

**DAIKIN**



## **CONTROL PANEL OPERATING MANUAL**

**WATER COOLED SCREW CHILLER with flooded evaporator**  
Software version 7.001 *and later*

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## 1 Introduction

This manual provides the information needed for commissioning, setting and troubleshooting the control system installed on the units with screw compressor Frame 4 and flooded evaporator at one or two compressors.

All operational descriptions contained in this manual refer to control software ver. 21.101 and subsequent revisions. The modes of operation of the unit and the selection of the Menu, may differ depending on the version of the software installed. Please contact Daikin Service office for updates and information.

### 1.1 Caution during commissioning

#### **Warning**

Danger of electric shock. There is a risk of injury to people and damage to devices. This device must be correctly connected to earth. The installation and maintenance of the control panel must be done by skilled personnel who are familiar with the operation of the control devices.

#### **Warning**

The components are sensitive to electrostatic energy. An electrostatic discharge during the handling of the electronic cards of the control system, may cause damage to its components. Discharge the electrostatic energy by touching the metal bars in the panel before carrying out any service work. Never disconnect a wire or terminal of a card in the control system while the electric supply is still applied to the panel.

### 1.2 Temperature and humidity considerations

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

## 2 General description

The control panel consists of a controller with expansible microprocessor that takes the necessary actions to monitor and control all functions and safeties, for an efficient operation of the unit.

The operator can monitor all the operating conditions by using the 4-line, 20-character backlight display or by running the monitoring program MicroPlant 2.0 or later -or any other compatible supervisory system- on a IBM compatible computer.

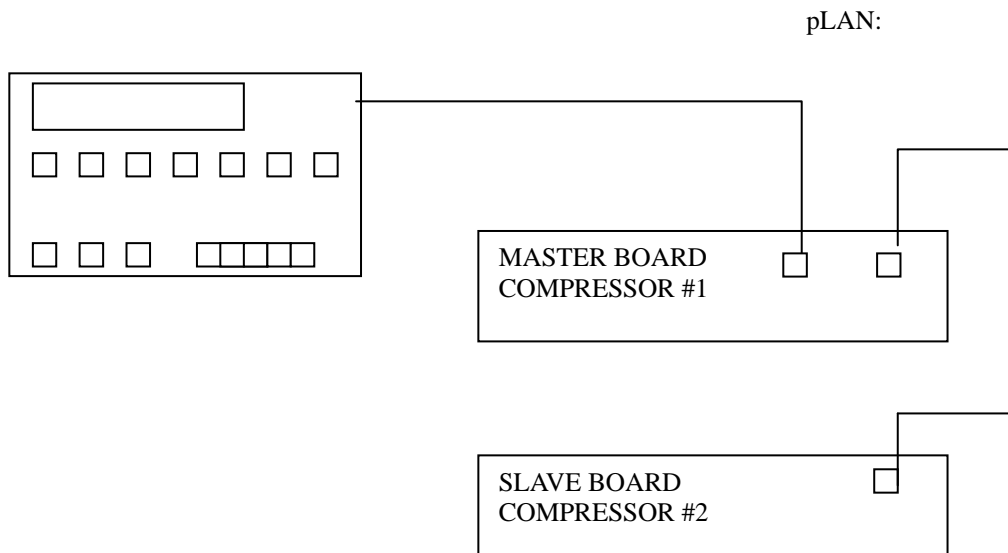
Apart from monitoring the normal operating conditions, the controller checks all the safety devices of the unit and takes corrective action when the unit works out of the normal limits. If an alarm condition is detected, the controller shuts down the relevant compressor and activates an alarm relay.

The controller also records the existing operating conditions at the time the alarm was triggered (for the last ten alarms occurred) to assist the operator in the analysis and fault finding.

The system is protected by several password levels that allow access only to the authorized personnel. The system requires a password to be entered before any changes to the functional parameters of the unit are allowed.

### 2.1 Network layout (LAN layout)

DISPLAY



Master board	Master board
Compressor #1	Compressor #1
Slave board	Slave board
Compressor #2	Compressor #2

### **3 Main Features of the Control Software**

- Management of flooded evaporator water chillers with condenser refrigerant level control valve.
- Control of evaporator /condenser water outlet temperature.
- Accurate control of water temperature (0.1°C under constant load conditions).
- Can handle sudden load drops of up to 50% while keeping temperature deviation not higher than 3°C.
- Readout of all main operating parameters of the unit (temperature, pressures, etc.).
- Automatic control of the primary pump of the evaporator and the condenser.
- Condensation control based on either condenser inlet temperature or pressure ratio.
- 3-step control of the cooling tower or modulation of the regulating valve (or by-pass valve) using a proportional 0-10 VDC signal.
- Evaporation control based on either evaporator outlet temperature or pressure ratio (only on HP units, version 7.100 or later), by steps (up to 3 control steps), or by modulation of the regulating valve (or bypass valve) using a proportional 0-10 VDC signal.
- Dual setpoint through local or remote change-over switch. This function allows the switching of the local setpoint between two preset values.
- Possibility to override the setpoint using an external 4-20mA signal.
- Possibility to set the max temperature drop rate (max increase rate for HP versions) of the chilled water, thus preventing sudden and excessive temperature reduction.
- The Hot-water start function allows to start the unit smoothly even under hot temperature conditions of the water in a given evaporator.
- The SoftLoad function helps reduce the electric consumption and the start-up peak loads during the periods the water temperature is decreasing.
- The Demand Limit function allows to set a threshold for the electrical consumption of the unit by limiting the power output.
- The panel includes a 15-key keypad for a quick interface.
- The operator can read the operating conditions of the unit on the 4-line, 20-character backlight display.
- Four security levels against unauthorized change of settings.
- Compressor diagnostic system that includes logging of the last ten alarms and information on date, time and current operating conditions at the time the alarm was activated.
- Easy integration with Building Automation Systems (BAS) through a 4-20 mA signal for water setpoint regulation and load limitation of the unit (Demand Limit).
- Remote communication via serial line for system monitoring, setpoint change-over, and alarm/event supervision using supervisory software to be installed on a IBM compatible PC.
- BAS communication capabilities via Modbus protocol (or proprietary protocol using a ModBus Gateway).
- Remote connection capabilities via modem (up to 8 chillers with Gateway Modem).
- Remote connection capabilities through GSM modem.
- Speed control of condenser fans, based on pressure and ambient temperature transducers, that includes SUMMER/ WINTER logic.
- Condensation control, based on VFDs using a pressure sensor and an ambient temperature sensor, that includes SUMMER/WINTER logic.

## 4 Description of the components

### 4.1 Control panel

The control panel consists of a 4-line, 20-character backlight display and a 15-key keypad whose features are described below.

