LOGIC:

- Set a threshold. When it is reached the rotation procedure will be activated (hours threshold: RANGE 1_5000 hours, default 8 hours).
- When the pump reaches the selected threshold, Macroplus instructs the stand-by pump to start.
- After having reached its maximum working hours (set threshold), the pump automatically stops after a selectable time-interval (RANGE 0_9999 sec., default 30 sec.).

In case an OFF-normal condition should block the working pump, Macroplus forces the rotation procedure and the stand-by pump will immediately start working.

NOTE

If the unit controlled by Macroplus has no pumps, it is necessary to bridge all the alarm inputs relative to the pumps. In this way Macroplus will regulate and control the compressors only.

COMPRESSORS

Macroplus can control units equipped with up to 4 alternative compressors.

The number of capacity-controlled cycles (partializations) per compressor depends on the type of chiller and can be set via dedicated mask (protected by the 'Manufacturer' password). Macroplus can manage three different compressors configurations:

- 1 - compressor with no partialization
- 2 - compressor with one partialization step:
 - capacity = 50% when the compressor starts working, WIND. "A","B"
 - capacity = 100% when the partialization solenoid is activated.
- 3 - compressor with 2 partialization steps:
 - capacity = 33% when the compressor starts working, WIND. "A","B"
 - capacity = 66% when the first partialization solenoid is activated
 - capacity = 100% when the second solenoid is activated.

ON ROUTINES OF THE COMPRESSORS (CAPACITY-CONTROLLED AND FULL CAPACITY COMPRESSORS)

When the compressor starts working, its contactor will activate.

The procedure to turn on a compressor in relation to the **WATER TEMPERATURE** value is the following:

- the water temperature value requires the intervention of a compressor;
- the SOLENOID valve energizes;
- the compressor is activated with the PART WINDING procedure.

PART WINDING

The compressors are equipped with 2 windings (A and B).

They start working as follows:

- 1- Request for compressor ON: the output of contactor winding 'A' relative to the compressor energizes;
- 2- Allow 1 second to pass (+ or - 0.1 sec)
- 3- Winding 'B' of the same compressor activates;

To stop the compressor, disenergize windings 'A' and 'B' simultaneously.

If the part winding procedure is not used to activate the compressors, the switch of the compressor will be managed by the digital output **WINDING 'A'** of each single compressor.

TIMED ON/OFF ROUTINES (TIMED ROUTINES AMONG CAPACITY-CONTROLLED COMPRESSORS)

The compressors can work according to selectable timed ON/OFF routines:

- 1) minimum time between two ON routines of the same compressor (this is meant to limit the number of hourly ON routines).
RANGE 1:9999 sec., DEFAULT 360 sec. (10 ON routines max. per hour)
- 2) minimum time between the ON routine of two different compressors (to reduce energy requirements).
RANGE 1:9999 sec., DEFAULT 10 sec.
- 3) minimum time compressor ON.
RANGE 1:9999 sec., DEFAULT 60 sec.
- 4) minimum time between the activation of two partialization steps.
RANGE 0:100 sec., DEFAULT 10 sec.
- 5) minimum time compressor OFF.
RANGE 1:9999 sec., DEFAULT 180 sec.

ROTATION OF THE COMPRESSORS

The automatic rotation of the compressors depends on their ON/OFF routines and is based on a **F.I.F.O.** logic (first in first out).

At the very beginning this logic may result in noteworthy differences concerning the working hours of the compressors but these values will gradually balance.

The rotation is necessary to balance the working hours of each compressor as well as the number of their ON/OFF routines.

LOGIC:

- The compressor that has been OFF for the longest time will be the first to start working;
- The first compressor that starts working will be the first to stop;
- Every compressor will turn on again only after all the other compressors have turned ON.

***** IMPORTANT *****

THE ROTATION INVOLVES THE COMPRESSORS ONLY, NOT THE PARTIALIZATION STEPS.
IN CASE OF CAPACITY-CONTROLLED COMPRESSORS, THE ROTATION WILL INVOLVE EACH SINGLE COMPRESSOR GROUP (INCLUDING MAIN ENGINE [WINDINGS 'A' AND 'B'] AND ITS PARTIALIZATIONS).

The rotation of the compressors can be selected through dedicated mask protected by the 'Manufacturer' password. If you want to disenable the rotation, the compressors will start working in sequence: the last to turn ON will be the first to turn OFF.

PUMPDOWN PROCEDURE

The pump-down procedure is NOT factory-set and should therefore be selected through the dedicated mask protected by the 'Manufacturer' password.

The pump-down procedure starts either when the compressor has to be stopped or - in case of capacity-controlled compressors - when the last step turns OFF.

Here are the main stages concerning the PUMP-DOWN procedure.

- a) Disenergization of the LIQUID SOLENOID VALVE corresponding to the gas circuit of the compressor that has to undergo the pump-down procedure. The disenergized valve closes the circuit.
- b) The compressor goes on working until the pressure (LOW PRESSURE ZONE) requires the intervention of the LOW PRESSURE PRESSURESTAT (open contact at Macroplus input).
- c) When the low pressure indicated by the low pressure pressurestat has been reached, the compressor turns OFF and the PUMP-DOWN procedure is over.

Should the compressor go on working for more than 50 seconds without reaching the low pressure condition, Macroplus forces the OFF routine of the compressor and indicates a faulty pump-down procedure:

'Check LIQUID SOLENOID valve and LOW PRESSURE PRESSURESTAT'

COMPRESSORS TIMER

Macroplus can display - through a series of masks defined 'synoptic' masks - the working hours of the compressors.

