CONTROL PANEL OPERATING MANUAL

AIR COOLED SCREW CHILLER GLOBAL DESIGN

Software version *ASDU01C and later*

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1 CONTENTS

This manual provides installation, setup and troubleshooting information for the control panel for Air Cooled Chillers with screw compressor.

Any operational description contained in this manual is based on control software ver. ASDU01C and following revisions.

Chiller operating characteristics and menu selections may vary with other versions of control software. Contact Daikin for software update information

1.1. Installation Precautions

⚡ Warning

Electric shock hazard. It can cause personal injury or equipment damage. This equipment must be properly grounded. Connections and service of the control panel must be performed only by personnel that are knowledgeable in the operation of the equipment being controlled.

⚡ Caution

Static sensitive components. A static discharge while handling electronic circuit boards can cause damage to the components. Discharge any static electrical charge by touching the bare metal inside the control panel before performing any service work. Never unplug any cables, circuit board terminal blocks, or power plugs while power is applied to the panel.

1.2. Temperature and Humidity considerations

The controller is designed to operate within an ambient temperature range of –40°C to +65°C with a maximum relative humidity of 95% (non-condensing).

2. GENERAL DESCRIPTION

The Control panel contains a microprocessor based controller which provides all monitoring and control functions required for the safe, efficient operation of the Chiller. The operator can monitor all operating conditions by using the built in panel 4 line by 20 character display and a 6 keys keypad or using an additional remote semi-graphical display or an IBM compatible computer running a compatible Daikin monitor software.

If a fault condition develops, the controller will shut the system down and activate an alarm output. Important operating conditions at the time when an alarm condition occurs is retained in the controller's memory to aid in troubleshooting and fault analysis.

The system is protected by a password scheme, which allows access only by authorized personnel. The operator must enter a password into the panel keypad before any configuration may be altered.

3. MAIN CONTROL SOFTWARE FEATURES

- Management of air cooled screw chillers with stepless screw compressors
- Control of evaporator outlet temperature within ± 0.1 °C (with a quasi-steady load).
- Management of sudden load reduction up to 50% with max 3°C controlled temperature oscillation
- Readout of all unit operating main parameters (temperature, pressures, etc.)
- Condensation control with step logic, single or double fan speed controllers and mixed step + speed control (speedtroll)
- Setting of a double leaving water temperature setpoint with local or remote switch.
- Setpoint override using an external signal (4-20 mA), evaporator return temperature or outside ambient temperature.
- Adjustable max pull-down rate to reduce under-shoot during loop pull-down.
- Hot Chilled Water Start feature to allow to startup the unit also with high temperature evaporator water.
- SoftLoad feature to reduce electrical consumption and peak demand charges during loop pulldown.
- Unit Limiting feature to allow to limit electrical consumption based either on current absorption (current limit) or on demand capacity (demand limit).
- Fan Silent Mode feature to allow the reduction of unit noise limiting fans speed on the base of a time schedule
- Management of two evaporator water pumps
- 6 keys keypad for a rapid interface. Operator can log chiller operating conditions on the backlight display 4 lines by 20 columns.
- Three levels of security protection against unauthorized changing.
- Diagnostic system for compressors which stores last 10 alarms with date, time, and working conditions at the time the alarm occurred
- Weekly and yearly start-stop time schedule.
- Easy integration into building automation systems via separate digital connection for unit start/stop and 4-20 mA signals for chilled water reset and demand limiting.
- Communications capabilities for remote monitoring, changing of setpoint, trend logging, alarm and event detection, via a Windows compatible interface.
- BAS communication capability via selectable protocol (Protocol Selectability) or Communication Gateway.
- Remote communications capabilities via analog or GSM Modem.

4. SYSTEM ARCHITECTURE

The modular architecture is based on the use of the ASDU01C Series control.

In particular, a base controller (large version, built-in display, or, optionally, semi graphical additional display) is used to control the basic unit functions and to manage the first two compressors; a second controller (large version) is used to manage the third and fourth compressor if they are present.

Several, up to four for each controller, controller expansion board are used to add optional features to the control.

Drivers for electronic expansion valve are foreseen as an optional feature.

The overall architecture is shown in fig. 1

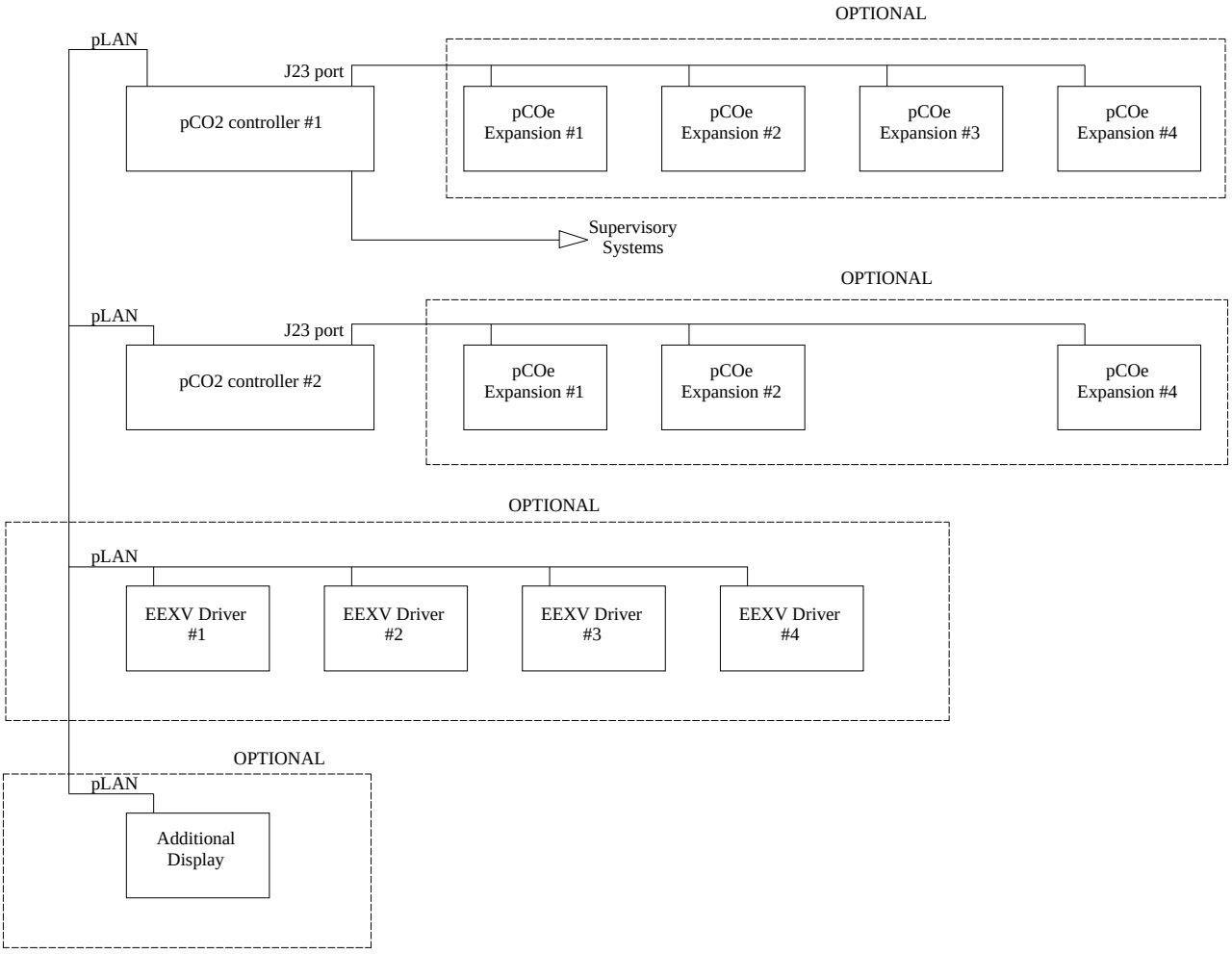


Fig. 1 - Architecture

Electronic expansion valves drivers and the additional display are connected using pLAN network of ASDU01Ccontrols while pCO^e expansion boards are connected to ASDU01C controllers using the RS485 network dedicated to expansion.

Hardware configuration

Board	Type	Function	Mandatory
pCO^e #1	Large Built In display (*)	Unit control Compressors #1 & #2 control	Y
pCO^e #2	Large	Compressors #3 & #4 control	Only on 3 & 4 compressors units
pCO^e #1	-	Additional hardware for compressors #1 & 2 or for compressors #3 & #4 (**)	N
pCO^e #2	-	Heat recovery or Heat pump control (***)	N
pCO^e #3	-	Water pump control	N
pCO^e #4	-	Additional fan steps for compressors #1 & #2 or for compressors #3 & #4 (**)	N
EEXV driver #1	EVD200	Electronic expansion valve control for compressor #1	N
EEXV driver #2	EVD200	Electronic expansion valve control for compressor #2	N
EEXV driver #3	EVD200	Electronic expansion valve control for compressor #3	N
EEXV driver #4	EVD200	Electronic expansion valve control for compressor #4	N
Additional display	PGD	Special characters or additional display	N

(*) The contemporaneous presence of built-in display and additional PGD may be accepted.
(**) Depending on the pLAN address of the controller where the expansion is connected
(***) pCO^e #2 connected to ASDU01C #2 is foreseen only for heat pump control

Control Panel

Control Panel is constituted by a backlight display 4 lines by 20 characters with a 6 key keypad whose functions will be illustrated in the following.

This display can be built-in as a part of the master controller (standard option), or it can be optionally a separate device based on the control panel PGD serigraphic technology.

Figure 2 - Control panel – PGD and Built-in display option

No setting is required for the built in display, while PGD device require addressing based on a procedure through keypad (see plan appendix for details).

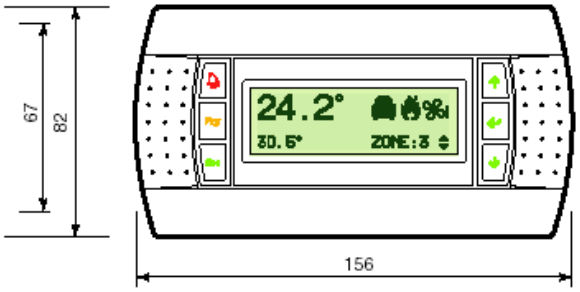
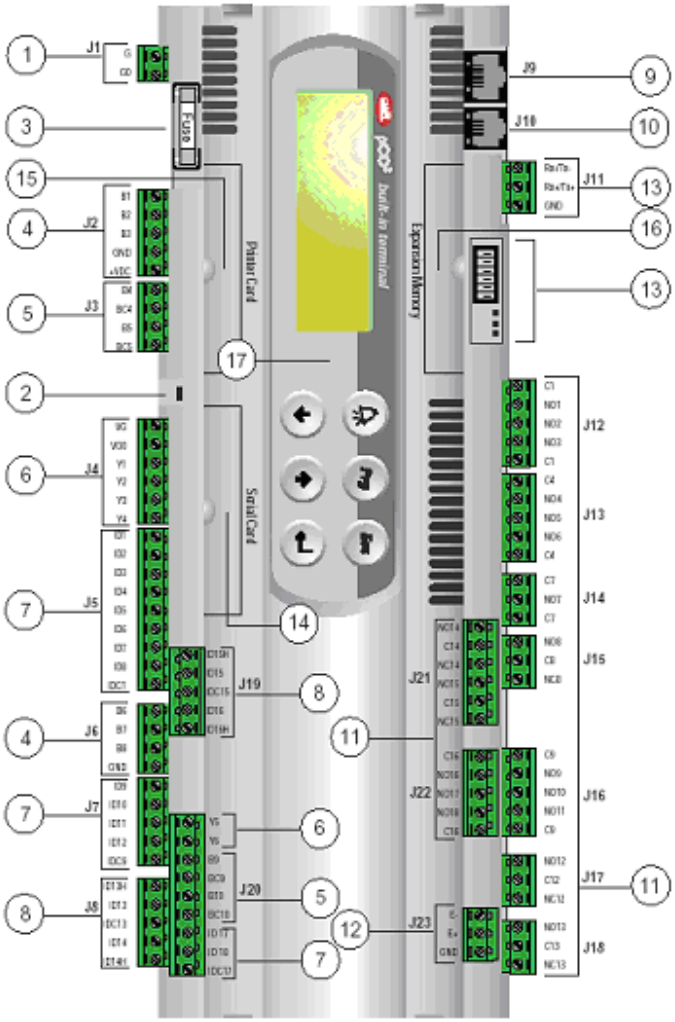
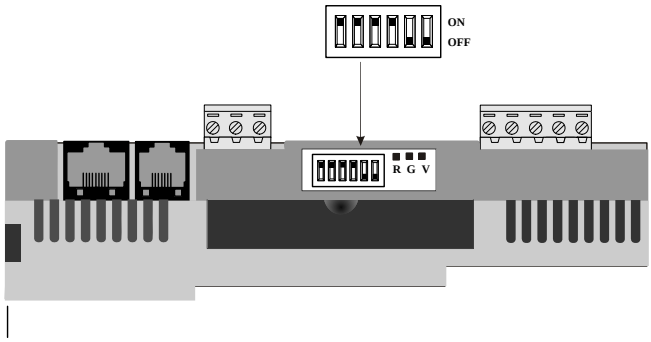


Fig. 3 – PGD Display

4.2. Main board

The control board contains the hardware and the software necessary to monitor and to control the unit.





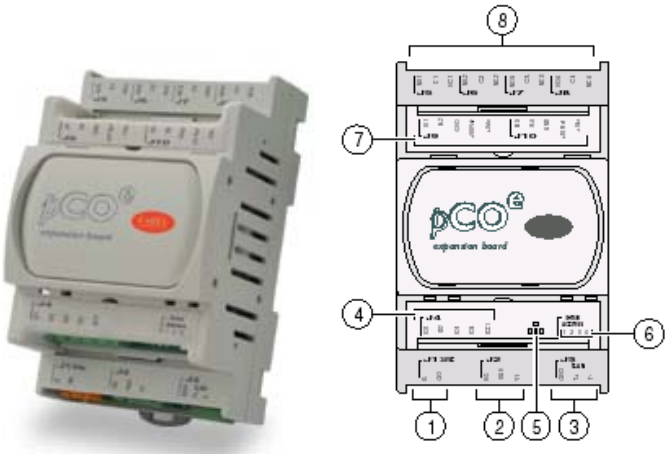
Address Microswitches

1. Power supply G (+), G0 (-)
2. Status LED
3. Fuse 250Vac
4. Universal analog inputs (NTC, 0/1V, 0/10V,0/20mA, 4/20mA)
5. Passive analog inputs (NTC, PT1000, On-off)
6. Analogic outputs 0/10V
7. 24Vac/Vdc Digital inputs
8. 230Vac or 24Vac/Vdc Digital inputs
9. Synoptic terminal connection
10. Standard terminal (and program download) connector
11. Digital outputs (relays)
12. Expansion board connection
13. pLAN connection and microswitches
14. Serial card connection
15. Printer card connection
16. Memory expansion connection
17. Built-in panel

Fig. 4 – controller

4.3. pCO^e Expansion

The introduction of additional (optional) functionality in controller architecture requires the use of expansion boards shown in figures 5-6.



Key
1. *power supply connector [G (+), G0 (-)];*
2. *analogue output 0 to 10 V ;*
3. *network connector for expansions in RS485 (GND, T+, T-) or tLAN (GND, T+);*
4. *24Vac/Vdc digital inputs;*
5. *yellow LED showing power supply voltage and 3 signalling LEDs;*
6. *serial address;*
7. *analogue inputs and probe supply;*
8. *relay digital outputs.*

Figure 5 - pCO^e expansion

This device needs to be addressed to ensure correct communication with controller via RS485 protocol. Addressing microswitches are placed nearby status leds (refer to key ⑥ in figure 5). Once the address is correctly set the expansion could be linked to ASDU01C board. The correct connection is achieved connecting J23 pin on ASDU01C with J3 pin on the expansion board (note that expansion board connector is different from the controller one, but wires must be placed in the same positions of connectors). Expansion boards are only I/O extensions for the controller and don't need any software.

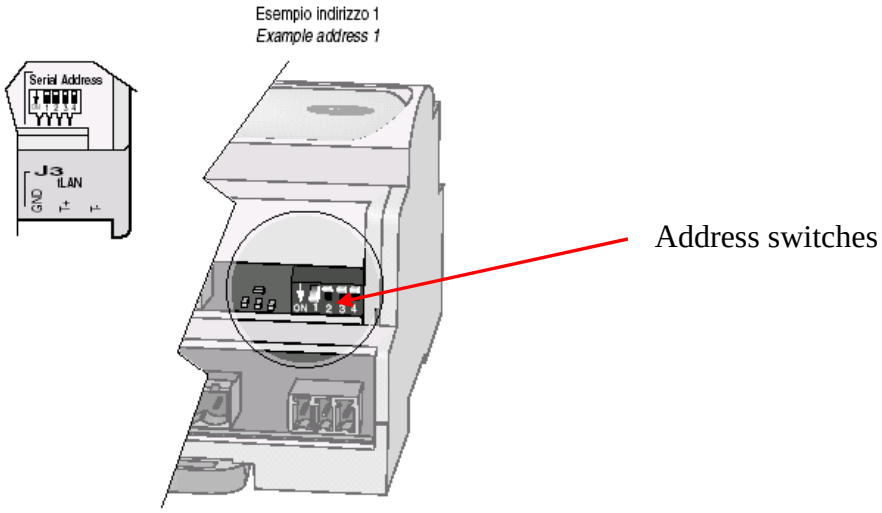


Fig. 6 – pCO^e detail: switches

As shown in figure 6, expansion boards have only four microswitches to set the net address. For more details on microswitches configuration refer to next section.

Three status leds are present, their status represent different status of the expansion board.

RED	YELLOW	GREEN	Meaning
-	-	**ON**	Active CAREL/tLAN supervisor protocol
-	**ON**	-	Probe error
ON	-	-	"I/O mismatch" error caused by the inhibition matrix
flashing	-	-	Lack of communication
-	-	-	Waiting for the system startup by the master (max. 30 s)

4.4. EEXV Valve Driver

The valve drivers contain the software for the control of the electronic expansion valve and are connected to the battery group that provides to close valve in case of power failure.

Addressing

Fig. 7 – EXV driver

4.4.1. Meaning of the Driver EEXV status leds

Under normal conditions five(5) LED indicates:

- POWER: (yellow) remains On in presence of supply. Remains Off in case of battery operation OPEN: (green) Flashing during the valve opening. On when valve is fully open.
- CLOSE: (green) Flashing during the valve closing. On when valve is fully close.
- Alarm: (red) On or flashing in case of hardware alarm.
- pLAN: (green) On during the normal working of pLAN.

In presence of critical alarm situations, the combination of LED On identifies the alarm as shown below.

Highest priority is level 7. In the case more alarms occur is visualized that with higher priority.

Alarms that stops the system	**PRIORITY**	**LED OPEN**	**LED CLOSE**	**LED POWER**	**LED ALARM**
Eprom reading error	7	**Off**	**Off**	**On**	**Flashing**
Valve open in case of lack of supply	6	**Flashing**	**Flashing**	**On**	**Flashing**
At start up, wait for battery loading (parameter…….)	5	**Off**	**On**	**Flashing**	**Flashing**
Other alarms	**PRIORITY**	**LED OPEN**	**LED CLOSE**	**LED POWER**	**LED ERROR**
Motor connection error	4	**Flashing**	**Flashing**	**On**	**On**
Probe error	3	**Off**	**Flashing**	**On**	**On**
Eeprom writing error	2	-	-	**On**	**On**
Battery error	1	-	-	**Flashing**	**On**

PL pLAN	**LED pLAN**
Connection OK	On
Driver connection or address error = 0	Off
The Pco Master doesn't answer	Flashing

4.5. Addressing of pLan/RS485

To get the correct functionality of the pLAN net system, is necessary to address correctly all the installed components. Each component, as previously described, has a series of microswitch that must be settled as specified in the following table.

pLAN component	Microswitches					
	1	**2**	**3**	**4**	**5**	**6**
COMP. BOARD #1	**ON**	OFF	OFF	OFF	OFF	OFF
COMP. BOARD #2	OFF	**ON**	OFF	OFF	OFF	OFF
DRIVER EXV #1	**ON**	**ON**	OFF	OFF	OFF	OFF
DRIVER EXV #2	OFF	OFF	**ON**	OFF	OFF	OFF
DRIVER EXV #3	**ON**	OFF	**ON**	OFF	OFF	OFF
DRIVER EXV #4	OFF	**ON**	**ON**	OFF	OFF	OFF
Additional DISPLAY	**ON**	**ON**	**ON**	OFF	OFF	OFF
RS485 component	**Microswitch**					
	1	**2**	**3**	**4**		
EXP. BOARD #1	**ON**	OFF	OFF	OFF		
EXP. BOARD #2	OFF	**ON**	OFF	OFF		
EXP. BOARD #3	**ON**	**ON**	OFF	OFF		
EXP. BOARD #4	OFF	OFF	**ON**	OFF		

4.6. Software

A unique control software is installed on both ASDU01C controllers (if two are present), the unit controller is directly recognized on the basis of the pLAN address.

No software is installed on pCO^e boards and on EEXV drivers (a factory-installed software is used).

A pre-configuration procedure is available in each ASDU01C controller to recognize the whole network hardware configuration; the configuration is stored in the controller in a permanent memory and an alarm is generated if the hardware configuration would change during the operation (network or boards faults or added boards).

The pre-configuration procedure will automatically start at the first bootstrap of the unit (after the software is installed); it is possible to activate it manually (network refresh) if network configuration changes, either if an expansion is permanently removed or if a new expansion is linked after the first software bootstrap.

Changes in the network configuration without network refresh will generate alarms, either if an expansion is removed (or faulted) or if a new expansion is added.

The configuration of functions requiring expansion boards are allowed only if expansion boards have been recognized in the network configuration.

Network refresh is required in case of a substitution of a ASDU01C controller.

Network refresh is not required in case of a substitution of a fault expansion board already used in the system.