Figure 1. Control panel - front view

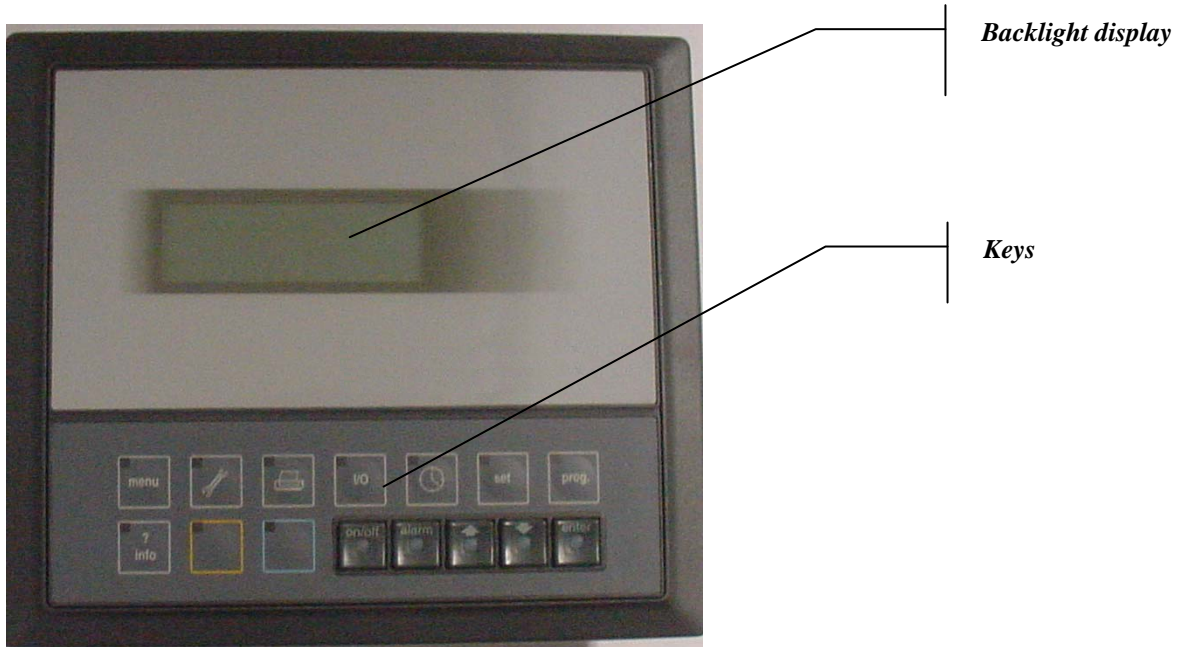
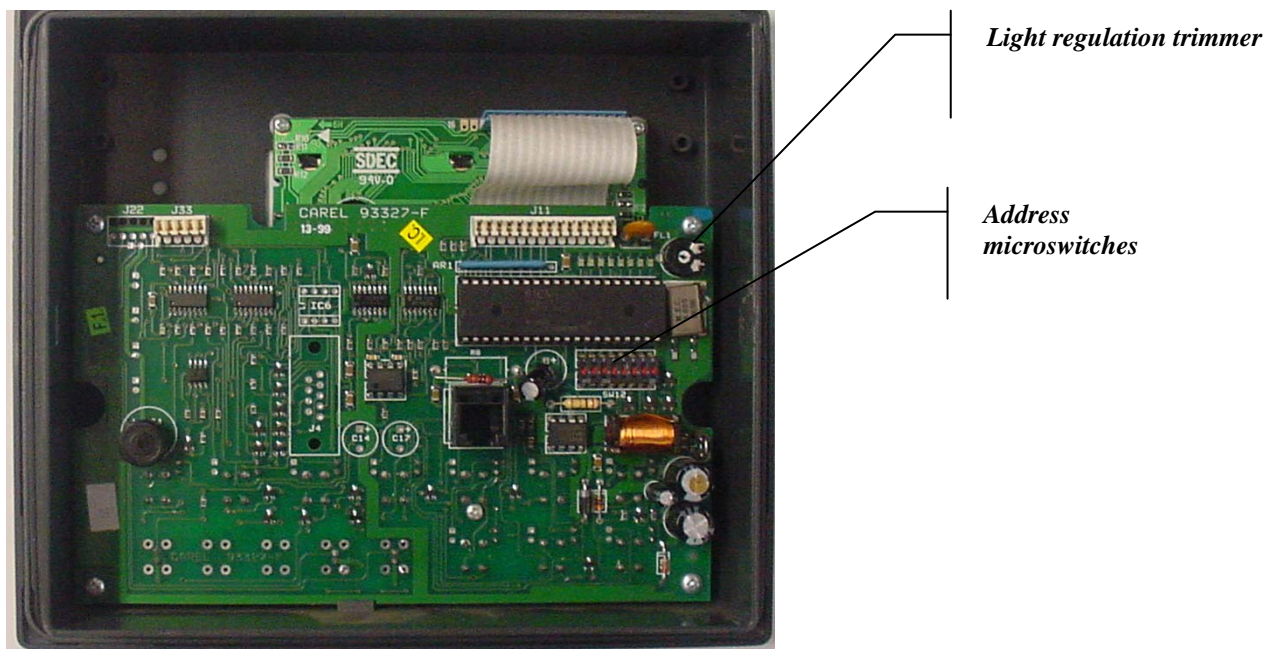


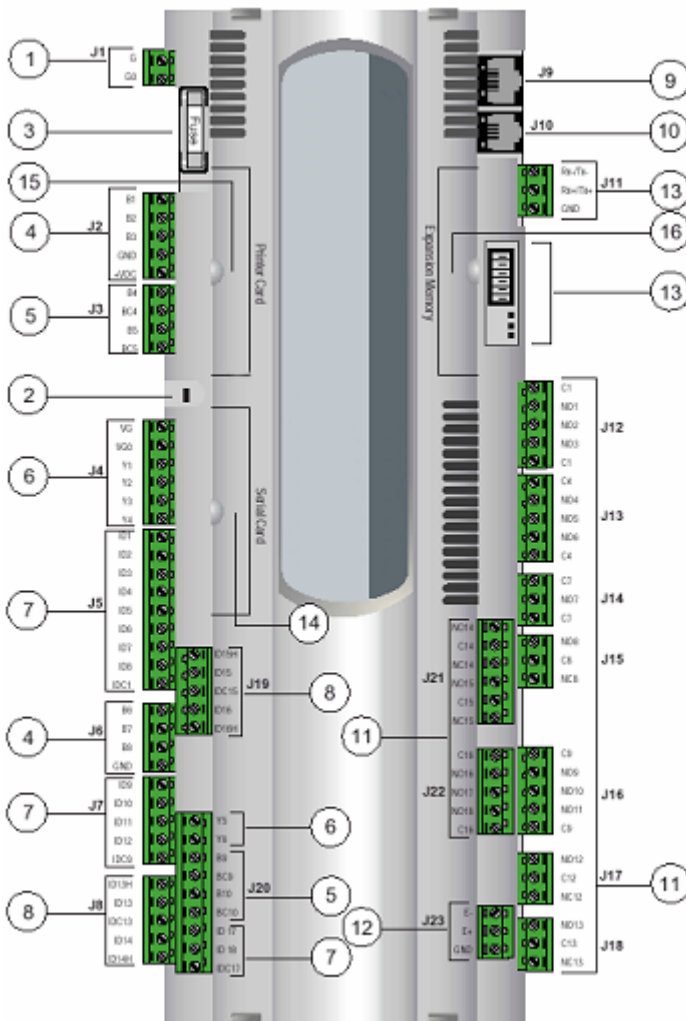
Figure 2. Control panel - rear view



## 4.2 Microprocessor board

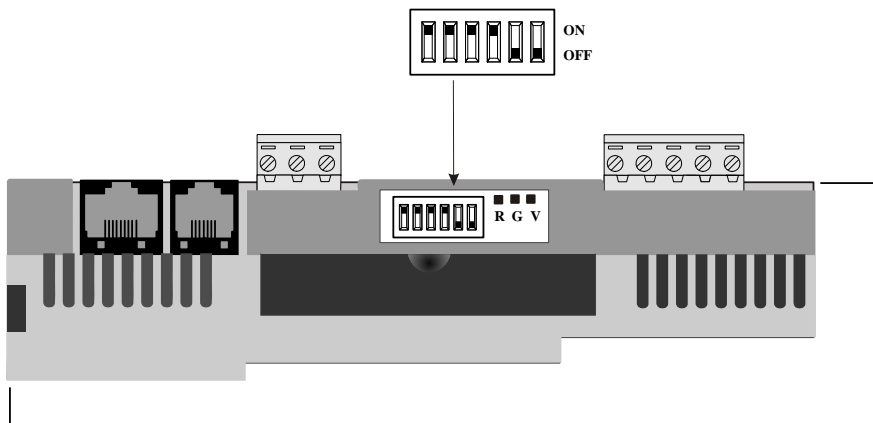
The control board contains the hardware and the software necessary to monitor and to control the unit.

Figure 3. Microprocessor Board



1. Supply G(+), G0(-)
2. Status LED
3. 250Vac fuse
4. Universal analog inputs (NTC, 0/1V, 0/10V, 0/20mA, 4/20mA)
5. Analog inputs passive (NTC, PT1000, On-off)
6. Analog Output 0/10 V
7. Digital input 24Vac/Vcc
8. Digital input 230Vac or 24Vcc
9. Synoptic terminal connection
10. Terminal connector LCD and program download
11. Digital Outputs (relays)
12. Expansion card connector
13. Connector and PLAN microswitches
14. Connection serial card
15. Connector serial printer
16. Memory expansion connector

Figure 4. Microswitches for PLAN addressing



### 4.3 Network addresses

To get the correct functionality of the pLAN system, it is necessary to address the microprocessor boards and the terminal correctly. Each component, as previously described, has a number of microswitches that must be set as specified in the following table.

Net component pLAN component	Microswitches					
	1	2	3	4	5	6
local DISPLAY	OFF	OFF	OFF	OFF	ON	OFF
remote DISPLAY (if any)	ON	OFF	OFF	OFF	ON	OFF
COMP CARD. #1	ON	OFF	OFF	OFF	OFF	OFF
COMP CARD. #2	OFF	ON	OFF	OFF	OFF	OFF

## 5 Controller Inputs/Outputs

The software refers to the configuration of the input and output channels of the controller as shown below.

### 5.1 Digital inputs

N	COMPRESSOR CARD 1	COMPRESSOR CARD 2
1	On/Off, compressor #1	On/Off, compressor #2
2	Low pressure switch, compressor #1	Low pressure switch, compressor #2
3	High pressure switch, compressor #1	High pressure switch, compressor #2
4	Oil level switch, compressor #1	Oil level switch, compressor #2
5	Overload, compressor #1	Overload, compressor #2
6	Transition, compressor #1	Transition, compressor #2
7	On/Off, remote unit	.....
8	Cooling/heating switch	.....
9	Phase monitor	.....
10	Dual setpoint activation	.....
11	Flow switch, evaporator	.....
12	Flow switch, condenser	.....

### 5.2 Analog inputs

N	COMPRESSOR CARD 1	COMPRESSOR CARD 2
1	Evaporator pressure	Current consumed by the unit
2	Oil pressure, compressor #1	Oil pressure, compressor #2
3	Slide transducer, compressor #1	Slide transducer, compressor #2
4	Discharge temperature, compressor #1	Discharge temperature, compressor #2
5	Condenser outlet temperature	Condenser inlet temperature
6	Setpoint override	.....
7	Demand limit	.....
8	Condensation pressure	.....
9	Evaporator inlet temperature	.....
10	Evaporator outlet temperature	.....