The timer of the compressors allows the User to:

- ZERO DOWN EACH SINGLE TIMER
- SELECT THE MAX. HOURS THRESHOLD FOR THE COMPRESSOR.
WHEN THE THRESHOLD SET IS OVERSHOT, AN ALARM MESSAGE WILL BE DISPLAYED.

EXAMPLE:

'MAINTENANCE OF THE REFRIGERATION UNIT':

THIS TYPE OF MESSAGE DOES NOT BLOCK THE COMPRESSOR BUT IS MEANT TO INFORM THE USER THAT THE SELECTED THRESHOLD HAS BEEN OVERSHOT. MAINTENANCE IS THEREFORE REQUIRED.

Default value (max. hours threshold) = 10,000 hours.

Set the timer through dedicated masks (protected by the 'Customer' password).

CAPACITY-CONTROLLED COMPRESSORS

The possibility of controlling the CAPACITY of each compressor reduces its hourly ON routines and ensures the well-balanced functioning of the entire unit.

- FOR EACH STEP IT IS POSSIBLE TO SELECT SET-POINT AND HYSTERESIS IN % OF THE SELECTED REGULATION ZONE
- THE NUMBER OF PARTIALIZATION STEPS FOR EACH COMPRESSOR CAN BE SELECTED THROUGH DEDICATED MASK (possible selection 0-2)

The partialization steps not utilized (in case you select just one partialization or there are less than 4 compressors) must be given the value 90.0% both to the set-point and hysteresis.

The controller can drive up to 2 solenoid valves regulating the capacity of the compressor. The user can select the following working modes:

- 1- PARTIALIZATION SOLENOID TYPE "DWM COPELAND"
- 2- PARTIALIZATION SOLENOID TYPE "FEDDERS COMP"

PRESSURE-SWITCH OF LOW PRESSURE

LOGIC:

Open contact =====> LOW PRESSURE
 Closed contact =====> NORMAL PRESSURE

The LOW PRESSURE PRESSURESTAT is recognized by Macroplus as a digital contact. It can be used for :

- the PUMP-DOWN procedure
- or as a LOW PRESSURE indicator, when the compressor is normally working and the pressurestat contact is open.
 When the compressor starts working, the indications of the pressurestat are ignored for a selectable "T" time (0:900 sec., default 50 sec.), to allow the unit to reach normal pressure conditions.

There is a LOW PRESSURE PRESSURESTAT for each compressor circuit.

FANS

The condenser fans regulate the condensation temperature of the refrigerant liquid. Macroplus activates the fans in relation to the HIGH PRESSURE values measured by the pressure transducers. Macroplus can manage up to max. 12 fans (3 per circuit). Select their number in the dedicated mask (protected by the 'Manufacturer' password).

It is possible to select the set-points and differentials of each single fan step.

For example:

```

+-----+
3Fan 1
3ON routine      bar3
|OFF routine      bar
|
+-----+

```

³ The first fan of each circuit
³
³

******* IMPORTANT *******

IF THERE ARE LESS THAN 4 PRESSURE PROBES, THE FREE ANALOG INPUTS (FOR THE PRESSURE PROBES) MUST BE BRIDGED TO EARTH. THIS PREVENTS ANY OFF-NORMAL FUNCTIONING OF THE FANS.

IF THE INPUTS ARE NOT BRIDGED, MACROPLUS MIGHT GENERATE AN ALARM MESSAGE ('FAULTY PROBE').

The User can create his own regulation diagram on the basis of his actual application requirements, by simply selecting the set-point for the activation of each step.

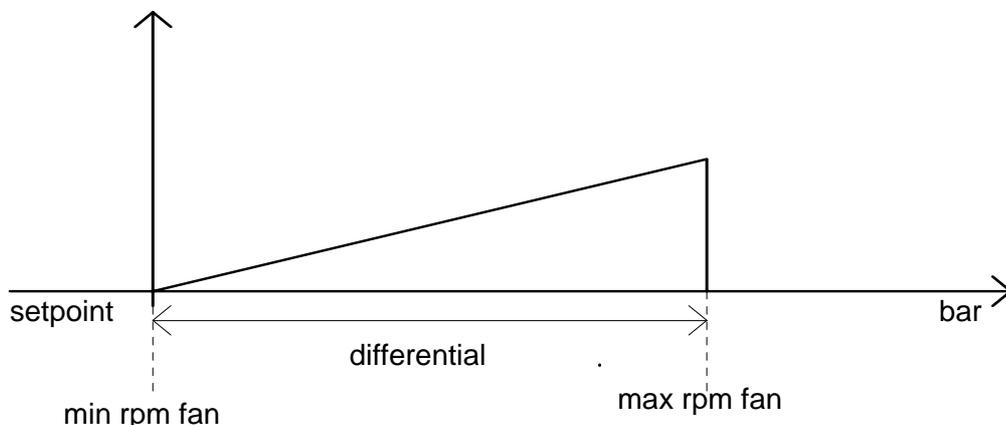
FANS MANAGEMENT IN FREECOOLING

The functioning logic of the fans in a freecooling machine is different from that of a normal chiller.

In a freecooling machine the fans are activated according to the temperature values measured by the inlet water, or following the starting of at least one compressor.

NUMBER OF TURNS

To regulate the number of turns, use the dedicated analog output. The turns of a fan depend on the average number of pressure probes present in the circuit. In the masks tree (protected by the 'Manufacturer' password) it is possible to select the pressure set-point and regulation zone determining the min. and max. number of turns.