4.6.1. Version identification

To identify unambiguously the software class and version (also with respect to other Daikin control software) a string made of four fields is used:

C_1	C_2	C_3	F	M	M	m

A three-digit literal field ($C_1C_2C_3$) to identify the class of units for which the software is usable

The first digit C_1 is for chillers cooling type and will assume the following values:

- A : for air cooled chillers
- W : for water cooled chiller

The second digit C_2 is for compressor type and will assume the following values:

- S : for screw compressors
- R : for reciprocating compressors
- Z : for scroll compressors
- C : for centrifugal compressors
- T : for turbocor compressors

The third digit C_3 is for evaporator type and will assume the following values:

- D : for direct expansion evaporator
- R : for remote direct expansion evaporator
- F : for flooded evaporator

- A single-digit literal (**F**) field to identify the unit family

  Within the scope of this document (screw chillers identified by C_2 field) it will assume the following values
  - A : Frame 3100 family
  - B : Frame 3200 family
  - C : Frame 4 family
  - U : when the software is applicable to all families within the class

- A major version two-digit numeric field (**MM**)
- A minor version single-digit literal field (**m**)

Within the scope of this document the first version is :

ASDU01C

Any version is also identified by a release date.

The first three digits of the version string will never be changed (otherwise a new unit class, and consequently a new software is released).

The fourth digit will change if a family-specific feature is added and it is not applicable to other families; in this case the U value may not be used anymore and a software for any family will be released. When this happens the versions digit is reset to the lower value.

The major version number (MM) will increase any time a completely new function is introduced in the software, or the minor version digit as reached the maximum allowed value (Z).

The minor version digit (m) is increased any time minor modification is introduced in the software without modifying its main working mode (this includes bugs fixing and minor interface modifications).

Engineering version, that meanings versions under tested, is identified adding to the version string the letter E followed by a number digit identifying the progression of engineering versions.

5. PHYSICAL INPUTS AND OUTPUTS

The following parameters are inputs and outputs of the electronic boards.

They are used internally and/or sent to pLAN and supervisory system according to software requirements and to the monitoring requirements

5.1. ASDU01C controller #1 – Base unit and compressors #1 & #2 control

Analog Input		
Ch.	**Description**	**Type**
B1	Oil Pressure #1	4-20mA
B2	Oil Pressure #2	4-20mA
B3	Suction Pressure #1 (*)	4-20mA
B4	Discharge Temperature #1	PT1000
B5	Discharge Temperature #2	PT1000
B6	Discharge Pressure #1	4-20mA
B7	Discharge Pressure #2	4-20mA
B8	Suction Pressure #2 (*)	4-20mA
B9	Entering water Temp. Sensor	NTC
B10	Leaving Water Temp. Sensor	NTC

Digital Input	
Ch.	**Description**
DI1	On/Off Comp #1 (Cir. #1 Shut-off)
DI2	On/Off Comp #2 (Cir. #2 Shut-off)
DI3	Evaporator Flow Switch
DI4	PVM or GPF Unit or #1 (**)
DI5	Double setpoint
DI6	High Press. Switch #1
DI7	High Press. Switch #2
DI8	Oil Level Switch #1 (**)
DI9	Oil Level Switch #2 (**)
DI10	Low Press. Switch #1
DI11	Low Press. Switch #2
DI12	Transition or Solid State Fault #1
DI13	Transition or Solid State Fault #2
DI14	Overload or Motor Protection #1
DI15	Overload or Motor Protection #2
DI16	Unit On/Off
DI17	Remote On/Off
DI18	PVM or GPF #2 (**)

Analog Output		
Ch.	**Description**	**Type**
AO1	Fan Speed control #1	0-10Vdc
AO2	Second Fan Speed control #1 or Fan Modular output #1	0-10Vdc
AO3	SPARE	
AO4	Fan Speed control #2	0-10Vdc
AO5	Second Fan Speed control #2 or Fan Modular output #2	0-10Vdc
AO6	SPARE	

Digital Output	
Ch.	**Description**
DO1	Start Comp #1
DO2	Load Comp #1
DO3	Unload Comp #1
DO4	Liquid Injection #1
DO5	Liquid Line #1 (*)
DO6	1st Fan step #1
DO7	2nd Fan Step #1
DO8	3rd Fan Step #1
DO9	Start Comp #2
DO10	Load Comp #2
DO11	Unload Comp #2
DO12	Evaporator Water Pump
DO13	Unit Alarm
DO14	Liquid Injection #2
DO15	Liquid Line #2 (*)
DO16	1st Fan step #2
DO17	2nd Fan Step #2
DO18	3rd Fan Step #2

(*) In case EEXV driver is not installed. If EEXV driver is installed, low pressures should be detected through EEXV driver.
(**) Optional

5.2. ASDU01C controller #2 – Compressors #3 & #4 control

Analog Input			Digital Input	
Ch.	**Description**	**Type**	**Ch.**	**Description**
B1	Oil Pressure #3	4-20mA	DI1	On/Off Comp #3
B2	Oil Pressure #4	4-20mA	DI2	On/Off Comp #4
B3	Suction Pressure #3 (*)	4-20mA	DI3	SPARE
B4	Discharge Temperature #3	PT1000	DI4	PVM or GPF #3 (***)
B5	Discharge Temperature #4	PT1000	DI5	SPARE
B6	Discharge Pressure #3	4-20mA	DI6	High Press. Switch #3
B7	Discharge Pressure #4	4-20mA	DI7	High Press. Switch #4
B8	Suction Pressure #4 (*)	4-20mA	DI8	Oil Level Switch #3 (***)
B9	Evap. # 2 Entering Water Temp. (**)	NTC	DI9	Oil Level Switch #4 (***)
B10	Evap. # 2 Leaving Water Temp. (**)	NTC	DI10	Low Press. Switch #3 (***)
			DI11	Low Press. Switch #4 (***)
			DI12	Transition or Solid State Fault #3
			DI13	Transition or Solid State Fault #4
			DI14	Overload or Motor Protection #3
			DI15	Overload or Motor Protection #4
			DI16	1st or 2nd fan speed control fault #3 (**)
			DI17	1st or 2nd fan speed control fault #4 (**)
			DI18	PVM or GPF #4 (***)

Analog Output			Digital Output	
Ch.	**Description**	**Type**	**Ch.**	**Description**
AO1	Fan Speed control #3	0-10Vdc	DO1	Start Comp #3
AO2	Second Fan Speed control #3 or Fan Modular output #3	0-10Vdc	DO2	Load Comp #3
AO3	SPARE		DO3	Unload Comp #3
AO4	Fan Speed control #4	0-10Vdc	DO4	Liquid Injection #3
AO5	Second Fan Speed control #4 or Fan Modular output #4	0-10Vdc	DO5	Liquid Line #3 (*)
AO6	SPARE		DO6	1st Fan step #3
			DO7	2nd Fan Step #3
			DO8	3rd Fan Step #3
			DO9	Start Comp #4
			DO10	Load Comp #4
			DO11	Unload Comp #4
			DO12	SPARE
			DO13	SPARE
			DO14	Liquid Injection #4
			DO15	Liquid Line #4 (*)
			DO16	1st Fan step #4
			DO17	2nd Fan Step #4
			DO18	3rd Fan Step #4

(*) In case EEXV driver is not installed. If EEXV driver is installed, low pressures are detected through EEXV driver.
(**) Only for units with 2 evaporators
(***) Optional

5.3. pCO^e expansion #1 – Additional hardware

5.3.1. Expansion connected to ASDU01C #1

Analog Input				Digital Input	
Ch.	**Description**	**Type**		**Ch.**	**Description**
B1	Comp. Capacity Sensor #1 (*)	4-20mA		DI1	SPARE
B2	Comp. Capacity Sensor #2 (*)	4-20mA		DI2	SPARE
B3	Suction Temp #1 (**)	NTC		DI3	Low Pressure Switch #1 (*)
B4	Suction Temp #2 (**)	NTC		DI4	Low Pressure Switch #2 (*)

Analog Output				Digital Output	
Ch.	**Description**	**Type**		**Ch.**	**Description**
AO1	SPARE			DO1	Compressor #1 alarm (*)
				DO2	Compressor #2 alarm (*)
				DO3	Economizer #1 (*)
				DO4	Economizer #2 (*)

(*) Optional
(**) In case EEXV driver is not installed. If EEXV driver is installed, suction temperature is detected through EEXV driver.

5.3.2. Expansion connected to ASDU01C #2

Analog Input				Digital Input	
Ch.	**Description**	**Type**		**Ch.**	**Description**
B1	Comp. Capacity Sensor #3 (*)	4-20mA		DI1	SPARE
B2	Comp. Capacity Sensor #4 (*)	4-20mA		DI2	SPARE
B3	Suction Temp #3 (**)	NTC		DI3	Low Pressure Switch #3 (*)
B4	Suction Temp #4 (**)	NTC		DI4	Low Pressure Switch #4 (*)

Analog Output				Digital Output	
Ch.	**Description**	**Type**		**Ch.**	**Description**
AO1	SPARE			DO1	Compressor #3 alarm (*)
				DO2	Compressor #4 alarm (*)
				DO3	Economizer #3 (*)
				DO4	Economizer #4 (*)

(*) Optional
(**) In case EEXV driver is not installed. If EEXV driver is installed, suction temperature is detected through EEXV driver.

5.4. pCO^e expansion #2 – Heat recovery or heat pump control

The heat recovery and heat pump options will alternative; just one of them may be used and are specified in the manufacturer setup

5.4.1. Heat recovery option

Analog Input				Digital Input	
Ch.	**Description**	**Type**		**Ch.**	**Description**
B1	Ambient temperature sensor			DI1	Heat Recovery switch
B2	SPARE			DI2	Heat Recovery Flow switch
B3	Entering HR water sensor	NTC		DI3	SPARE
B4	Leaving HR water sensor	NTC		DI4	SPARE

Analog Output			Digital Output	
Ch.	**Description**	**Type**	**Ch.**	**Description**
AO1	Heat Recovery Bypass valve (*)	4-20mA	DO1	4 Way valve HR #1
			DO2	4 Way valve HR #2
			DO3	4 Way valve HR #3
			DO4	4 Way valve HR #4

(*) Optional

5.4.2. Heat pump option

5.4.2.1. Expansion connected to ASDU01C #1

Analog Input			Digital Input	
Ch.	**Description**	**Type**	**Ch.**	**Description**
B1	Ambient temperature sensor	NTC	DI1	Heating/Cooling Switch
B2	Defrost Sensor #1 (*)	NTC	DI2	SPARE
B3	Defrost Sensor #2 (*)	NTC	DI3	SPARE
B4	SPARE		DI4	SPARE

Analog Output			Digital Output	
Ch.	**Description**	**Type**	**Ch.**	**Description**
AO1	Heat Pump Bypass valve	4-20mA	DO1	4 Way valve Comp #1
			DO2	Suction liquid injection #1
			DO3	4 Way valve Comp #2
			DO4	Suction liquid injection #2

(*) In case EEXV driver is not installed. If EEXV driver is installed, defrost temperature should be detected through EEXV driver (suction temperature).
(**) Optional

5.4.2.2. Expansion connected to ASDU01C #2

Analog Input			Digital Input	
Ch.	**Description**	**Type**	**Ch.**	**Description**
B1	SPARE	NTC	DI1	SPARE
B2	Defrost Sensor #3 (*)	NTC	DI2	SPARE
B3	Defrost Sensor #4 (*)	NTC	DI3	SPARE
B4	SPARE		DI4	SPARE

Analog Output			Digital Output	
Ch.	**Description**	**Type**	**Ch.**	**Description**
AO1	SPARE	4-20mA	DO1	4 Way valve Comp #3
			DO2	Suction liquid injection #3
			DO3	4 Way valve Comp #4
			DO4	Suction liquid injection #4

(*) In case EEXV driver is not installed. If EEXV driver is installed, defrost temperature should be detected through EEXV driver (suction temperature).

5.5. pCO^e expansion #3 – Water pump control

Analog Input			Digital Input	
Ch.	**Description**	**Type**	**Ch.**	**Description**
B1	SPARE		DI1	First pump Alarm
B2	SPARE		DI2	Second pump Alarm
B3	SPARE		DI3	First HR pump Alarm (*)

B4	SPARE			DI4	Second HR pump Alarm (*)

Analog Output				Digital Output	
Ch.	**Description**	**Type**		**Ch.**	**Description**
AO1	SPARE			DO1	Second water pump
				DO2	SPARE
				DO3	First HR pump (*)
				DO4	Second HR pump (*)

(*) Optional

5.6. pCO^e expansion #4 – Fan step control

5.6.1. Expansion connected to ASDU01C #1

Analog Input				Digital Input	
Ch.	**Description**	**Type**		**Ch.**	**Description**
B1	Setpoint Override	4-20mA		DI1	Current Limit Enable
B2	Demand Limit	4-20mA		DI2	External Alarm
B3	SPARE			DI3	SPARE
B4	Unit Amps.	4-20mA		DI4	SPARE

Analog Output				Digital Output	
Ch.	**Description**	**Type**		**Ch.**	**Description**
AO1	SPARE			DO1	4° Fan Step comp. #1
				DO2	5° Fan Step comp. #1
				DO3	4° Fan Step comp. #2
				DO4	5° Fan Step comp. #2

(*) Only if heat pump board is not present

5.6.2. Expansion connected to ASDU01C #2

Analog Input				Digital Input	
Ch.	**Description**	**Type**		**Ch.**	**Description**
B1	SPARE			DI1	SPARE
B2	SPARE			DI2	SPARE
B3	SPARE	4-20mA		DI3	SPARE
B4	SPARE	4-20mA		DI4	SPARE

Analog Output				Digital Output	
Ch.	**Description**	**Type**		**Ch.**	**Description**
AO1	SPARE			DO1	4° Fan Step comp. #3
				DO2	5° Fan Step comp. #3
				DO3	4° Fan Step comp. #4
				DO4	5° Fan Step comp. #5

(*) Only if heat pump board is not present

5.6.3. EXV Driver

Analog Input		
Ch.	**Description**	**Type**
B1	Suction temperature #1, #2, #3, #4 (*)	NTC
B2	Suction pressure #1, #2, #3, #4 (*)	4-20mA

(*) Depending on pLan address of Driver

6. MAIN CONTROLLER FEATURES

In the following the main features of the control software are described

6.1. Controller purpose

Then system will control the evaporator leaving water temperature to keep it at a setpoint value.

The system operates to optimize components performances from the point of view of their efficiency and of their duration.

The system assures a safe operation of the unit and of all components and prevents dangerous situations.

6.2. Unit enabling

The control allows different ways to enable/disable the unit:

- Keypad : Enter key on the keypad allows to switch between “Power OFF” mode and “Unit On” if other signals allows this state

- Local Switch: when the digital input “Unit On/Off” is open the unit is in “Local switch Off”; when the digital input “Unit On/Off” is closed the unit may be in “Unit On” or “Remote switch Off” on the basis of the “Remote On/Off “ digital input

- Remote Switch: when the local switch is On (“Unit On/Off” digital input closed) if the digital input “Remote On/Off “ is closed the unit is in “Unit On”, when digital input “Remote On/Off “ is open the unit is in “Remote switch Off”

- Network : a BAS or a Monitoring system may send an On/Off signal trough the serial line connection to put the unit on or in “Rem. Comm. Off”

- Time schedule : a timetable allows to program “Time Schedule Off” on a week base; several holiday days are include.

- Ambient LockOut : the unit is not enabled to operate unless the ambient temperature is higher than an adjustable value (default 15.0°C (59.0 F))

  To be in “Unit On” all the allowed signals must enable the unit.

6.3. Unit modes

The unit is able to work in the following modes:

- Cooling:
  When this mode is selected the control will operate to cool the evaporator water; the setpoint range is +4.0 ÷ +14.0 °C, (39.2 ÷ 57.2 F) a freeze alarm setpoint is set to 2 °C (34.6 F) (adjustable by the operator in the range +1 ÷ +3 °C (33.8 ÷ 37.4 F)) and a freeze prevent setpoint is set to 3 °C (37.4 F) (adjustable by the operator in the range: “freeze alarm setpoint” + 1 ÷ +3 °C (“freeze alarm setpoint” + 1.8 F ÷ 37.4 F)).

- Cooling/Glycol:
  When this mode is selected the control will operate to cool the evaporator water; the setpoint range are -8°C ÷ +14.0°C (17.6 ÷ 57.2 F) , a freeze alarm setpoint are set to –10 °C (14.0 F) (adjustable by the operator in the range –12 °C ÷ -9°C (10.4 ÷ 15.8 F)) and a freeze prevent setpoint are set to –9 °C (15.8 F) (adjustable by the operator in the range "freeze alarm setpoint" + 1°C ÷ -9 °C ("freeze alarm setpoint" + 1.8 F ÷ 15.8 F))

- Ice:
  When this mode is selected the control will operate to cool the evaporator water; the setpoint range are -8°C ÷ +14.0°C (17.6 ÷ 57.2 F) , a freeze alarm setpoint are set to –10 °C (14.0 F) (adjustable by the operator in the range –12 °C ÷ -9°C (10.4 ÷ 15.8 F)) and a freeze prevent setpoint are set to –9 °C (15.8 F) (adjustable by the operator in the range "freeze alarm setpoint" + 1°C ÷ -9 °C ("freeze alarm setpoint" + 1.8 F ÷ 15.8 F))
  While working in ice mode compressors are not be allowed to unload but are stopped using a step procedure (se § 6.5.1)

- Heating:
  When this mode is selected the control will operate to heat the evaporator water; the setpoint range is +30 ÷ +45°C (86 ÷ 113°C), a hot water alarm setpoint are set to 50°C (adjustable by the operator in the range +46 ÷ +55°C (114.8 ÷ 131 F)) and a hot prevent setpoint are set to 48°C (118.4 F) (adjustable by the operator in the range +46°C ÷ "hot water alarm setpoint" + 1°C (114.8 F ÷ "hot water alarm setpoint" + 1.8 F)).

- Cooling + Heat Recovery:
  Setpoints and freeze protection are managed as described in the cooling mode; in addition the control will enable the heat recovery input and outputs foreseen on the expansion #2

- Cooling/Glycol + Heat Recovery:
  Setpoints and freeze protection are managed as described in the cooling/glycol mode; in addition the control will enable the heat recovery input and outputs foreseen on the expansion #2

- Ice + Heat Recovery:
  Setpoints and freeze protection are managed as described in the ice mode; in addition the control will enable the heat recovery input and outputs foreseen on the expansion #2

The selection between cooling, cooling/glycol and ice mode are performed by the operator using the interface under password.

The switching between cooling and ice and heating modes will cause the unit shutdown and than the switching between the two modes.

6.4. Setpoints management

The control is able to manage the evaporator leaving water temperature on the base of several inputs:

- Changing the setpoint from the keypad

- Switching between the main setpoint (set by keypad) and an alternative value (set by keypad to) on the base of a digital input state (double setpoint function)
- Receiving a setpoint by a monitoring system or a BAS connected via serial line
- Resetting the setpoint of the base of analogic inputs

The control shows the source of the used (Actual) setpoint:

Local : the main setpoint set by keypad is being used
Double : the alternative setpoint set by keypad is being used
Reset : the setpoint is being reset by external input

The following setpoint reset methods are available to modify the local or double setpoint:

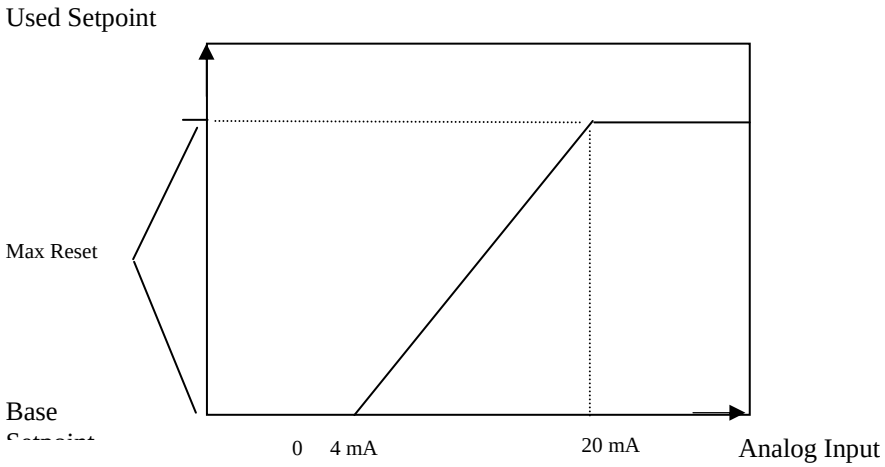
None : local or double setpoint are used on the base of the double setpoint digital input. This is called “base setpoint”
4-20mA : base setpoint is modified on the base of an user analog input
OAT : base setpoint is modified on the base of outside ambient temperature (if available)
Return : base setpoint is modified on the base of evaporator entering temperature
Network : the setpoint sent by serial line is used

In the case of a failure in the serial connection or in the 4-20mA input the base setpoint is used. In case of a setpoint reset, the system display will show the type of reset.

6.4.1. 4-20mA setpoint override

The base setpoint is modified on the base of the value of the analog input and of a max reset value, as shown in fig 8.

Fig.8 – 4-20mA setpoint override



6.4.2. OAT setpoint override

To enable the OAT setpoint override the unit limiting control expansion board pCO^e#2 is required, with the ambient sensor installed.