### 5.3 Digital/analog outputs

N	COMPRESSOR CARD 1	COMPRESSOR CARD 2
1	Line contactor, compressor #1	Line contactor, compressor #2
2	Star contactor, compressor #1	Star contactor, compressor #2
3	Delta contactor, compressor #1	Delta contactor, compressor #2
4	Liquid injection, compressor #1	Liquid injection, compressor #2
5	Load solenoid, compressor #1	Load solenoid, compressor #2
6	Unload solenoid, compressor #1	Unload solenoid, compressor #2
7	Oil heater, compressor #1	Oil heater, compressor #2
8	Evaporator pump	.....
9	Condenser pump	.....
10	First tower step	.....
11	Second tower step	.....
12	Third tower step	.....
13	Unit in operation	.....
14	Unit alarm	.....
15	Liquid solenoid	.....

### 5.4 Analog outputs

N	COMPRESSOR CARD 1	COMPRESSOR CARD 2
1	Valve output, condensation control	.....
2	Valve output, evaporation control (only HP units from ver. 7.100)	.....

## 6 Display and keypad

The display and the keypad are the main interfacing elements between the operator and the unit. Any operational conditions, alarms and setpoints can be monitored on the display, and any setpoint value can be modified through the keypad.

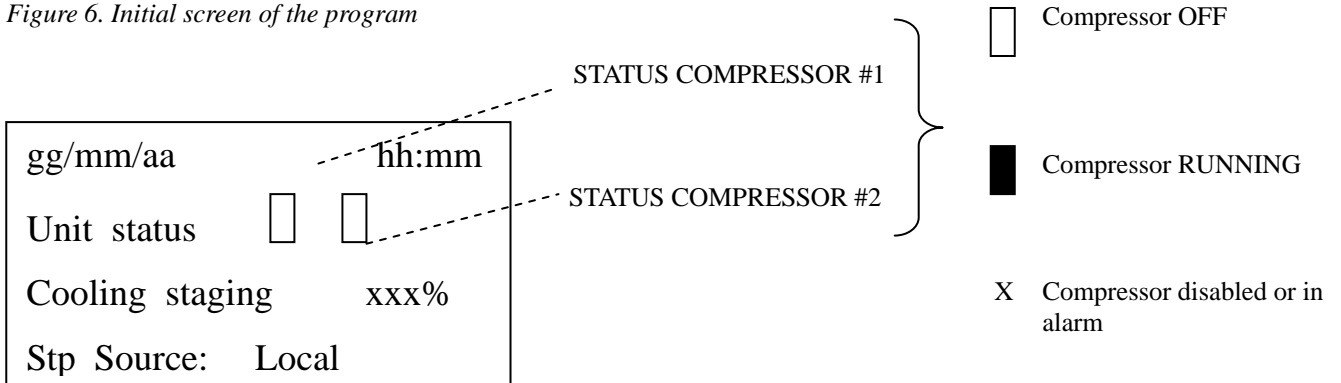
### 6.1 General description

The keypad has 15 keys for access to the operational conditions of the unit and functions of the program. The requested information is shown in the 4-line, 20-character backlight display.

Figure 5. Control panel

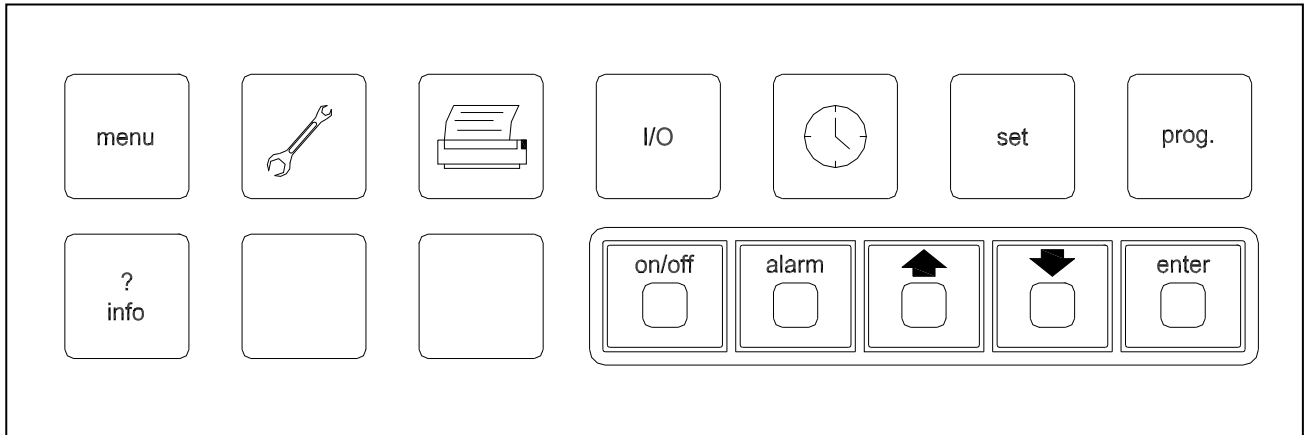




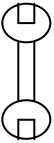
Figure 6. Initial screen of the program







## 6.2 Keypad keys and function

Figure 7. Keypad



- **prog:** by entering a password, it is possible to set the following parameters:
  - Setpoint limits
  - Setpoint reset values
  - Enable dual setpoint
  - Regulation parameters
  - Startup and shutdown parameters
  - Dual setpoint configuration
  - Softload parameters
  - Hot-start parameters for chilled water
  - Pump timing parameters
  - Load limitation of the unit
  - Enable digital and supervisory inputs
  
- **set:** it allows to modify the setpoint value within the limits previously set up in the program
  
-  setup date and time
  
- **I/O:** it allows to show all the inputs and outputs and all the analog and digital parameter values of the corresponding circuit
  
-  (=print): printer (not available)
  
-  (=maint): by entering a password, it is possible to access the maintenance functions
  
- **menu:** it allows to show the structure of main forms with:
  - General status of the unit
  - Input and output temperatures at evaporator and condenser
  - Evaporation and condensation pressure and pressure ratio
  - Evaporation and condensation temperature and temperature approach for the evaporator and the condenser
  - Status and parameters of the selected compressor
  - Status of the cooling tower or of the evaporation control (only HP units of version 7.100 and later)

- **info:** it allows to go from one card to another (showing the parameters of the corresponding compressor)
-  Not available
-  Not available
- **On/Off:** Start/Stop button of the unit
- **alarm:** indicates a possible technical fault and allows to enter a fault description screen for further details
-  (=up): it allows to return to the previous form or, if the cursor is positioned on a data input field, increase the current value in the field
-  (=down): it allows to advance to the next form or, if the cursor is positioned on a data input field, decrease the current value in the field
- **enter:** it allows to access the data input field or, if already in, confirm the entered value

It is possible to access several sections of the program by using the display keypad. There are nine available form categories, which are shown in the following table along with the keys used to access them and the type of operations that they allow (it might be necessary to press two or more keys simultaneously to access some of the sections).

CATEGORY	DESCRIPTION	KEYS	PASSWORD
Main Menu	Displays the operating parameters of the unit (only output)	<i>menu</i>	NO
User menu	Setting of parameters by the user (only input)	<i>prog</i>	YES
Setup menu	Setting of the setpoint value (input/output)	<i>Set</i>	NO
Input/Output menu	Displays the operating parameters of the compressors (only output)	<i>I/O</i>	NO
Manufacturer menu	Setting of parameters by the manufacturer (input)	<i>Menu+prog</i>	YES
Maintenance menu	Access to the maintenance parameters (Input/output)	<i>maint</i>	NO (output) YES (input)
Auxiliary maintenance menu	Setting of parameter values for auxiliary maintenance (input/output)	<i>Menu+maint</i>	YES
Alarm menu	Alarms (output)	<i>alarm</i>	NO
Historical alarm menu	Storage of last 10 alarms (output)	<i>Menu+alarm</i>	NO

The used password (except for the maintenance menu) remains active for ten minutes after being entered.