**ANTIFROST PROCEDURE**

The antifrost procedure is activated when the digital input relative to the ANTIFROST THERMOSTAT is open or when the water temperature at the evaporator outlet goes below the selected threshold.

The compressors are immediately stopped, without pump-down procedure and the solenoid for liquid interception is disenergized.

The antifrost alarm appears on the LCD of Macroplus.

*******IMPORTANT*******

THE MOTOR-DRIVEN PUMP DOES NOT STOP.

USER INTERFACE

The User Interface allows Macroplus to 'dialogue' with the User, by exchanging information and displaying operative data.

The User Interface comprises:

**KEYPAD
DISPLAY
LED INDICATORS**

As for the keypad see chapter 3 above.

The Liquid Crystal Display shows any information concerning the controlled parameters in a format defined 'mask' (see chapter below).

The LED indicators on the front panel are meant to directly inform the User of the status of the controlled devices.

EXAMPLE:
 LED ON ====> STEP ON
 LED OFF ====> STEP OFF

MASKS

A mask comprises a series of alphanumeric strings on a DISPLAY (4x20).

All the displayed messages are stored in a database (in the eeprom), so as to create a set of information meant to:

- help the User manage his unit
- inform the User of any alarm condition
so as to avoid any damage to the system

The masks structure is a TREE structure where each mask can be the starting point for further mask branches.

Example:

FOR THE GENERAL TREE STRUCTURE, SEE BELOW

PASSWORD

THERE ARE TWO PASSWORD LEVELS ALLOWING THE AUTHORIZED STAFF TO ENTER SPECIFIC MASKS:

LEVEL 1 =====> "USER" PASSWORD
 For the selection of:
 - TEMPERATURE DIFFERENTIAL
 - CLOCK REGULATION
 - ALARM THRESHOLDS
 - TEMPERATURE SET-POINT (1st level)

LEVEL 2 =====> "MANUFACTURER" PASSWORD
 For the selection of:
 - MIN. ("MANUFACTURER") VALUE FOR MIN. TEMPERATURE SET-POINT (absolute value).
 It indicates the minimum value allowable for the chiller's set-point. An error message appears if the User digits wrong data.
 - LOGIC OF THE REGULATION STEPS FOR THE COMPRESSORS
 - FANS MANAGEMENT
 - INITIALIZATION PROCEDURES.

CLOCK/TIME-BANDS

The clock board ensures the display of date and time ('synoptic' masks).
 Set time and date through the dedicated masks.

WEEKLY TIME-BANDS

This is an optional control function, enabled by the presence of the clock board.

In brief, it is possible to turn ON / OFF the unit weekly:

EX. turn ON on Monday at 4:00
 turn OFF on Saturday at 18:00

DAILY TIME-BANDS

In order to save energy, it is possible to select up to 4 daily time-bands with different SET-POINTS. It is enough to set:

- the time of the last time-band, (except 23:59, fixed).

MANUAL MANAGEMENT

A series of masks allows you to automatically control the digital outputs (relays) so as to force the ON routines of the instruments connected to Macroplus.

To enter the manual procedure, go to the masks identified by the 'MANUAL PROCEDURE' message (see below).

The manual procedure is useful to:

- TEST THE CONNECTIONS OF THE ELECTRICAL PANEL
- THE CONTROL BYPASS
- CHECK THE CORRECT FUNCTIONING OF ALL THE INSTRUMENTS CONNECTED TO MACROPLUS

During the manual procedure the alarms will be active for safety reasons.

The masks branch relative to the MANUAL COMMANDS is protected by the 'Manufacturer' password.

STATUS OF THE UNIT

Any specific status of the unit is displayed on the synoptic masks and on the first mask, in particular in the 4th row of the display where the following messages will appear:

"MACHINE OFF"

It indicates that the control is in an OFF status.

The User can read the masks, modify their values and read the data measured by the probes.

All the outputs will be in an OFF status: the relays will be disenergized and the analog outputs at 0 volt.

This condition occurs when pressing the OFF button or just after having turned Macroplus ON.

"MACHINE ON"

It indicates that Macroplus has been powered and is therefore capable of controlling the connected unit.

Press the ON button to get this condition.

"MANUAL PROCEDURE"

This message appears in the 4th row of the display and indicates the 'manual' procedure. (See below).

"TIME-BAND OFF"

This message indicates that although the ON button has been pressed, the controller is still in a STAND-BY status.

" AL "----> ***** WARNING: ALARM CONDITION *****

This message indicates an off-normal condition and is displayed in the last two fields of the first row.

ALARMS

When Macroplus detects an off-normal condition, the User will be immediately informed by the activation of the BUZZER that can be silenced by simply pressing the 'CLEAR' button.

It is also possible to get a remote alarm detection by an alarm relay with NC-NO contacts placed on the 1st 'large' Interface.

By pressing the 'CLEAR' button the alarm relay is energized again; this makes the remote alarm indication disappear.

By pressing the 'ALARM' button it is possible to read on the display the exact type of alarm occurred.

In case of several simultaneous alarms, the User will use the  and  buttons to display their relative masks.

THERE ARE TWO TYPES OF ALARMS:

- 1) AUTOMATIC RESET ALARMS
Once the cause that generated the alarm disappears, the device re-starts automatically
- 2) MANUAL RESET ALARMS
Once the cause that generated the alarm has been removed, it is necessary to press the 'CLEAR' button to restart the device previously blocked.