The base setpoint is modified on the base of outside ambient temperature and of a max reset value, of a value of OAT to start reset and a value of OAT to apply max reset, as shown in fig 9

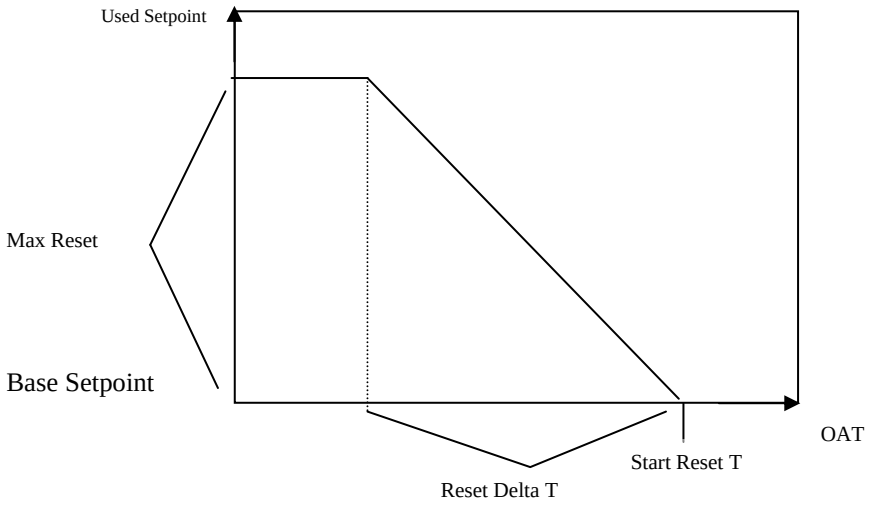


Fig. 9 – OAT setpoint override

6.4.3. Return setpoint override

The base setpoint is modified on the base of evaporator ΔT and of a max reset value, of a value of OAT to start reset and a value of OAT to apply max reset, as shown in fig 10

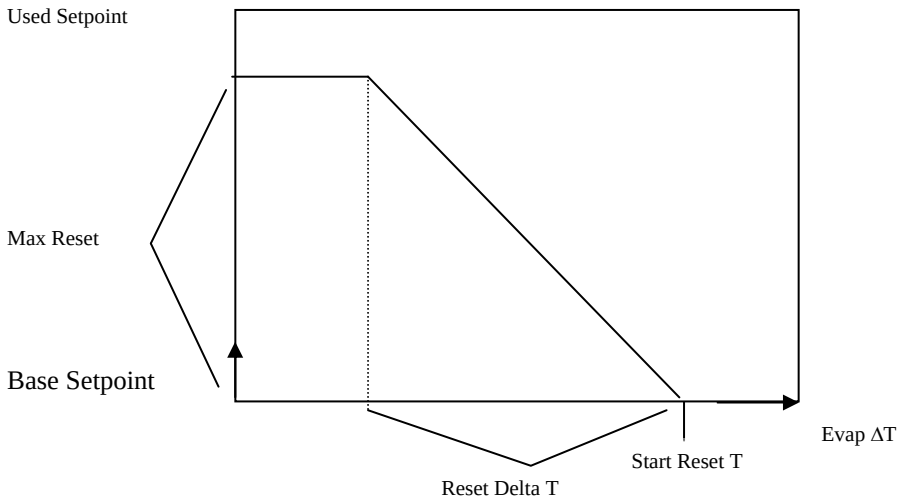


Fig. 10 – Return setpoint override

6.5. Compressors capacity control

Two types of capacity control are implemented:

- Automatic: the compressor start/stop and its capacity are automatically managed by the software to allow the setpoint respect

- Manual: the compressor is started by the operator and its capacity is managed by the operator acting on the system terminal. In this case the compressor will not be used by the software to allow the setpoint respect.

Manual control is automatically switched to Automatic control if any safety action is required on the compressor (safety standby or unloading or safety shutdown). If this case the compressor remains in Automatic and must be re-switched to Manual by the operator if required.

Compressors in manual mode are automatically switched in automatic mode at their shutdown.

The compressor load by may be evaluated on the basis of:

- Calculation of loading and unloading pulses
- Analogic slide valve position signal (optional)

6.5.1. Automatic Control

A specialized PID algorithm is used to determinate the magnitude of corrective action on capacity control solenoid.

The compressor loading or unloading is obtained keeping the loading or unloading solenoid energized for a fixed time (pulse duration), while the time interval between two subsequent pulses are evaluated by a PD controller (see fig. 11).

If the output of the PD algorithm doesn't change, the time interval among pulses is constant; this is the integral effect of the controller, at a constant error the action is repeated with a constant time (with the additional feature of a variable integral time).

The compressor load evaluation (based on analog slide valve position or calculation[1]) is used to allow the start of another computer or the stop of a running one.

It is required to define the proportional band and the derivative time of the PD control, together with the pulse duration and a minimum and maximum value for pulses interval.

The minimum pulse interval is applied when the maximum correction action is required, while the maximum interval is applied when the minimum correction action is required.

[1] The calculation is based on the load increase (or decrease) associated to each pulse:

$$Load\ Inc\ per\ pulse\ (\%) = \frac{100 - 25}{n\ load\ pulse} \qquad Load\ Dec\ per\ pulse\ (\%) = \frac{100 - 25}{n\ unload\ pulse}$$

Being "n load pulses" and "n unload pulses" the number of pulses to load and unload the compressor. Counting the number of pulses given to the compressor its load is evaluated.

A dead band is introduced to allow to reach a stable compressor condition.

Fig. 12 shows the proportional action of the controller as a function of the input parameters.

The proportional gain of the PD controller is given by:

$$K_p = \text{Max} \cdot \frac{\text{RegBand}}{2}$$

The derivative gain of the PD controller is equal to:

$$K_d = K_p \cdot T_d$$

where T_d is the input derivative time.

In addition to the specialized PID controller, a max pull-down-rate is introduced in the control; this meanings that if the controlled temperature is approaching the setpoint with a rate greater than a set value, any loading action is inhibited, even if require by the PID algorithm. This makes the control slower but allows to avoid oscillations around setpoint.

The controller is designed to act both as a “chiller” and as a “heat pump”; when the “chiller” option is selected the controller will load the compressor if the measured temperature is above the setpoint and will unload the compressor if the measured temperature is below the setpoint.

When the “heat pump” option is selected the controller will load the compressor if the measured temperature is below the setpoint and will unload the compressor if the measured temperature is above the setpoint.

The starting sequence of compressors is selected on the base of lower working hours amount (it means that the first compressor that is started is the one with the lower amount of working hour); between two compressors with the same operating hours, the compressor with minimum number of starts will start first.

A manual sequencing of compressors is possible.

The start of the first compressor is allowed only if the absolute value of difference between the measured temperature and the setpoint exceeds a Startup ΔT value.

The stop of the last compressor is allowed only if the absolute value of the difference between the measured temperature and the setpoint exceeds a Shutdown ΔT value.

A FILO (First In - Last Off) logic is adopted.

The start/loading and unloading/stop sequence will follow the schemes in table 2 and table 3, where RDT is the Reload/Reunload ΔT, a set value (that represent the minimum difference between the evaporator leaving water temperature and its setpoint) that will a running compressor to be reload when a compressor is shutdown or a running compressor to be unload when a new compressor is started.

This is made to keep the unit total capacity at the same level when the evaporator leaving water temperature is close to the setpoint and a compressor stops, or another compressor starts, is required.

In Ice mode, while the compressor loading is not affected, the compressors downloading is inhibited. When downloading is required compressors are shutdown on the basis of the evaporator leaving water temperature.

In particular, said Stp the evaporator leaving temperature setpoint, SDT the shutdown ΔT value and n the number of compressors, the scheme in table 6 is used.

In addition when the heat pump option is installed, the compressor could be managed using a variable speed driver (inverter). An analog output of pCO board is used to control the compressor speed with a 0-10V signal. Load management will still determine the time distance between load/unload pulses where pulse in this case means relative variation of the output voltage. The magnitude of the variation could be adjusted under manufacturer password.

When the unit is working in heating mode the maximum speed will be the nominal speed (default value 67Hz).

When the unit is working in cooling mode an overboost option (activated either with the digital input 2 on the expansion board #2 or automatically if the outside ambient temperature is grater than 35°C and disabled when it falls below 34°C) is managed. It allows the compressor to run at its full speed of 90Hz if the maximum available capacity is reached. When the overboost is disabled the valve opening (if the electronic expansion valve)

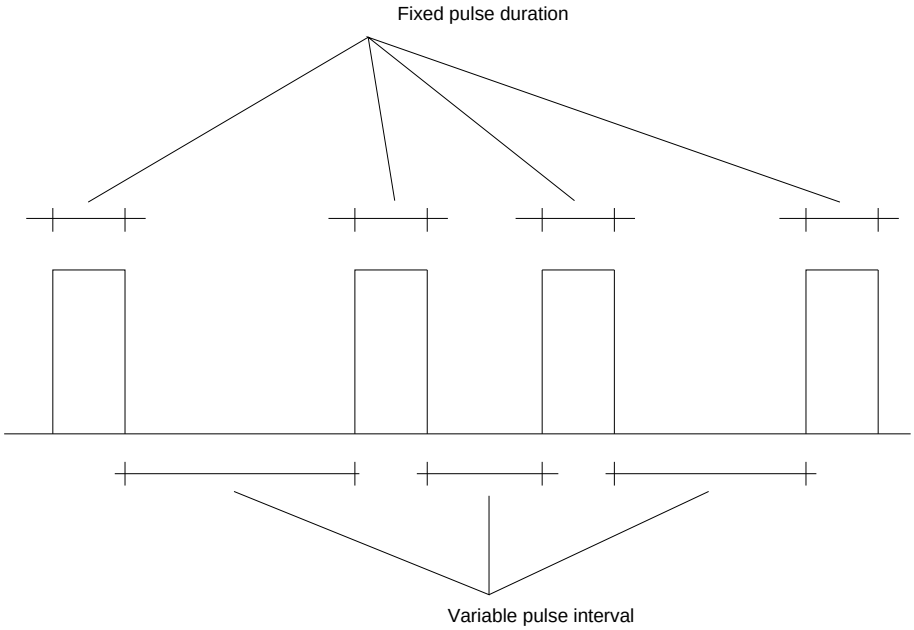


Fig. 11 – Loading or unloading pulses

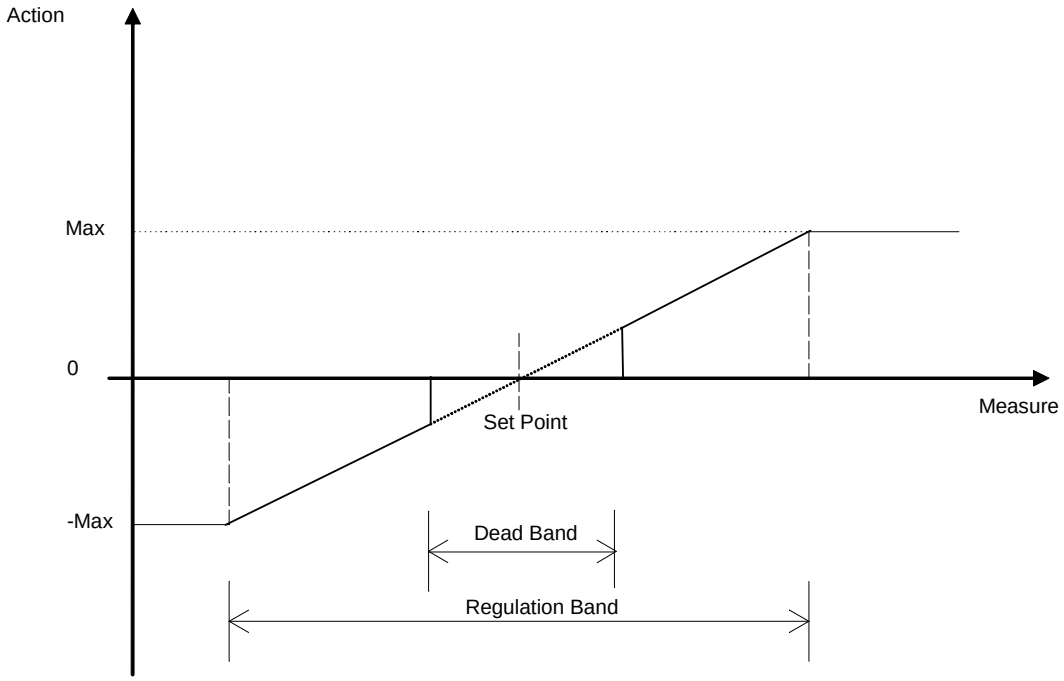


Fig. 12 – PD controller proportional action

6.5.2. Manual Control

The control will apply a fixed duration pulse (the magnitude is the pulse duration set in the automatic control) for each manual (by keyboard) load or unload signal.

In the manual control the load/unload action follows any pressing of defined up/down keys. (see fig. 13).

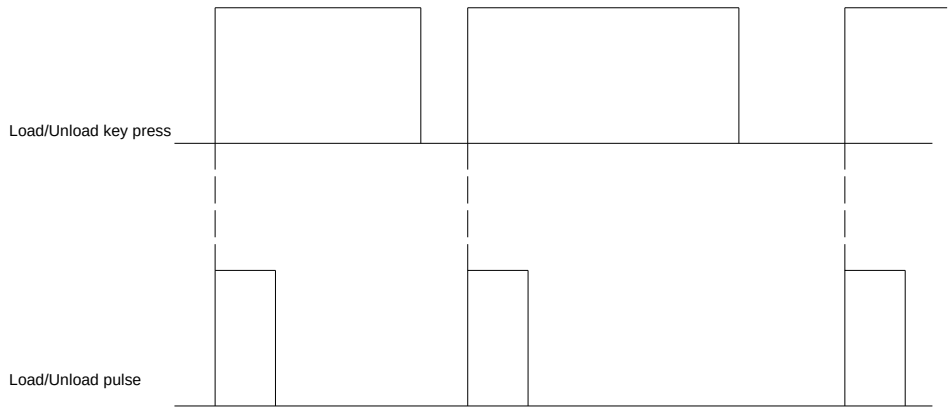


Fig. 13 – Compressor manual control

Table 2 - **Compressors startup and loading management (4 compressors unit)**

Step n.	***Leader Comp.***	***Lag 1 Comp.***	***Lag 2 Comp.***	***Lag 3 Comp.***
0	Off	Off	Off	Off
1	If (T – SetP) < Startup DT & Cooling or (SetP - T) < Startup DT & Heating … Waiting …			
2	Start	Off	Off	Off
3	Load up to 75%	Off	Off	Off
4	If T in Regulation Band … Wait interstage time …			
5	If T is approaching SetP … Waiting …			
6a SetP-RDT<T< SetP-RDT	Unload up to 50%	Start	Off	Off
6b SetP-RDT<T or T> SetP-RDT	Fixed at 75%	Start	Off	Off
7	Fixed at 75% or 50%	Load up to 50%	Off	Off
8 (if leader at 50%)	Load up to 75%	Fixed at 50%	Off	Off
9	Fixed at 75%	Load up to 75%	Off	Off
10	If T in Regulation Band … Wait interstage time …			
11	If T is approaching SetP … Waiting …			
12a SetP-RDT<T< SetP-RDT	Fixed at 75%	Unload up to 50%	Start	Off
12b SetP-RDT<T or T> SetP-RDT	Fixed at 75%	Fixed at 75%	Start	Off
13	Fixed at 75%	Fixed at 75% or 50%	Load up to 50%	Off
14 (if lag1 at 50%)	Fixed at 75%	Load up to 75%	Fixed at 50%	Off
15	Fixed at 75%	Fixed at 75%	Load up to 75%	Off
16	If T in Regulation Band … Wait interstage time …			
17	If T is approaching SetP … Waiting …			
18a SetP-RDT<T< SetP-RDT	Fixed at 75%	Fixed at 75%	Unload up to 50%	Start
18b SetP-RDT<T or T> SetP-RDT	Fixed at 75%	Fixed at 75%	Fixed at 75%	Start
17	Fixed at 75%	Fixed at 75%	Fixed at 75% or 50%	Load up to 50%
18 (if lag2 at 50%)	Fixed at 75%	Fixed at 75%	Load up to 75%	Fixed at 50%
19	Fixed at 75%	Fixed at 75%	Fixed at 75%	Load up to 75%
20	Load up to 100%	Fixed at 75%	Fixed at 75%	Fixed at 75%
21	Fixed at 100%	Load up to 100%	Fixed at 75%	Fixed at 75%
22	Fixed at 100%	Fixed at 100%	Load up to 100%	Fixed at 75%
23	Fixed at 100%	Fixed at 100%	Fixed at 100%	Load up to 100%
24	Fixed at 100%	Fixed at 100%	Fixed at 100%	Fixed at 100%

Table 3 - Compressors unloading and shutdown management (4 compressors unit)

Step n.	Leader Comp.	Lag 1 Comp.	Lag 2 Comp.	Lag 3 Comp.
0	100%	100%	100%	100%
1	Fixed at 100%	Fixed at 100%	Fixed at 100%	Unload up to 75%
2	Fixed at 100%	Fixed at 100%	Unload up to 75%	Fixed at 75%
3	Fixed at 100%	Unload up to 75%	Fixed at 75%	Fixed at 75%
4	Unload up t75%	Fixed at 75%	Fixed at 75%	Fixed at 75%
5	Fixed at 75%	Fixed at 75%	Fixed at 75%	Unload up to 50%
6	Fixed at 75%	Fixed at 75%	Unload up to 50%	Fixed at 50%
7	Fixed at 75%	Fixed at 75%	Fixed at 50%	Unload up to 25%
8	If T is approaching SetP … Waiting …			
9a SetP-RDT<T< SetP-RDT	Fixed at 75%	Fixed at 75%	Load up to 75%	Stop
9b SetP-RDT<T or T> SetP-RDT	Fixed at 75%	Fixed at 75%	Fixed at	Stop
10 (if lag2 at 75%)	Fixed at 75%	Fixed at 75%	Fixed at	Off
11	Fixed at 75%	Unload up to 50%	Fixed at 50%	Off
12	Fixed at 75%	Fixed at 50%	Fixed at 25%	Off
13	If T is approaching SetP … Waiting …			
14a SetP-RDT<T< SetP-RDT	Fixed at 75%	Load up to 75%	Stop	Off
14b SetP-RDT<T or T> SetP-RDT	Fixed at 75%	Fixed at 50%	Stop	Off
15 (if lag1 at 75%)	Fixed at 75%	Unload up to 50%	Off	Off
16	Unload up to 50%	Fixed at 50%	Off	Off
17	Fixed at 50%	Unload up to 25%	Off	Off
18	If T is approaching SetP … Waiting …			
19a SetP-RDT<T< SetP-RDT	Load up to 75%	Stop	Off	Off
19b SetP-RDT<T or T> SetP-RDT	Fixed at 50%	Stop	Off	Off
20	Unload up to 25%	Off	Off	Off
21	If T is approaching SetP … Waiting …			
22	If (SetP - T) < Shutdown DT & Cooling or (T – SetP) < Shutdown DT & Heating ….Wait….			
23	Stop	Off	Off	Off
24	Off	Off	Off	Off

Table 4 - Compressors shutdown scheme in Ice mode

Evap Lvg Temp	Compressors status
< SetP > SetP – SDT/n	All compressors allowed to run
< SetP– SDT/n > SetP – 2*SDT/n	(n-1) compressors allowed to run
< SetP – 2*SDT/n > SetP – 3*SDT/n	(n-2) compressors allowed to run
< SetP – 3*SDT/n > SetP – 4*SDT/n	(n-3) compressors allowed to run
> SetP – 4*SDT/n	No compressor allowed to run

6.6. Compressors timing

Compressors operation will meet four timer requirements:

- Minimum time between a same compressor starts (start to start timer): it is the minimum time between two starts of the same compressor
- Minimum time between different compressor starts : it is the minimum time between two starts of two different compressors
- Minimum time compressor on (start to stop timer): it is the minimum time the compressor may run; the compressor cannot be stopped (unless an alarm occurs) if this timer is not expired
- Minimum time compressor off (stop to start timer): it is the minimum time the compressor may be stopped; the compressor cannot be start if this timer is not expired

The minimum time compressor off (stop to start timer) will has two different settings; one applicable to cooling, cooling/glycol and heating mode and the other one applicable in ice mode.

6.7. Compressors protection

To protect compressor against loss of lubrication, the compressor pressure ratio is continuously checked; a minimum value is set for compressor minimum and maximum load; for intermediate compressor loads a linear interpolation are executed.

The low pressure ratio alarm will occur if pressure ratio remains lower than the minimum value at rated compressor capacity while a timer expiration.

At the startup the compressor is completely downloaded and its loading will not be enabled up to the pressure ratio exceeds a set value (default equal to 2).

6.8. Compressors startup procedure

Before to start compressors the unloading solenoid valve is energized up to a timer is expired (default 60 sec).

At compressor startup the control will executed a series of prepurge procedure to evacuate evaporator; the prepurge procedure will depend on the expansion valve type.

Prepurge procedure will not be executed if the evaporating pressure is below the low pressure alarm setpoint (vacuum conditions inside the evaporator).

The compressor will not be allowed to load up to the discharge superheat exceeds a set value (default 12.2 °C, 22 F) for a time longer than a set value (default 30 sec) .

6.8.1. Fan pre-starting in heating mode

When the unit is operated in heating mode, if the outside ambient temperature is lower than an fixed threshold of 10.0°C (50.0F) before the compressor is started and the start-up procedure is initiated all fans are started with a constant delay between each other.

6.8.2. Prepurge procedure with electronic expansion

At the compressor start the EEXV are completely closed up to the saturated temperature at the evaporator pressure reaches the value of –10 °C (14 F) (adjustable in the range –12 ÷ -4 °C (10.4 ÷ 24.8 F)), then the valve are opened at a fixed position (adjustable by the manufacturer with a default value equal to 20%) up to a timer is expired (default 30 sec).

6.8.3. Prepurge procedure with thermostatic expansion

At the compressor start the liquid line solenoid is completely closed up to the saturated temperature at the evaporator pressure reaches the value of –10°C (14 F) (adjustable in the range –12 ÷ -4 °C (10.4 ÷ 24.8 F)), then the valve is opened up to a timer is expired; this procedure is repeated for a number of times adjustable by the operator (default is 1 time).

6.8.4. Oil heating

The startup of compressors will not be allowed if the following formula is not respected:

DischTemp – TOilPress > 5 °C

Where:
DischTemp is the compressor discharge temperature
TOilPress is the saturated temperature at the oil pressure

6.9. Pumpdown

As a compressor stop request is recorded (and if the request doesn't originate from an alarm), before to proceed, the compressor is fully discharged and operated for a certain amount of time with a closed expansion valve (in the case of electronic expansion valve) or closed liquid line valve (in the case of thermostatic expansion valve).

