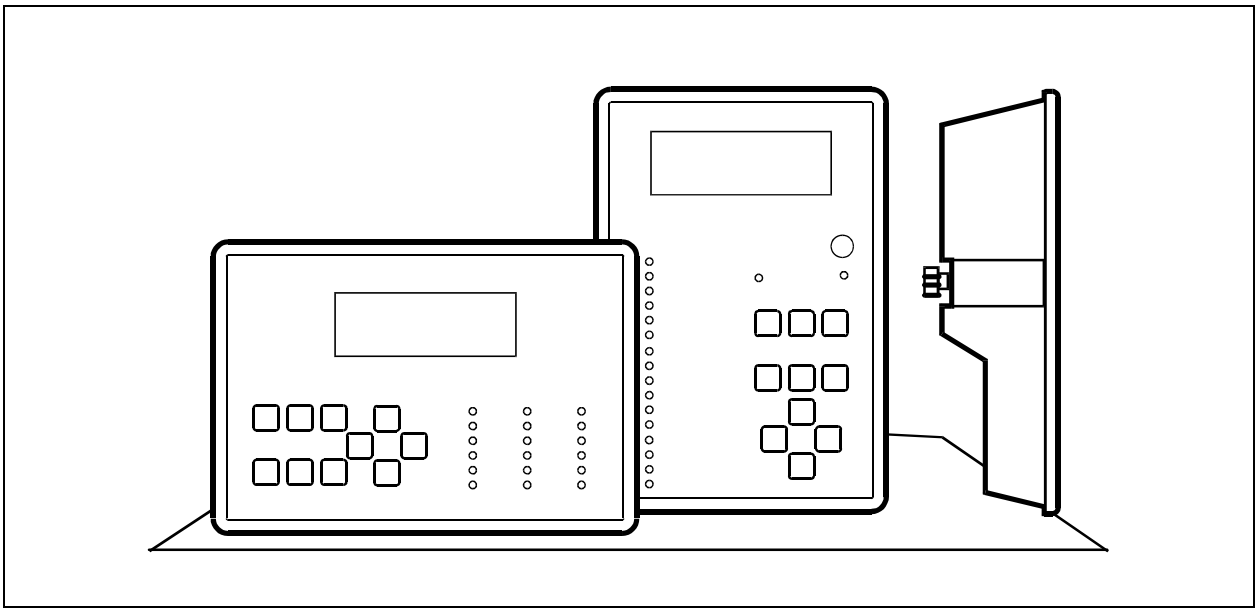
Application program for Macroplus II



Standard 1/4 compressor chiller/heat pump with heating recovery

Manual version: 2.2 - 06/02/97

Program code: **EP000EPDC0**

CAREL
Technology & Evolution

Rif.: **17EM**

INDEX

MAIN FEATURES

The MACROPLUS controller allows you to manage refrigeration units (CHILLERS or HEAT PUMPS) having different configurations, with WATER or AIR condensation.

Minimum Configuration:
1 COMPRESSOR CHILLERS
Maximum Configuration:
4 COMPRESSOR CHILLERS

The system comprises 2 main parts:
1 - CONTROL UNIT (USER INTERFACE)
2 - INPUT / OUTPUT UNIT

The system has 3 levels of masks (user interface), 2 of them are protected by a password so as to avoid any data handling on the part of unauthorized staff.

LEVEL 1	accessible by everyone (SYNOPTIC)
LEVEL 2	accessible to the user by dedicated PASSWORD (PROGRAMMING action)
LEVEL 3	accessible to the manuafacturer by dedicated PASSWORD (machine INITIALIZATION)

HARDWARE DESCRIPTION

The basic system comprises:
- MACROPLUS control board
- INPUT / OUTPUT boards

Macroplus is the intelligent part of the system. It also represents the 'user interface' for an easy communication between User and controller. The type and number of the boards depend on the kind of application and on the devices used (COMPRESSORS and FANS).
The minimum configuration - 1 'large' board - allows you to manage:

- 1 COMPRESSOR
- 3 CONDENSER FANS
- 2 PUMPS
- 1 MODULATING OUTPUT 0:10 Volt for FREECOOLING VALVE
- 1 MODULATING OUTPUT 0:10 Volt for FAN INVERTER

The maximum configuration - 2 'large' boards + 1 'additional' board - allows you to manage:

- 4 COMPRESSORS
- 12 CONDENSER FANS (3 for each circuit)
- 2 PUMPS
- 1 ANALOGUE OUTPUT for FREECOOLING VALVE
- 1 MODULATING OUTPUT 0:10 Volt for FAN INVERTER

OPTIONS:
- CLOCK board, necessary to display DATE and TIME, or to manage the chiller's time-bands (start-stop), or to manage daily time-bands with set-point variation;
- Serial output RS422 for connection to a remote supervisory system;

SPECIFICATIONS AND FUNCTIONS OF THE SYSTEM

The system controls and regulates the following conditions:

- Water temperature according to the evaporator inlet/outlet temperature;

- Summer / Winter functioning mode (HEAT PUMP);

- Intervention of each single device of the unit;

- Protection of each single compressor with indication of any possible anomalous condition (LOCAL or REMOTE indication, via serial line);

- Protection of each single refrigeration group;

- Display of: programming data (via **DISPLAY**)
devices ON status (via **LED** indicators)

PROTECTIONS

Macroplus manages the following protections for each refrigeration group:

- Inlet high pressure overload (through a PRESSOSTAT)
  By combining the pressostat with a PRESSURE TRANSDUCER (DANFOSS or FANAL 4- 20 mA), it is possible to continuously monitor the inlet pressure and signal any HIGH pressure condition within the circuit.
- Low suction pressure overload (through a PRESSOSTAT)
- Min. pressure oil differential overload (through a PRESSOSTAT)
- Max. absorption compressor engine (OVERLOAD)
- Max. absorption fans engine (OVERLOAD)
- Max. absorption pumps engine (OVERLOAD).

The global protections are:
- Antifreeze protection (1 antifreeze thermostat for 4 different circuits)
- Protection in case of pumps starting failure (FLOW DETECTORS for 2 pumps)
- Protection in case of serious optional ALARM (n. 1 digital input to block the machine in case of serious alarms such as SMOKE/FIRE or FLOODING)
  When the protections intervene, the whole unit turns OFF.
  The contoller informs the user of any anomalous condition via:
- BUZZER
- Change-over relay 'ALARM RELAY' (in the first interface board. A signalling remote devicecan be connected to the relay)
- The 'AL' message (alarm) appears on the display.

The User can recognize the type of alarm by pressing the ALARM Button. In this way the display shows the exact type of alarm occurred.

EXAMPLE: Alarm mask:

```
Pressostat High
Pressure 1
```

WARNING: ALL the alarms should be manually reset: They remain stored in the microprocessor until the User resets normal conditions by pressing the 'CLEAR' Button.

AUTODIAGNOSIS

There is a continuous exchange of information between the controller and its I/O interfaces (the 'peripheral' parts of the system).
The connected I/O are constantly controlled, so as to ensure the block of the machine in case one of the interface should fail and hence, cause the irregular functioning of the entire unit.
Should such a condition occur, the controller signals the alarm as described above.
Should the controller be blocked for any reason, the interfaces' microprocessors connected to the controller will automatically place themselves in a STAND-BY status with all their outputs disenergized (there is a 40 s' delay to ensure the posssibility of restoring normal working conditions).

CONTROL ACTIONS

- Regulation of water temperature at the evaporator INLET/OUTLET
  (P or P+I REGULATION)
- Regulation based on a CENTRAL SET-POINT or on a LATERAL ZONE
- Heating recovery
- Cyclic compressors rotation so as to balance the working hours of all the compressors
- Cyclic automatic defrost of each circuit
- Minimum ON time
- Minimum OFF time
- Minimum time between the ON routines of different compressors so as to avoid simultaneous startings
- Minimum time between two consecutive startings of the same compressor to limit the number of hourly ON routines
- Display of the compressors working hours and indication of overshot limits (maintenance will then be required)
- No flow detector action at motor-driven pump starting
- No low pressure signal at the compressor starting
- Delay of the oil differential pressostat signal

- Otional PUMPDOWN for the compressors
- Compressor PART WINDING (1s)
- Pumps hourly rotation (optional) and starting of the stand-by pump in case the current pump should fail
- Weekly time-bands of the chiller (start/stop)
- Daily time-bands for the SET-POINT variation (to save energy)
- Possibility of forcing the starting of each compressor or of ignoring them for an easy maintenance, without intervention on the electrical panel
- Control of the parameters ERROR (overshot selected limits)

USER INTERFACE: LIQUID CRYSTAL 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 any other information concerning the controlled variables.

DISPLAY types:

4 rows x 20 characters, character dimension = 5 mm
4 rows x 20 characters, character dimension = 8 mm

LEDS INDICATING THE STATUS OF THE DEVICES

There are 18 LED indicators on the chiller front panel. They give the following information:

L1 - yellow LED "POWER ON" : Indicates that the controller is being powered
L2 - red LED "ALARM" : Indicates an alarm condition
1 - green LED "COMP. 1 ON": Indicates that compressor 1 is ON
2 - green LED "PART1 C1 ON": Indicates active partialization 1
3 - green LED "PART2 C1 ON": Indicates active partialization 2
4 - green LED "COMP. 2 ON": Indicates that compressor 2 is ON
5 - green LED "PART1 C2 ON": Indicates active partialization 1
6 - green LED "PART2 C2 ON": Indicates active partialization 2
7 - green LED "COMP. 3 ON": Indicates that compressor 3 is ON
8 - green LED "PART1 C3 ON": Indicates active partialization 1
9 - green LED "PART2 C3 ON": Indicates active partialization 2
10 - green LED "COMP. 4 ON" : Indicates that compressor 4 is ON
11 - green LED "PART1 C4 ON": Indicates active partialization 1
12 - green LED "PART2 C4 ON": Indicates active partialization 2
13 - green LED "PUMP 1 ON" : Indicates that pump 1 is ON
14 - green LED "PUMP 2 ON" : Indicates that pump 2 is ON
15 - green LED "WINTER": Selection of winter functioning mode
16 - green LED "RECOVER" : Indicates ideal conditions for heating recovery

DESCRIPTION OF INPUTS/OUTPUTS

There are different configurations available, depending on the number of refrigeration circuits, cooling steps and digital inputs and outputs.
The I/O configuration allows not just the management of a 'minimum' configuration (1 compressor version) but also of a 'maximum' configuration (4-compressor machine).

N.B: Here is the logic of the digital inputs:

- ALARMS:	closed contact: regular functioning open contact: alarm
- SUMMER/WINTER SELECTION:	closed contact: 'WINTER' functioning mode open contact: 'SUMMER' functioning mode
- REMOTE START/STOP:	closed contact: machine OFF open contact: machine ON
- SELECTION PUMP FUNCTIONING MODE:	closed contact: refrigeration functioning mode open contact: conditioning functioning mode

The configurations below will be useful for a correct connection within the electrical panel, on the basis of the type of machine adopted.

The **ANALOGUE INPUTS** are shared by all versions:

n logic - terminal - probe type

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

1 - B1 - M - WATER TEMPER. PROBE AT EVAPORATOR OUTLET
2 - B2 - M - WATER TEMPER. PROBE AT EVAPORATOR INLET
3 - B3 - M - AMBIENT AIR TEMPERATURE PROBE
4 - B4 - M - FREECOOLING 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 - non-connected
8 - B8 - M - CONDENSER WATER TEMPERATURE PROBE
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 the above mentioned probes are not used, the corresponding analogue inputs should be earth connected to avoid any faulty reading on the part of the controller.

ANALOGUE OUTPUTS

Common to all versions, and active just in case the freecooling function has been selected.
(1I/O "**large**" board)

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

1 compressor version:

HARDWARE FOR I/O:
1 "LARGE" BOARD
1 "ADDITIONAL" BOARD (optional)

DIGITAL INPUTS:

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

1 HIGH PRESSURE PRESSOSTAT COMPRESSOR 1
2 END DEFROST PRESSOSTAT COMPRESSOR 1
3 LOW PRESSURE PRESSOSTAT COMPRESSOR 1
4 HIGH TEMPERATURE WINDING COMPRESSOR 1
5 OVERLOAD COMPRESSOR 1
6 OIL DIFFERENTIAL PRESSOSTAT COMPRESSOR 1

7 WATER ANTIFREEZE THERMOSTAT
8 WATER FLOW DETECTOR
9 MOTOR-DRIVEN PUMP 1 OVERLOAD
10 MOTOR-DRIVEN PUMP 2 OVERLOAD
11 FAN 1 OVERLOAD
12 FAN 2 OVERLOAD
13 FAN 3 OVERLOAD
14 to be bridged to the COMMON contact
15 to be bridged to the COMMON contact
16 to be bridged to the COMMON contact
17 to be bridged to the COMMON contact
18 to be bridged to the COMMON contact
19 to be bridged to the COMMON contact
20 to be bridged to the COMMON contact
21 to be bridged to the COMMON contact
22 to be bridged to the COMMON contact
23 REMOTE START /STOP

(1 I/O **"additional"** board)
(The presence of this board depends on the type of motor-driven pumps functioning mode, that is in refrigeration or in conditioning (where no board is required) applications).

