ESIE07-05

Service Manual

EWWQ-AJYNN

Water-cooled screw chillers

IMPORTANT NOTICE

This manual for the EWWQ-AJYNN chillers is a draft. Not all information on this chiller is already present in this service manual.
However, together with the installation & operation manual and the databook, this manual should provide you with enough information to do maintenance and troubleshooting on this unit.

1.2 About This Manual

Purpose of the manual

The manual allows the installer and the operator to perform correctly all the operations required for the installation and maintenance of the chiller without provoking any damages to the unit or to the qualified personnel.Therefore the manual is essential to help qualified personnel that have to arrange the equipment to provide the correct installation in accordance with local codes and regulation.

Inspection

When the equipment is received, all items on the bill of lading should be carefully checked to insure a complete shipment. All units should be carefully checked and all shipping damage should be reported to the carrier. The unit serial plate should be checked before unloading the unit to be sure that it agrees with the power supply available. Physical damage to unit after acceptance is not Daikin's responsibility.

Responsibilities

Daikin declines all present and future responsibilities referred to injuries to people and damage to things and unit, coming from operators negligence, the unrespected installation/maintenance data carrier in this manual, the lacking of the current regulations respect referred to the safety of the equipment and the qualified personnel.

Servicing and maintenance

Servicing and maintenance of these unit must carried out by experienced personnel with specific training refrigeration. Regular checking of safety devices should be carried out but routine maintenance should be out in line with the recommendations list in the main section. The simple design of the refrigeration circuit minimizes potential problems during normal unit operation.

1.3 Characteristics

General description

Daikin introduces their newest water cooled screw chillers equipped with new single screw compressors.

Daikin water cooled EWWQ-AJYNN chillers equipped with 1, 2, 3 and 4 screw compressors are a new range of the unit using the StarGateTM Frame 4 single screw compressors. They are manufactured by Daikin to satisfy the requirements of the consultants and the end user. Daikin EWWQ_AJYNN units are designed to minimise energy costs while maximising the refrigeration capacities. Once again Daikin has developed a line of chillers unsurpassed in performance and quality that will meet the most stringent requirements of comfort cooling, ice storage and process applications.

1.4 Safety Measures

The unit must be suitably clamped to the ground.

It is necessary to follow these cautions and warnings:

- The unit must be lifted only by using the proper tools able to support the weight of the unit.
- No admittance to unauthorized or unqualified personnel should be allowed.
- No operation on electrical components is allowed without having switched off electricity supply.
- No operation on electrical components is allowed without using insulated platforms; no water or moisture should be present.
- All the operation on refrigerant circuit and pressurised components are to be performed by qualified personnel only.
- Compressor substitution or oil addition must be performed by qualified personnel only.
- Avoid contamination of unrelated bodies into the water piping during the unit connection to the water system.
- It is necessary that a mechanical filter is fitted to the piping connected to the exchangers entry.

1.5 Installation

Before any operation please check the instruction for use.

Warning

Installation and maintenance are to be performed only by qualified personnel who are familiar with local codes and regulations, and who are experienced with this type of equipment. Must be avoided the installation of the unit in places that could be considered dangerous for maintenance operations.

Receiving and handling

Inspect the unit immediately after receipt for possible damage. The unit is shipped ex-factory and all claims for handling and shipping damage are the responsibility of the consignee. Leave the shipping skid in place until the unit is in final position. This will aid in handling the equipment. Use extreme care when rigging the equipment to prevent damage to the control centre, or refrigerant piping. See Dimensional Data for the centre of gravity of the unit.

Location

A levelled and sufficiently strong floor is required. If necessary, additional structural members should be provided to transfer the weight of the unit to the nearest beams.

Rubber-in-shear isolators can be furnished and field placed under each corner of the package. A rubber anti–skid pad should be used under isolators if hold-down bolts are not used.

Vibration isolator in all water piping connected to the chiller are recommended to avoid straining the piping and transmitting vibration and noise.

Compressor condensation

Condensation occurs on the compressor surface when the temperature of the compressor surface is lower than the ambient dew point temperature. Drain pans with drain connections are provided underneath each compressor to collect the condensate. The compressor motor housing extends past the drain pans. Install a floor drain close to the unit to collect condensate from motor housing and condensate pans.