This operation, known as "pumpdown", is used to evacuate the evaporator avoiding that in a following restart the compressor will such liquid.

Pumpdown procedure will end after a user defined timer is expired (adjustable, default 30 sec.) or the saturated temperature at the evaporator pressure reaches the value of –10°C (adjustable in the range –12 ÷ -4 °C (10.4 ÷ 24.8 F)).

After compressor stop the unloading solenoid valve are energized for a time equal to the minimum compressor off time to assure the complete unloading also in case of non-normal stop procedure completion.

6.10. Low ambient temperature start

Units working in cooling, cooling/glycol or ice mode has to manage start-up with low outside ambient temperature

A low OAT start is initiated if, at the compressor start up, the condenser saturated temperature is less than 15.5 °C (60 F).

Once this happens, 3 seconds after the end compressor startup procedure (end of prepurge cycles) low pressure events are disabled for a time equal to the low OAT time (setpoint has an adjustable range from 20 to 120seconds, defaults 120 sec.).

The absolute low pressure limit (the threshold which has no time delay) is still enforced. If this limit pressure is reached a Low Ambient Start-Up low pressure alarm is issued.

At the end of the low OAT start, the evaporator pressure is checked. If the pressure is greater than or equal to the evaporator pressure stage down setpoint, the start is considered successful. If the pressure is less than this, the start is not successful and the compressor shall stop. Three start attempts are allowed before tripping on the restart alarm.

The restart counter should be reset when either a start is successful or the circuit is off on an alarm.

6.11. Compressors and unit trips

6.11.1. Unit trips

Unit trips are caused by:

- Low evaporator flow rate

  A “Low evaporator flow rate alarm” will trip the whole unit if the evaporator flow switch remains open for more than an adjustable value; the alarm are automatically reset for three times if the evaporator flow switch closes for more than 30 seconds. Starting from the fourth alarm it has to be reset manually.

- Low evaporator outlet temperature

  A “Low evaporator outlet temperature alarm” will trip the whole unit as soon as the evaporator leaving water temperature (evaporator leaving temperature in the case of single evaporator units or manifold temperature in the case of a double evaporator unit) falls below the freeze alarm setpoint.

  A manual reset of the alarm are required to restart the unit

- Phase-Voltage Monitor (PVM) or Ground Protection (GPF) failure

  A “Bad phase/voltage or Ground protection failure alarm” will trip the whole unit as soon as the phase monitor switch opens (if a single phase monitor is used) after the unit start request.

  A manual reset of the alarm will required to restart the unit

- Evaporator leaving water temperature fault

  An “Evaporator leaving water temperature fault alarm” will trip the whole unit if the reading of evaporator leaving water temperature (evaporator leaving temperature in the case of

single evaporator units or manifold temperature in the case of a double evaporator unit) goes out of probe allowable range for a time longer than ten seconds.

A manual reset of the alarm will required to restart the unit

- External alarm (only if enabled)

  A "External alarm" will trip the whole unit as soon as the external alarm switch closes after the unit start request, if the unit trip on external alarm has been set.

  A manual reset of the alarm will required to restart the unit

- Probe failure

  A "Probe failure" will trip the unit if the reading of one among the following probes goes out of probe allowable range for a time longer than ten seconds.

  - Evaporator #1 leaving temperature probe (on 2 evaporators units)
  - Evaporator #2 leaving temperature probe (on 2 evaporators units)

  The controller display will show the faulted probe identification

6.11.2. Compressors trip

Compressor trips are caused by:

- Mechanical High pressure

  A "High pressure switch alarm" will trip the compressor as soon as the high pressure switch opens.

  A manual reset of the alarm is required to restart the unit (after the manual reset of the pressure switch).

- High discharge pressure

  A "High discharge pressure alarm" will trip the compressor as soon as the compressor discharge pressure exceeds the adjustable high pressure setpoint.

  A manual reset of the alarm are required to restart the unit

- High discharge temperature

  A "High discharge temperature alarm" will trip the compressor as soon as the compressor discharge temperature exceeds the adjustable high temperature setpoint.

  A manual reset of the alarm are required to restart the unit

- Low evaporator outlet temperature

  A "Low evaporator outlet temperature alarm" will trip the two compressors connected to the same evaporator in the case of a double evaporator unit as soon as the evaporator leaving water temperature falls below the adjustable freeze threshold.

  A manual reset of the alarm are required to restart the unit

- Mechanical Low pressure

  A "Low pressure switch alarm" will trip the compressor if the low pressure switch opens for more than 40 seconds during compressor running. Five automatic reset alarms (both from transducers and switches) are managed in all modes (cooling, cooling glycol, ice, heat pump). These alarms switch off the compressor without signalling (alarm relay is not activated). Only the sixth will be a manual reset alarm.

The “Low pressure switch alarm” are disabled during prepurge cycles and during pumpdown.

At compressor startup (after the end of prepurge cycles) the “Low pressure switch alarm” is disabled if a low ambient start has been recognized otherwise are delayed by 120 sec.

A manual reset of the alarm are required to restart the unit

- Low suction pressure

A “Low suction pressure alarm” will trip the compressor if the compressor suction pressure remains below the adjustable low pressure alarm setpoint for a time longer than that listed in the following table.

Low suction pressure alarm delay

Low press setpoint – Suct press (bar / psi)	Alarm delay (seconds)
0.1 / 1.45	160
0.3 / 4.35	140
0.5 / 7.25	100
0.7 / 10.15	80
0.9 / 13.05	40
1.0 / 14.5	0

No delay is introduced if the suction pressure falls below the low pressure alarm setpoint by an amount greater or equal to 1 bar. Five automatic reset alarms (both from transducers and switches) are managed in all modes (cooling, cooling glycol, ice, heat pump). These alarms switch off the compressor without signalling (alarm relay is not activated). Only the sixth will be a manual reset alarm.

The “Low suction pressure alarm” are disabled during prepurge cycles and during pumpdown.

At compressor startup (after the end of prepurge cycles) the “Low suction pressure alarm” are disabled if a low ambient start has been recognized.

A manual reset of the alarm are required to restart the unit

- Low oil pressure

A “Low oil pressure alarm” will trip the compressor if the oil pressure remains below the following thresholds by a time longer than an adjustable value during compressors running and at compressor startup

Suction pressure*1.1 + 1 bar	at compressor minimum load
Suction pressure*1.5 + 1 bar	at compressor full load
Interpolated values	at compressor intermediate load

A manual reset of the alarm are required to restart the unit

- High oil pressure difference

A “High oil pressure difference alarm” will trip the compressor if the difference between the discharge pressure and the oil pressure remains over an adjustable setpoint (default 2.5 bar) by a time longer than an adjustable value

A manual reset of the alarm are required to restart the unit

- Low pressure ratio

  A “Low pressure ration alarm” will trip the compressor if the pressure ratio remains below the adjustable threshold at rated compressor load by a time longer than an adjustable value

  A manual reset of the alarm are required to restart the unit

- Compressor Startup failure

  A “Failed transition or starter alarm” will trip the compressor if the transition/starter switch remains open for more than 10 seconds from compressor start

  A manual reset of the alarm are required to restart the unit

- Compressor overload or motor protection

  A “Compressor overload alarm” will trip the compressor if the overload switch remains open for more than 5 seconds after the compressor start.

  A manual reset of the alarm are required to restart the unit

- Slave board failure

  A “Unit xx off-line alarm” will trip slave compressors if the master board cannot communicate with slave boards for a time longer than 30 seconds.

  A manual reset of the alarm are required to restart the unit

- Master board failure or network communication

  A “Master off-line alarm” will trip the slave compressors if slave board cannot communicate with master board for a time longer than 30 seconds.

- Probe failure

  A “Probe failure” will trip the compressor if the reading of one among the following probes goes out of probe allowable range for a time longer than ten seconds.

  - Oil Pressure probe
  - Low Pressure probe
  - Suction temperature probe
  - Discharge Temperature probe
  - Discharge Pressure probe

  The control display will show the faulted probe identification

- Auxiliaries signal failure

  The compressor is tripped if one among the following digital inputs is opened for a timer greater than an adjustable value (default is 10 s).
  - Compressor phase monitor or Ground protection failure
  - Variable speed driver alarm

6.11.3. Other trips

Other trips may disable particular functions described in the following (e.g. heat recovery trips).

The addition of optional expansion boards will also activate the alarms related to communication with expansion boards and to probes connected to expansion boards.

For units with electronic expansion valve, all the drivers critical alarms will trip the compressors

6.11.4. Unit and compressors alarms and corresponding codes

In the following table the list of the managed alarms for both unit and compressors is shown.

Alarm code	Interface alarm label	Details
0	-	
1	Phase Alarm	Phase alarm (Unit or Circuit)
2	Freeze Alarm	Freeze alarm
3	Freeze Alarm EV1	Freeze alarm on Evaporator 1
4	Freeze Alarm EV2	Freeze alarm on Evaporator 2
5	Pump Alarm	Pump overload
6	Fan Overload	Fan overload
7	OAT Low Pressure	Low press alarm during low OAT start.
8	Low Amb Start Fail	Low OAT start-up failed
9	Unit 1 Offline	Board #1 offline (Master)
10	Unit 2 Offline	Board #2 offline (Slave)
11	Evap. Flow Alarm	Evaporator flow switch alarm
12	Probe 9 Error	Inlet temperature probe fault
13	Probe 10 Error	Outlet temperature probe fault
14	-	-
15	Prepurge #1 Timeout	Prepurge failed on circuit #1
16	Comp Overload #1	Compressor #1 overload
17	Low Press. Ratio #1	Low Pressure Ratio on circuit #1
18	High Press. Switch #1	High pressure switch alarm on circuit #1
19	High Press. Trans #1	High pressure transducer alarm on circuit #1
20	Low Press. Switch #1	Low pressure switch alarm on circuit #1
21	Low Press. Trans #1	Low pressure transducer alarm on circuit #1
22	High Disch Temp #1	High discharge temperature circuit #1
23	Probe Fault #1	Probes on circuit #1 failure
24	Transition Alarm #1	Transition alarm compressor #1
25	Low Oil Press #1	Low oil pressure on circuit #1
26	High Oil DP Alarm #1	High oil delta pressure alarm on circuit #1
27	Expansion Error	Expansion boards error
28	-	-
29	EXV Driver Alarm #1	EXV Driver #1 Alarm
30	EXV Driver Alarm #2	EXV Driver #2 Alarm
31	Restart after PW Loss	Restart after power loss
32	-	-
33	-	-

34	Prepurge #2 Timeout	Prepurge failed on circuit #2
35	Comp Overload #2	Compressor overload #2
36	Low Press. Ratio #2	Low Pressure Ratio on circuit #2
37	High Press. Switch #2	High pressure switch alarm on circuit #2
38	High Press. Trans #2	High pressure transducer alarm on circuit #2
39	Low Press. Switch #2	Low pressure switch alarm on circuit #2
40	Low Press. Trans #2	Low pressure transducer alarm on circuit #2
41	High Disch Temp #2	High discharge temperature circuit #2
42	Maintenance Comp #2	Maintenance required on compressor #2
43	Probe Fault #2	Probes on circuit #1 failure
44	Transition Alarm #2	Transition alarm compressor #2
45	Low Oil Press #2	Low oil pressure on circuit #1
46	High Oil DP Alarm #2	High oil delta pressure alarm on circuit #1
47	Low Oil Level #2	Low oil level on circuit #2
48	PD #2 Timer Expired	Pump down timer expired on circuit #2 (Warning not signalled as alarm condition)
49	-	
50	-	
51	-	
52	Low Oil Level #1	Low oil level on circuit #1
53	PD #1 Timer Expired	Pump down timer expired on circuit #1 (Warning not signalled as alarm condition)
54	HR Flow Switch	Heat recovery flow switch alarm.

6.12. Economizer valve

If the option is present (expansion board 1) and enabled under manufacturer password, when the compressor's load percentage is greater than an adjustable threshold (default is 90%) and if the saturated condensing temperature is lesser than an adjustable setpoint (default is 65.0°C) the economizer valve is energized. The valve is deenergized if either the compressor's load percentage falls below another adjustable threshold (default is 75%) or if the saturated condensing temperature falls below the setpoint minus an adjustable differential (default is 5.0 °C).

6.13. Switch between cooling and heating mode

Any time the switching of a compressor between cooling (or cooling/glycol or ice) and heating mode is require, either if this is required by unit switching form one mode to other or to start defrost or to end defrost, the following procedures are followed.

6.13.1. Switching from cooling modes to eating mode

6.13.1.1. Compressor running in cooling mode

A compressor running in cooling mode (four-way valve de-energized) is switched off without executing pumpdown, the four-way valve is energized 5 seconds after the compressor has been switched off, than the compressor is switched on after the minimum time compressor off is expired and the standard prepurge procedure is executed.

6.13.1.2. Compressor stopped in cooling mode

If a compressor that was stopped in cooling mode is required to start in heating mode it is switched on in standard cooling mode (with four-way valve de-energized and executing the

standard prepurge procedure), it is kept running for 120 seconds in cooling mode and than is switched off without pumpdown, the four-way valve is energized 5 seconds after the compressor has been switched off, than the compressor is switched on after the minimum time compressor off is expired.

6.13.2. Switching from heating modes to cooling modes

6.13.2.1. Compressor running in heating mode

A compressor running in heating mode (four-way valve energized) is switched off without executing pumpdown, the four-way valve is de-energized 5 seconds after the compressor has been switched off, than the compressor is switched on after the minimum time compressor off is expired and the standard prepurge procedure is executed.

6.13.2.2. Compressor stopped in heating mode

If a compressor that was stopped in heating mode (four-way valve energized) is required to start than then four-way valve is de-energized and the compressor is switched on after the 20 sec.

6.13.3. Additional consideration

The previous procedures relay on the fact that the cooling or heating state is a property of the compressor regardless the fact it is switched on or off. This meanings that, if a compressor is switched of in heating mode its four-way valve remains energized (at the same manner a compressor switched off in cooling mode has the four-way valve de-energized).

If the unit power is removed the four-way valves are automatically de-energized (it is an hardware characteristic of the valves); this meanings that also compressors switched off in heating mode goes in cooling mode. So the heating mode of each compressor is reset if the unit power is removed.

6.14. Defrost procedure

In units configured as heat pumps running in heating mode a defrost procedure are executed.

Two compressors will not execute the defrost procedure at the same time.

A compressor will not execute the defrost procedure unless an adjustable timer (default 30 min) is expired since its startup and will not execute two defrost time before another adjustable timer (default 30 min) is expired (if this is required a warning message are generated).

The defrost procedure are based on the measure of ambient temperature (Ta) and the suction temperature measure by the defrost sensors (Ts). When the Ts remains below Ta by an amount greater than a value, depending from ambient temperature and coil design, for a time longer than an adjustable (default 5 min) value the defrost will start.

The formula to evaluate needs for defrost is:

$Ts < 0.7 \times Ta - \Delta T$ & $Ssh < 10$ °C (adjustable value)

Where ΔT is the adjustable coil design approach (default=12°C) and Ssh is the suction superheat.

Defrost procedure will never be executed if Ta > 7 °C (adjustable under maintenance password).

Defrost procedure will never be executed if Ts > 0 °C (adjustable under maintenance password).

During defrost the circuit are switched in “cooling mode” for an adjustable time (default 10 min) if Ta < 2 °C (adjustable under maintenance password), otherwise the compressor are stopped and fans are kept at maximum speed for another adjustable time (default 15 min).

Defrost procedure are stopped if evaporator outlet temperature fall below a set value or if discharge pressure reaches a set value.

During defrost procedure “Low pressure switch alarm” and “Low suction pressure alarm” are disabled.

If the switch in “cooling mode” is required, it are executed only if the pressure difference between compressor discharge and suction exceeds 4 bar; if this isn’t the compressor are loaded to reach such a condition. After the switching compressor fans are switched off and a pre-purge procedure are executed (at minimum compressor load) . After prepurge the compressor are loaded energizing the loading solenoid with an adjustable number of pulse (default 3).

At the end of defrost procedure executed in “cooling mode” compressor are switched off after its complete download without execution of pumpdown; than the 4-way valve are deenergized; than the compressor are available for temperature control system ignoring the start to start timer.

6.15. Liquid injection

Liquid injection in the discharge line is activated both in cooling/ice and heating mode if the discharge temperature exceeds an adjustable value (default 85°C).

Liquid injection in the suction line are activated, only in heating mode, if the discharge superheat exceeds an adjustable value (default 35°C).

6.16. Heat Recovery procedure

The heat recovery procedure is available only in units configured as chillers (not available for heat pumps).

The manufacturer will select the circuits equipped with heat recovers.

6.16.1. Recovery pump

When heat recovery is activated the control will start the recovery pump (if the second pump is foreseen the pump with low operating hours is selected, a manual pump sequencing is foreseen); within 30 sec a recovery flow switch must close otherwise and “Recovery Flow Alarm” will rise and the heat recovery function is disabled; the alarm is automatically reset for three times if the evaporator flow switch closes for more than 30 seconds. Starting from the fourth alarm it has to be reset manually.

No recovery circuit must be activated if a flow switch alarm occurs.

In case of a flow switch alarm during recovery circuit operation, the related compressor will trip and the alarm reset will not be allowed up to the flow is recovered (otherwise recover heat exchanger freeze will occur).

6.16.2. Recovery control

When heat recovery is activated the control will activate or deactivate recovery circuits with a step logic.

In particular a next heat recovery stage is activated (a new heat recovery circuit is inserted) if the heat recovery leaving water temperature remains below the setpoint by an amount greater than an adjustable regulation band for a timer greater than an adjustable value (heat recovery interstage). When a recovery stage is requested, the relative compressor is completely downloaded and then the recovery valve is energized. After recovery valve switches the compressor load is inhibited until the saturated condensing temperature is lower than an adjustable threshold (default is 30.0°C).

At the same manner a heat recovery stage is deactivated (a heat recovery circuit is removed) if the heat recovery leaving water temperature remains above the setpoint by an amount greater than an adjustable dead regulation band for a timer greater than the previous defined value.

An high temperature setpoint is active in the recovery loop; it will disable all recovery circuits at the same time if the heat recovery water temperature rises above an adjustable threshold (default 50.0°C).

A three-way valve is used to increase recovery water temperature at startup; a proportional control is used to establish valve position; at low temperature the valve will recirculate recovery water, while at temperature increasing the valve will bypass a portion of the flow.

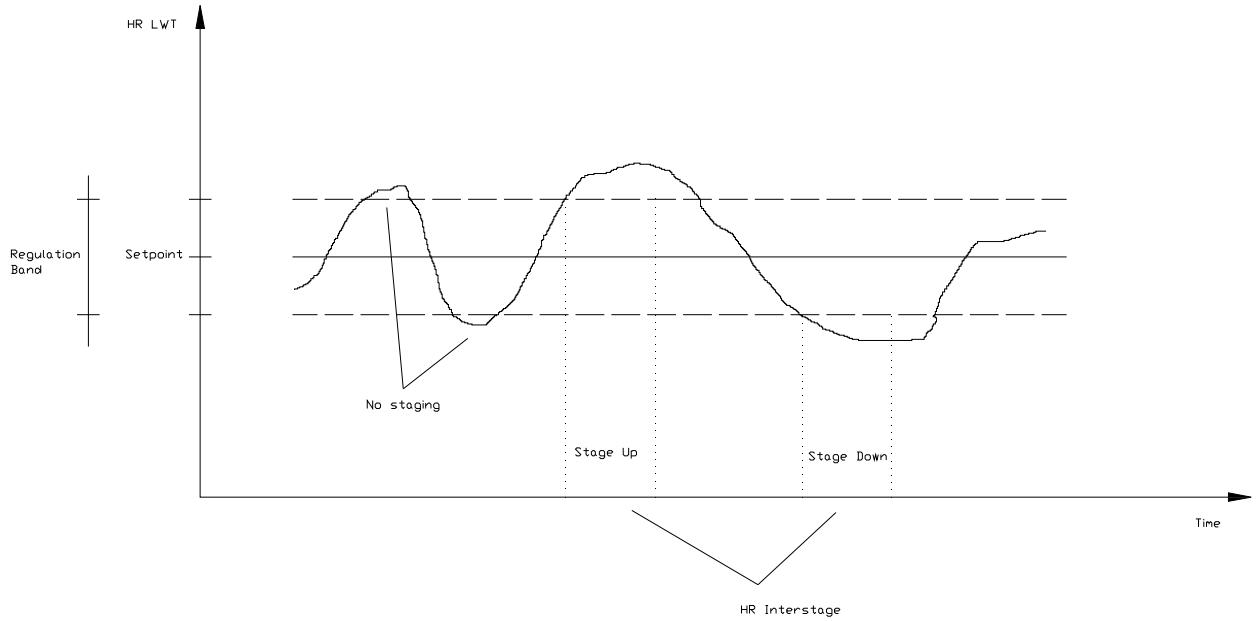


Fig. 14 – Heat recovery interstage

6.17. Compressor limiting

Two levels of limits are included in the control:

- Load inhibit
  The load is not allowed; another compressor may start or may be loaded
- Forced unload
  The compressor is unloaded; another compressor may start or may be loaded

The parameters that may limit compressors are :

- Suction pressure
  The compressor load is inhibited if the suction pressure is lower than a “stage-hold” setpoint
  The compressor is unloaded if the suction pressure is lower than a “stage-down” setpoint

- Discharge pressure
  The compressor load is inhibited if the discharge pressure is higher than a “stage-hold” setpoint
  The compressor is unloaded if the discharge pressure is higher than a “stage-down” setpoint

- Evaporator outlet temperature
  The compressor is unloaded if the evaporator outlet temperature is lower than a “stage-down” setpoint

- Discharge Superheat
  The compressor load is inhibited if, the discharge superheat is below an adjustable threshold (default 1.0°C) for an adjustable time (default 30s) from the compressor starts at the end of prepurge procedure.