<u>TYPE OF ALARM</u>	<u>ACTION</u>
COMPRESSORS OVERLOAD	The relative compressor stops immediately. There is no PUMP-DOWN procedure. The relative liquid solenoid valve disenergizes. MANUAL RESET
HIGH TEMPERATURE WINDING COMPRESSOR ENGINE	The relative compressor stops immediately. There is no PUMP-DOWN procedure. The relative liquid solenoid valve disenergizes. MANUAL RESET.
HIGH PRESSURE PRESSURESTAT	The compressor corresponding to the gas circuit under alarm, stops immediately with no pump down procedure. The relative liquid solenoid valve disenergizes. MANUAL RESET
HIGH PRESSURE PRESSURESTAT	The compressor corresponding to the gas circuit (limit control) under alarm, stops immediately with no pump down procedure. The relative liquid solenoid valve disenergizes. MANUAL RESET
LOW PRESSURE PRESSURESTAT	Generated when the compressor is working and the PUMP-DOWN pressurestat indicates an open contact. There is a 'T' delay at the compressor starting. (0:900 seconds, default = 40 sec.). When the compressor is normally working the alarm detection is immediate. The compressor stops and there is no PUMP-DOWN procedure. The corresponding solenoid valve disenergizes.
MANUAL RESET.	
OIL DIFFERENTIAL PRESSURE OF THE COMPRESSOR	The circuit relative to the compressor under alarm is locked. There is a selectable 'T' delay (1:1500 sec, default 120 sec). The alarm is generated only if the compressor is ON. The corresponding solenoid valve disenergizes. MANUAL RESET.
FAULTY PUMP-DOWN	This alarm is generated in case of pump-down failure. This means that the low pressure pressurestat has not intervened within 50 seconds, as required by the procedure (see chapter above). The corresponding solenoid valve disenergizes.
COMPRESSOR MAINTENANCE	This alarm informs the User that the compressor has reached its maximum hours threshold. Maintenance is therefore recommended.
MOTOR-DRIVEN PUMP OVERLOAD	This alarm blocks the pump and makes the 'stand by' pump start. If there are two motor-driven pump overloads, the entire machine turns OFF. MANUAL RESET.
FLOW DETECTOR	This alarm blocks the pump and makes the 'stand-by' pump start. If both the flow detectors intervene, the entire unit turns OFF. This alarm is ignored when the chiller starts working for a selectable 'T' time (selectable range: 0:300 seconds, default =10 seconds). When the chiller is normally working, the alarm is delayed for a selectable 'T2' time (0:900 sec., default 3 sec.). MANUAL RESET.
ANTIFROST	This alarm blocks the compressors and there is no PUMP-DOWN procedure. MANUAL RESET.
FANS OVERLOADS	The relative fan is immediately stopped. MANUAL RESET.

EXTERNAL INTERBLOCKS	The unit turns OFF. MANUAL RESET.
LOW EXTERNAL TEMPERATURE ALARM	This alarm appears when the external temperature is lower than the selected value (def. 3 [^] C). The compressors stop and there is no PUMP-DOWN procedure (see antifreeze). MANUAL RESET.
HIGH TEMPERATURE INDICATION	This indication appears when the internal temperature is higher than the selected threshold (5:60 [^] C, def. 17 [^] C). There is a selectable time-delay (def. 30 min).
LOW INTERNAL TEMPERATURE INDICATION	This indication appears when the internal temperature is lower than the selected value (def. 3 [^] C).
HIGH PRESSURE INDICATION	This alarm is generated when the pressure in one of the circuit is higher than the selected value (def. 24 bar). The indication concerns the circuit undergoing the high pressure condition.
FAULTY OR DISCON. PROBE	This alarm message appears when the probes measure out-of-range temperature values.
ERROR IN THE INTERFACE MANAGEMENT Macroplus	This alarm message indicates that I/O boards are not correctly connected.
FAULTY OR DISCONNECTED CLOCK	This alarm message appears when the clock board is damaged or disconnected.
FAULTY EEPROM	This alarm appears in case of faulty EEPROM

ACCESSORIES

<u>PRINTER:</u>	A serial printer, ALFAPANEL model. It will print all alarms, temperature and set-point values. Hourly printouts will show the temperature probe values.
<u>CLOCK:</u>	Necessary for the time-band management of the chiller (if previously selected on the dedicated mask).
<u>SERIAL LINE:</u>	The serial connection allows you to read all the selected parameters and know the status of the machine, as well as any possible alarm condition.

FACTORY-SET VALUES

The standard values set during the initialization procedure by the Manufacturer can be modified by the end-User according to his specific application requirements.

The initialization of the machine consists in:

- cleaning the the back-up memory (EEPROM) since it contains uncorrect data (they refer to the tests made by Carel's technicians);
- selecting the unit MODEL and the consequent automatic setting of the standard working parameter.

The initialization of the machine should be done any time

- you replace the program **EPROM**;
- you want to change the **MODEL** of the controlled unit.

IMPORTANT

It is recommended to turn Macroplus OFF and ON again any time you delete and reset the working parameters.