30 WINTER/SUMMER SELECTION (SUMMER = open contact)
31 PUMP FUNCTIONING IN REFRIGERATION: PUMP START/STOP

DIGITAL OUTPUTS:
(1 I/O "**large**" board)
1 CONTACTOR WINDING A COMPRESSOR 1
2 CONTACTOR WINDING B COMPRESSOR 1
3 SOLENOID LIQUID COMPRESSOR 1
4 SOLENOID PARTIALIZATION 1 COMPRESSOR 1
5 SOLENOID PARTIALIZATION 2 COMPRESSOR 2
6 MOTOR-DRIVEN VALVE FOR CYCLE REVERSE COMPRESSOR 1
7 MOTOR-DRIVEN PUMP 1
8 MOTOR-DRIVEN PUMP 2
9 FAN 1
10 FAN 2
11 FAN 3
RA ALARM RELAY

(1 I/O **"additional"** board)
(This board is necessary just in case the "HEATING RECOVERY" function is enabled.)
21 RECOVERY

2-compressor version

HARDWARE for I/O:
- 1 "LARGE" BOARD
- 1 "ADDITIONAL" BOARD

DIGITAL INPUTS:
(1 I/O "**large**" board)

1 HIGH PRESSURE PRESSOSTAT COMPRESSOR 1
2 END-DEFROST PRESSOSTAT COMPRESSOR 1
3 LOW PRESSURE PRESSOSTAT COMPRESSOR 1
4 HIGH TEMPERATURE WINDING COMPRESSOR 1
5 COMPRESSOR 1 OVERLOAD
6 OIL DIFFERENTIAL PRESSOSTAT COMPRESSOR 1
7 WATER ANTIFREEZE THERMOSTAT
8 WATER FLOW DETECTOR
9 MOTOR-DRIVEN PUMP 1 OVERLOAD
10 MOTOR-DRIVEN PUMP 2 OVERLOAD
11 FAN 1 OVERLOAD
12 FAN 2 OVERLOAD

13 FAN 3 OVERLOAD
14 FAN 4 OVERLOAD
15 FAN 5 OVERLOAD
16 FAN 6 OVERLOAD
17 to be bridged to the COMMON contact
18 to be bridged to the COMMON contact
19 to be bridged to the COMMON contact
20 to be bridged to the COMMON contact
21 to be bridged to the COMMON contact
22 to be bridged to the COMMON contact
23 REMOTE STARTING / STOP
24 HIGH PRESSURE PRESSOSTAT COMPRESSOR 2

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

25 END-DEFROST PRESSOSTAT COMPRESSOR 2
26 LOW PRESSSURE PRESSOSTAT COMPRESSOR 2
27 HIGH TEMPERATURE WINDING COMPRESSOR 2
28 COMPRESSOR 2 OVERLOAD
29 OIL DIFFERENTIAL PRESSOSTAT COMPRESSOR 2
30 WINTER/SUMMER SELECTION (SUMMER = open contact)
31 PUMP FUNCTIONING IN REFRIGERATION: PUMP STARTING/STOP
32 to be bridged to the COMMON contact

DIGITAL OUTPUTS:

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

1 CONTACTOR WINDING A COMPRESSOR 1
2 CONTACTOR WINDING B COMPRESSOR 1
3 SOLENOID LIQUID COMPRESSOR 1
4 SOLENOID PARTIALIZATION 1 COMPRESSOR 1
5 SOLENOID PARTIALIZATION 2 COMPRESSOR 1
6 SOLENOID VALVE FOR CYCLE REVERSE COMPRESSOR 1
7 MOTOR-DRIVEN PUMP 1
8 MOTOR-DRIVEN PUMP 2
9 FAN 1
10 FAN 2
11 FAN 3
12 FAN 4
13 FAN 5
14 FAN 6
15 CONTACTOR WINDING A COMPRESSOR 2
16 CONTACTOR WINDING B COMPRESSOR 2

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

17 SOLENOID LIQUID COMPRESSOR 2
18 SOLENOID PARTIALIZATION 1 COMPRESSOR 2
19 SOLENOID PARTIALIZATION 2 COMPRESSOR 2
20 SOLENOID VALVE FOR CYCLE REVERSE COMPRESSOR 2
21 RECOVERY
RA ALARM RELAY

3-compressor version

HARDWARE FOR I/O:

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

DIGITAL INPUTS:

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

1 HIGH PRESSURE PRESSOSTAT COMPRESSOR 1
2 END-DEFROST PRESSOSTAT COMPRESSOR 1
3 LOW PRESSURE PRESSOSTAT COMPRESSOR 1

4 HIGH TEMPERATURE WINDING COMPRESSOR 1
5 COMPRESSOR 1 OVERLOAD
6 OIL DIFFERENTIAL PRESSOSTAT COMP.1
7 WATER ANTIFREEZE THERMOSTAT
8 WATER FLOW DETECTOR
9 MOTOR-DRIVEN PUMP 1 OVERLOAD
10 MOTOR-DRIVEN PUMP 2 OVERLOAD
11 FAN 1 OVERLOAD
12 FAN 2 OVERLOAD
13 FAN 3 OVERLOAD
14 FAN 4 OVERLOAD
15 FAN 5 OVERLOAD
16 FAN 6 OVERLOAD
17 FAN 7 OVERLOAD
18 FAN 8 OVERLOAD
19 FAN 9 OVERLOAD
20 to be bridged to the COMMON contact
21 to be bridged to the COMMON contact
22 to be bridged to the COMMON contact
23 REMOTE STARTING/STOP
24 HIGH PRESSURE PRESSOSTAT COMPRESSOR 2

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

25 END-DEFROST PRESSOSTAT COMPRESSOR 2
26 LOW PRESSURE PRESSOSTAT COMPRESSOR 2
27 HIGH TEMPERATURE WINDING COMPRESSOR 2
28 COMPRESSOR 2 OVERLOAD
29 OIL DIFFERENTIAL PRESSOSTAT COMPRESSOR 2
30 SUMMER/WINTER SELECTION (SUMMER = open contact)
31 PUMP FUNCTIONING IN REFRIGERATION: PUMP STARTING/STOP
32 HIGH PRESSURE PRESSOSTAT COMPRESSOR 3

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

1 END-DEFROST PRESSOSTAT COMPRESSOR 3
2 LOW PRESSURE PRESSOSTAT COMPRESSOR 3
3 HIGH TEMPERATURE WINDING COMPRESSOSR 3
4 COMPRESSOR 3 OVERLOAD
5 OIL DIFFERENTIAL PRESSOSTAT COMPRESSOR 3
6 EXTERNAL INTERBLOCK (alarm: machine blocked)

DIGITAL OUTPUTS:

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

1 CONTACTOR WINDING A COMPRESSOR 1
2 CONTACTOR WINDING B COMPRESSOR 1
3 SOLENOID LIQUID COMPRESSOR 1
4 SOLENOID PARTIALIZATION 1 COMPRESSOR 1
5 SOLENOID PARTIALIZATION 2 COMPRESSOR 1
6 SOLENOID VALVE FOR CYCLE REVERSE COMPRESSOR 1
7 MOTOR-DRIVEN PUMP 1
8 MOTOR-DRIVEN PUMP 2
9 FAN 1
10 FAN 2
11 FAN 3
12 FAN 4
13 FAN 5
14 FAN 6
15 CONTACTOR WINDING A COMPRESSOR 2
16 CONTACTOR WINDING B COMPRESSOR 2

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

17 SOLENOID LIQUID COMPRESSOR 2
18 SOLENOID PARTIALIZATION 1 COMPRESSOR 2
19 SOLENOID PARTIALIZATION 2 COMPRESSOR 2

20 SOLENOID VALVE FOR CYCLE REVERSE COMPRESSOR 2
21 RECOVERY
22 CONTACTOR WINDING A COMPRESSOR 3
23 CONTACTOR WINDING B COMPRESSOR 3
24 SOLENOID LIQUID COMPRESSOR 3
RA ALARM RELAY

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

1 SOLENOID PARTIALIZATION 1 COMPRESSOR 3
2 SOLENOID PARTIALIZATION 2 COMPRESSOR 3
3 SOLENOID VALVE FOR CYCLE REVERSE COMPRESSOR 3
10 FAN 7
11 FAN 8
12 FAN 9

4-compressor version

HARDWARE FOR I/O:
- 2 "LARGE" BOARDS
- 1 "ADDITIONAL" BOARD

DIGITAL INPUTS:

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

1 HIGH PRESSURE PRESSOSTAT COMPRESSOR 1
2 END-DEFROST PRESSOSTAT COMPRESSOR 1
3 LOW PRESSURE PRESSOSTAT COMPRESSOR 1
4 HIGH TEMPERATURE WINDING COMP.1
5 COMPRESSOR 1 OVERLOAD
6 OIL DIFFERENTIAL PRESSOSTAT COMP.1
7 WATER ANTIFREEZE THERMOSTAT
8 WATER FLOW DETECTOR
9 MOTOR-DRIVEN PUMP 1 OVERLOAD
10 MOTOR-DRIVEN PUMP 2 OVERLAOD
11 FAN 1 OVERLOAD
12 FAN 2 OVERLOAD
13 FAN 3 OVERLOAD
14 FAN 4 OVERLOAD
15 FAN 5 OVERLOAD
16 FAN 6 OVERLOAD
17 FAN 7 OVERLOAD
18 FAN 8 OVERLOAD
19 FAN 9 OVERLOAD
20 FAN 10 OVERLOAD
21 FAN 11 OVERLOAD
22 FAN 12 OVERLOAD
23 REMOTE STARTING / STOP
24 HIGH PRESSURE PRESSOSTAT COMPRESSOR 2

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

25 END-DEFROST PRESSOSTAT COMPRESSOR 2
26 LOW PRESSURE PRESSOSTAT COMPRESSOR 2
27 HIGH TEMPERATURE WINDING COMP.2
28 COMPRESSOR 2 OVERLOAD
29 OIL DIFFERENTIAL PRESSOSTAT COMP.2
30 SUMMER/WINTER SELECTION (SUMMER = open contact)
31 PUMP FUNCTIONING IN REFRIGERATION: PUMP STARTING/STOP
32 HIGH PRESSURE PRESSOSTAT COMPRESSOR 3

(2nd I/O "**large**" board)

1 END-DEFROAT PRESSOSTAT COMPRESSOR 3
2 LOW PRESSURE PRESSOSTAT COMPRESSOR 3
3 HIGH TEMPERATURE WINDING COMP.3

4 COMPRESSOSR 3 OVERLOAD
5 OIL DIFFERENTIAL PRESSOSTAT COMP.3
6 EXTERNAL INTERBLOCK (alarm: machine lockout)
7 HIGH PRESSUSRE PRESSOSTAT COMPRESSOR 4
8 END-DEFROST PRESSOSTAT COMPRESSOR 4
9 LOW PRESSURE PRESSOSTAT COMPRESSOR 4
10 HIGH TEMPERATURE WINDING COMPRESSOR 4
11 COMPRESSOSR 4 OVERLOAD
12 OIL DIFFERENTIAL PRESSOSTAT COMP.4
13 to be bridged to the COMMON contact

DIGITAL OUTPUTS:

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

1 CONTACTOR WINDING A COMPRESSOR 1
2 CONTACTOR WINDING B COMPRESSOR 1
3 SOLENOID LIQUID COMPRESSOR 1
4 SOLENOID PARTIALIZATION 1 COMPRESSOR 1
5 SOLENOID PARTIALIZATION 2 COMPRESSOR 1
6 SOLENOID VALVE FOR CYCLE REVERSE COMPRESSOR 1
7 MOTOR-DRIVEN PUMP 1
8 MOTOR-DRIVEN PUMP 2
9 FAN 1
10 FAN 2
11 FAN 3
12 FAN 4
13 FAN 5
14 FAN 6
15 CONTACTOR WINDING A COMPRESSOR 2
16 CONTACTOR WINDING B COMPRESSOR 2

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

17 SOLENOID LIQUID COMPRESSOR 2
18 SOLENOID PARTIALIZATION 1 COMPRESSOR 2
19 SOLENOID PARTIALIZATION 2 COMPRESSOR 2
20 SOLENOID VALVE FOR CYCLE REVERSE COMPRESSOR 2
21 RECOVERY
22 CONTACTOR WINDING A COMPRESSOR 3
23 CONTACTOR WINDING B COMPRESSOR 3
24 SOLENOID LIQUID COMPRESSOR 3
RA ALARM RELAY

(2nd I/O "**large**" board)

1 SOLENOID PARTIALIZATION 1 COMPRESSOR 3
2 SOLENOID PARTIALIZATION 2 COMPRESSOR 3
3 SOLENOID VALVE FOR CYCLE REVERSE COMPRESSOR 3
4 CONTACTOR WINDING A COMPRESSOR 4
5 CONTACTOR WINDING B COMPRESSOR 4
6 SOLENOID LIQUID COMPRESSOR 4
7 SOLENOID PARTIALIZATION 1 COMPRESSOR 4
8 SOLENOID PARTIALIZATION 2 COMPRESSOR 4
9 SOLENOID VALVE FOR CYCLE REVERSE COMPRESSOR 4
10 FAN 7
11 FAN 8
12 FAN 9
13 FAN 10
14 FAN 11
15 FAN 12

MACROPLUS KEYPAD

ON BUTTON ON — places MACROPLUS in an operative status, leaving the stand-by status in which it normally is after power has been given. If pressed after a condition of POWER OFF (before power is restored), the machine re-starts automatically only if the AUTOSTART procedure has been previously selected.