### 6.3 Main Menu

Output parameters in this section are shown in the following screens (as said before, going from one screen to another can be done with the arrow keys):

- Date and time, compressors status (running, stop or disabled), type of active setpoint and unit status in terms of load percentage, with the following possible scenarios:
  - **Off: Alarm: unit shut down due to general alarm condition**
  - **Off: Rem. Comm: Unit switched off remotely (supervisory system or BMS)**
  - **Off: Remote Sw: Unit switched off (by local or remote switch)**
  - **Off System Sw: Unit switched off through the keypad (on/off key)**
  - **Wait flow Evap: unit in stabilization process, waiting for evaporator water flow to reach the set value**
  - **Wait flow Cond: unit in stabilization process, waiting for condenser water flow to reach the set value**
  - **Waiting for load: unit ON, but compressors not running because no load is applied**
  - **Off: PumpDn Sw: unit ON without any possibility for automatic management of the compressors (compressors disabled by switch)**
- Evaporator water inlet and outlet temperature
- Condenser water inlet and outlet temperature
- Condensation pressure, evaporation pressure and pressure ratio
- Condensation temperature, approach to the condenser, evaporation temperature and approach to the evaporator
- Compressor status in terms of load percentage, with the following possible scenarios:
  - **Off: Alarm: Compressor shut down due to alarm condition**
  - **Off: Ready: Compressor is OFF and ready to start**
  - **Off: PumpDnSw: Compressor switched OFF with local switch**
  - **Auto Xx%: automatic control of compressor on load percentage**
  - **Manual xx%: manual control of compressor on load percentage**
  - **Off: Oil Heat: compressor is waiting for oil to warm up**
  - **Cycle time: compressor is waiting for start time**
  - **Off: Manual: compressor disabled by means of the keypad**
  - **Downl. XX%: compressor in unloading phase by-halt with Limitation of load indication**
  - **Pumping down: the compressor is in the process of pumping down the refrigerant**
  - **Download: compressor is unloaded during the start sequence**
  - **Starting: compressor starting**
- Discharge temperature, discharge superheat and oil pressure of the selected compressor
- Status of the selected compressor (Load/Unload/standby)
- Number of active step or position of the cooling tower regulating valve
- Number of active step or position of the evaporator regulating valve (only HP units of version 7.100 and later)

### 6.4 User menu

In this section, it is possible to set up the user parameters by entering a password to access the following forms:

Parameter description/Item description	Default	
Limits of the setpoint for evaporator chilled water outlet		
Low	4.0	°C
High	10.0	°C
Limits of the setpoint for condenser hot water outlet (mode heat pump or pursuit)		
Low	40.0	°C
High	50.0	°C
Reset limits for evaporator water outlet setpoint		
Low	4.0	°C
High	10.0	°C
Reset limits for condenser water outlet setpoint (mode heat pump or pursuit)		
Low	40.0	°C
High	50.0	°C
Water temperature regulation band	3.0	°C
Dead band regulation	0.2	°C
Max reduction speed of water temperature (max pull-down rate)	0.7	°C/min
Start differential temperature of first compressor (Startup DT)	2.6	°C
Stop differential temperature of last compressor (ShutDown DT)	1.7	°C
Enable dual setpoint	N	
SOFTLOAD Enable (load limitation at start-up)	N	
Unit max load (only if enabled)	50	%
Maximum activation time (only if enabled)	20	min
Start enable limitation under evaporator hot water conditions		

Evaporator outlet temperature (only if enabled)	18	°C
Unit max load (only if enabled)	50	%
Time between the starting of the evaporator/condenser pump and the starting of the first compressor	30	Sec
Stop delay for evaporator pump	180	Sec
ON/OFF Enable from digital input	Y	
Cooling/heating Enable from digital input	N	
ON/OFF Enable from supervisory system	N	
Cooling/heating Enable from digital input	N	
Change of user password	0003	

### 6.5 Setup menu

In this section it is possible to set up the following setpoints:

- Local setpoint for evaporator water (°C)
- Local setpoint for condenser water (°C) (only HP unit or pursuit)
- Second setpoint for evaporator water (°C)
- Second setpoint for condenser water (°C) (only HP unit or pursuit)

The active setpoint (currently used by the system) is then shown

### 6.6 Input / Output Menu

The parameters in this section can only be shown as follows:

- Software name, software version and release date
- Status of digital inputs/outputs (c = closed, to = open)
- Evaporation pressure (Master board) or unit absorbed current (Slaves)
- Oil pressure
- Slide position
- Compressors discharge temperature
- Water temperature input (Master board) or condenser output (Slaves)
- Input value for the reset of the setpoint (only Master board)
- Input value for the demand limit (only Master board)
- Condensation pressure (only Master board)
- Evaporator water inlet temperature (only Master board)
- Evaporator water outlet temperature (only Master board)
- Analog output values in Volts dc

### 6.7 Manufacturer menu

In this section, it is possible to set up the factory parameters by entering a password to access the corresponding forms. These parameters may only be modified by qualified persons.

Configuration of the unit	00 = Chiller (control of the evaporator outlet water) 01 = Heat pump (control of the condenser outlet water) 02 = Chiller to pursuit (Simultaneous control of the evaporator and condenser outlet water)
Compressor number	2
Enabling of sensors /input signals Master card Slave card	B1, B2, B3, B4, B5, B6*, B7**, B8, B9, B10 B1, B2, B3, B4, B5  The inputs B6 and B7 of the master card must be enabled to activate, respectively, the setpoint override and the demand limit functions The B1 input of the Slave card must be enabled if the demand limit function is needed
Configuration of low pressure sensor 4mA 20mA	-00.5 bar 07.0 bar
Unit absorbed current (only on Slave card if the B1 input is enabled)	400 A
Configuration of high pressure sensor	

4mA 20mA	00.0bar 30.0 bar
Oil pressure configuration 4mA 20mA	00.0bar 30.0 bar
Temperature regulation Integral time Derivative time Sampling time	200 s 060 s 030 s
Impulse number to load the compressor Impulse number to unload the compressor	15 15
Minimum time between two starts of a given compressor Minimum time between two starts of different compressors	600 s 120 s
Minimum time of compressor operation Minimum time of compressor inactivity	120 s 120 s
Minimum load of last compressor Minimum load of last but one compressor	35 % 50 %
Last compressor reload at compressor stop	85 %
Interstage (minimum time for starting the next compressor) Double pulse under	210 s 35 %
Compressor unload Impulse duration Minimum impulse period Maximum impulse period	00.6 s 1 s 10 s
Compressor load Impulse duration Minimum impulse period Maximum impulse period	0.4 s 05 s 90 s
Threshold for unload on high pressure Threshold for stand-by on high pressure Threshold for unload on low pressure Threshold for stand-by on low pressure	16.5 bar 16.0 bar 1.6 bar 1.3 bar
Antifreeze prevention Setpoint Differential	3.5 °C 1.0 °C
Tower control Type Input	Steps Temperature
Tower temperature control Setpoint Differential	35.0 °C 5.0 °C
Pressure ratio, tower control Min Max	1.8 2.5
Steps, tower (if Type=Steps)	3
Tower control valve (if Type=Valve) Minimum opening Maximum opening	25% 100%
Evaporation control (only HP mode) Type Input	Steps Temperature
Evaporation temperature control (only HP mode) Setpoint Differential	7.0 °C 3.0 °C
Evaporation control based on compression ratio (only HP mode) Min Max	1.8 2.5
Steps, evaporation (if Type=Steps and only HP mode)	3
Evaporation control valve (if Type=Valve and only HP mode) Minimum opening Maximum opening	25% 100%

Enable Evaporator flow alarm	Yes (only master)
Enable Condenser flow alarm	Yes (only master)
Alarm delay for evaporator flow switch	
At startup	20s
Run	05s
Alarm delay for condenser flow switch	
At startup	20s
Run	05s
Minimum valve position for condenser flow switch alarm	50%
Minimum valve position for evaporator flow switch alarm	50%
Enable phase monitor alarm	Yes (only MASTER)
Enable heating oil control	Yes
High discharge temperature alarm	
Setpoint	110 °C
Differential	05 °C
High pressure alarms	
Setpoint	17.0 bar
Diff.	05.0 bar
Low pressure alarms	
Setpoint	01.0 bar
Diff.	00.5 bar
Low pressure alarm delay	
At startup	120 s
Run	60 s
Low pressure ratio alarm	
minimum load	1.4
maximum load	2.0
Low pressure ratio alarm delay	
At startup	180 s
Run	90 s
Oil level alarm delay	
At startup	180 s
Run	010 s
Low oil pressure alarm delay	
At startup	300 s
Run	090 s
High oil DP alarm	
Setpoint	02.5 bar
Delay	020 s
Antifreeze alarm	
Setpoint	03.0 °C
Diff.	01.0 °C
Liquid injection	
Setpoint	085.0 °C
Diff.	10.0 °C
Antifreeze heaters	
Setpoint	4,5 °C
Diff.	1,0 °C
Supervisory system	
Communication speed	19200 (RS485/RS422)
To register	.....
Identification No.	1
Change Manufacturer password	0033

## 6.8 Maintenance menu

In this section, it is possible to show the maintenance parameters by accessing the following forms:

- Evaporator/condenser pump running hours
- Compressor running hours and number of starts
- Status of the PID control (only Master board):

By entering the maintenance password, it is possible to access the input form of maintenance parameters.

- Zero resetting or adjustment of evaporator pumps running hours
- Zero resetting or adjustment of condenser pumps running hours
- Zero resetting or adjustment of compressors running hours and number of starts
- Adjustment of pressure and temperature sensors
- Setup of the position transducer for the unload slide
- Adjustment of the position transducers for unload slide
- Adjustment of the slide position sensor for max /min compressor load conditions

### 6.9 Auxiliary maintenance menu

In this section, it is possible to set up the service parameters by entering a password to access the corresponding forms.

- Compressor control mode (OFF/AUTO/MANUAL) and compressor load in manual mode
- Alarm reset
- Softload Reset
- Oil heating reset

### 6.10 Menu alarms

Every time an alarm occurs the BUZZER is activated. By pressing the alarm key, the current alarm is shown. By pressing the alarm key for a second time, the buzzer is muted, and further pressing the key causes the cancellation of the alarm.