SELECTABLE PARAMETERS	RANGE	PRE-SET	PW. NOTE
Water temperature setpoint	-50÷100 °C	12 °C	
Water temperature setpoint Customer	-50÷100 °C	10 °C	1
Water temperature setpoint Manufacturer	-50÷50 °C	5 °C	2
Water temperature differ.	0÷20.0 °C	3 °C	1
Low temperature threshold outlet water		3 °C	1
High temperature threshold inlet water	17 °C	1	
Low temperature threshold inlet water	3 °C	1	
High pressure threshold	24 bar	1	
Delay between an OFF routine of the compressor and its partialization or between partializations	0÷100 sec	10 sec	2
Min. time compressor OFF	1÷9999sec	180 sec	2
Min. time between ON routines of 2 different compressors	1÷9999sec	10 sec	2
Delay between two consecutive ON routines of the same compressor (hourly On routines)	1÷9999sec	360 sec	2
Min. time compressor ON routine	1÷999 sec	60 sec	2
Delay of flow alarm when the unit is working	0÷900 sec	3 sec	2
Delay of flow alarm at start-up	0÷300 sec	10 sec	2
High temperature alarm delay (outlet water)		30 min	2
High pressure alarm delay	0÷900 sec	40 sec	2
Delayed OFF routine of motor-driven pumps		20 sec	2
Motor-driven pumps rot. thres.	1÷5000 sec	8 hours	2
Oil differential delay	1÷5000 sec	120 sec	2
Integration time	300÷900 sec	600 sec	2
Hours threshold for compressors maintenance	1÷32000 h	10000 h	1
Freecooling delta	0.5÷10 °C	20 °C	2
Lower limit ramp of freecooling valve	-10÷25 °C	9 °C	2
Higher limit ramp of freecooling valve	-10÷25 °C	12 °C	2
Lower limit pressure probes	-10÷40 bar	10 bars	2
Higher limit pressure probes	-10÷40 bar	28 bars	2
Inverter setpoint		13 bars	2
Inverter zone		3 bars	2

Control probe	in/out	input	1
Number of fans	0÷12	12	2
No. of partializations	0÷2	0	2
Rotation enablement		yes	2

COMPONENTS

MACROPLUS, I/O AND OPTIONAL BOARDS

MACROPLUS CONTROLLER, HORIZONTAL MODEL
DISPLAY 4X20

code **MACRONEW00**

"LARGE" INTERFACE BOARD

code **INTMNEWB00**

"ADDITIONAL" INTERFACE BOARD

code **INTMNEWA00**

CLOCK BOARD

code **MNEWCLOCK0**

RS422 OPTIONAL BOARD

code **MNEWRS4220**

SERIAL CONNECTION CABLE BETWEEN MACROPLUS
AND "LARGE" INTERFACE BOARD

code **59C222A003**

SERIAL CONNECTION CABLE BETWEEN MACROPLUS
AND 2 "LARGE" INTERFACE BOARDS

code **59C155A001**

CONFIGURATIONS:

SINGLE COMPRESSOR CHILLER

- MACROPLUS CONTROL BOARD
- CLOCK BOARD
- INTERFACE "LARGE"
- CONNECTION CABLE BETWEEN CONTROLLER AND INTERFACE

2-COMPRESSOR CHILLER

- MACROPLUS CONTROL BOARD
- CLOCK BOARD
- INTERFACE "LARGE"
- CONNECTION CABLE BETWEEN CONTROLLER AND INTERFACE

3-COMPRESSOR CHILLER

- MACROPLUS CONTROL BOARD
- CLOCK BOARD
- INTERFACE "LARGE"
- INTERFACE "ADDITIONAL"
- CONNECTION CABLE BETWEEN CONTROLLER AND INTERFACES

4-COMPRESSOR CHILLER

- MACROPLUS CONTROL BOARD

- CLOCK BOARD
- 1 INTERFACE "LARGE"
- INTERFACE "ADDITIONAL"
- INTERFACE "SMALL NON-EXPANDABLE"
- CONNECTION CABLE BETWEEN CONTROLLER AND INTERFACES

CONNECTION DIAGRAM: PRESSURE TRANSDUCERS FANAL WESTINGHOUSE

THE FANAL PRESSURE PROBES, MODELS:

- SPLOOB -0.5: 7 bar code 9995517ACA
- SPLOOC 2: 24 bar code SPLOOC0000

NEED, FOR A CORRECT FUNCTIONING, A POWER FEEDER 0:24V d.c.

MODEL: AD10000000

THE AD1 MODULE IS POWERED BY THE SAME CABLES POWERING MACROPLUS.

HERE ARE THE CABLES TO BE CONNECTED TO THE I/O INTERFACE:

- THE **M** CABLE (REFERENCE OF THE PRESSURE PROBE)
- THE GREEN SIGNAL CABLE TO BE CONNECTED TO THE CURRENT INPUTS OF MACROPLUS (**B5/B6**)

******* WARNING *******

PAY ATTENTION: THE OUTPUT OF THE AD1 MODULE - **TERMINAL 7** - MUST BE CONNECTED TO THE TERMINAL **M** OF THE MACROPLUS INTERFACE BOARD.

THE '**G0**' MUST BE CORRECTLY POSITIONED AMONG INTERFACE 'LARGE', 'AD1' AND 'CONTROLLER'.

ELECTRICAL PANEL CONNECTIONS

Special care should be given to the connections concerning the following alarms:

- **WATER FLOW DETECTOR**
- **COMPRESSORS HIGH PRESSURE**
- **ANTIFROST THERMOSTAT**

In order to ensure the complete safety of the entire system, they stop the relative device:

- **WATER FLOW DETECTOR AND ANTIFROST THERMOSTAT:**
They stop the machine
- **COMPRESSOR HIGH PRESSURE:**
This alarm stops the relative compressor.

IMPORTANT

All electronic parts must be kept far from the power components (TRANSFORMERS and SWITCHES). The cables of the probes (better if shielded) should be positioned in individual ducts, far from the power cables of compressors and/or fans.

This avoids any possible noise.

It is also recommended to respect the max. length of the probes cables.