OFF BUTTON OFF — It brings MACROPLUS back to a stand-by status.
However, it is still possible to read the masks tree, to change the working parameters and read the probes values.

MENU BUTTON MENU — It allows you to come back immediately to the main mask (mask MENU).
The MENU mask is a reference mask, useful to enter various working fields.

CLEAR BUTTON CLEAR — It allows you to silence the alarm buzzer and to reset any alarm condition (erasure of the stored 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 is kept stored (see "AL" message). After you have removed the cause of the alarm, press CLEAR a second time and all alarm messages will be cancelled.
WARNING: Once turned OFF, the buzzer will sound again whenever an alarm condition DIFFERENT from the previous one should arise.
Press simultaneously the 'CLEAR' and 'LEFT' Buttons to modify the display contrast (the chosen contrast is stored and returns even in case of power failure).

ALARM BUTTON ALARM — It allows you to display any alarm message. Should more than one alarm go off, the alarm masks can be displayed in sequence, by using the ▲ and ▼ Buttons.

ENTER BUTTON ENTER — It allows you to confirm the parameters during the selection phase.
Position the cursor on the mask whose value has to be selected 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 variable overshoots the allowable range, the buzzer will briefly sound.
In case of binary parameter (yes/no, present/absent, etc.), when ENTER is pressed the cursor always positions itself on the data to be modified. Modify it by acting on the ▲ and ▼ Buttons.

△ BUTTON ▲ — It allows you to move upwards in the messages trees (both the main and the alarm tree).
When you select a numeric variable, the ▲ Button increases the value on which the cursor is positioned (see ENTER Button).

▽ BUTTON ▼ — It allows you to move downwards in the messages trees (both the main and the alarm tree).
When a numeric variable is being selected, the ▼ Button decreases the value of the parameter on which the cursor is positioned (see ENTER Button).

BUTTON RIGHT — It allows you to move to the right in the messages tree and to display the masks present at a level lower than the active one. When a numeric variable is being selected, the RIGHT Button moves to the right the cursor indicating the value to be modified.

BUTTON LEFT — It allows you to move the cursor to the left in the messages tree and to come back to the masks present on a higher level than the active one.
When a numeric variable is being selected, the LEFT Button moves to the left the cursor indicating the value to be modified.
NOTICE that the simultaneous pressure of the 'CLEAR' and 'LEFT' Buttons allws you to change the display contrast (it is stored even in case of power failure).

HOW TO TURN ON/OFF THE MACHINE

HOW TO TURN ON THE CHILLER

The unit is turned ON when all the following conditions are true:
- the ON button was pressed
- the unit is enabled by supervisor
- the unit is enabled by time zones (if selected).
- the unit is enabled by digital input

The first device to be started is the MOTOR-DRIVEN pump. Then, if necessary, Macroplus will decide whether to start the compressors or not.

******* WARNING *******
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 POSITION.

******* WARNING *******
IT IS ALSO POSSIBLE TO ENABLE THE AUTOSTART FUNCTION. IN THIS WAY THE MACHINE WILL AUTOMATICALLY RE-START AFTER A POWER OFF CONDITION.

HOW TO TURN OFF THE CHILLER

The unit is turned OFF when one or more of the following conditions are false:
- the ON button was pressed
- the unit is enabled by supervisor
- the unit is enabled by time zones (if selected).
- the unit is enabled by digital input

When the unit is turned OFF, all devices connected to MACROPLUS are disenergized, in particular the compressors. Please keep in mind that if you have selected the PUMPDOWN procedure, the compressors execute it before being turned OFF.
The motor-driven pump disenergizes on the basis of a selectable delay (0:999 sec., default 20 s); this delay ensures the water flow in the EVAPORATORS during the PUMP-DOWN cycle.

SELECTION OF THE FUNCTIONING MODE

The functioning mode of the unit can be selected via the digital input n. 30.

Open contact:	SUMMER functioning mode (CHILLER)
Closed contact:	WINTER functioning mode (HEATING PUMP)

REGULATION OF WATER TEMPERATURE

The regulation of the water temperature is ususally (default) based on the values picked up by the INLET WATER TEMPERATURE PROBE. However, by acting on the CUSTOMER PASSWORD (via dedicated mask) you can regulate the water temperature on the basis of the value picked up by the WATER TEMPERATURE PROBE AT THE EVAPORATOR OUTLET.

CONTROL TYPE

The User can select the following control functioning modes:

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

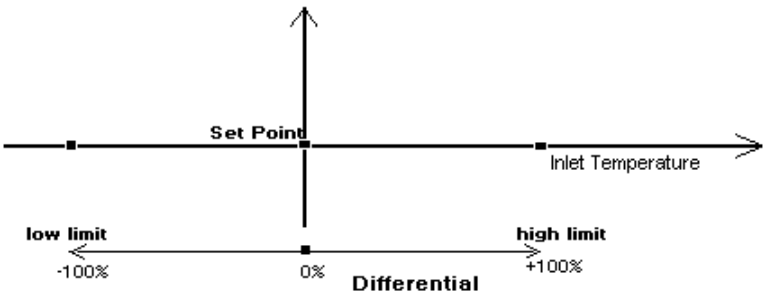
PROPORTIONAL CONTROL:
After having selected the SET-POINT value, the controller will reach such a working condition in a proportional way - eg. proportionally to the distance of the set-point to be reached (ideal working condition).
The proportional zone is to be selected near the SET-POINT. The controller will therefore increase the action of each single device gradually, instructing the devices to work at a different capacity (in relation to the position in the regulation zone with respect to the set-point) to reach the set-point value and reducing their work as the distance to the set-point lessens (the controller action is minimum in proximity to the set-point value).

PROPORTIONAL + INTEGRAL CONTROL:
Besides the action described above, the proportional+integral control acts on the basis of the difference between the selected temperature (SET-POINT) and the temperature value read by the probe.

There are two different set-points: one for the 'SUMMER' functioning mode, the other for the 'WINTER' mode. Their values - in relation to the chosen functioning mode - will appear in the masks allowing the selection of the set-point itself and its limits (The same happens for the management of the values concerning the high/low temperature thresholds at water inlet/outlet)

SET-POINT AND DIFFERENTIAL

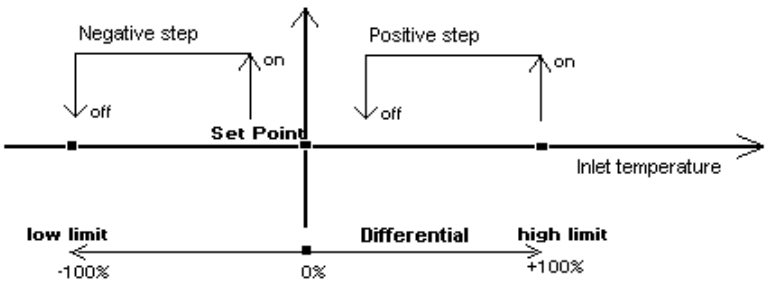
SET-POINT ==> selectable in ºC: Ideal working condition
PROPORTIONAL ZONE ==> selectable in ºC: Indicates the operating zone/field of the controller



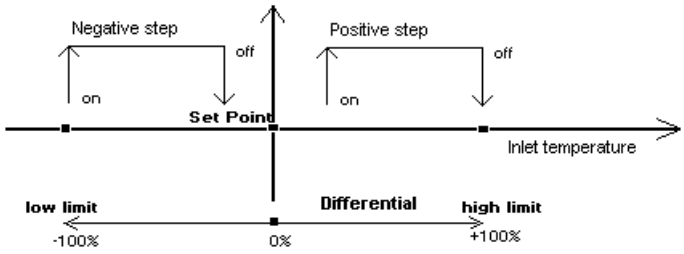
In the application shown in the diagram the set-point can be defined as the **CENTRAL** point of the regulation zone.

STEPS POSITION

EXAMPLE OF STEPS POSITION (**Summer** functioning mode)



EXAMPLE OF STEPS POSITION (**Winter** functioning mode)



ON ===> STEP ON (active)
OFF ===> STEP OFF (disactive)

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

- **SET-POINT** of the step itself (% 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 machine to be controlled, eg a CHILLER or a HEAT PUMP.
The number of steps necessary to activate the various devices depends on:

- number of compressors;
- number of partializations.

The table below shows the relation among the different types of chillers, compressors and number of steps.

CHILLER TYPE	**number of COMP.**	**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 steps number means no partializations at all, viceversa the maximum number of steps corresponds to the activation of all partializations relative to each compressor.
In the **'SUMMER'** functioning mode the steps activate when the temperature rises and disactivate when the temperature decreases.
In the **'WINTER'** functioning mode, the steps activate when the temperature decreases and disactivate when it rises.

The consequence of their action consists in the variation of the working point of the machine: it is moved to the left ('SUMMER' functioning mode) or to the right ('WINTER' functioning mode) in order to reach the ideal working condition of the chiller (SET-POINT).

The Manufacturer can avail himself of a series of masks where it will be possible to select a different SET-POINT and DIFFERENTIAL for each step so as to generate:

- DEAD ZONES near the SETPOINT
- or OVERLAPPING STEPS, to start more than one compressor simultaneously.

STANDARD STEPS POSITION

During the initialization phase - after having cleared the 'back up memory' - a mask will appear requiring the User to specify the SORT of machine that MACROPLUS has to control.
On the basis of the machine selected - with 1, 2, 3, 4 compressors - Macroplus will automatically set a series of factory-set values.

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

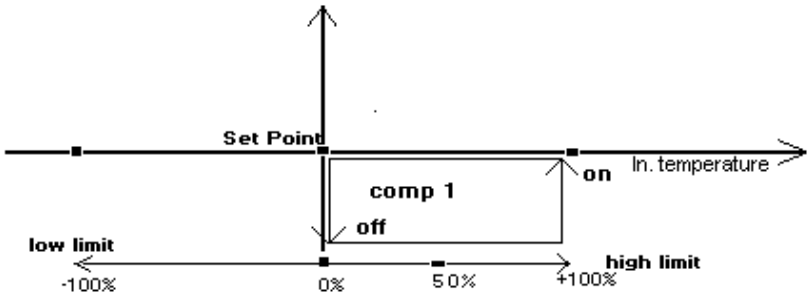
The STANDARD cooling steps for the activation of the compressors and relative to the temperature probe values (inlet or outlet water) are positioned in sequence and will cover the entire POSITIVE REGULATION ZONE (from the SET-POINT up to the HIGH LIMIT). All the steps will have the SAME DIFFERENTIAL.

The ideal working condition (SET-POINT) implies no activation at all of the cooling steps.

REGULATION

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

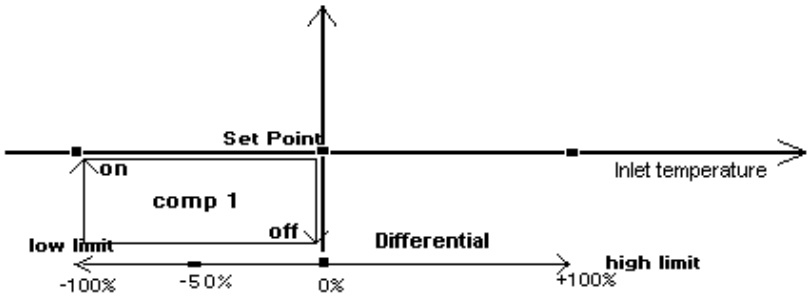
'SUMMER' FUNCTIONING MODE



COMP1set-point	50%
differential	50%

The % values refer tot the selected regulation zone.

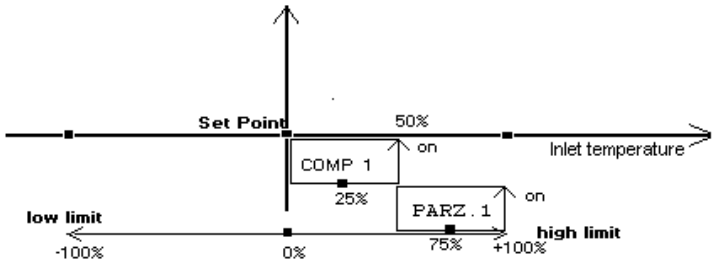
'WINTER' FUNCTIONING MODE



COMP1set-point	- 50%
differential	50%

The % values refer to the selected regulation zone.