N.B. Sometimes, after an alarm has been activated, it might happen that also a spurious star/delta transition failure alarm occurs; in this case fix the original alarm first and, only if the spurious one occurs again, check the electrical connections.

When an alarm cannot be cancelled after pressing the alarm key several times, it means that the abnormal conditions for the alarm still persist.

### 6.11 Historical alarm menu

The last ten alarms of every chiller circuit are stored in this section.

All ten forms include information on the date and time when the alarm occurred and the description of the alarm.

By pressing the enter key while the description of an alarm is displayed, the status of the unit at the moment the alarm occurred (temperatures, pressures and compressor load) will be shown.

### 6.12 Alarm list

A list is shown below which shows the alarms in the system, each including its id number, the cause that triggers the alarm, and the reset type (A= automatic; M= manual).

	<b>Alarm</b>	<b>Cause of the alarm</b>	<b>Reset</b>
001	Phase Monitor alarm	Activation of the phase control device. Phases are not sequenced correctly or the supply voltage is out of range.	M
002	Antifreeze alarm	Antifreeze protection. The temperature of the outlet water has reached the antifreeze alarm level.	M
003	Low evaporation pressure alarm	Low pressure alert activated by the microprocessor.	M
005	Evaporator flow alarm	Activation of the evaporator flow switch. The water pump might have stopped.	M
006	Condenser flow alarm	Activation of the condenser flow switch. The water pump might have stopped or the valve might be out of order.	M
007	High discharge temperature alarm	Activation of the compressor high discharge temperature alarm	M
008	Transition fault	The starting sequence could not be completed. Check the contactors	M
009	Low oil pressure alarm	Low oil pressure. The oil pressure is not enough to guarantee the correct lubrication of the compressor.	M
010	Low pressure alarm (pressure switch)	Activation of the mechanical low pressure switch	M
011	High oil DP alarm	High differential pressure of the oil. The oil filter might be dirty or the solenoid valve in the oil circuit might be out of order.	M
012	High pressure alarm (pressure switch)	Activation of the mechanical high pressure switch	M
014	Oil level Alarm	Activation of the level switch in the oil separator. The compressor has lost the oil.	
016	Compressor overload	Activation of the thermal protection for the compressor electric motor or activation of the thermistor for high discharge	M

		temperature	
019	Low pressure ratio alarm	The pressure ratio is less than the anticipated minimum. Temperatures of the evaporator and condenser water might be out of the acceptable range (evaporator water temperature too high or condenser water temperature too low)	M
023	High pressure alarm	Activation of high pressure alarm by microprocessor	M
030	Evaporation current/pressure sensor fault	The sensor connected to the B1 input of the controller gives a signal which is out of range	
031	Oil pressure sensor fault	The sensor connected to the B2 input of the controller gives a signal which is out of range	
032	Load sensor fault	The sensor connected to the B3 input of the controller gives a signal which is out of range	
033	Discharge temperature sensor fault	The sensor connected to the B4 input of the controller gives a signal which is out of range	
034	Condenser temperature sensor input/output fault	The sensor connected to the B5 input of the controller gives a signal which is out of range	
035	Setpoint override input fault	The sensor connected to the B6 input of the controller gives a signal which is out of range	
036	Demand limit input fault	The sensor connected to the B7 input of the controller gives a signal which is out of range	
037	Condensation pressure sensor fault	The sensor connected to the B8 input of the controller gives a signal which is out of range	
038	Evaporator inlet temperature sensor fault	The sensor connected to the B9 input of the controller gives a signal which is out of range	
039	Evaporator outlet temperature sensor fault	The sensor connected to the B10 input of the controller gives a signal which is out of range	
040	Condenser pump maintenance	The condenser pump has reached a number of running hours and is due for maintenance	
041	Compressor maintenance	The compressor has reached a number of running hours and is due for maintenance	
050	Evaporator pump maintenance	The evaporator pump has reached a number of running hours and is due for maintenance	
050	Unit 1 offline	Compressor #1 not in network	A
051	Unit 2 offline	Compressor #2 not in network	A
055	Clock card alarm	Microprocessor clock card not working. The battery might be discharged	M

## 7 Capacity control of the compressors

Every screw compressor of the Frame 4 series can be equipped with a sensor that detects the position of the capacity control slide. Such position data is sent to the controller through a 4-20mA proportional signal. The controller uses this signal to control the logic of the refrigerated water system and the starting of the compressors.

The minimum signal corresponds to 25% of the volume capacity of the compressor while the maximum signal corresponds to 100%.

The software, however, is able to manage the compressors even if the slide position sensor is missing; in such a case, the position is estimated based on the load /unload impulse degree sent to the compressors. This allows, in case of sensor malfunction, to easily disable the B3 input to force the software to work without it.

So, there might be no sensors; otherwise, they could be of two different types.

- **Sensor with reset button:**

This type of sensor has a reset button, located on the sensor head, close to the electric connection, which is protected by a circular hood (see figure (a)). This button allows to correct the minimum and maximum signal based on the minimal and maximal limits of the compressor.

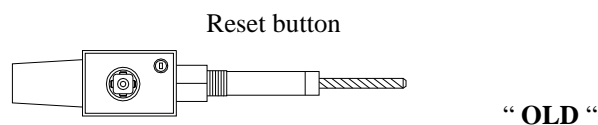


Figure (a)

- **Sensor without reset button:**

This type of sensor guarantees the linear response of the signal according to the position of the capacitive pole and has no reset capabilities (see Figure b). To reset the slide position signal, it is necessary to access the software through the keypad.

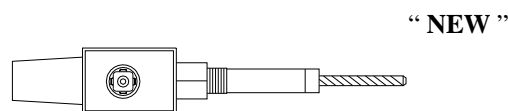


Figure (b)

### 7.1 Setup of a capacity transducer with position reset

Under the Service menu (protected by password) of the relevant compressor, once the request “adjustable sensor?” appears on the display, just select “Y”.

Such operation enables the corresponding circuit to use the capacity sensor with reset button. Once this operation is completed for each compressor, it is necessary to reset the sensor itself. After the relevant compressor has started, bring it to minimum load by jumpering the unload relay (use an ammeter to identify the minimum load). While the compressor is on minimum load, press the reset button under the sensor head cover.

After this operation, the green LED stops blinking and turns red. Load the compressor to full capacity by jumpering the load relay (use an ammeter to identify the maximum load) and press the reset button once again. The position sensor is now correctly set.

### 7.2 Setup of a capacity transducer without position reset

Under the Service menu (protected by password) of the relevant compressor, once the request “adjustable sensor?” appears on the display, just select “N”.

After this, the operator will be prompted to enter the type of the installed compressor. Verify the compressor model on the nameplate and input the information.

Once the compressor model has been entered, it is necessary to adjust the minimum and maximum load positions. Unload the compressor completely as previously described and verify, by means of the I/O key, that the value of the reference signal is 25%. If different from 25%, make the necessary adjustment of the measured value under the service menu password (the screen next to the compressors setup). The same procedure has to be done under 100% compressor load.

## 8 Condensation control

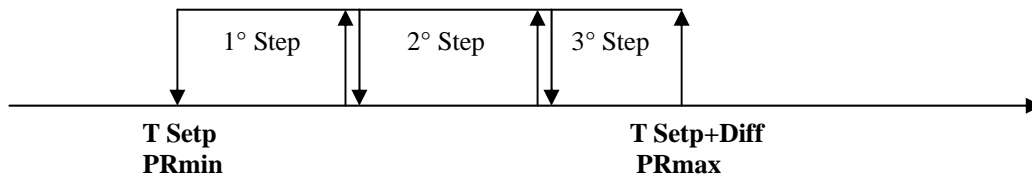
The microprocessor controller allows to control the fans in many ways, making the control of condensation more accurate and reliable, even under severe environmental conditions.

The controller allows to set up, under manufacturer password, the following fan control logic:

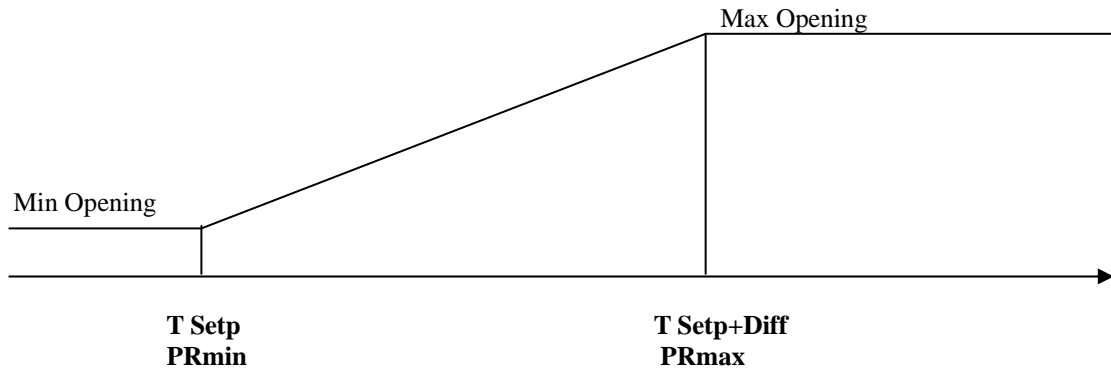
**Steps (Steps): up to three control steps for the tower fans can be set up.** Each step allows a cut-in threshold value and a cut-out threshold value.