MASKS

Out Wat.Temp	00.0 °C
In. Wat.Temp	00.0 °C
Set Point	12.0 °C
MACHINE	OFF

This is the main mask. It appears when you turn Macroplus ON or any time you press the MENU button. It displays the values measured by the water temperature probes. By pressing the ENTER button, it will be possible to select the SET-POINT.

Macroplus will accept any set-point value ranging between the lower/higher limits previously selected (Customer/Manufacturer password). Otherwise Macroplus will consider the pre-selected value.

If the set-point undergoes variations according to the TIME-BANDS management, it is not possible to set it in this mask. In this case the set-point displayed refers to the ACTUAL SET-POINT (you can easily recognize it by the '*' placed near the numeric field).

The last row displays the machine status: MACHINE ON, MACHINE OFF, MANUAL PROCEDURE, TIME-BANDS OFF , etc.

Use the RIGHT button to move into a new masks branch or the ALARM button to enter the alarm branch.

***** IMPORTANT *****

THE "*" NEAR THE 'SET-POINT' INDICATES THAT IT IS NOT POSSIBLE TO SELECT THE SET-POINT VALUE IN THE MENU MASK.

Possible Menu options:

```
Synoptic:
Service/User
Manufacturer
Timer
```

```
Synoptic
Inputs State
Version
```

Synoptic Menu:

```
Synoptic:
Inputs State
Version
```

```
06/08/1992 12:30
  Out.Wat.Temp.      °C
  In. Wat.Temp       °C
MACHINE OFF
```

```
06/08/1992 12:30
  Env. Air Temp.     °C
  FreeCool.Temp.    °C
MACHINE OFF
```

```
06/08/1992 12:30
  HPress. Trans.1    bar
  HPress. Trans.2    bar
MACHINE OFF
```

```
06/08/1992 12:30
  HPress. Trans.3    bar
  HPress. Trans.4    bar
MACHINE OFF
```

These masks display the status of all the probes connected to Macroplus.

```
Synoptic
Inputs State
Version
```

```
01-45 O=NO C=NC
00000 00000 00000
00000 00000 00000
00000 00000 0000
```

Display of the status of digital inputs: Open - Close

```
Synoptic
Inputs State
Version
```

```
Standard Chiller
CAREL srl ITALY
Ver 1.711 - TIO
15 October 1996
```

Software version display.

Programming masks for the 'End-User'

Standard password: "1234"

```
Synoptic
Service/User
Manufacturer
Timer
```

```
Insert Password
Service/User      1234
  Exact
Password
```

```
Param. Selection
Printer-
Supervisor
Hourly Time-Bands
New Password
```

'Customer' branch for the selection of set-point and regulation zone (regulation on input/output probe).

```
Param.Selection
Printer-Supervisor
Hourly Time-Band
New Password
```

```
Set Point
Alarms Thresholds
```

```
Min.Set-Point 0.0 °C
Differential 03.0 °C
Probe Reading:  IN
```

In this mask it is possible to select the lower set-point limit (default 10 °C). The selected value, however, must not be lower than the 'Manufacturer' set-point (default 5 °C) selected in the branch reserved to the manufacturer.

This mask also allows you to select the proportional zone and the probe parameters.

Selection of alarm thresholds:

Set Point Alarms Thresholds	Wat. Temp. Evap. Out Low Thres. 03.0 °C High Press. Trans.: High Thres.4.0 bar
---------------------------------------	---

Wat. Temp. Evap.In: High Thres. 17.0 °C Low Thres. 03.0 °C
--

By entering this branch it is possible to select all the alarm thresholds (outlet water high temperature, high pressure and input water high/low temperature).

SERIAL LINES Management (Printer/Supervisor)

Param. Selection Printer-Supervisor Hourly Time-Zone New Password	Type of Printout: Cyclic 0 h Immediate No
---	---

Identification : Number: 000

These masks define the type of printout, that is cyclic (every 'x' hours) or immediate. Besides, it is necessary to give Macroplus an identification number, particularly useful when the controller is connected into Carel serial line.

Hourly programming / Clock

Param. Selection Printer-Supervisor Hourly Time-Bands New Password	Hourly Time-Bands Clock AutoStart Maintenance	Time-Bands Daily Weekly
--	---	-------------------------------

Time-Bands? Daily Weekly	Daily Time-Bands With Set Point Variation? No
---------------------------------------	--

1 00:00h Set = 00.0 2 00:00h Set = 00.0 3 00:00h Set = 00.0 4 23:59h Set = 00.0
--

The DAILY TIME-BANDS function ensures the modification of the chiller's set-point during the day. This ensures a well balanced functioning of the unit and reduces the energy requirements of the system. Before entering the time-bands programming masks it is necessary to enable the function itself. Then press the  button to enter the selection mask where you can select the necessary values (this mask will be accessible only if you enable the daily time-bands management in the mask shown above).

Time-Bands? Daily Weekly	Time - Bands? No ON. : MON=1 04:00 OFF. : SAT=6 18:00
---------------------------------------	---

The weekly time-bands management allows you to turn ON and OFF the chiller on the days and times selected in the relative mask.

It is therefore possible, for example, to turn ON the chiller on Monday, at 5:00 am and to turn it OFF on Friday, at 18:00 pm.