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

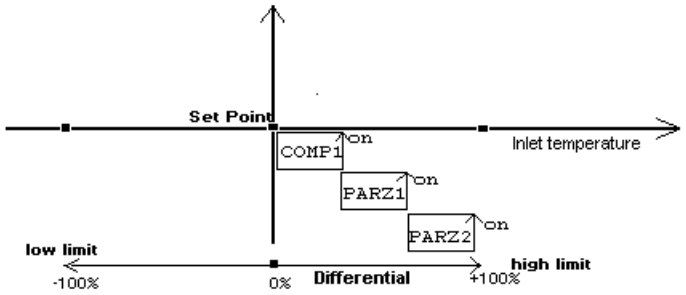


COMP1	set-point	25%
	differential	25%
PART1	set-point	75%
	differential	25%

The % values refer to the selected regulation zone.

N.B.:The above example concerns the refrigeration functioning mode ('SUMMER'). In the heating functioning mode ('WINTER') the steps are positioned specularly with respect to the set-point (see page 15).

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

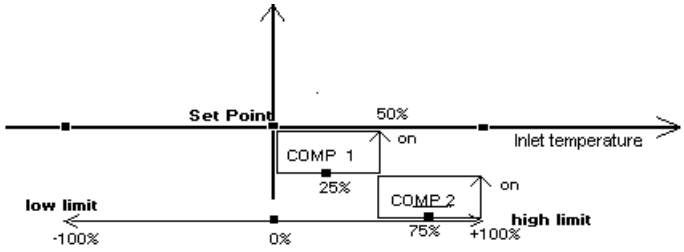


COMP1	se-tpoint	17.0 %
	differential	16.0 %
PART1	set-point	50.0 %
	differential	16.0 %
PART2	set-point	83.0 %
	differential	16.0 %

The % values refer to the selected regulation zone.

N.B.:The above example concerns the refrigeration functioning mode ('SUMMER'). In the heating functioning mode ('WINTER') the steps are positioned specularly with respect to the set-point (see page 15).

EXAMPLE OF STANDARD SELECTION FOR TWO-COMPRESSOR CHILLERS WITH NO PARTIALIZATION

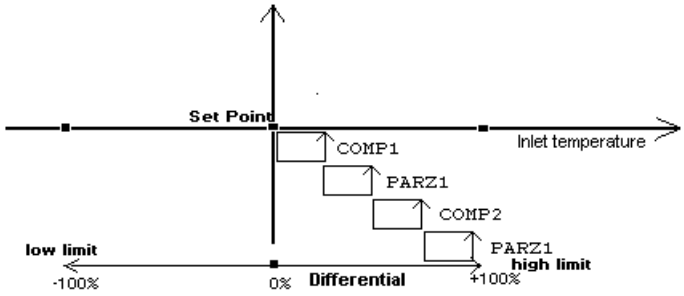


COMP1	set-point	25%
	differential	25%
COMP2	set-point	75%
	differetial	25%

The % values refer to the selected regulation zone.

N.B.:The above example concerns the refrigeration functioning mode ('SUMMER'). In the heating functioning mode ('WINTER') the steps are positioned specularly with respect to the set-point (see page 15).

EXAMPLE OF STANDARD SELECTION FOR TWO-COMPRESSOR CHILLERS WITH 1 PARTIALIZATION PER COMPRESSOR



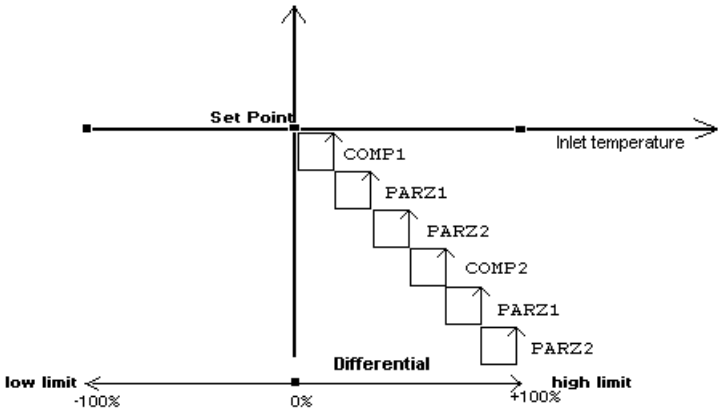
COMP1	set-point	13.0 %
	differential	12.0 %
PART1	set-point	38.0 %

	differential	12.0 %
COMP2	set-point	62.0 %
	differential	12.0 %
PART1	set-point	86.0 %
	differential	12.0 %

The % values refer to the selected regulation zone.

N.B.:The above example concerns the refrigeration functioning mode ('SUMMER'). In the heating functioning mode ('WINTER') the steps are positioned specularly with respect to the set-point (see page 15).

EXAMPLE OF STANDARD SELECTION FOR TWO-COMPRESSOR CHILLERS WITH 2 PARTIALIZATIONS PER COMPRESSOR

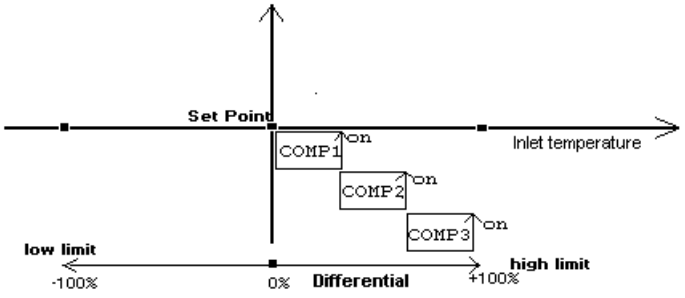


COMP1	set-point	8.0 %
	differential	8.0 %
PART1	set-point	24.0 %
	differential	8.0 %
PART2	set-point	40.0 %
	differential	8.0 %
COMP2	set-point	56.0 %
	differential	8.0 %
PART1	set-point	72.0 %
	differential	8.0 %
PART2	set-point	88.0 %
	differential	8.0 %

The % values refer to the selected regualtion zone.

N.B.:The above example concerns the refrigeration functioning mode ('SUMMER'). In the heating functioning mode ('WINTER') the steps are positioned specularly with respect to the set-point (see page 15).

EXAMPLE OF STANDARD SELECTION FOR THREE-COMPRESSOR CHILLERS WITH NO PARTIALIZATION.



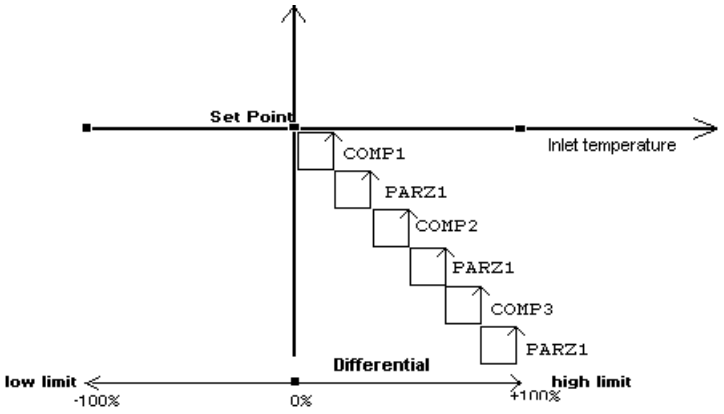
COMP1	set-point	17.0 %
	differential	16.0 %
COMP2	set-point	50.0 %

	differential	16.0 %
COMP3	set-point	83.0 %
	differential	16.0 %

The % values refer to the selected regulation zone.

N.B. The above example concerns the refrigeration functioning mode ('SUMMER'). In the heating functioning mode ('WINTER') the steps are positioned specularly with respect to the set-point (see page 15).

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

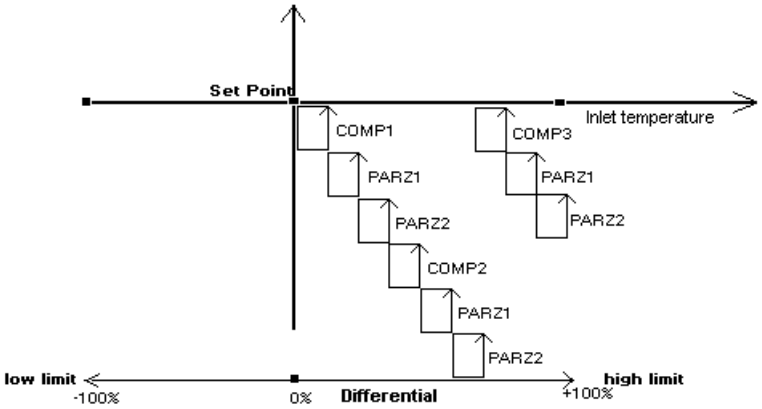


COMP1	set-point	8.0 %
	differential	8.0 %
PART1	set-point	24.0 %
	differential	8.0 %
COMP2	set-point	40.0 %
	differential	8.0 %
PART1	set-point	56.0 %
	differential	8.0 %
COMP3	set-point	72.0 %
	differential	8.0 %
PART1	set-point	88.0 %
	differential	8.0 %

The % values refer to the selected regulation zone.

N.B.:The above example concerns the refrigeration functioning mode ('SUMMER'). In the heating functioning mode ('WINTER') the steps are positioned specularly with respect to the set-point (see page 15).

EXAMPLE OF STANDARD SELECTION FOR THREE-COMPRESSOR CHILLERS WITH TWO PARTIALIZATIONS PER COMPRESSOR.



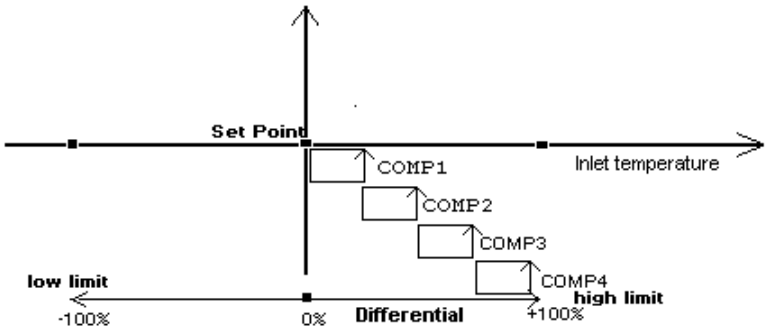
COMP1	set-point	6.0 %
	differential	5.0 %
PART1	set-point	18.0 %

	differential	5.0 %
PART2	set-point	30.0 %
	differential	5.0 %
COMP2	set-point	42.0 %
	differential	5.0 %
PART1	set-point	54.0 %
	differential	5.0 %
PART2	set-point	66.0 %
	differential	5.0 %
COMP3	set-point	78.0 %
	differential	5.0 %
PART1	set-point	90.0 %
	differential	5.0 %
PART2	set-point	94.0 %
	differential	5.0 %

The % values refer to the selected regulation zone.

N.B.:The above example concerns the refrigeration functioning mode ('SUMMER'). In the heating functioning mode ('WINTER') the steps are positioned specularly with respect to the set-point (see page 15).

EXAMPLE OF STANDARD SELECTION FOR 4-COMPRESSOR CHILLERS WITH NO PARTIALIZATION

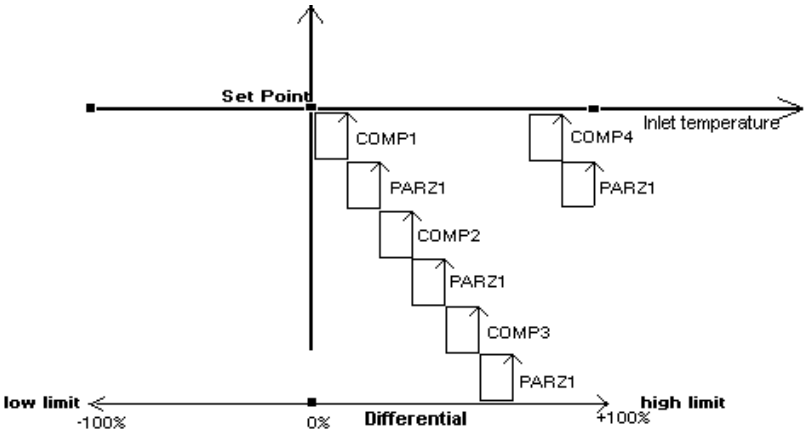


COMP1	set-point	13.0 %
	differential	12.0 %
COMP2	set-point	38.0 %
	differential	12.0 %
COMP3	set-point	62.0 %
	differential	12.0 %
COMP4	set-point	86.0 %
	differential	12.0 %

The % values refer to the selected regulation zone.

N.B.:The above example concerns the refrigeration functioning mode ('SUMMER'). In the heating functioning mode ('WINTER') the steps are positioned specularly with respect to the set-point (see page 15).