The manufacturer establishes either a setpoint for condenser water inlet temperature and a desired differential, or the minimum and maximum pressure ratio.

The controller divides the differential in a number of intervals that define the cut-in and cut-out threshold values for each step



**Continuous regulation:** The position of a regulation or bypass valve can be controlled through a 0-10Vdc signal.



The same logic is used to control the evaporation (in the heat pump units); of course, the cut-in and cut-out thresholds are inverted.

## 9 Setpoint change of the refrigerated water

One of the many possibilities of the controller is to regulate the unit to get several results.

One of the functions that engineers and technicians find most useful, is the possibility to modify the local control setpoint of the refrigerated water in accordance with the following logics:

**Dual setpoint:** Through an external contact (optionally a switch can be installed on the electric control panel), it is possible to change the local setpoint between two defined values. Such option is advantageously applicable, as example, in ice bank installations. Such application normally requires a positive setpoint (e.g. 7°C) to be used in the daytime and a second negative setpoint (e.g. - 5°C) for the night time. Of course, in the case that the water temperature at the evaporator outlet is lower than 4°C, the correct amount of antifreeze must be added to the water system.

**From external signal:** By using an external 4-20mA signal, it is possible to modify the value of the local setpoint within predetermined minimum and maximum limits. The setpoint value is calculated by linear interpolation of the 4-20 mA input signal between the corresponding setpoint values assigned to respectively 4 and 20 mA in the password-protected User menu.

## **10 Load limitation of the unit**

Such function is useful in all those situations where a reduction in the electric consumption of the unit is necessary during certain hours of the day.

It is possible to limit the electric consumption of the unit using the Demand Limit mode.

This requires an external 4-20mA signal; inputs lower than 4mA have no effect on the load of the unit, while an input between 4 and 20 mA will render a proportional load in the range from respectively 100% to 0%.

## **11 Start under high temperature conditions of evaporator water**

This function, which can be enabled through the keypad under User password, limits the unit load to a predetermined value for a selectable time, every time the unit starts. This function is applicable in situations where the water temperature is high at the startup but thermal load is not consistently high. This logic allows to save energy during the load reduction period by preventing the compressors from unnecessarily increasing and then decreasing their capacity.

## **12 Start under high temperature conditions of evaporator water**

This function limits the load of each compressor to a set value (default 70%), until the outlet water temperature cannot be kept below the set value (default 25°C). Such logic helps the starting of the chiller group when the water temperature is initially very high (35-40°C).

This function prevents from dangerous superheating of the motor and undesirable triggering of the high pressure protection. The values of maximum compressor load and water temperature limit are modifiable under "User" password.

### 13 Appendix 1: Loading of the program on the controller

To load the program on the controller it is possible to follow two different ways: using a personal computer or using the Carel programming key.

#### 13.1 Direct loading using a PC

To perform the load directly using a PC, it is necessary to:

- install the WinLoad program provided by Carel, and available on the site ksa.carel.com, in the PC. It can be requested directly to Daikin
- connect the PC, via serial cable RS232 or USB, to the RS232/RS485 or USB Carel converter
- connect the RS485 port of the converter to the input terminal (J10) of the controller using a 6-wire telephone cable
- disconnect the controller from the pLAN and set the network address to 0.

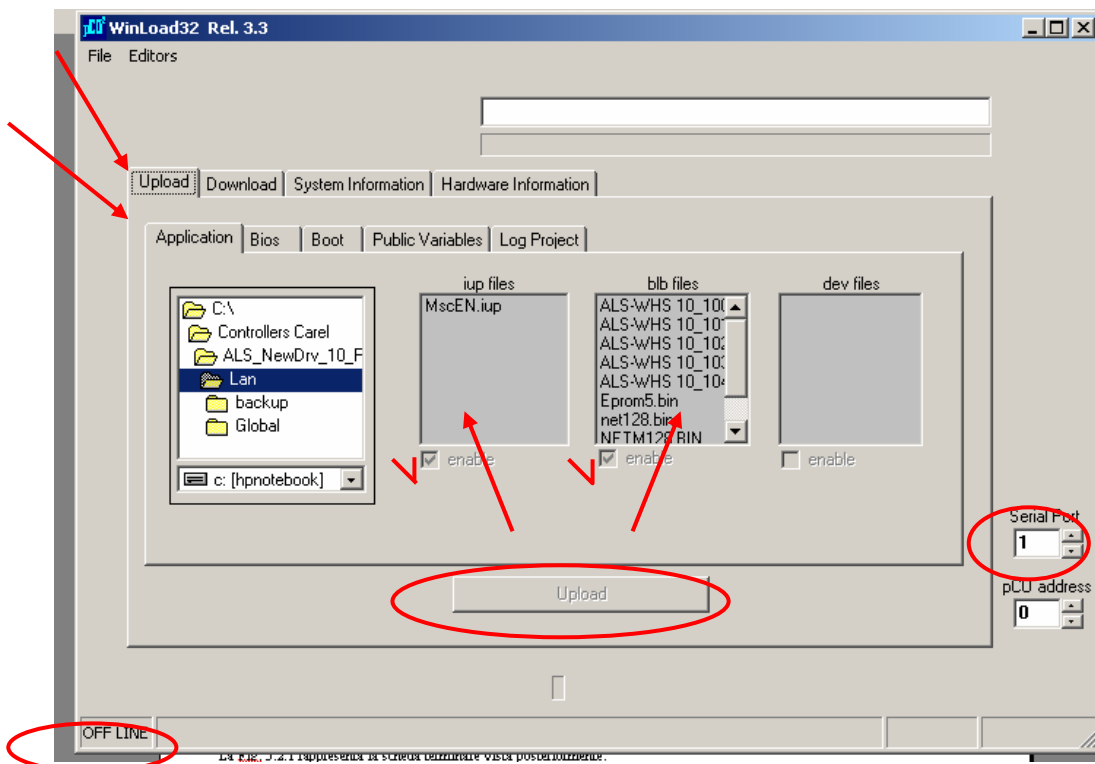
Power up the controller and then launch the WinLoad program, select the number of the serial port which has been connected to the converter and wait (for about a tenth of a second) for the text “ON LINE” to appear on the bottom left side of the screen (indicating that the connection has been established between PC and controller).

Then select the “Upload” folder and the “Application” section and select all program files supplied by Daikin (one file should be in the “blb files” box and one or more in the “iup files” box).

At this stage press the Upload button and wait for the completion of the transfer. For this purpose, the program shows the different phases of the transfer in a special window and, if everything goes well, the text “UPLOAD COMPLETED” should appear at the end of the process.

Shut down the controller, disconnect it from the PC, connect it to the pLAN and restore the correct net address.

This procedure has to be applied to all the controllers available in the unit.



#### 13.2 Upload from programming key

To upload the program using the Programming Key it is first necessary to load the program on the key and then transfer it to one or more controllers; the same procedure is used for either downloading the program to the key or uploading the program from the key to the controller, the position of the dedicated switch on the key must be changed accordingly:

Switch position	Transfer to
1 (green light)	programming key from pCO <sup>2</sup>
2 (red light)	programming pCO <sup>2</sup> from key