Water treatment

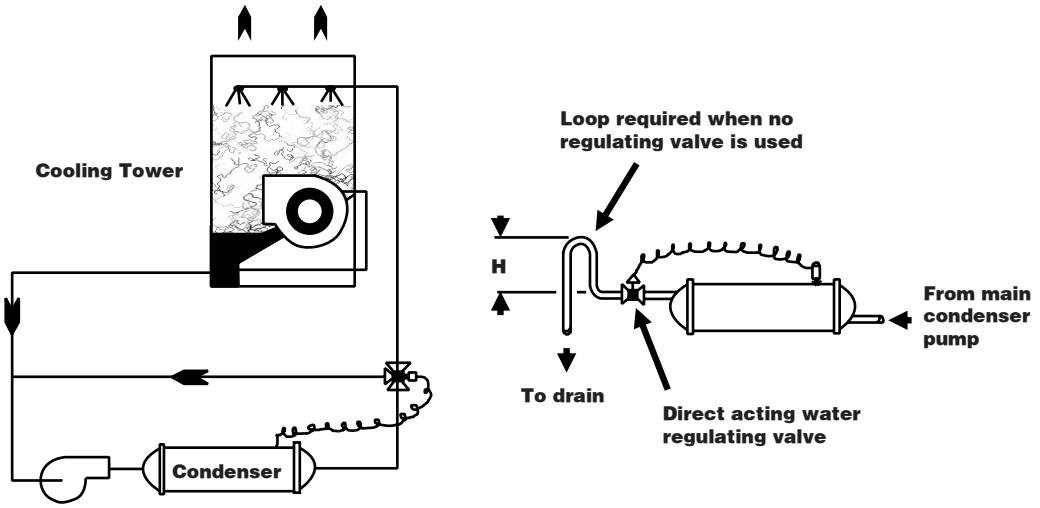
If unit is operating with a cooling tower, clean and flush cooling tower. Make sure tower "blowdown" or bleedoff is operating. Atmospheric air contains many contaminants which increases the need for water treatment. The use of untreated water may result in corrosion, erosion, sliming, scaling, or algae formation. A water treatment service is recommended. Daikin is not responsible for damage or faulty operation from untreated or improperly treated water.

Head pressure control, tower system

The minimum entering water temperature to the condenser must not be lower than 15 °C at full tower water flow. If lower temperature water is used, the flow must be reduced proportionally. Use a three-way bypass valve around the tower to modulate the condenser water flow. Figure 1 shows a three-way pressure actuator water regulating valve used for cooling applications. This regulating valve will assure an adequate condensing pressure if the inlet condenser water temperature falls below 15 °C.

Head pressure control, well water system

When using city or well water for condensing refrigerant, install a normally closed direct acting water regulating valve in the outlet piping of the condenser. This regulating valve will assure an adequate condensing pressure if the inlet condenser water temperature falls below 15 °C. The condenser service valve provides a pressure tap for the regulating valve. The valve can modulate in response to head pressure. On shutdown, the valve closes, preventing water from siphoning out of the condenser. Siphoning causes condenser waterside drying and accelerates fouling. If a valve is not used, Figure 2 illustrates the recommendation of a loop at the outlet. Size the loop height (H) to offset the negative pressure caused by the siphoning effect. A vacuum breaker may be required.



Temperature and waterflow limitations

EWWQ-AJYNN units are designed to operate in conditions from -8 °C to +15 °C leaving water temperature on the evaporator side and +15 °C to +55 °C entering water temperature on the condenser side. Glycol in the evaporator is required on all applications below +4 °C leaving evaporator fluid temperature. The maximum allowable water temperature to the cooler in a non-operating cycle is 40 °C. The non-operating leaving condenser water temperature maximum is 46 °C. Flow rates below the minimum values shown in the evaporator and condenser pressure drop curves may cause freeze-up problems, scaling and poor control. Flow rates above the maximum values shown in the evaporator and condenser pressure drop curves will result in unacceptable pressure drops, excessive nozzle and tube erosion and possibly cause tube failure.

Evaporator freeze protection

When freeze protection is a concern, do the following:

- If the unit will not be operated during the winter, drain and flush the evaporator and chilled water piping with glycol. Drain and vent connections are provided on the evaporator.
- When using a cooling tower, add glycol solution to the chilled water system. Freeze point should be approximately 6°C below minimum design ambient temperature.
- Insulate field water piping, especially on the chilled water side.

Note: Freeze damage is not considered a warranty failure and is not the responsibility of Daikin.

Water piping

Due to the variety of piping practices, it is advisable to follow the recommendations of local authorities. They can supply the installer with the proper building and safety codes required for a safe and proper installation.