EXAMPLE OF STANDARD SELECTION FOR 4-COMPRESSOR CHILLERS WITH 1 PARTIALIZATION PER COMPRESSOR

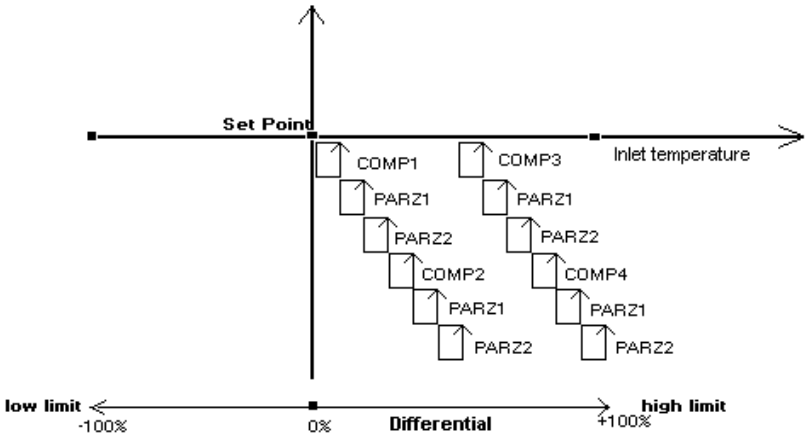


COMP1	set-point	6.0 %
	differential	6.0 %
PART1	set-point	18.0 %
	differential	6.0 %
COMP2	set-point	30.0 %
	differential	6.0 %
PART1	set-point	42.0 %
	differential	6.0 %
COMP3	set-point	54.0 %
	differential	6.0 %
PART1	setpoint	66.0 %
	differenziale	6.0 %
COMP4	set-oint	78.0 %
	differential	6.0 %
PART1	set-point	92.0 %
	differential	6.0 %

The % values refer to the selected regulation zone.

N.B.:The above example concerns the refrigeration functioning mode ('SUMMER'). In the heating functioning mode ('WINTER') the steps are positioned specularly with respect to the set-point (see page 15).

EXAMPLE OF STANDARD SELECTION FOR 4-COMPRESSOR CHILLERS WITH 2 PARTIALIZATIONS PER COMPRESSOR



COMP1	set-point	4.0 %
	differential	4.0 %
PART1	set-point	12.0 %

	differential	4.0 %
PART2	set-point	20.0 %
	differential	4.0 %
COMP2	set-point	28.0 %
	differential	4.0 %
PART1	set-point	36.0 %
	differential	4.0 %
PART2	set-point	44.0 %
	differential	4.0 %
COMP3	setpoint	52.0 %
	differential	4.0 %
PART1	set-point	60.0 %
	differenziale	4.0 %
PART2	set-point	68.0 %
	differential	4.0 %
COMP4	set-point	76.0 %
	differential	4.0 %
PART1	set-point	84.0 %
	differential	4.0 %
PART2	set-point	95.0 %
	differential	4.0 %

The % values refer to the selected regulatio zone.

N.B.:The above example concerns the refrigeration functioning mode ('SUMMER'). In the heating functioning mode ('WINTER') the steps are positioned specularly with respect to the set-point (see page 15).

FREECOOLING

The FREECOOLING functioning ensures the production of cold water with a low energy consumption since the water is cooled by the low ambient temperature.
For this purpose the water is contained in a finned pack exchanger placed near the condenser and it is cooled by the condenser fans. The water flows within the circuit through a 3-way valve.

The freecooling functioning can be selected via dedicated mask (MANUFACTURER PASSWORD).

The necessary devices are:

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

The freecooling procedure starts whenever:

temp. probe at machine inlet-external temperature > DELTA Temp.

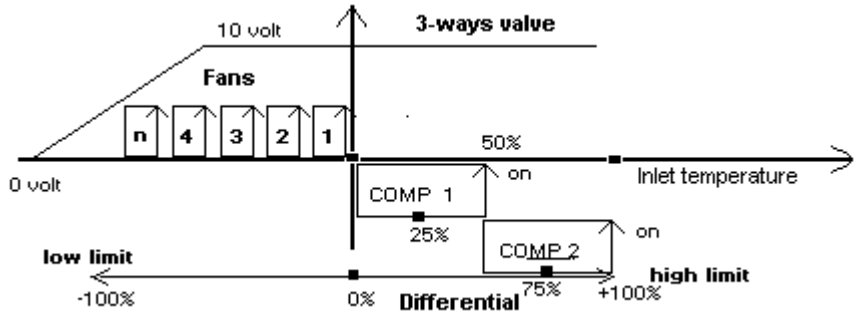
The '**DELTA Temperature**' value can be selected by the User through dedicated mask (MANUFACTURER PASSWORD) (default 2^C, range 1_20^C).

During the FREECOOLING procedure the normally closed 3-way valve begins to mix the cold water in the freecooling exchanger with the inlet evaporator water in order to reach the SET-POINT temperature value. This occurs by running the minimum number 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.

REGULATION DIAGRAM: CHILLER + FREECOOLING

(Machine with 2 alternative compressors)



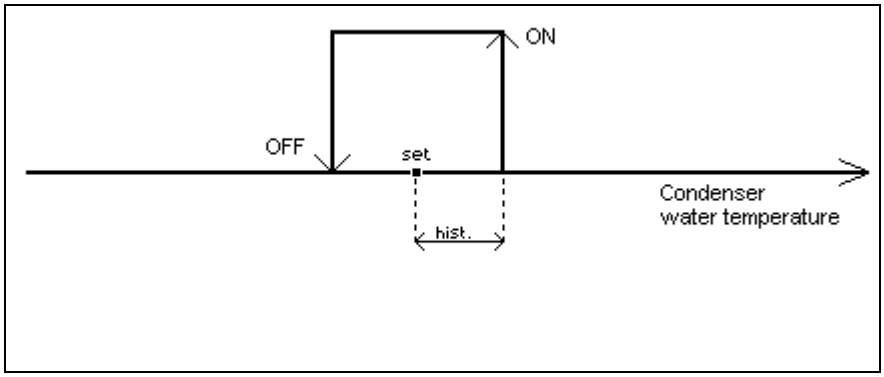
SELECTABLE PARAMETERS:

- SET-POINT WHEN THE FREECOOLING VALVE BEGINS TO OPEN (in ^C)
- SET-POINT WHEN THE FREECOOLING VALVE IS COMPLETELY OPEN (in ^C)
- FANS TEMPERATURE AT STARTING/STOP (^C) BASED ON THE WATER PROBE AT EVAPORATOR INLET

When the freecooling function has been selected, the condenser fans will be energized according to a step control action that acts through the WATER TEMPERATURE PROBE at the chiller inlet or when at least one compressor is working.

HEAT RECOVER

This function allows you to use the heating produced by the hot gas in the condenser.
The heat recovery function is based on the temperature of the condenser water (analogue input n. 8) as well as on the following set-point and hysteresis:



When the step is ON (active) the digital output n. 21 energizes.
The heat recovery function is enabled through the mask "CONF_MACHINE8".

MOTOR-DRIVEN PUMPS

NORMAL FUNCTIONING

The MOTOR-DRIVEN PUMP is the first device to be started after the chiller has been started. The motor-driven pump functioning has absolute priority on all the other devices. Should an alarm condition block the pumps, the chiller is forced into a STAND-BY condition. Therefore the compressors will carry out the PUMP-DOWN procedure (if previously selected), then will be turned OFF.

Should the water temperature go below the safety values (during the pump-down procedure) and the pump be OFF, the relative ANTIFREEZE THERMOSTAT will force the compressors to stop even if they have not completed the pump-down procedure.

The motor-driven pumps work on the basis of the following logic:

1) CONDITIONING LOGIC
2) REFRIGERATION LOGIC

CONDITIONING: THE MOTOR-DRIVEN PUMPS ACT ON THE BASIS OF THE MACHINE STATUS: IF THE MACHINE IS 'ON' THE PUMPS ARE 'ON', IF THEY ARE 'OFF' ALSO THE PUMPS WILL BE TURNED OFF (IN THIS CASE THERE IS A DELAY SELECTABLE BY THE USER).

REFRIGERATION: THE MOTOR-DRIVEN PUMPS CARRY OUT THE FOLLOWING ALGORITHM:

- THE PUMP THAT IS CURRENTLY WORKING CAN BE STOPPED WHEN THE SET-POINT OF THE WATER TEMPERATURE PROBE HAS BEEN REACHED (compressors OFF)
- ALTHOUGH OFF, THE PUMP CAN BE FORCED TO TURN ON BY ACTING ON THE DIGITAL INPUT N. 31 WITH THE FOLLOWING LOGIC:

- when input 31 is "OPEN", THEN THE PUMP WILL TURN ON
- when input 31 is "CLOSED", THEN THE PUMP WILL BE KEPT OFF

However, the pump turns ON when one compressor is turned ON.
If the temperature set-point is reached but the input n. 31 is open, the pump goes on working. The delay before the OFF routine of the pump is always carried out (both in the refrigeration and conditioning functioning modes).

For safety reasons, there are 2 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 started by the rotation procedure or in case the first pump does not work correctly (alarm condition).

*** ALARMS ***

The alarms that can block the pump are:
- motor-driven pump OVERLOAD
ACTION: the pump is immediately stopped
Manual reset is required.

- WATER FLOW DETECTOR
This alarm is ignored at the starting of each pump for a selectable 'T' time (RANGE 1_300 sec. default 10 sec.)
ACTION: the pump currently working is stopped and the stand-by pump is started.
Manual reset is required.

ROTATION OF THE MOTOR-DRIVEN PUMPS

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

FUNCTIONING LOGIC:

- Select an hours threshold. When it is reached, the rotation procedure will start (hours threshold: RANGE 1_5000 h default 8 h)

- When a pump reaches the selected hours threshold, MACROPLUS instructs the stand-by pump to start.

- After having reached its maximum threshold, the pump stops after a selectable time (RANGE 0_9999 sec - default 30 sec) so as to avoid any lack of water flow.

In case of pump alarm, Macroplus forces the pumps rotation by starting the stand-by pump and stopping the first one immediately.

NOTE: If the machine controlled by Macroplus has no pumps at all, it is necessary to bridge all the alarm inputs concerning the pumps. In this way only the compressors will be managed.

COMPRESSORS

Macroplus can manage from 1 up to 4 alternative compressors.

The number of partializations per compressor is selected by the Manufacturer, depending on the type of chiller (through mask protected by Manufacturer password). Macroplus can manage three different compressors configurations:

1 - compressor with no partialization
2 - compressor with 1 partialization step:
- capacity= 50% at compressor starting WIN. "A","B"
- capacity= 100% when the partialization solenoid is activated.

3 - compressor with 2 partialization steps:
- capacity= 33% at compressor starting WIN "A","B"
- capacity= 66% when the first partialization solenoid is activated.
- capacity= 100% when the second partialization solenoid is activated

HOW TO TURN THE COMPRESSORS ON (capacity-controlled and full capacity compressors)

When the compressor is started, its contactor will energize

Here is the procedure necessary to turn ON a compressor (both capacity-controlled and full capacity compressors) in relation to the **WATER TEMPERATURE** value:

- the water temperature control requires the compressor starting;
- the SOLENOID is energized;
- the compressor is started with the PART WINDING procedure.

PART WINDING

The compressors are equipped with 2 windings (a - b); they can be started in the following way:

1 - request for compressor ON: the output of contactor winding "a" of the same compressor energizes;
2 - wait for about **1 second** (+ o - 0.1 sec);
3 - the winding "b" of the same compressor activates.

To turn the compressor OFF, disenergize windings "a" and "b" simultaneously.

If the PART WINDING procedure is not used to turn ON the compressors, the switch of the compressor will be managed by the digital output **WINDING "A"** of each single compressor.

TIMED ON/OFF ROUTINES (CAPACITY-CONTROLLED COMPRESSORS)

The compressors can follow these timed 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 routines of a compressor and the ON routines of the successive; this is meant to save energy.
   RANGE 1:9999 sec. DEFAULT 10 sec.
3) minimum time compressor ON.
   RANGE 1:9999 sec. DEFAULT 60 sec.
4) min. time between the starting of two PARTIALIZATION steps.
   RANGE 0:100 sec. DEFAULT 10 sec.
5) minimum time OFF routine.
   RANGE 1:9999 sec. DEFAULT 180 sec.

COMPRESSORS ROTATION

The automatic rotation of the compressors depends on the machine model and its logic is of a **F.I.F.O.** (first in first out) type.
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 START/STOP routines.

LOGIC:

- The compressor that has been OFF for the longest time will be the first to be turned ON
- The first compressor that turns ON will be the first to turn OFF
- The compressor will turn ON again only after all the other compressors have turned ON (since its last ON routine).

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

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

To select the rotation procedure act on the dedicated mask ("Manufacturer" password). If you want to disenable the rotation, the compressors will turn ON in sequence: THE LAST TO TURN ON WILL BE THE FIRST TO TURN OFF.

PUMP-DOWN PROCEDURE

The PUMP-DONW procedure can be selected through dedicated mask ('MANUFACTURER' password). **DEFAULT= PROCEDURE DISENABLED**.
The pump-down procedure starts either when the compressor has to be stopped or - in case of capacity-controlled compressors - when the last partialization step is turned 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 and intercepts the circuit.
b) The compressor goes on working until the pressure (LOW PRESSURE ZONE) requires the intervention of the LOW PRESSURE PRESSOSTAT (open contact at Macroplus input)
c) When the low pressure indicated by the low pressure pressostat has been reached, the compressor turns OFF and the PUMP-DOWN procedure is over.