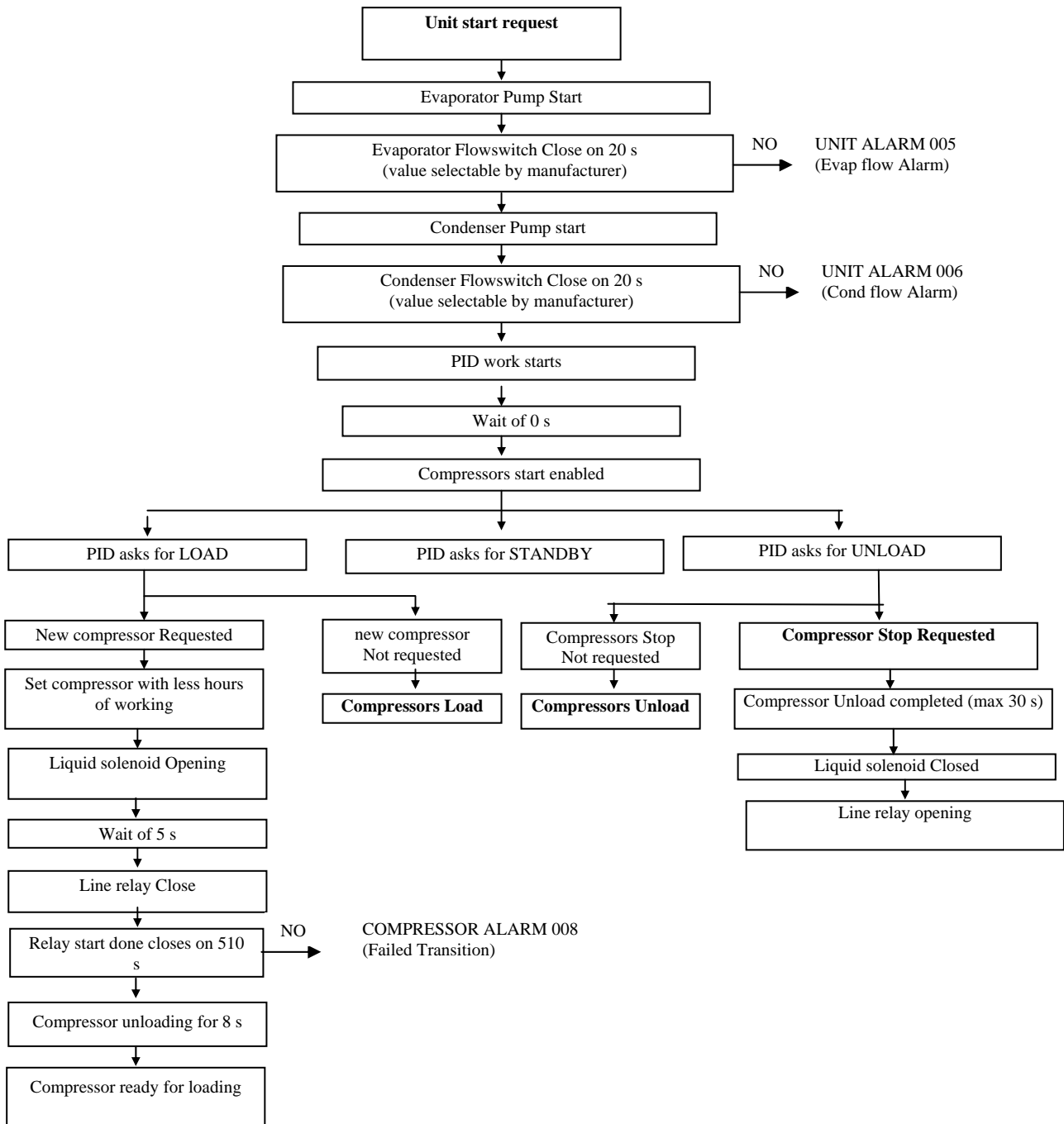
The procedure is described as follows.

- disconnect the controller from the pLAN and set the network address to 0.
- put the switch of the key in the desired position
- insert the switch in the special expansion memory connector (after you have, eventually, removed the cover)
- maintain the up and down keys pressed at the same time and power up the PCO2 board
- confirm the operation with the enter key
- wait for the controller to restart
- switch off the supply to the PCO<sup>2</sup> board
- remove the key.

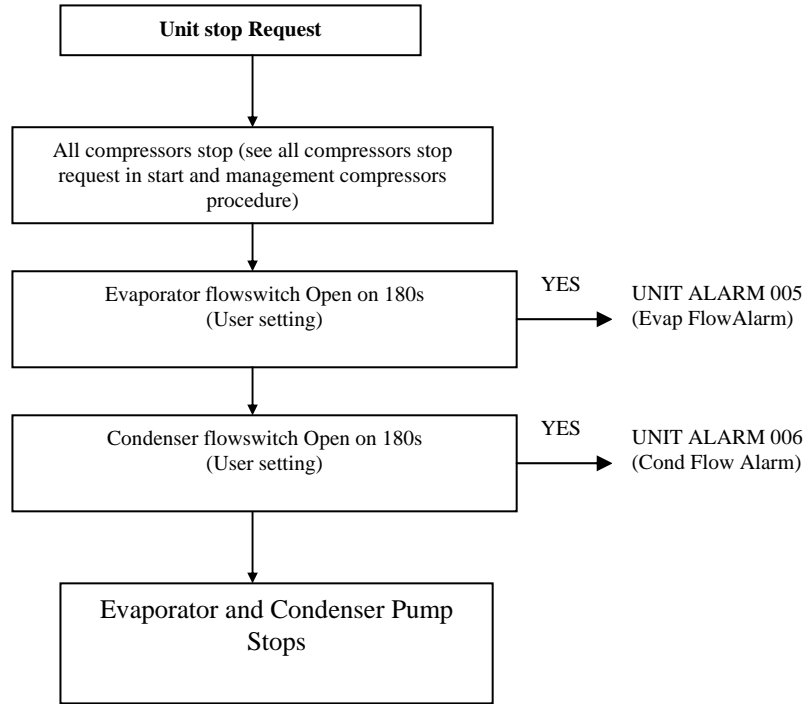
In case no controller with an installed programme is available, the key may be programmed by using the same procedure described for the direct upload from a PC. In this case, the key must be inserted in the controller with its switch in position 2 (red light), and the program will be written on the key rather than on the controller.

## 14 Appendix 2: Procedure for start and stop unit and compressors

The starting, management and stop procedures of the unit are described below. The procedure for loading and unloading the compressors is also described.



### Unit Start and Compressor Management



**Unit Stop**

### Start Sequence and Compressors load

Phase No.	First Comp. Started	Second Comp. Started
0	Off	Off
1	If $(T - \text{SetP}) < \text{Startup DT}$ & Cooling or $(\text{SetP}-t) < \text{Startup DT}$ & Heating Wait ...	
2	At startup	Off
3	Position up to 100%	Off
4	If T within the regulation band Wait for inter-stage time	
5	If T is approaching the setpoint Wait ...	
6	Fixed at 100%	At startup
7	Fixed at 100%	Position up to 100%
8	Fixed at 100%	Fixed at 100%

### Unload sequence and compressors stop

Phase No.	First Comp. Started	Second Comp. Started
0	100%	100%
1	Fixed at 100%	Discharge up to “minimum load of last comp”
2	Discharge up to “minimum load of second last comp”	Fixed to “minimum load of last comp”
3	If T is approaching the setpoint Wait ...	
4	Load up to “Reloading last compressor”	Stop
5	Discharge up to “minimum load of last comp”	Off
6	If T is approaching the setpoint Wait ...	
7	If $(\text{SetP}-t) < \text{Shutdown DT}$ & Cooling or $(t-\text{SetP}) < \text{Shutdown DT}$ & Heating Wait ...	
8	Stop	Off
9	Off	Off

## 15 Appendix 3: Supervisory variables

The following table shows the variables that the controller is able to exchange with supervisory or BMS systems, along with their description, the flow type (inlet or outlet) and the channel or register where the communication takes place.

### Digital variables

Variable	Index	Flux	Description	Modbus coil
SYSON	1	O	Unit Ready	2
LINE_METTER	2	O	Compressor line relay	3
STAR_METTER	3	O	Compressor star relay	4
DELTA_METTER	4	O	Compressor delta relay	5
ELECTROVALVES	5	O	Liquid injection valve	6
OIL_HEATER	8	O	Oil heater	9
MAIN_PUMP	9	O	Evaporator pump	10
PUMP_COND	10	O	Condenser pump	11
TOWER_STEP1	11	O	Tower step #1	12
TOWER_STEP2	12	O	Tower step #2	13
TOWER_STEP3	13	O	Tower step #3	14
EN_EVAP_FLOW_AL	15	I/O	Enable evaporator flow alarm	16
EN_B1	16	I/O	Enable Analog Input B1	17
EN_B2	17	I/O	Enable Analog Input B2	18
EN_B3	18	I/O	Enable Analog Input B3	19
EN_B4	19	I/O	Enable Analog Input B4	20
EN_B5	20	I/O	Enable Analog Input B5	21
EN_B6	21	I/O	Enable Analog Input B6	22
EN_B7	22	I/O	Enable Analog Input B7	23
EN_B8	23	I/O	Enable Analog Input B8	24
SUPERV_ONOFF	24	I/O	Network ON/OFF	25
EN_START_RESTR	25	I/O	Enable start	26
SUM_WIN_SEL	27	O	Cooling /heating switch	28
CONFIG_1	28	O	Summer/Winter selection	29
COOLING_HEATING	29	O	Water/Water heat pump configuration	30
EN_DOUBLE_SETP	32	O	Heating mode	33
UNIT1_ONLINE	33	O	Unit 1 is online	34
EN_WW_UNIT	34	O	Heating mode allowed	35
INCREASING_STAT	40	O	Comp # 1 is loading	41
DECREASING_STAT	41	O	Comp # 1 is unloading	42
STANDBY_STAT	42	O	Comp # 1 is in standby	43
OFF_RELAY	43	O	Comp # 1 is off	44
MAL_DISCH_TEMP_2	45	O	High discharge temperature alarm, comp # 2	46
EN_COMP	46	I/O	Enable comp # 1	47
EN_COMP2	47	I/O	Enable comp # 2	48
SUM_WIN_SUP	51	I/O	Heating/cooling supervisory selection	52
SAFETY_UNLOADER	59	O	Comp # 1 safety unloading	60
MAL_CLOCK32_2	66	O	Clock bord comp. # 2 alarm	67
MAN_GLB_AL	70	O	Comp # 1 global alarm	71
MAL_FREEZE	71	O	Freeze alarm	72
MAL_COMP	72	O	Comp # 1 overload	73
MAL_OIL_PRESS_2	73	O	Low oil pressure alarm, comp # 2	74
MAL_EVAP_FLOW	76	O	Evaporator flow alarm	77
MAL_HIGH_PRESS	78	O	Mechanical high pressure alarm, comp # 1	79
MAL_OIL_LEVEL	80	O	Oil level alarm comp # 1	81
MAL_LOW_PRESS	82	O	Low pressure alarm comp # 1	83