Basically, the piping should be designed with a minimum number of bends and changes in elevation to keep system cost down and performance up. It should contain:

1 Vibration eliminators to reduce vibration and noise transmission to the building.

2 Shutoff valves to isolate the unit from the piping system during unit servicing.

3 Manual or automatic air vent valves at the high points of the system. Drains at the low parts in the system. The evaporator should not be the highest point in the piping system.

4 Some means of maintaining adequate system water pressure (e.g., expansion tank or regulating valve).

5 Water temperature and pressure indicators located at the unit to aid in unit servicing.

6 A strainer or some means of removing foreign matter from the water before it enters the pump. The strainer should be placed far enough upstream to prevent cavitation at the pump inlet (consult pump manufacturer for recommendations). The use of a strainer will prolong pump life and help maintain high system performance levels.

7 A strainer should also be placed in the supply water line just prior to the inlet of the evaporator. This will aid in preventing foreign material from entering and decreasing the performance of the evaporator.

8 The shell-and-tube evaporator has a thermostat and heating cable to prevent freeze-up down to -28°C. Any water piping to the unit must also be protected to prevent freezing.

9 If the unit is used as a replacement chiller on a previously existing piping system, the system should be thoroughly flushed prior to unit installation and then regular chilled water analysis and chemical water treatment is recommended immediately at equipment start-up.

10 In the event glycol is added to the water system, as an afterthought for freeze protection, recognize that the refrigerant suction pressure will be lower, cooling performance less, and water side pressure drop greater. System safety devices such as freeze protection and low pressure protection must be reset.

Prior to insulating the piping and filling the system, a preliminary leak check should be made.

Chilled water thermostat

The EWWQ-AJYNN water-cooled chiller is equipped with the MicroTech II leaving water controller. Be careful when working around the unit to avoid damaging lead wires and sensor cables. Check lead wires before running the unit. Avoid rubbing the lead wires on the frame or other components. Verify the lead wires are firmly anchored. If the sensor is removed from the well for servicing, do not wipe off the heat conducting compound supplied in the well.

Refrigerant charge

All units are designed for use with HFC-410A and are shipped with a full operating charge. The operating charge for each unit is shown in the Physical Data Table.

Flow switch

A water flow switch must be mounted in either the entering or leaving water line to insure that there will be adequate water flow to the evaporator before the unit can start. This will safeguard against slugging the compressors on start-up. It also serves to shut down the unit in the event that water flow is interrupted to guard against evaporator freeze-up.

Glycol solutions

Use industrial grade glycols only. Do not use an automotive grade antifreeze. Automotive antifreeze contains inhibitors that will cause plating on the copper tubes within the chiller evaporator. The type and handling of glycol used must be consistent with local codes.

1.6 Standard Accessories (furnished on basic unit)

Star Delta Compressors starter	For low inrush current and reduced starting torque.
Phase monitor	The phase monitor controls the voltage values on the supply line stopping the unit when the calibration threshold is reached (± 10%). This safety device is automatically reset.
Evaporator connection water side Victaulic	Hydraulic joint with gasket for an easy and quick water connection.
Condenser connection water side Victaulic	Hydraulic joint with gasket for an easy and quick water connection.
Hour run meter	Digital compressors hour run meter.
General fault contactor	Contactor for the alarm warning.
Brine double set point version	Dual leaving glycol mixture temperature setpoints. The lower setpoint can go down to -8 °C.
Compressor thermal overload relays	Safety devices against compressor motor overloading in addition to the normal protection envisaged by the electrical windings.
Flow switch	Supplied separately to be wired and installed on the evaporator water piping (by the customer).
Rubber type antivibration mounts	Supplied separately, these are positioned under the base of the unit for “floor” installation.

1.7 Options (on request)

100% total heat recovery (OPTR)	Produced with tube bundle placed in a single shell with the water condensers. Heat exchangers heads are provided with 2 connections for entering/leaving heat recovery water and 2 separate connections for condensing water.
Partial heat recovery (OPPR)	Produced with plate to plate heat exchangers installed on discharge side of compressor hot gas. These allow hot water to be produced up to a maximum temperature of + 50 °C.
Ampmeter and voltmeter (OP57)	Digital meters of unit drawn amperes and voltage values, installed on the electrical control panel.
Condenser power factor correction (OPPF)	Installed on the electrical control panel to ensure it conforms to the plant rules. (DAIKIN advises maximum 0.9).
Suction line shut off valve (OP12)	Suction shut-off valve installed on the suction port of the compressor to facilitate maintenance operation.
Cu-Ni 90-10 condenser (OPNI)	To work with sea water the heat exchangers are fitted with Cu-Ni tubes and special protection inside the end covers.
Witness tests	The units are normally tested at the test bench prior to the shipment. On request, a second test can be carried out, at customer's presence, in accordance with the procedures indicated on the test form. (Not available for units with Glycol mixtures).
Soft start (OPSS)	Electronic starting device to reduce inrush current. An overload protection is included.