Should the compressor go on working for more than 50 s without reaching the low pressure condition, Macroplus forces the compressor to turn OFF and indicates a faulty pump-down procedure.
In this case check LIQUID SOLENOID and LOW PRESSURE PRESSOSTAT'.

N.B. the pump-down procedure is disabled when the compressor is turned OFF in the reverse cycle phase (defrost).

COMPRESSORS HOURS METER

Macroplus can display - through a series of masks defined as 'synoptic' - the working hours of the compressors.
The management of the 'COMPRESSORS HOURS METER' allows the user to:

- ZERO DOWN EACH SINGLE HOURS METER
- SELECT THE MAX. HOURS THRESHOLD FOR THE COMPRESSOR.
  WHEN THIS THRESHOLD IS OVERSHOT, THERE WILL BE AN ALARM MESSAGE.

EXAMPLE:

'MAINTENANCE OF THE REFRIGERATION UNIT':
THIS TYPE OF 'ALARM' 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.

The management of the hours meter is achieved through dedicated masks ('CUSTOMER' password).

PARTIALIZATIONS

The possibility of controlling the CAPACITY of each compressor reduces the startings per hour 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 indicated with the value 90.0% both for the set-point and the hysteresis.

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

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

SOLENOID VALVES FOR CYCLE REVERSE

The solenoid valves for the cycle reverse follow this logic:

'SUMMER' functioning mode:	the solenoid valves are always disenergized
'WINTER' functioning mode:	the solenoid valves are always energized, except when the machine is OFF and during the defrost phase.

DEFROST

The desfrost is a necessary procedure for the good functioning of the evaporator.
The parameters necessary to manage the defrost procedure are:

- **Defrost temperature:** It indicates the ambient temperature threshold (A.IN.#3) below which the circuit defrost is enabled. This parameter is selected in the mask 'CONF_MACHINE9'. (RANGE /:/, DEFAULT 2.0 °C)
- **Simultaneous defrostings**: The defrost procedures start simultaneously. This value is selected in the mask 'CONF_MACHINE10'.. (DEFAULT NO)
- **Time between successive defrost cycles**: It indicates the time-delay before the defrost of the first circuit (see defrost temperature). It also indicates the minimum time between two successive defrost cycles of the first circuit. Select this value in the mask 'CONF_MACHINE10'. (RANGE 0:9999, DEFAULT 600s)
- **Maximum defrost time**: It indicates the maximum time during which the compressor can tolerate the defrost procedure in case the defrost is not interrupted by the end-defrost signal.
When the maximum defrost time has elapsed, no alarm is generated if the procedure is interrupted. Select this value in the mask 'CONF_MACHINE10' (RANGE 0:9999, DEFAULT 300s)
- **Time between two defrost cycles**: It indicates the minimum time between the end of the defrost of a circuit and the beginning if the defrost of the following circuit. This parameter has no use in case of simultaneous defrostings. Select this value in the mask 'CONF_MACHINE10' (RANGE 0:9999, DEFAULT 300s)

Defrost procedure for each circuit (not-simultaneous defrost):
1) When there is a defrost request, the compressor, the liquid solenoid, the fans stop and the reverse cycle solenoid valve disenergizes. **There is no pump-down procedure**.
2) After about 10s the liquid solenoid valve energizes and the compressor starts again.
3) The compressor stops (with no pump-down procedure) and the liquid solenoid valve disenergizes when the end-defrost signal is generated or when the maximum defrost time has elapsed. Then the cycle reverse solenoid valve will be energized.
4) After 10s the liquid solenoid valve energizes and the compressor and the fans start again.
5) The defrost of the successive circuit is carried out when the time between two defrostings has elapsed.
If a circuit has to undergo the defrost cycle but the relative compressor is OFF, the defrost action will affect the successive circuit.
If a circuit has to undergo the defrost procedure but the end-defrost signal has already been generated, the defrost action will affect the successive circuit (after the time between two defrostings has elapsed).

Defrost procedure for each circuit (simultaneous defrost):
1) When there is a defrost request, all the compressors, the liquid solenoids, the fans stop and the reverse cycle solenoid valves disenergize. **There is no pump-down procedure**.
2) After about 10s the liquid solenoid valve energizes and the compressors start again.
3) The single compressor stops (with no pump-down procedure) and the liquid solenoid valve disenergizes when the end-defrost signal is generated or when the maximum defrost time has elapsed.
4) When all circuits end the defrost procedure the cycle reverse solenoid valves will be energized
5) After 10s the liquid solenoid valve energizes and the compressors and the fans starts again.
If the defrost is simultaneous all the cycle reverse solenoid valves are energized when no circuit is defrosting, and all the cycle reverse solenoid valves are not energized when at least one circuit is defrosting.
During the defrost procedure the temperature control is suspended, so new compressors can't turned on or off.
Note: In the 'CONF_MACCHINA9' mask you can enable the putting out of the compressor for 10s at the beginning and at the and of the defrost procedure.
If during the defrost cycle the ambient air temperature > the defrost set-point, the current cycle is regularly carried out.

LOW PRESSURE PRESSOSTAT

LOGIC:

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

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

- the PUMP-DOWN procedure
- or as a LOW PRESSURE indication, when the compressor is normally
- working and the pressostat contact results to be OPEN.
- When the compressor is started, the pressostat's indications are ignored for a
- selectable time (0:900s, default 50s), to allow the compressor to
- reach its normal pressure conditions.

The 'LOW PRESSURE ALARM' is disabled during defrost.
There is a LOW PRESSURE PRESSOSTAT for each compressor circuit.

FANS

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

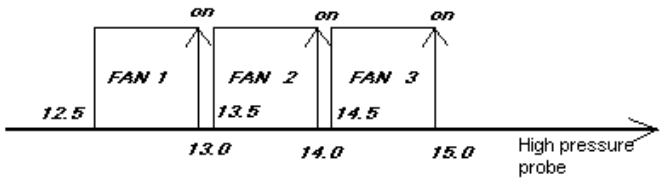
Through a series of masks, it is possible to select the set-points and differentials of each single fan step.

For example:

Fan 1		
System On	bar	The first fan of each
System Off	bar	circuit

******* **IMPORTANT** *******
IF THERE ARE LESS THAN 4 PROBES, THE FREE ANALOGUE INPUTS (FOR THE PRESSURE PROBES) MUST BE BRIDGED TO EARTH. THIS PREVENTS ANY FAULTY FUNCTIONING OF THE FANS.
IF NOT BRIDGED, MACROPLUS MIGHT GENERATE AN ALARM MESSAGE ('FAULTY PROBE').

FANS REGULATION DIAGRAM



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

FANS MANAGEMENT IN THE WINTER FUNCTIONING MODE (HEAT PUMP)

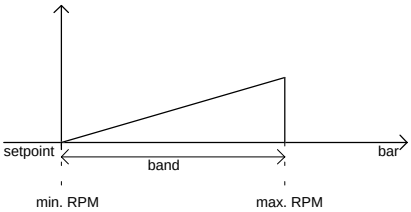
In the 'Winter' functioning mode the fans are forced to turn ON, except during the defrost cycle (when they are forced to turn OFF).

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 started on the basis of the temperature values read by the WATER probe at chiller inlet, or following the starting of at least one compressor.

NUMBER OF TURNS

Use the dedicated analogue output. The turns of a fan depends on the higher value of pressure. In the masks tree ('Manufacturer' password) it is possible to select the set-point and regulation zone as well as the pressure values affecting the min. and max. number of turns. During the 'WINTER' unit functioning the inverter is forced at 100%.
When almost a circuit is defrosting, the inverter is forced at 0%.



NOTE:
During the 'WINTER' unit functioning the inverter can be used only if the option 'SIMULTAN.DEFROST' is selected.

ANTIFREEZE PROCEDURE

The antifreeze procedure activates when the WATER ANTIFREEZE THERMOSTAT digital input 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 antifreeze alarm is displayed on the Macroplus' **LCD**.

***** WARNING *****
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.

The Lyquid 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

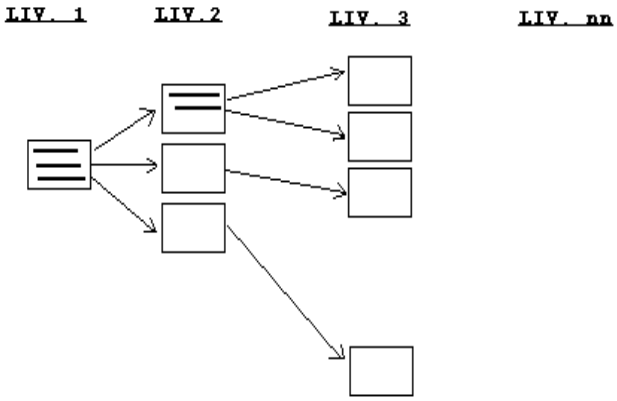
MASKS

The masks comprise a series of alphanumeric strings on a DISPLAY (4x20).
All the displayed messages are stored in a database (in the eprom), so as to create a set of information meant to:

- help the User
- inform the User in case of alarm conditions
- that might damage the functioning of the entire machine.

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

Example:



SEE THE ENCLOSED SHEETS FOR THE GENERAL TREE STRUCTURE.

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 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).
Time and date can be regulated through a dedicated series of masks.

WEEKLY TIME-BANDS

This is an optional kind of control whose action depends on the presence of the clock board.

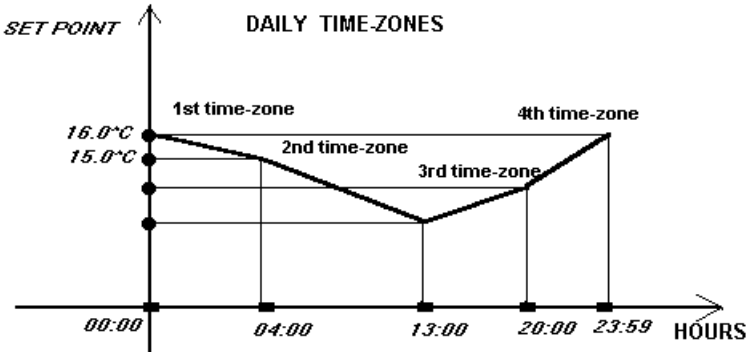
In brief, it is possible to turn ON / OFF the machine weekly:

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 for the SET-POINT. It is enough to select:

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



MANUAL MANAGEMENT OF THE DEVICES

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

This procedure, called 'manual' is indicated in the masks identified by the 'MANUAL PROCEDURE' message (see ch. 11e).

The manual procedure is useful to:

- TEST THE CONNECTIONS OF THE ELECTRICAL PANEL
- THE CONTROL BYPASS
- CHECK THE CORRECT FUNCTIONING OF ALL DEVICES

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

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

INDICATION OF MACHINE STATUS

Any machine status is displayed in the synoptic masks and in 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 picked up by the probes.
All the outputs will be in an OFF status: the relays will be disenergized and the analogue outputs at 0 volt.
This condition occurs any time you press the OFF Button or when you turn Macroplus ON the first time.

"MACHINE ON"

It indicates that Macroplus has been powered and is therefore capable of controlling the connected devices.
This status is active when all the following conditions are true:
- the ON button was pressed
- the unit is enabled by supervisor
- the unit is enabled by time zones (if selected).
- the unit is enabled by digital input

"MANUAL PROCEDURE"

This message indicates that the unit is in the 'manual' procedure.

"TIME-BANDS OFF"
This message indicates that the unit is OFF due to the time zones.

"OFF BY SUPERVISOR"
This message indicates that the unit is OFF by supervisor.

"OFF BY EXT.ON/OFF'
This message indicates that the unit is OFF by the external ON/OFF (digital input)

" AL "---> *** WARNING: ALARM CONDITION ****
This indication is displayed on the last two fields of the first row.

THIS MESSAGE INDICATES A FAULTY/ANOMALOUS WORKING CONDITION AND WILL THEREFORE BE DISPLAYED - IN CASE OF ALARM - ON EACH SINGLE MASK.

ALARMS

Should Macroplus detect a faulty working condition, the User will be immediately informed by the BUZZER. It 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 acknowledge the type of alarm through the dedicated indication masks.

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 devices.

TYPE OF ALARM	ACTION
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 disenegizes. MANUAL RESET.
HIGH PRESSURE PRESSOSTAT	The compressor corresponding to the gas circuit under the alarm condition, stops with no PUMP-DOWN procedure. The relative liquid solenoid valve disenergizes. MANUAL RESET
LOW PRESSURE PRESSOSTAT	Generated when the compressor is working and the PUMP-DOWN pressostat indicates an open contact. There is a 'T' delay at the compressor starting. (0:900s, default = 40s) 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. The alarm is not detected during the defrost. MANUAL RESET.
OIL DIFFERENTIAL PRESSURE OF THE COMPRESSOR	The circuit relative to the compressor under alarm is blocked. There is a selectable 'T' delay (1:1500s, default 120s). 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 pressostat has not intervened within 50s, as required by the procedure. The corresponding solenoid valve disenergizes.
COMPRESSORS 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 is turned OFF. MANUAL RESET.
FLOW DETECTOR	This alarm blocks the pump and makes the 'stand-by' pump start. If both the motor-driven flow detectors intervene, the entire machine turns OFF. This alarm is ignored at the chiller starting for a selectable time (T) (selectable range: 0:300s, default=10s). When the chiller is normally working, the alarm is delayed for a selectable time 'T2' (0:900sec., default 3sec). MANUAL RESET.
ANTIFREEZE	This alarm blocks the compressors. Therefore there is no PUMP-DOWN procedure. MANUAL RESET.
FANS OVERLOAD	The relative fan is immediately stopped. MANUAL RESET.
EXTERNAL INTERBLOCK	This alarm turns OFF the machine. MANUAL RESET.