Program the days of the week by selecting the relative number:

- 0 SUNDAY
- 1 MONDAY
- 2 TUESDAY
- 3 WEDNESDAY
- 4 THURSDAY
- 5 FRIDAY
- 6 SATURDAY

Time-Bands Clock Autostart Maintenance	Clock Present? No Time 00:00 Date 00/00/0000 dd/mm/yyyy
--	--

Automatic restart after POWER OFF:

Time-Bands Clock Autostart Maintenance	Automatic Starting? No
--	---------------------------

Maintenance branch:

Time-Bands Clock Autostart Maintenance	Timer Threshold Timer Reset	Hours Threshold Compressors 10000
	Timer Threshold Timer Reset	Reset H.Comp. 1 No Reset H.Comp. 2 No Reset H.Comp. 3 No Reset H.Comp. 4 No

In these masks it is possible to select the hours threshold for the compressors, so as to provide the necessary maintenance and reset the timer as appropriate.

New Password Selection:

Param. Selection Printer-Supervisor Time-Bands New Password	Change Password Service/User 0000
---	---

'Manufacturer' Programming masks

Standard Password = "4321"

Synoptic Service/User Manufacturer Timer	Insert Password Manufacturer 4321 Exact Password	Machine Config. Regulation Param. Manual Procedure Particular Proc.
--	---	--

Programming branch reserved to the Manufacturer:

Machine Config. Regulation Param. Manual Procedure Particular Proc.	Low I. Temp. Set 5.0 Control Type: P Integ. Time. 0600 Rotat. Enabled Yes
---	--

Number of Fans	12
Number of Part.	0
PumpDown Enabled	No
FreeCool. Enabled	No

Part. Delay	010
Run. Flow. Delay	003
Start Flow.Delay	010
Pump OFF Delay	020

Hi Temp.IN Delay	030
Press.Al.Delay	040
FreeCool.Delta	02.0
Part.Logic	DWM COP.

Oil Dif.Al.Delay	120
Max. Hours	0008
Press.Probes Limits	
Min.: 010	Max.: 028

Min. OFF Time	0180
Same Comp.	0360
Between Comp.	0010
Min. ON Time	0060

Motor-driven Pumps	
Conditioning or	
Refrigeration	
Choice:	COND

Passive temperature	
sensors (NTC)?	
B1 - No	B2 - No
B3 - No	B4 - No

Setp. selection from the	
MASK	

In the "CONFIGURATION MACHINE" branch it is possible to select the following parameters:

- Lower set-point limit selectable in the dedicated mask (customer password);
- Type of control: Proportional (P) or P+I;
- Integration time in case of P+I control;
- Compressors rotation;
- Number of fans;
- Number of partializations per compressor;
- Pump-Down procedure;
- Freecooling Management;
- Min. time between two successive partializations or min. time between the compressor's starting and its partialization;
- Delay of the flow detector alarm when the compressors are normally working;
- Delay of the flow detector alarm when the compressors starts working;
- Delay before turning the pumps OFF, after the pressure of the OFF button;
- High temperature alarm delay (minutes);
- Low pressure alarm delay;
- Selection of the freecooling delta (min. difference between the freecooling temperature and the ambient air temperature beyond which the freecooling is enabled)
- Logic of the partializations: DWM COPELAND (open contact) or FEDDERS (closed contact);
- 'Oil Differential Pressure' alarm delay;
- Rotation time of the motor-driven pumps (in hours);
- High and Low limits of the high pressure transducers;
- Min. time compressor OFF;
- Selection of the time-delay between successive startings of the same compressor;
- Min. time between the startings of two compressors;
- Min. time ON routines of the same compressor;

- Functioning mode of the motor-driven pumps:

Conditioning: The PUMP turns ON when the machine is powered and turns OFF when the machine is turned OFF but after the delay selected by the User.

Refrigeration: The pump turns ON when the machine is powered and can be turned OFF as soon as the chiller reaches the selected temperature set-point. In temperature functioning mode, the pump can be started by a device placed on the digital input No. 31.

- selection of the temperature sensors to be utilized: active (0/1volts) or passive (NTC);
- selection of the set-point from the mask or analog input (B7).

"REGULATION" masks

Machine Conf. Regulation Param. Manual Procedure Particular Proc.
--

Compressor Steps Valve Limits Fan Step in Press. Fan Step in Temp.
--

COMPRESSORS' steps

Compressor Steps Valve Limits Fan Steps in Pres. Fan Steps in Temp.

Comp. Steps Sel. Part. Steps Sel.

Step 1
Threshold 00.0 %
Different. 00.0 %

Step 2
Threshold 00.0 %
Different. 00.0 %

Step 3
Threshold 00.0 %
Different. 00.0 %

Step 4
Threshold 00.0 %
Different. 00.0 %

Programming the partialization steps:

Comp. Steps Sel. Part. Steps Sel.

Part. 1 - Step 1
Threshold 00.0 %
Different. 00.0 %

Part. 2 - Step 1
Threshold 00.0 %
Different. 00.0 %

Part. 1 - Step 2
Threshold 00.0 %
Different. 00.0 %

Part. 2 - Step 2
Threshold 00.0 %
Different. 00.0 %

Part. 1 - Step 3
Threshold 00.0 %
Different. 00.0 %

Part. 2 - Step 3	
Threshold	00.0 %
Different.	00.0 %

Part. 1 - Step 4	
Threshold	00.0 %
Different.	00.0 %

Part. 2 - Step 4	
Threshold	00.0 %
Different.	00.0 %

REGULATION OF THE ANALOG OUTPUTS

Compressor Steps	Closed Val.	09.0 °C
Valve Limits	Open Valve	12.0 °C
Fan Steps in Pres.	Set Inv.	13.0 bar
.	Diff.Inv.	03.0 bar
Fan Steps in Temp.		

Programming the set-point for the 3-way freecooling valve (in ^C) (beginning/fully open valve) and selecting the set-point and inverter zone to regulate the number of turns of the fans.