Part 2
Functional Description

Introduction

This part gives more detailed information on the functions and controls of the unit. This information is used as background information for troubleshooting. An extensive overview of the functioning of the controller is also given in this part. Knowledge of the controller is essential to gather information prior to servicing and troubleshooting.

What is in this part?

This part contains the following chapters:

Chapter	See page
1–The Digital Controller	2–3
2–Functional Control	2–47

1 The Digital Controller

1.1 What Is in This Chapter?

Introduction

This chapter gives more detailed information about the controller and the software. Understanding these functions is vital when diagnosing a malfunction, which is related to system architecture or software.

Overview

This chapter contains the following topics:

Topic	See page
1.2–General Description	2–4
1.3–Main Control Software Features	2–5
1.4–Component Description Digital controller	2–6
1.5–Controller Menu’s	2–22

1.2 General Description

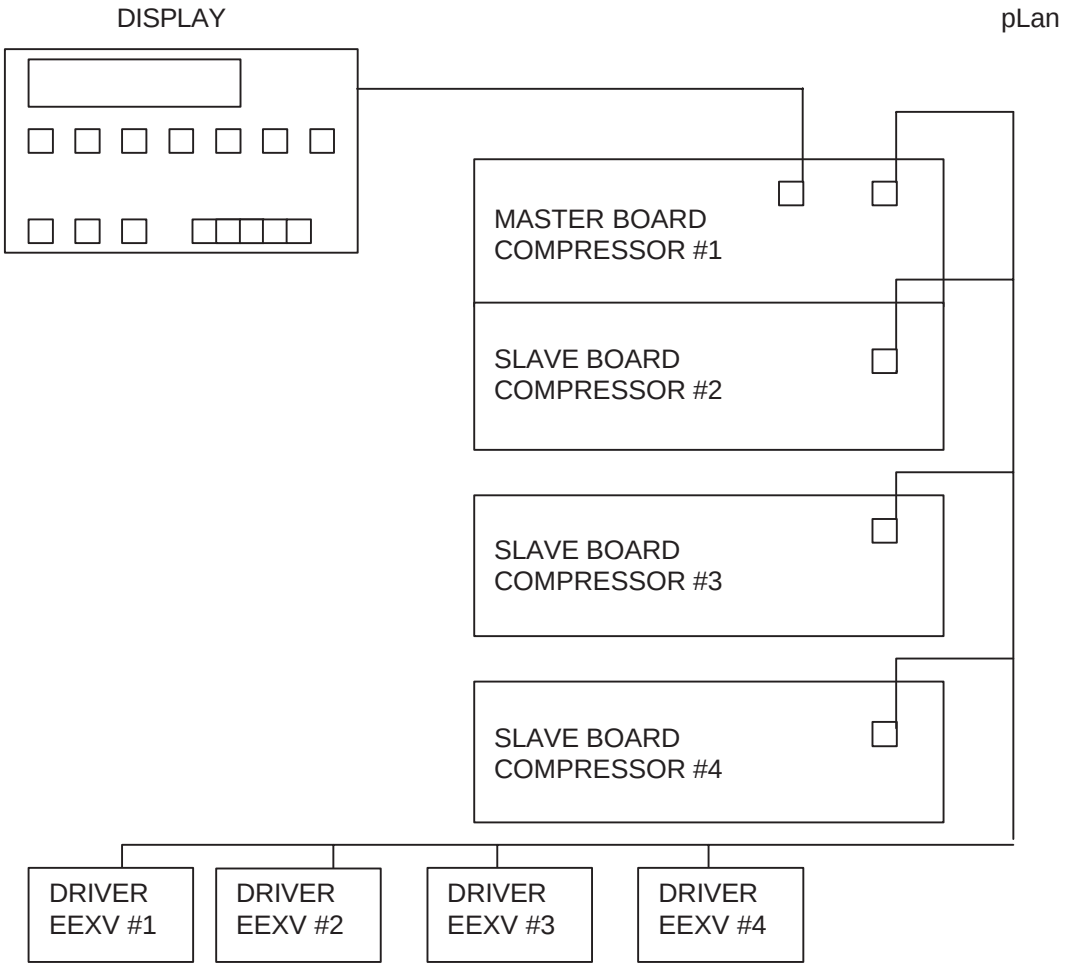
Introduction

The Microtech II C Plus 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 panel's built in 4 line by 20 character keypad/display or by using an IBM compatible computer running MicroPlant monitor software release 2.0 and later. In addition to providing all normal operating controls, the MicroTech II CV Plus controller monitors all safety devices on the unit and will take corrective action if the chiller is operating of it's normal design conditions. If a fault condition develops, the controller will shut the system down and activate an alarm output. Important operating conditions at the time an alarm condition occurs are retained in the controller's memory to aid in troubleshooting and fault analysis.

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

Lan layout

The illustration below shows the Lan layout.



1.3 Main Control Software Features

- Control of evaporator outlet or condenser outlet or both temperature.
- Control of leaving water within a ± 0.1 °C (with a steady-state load).
- Management of sudden load reduction up to 50% with max 3°C controlled temperature obscillation
- Readout of all unit operating main parameters (temperature, pressures, etc.)
- Automatic control of primary evaporator and condenser pumps.