N.B: There are TWO different values for the high/low temperature thresholds for water inlet/outlet: one used during the 'Summer', the other in the 'Winter' functioning mode. The masks will display the threshold value relative to the selected functioning mode. The same logic for the set-points and their limits.

LOW TEMPERATURE ALARM AT OUTLET (only in the 'Summer' functioning mode)	This alarm is generated when the outlet temperature is lower than the selected value (def. 3 ºC). The compressors stop and there is no PUMP-DOWN procedure (see antifreeze). MANUAL RESET
HIGH TEMPERATURE ALARM AT OUTLET	This alarm is generated when the outlet temperature goes above the selected value (def. 55.0 ºC). (only in the 'Winter' functioning mode)
INDICATION INLET HIGH TEMPERATURE	This alarm indication appears when the internal temperature goes above the selected threshold (5:60 ºC, default 25.0 ºC in the 'Summer' mode, default 50 ºC in the 'Winter' mode). In the 'Summer' functioning mode there is a selectable delay (def. 30 min) . In the 'Winter' mode, the alarm indication is immediate.
INDICATION INLET LOW TEMPERATURE	This alarm indication appears when the inlet temperature goes below the selected value (def. 10.0 ºC in the 'Summer' mode, default 15.0 ºC in the 'Winter' mode). This indication is delayed for a selectable time during the 'Winter' functioning mode (def.30 min) but is immediate in the 'Summer' mode.
HIGH PRESSURE INDICATION	This alarm is generated when the circuit pressure is higher than the selected value (def. 24 bar). The indication concerns the circuit undergoing the high pressure condition.
FAULTY OR DISCONNECTED PROBE	This alarm message appears when there are too high temperature values coming from the probes.
ERROR IN THE INTERFACE MANAGEMENT	This alarm message indicates that Macroplus 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

CLOCK: Necessary for the time-band management of the chiller (via previous selection on the dedicated mask).

SERIAL LINE: The serial connection allows you to read all the selected parameters and acknowledge the status of the machine, as well as any possible alarm condition.

FACTORY PRE-SET

The factory pre-set is carried out during the machine initialization phase. The Manufacturer inserts a series of standard values but the User can then modify some or all of them, according to his application requirements.

The machine initialization consists in:

- the erasure of the back-up memory (EEPROM) since it contains uncorrect data (they depend on the tests made by Carel);
- the choice of the machine MODEL: this brings about the automatic
- selection of the STANDARD working parameters.

The initialization of the machine should be made any time

- you replace the program **EPROM**
- you want to change the machine **MODEL**

IMPORTANT

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

SELECTABLE PARAMETERS	RANGE	PRE-SET	PW.	NOTE
Setpoint water temperature ('Summer' functioning mode)	-20÷50 ºC	12 ºC		
Setpoint water temperature ('Winter' functioning mode)	-20÷50 ºC	45 ºC		
Setpoint water temperature Customer ('Summer' functioning mode)		5 ºC	1	
Setpoint water temperature Customer ('Winter' functioning mode)		48 ºC	1	
Setpoint water temperature Manufacturer ('Summer' functioning mode)	-20÷50 ºC	9 ºC	2	
Setpoint water temperature Manufacturer ('Winter' functioning mode)	-20÷50 ºC	48 ºC	2	
Water temp. differential	0÷20.0 ºC	3 ºC	1	
Low temperature threshold outlet water ('Summer' mode only)		3 ºC	1	
High temperature threshold outlet water ('Winter' mode only)		55 ºC	1	
High temperature threshold inlet water				
SUMMER functioning	5÷60 ºC	25 ºC	1	
WINTER functioning	25÷80 ºC	50 ºC	1	
Low temperature threshold inlet water				
SUMMER functioning		10 ºC	1	
WINTER functioning		15 ºC	1	
Fans pressure management (normal functioning)				
Presure at fan 1 starting		13.0 bar	2	
Pressure at fan 1 stoppage		12.5 bar	2	
Pressure at fan 2 starting		14.0 bar	2	
Pressure at fan 2 stoppage		13.5 bar	2	
Pressure at fan 3 starting		15.0 bar	2	
Pressure at fan 3 stoppage		14.5 bar	2	
Fans temperature management (freecooling functioning)				
Temperature at fan 1 starting		12.0 ºC	2	
Temperature at fan 1 stoppage		11.5 ºC	2	
Temperature at fan 2 starting		11.0 ºC	2	
Temperature at fan 2 stoppage		10.5 ºC	2	
Temperature at fan 3 starting		10.0 ºC	2	
Temperature at fan 3 stoppage		09.5 ºC	2	
Temperature at fan 4 starting		09.0 ºC	2	
Temperature at fan 4 stoppage		08.5 ºC	2	

Temperature at fan 5 starting			08.0 ºC	2
Temperature at fan 5 stoppage		07.5 ºC		2
Defrost set-points			2.0 ºC	2
Simultaneous defrostings			no	2
Time between def. cycles			600s	2
Max. defrost time			300s	2
Time between two defrostings			300s	2
Setpoint recovery step			45.0 ºC	2
Hysteresis recovery step			3.0 ºC	2
High pressure threshold		24 bar		1
Delay between a compressor starting and its partialization or between partializations	0÷100s	10s		2
pumpdown max. time			30s	2
Min. time between starting of 2 compressors	1÷9999s		10s	2
Delay between two consecutive startings of the same compressor (hourly startings)	1÷9999s		360s	2
Min. time compressor starting	1÷9999s	60s		2
Min. time compressor OFF	30÷9999s		180s	2
Delay of flow alarm while the machine is working	0÷900s	3s		2
Delay of flow detector alarm at machine start-up	0÷300s	10s		2
Delay at high temperature inlet water alarm (Summer) o low temperature inlet water (Winter)	30min			2
High pressure alarm delay	0÷900s	40s		2
Delay at motor-driven pumps stoppage			20s	2
Motor-driven pumps rotation threshold	1÷5000s		8 hours	2
Oil differential delay	1÷5000s		120s	2
Integration time	300÷900s	600s		2
Hours threshold for compressors maintenance	1÷32000h		10000h	1
Freecooling delta	0.5÷10 ºC		20 ºC	2
Lower limit ramp of freecooling valve	0.5÷20 ºC		9 ºC	2
Higher limit ramp of freecooling valve	0.5÷20 ºC		12 ºC	2
Lowe limit pressure probes	-10÷40bar		10bar	2
Higher limit presure probes	-10÷40bar		28bar	2
Control probe in/out			input	1
Number of fans	0÷12	12		2
Number of partializations	0÷2		0	2
Rotation enablement			yes	2

MASKS

```
Out Wat.Temp.00.0 ºC
In  Wat.Temp 00.0 ºC
Set Point *  12.0 ºC
MACHINE OFF
```

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

There are DIFFERENT set-points; one for the 'Summer', the other for the 'Winter' functioning mode. The value that appears on the display is relative to the selected mode.

Macroplus will accept any set-point value ranging between the lower/higher limits previously selected (Customer/Manufacturer password). Otherwise Macroplus will rely upon the pre-selected value.
If the set-point must be modified according to the TIME-BANDS management of the set-point, you can not select the set-point 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, OFF BY SUPERVISOR, OFF BY EXT.ON/OFF..
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 option:

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

```
Synoptic
Input State
Version
```

Synoptic Menu:

```
Synoptic:
Inputs State
Version
```

```
06/08/1992  12:30
Out.Wat.Temp.   00.0
In. Wat.Temp    00.0
MACHINE OFF
```

```
06/08/1992  12:30
Env. Air Temp.  00.0
FreeCool.Temp.  00.0
MACHINE OFF
```

```
06/08/1992  12:30
HPress.Trans.1  00.0
HPress.Trans 2  00.0
MACHINE OFF
```

```
06/08/1992  12:30
HPress.Trans.3  00.0
HPress.Trans.4  00.0
MACHINE OFF
```

```
06/08/1992  12:30
Water Regeneration
Temperature     00.0
MACHINE OFF
```

These masks display the status of all the probes connected to Macroplus.
The mask displaying the condenser water temperature is enabled only if the heat recovery function has been selected.

```
Synoptic
Input State
Version
```

```
01-45 O=NO C=NC
CCCCC  CCCCC  CCCCC
CCCCC  CCCCC  CCCCC
CCCCC  CCCCC  CCCCC
```

Display of the digital input status: O=Open - C=Closed

```
Synoptic
Input State
Version
```

```
Std.Chiller + H.P.
CAREL srl ITALIA
Ver -.---  --/--/--
Code:   EP000EPDC0
```

Display of the software version.

Programming masks for the end-User. Standard password = "1234"

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

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

```
Param. Selection
Printer-Superv.
Time-Zones
New Password
```

'Customer' branch for the SET-POINT and REGULATION ZONE selection (IN/OUT probe).
The set-point limit can be either the 'Summer' or the 'Winter' one, depending on the selected functioning mode.

```
Param.Selection
Printer-Superv.
Time-Zone
New Password
```

```
Set Point
Alarms Thresholds
```

```
Setp. Limit  10.0 ºC
Differential 03.0 ºC
Sel. Set on      OUT
```

In this mask it is possible to select the lower set-point limit (default 10 ºC 'Summer' functioning, default 32 ºC 'Winter functioning). The selected value, however, must not be lower than the 'Manufacturer' set-point (default 5 ºC 'Summer' functioning, default 20 ºC Winter' functioning) 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. Out Evap:
Low Thres.  03.0  ºC
High Press. Trans. :
High Thres. 04.0 bar
```

(*)

```
Wat. Temp. Out Evap:
High Thres..03.0  ºC
High Press. Trans. :
High Thresh.24.0 bar
```

(**)

```
Wat. Temp. In Evap.:
High Thres. .17.0 ºC
Low  Thres.  03.0 ºC
```

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

(*) The mask is enabled in the 'SUMMER' functioning mode

(**) The mask is enabled in the 'WINTER' functioning mode

SERIAL LINES Management (Printer / Supervisor)

```
Param. Selection
Printer-Superv.
Time-Zones
New Password
```

```
Type of Print
Cyclic    0  h
Immediate N
```

```
Identification :
Number
              000
```

These masks define the type of printout, that is cyclic or immediate. Besides, it is necessary to give Macroplus an identification number, particularly useful when the controller is connected to any Carel serial line.

Hourly programming / Clock

```
Param. Selection
Printer-Superv.
Time-Zone
New Password
```

```
Time-Zones
Clock
Self-Start
Maintenance
```

```
Time-Zones :
Daily
Weekly
```

```
Time-Zones
Daily
Weekly
```

```
Daily Time-Zones
With Set Variation
Enabled ?
              N
```

```
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 as well as an energy saving.
Before entering the time-bands programming mask it is necessary to enable the mask itself. Then press the ▼ Button to enter the selection mask where you can select the necessary values.

```
Time-zones
Daily
Weekly
```

```
Time-zones ?      N
ON  :   MON=1  04:00
OFF :   SAT=6  18:00
```

The WEEKLY TIME-BANDS MANAGEMENT allows to turn ON and OFF the chiller on the days and times selected in the relative mask.
Therefore you can, for example, turn ON the chiller on Monday, at 5:00 and turn it OFF on Friday, at 18:00.
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-zones
Clock
Self-Start
Maintenance
```

```
Clock Present?    No
Hours  00:00
Date   00/00/0000
       dd/mm/yyyy
```

Automatic re-start after a POWER OFF condition.

```
Time-zones
Clock
Self-Start
Maintenance
```

```
Automatic Start-Up ?
              N
```

Maintenance Branch:

```
Time-zones
Clock
Self-Start
Maintenance
```

```
Timer Coun. Thres.
Timer Coun. Reset
```

```
Hours Thres.
Compressor
            10000
```

```
Timer Coun. Thres.
Timer Coun. Reset
```

```
Reset H.Comp. 1   N
Reset H.Comp. 2   N
Reset H.Comp. 3   N
Reset H.Comp. 4   N
```

In these masks it is possible to select the hours threshold for the compressors, so as to provide the necessary maintenance as well as the hours meter reset (after the maintenance process).

New Password Selection:

```
Param. Selection
Printer-Superv.
Time-Zones
New Password
```

```
Change Password
Sevice/User
              0000
```

'Manufacturer' Programming masks.
Password = '1234'.