CONDENSATION

Selecting the pressure thresholds for fans START/STOP routines.

Compressors Steps	Fan 1	
Valve limits	On	00.0 bar
Fan Steps in	Off	00.0 bar
Press.		
Fan Steps in Temp.		

Fan 2	
On	00.0 bar
Off	00.0 bar

Fan 3	
On	00.0 bar
Off	00.0 bar

CONDENSATION + FREECOOLING (if the freecooling function has been selected).
Selection of temperature thresholds at evaporator inlet managing the START/STOP routines of the fans.

Comp. Steps	Fan 1 - Circuit 1	
Valve Limits	On	00.0 °C
Fan Steps in Pres.	Off	00.0 °C
.		
Fan Steps in Temp.		

Fan 2 - Circuit 1	
On	00.0 °C
Off	00.0 °C

Fan 3 - Circuit 1	
On	00.0 °C
Off	00.0 °C

Fan 1 - Circuit 2	
On	00.0 °C
Off	00.0 °C

Fan 2 - Circuit 2
On 00.0 °C
Off 00.0 °C

Fan 3 - Circuit 2
On 00.0 °C
Off 00.0 °C

Fan 1 - Circuit 3
On 00.0 °C
Off 00.0 °C

Fan. 2 - Circuit 3
ON 00.0 °C
OFF 00.0 °C

Fan 3 - Circuit 3
ON 00.0 °C
OFF 00.0 °C

Fan 1 - Circuit 4
ON 00.0 °C
OFF 00.0 °C

Fan 2 - Circuit 4
ON 00.0 °C
OFF 00.0 °C

Fan 3 - Circuit 4
ON 00.0 °C
OFF 00.0 °C

MANUAL PROCEDURE

The manual procedure allows you to exclude the automatic control of the devices and to directly manage them manually.

In order to start the compressors manually, it is necessary to start beforehand at least one pump. If you don't start the pump, you can not enter the following masks:

Machine Config.
Regulation Param.
Manual Procedure
Particular Proc.

Pump 1	No
Pump 2	No
Fans	No

	1	2	3	4
Compres.	No	No	No	No
Part. 1	No	No	No	No
Part. 2	No	No	No	No

SPECIAL PROCEDURES branch:
Selection New Manufacturer PW

Machine Config.
Regulation Parame.
Manual Procedure
Particular Proc.

Change Pass. Man.
Memory Erasure
Machine Model

Change Password
Manufacturer
0000

- The special procedure to clean the back-up memory should be done :
- the first time you turn ON the machine;
 - any time you replace the eprom;
 - any time that you select a new machine version.

WARNING: once you have confirmed "Yes", after 5 seconds "No" appears again.

Change Pass.Man. Memory Erasure Machine Model	Back-up Memory Erasure? No
--	--------------------------------------

TYPE OF MACHINE MODEL:

- 1 ==> 1 compressor machine
- 2 ==> 2-compressor machine
- 3 ==> 3-compressor machine
- 4 ==> 4-compressor machine

IMPORTANT: If you select a single compressor machine, it is necessary to press the ENTER button. After the selection, a series of factory-set (standard) values will automatically be operative.

Change Pas.Man. Memory Erasure Machine Model	Machine Model? (Choice 0 - 3) 0 1 Comp
---	---

COMPRESSORS TIMER

Synoptic: Service/User Manufacturer Timer	H. Comp. 1 00000 H. Comp. 2 00000 H. Comp. 3 00000 H. Comp. 4 00000
---	---

OFFSET TEMPERATURE PROBE READING

Offset probes read. OUT Water Temp: 0.0C OUT Water Temp: 0.0C

To enter this mask, press the MENU and  buttons simultaneously. It allows you to select an offset value relative to the water temperature probes (outlet and inlet evaporators).

ALARM MASKS

ALL THE ALARMS SHOULD BE MANUALLY RESET.
THEY STOP THE RELATIVE DEVICE UNTIL THEIR RESET.

Overload Compressor 1/2/3/4	THE RELATIVE COMPRESSOR STOPS
Overload Fan 1 - Circuit 1	THE RELATIVE FAN STOPS
Pressurestat High Pressure 1/4	THE RELATIVE COMPRESSOR STOPS
Overload Pump 1/2	THE RELATIVE MOTOR-DRIVEN PUMP STOPS

Flow detector 1/2	THE RELATIVE MOTOR-DRIVEN PUMP STOPS
Antifrost	ALL COMPRESSORS STOP
Overshot High Pressure Threshold	INDICATION
Overshot Threshold Low Temp. Water Evaporator Outlet	ALL COMPRESSORS STOP
Overshot Threshold High Temp. Water Evaporator Inlet	INDICATION
Overshot Threshold Low Temp. Water Evaporator Inlet	INDICATION
Pressurestat Low Pressure 1/4	THE RELATIVE COMPRESSOR STOPS
Maintenance Compressor 1 /4	INDICATION
Faulty Pump Down 1 Control of Solenoid and Pump-Down Press.	THE RELATIVE COMPRESSOR STOPS
High Temperature Winding Compressor 1	THE RELATIVE COMPRESSOR STOPS
Oil Differential Pressurestat 1	THE RELATIVE COMPRESSOR STOPS
Interblock 1 / 2	THE MACHINE STOPS
Limit Control High Pressure Pressurestat 1	THE RELATIVE COMPRESSOR STOPS
Faulty Eeprom	INDICATION

Lack or Faulty
Clock

INDICATION

Error in Interface
Management

INDICATION

NO ACTIVE ALARM:

No Alarm

CAREL

Technology & Evolution

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