- Condensation control with step logic, single or double fan speed controllers and mixed step+speed control (speedtroll)
- Control up to 4 steps of cooling tower plus bypass valve with proportional signal 0-10 Vdc
- Setting of a **double setpoint** with local or remote switch. This function allows to modify the local setpoint between two values previously settled.
- **Setpoint override** using an external signal (4-20 mA), outside ambient temperature or evaporator return temperature.
- Adjustable **Max Pull-Down rate** reduces under-shoot during loop pull-down.
- **Hot Chilled Water Start** feature allows the unit startup without any problem also with high temperature evaporator water.
- **SoftLoad** feature reduces electrical consumption and peak demand charges during loop pulldown.
- **Unit Limiting** feature allows to limit electrical consumption based either on current absorption (current limit (SPN)) or on demand capacity (demand limit).
- Panel mounted 15 key keypad for a rapid interface. Operator can log chiller operating conditions on the backlight display 4 line by 20 character.
- Four levels of security protection against unauthorized changing.
- Diagnostic System of compressors constituted by the memorization of the last ten alarms, showing the date, the time and operating conditions at the time the alarm occurred.
- Weekly and yearly start-stop time schedule
- Easy integration into building automation systems via separate 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 compatible IBM-PC where is installed MICROPLANT 2.0 software.
- BAS communication capability via Modbus, LonWork, Johnson Metasys
- Remote communications capabilities via modem (up to 8 chillers with Gateway Modem).
- Remote communications capabilities via GSM Modem.

1.4 Component Description Digital controller

Overview

This chapter contains the following topics:

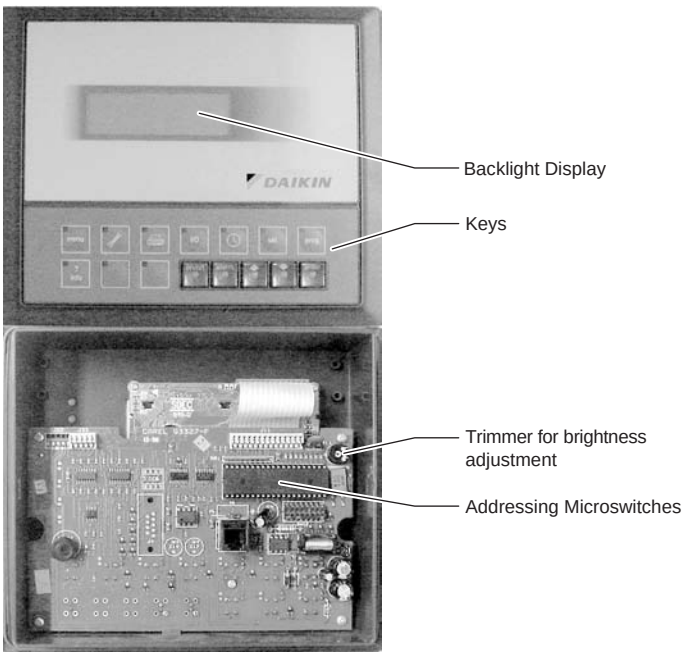
Topic	See page
1.4.1–Control Panel	2–7
1.4.2–Main Board	2–8
1.4.3–EEXV Valve Driver	2–10
1.4.4–Meaning of the Driver EEXV Status LEDs	2–12
1.4.5–Addressing of pLAN	2–13
1.4.6–Controller Input/Output	2–14
1.4.7–Display and Keypad	2–19

1.4.1 Control Panel

Introduction

The Control Panel is constituted by the backlight display 4 line by 20 character and by the 15 key keypad. In this chapter we will described this functions.