- Absorbed inverter current
  The compressor load is inhibited if, the absorbed inverter current is above an adjustable threshold .
  The compressor is unloaded if the absorbed inverter current is above the inhibit threshold of an adjustable percentage.

6.18. Unit limiting

Unit load may be limited by the following inputs:

- Unit current
  The unit load is inhibited if the absorbed current is near to a maximum current setpoint (within -5% from setpoint)
  The unit is unloaded if the absorbed current is higher than a maximum current setpoint

- Demand limit
  The unit load is inhibited if the unit load (measured by slide valve sensors or calculated as described) is near to a maximum load setpoint (within -5% from setpoint)
  The unit is unloaded if the unit load is higher than the maximum load setpoint.

The maximum load setpoint may be derived by a 4-20 mA input (4mA → limit=100%; 20 mA → limit=0%); or from a numeric input coming from monitoring system (network demand limit).

- SoftLoad

  At unit startup (when the first compressor stats) a temporary demand limit may be set up to a time expired.

6.19. Evaporator pumps

An evaporator pump is foreseen in the base configuration while a second pump is an optional.

When the two pumps are selected, the system will automatically start the pump with lower operating hours each time a pump has to be started. A fixed starting sequence may be set.

A pump is started when the unit is switched on; within 30 sec an evaporator flow switch must close otherwise and "Evaporator Flow Alarm" will rise. The alarm is automatically reset for three times if the evaporator flow switch closes for more than 30 seconds. Starting from the fourth alarm it has to be reset manually.

6.19.1. Inverter pump[2]

Inverter pump is used to modify water flow through the evaporator in order to keep evaporator water ΔT at the rated value (or close to it) even if the required capacity is reduced due to the switching off of some terminals. In fact, in this case the water flow across the remaining ones increases as well as the pressure drops and the head required to the pump.

So the pump speed is reduced to reduce the water pressure drops across terminals at the rated value.

Since a minimum flow through the evaporator is required (about 50% of rated one) as well as inverter pumps may not run at low frequency, a minimum flow bypass is managed.

The flow control is based on the measurement of pressure difference across the pump (pump head) and will act on the pump speed and on the bypass valve position.

Both actions are executed by 0-10V analog output.

In particular, since pressure drops across evaporators and piping change with flow while pressure drops across terminal units are flow-independent, the pump required head (head setpoint) is a function of the flow:

$$\Delta h = (\Delta h_r - \Delta P_t) \cdot \left(\frac{f}{f_r} \right)^2 + \Delta P_t$$

being

Δh = required pump head at the supply frequency f (pump head target)
Δh_r = pump head at rated flow (pump head setpoint)
ΔP_t = terminal units pressure drop at rated flow
f = pump required supply frequency

[2] Inverter pump control is included in versions from ASDU01A.

f_r = pump supply frequency at rated flow

A tuning procedure is available to allow the setting of Δh_r .

This procedure has to be activated with unit on, both compressors running at 100% and all terminal units on. When this procedure is active the pump speed may be adjusted manually from 70% to 100% (35 to 50Hz) and the they bypass valve is completely close (0V output) and the evaporator water ΔT is shown. When the operator, changing the pump speed reaches the right water ΔT will stop the setup procedure and the pump head is chosen as Δh_r (head setpoint).

If the setup procedure has not been executed the system will work with 100% pump speed and bypass valve completely closed and a "No pump VFD calibration alarm" will rise (delayed by 30 minutes) without stopping the unit.

During the operation a PID controller acts on the pump speed to keep the pump head to the target value Δh (reducing the speed as well as the head increases) and keeping the bypass valve completely close; the PID controller will never reduce the pump speed below 75% (35Hz) since this is the operating limit of inverter pump, if this set is reached and the head continues to increase a PID controller will start to open the bypass valve.

The reverse occurs when pump head decreases; the controller will start to close the valve and when it is completely closed it will start to speed-up the pump.

Pump speed and bypass valve will never move together (to avoid flow instability); pump will be adjusted from 100% to minim flow, valve will be used when required flow is below the minimum.

At the unit startup the pump will start at minimum frequency (35 Hz) and will accelerate up to 50 Hz in 10 sec. while the bypass valve is completely open (100% output).

Then it will start to regulate pump head accordingly to the previous procedure; the compressors start will be enabled once the target pump head is reached (within a 10% tolerance).

6.20. Fans control

Fans control is used to manage condensation pressure in cooling, cooling glycol or ice mode and evaporating pressure in heating mode.

In both cases the fans may be managed to control:

- Condensation or evaporation pressure,
- Pressure ratio,
- Pressure difference between condensation and evaporation.

Four control methods are available:

- Fantroll,
- Fan Modular,
- Variable speed driver,
- Speedtroll.

6.20.1. Fantroll

A step control is used; fan steps are activated or deactivated to keep compressor operating conditions within the allowed envelope.

Fan steps are activated or deactivated keeping condensing (or evaporating pressure) change to a minimum; to do this one next fan is started or stopped at time.

Fans are connected to steps (digital outputs) according to the scheme in table below

Fans connection to steps

	N° of fans per circuit							
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Step	**Fans on the step**							
1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2
3		3	3,4	3,4	3,4	3,4	3,4	3,4
4				5	5,6	5,6	5,6	5,6
5						7	7,8	7,8,9

Fan steps are activated or deactivated on the base of the staging table below

Steps staging

	N° of fans per circuit							
	2	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Stage	**Active step**							
1	1	1	1	1	1	1	1	1
2	1+2	1+2	1+2	1+2	1+2	1+2	1+2	1+2
3		1+2+3	1+3	1+3	1+3	1+3	1+3	1+3
4			1+2+3	1+2+3	1+2+3	1+2+3	1+2+3	1+2+3
5				1+2+3+4	1+3+4	1+3+4	1+3+4	1+3+4
6					1+2+3+4	1+2+3+4	1+2+3+4	1+2+3+4
7						1+2+3+4+5	1+3+4+5	1+2+3+5
8							1+2+3+4+5	1+3+4+5
9								1+2+3+4+5

6.20.1.1. Fantroll in cooling mode

6.20.1.1.1. Control of condensing pressure

A stage up is executed (the next stage is activated) if the condensing saturated temperature (saturated temperature at discharge pressure) exceeds the target setpoint (default 43.3 °C (110 F)) by an amount equal to a stage up dead band by a time depending by the difference between the reached values and the target setpoint plus stage up dead band (high condensing temperature error).

In particular the stage up is executed when the integral of the high condensing temperature error reaches the value 50 °C x sec (90 Fxsec).

At the same manner a stage down is executed (the previous stage is activated) if the condensing saturated temperature falls below the target setpoint by an amount equal to a stage down dead band by a time depending by the difference between the reached the target setpoint minus the stage down dead band values and the reached value (low condensing temperature error).

In particular the stage down is executed when the integral of the low condensing temperature error reaches the value 14 °Cxsec (25.2 Fxsec).

The condensing temperature error integral is reset to zero when condensing temperature is within the deadband or a new stage is activated.

Each fan stage will have its own adjustable stage up (default 4.5 °C (8.1F)) and stage down (default 6.0 °C (10.8 F)) deadband.

6.20.1.1.2. Control of pressure ratio

The control will operate to keep pressure ratio equal to a target adjustable value (default 2.8)

A stage up is executed (the next stage is activated) if the pressure ratio exceeds the target pressure ratio by an amount equal to an adjustable stage up dead band by a time depending by the difference between the reached values and the target value plus stage up dead band (high pressure ratio error).

In particular the stage up is executed when the integral of the pressure ratio error reaches the value 25 sec.

At the same manner a stage down is executed (the previous stage is activated) if the pressure ratio falls below the target setpoint by an amount equal to a stage down dead band depending by the difference between the target setpoint minus the stage down dead band values and the reached value (low pressure ratio error).

In particular the stage down is executed when the integral of the low pressure ratio error reaches the value 10 sec.

The pressure ratio error integral is reset to zero when condensing temperature is within the deadband or a new stage is activated.

Each fan stage will have its own adjustable stage up (default 0.2) and stage down (default 0.2) deadband.

6.20.1.1.3. Control of temperature difference

The control will operate to keep difference between the condensing temperature (saturated temperature at discharge pressure) and evaporating temperature (saturated temperature at suction pressure) equal to an adjustable target value (default 40°C (72 F)).

A stage up is executed (the next stage is activated) if the pressure difference exceeds the target pressure difference by an amount equal to an adjustable stage up dead band by a time depending by the difference between the reached values and the target value plus a stage up dead band (high pressure difference error).

In particular the stage up is executed when the integral of the pressure difference error reaches the value 50 °C x sec (90 Fxsec).

At the same manner a stage down is executed (the previous stage is activated) if the pressure difference falls below the target setpoint by an amount equal to a stage down dead band depending by the difference between the target setpoint minus the stage down dead band values and the reached value (low pressure difference error).

In particular the stage down is executed when the integral of the low pressure ratio error reaches the value 14 °C x sec (25.2 Fxsec).

The pressure ratio error integral is reset to zero when condensing temperature is within the deadband or a new stage is activated.

Each fan stage will have its own adjustable stage up (default 4.5 °C (8.1F)) and stage down (default 6.0 °C (10.8 F)) deadband.

6.20.1.2. Fantroll in heating mode

6.20.1.2.1. Control of evaporation pressure

A stage up is executed (the next stage is activated) if the evaporating saturated temperature (saturated temperature at suction pressure) is below the target setpoint (default 0 °C (32 F)) by an amount equal to a stage up dead band by a time depending by the difference between the reached values and the target setpoint plus stage up dead band (high condensing temperature error).

In particular the stage up is executed when the integral of the high condensing temperature error reaches the value 50 °C x sec (90 F x sec).

At the same manner a stage down is executed (the previous stage is activated) if the evaporating saturated temperature exceeds the target setpoint by an amount equal to a stage down dead band by a time depending by the difference between the reached the target setpoint minus the stage down dead band values and the reached value (low condensing temperature error).

In particular the stage down is executed when the integral of the low condensing temperature error reaches the value 14 °C x sec (25.2 Fxsec).

The condensing temperature error integral is reset to zero when condensing temperature is within the deadband or a new stage is activated.

Each fan stage will have its own adjustable stage up (default 3 °C (5.4F)) and stage down (default 3 °C (5.4 F)) deadband.

6.2.1.1.1. Control of pressure ratio

The control will operate to keep pressure ratio equal to a target adjustable value (default 3.5)

A stage up is executed (the next stage is activated) if the pressure ratio exceeds the target pressure ratio by an amount equal to an adjustable stage up dead band by a time depending by the difference between the reached values and the target value plus stage up dead band (high pressure ratio error).

In particular the stage up is executed when the integral of the pressure ratio error reaches the value 25 sec.

At the same manner a stage down is executed (the previous stage is activated) if the pressure ratio falls below the target setpoint by an amount equal to a stage down dead band depending by the difference between the target setpoint minus the stage down dead band values and the reached value (low pressure ratio error).

In particular the stage down is executed when the integral of the low pressure ratio error reaches the value 10 sec.

The pressure ratio error integral is reset to zero when condensing temperature is within the deadband or a new stage is activated.

Each fan stage will have its own adjustable stage up (default 0.2) and stage down (default 0.2) deadband.

6.2.1.1.2. Control of temperature difference

The control will operate to keep difference between the condensing temperature (saturated temperature at discharge pressure) and evaporating temperature (saturated temperature at suction pressure) equal to an adjustable target value (default 50°C (90 F))

A stage up is executed (the next stage is activated) if the pressure difference exceeds the target pressure difference by an amount equal to an adjustable stage up dead band by a time depending by the difference between the reached values and the target value plus a stage up dead band (high pressure difference error).

In particular the stage up is executed when the integral of the pressure difference error reaches the value 50 °C x sec (90 Fxsec).

At the same manner a stage down is executed (the previous stage is activated) if the pressure difference falls below the target setpoint by an amount equal to a stage down dead band depending by the difference between the target setpoint minus the stage down dead band values and the reached value (low pressure difference error).

In particular the stage down is executed when the integral of the low pressure ratio error reaches the value 14 °C x sec (25.2 Fxsec)..

The pressure ratio error integral is reset to zero when condensing temperature is within the deadband.

6.20.2. Fan Modular

The Fan Modular method will work at the same way of Fantroll method (staging sequence), but instead of using digital outputs, it will use and analog output.

In particular the analog output will assume a value, in volts, equal to the stage number (at stage 2, 2V is output, at stage 3, 3V and so on).

6.20.3. Variable Speed Driver

A continuous control is used; fans speed is modulated to keep saturated condensation pressure at a setpoint; a PID control is used to allow a stable operation.

A Fan Silent Mode function (FSM) is implemented on unit with Variable Speed Driver (VSD) to keep fan speed below a set value during some periods.

6.2.1.2. VSD in cooling, cooling glycol or ice mode

When the system is operating in cooling mode, either if it is controlling the condensation pressure, the pressure ratio or the pressure difference, the PID proportional gain is positive (the higher the input the higher the output).

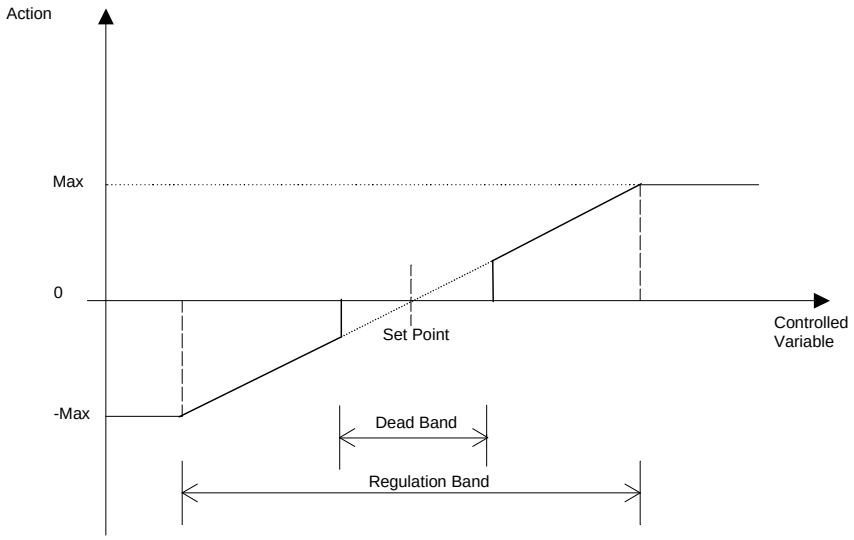


Fig. 15 – Proportional action of VSD PID in cooling/iced mode

6.2.1.3. VSD in heating mode

6.2.1.3.1. Control of evaporation temperature

When the system is operating in heating mode to control the evaporation temperature the proportional gain is negative (the higher the input the lower the output).

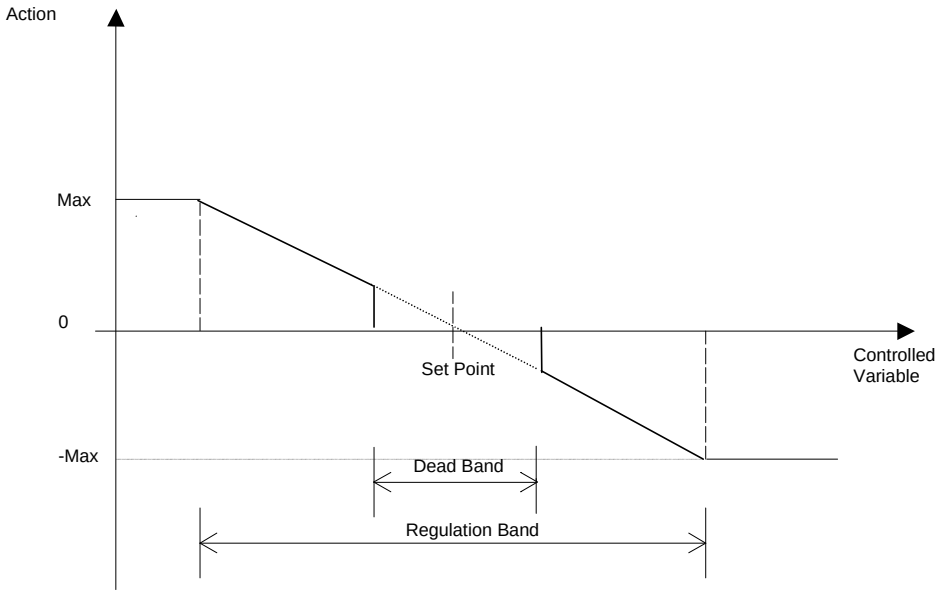


Fig. 16 – Proportional action of VSD PID in heating mode

6.2.1.3.2. Control of pressure ratio or temperature differences

When the system is operating in heating mode to control the pressure ration the proportional gain is positive (the higher the input the higher the output).

6.20.4. Speedtroll

A mixed step-VSD control are used; the first fans step are managed using a VSD (with related PID control), next steps are activated as in the step control, only if the cumulated stage-up and stage-down error is reached and the VSD output is at maximum or minimum respectively.

6.20.5. Double VSD

Two VSD are managed to keep controlled parameter at a setpoint; the second VSD are activated when the first one reaches the maximum speed and the PID control requires greater air flow

6.20.6. Fans control at startup in heating mode

At the compressors start in heating mode fans are started before that the compressors begin their normal start up sequence if the outside ambient temperature is below a fixed temperature of 10.0°C (50.0F). If the condensation control is either speedtroll or fantroll each step is activated after a fixed delay of 6 seconds. The control is released to automatic control if the outside ambient temperature is greater than a fixed threshold of 15.0°C (59.0F).

6.21. Other functions

The following functions are implemented.

6.21.1. Hot Chilled Water Start

This feature will allow the unit startup also in case of high evaporator outlet water temperature.

It will not allow the compressors loading above an adjustable percentage until the evaporator leaving water temperature falls below an adjustable threshold; another compressor is enabled to start when the others are limited.

6.21.2. Fan Silent Mode

This feature will allow to reduce unit noise limiting fans speed (only in case of VSD fan control) on the base of a time schedule. A maximum output voltage for the VSD could be set for FSM operations (default value 6.0V).

6.21.3. Double evaporator units

This feature will allow to limit freezing problems on units with two evaporators (3 and 4 compressors units).

In this case compressors are started alternatively on the two evaporators.

7. UNIT AND COMPRESSORS STATUS

In the following tables it will be possible to find all the configured unit and compressors status with some details explaining the status.

Status code	Interface status label	Explanation
0	-	Not reachable.
1	Off Alarm	Unit is off due to a unit alarm.
2	Off Rem Comm	Unit is off from Remote Supervisor.
3	Off Time Schedule	Unit is off due to time schedule.
4	Off Remote Sw	Unit is off from remote switch.
5	Pwr Loss Enter Start	Power failure. Press Enter button to start the Unit.
6	Off Amb. Lockout	Unit is off due to external temperature below ambient lockout threshold.
7	Waiting Flow	Unit is verifying the flow switch status before temperature control start.
8	Waiting Load	Waiting for thermal load on water circuit.
9	No Comp Available	No compressor available (both off or in conditions that inhibits their start).
10	FSM Operation	Unit is working in Fan Silent Mode.
11	Off Local Sw	Unit is off from local switch.
12	Off Cool/Heat Switch	Unit is in idle after a Cool/Heat switch.

Tab. 15 – Unit status

Status code	Interface status label	Explanation
0	-	Not reachable.
1	Off Alarm	Compressor is off due to unit alarm.
2	Off Ready	Compressor is ready but the Unit is off.
3	Off Ready	
4	Off Ready	
5	Off Ready	
6	Off Ready	
7	Off Switch	Compressor is off from switch.
8	Auto %	Automatic compressor load management.
9	Manual %	Manual compressor load management.
10	Oil Heating	Compressor is off due to Oil Heating.
11	Ready	Compressor is ready to start.
12	Recycle Time	Compressor is waiting for safety timers to expire before it could be kicked again.
13	Manual Off	Compressor is off from terminal.
14	Prepurge	Compressor is in pre-emptying evaporator before it could be automatically managed.
15	Pumping Down	Compressor is pre-emptying the evaporator before shut-down.
16	Downloading	Compressor is reaching its minimum load percentage.

17	Starting	Compressor is starting.
18	Low Disch SH	Discharge superheat is lower than a adjustable threshold
19	Defrost	Compressor is in defrosting procedure.
20	Auto %	Automatic compressor load management (Inverter).
21	Max VFD Load	Maximum absorbed current reached compressor cannot load.
22	Off Rem SV	Compressor is off from Remote Supervisor.