MAL_HP_TRANSD	84	O	Tranducer high pressure alarm, comp # 1	85
MAL_OIL_DP_2	88	O	High oil differential pressure, comp #2	89
MAL_MASTER_OFFFL	93	O	Master offline alarm	94
MAL_UNIT2_OFFFL	94	O	Comp # 2 offline alarm	95
MAL_B1	97	O	Probe B1, comp. # 1 alarm	98
MAL_B2	98	O	Probe B2, comp. # 1 alarm	99
MAL_B3	99	O	Probe B3, comp. # 1 alarm	100
MAL_B4	100	O	Probe B4, comp. # 1 alarm	101
MAL_B5	101	O	Probe B5, comp. # 1 alarm	102
MAL_B6	102	O	Probe B6, comp. # 1 alarm	103
MAL_B7	103	O	Probe B7, comp. # 1 alarm	104
MAL_B8	104	O	Probe B8, comp. # 1 alarm	105
MAL_PUMP_COND_H	105	O	Condenser pump maintenance alarm	106
MAL_PUMP_EV_H	106	O	Evaporator pump maintenance alarm	107
MAL_COMP_HOUR	107	O	Comp. # 1, maintenance alarm	108
MAL_PHASE	108	O	Phase alarm, comp # 1	109
MAL_CLOCK32	110	O	Clock board comp. # 1 alarm	111
MAL_LP_TRANSD	111	O	Transducer low pressure alarm, comp. # 1	112
MAL_OIL_PRESS	113	O	Low oil pressure alarm, comp # 1	114
MAL_OIL_DP	114	O	High oil differential pressure, comp #1	115
MAL_DISCH_TEMP	115	O	High discharge temperature alarm, comp # 1	116
MAL_PRESSURE_RATIO	116	O	Low pressure ratio alarm, comp #1	117
EN_UNIT2	129	O	Enable controller # 2	130
INCREASING_STAT_2	150	O	Comp #2 is loading	151
DECREASING_STAT_2	153	O	Comp #2 is unloading	154
STANDBY_STAT_2	156	O	Comp #2 is in standby	157
OFF_RELAY_2	159	O	Comp #2 is off	160
MAN_GLB_AL2	162	O	Comp. # 2 global alarm	163
MAL_COMP_2	168	O	Overload, comp. # 2	169
MAL_OIL_LEVEL_2	174	O	Oil level alarm, comp # 2	175

### Analog variables

Variable	Index	Flux	Description	Modbus register
INLET_TEMP	1	O	Evaporator inlet temperature	40002
OUTLET_TEMP	2	O	Evaporator outlet temperature	40003
IN_W_TEMP_COND	3	O	Condenser inlet temperature	40004
DISCH_TEMP	4	O	Discharge temperature, comp #1	40005
EXTERNAL_SETP	5	O	External setpoint	40006
OUT_W_TEMP_COND	6	O	Condenser outlet temperature	40007
HIGH_PRESS_TR	7	O	Condensing pressure, comp #1	40008
OIL_PRESS_TR	8	O	Oil pressure, comp #1	40009
S_TEMP_SETPOINT	11	O	Cooling setpoint	40012
W_TEMP_SETPOINT	12	O	Heating setpoint	40013
IN_TEMP_SETP	14	O	Actual setpoint	40015
IN_TEMP_BAND	15	I/O	Regulation band	40016
SUM_LOW_T_LIM	20	O	Cooling setpoint, low limit	40021
SUM_HIGH_T_LIM	21	O	Cooling setpoint, high limit	40022
WIN_LOW_T_LIM	22	O	Heating setpoint, low limit	40023
WIN_HIGH_T_LIM	23	O	Heating setpoint, high limit	40024
AOUT_1_DISPLAY	26	O	Analog output # 1	40027
AOUT_2_DISPLAY	27	O	Analog output # 2	40028

LOW_PRESS_TR	30	I/O	Evaporating pressure, comp #1	40031
EVAP_TEMP	33	O	Evaporating temperature	40034
UNIT_LOAD	34	I/O	Unit load	40035
COMP_STAT	35	I/O	Comp #1 load	40036
COMP_STAT2	36	O	Comp #2 load	40037
OIL_PRESS_TR_2	54	O	Oil pressure, comp #2	40055
DISCH_TEMP_2	57	O	Discharge temperature, comp #2	40058

### Integer variables

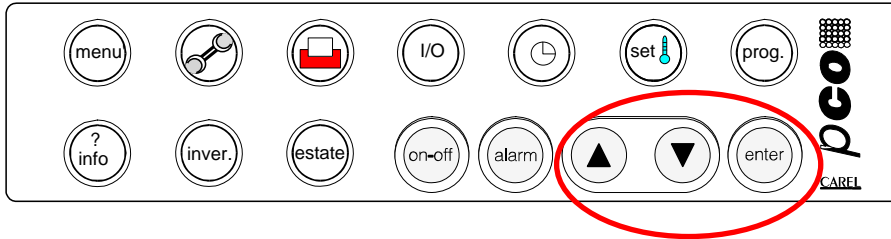
Variable	Index	Flux	Description	Modbus register	Notes
T_H_PUMP_COND	10	O	Condenser pump operating hours (thousands)	40139	
T_L_PUMP_COND	11	O	Condenser pump operating hours (units)	40140	
					0 = Unit On 1=Off Alarm 2=Off Superv. 3=Not Used 4=Off Switch 5=Off Keypad
UNIT_STATUS	12	O	Unit status	40141	
T_H_PUMP_EVAP	20	O	Evaporator pump operating hours (thousands)	40149	
T_L_PUMP_EVAP	21	I/O	Evaporator pump operating hours (units)	40150	
T_H_COMPRESSOR	22	O	Comp. #1 operating hours (thousands)	40151	
T_L_COMPRESSOR	23	O	Comp. #1 operating hours (units)	40152	
T_H_COMPRESSOR2	24	O	Comp. #2 operating hours (thousands)	40153	
T_L_COMPRESSOR2	25	O	Comp. #2 operating hours (units)	40154	
				40160	0=Chiller 1=Heat pump 2=Pursuit
CONFIG_TYPE	31	O	Unit configuration		
NUMBER_COMPS	33	I/O	Number of compressors	40162	
NET_ADDRESS	46	O	Network address	40175	
MIN_PULSE_DECR	48	O	Min unloading pulse interval	40177	
MAX_PULSE_DECR	49	I/O	Max unloading pulse interval	40178	
MIN_PULSE_INCR	50	I/O	Min loading pulse interval	40179	
MAX_PULSE_INCR	51	I/O	Max loading pulse interval	40180	
				40192	0=Local 1=Double 2=External
SETP_SOURCE	63	I/O	Setpoint source		
COMP_STATUS	64	I/O	Comp. # 1 status	40193	Not used anymore
COMP_STATUS2	65	I/O	Comp. # 2 status	40194	Not used anymore
NSTART	68	O	Number of starts comp. #1	40197	
N_STEPS	69	O	Number of tower steps #1	40198	
SUM_DOUBLE_SETP	70	O	Cooling double setpoint	40199	
WIN_DOUBLE_SETP	71	O	Heating double setpoint	40200	
DIFF_NEUTRAL	72	I/O	Neutral band	40201	

SUM_DEADB_THR	73	I/O	Cooling force off setpoint	40202
WIN_DEADB_THR	74	I/O	Heating force off setpoint	40203
NSTART_2	91	O	Number of starts comp. #2	40220
N_STEPS_2	94	O	Number of tower steps #2	40223

## 16 Appendix 4: pLAN Network setup

This operation must be performed if a terminal is added to the pLAN or if settings are changed.

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



2. A form will appear showing the net address of the terminal and the net address of the card on which it is operating.

```
Terminal Adr: 16
I/O Board Adr: n
```

3. Using the “Up” and “Down” keys, it is possible to choose a different card (1, 2, 3, 4 for the compressor cards and 5, 7, 9, 11 for the electronic valve drivers).
4. Select 1 for “I/O Board Adr” (card with address 1) and press “Enter”. In about two seconds the following screen will appear:
5. Digit, then, again Enter . And the following form appear:

```
Terminal Config

Press ENTER
To continue
```

6. To add a second terminal (remote terminal) replace the line reading Trm2 None -- with Tmr2 17 sh . To enable the new configuration, put the pointer on “No” (using the “Enter” key) and change it to “Yes” with the “Up” and “Down” keys, then press “Enter”.

```
P:01 Adr Priv/Shared
Trm1 16 Sh
Trm2 None --
Trm3 None -- Ok? No
```

The operations 1 through 6 must be repeated for all the compressor boards (“I/O Board” from 1 to 4)

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

**Note:**

*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 retains the data of the preceding configuration. In that case it is enough to systematically disconnect the batteries from all the driver and then reconnect them.*



**CE** Daikin units comply with the European regulations that guarantee the safety of the product.



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