```
Synoptic
Service/User
Manufacturer
Hours Meter
```

```
Insert Password
Manufacturer
             1234
   Exact Password
```

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

Programming Branch reserved to the Manufacturer:

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

```
Setpoint Limit  05.0
Control Type       P
Integ. Time     0600
Rotat. Enabled   Yes
```

```
Number of Fans    12
Partializ.Number   0
PumpDown Enabled   N
FreeCool. Enabled N
```

```
Part. Delay      010
Run. Flow. Delay 003
Start Flow Delay 010
Pump Off Delay   020
```

```
In.H/L.Temp.Delay030
Press. Al. Delay 040
FreeCool. Delta 02.0
Part. Logic DWM COP.
```

```
Oil Dif.Al.Delay 120
Pump Max Hours  0008
Press.Prob.End Scale
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
```

```
Regener.Enabled   N
Set  Regenerat. 45.0
Hyst.Regenerat  03.0
Pumpdown Max Time000
```

```
Defrost
Temperature     02.0
Enable Compressor
Off Procedure?    N
```

```
Simultan.Defrost  N
Time Bet.Defrost0600
Max.Defrost Time0300
2 Defr.Interval 0300
```

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 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 are being started;
- Delay before turning the pumps OFF, after the pressure of the OFF Button;
- Delay of the indication of high (SUMMER) or low (WINTER) temperature (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);
- The 'Oil Differential Pressure' alarm is delayed when the digital input opens;
- Threshold for the automatic pumps rotation;
- Pressure corresponding to 04 mA (high pressure transducers);
- Pressure corresponding to 20 mA (high pressure transducers);
- MIn. time compressors 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 for the motor-driven pumps:

  Conditioning: Tthe PUMP turns ON when the machine is powered and turns OFF when the machine is turned OFF but after a delay selectable 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, the pump can be started by a device placed on the digital input n. 31.
- Enablement to the heating recovery function;
- Set-point of the step that activates the recovery function;
- Hysteresis (half of the total zone) of the step that activates the recovery function;
- Pumpdown procedure maximum time;
- External temperature below which the defrost procedure is enabled;
- Enablement to simultaneous defrostings;
- Time between defrost cycles;
- Max. duration of the defrost (of a circuit);
- Min. time between defrostings of different circuits.

"REGULATION" masks

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

```
Comp. Steps
Valve Lim./Inverter
Fan Step in Press
Fan Step in Temp.
```

Steps programm for COMPRESSORS startings (SUMMER functioning mode)

```
Compressor Steps
Valve Lim./Inverter
Fan Step in Press
Fan Step in Temp.
```

```
Comp.Steps (Summer)
Part.Steps (Summer)
Comp.Steps (Winter)
Part.Steps (Winter)
```

```
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 %
```

Program for Partialization Steps (SUMMER functioning mode)

```
Comp.Steps (Summer)
Part.Steps (Summer)
Comp.Steps (Winter)
Part.Steps (Winter)
```

```
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 %
```

Steps program for COMPRESSORS starting (WINTER functioning mode)

```
Comp. Steps
Valve Lim./Inverter
Fan Step in Press
Fan Step in Temp.
```

```
Comp.Steps (Summer)
Part.Steps (Summer)
Comp.Steps (Winter)
Part.Steps (Winter)
```

```
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 %
```

Partialization Steps Program (WINTER functioning mode)

```
Comp.Steps (Summer)
Part.Steps (Summer)
Comp.Steps (Winter)
Part.Steps (Winter)
```

```
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 ANALOGUE OUTPUTS

```
Comp. Steps
Valve Lim./Inverter
Fan Step in Press
Fan Step in Temp.
```

```
F.C. Start   00.0 °C
F.C. End     00.0 °C
Inv. Setp.   00.0bar
Inv. Diff    00.0bar
```

In this mask it is possible to program the start/end points for the 3-way freecooling valve and the setpoint and differential for the condenser fans inverter.

CONDENSATION

Selection of pressure thresholds for fans START/STOP.

```
Comp. Steps
Valve Lim./Inverter
Fan Steps in Press
Fan Steps in Temp.
```

```
Fan 1
System On   00.0 bar
System Off  00.0 bar
```

```
Fan 2
System On   00.0 bar
System Off  00.0 bar
```

```
Fan 3
System On   00.0 bar
System Off  00.0 bar
```

CONDENSATION + FREECOOLING (if the freecooling function has been selected).

Selection of water temperature thresholds at evaporator inlet managing the START/STOP routines of the fans.

```
Comp. Steps
Valve Lim./Inverter
Fan Steps in Press
Fan Steps in Temp.
```

```
Fan 1
System On    00.0 °C
System Off   00.0 °C
```

```
Fan 2
System On    00.0 °C
```

```
System Off   00.0 °C
```

...

```
Fan 11
System On    00.0 °C
System Off   00.0 °C
```

```
Fan 12
System On    00.0 °C
System 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 Conf.
Regulation Param.
Manual Procedure
Particular Proc.
```

```
Pump 1            N
Pump 2            N
Fans              N
```

```
Cycle RevN  N  N  N
Compres. N  N  N  N
Part. 1  N  N  N  N
Part. 2  N  N  N  N
```

Branch of the SPECIAL PROCEDURES:
Selection New PW Manufacturer

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

```
Change Pass.Man.
Memory  Erasure
Machine Model
```

```
Change Password
Manufacturer
              0000
```

The special procedure for cancelling the back-up memory should be done:
- the first time you turn ON the machine;
- any time you replace the eprom;
- any time that a new machine version is selected.

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

```
Change Pass.Man.
Memory  Erasure
Machine Model
```

```
Memory
Erasure
              N
```

TYPE OF MACHINE MODEL:

0 ==> 1-compressor machine
1 ==> 2-compressor machine
2 ==> 3-compressor machine
3 ==> 4-compressor machine

WARNING: if you select 1 compressor machines, it is necessary to press the ENTER Button.
Automatically, a series of factory-set (standard) values will be operative.

```
Change Pass.Man.
Memory  Erasure
Machine Model
```

```
Machine
Model ?
(Chioce  0 - 3) 0
      1 Comp
```

DISPLAY OF COMPRESSORS HOURS METER

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

```
H. Comp. 1  00000
H. Comp. 2  00000
H. Comp. 3  00000
H. Comp. 4  00000
```

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/.../12	THE RELATIVE FAN STOPS
Pressostat High Pressure 1/4	THE RELATIVE COMPRESSOR STOPS
Overload Pump 1/2	THE RELATIVE MOTOR-DRIVEN PUMP STOPS
Flowmeter 1/2	THE RELATIVE MOTOR-DRIVEN PUMP STOPS
Water Antifreeze	ALL COMPRESSORS STOP
High Pressure Thres. Exeeded Circuit 1/4	INDICATION
Thres. Exceeded Low Temp. Water Out Evaporator	ALL COMPRESSORS STOP
Thres. Exceeded High Temp. Water Out Evaporator	INDICATION
Thres. Exceeded High Temp. Water Inp.Evaporator	INDICATION
Thres. Exceeded Low Temp. Water Inp. Evaporator	INDICATION
Pressostat Low Pressure 1/4	THE RELATIVE COMPRESSOR STOPS This alarm is not detecded during defrost.

Maintenance Compressor 1 /4	INDICATION
Temperature Set Lower than Allowed Value	INDICATION OF WRONG PROGRAMMING OF THE SUMMER TEMPERATURE SET-POINT
Temperature Set Higher than Allowed Value	INDICATION OF WRONG PROGRAMMING OF THE WINTER TEMPERATURE SET-POINT
Faulty Pump_Down 1 Control of Solenoid and Pump_Down Press.	THE RELATIVE COMPRESSOR STOPS
High Temperature Winding Compressor 1/4	THE RELATIVE COMPRESSOR STOPS
Oil Differential Pressostat 1/4	THE RELATIVE COMPRESSOR STOPS
Interblock	THE MACHINE STOPS
Faulty Eeprom	INDICATION
Lack or Faulty Clock	INDICATION
Error in Interface Management	INDICATION

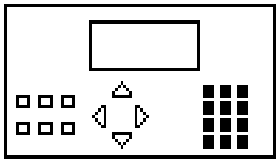
MASK INDICATING LACK OF ALARMS:

No Alarm

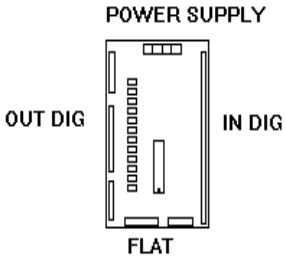
For further information on alarms, see the relative chapter.

COMPONENTS

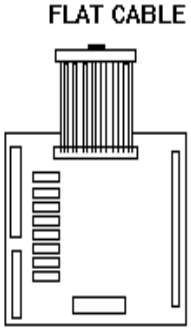
MACROPLUS, I/O BOARDS AND OPTIONAL BOARDS



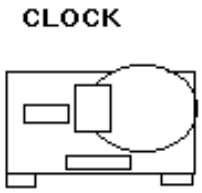
HORIZONTAL **MACROPLUS** CONTROL
WITH LARGE 4X20 DISPLAY code **MACRONEW00**



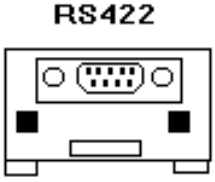
'LARGE' INTERFACE BOARD code **INTMNEWB00**



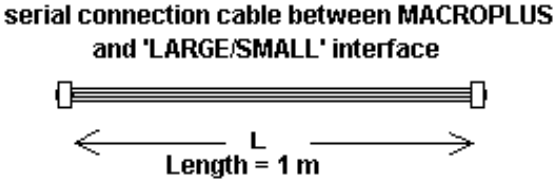
'ADDITIONAL' INTERFACE BOARD code **INTMNEWA00**



CLOCK BOARD code **MNEWCLOCK0**

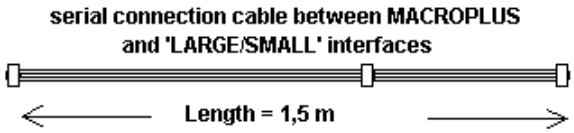


OPTIONAL RS422 BOARD code **MNEWRS4220**



CONNECTION CABLE BETWEEN MACROPLUS AND

THE 'LARGE' INTERFACE BOARD (l=1 m) code **59C222A003**



SERIAL CONNECTION CABLE BETWEEN MACROPLUS AND
2 'LARGE' INTERFACE BOARDS (l=1,5 m) code **59C155A001**

CONFIGURATIONS:

SINGLE-COMPRESSOR CHILLER/HEAT PUMP

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

TWO-COMPRESSOR CHILLER/HEAT PUMP

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

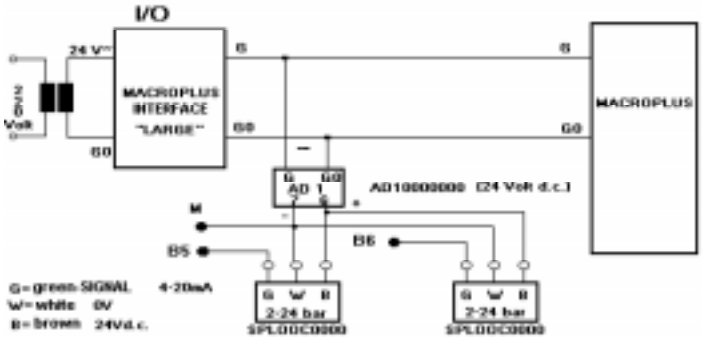
THREE-COMPRESSOR CHILLER/HEAT PUMP

- MACROPLUS CONTROL BOARD
- CLOCK BOARD
- 2 INTERFACES "LARGE"
- 'ADDITIONAL' INTERFACE
- CONNECTION CABLE BETWEEN CONTROLLER AND 2 INTERFACES 'LARGE'

FOUR-COMPRESSOR CHILLER/HEAT PUMP

- MACROPLUS CONTROL BOARD
- CLOCK BOARD
- 2 INTERFACES "LARGE"
- 'ADDITIONAL' INTERFACE
- CONNECTION CABLE BETWEEN CONTROLLER AND 2 INTERFACES 'LARGE'

CONNECTION DIAGRAM FOR PRESSURE TRANSDUCERS FANAL WESTINGHOUSE MODELS



THE FANAL PRESSURE BROBES, 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

POWER SUPPLY TO THE AD1 MODULE IS GIVEN BY THE SAME CABLES POWERING MACROPLUS.

THESE ARE THE CABLES THAT MUST 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

- **COMPRESSOR HIGH PRESSURE &**
- **ANTIFREEZE THERMOSTAT**

alarms.

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

- **ANTIFREEZE THERMOSTAT: It stops the machine**
- **COMPRESSOR HIGH PRESSURE: It stops the relative compressor.**

WARNING

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 fans.
This avoids any possible noise.
It is also recommended to respect the max. length of the probes cables.

CAREL

Technology & Evolution

CAREL srl
Via dell'Industria, 11 - 35020 Brugine - Padova (Italy)
Tel. (+39) 0499716611 – Fax (+39) 0499716600
http://www.carel.com – e-mail: carel@carel.com

Agency:

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