Tab. 16 – Compressors status

8. START-UP SEQUENCE

8.1. Unit start-up and shut-down flowcharts

Unit startup and shutdown will follow the sequence shown in fig. 16 and 17

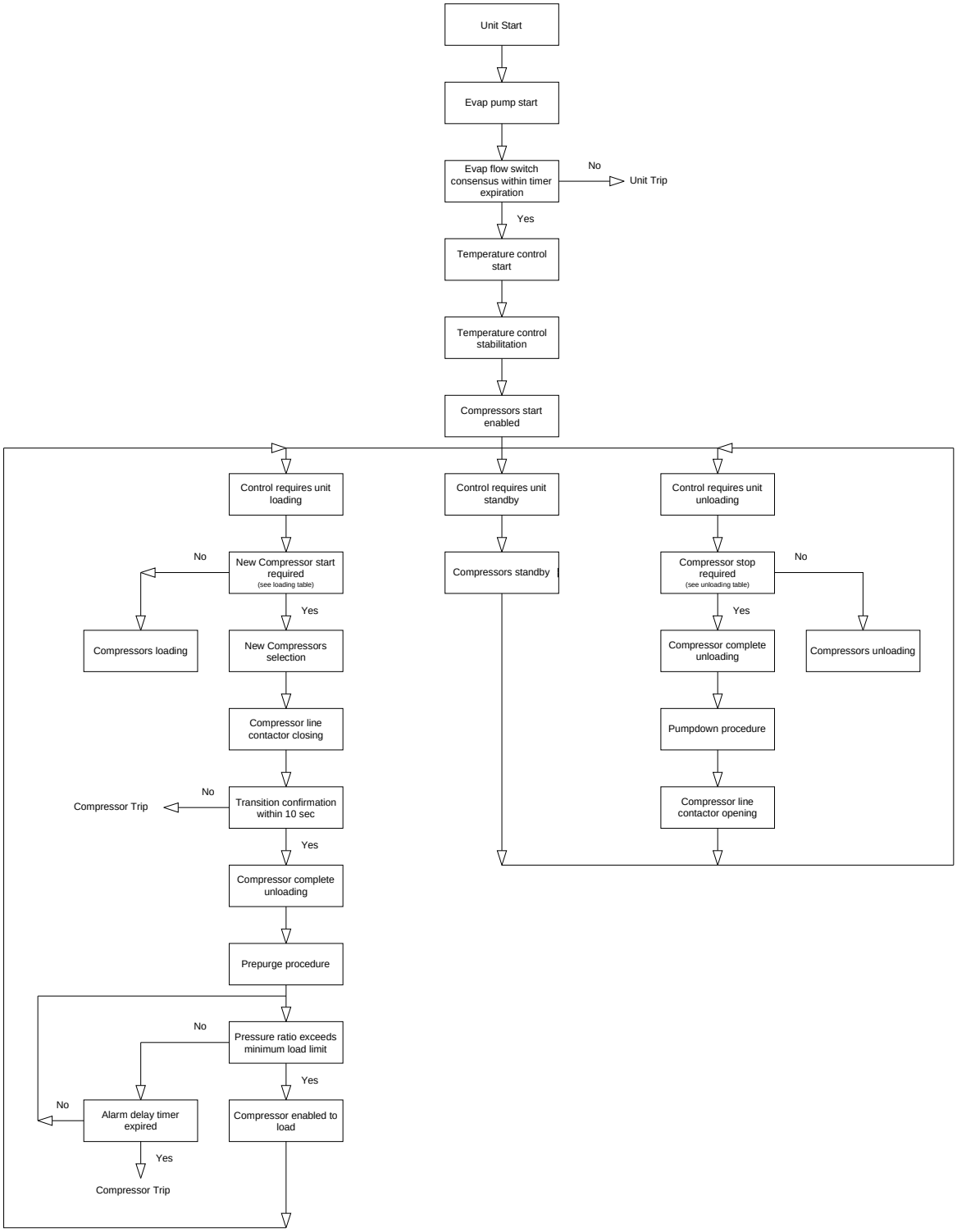


Fig. 17 – Unit startup sequence

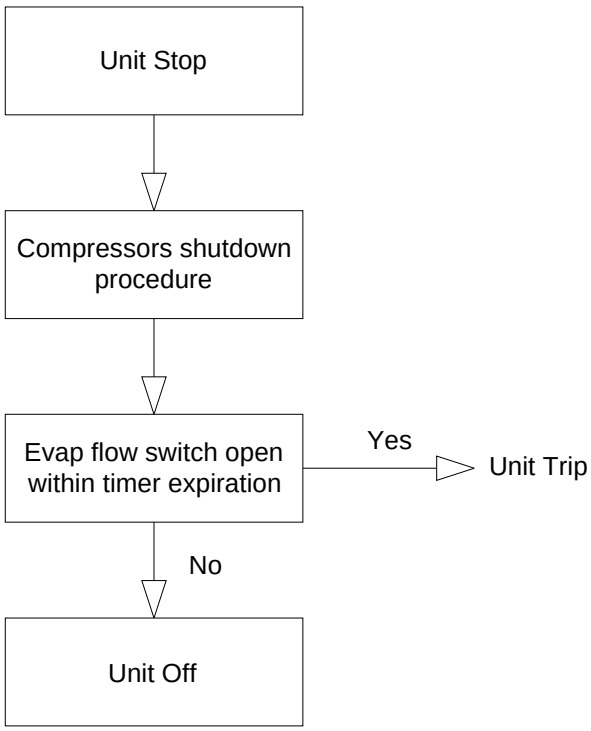


Fig. 18 – Unit shutdown sequence

8.2. Heat recovery start-up and shut-down flowcharts

Unit startup and shutdown will follow the sequence shown in fig. 18 and 19

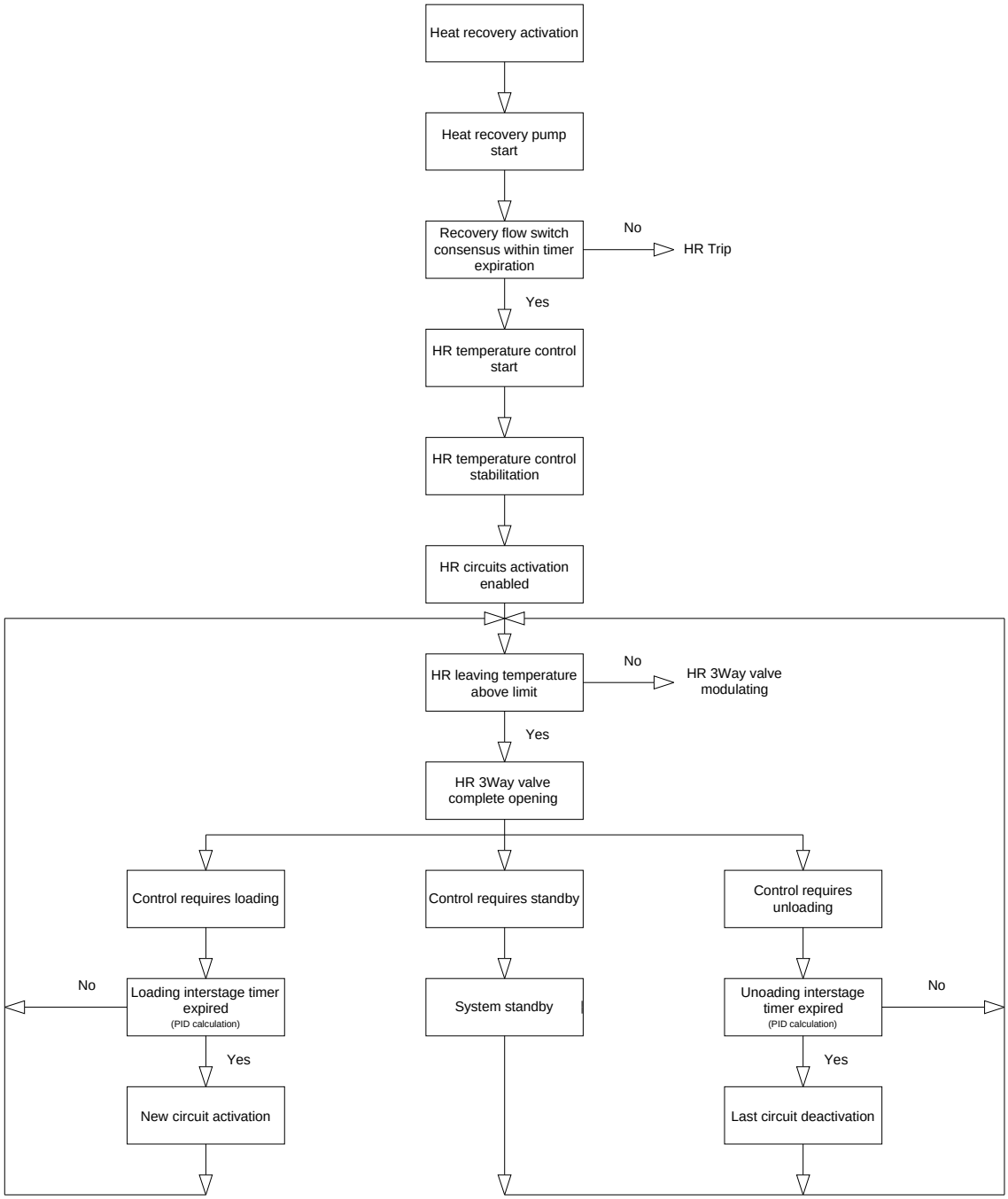


Fig. 19 – Heat recovery startup sequence

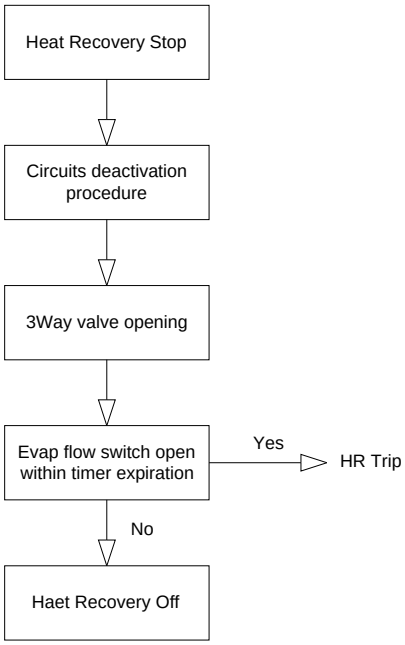


Fig. 20 – Heat recovery shutdown sequence

9. USER INTERFACE

Two types of user interface are implemented in the software: built-in display and PGD; the PGD display is used as optional remote display.

Both interfaces have a 4x20 LCD display and a 6 keys keypad.

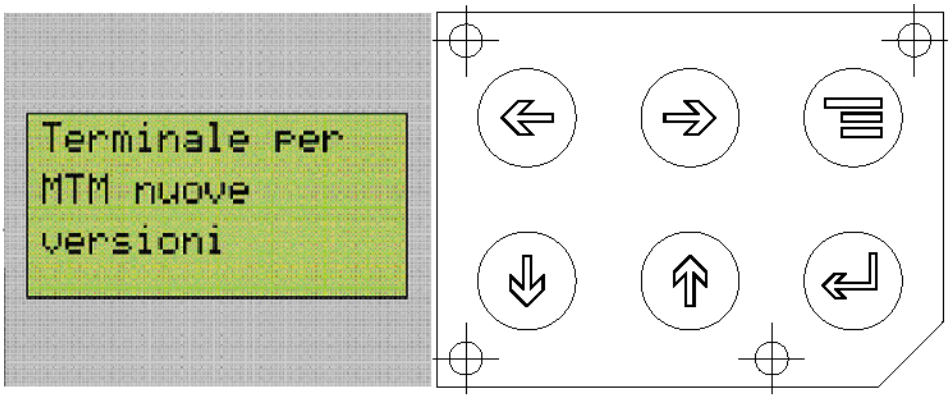


Fig 21 – Built-In Display

Fig 22 – PGD Display

In particular, from the main menu, that may be accessed using  (*MENU* key), 4 different menu sections are addressable. Each section may be accessed using the related key:

 (*ENTER* key) is used to access the Unit status loop from every menu mask.

 (*LEFT* key) access the section listed on the first row of the list

 (*RIGTH* key) access the section listed on the second row of the list

 (*UP* key) access the section listed on the third row of the list

 (*DOWN* key) access the section listed on the fourth row of the list

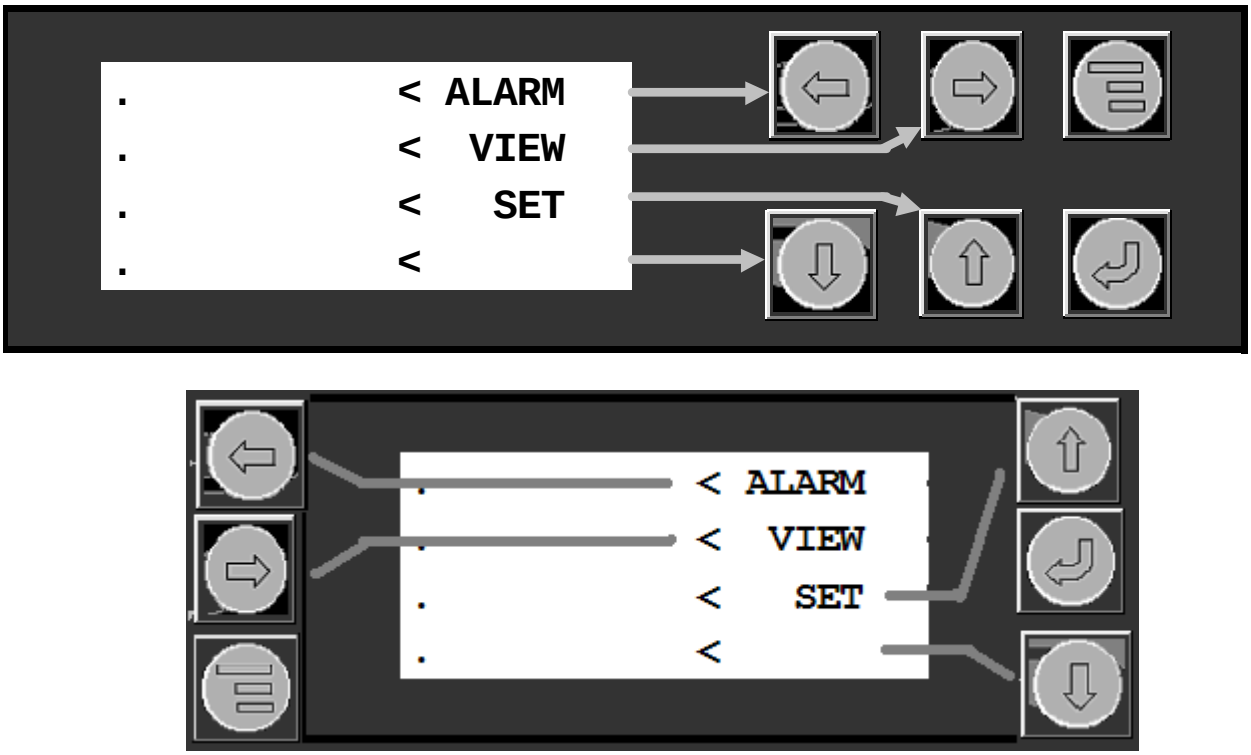


Fig 23 – Built-In & PGD navigation

In case of different key labels (this may happen if a standard Carel controller is used instead of one with personalized keypad) please refer to key position to access the same function.

Entering any other section different menus or mask loops are shown.

From every loop with MENU key it is possible to access the father menu and so on until main menu is reached.

In each loop horizontal navigation have been introduced. Using *LEFT* and *RIGHT* keys it is possible to move between masks of similar usage (i.e. from View Unit loop is possible to move to View Compressor #1 loop; from Unit Configuration loop is possible to move to Unit Setpoint loop and so on, refer to Masks Tree).

In a mask with different I/O fields, with *ENTER* key is possible to access the first one, then with *UP* and *DOWN* it is possible to increase and decrease respectively the value, with *LEFT* it is possible to reload the default value and with *RIGHT* it is possible to skip leaving the value unchanged.

The possibility of change values is subordinated to passwords of different levels depending on the sensibility of the value.

When a password is active, pressing *UP+DOWN* it is possible to reset all passwords (to make the access to protected values not accessible anymore without the re-insertion of the password).

In any main loops it is possible to change the password for the corresponding level (Unit Config for Tech password, User Setpoint for Operator password and Maint Setpoint for Manager password).

9.1. Mask tree

In fig 22 the structure of the mask tree beginning from the main menu is shown.

In violet the loop horizontally linked are shown.

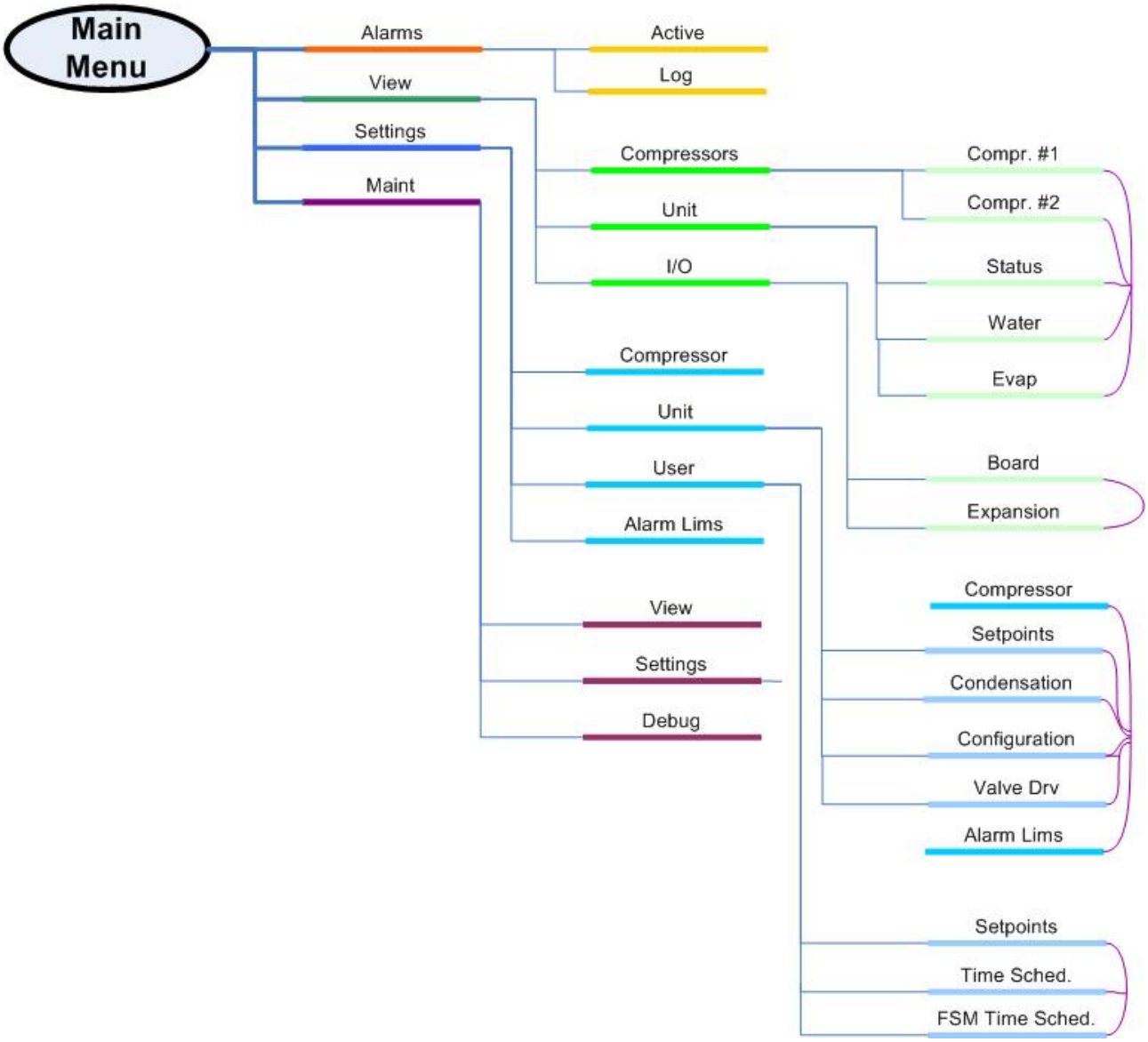


Fig 24 – Mask tree

9.1.1. Details on Human Machine Interface structure

The HMI of the ASDU01C was developed trying to optimize its usability. This is the reason why masks loops of the same group of parameters could be accessed using left and right arrows creating also horizontal loops.

Parameters within a same horizontal loop could accessed with a unique password.

The structure of the interface assumes the layout of the following figure 24.

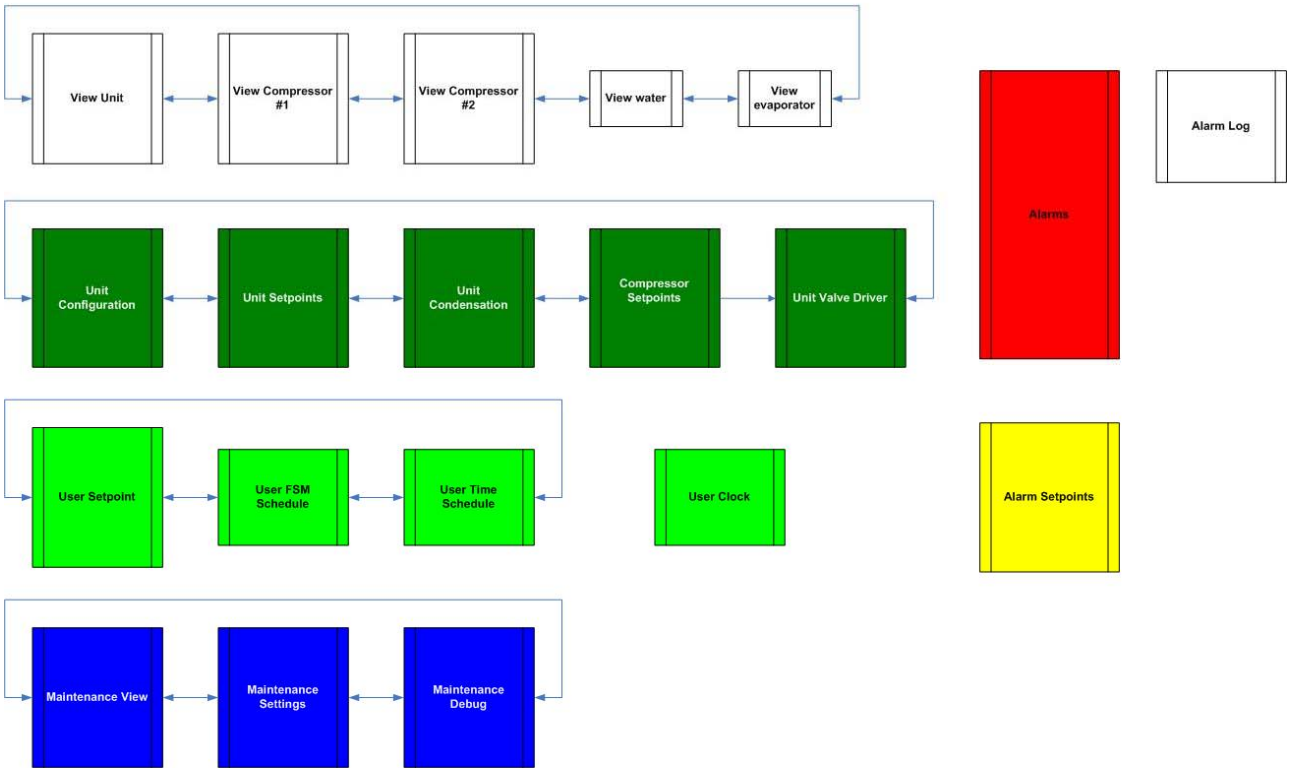


Fig 25 – HMI structure

All loops could be accessed directly from the main menu. Once in the selected loop the other loops, with the same colour in the previous scheme, could be reached with left and right arrows. This will mean for example that from the loop Unit Configuration it will be possible to move to Unit Setpoint pressing the right arrow.
Loops with no link with other loops could be accessed only from the menu.

9.2. Languages

User interface are Multilanguage; the user may select the language to be used.
The following language must be implemented in the base configuration[3]:

- English
- Italian
- French
- German
- Spanish

Chinese language are implemented on additional display (semi-graphic display)

9.3. Units

The interface is able to work using SI and Imperial units.

In the SI system the following units are used:

Pressure : bar

[3] English and Italian are available on ver. ASDU01C.

Temperature : °C
Time : sec
In the Imperial system the following units are used:

Pressure : psi
Temperature : °F
Time : sec

As far as pressure is concerning, the interface shows if shown data are gauge or absolute using the postfix “g” or “a” respectively.

9.4. Default passwords

Several levels of passwords for each subsection are available. Subsections are listed in the table below.

Section	Password
Super User	Daikin Use Only
Technician	Authorized Personnel can Contact Factory
Operator	0100

APPENDIX A: DEFAULT SETTINGS

Menu	Section	Subsection	Mask	Parameter	Value	Notes
SETTINGS	UNIT	CONFIGURATION	Expansion valve	Expansion valve	Electronic or Thermostatic	If electronic driver menu on
				Gas Type	R134a	
			Unit config	N. of comps	2	
				N. of pump	2	Only if pCO^c#3 is present
			Condensation fans number	Circuit #1	2 or 3 or 4	Real number of fans
				Circuit #2	2 or 3 or 4	
			Low Press Transd limits	Min	-0.5 barg	Only with thermostatic expansion valve on
				Max	7.0 barg	
			Condensation	Control var.	Press	PR not in use
				Type	Fantroll	LN andd XN units
					VSD	XXN units or optional
					SPEDTROLL	When specified
					DOUBLE VSD Fan Modular	When specified Not in use
				Update values	Y	When values are changed
			Oil heating	Enable	Y	
			RS485 Net	time check	30	Y only if expansion boards are changed
				Refresh	N	
			Exp Board 2			Exp Board 2 On
			Heat Recovery	Hr circuit recovery	C #1 N/Y C # 2 N/Y	Recovery Type; tot / part
			Economizer	Enabled	Y (optional)	Only on units with Economizer and expansion board 1
			Econ Settings	Econ thr	65°C	
				Econ diff	5 °C	
				Econ On	90%	Only on units with Economizer
				Econ Off	75%	
			Supervisory	Remote on/off	N	
			Autorestart	Autorestart after power fail	Y	
			Switch off	Switch off on ext alarm	N	
			Communication	Communication	Supervisor	
			Reset values	Reset all values to default	N	**Change to Y when replacing software/board**
			Password Technician			To change password
SETTINGS	UNIT	SETPOINTS	Temperature regulation	Derivative time	60 s	
			Prepurge	N. of prepurge cycles	1	When thermostatic valve
				Prep on time	2s	
				Evap T Thr	- 10 °C	
			Prepurge	Prepurge time-out	120 s	
				Downloading time	10 s	
			Pumpdow config	Enable	Y	
				Max Time	30 s	
				Min Press	1 bar	
			Main pump	Off delay	180 s	
			Liquid injection	LI Disc setp	85 °C	
				LI Disc diff	10 °C	
				LI Suct setp	035.0°C	Only in heating mode
				LI Suct diff	005.0°C	Only in heating mode
			Low ambient startup	Cond. Sat. T	-5.0 °C	

				L.Amb.Timer	180 s	
				Dead Band	02.0°C	Only heating mode
				Stage Time	045 s	
				Cond T. thr	030.0°C	
				Pause Time	02 min	
				Min Temp.	040.0°C	
				Max Temp.	030.0°C	
SETTINGS	UNIT	CONDENSATION	Setpoint	Setpoint	40.0 °C	
			FanTroll setpoint	StageUP Err	10 °Cs	
				StageDW Err	10 °Cs	
			FanTroll dead band n. 1	Stage Up	See fantroll table	
				Stage down		
			FanTroll dead band n. 2	Stage Up	See fantroll table	
				Stage down		
			FanTroll dead band n. 3	Stage Up	See fantroll table	
				Stage down		
			FanTroll dead band n. 4	Stage Up	See fantroll table	
				Stage down		
			Inverter config (only for VSD, SpeedTroll or Double VSD config)	Max speed	10.0 V	LN and XN units
					6.0 V	XXN units
				Min speed	0.0V	
				Speed up time	00 s	
			Cond regulation (only for VSD, SpeedTroll or Double VSD config)	Reg. Band	20 °C	Speedtroll
					60 °C	VSD
				Neutral Band	1 °C	
			Cond regulation (only for VSD, SpeedTroll or Double VSD config)	Integral time	150 s	
				Derivative time	001 s	
SETTINGS	UNIT	VALVE DRIVER (Only Units with EEXV)	Preopening	Valve Preopening	35%	
			EXV Settings #1	Warning	NO WARNING	
			EXV Settings #2	Warning	NO WARNING	
			EXV Settings #1	Act. Pos.	0000	Actual valve position
				Man. Posiz	0500	
				En. EXV Man	N	
			EXV Settings #2	Act. Pos.	0000	Actual valve position
				Man. Posiz	0500	
				En. EXV Man	N	
			Valve type	Valve Type	Sporland 50-SEH 250	
			Settings	Opening Extrasteps	Y	
				Closing Extrasteps	Y	
				Time extrasteps	0 sec	
			Settings	Super Heat setpoint	6 °C	
				Dead Band	0 °C	
			Settings	Proportional factor	80	
				Integral factor	30	
				Differential factor	0.5	
			Settings	Low SH protection setpoint	-2.0 °C	
				Low SH protection integral time	0 sec	
			Settings	LOP setpoint	-30 °C	
				LOP Integral time	0 sec	
			Settings	MOP setpoint	12 °C	
				MOP Integral time	4 sec	

			Settings	MOP startup delay	180 sec	
			Settings	High Cond temp protection setpoint	90 °C	
				High Cond temp protection Integral time	4 sec	
			Settings	Suction temperature High limit	60 °C	
			Pressure probe #1 settings	Min	-0.5 bar	
				Max	7.0 bar	
			Pressure probe #2 settings	Min	-0.5 bar	
				Max	7.0 bar	
			EXV settings #1	Battery present	Y	
				pLan present	Y	Output only
			EXV settings #2	Battery present	Y	
				pLan present	Y	Output only
SETTINGS	**COMPRESSOR**	-	Timing	Min T same comp starts	600 s	
				Min time diff comp starts	120 s	
			Timing	Min time comp on	30 s	
				Min time comp off	180 s	
			Timing	Interstage time	120 s	
			Press prot	Evap T hold	-4.0 °C	
				Evap T down	-8.0 °C	
			High pressure	Down delay Hold T. Down T.	020s 060.0 °C 065.0 °C	
			Dish SH prot	Disc. SH thr	1 °C	
				Disc SH Time	30 s	
			Comp Loading/unloading	N load Pulse	6	Check on commissioning
				N unload Pulse	9	Check on commissioning
			Loading	Pulse time	0.2 s	Modify if necessary
				Min pulse period	30 s	
				Max pulse period	150 s	
			Unloading	Pulse time	0.4 s	Modify if necessary
				Min pulse period	1 s	
				Max pulse period	150 s	
			First pulse timing	Loading	1 s	
				Unloading	0.8 s	
SETTINGS	**USER**	**Setpoints**	Setpoints	Cooling setpoint	as required	
			Double setpoint	Enabled	N	
			Double setpoint	Cooling double setpoint	as required	Only if double setpoint enabled
			LWT reset	Ldg water temp setpoint reset	As required	Return , 4-20ma, OAT
			Heat Recovery	Setpoint	0045.0°C	Only heating mode
			Working mode	Working mode	Cooling	
			Softload	Enable Softload	N	
			Demand limit	Enable supervisory demand limit	N	
			Sequencing	Comp sequence	AUTO	
			Supervisor	Protocol	LOCAL	
				Comm Speed	19200	
				Ident	001	
			Units	Interface Units	SI	
				Supervisory units	SI	
			Language	Choose language	English	Italian on separate file

			Passwords	Change passwords		
SETTINGS	**USER**	**Time Sch**	Enable	Enable Time Sch	N	
SETTINGS	**USER**	**FSM**	Enable	Enable Fan Silent Mode	N	
				Max Inv. Out.	06.0 v	
SETTINGS	**USER**	**Clock**	Settings	Set Clock		
SETTINGS	**ALARMS**		AntiFreeze Alarm	Setpoint	2.0°C	
				Diff	1.4°C	
			Freeze Prevent	Setpoint	03.5 °C	
				Diff.	01.0 °C	
			Oil Low pressure alarm delay	Startup delay	300 s	
				Run delay	90 s	
			Saturated disch temperature alarm	Setpoint	68.5 °C	
				Diff	12.0 °C	
			Saturated suction temperature alarm	Setpoint	-10.0 °C	
				Diff	2.0 °C	
			Oil Press Diff.	Alarm Setp	2.5 bar	
			Phase monitor type	PVM or GPF type	Unit	
			Evap flow switch alarm delay	Startup delay	20 s	
				Run delay	5 s	
			HR high water Temp. alarm	Threshold	050.0°C	Only heating mode
			Hr Flow switch Alarm delays	Start up delay	020 s	
				Running Delay	005 s	
MAINT	**SETTING**		Evap pump h. counter	Thresh	010x1000	
				Reset	N	
				Adjust		Current running hours
			Comp h. counter #1	Thresh	010x1000	
				Reset	N	
				Adjust		Current running hours
			Comp starts counter #1	Reset	N	
				Adjust		Current running Starts
			Comp h. counter #2	Thresh	010x1000	
				Reset	N	
				Adjust		Current running hours
			Comp starts counter #2	Reset	N	
				Adjust		Current running Starts
			Temp Regulation	Regul. Band	3.0 °C	
				Neutr. Band	0.2 °C	
				Max Pull Down rate	0.7 °C/min	For low inertia plants. It may be increased for high inertia plants
			StartUp/Shutdown	StartUp DT	2.6 °C	
				Shutdown DT	1.5 °C	Relate to set-point
			High CLWT start	LWT	25 °C	
				Max Comp Stage	70%	
			Load managment	Min load	40%	
				Max load	100%	
				En slides valve	N	
			ChLWT limits	Low	4.0 °C	Cooling Mode
					-6.7 °C	Cooling/glycol or Ice mode
				high	15 °C	
			Probes enable			Refer to wiring diagram
			Input probe offset			Depending on actual readings
			DT reload	Dt to reload comp	0.7 °C	
			Reset Alarm Buffer	Reset	N	
			Change password			

Fantroll settings				
		2 Fans circuit	3 Fans circuit	4 Fan Circuit
FanTroll dead band n. 1	Stage Up	3 °C	3 °C	3 °C
	Stage down	10 °C	10 °C	10 °C
FanTroll dead band n. 2	Stage Up	15 °C	6 °C	5 °C
	Stage down	3 °C	6 °C	5 °C
FanTroll dead band n. 3	Stage Up		10 °C	8 °C
	Stage down		3 °C	4 °C
FanTroll dead band n. 4	Stage Up			10 °C
	Stage down			2 °C

When speedtroll, do not consider the FanTroll Dead Band 1

APPENDIX B: SOFTWARE UPLOAD TO THE CONTROLLER

It is possible to upload the software into the controller using two different ways: using the direct download form a personal computer or using the Carel programming key.

B.1. Direct upload from PC

To upload the program, it is necessary:

- To install in the PC the program Winload supplied by Carel and available on the web site ksa.carel.com. It may also be required to Daikin.
- to connect the PC, by means of a RS232 serial cable, to the Carel RS232/RS485 adapter (code 98C425C001)
- to connect the RS485 adapter port to the controller terminal port (J10) using a 6 wire phone cable (terminal cable)
- to disconnect the controller from pLAN and to set the net address to 0.
- Switch on the controller and run Winload, select the correct serial port numer you are using and wait (some tenths of seconds) for the "ON LINE" status (this meanings the program is connected to the controller).
- Then select the "Upload" folder and the "Application" section and select al program files supplied by Daikin (one file in the "blb files" box and one or more files in the "iup files" box).
- Then press the "Upload" button and wait the transfer is completed; the program shows all transfer phase in a window and when the process is completed the "UPLOAD COMPLETED" message will appear.
- Finally turn off the controller, disconnect it from the PC, reconnect the pLAN and set the right net address.

This procedure has to be applied to all controllers on the unit with the exception of pCO^e boards and EEXV drivers.

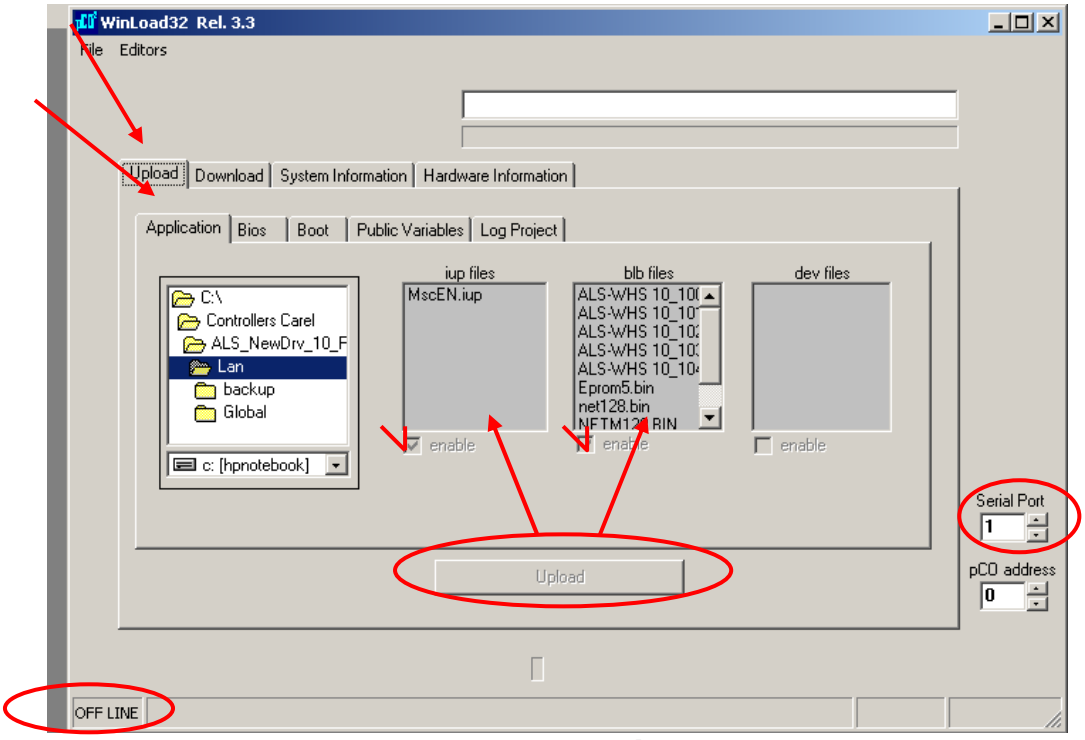


Fig 26 – WinLoad view

B.2. Upload from programming key

To upload the program using the Carel programming key it is necessary first to upload the program to the key and then to download it on one ore more controllers. The same procedure has to be used for both operations just selecting the right position on the key commuter:

Commuter position	Transfer type
1 (green light)	key programming from pCO²
2 (red light)	pCO² programming from key

The procedure is described in the following.

- disconnect the controller from pLAN and to set the net address to 0
- select the right commuter position
- insert the key in the “expansion memory” connection (remove the cover if necessary)
- press “up” and “down” keys at the same time and switch on the controller
- press “enter” key to confirm the operation
- wait until the controller boot
- turn off the controller
- remove the key.

In the case no controller with the program installed is available, the key may be programmed using the same procedure described for the direct upload from a PC. In this case, with the key inserted in the controller and the commuter in position 2 (red light) the program will write on the key instead of on the controller.

APPENDIX C: PLAN SETTINGS

Such work must be made in case a terminal is added in the pLan or if settings are changed.

1. Keep pressed for at least 10 seconds the keys “Up”, “Down” and “Enter”

2. A screen will appear with the terminal address and with the address of the board in examination

```
Terminal  Adr: 7
I/O Board Adr: n
```

Using the “Up” and “Down” keys is it possible choose the different board (1, 2, 3, 4 for the compressors and 5, 7, 9, 11 for the electronic valve drivers)

Select in correspondence of “I/O Board Adr” the number 1 (Board with address 1) and push “Enter”. In about two seconds the following screen will appear:

```
Terminal Config

Press ENTER
To continue
```

3. Push “Enter” again; the following screen will appear:

```
P:01  Adr    Priv/Shared
Trm1  7      Sh
Trm2  None     --
Trm3  None     -- Ok? No
```

3. If you had to add a second terminal (remote terminal), change the line “Trm2 None – “ with the line “Tmr2 17 sh”. To enable the new configuration put the pointer on “No” (using the key “Enter”) and with “Up” and “Down” change it in “Yes” and push “Enter”.The operations from 1. to 3. must be repeated for all the compressor boards (“I/O Board” from 1 to 4)

4. At the end of operations turn off and restart the system.

Remark: It is possible, after restart, that the terminal is stuck on a unit. This is due to the fact that the memory of the Drivers remains fed by the buffer battery and keeps on to contain the data of the preceding configuration. In this case, with the system not fed, is sufficient to disconnect batteries from all the drivers and then connect them again

APPENDIX D: COMMUNICATION

The control supports communication on the serial port with the following protocols :

- Carel Proprietary protocol (local and remote), and MODEM/GSM modem through it
- MODbus Standard RTU
- LONTalk FTT10A (chiller profile)
- BACnet MS/TP & IP (single master points list)
- EKCSCII communication over proprietary protocol for unit and site optimization, monitoring and sequencing

Your preferred protocol is Menu selectable under User Password (Protocol Selectability™)

Protocol Menu is reacheable through the arrow keys under Settings/USER/Setpoints menu.

To perform the right communication the serial card inserted in the serial plug of the controller must comply with the protocol selected.

As per the pictures above, to properly plug-in the card, open the cover of the serial card plug at the bottom of the controller, securely plug-in the card and close it back.

D. 1 Supervisor List Maps

Supervisory System
Chiller Profile Units (4-Jul-2007)
For Daikin Aircooled Screw units based on Carel pCO2 technology
This is the full list of variables managed by the supervisory system.

LEGENDA	
Flow	Type
I: Supervisor → pCO **O**: Supervisor ← pCO **I/O**: Supervisor ↔ pCO	**D**: Digital **I**: Integer **A**: Analog
Green Boxes : CHILLER PROFILE variables	**RED Lines: Not Available on all versions**
Grey, Yellow, Blue boxes are local variables subject to modification on release base	**Variable format b0b1…b15** refers to word of digitals to be interpreted bitwise
Variables with single location for multiple circuits (symbol #1234) are indexed through the COMPSELECT variable index I32	

D. 1. 1 Supervisor List: Digital Variables

PROGRAM VARIABLES	DESCRIPTION	TYPE	INDEX	I/O	BAC	LON	MODBUS COIL	NOTES
SUPERV_ONOFF	Chiller Enable - Network	D	1	I/O	x	5	2	0=Chiller Enable 1=Chiller Disable
Chiller On Off	nvoOnOff	D	2	O	x	27	3	0=Chiller Off 1=Chiller On
MAN_GLB_AL	Alarm Digital Output	D	3	O	x	5	4	0=NoAlarm 1=Alarm
UNIT_AV	Chiller Run Enabled	D	4	O	x	5	5	0=NotEnabled 1=Enabled
Chiller Local/Remote	Chiller Local/Remote	D	5	O	x	27	6	Local=1 Remote=0
LIMITATED	Chiller Capacity Limited	D	6	I/O	x	27	7	Limited=1 Not Limited=0
EVAPORATOR_FLOW	Evap Water Flow	D	7	I/O	x	5	8	0=No Flow 1=Flow
PwrUpState	Status request	D	9	I/O		3	10	0= RequestChillerAuto (run) 1= Request Chiller Off
CLS_AL	Clear Alarm (BAS)	D	24	I/O	x	5	25	0=Default 1=Clear Alarm
MAIN_PUMP	Evap Pump #1 (BAS Request)	D	29	O	x	5	30	0=Pump Commanded Off 1=Pump Commanded On
FAN1_STAT #1,2,3,4	Fan Stage 1 - Circuit #1, 2, 3, 4	D	33	O			34	0=Fan Stage Off 1=Fan Stage On
FAN2_STAT #1,2,3,4	Fan Stage 2 - Circuit #1, 2, 3, 4	D	34	O			35	
FAN3_STAT #1,2,3,4	Fan Stage 3 - Circuit #1, 2, 3, 4	D	35	O			36	
FAN4_STAT #1,2,3,4	Fan Stage 4 - Circuit #1, 2, 3, 4	D	36	O			37	
FAN5_STAT #1,2,3,4	Fan Stage 5 - Circuit #1, 2, 3, 4	D	37	O			38	
Unit_USA_SV	Supervisor Metrics	D	54	I/O			55	0 = SI 1 = IP
COMP_ENABLE #1,2,3,4	Comp Manual OFF #1, 2, 3, 4	D	58	O			59	0=CompressorOFFMan 1=CompressorAutoEnable
COMP_PD #1,2,3,4	Pump Down #1,2,3,4	D	62	O			63	0=Not Pumpdown 1=Pumpdown Active
LIQUID_INJ #1,2,3,4	Liquid Injection/Line #1, 2, 3, 4	D	114	O			115	0=Deenergized 1=Energized
COMP_LOAD #1,2,3,4	Stage Up Now #1, 2, 3, 4	D	150	O			151	0=Compressor Not Loading 1=Compressor Loading
COMP_UNLOAD #1,2,3,4	Stage Down Now #1, 2, 3, 4	D	154	O			155	0=Compressor Not Unoading 1=Compressor Unloading

D. 1.2. Supervisor List :Analog Variables

PROGRAM VARIABLES	DESCRIPTION	TYPE	INDEX	I/O	BAC	LON	MODBUS REGISTER
S_Temp_Setpoint	Cool Setpoint - Network	A	1	I/O	x	105	40002
Cold_Setpoint	Active Leaving Water Target	A	2	O	x	105	40003
W_CapL	Network Capacity Limit Input (#1,2, 3, 4)	A	3	I/O	x	81	40004
InletTemp	Evap Entering Water Temp	A	4	O	x	105	40005
W_TEMP_SETPOINT	Heat Setpoint - Network	A	5	I/O	x	105	40006
OUTLET_TEMP	Evap LWT - Unit	A	6	O	x	105	40007
UNIT_LOAD_DISP	Actual Running Capacity	A	10	O	x	81	40011
SUCT_TEMP	Suction Temp #1,2,3,4	A	15	O	x	105	40016
EVAP_TEMP	Evap Sat Refr Temp #1,2,3,4	A	16	O	x	105	40017
LOW_PRESS_TR	Evap Pressure #1,2,3,4	A	17	O	x	30	40018
AIN_4	Discharge Temp #1,2,3,4	A	19	O	x	105	40020
COND_TEMP	Cond Sat Refr Temp #1,2,3,4	A	20	O	x	105	40021
AIN_7	Cond Pressure #1,2,3,4	A	21	O	x	30	40022
nvoEntHRWTemp	Heat Recovery Entering Water Temperature	A	22	O	x	105	40023
nvoLvgHRWTemp	Heat Recovery Leaving Water Temperature	A	23	O	x	105	40024
COMP_STAT_DISP	Comp Load #1,2,3,4	A	25	O	x	81	40026
AIN_8	Feed Oil Pressure #1,2,3,4	A	32	O	x	30	40033
AMB_TEMP	Outdoor Air Temp – Sensor	A	39	O	x	105	40040
ACT_DEMAND	Active Capacity Limit	A	42	O	x	33	40043
AOUT_1_DISPLAY	VFD Fan Output Volt (#1,2,3,4 if available)	A	44	O		81	40045
AOUT_2_DISPLAY	VFD Comp Output Volt (#1,2,3,4 if available)	A	45	O		81	40046
VALVE_POS	EXV Position #1,2,3,4	A	46	O		8	40047
nviCoolSetpt	Cool Setpoint	A	47	I/O	x	105	40048
Sum_Double_Setp	Summer Double Setpoint	A	50	I/O	x	105	40051
Event Code_1	Alarm List codes master board	A	90	O	00 = NONE 01 = Phase Alarm 02 = Freeze Alarm 03 = Freeze Alarm EV1 04 = Freeze Alarm EV2 05 = Pump Alarm 06 = Fan Overload 07 = OAT Low Pressure 08 = Low Amb Start Fail 09 = Unit 1 Offline 10 = Unit 2 Offline 11 = Evap. flow Alarm 12 = Probe 9 Error 13 = Probe 10 Error 14 = "" 15 = Prepurge #1 Timeout 16 = Comp Overload #1 17 = Low Press. Ratio #1 18 = High Press. Switch #1 19 = High Press. Trans #1 20 = Low Press. Switch #1 21 = Low Press. Trans #1 22 = High Disch Temp #1 23 = Probe Fault #1 24 = Transition Alarm #1 25 = Low Oil Press #1 26 = High Oil DP Alarm #1 27 = Expansion Error	40091
Event Code_2	Allarm List codes slave board	A	91	O	28 = "" 29 = EXV Driver Alarm #1 30 = EXV Driver Alarm #2 31 = Restart after PW loss 32 = "" 33 = "" 34 = Prepurge #2 Timeout 35 = Comp Overload #2 36 = Low Press. Ratio #2 37 = High Press. Switch #2 38 = High Press. Trans #2 39 = Low Press. Switch #2 40 = Low Press. Trans #2 41 = High Disch. Temp #2 42 = Maintenance Comp #2 43 = Probe Fault #2 44 = Transition Alarm #2 45 = Low Oil Press. .#2 46 = High Oil DP #2 47 = Low Oil Level #2 48 = PD #2 Timer Expired 49 = Maintenance Comp #1 50 = Driver #1 offline 51 = Driver #2 offline 52 = Low Oil Level #1 53 = PD #1 Timer Expired 54 = HR Flow Switch	40092

D. 1.3 Supervisor List: Integer Variables

PROGRAM VARIABLES	DESCRIPTION	TYPE	INDEX #	I/O	BAC	LON	MODBUS REGISTER	Notes
Active_Alarms_1	Active Alarms (1 – 16)	I	1	O	x	8	40130	b0 Reserved b1 Not used b2 Not used b3 Not used b4 Not used b5 Not used b6 Not used b7 Not used b8 Not used b9 Not used b10 NO START - Ambient Temp Low b11 NO LOAD - Cond Press High #1 b12 NO LOAD - Cond Press High #2 b13 NO LOAD - Cond Press High #3 b14 NO LOAD - Cond Press High #4 b15 Not used
Active_Alarms_2	Active Alarms (17 – 32)	I	2	O	x	8	40131	b0 UNLOAD - Cond Press High #1 b1 UNLOAD - Cond Press High #2 b2 UNLOAD - Cond Press High #3 b3 UNLOAD - Cond Press High #4 b4 Not used b5 Not used b6 Not used b7 Not used b8 Not used b9 Not used b10 Not used b11 Not used b12 Not used b13 Not used b14 NO RESET-Evap EWT Sensor Fail b15 Not used
Active_Alarms_3	Active Alarms (33 – 48)	I	3	O	x	8	40132	b0 NO LOAD - Evap Press Low #1 b1 NO LOAD - Evap Press Low #2 b2 NO LOAD - Evap Press Low #3 b3 NO LOAD - Evap Press Low #4 b4 Not used b5 UNLOAD - Evap Press Low #1 b6 UNLOAD - Evap Press Low #2 b7 UNLOAD - Evap Press Low #3 b8 UNLOAD - Evap Press Low #4 b9 Not used b10 Not used b11 Not used b12 Not used b13 PUMP ON - Evap Water Freeze #1 b14 PUMP ON - Evap Water Freeze #2 b15 PUMP ON - Evap Water Freeze #3
Active_Alarms_4	Active Alarms (49 – 64)	I	4	O	x	8	40133	b0 PUMP ON - Evap Water Freeze #4 b1 START#2 - Evap Pump Fail #1 b2 START#1 - Evap Pump Fail #2 b3 Not used b4 UNIT STOP-AmbAirTempSensorFail b5 Not used b6 Not used b7 Not used b8 Not used b9 Not used b10 Not used b11 Not used b12 Not used b13 Not used b14 Not used b15 Not used
Active_Alarms_5	Active Alarms (65 – 80)	I	5	O	x	8	40134	b0 Not used b1 Not used b2 Not used b3 Not used b4 COMP STOP - Motor Temp High #1 b5 COMP STOP - Motor Temp High #2 b6 COMP STOP - Motor Temp High #3 b7 COMP STOP - Motor Temp High #4 b8 COMP STOP - Phase Loss #1 b9 COMP STOP - Phase Loss #2 b10 COMP STOP - Phase Loss #3 b11 COMP STOP - Phase Loss #4 b12 Not used b13 Not used b14 Not used b15 Not used
Active_Alarms_6	Active Alarms (81 – 96)	I	6	O	x	8	40135	b0 Not used b1 Not used b2 Not used b3 Not used b4 Not used b5 Not used b6 Not used b7 Not used b8 Not used b9 COMP STOP-CondPressSensFail #1 b10 COMP STOP-CondPressSensFail #2

								b11	COMP STOP-CondPressSensFail #3
								b12	COMP STOP-CondPressSensFail #4
								b13	Not used
								b14	Not used
								b15	COMP STOP - Cond Press High #1
Active_Alarms_7	Active Alarms (97 – 112)	I	7	O	x	8	40136	b0	COMP STOP - Cond Press High #2
								b1	COMP STOP - Cond Press High #3
								b2	COMP STOP - Cond Press High #4
								b3	Not used
								b4	Not used
								b5	Not used
								b6	Not used
								b7	COMP STOP-DischTempSensFail #1
								b8	COMP STOP-DischTempSensFail #2
								b9	COMP STOP-DischTempSensFail #3
								b10	COMP STOP-DischTempSensFail #4
								b11	COMP STOP-DischargeTempHigh #1
								b12	COMP STOP-DischargeTempHigh #2
								b13	COMP STOP-DischargeTempHigh #3
								b14	COMP STOP-DischargeTempHigh #4
								b15	Not used
Active_Alarms_8	Active Alarms (113 – 128)	I	8	O	x	8	40137	b0	COMP STOP-Evap Water Flow Loss
								b1	COMP STOP - Evap Water Freeze
								b2	Not used
								b3	COMP STOP - Evap Press Low #1
								b4	COMP STOP - Evap Press Low #2
								b5	COMP STOP - Evap Press Low #3
								b6	COMP STOP - Evap Press Low #4
								b7	Not used
								b8	COMP STOP-EvapPressSensFail #1
								b9	COMP STOP-EvapPressSensFail #2
								b10	COMP STOP-EvapPressSensFail #3
								b11	COMP STOP-EvapPressSensFail #4
								b12	Not used
								b13	Not used
								b14	Not used
								b15	Not used
Active_Alarms_9	Active Alarms (129 – 144)	I	9	O	x	8	40138	b0	COMP STOP- Pressure Ratio Low #1
								b1	COMP STOP- Pressure Ratio Low #2
								b2	COMP STOP- Pressure Ratio Low #3
								b3	COMP STOP- Pressure Ratio Low #4
								b4	Not used
								b5	Not used
								b6	Not used
								b7	Not used
								b8	Not used
								b9	Not used
								b10	Not used
								b11	Not used
								b12	Not used
								b13	Not used
								b14	Not used
								b15	Not used
Active_Alarms_10	Active Alarms (145 – 160)	I	10	O	x	8	40139	b0	Not used
								b1	UNIT STOP-Evap LWT Sensor Fail
								b2	COMP STOP-EvapLWT SensFail #1
								b3	COMP STOP-EvapLWT SensFail #2
								b4	Not used
								b5	Not used
								b6	Not used
								b7	COMP STOP-MechHighPressTrip #1
								b8	COMP STOP-MechHighPressTrip #2
								b9	COMP STOP-MechHighPressTrip #3
								b10	COMP STOP-MechHighPressTrip #4
								b11	COMP STOP-MechLowPress Trip #1
								b12	COMP STOP-MechLowPress Trip #2
								b13	COMP STOP-MechLowPress Trip #3
								b14	COMP STOP-MechLowPress Trip #4
								b15	Not used
Active_Alarms_11	Active Alarms (161– 176)	I	11	O	x	8	40140	b0	Not used
								b1	Not used
								b2	Not used
								b3	Not used
								b4	Not used
								b5	Not used
								b6	Not used
								b7	Not used
								b8	Not used
								b9	Not used
								b10	Not used
								b11	COMP STOP - Oil Level Low #1
								b12	COMP STOP - Oil Level Low #2
								b13	COMP STOP - Oil Level Low #3
								b14	COMP STOP - Oil Level Low #4
								b15	COMP STOP-Oil Filter DP High#1
Active_Alarms_12	Active Alarms (177 – 192)	I	12	O	x	8	40141	b0	COMP STOP-Oil Filter DP High#2
								b1	COMP STOP-Oil Filter DP High#3
								b2	COMP STOP-Oil Filter DP High#4
								b3	COMP STOP-OilFeedPrsSensFail#1
								b4	COMP STOP-OilFeedPrsSensFail#2
								b5	COMP STOP-OilFeedPrsSensFail#3
								b6	COMP STOP-OilFeedPrsSensFail#4
								b7	Not used
								b8	Not used
								b9	Not used
								b10	Not used
								b11	Not used
								b12	Not used
								b13	Not used
								b14	Not used

								b15 Not used
Active_Alarms_13	Active Alarms (193 – 208)	I	13	O	x	8	40142	b0 Not used b1 Not used b2 Not used b3 Not used b4 COMP STOP-NoStartrTransition#1 b5 COMP STOP-NoStartrTransition#2 b6 COMP STOP-NoStartrTransition#3 b7 COMP STOP-NoStartrTransition#4 b8 COMP STOP-OilPressLow/Start #1 b9 COMP STOP-OilPressLow/Start #2 b10 COMP STOP-OilPressLow/Start #3 b11 COMP STOP-OilPressLow/Start #4 b12 Not used b13 Not used b14 Not used b15 Not used
Active_Alarms_14	Active Alarms (209 – 224)	I	14	O	x	8	40143	b0 Not used b1 Not used b2 Not used b3 Not used b4 Not used b5 Not used b6 Not used b7 Not used b8 COMP STOP-SuctnTmpSensorFail#1 b9 COMP STOP-SuctnTmpSensorFail#2 b10 COMP STOP-SuctnTmpSensorFail#3 b11 COMP STOP-SuctnTmpSensorFail#4 b12 Not used b13 Not used b14 Not used b15 Not used
Active_Alarms_15	Active Alarms (225 – 240)	I	15	O	x	8	40144	b0 FAULT (Check Unit for Detail) b1 COMP SHUTDOWN-Comp Fault #1 b2 COMP SHUTDOWN-Comp Fault #2 b3 COMP SHUTDOWN-Comp Fault #3 b4 COMP SHUTDOWN-Comp Fault #4 b5 Not used b6 Not used b7 Not used b8 Not used b9 Not used b10 Not used b11 Not used b12 Not used b13 Not used b14 Not used b15 Not used
nvi_mode	Chiller Mode Setpoint	I	17	I	x	108	40146	01 = HVAC_HEAT 03 = HVAC_COOL (default) 11 = HVAC_ICE
UNIT_STAT	LON Chiller Run Mode	I	18	O		8	40147	1 = Off: CSM 2 = Start 3 = Run 4 = Pre Shutdown 5 = Service 6 = Communication Loss 7 = Off: Local
chlr_op_mode	Chiller Operating Mode	I	19	O	x	127	40148	b0 b1 b2 b3 b4 b5 b6 b7 b8 Unit Alarm b9 Unit On b10 Chiller Local or Remote b11 Limitated b12 Flow Switch Status b13 Not used b14 Not used b15 Not used 00 = Auto 01 = Heat 03 = Cool 06 = Off 11 = Ice
nvoSequenceStat	Sequence Status	I	22	O	x	165	40151	b0 Chiller Full Load: 0=Not at Full Load, 1 = Full Load b1 Circuit1 Availability: 0 = Not Available, 1 = Available b2 Circuit 2 Availability: 0 = Not Available, 1 = Available b3 Circuit 3 Availability: 0 = Not Available, 1 = Available b4 Circuit 4 Availability: 0 = Not Available, 1 = Available b5 - b6 - b7 - b8 -
COMP_SELECTED	**Compressor Select**	**I**	**32**	**I**	**x**	**8**	**40161**	**1, 2, 3, 4**
UNIT_STATUS_GLOB	Unit Status Display	I	34	O	x	8	40163	00 = RUNNING OK 01 = OFF ALARM 02 = OFF REM COMM 03 = OFF TIME SCHEDULE 04 = OFF REM SWITCH 05 = PWR LOSS ENTER START 06 = OFF AMB.LOCKOUT

								07 = WAITING FLOW 08 = WAITING LOAD 09 = NO COMP AVAILABLE 10 = FSM OPERATION 11= OFF LOCAL SWITCH 12 = OFF COOL / HEAT SWITCH 13 = WAITING HR FLOW
Circuit Status #1,2,3,4	Circuit Status Display #1,2,3,4	I	44	O	x	8	40173	01 = OFF ALARM 02 = OFF READY 03 = OFF READY 04 = OFF READY 05 = OFF READY 06 = OFF READY 07 = OFF SWITCH 08 = AUTO % 09 = MANUAL % 10 = OIL HEATING 11 = READY 12 = RECYCLE TIME 13 = MANUAL OFF 14 = PREPURGE 15 = PUMPING DOWN 16 = DOWNLOADING 17 = STARTING 18 = LOW DISCH SH 19 = DEFROSTING 20 = AUTO HEATING % 21 = MAX VFD LOAD 22 = OFF REM SV
N_START	Comp # of Starts #1,2,3,4	I	45	O	x	8	40174	
T_16_COMPRESSOR	Comp Operating Hours #1,2,3,4	I	46	O	x	8	40175	
T_16_PUMP_EVAP	Evap Pump Oper Hrs #1,2	I	47	O	x	8	40176	
MIN_T_:BT_S_C	Start-Start Time	I	94	O		8	40223	
MIN_OFF	Stop-Start Time	I	95	O		8	40224	

APPENDIX E: PLANTVISOR MONITORING ACCESS

Pl@ntVisor Configuration.

PlantVisor is a proprietary software. It can be purchased as a part of a installation kit for Monitoring and Telemaintenace of your unit and system. Original PlantVisor is provided in for of a CD and a dedicated protection dongle.

Once installed, the product is already configured to operate with a 485 network with two units (one based on Ir32 freddo and one Ir32). To configure the product for your network, proceed as follows.

a. Connect to the supervisor using the browser. Example:

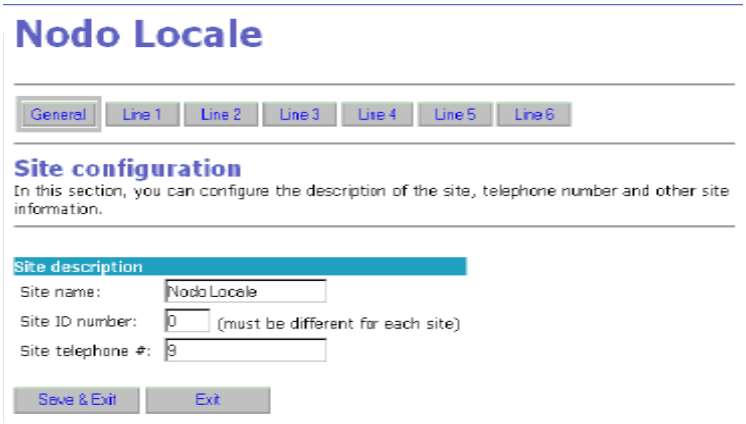
http://localhost

b. The following screen will be displayed

Click the "**Ok**" button to enter the site Home page. Note that initially "Guest" and "Administrator" are the only users defined, and therefore you
do not need to access Pl@ntVisor as the *Administrator* in order to perform the initial configuration. No password is required.

The Pl@ntVisor Home page will then be displayed:

d. Click the "Service" menu on the left and then select "Network".
e. The following page will be displayed:



The first operation required is to enter the fields with the information on the installation:

a) **Site name** : name of the installation (node).

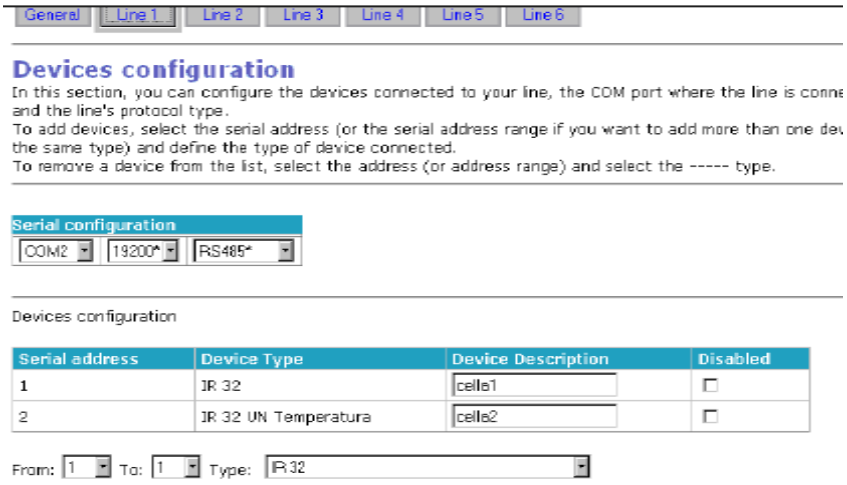
b) **Site ID number** : progressive identification number of the node (the installation cannot have two systems with the same ID).

c) **Site telephone #** : telephone number of the node (as a memo).

- All the instruments in the RS485 network must have been set with an address (see the corresponding parameter for the various models). The address, which is unique for each line, must be between 1 and 200
- Click the Line1, Line2, ..Line6 button (according to the number of lines being configured)
- Access the instruments in the network, as follows: first select the address or the series of addresses for the units, then assign a type of instrument (Device Type). In the Device Type menu list, all the options related to units
- "Daikin MSC" is the right Device Type option for units, EWAD AJ, EWAP AJ, EWAD BJ

To delete an already configured unit, select the address in the *From* and *To* fields and assign type "----". To save the settings, click the *Save&Exit* button. To disable a unit, check the corresponding box in the *Disabled* column (then save the configuration).

- Each unit can be assigned a customised description in the Device Description column.



After having done this, set the serial configuration in the "*Serial Configuration*" table.

• Select the communication port that the converter is connected to, the speed and the type of connection for each line in the network. The values displayed with the asterisk "*" are compatible with the Carel RS485 network.

• To save the configuration, click the *Save&Exit* button

For additional details, advanced management and troubleshoouting refer to the PlantVisor User Manual and Online Help.

Daikin Europe N.V. is participating in the EUROVENT Certification Programme. Products are as listed in the EUROVENT Directory of Certified Products.

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