Frontal and back view



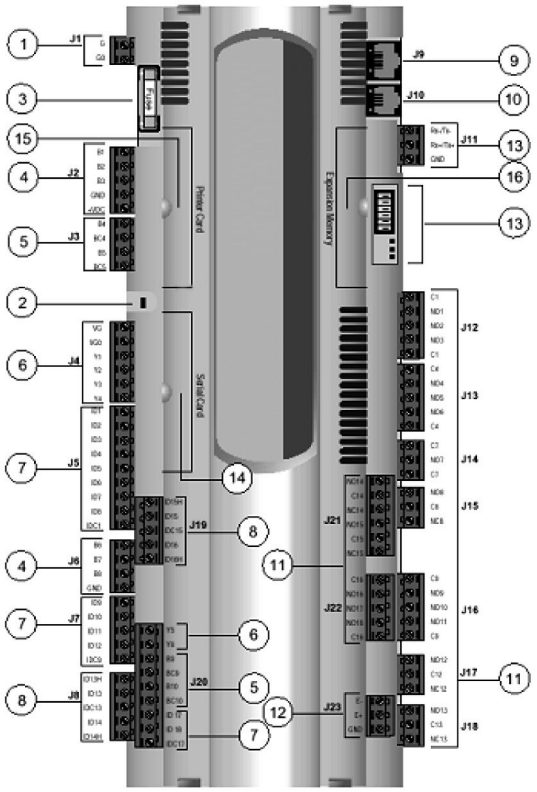
1.4.2 Main Board

Introduction

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

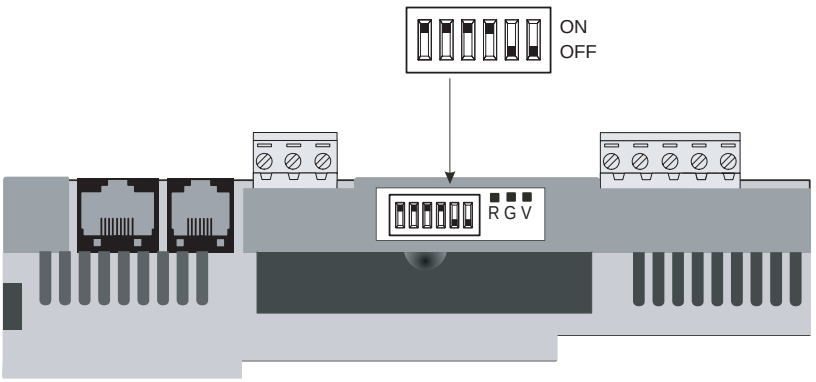
Main Board

The figure below shows the main board:



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	Analog 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

pLAN addressing microswitches

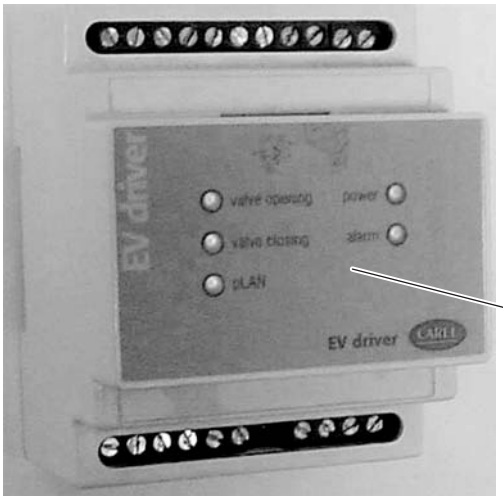


1.4.3 EEXV Valve Driver

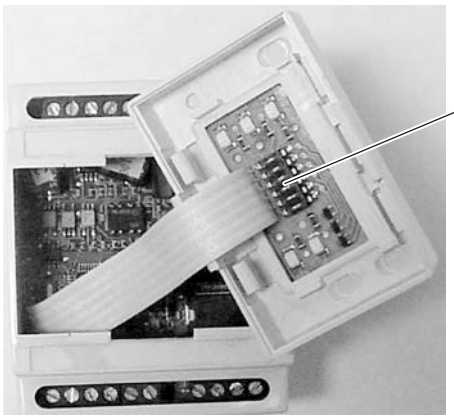
Introduction

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

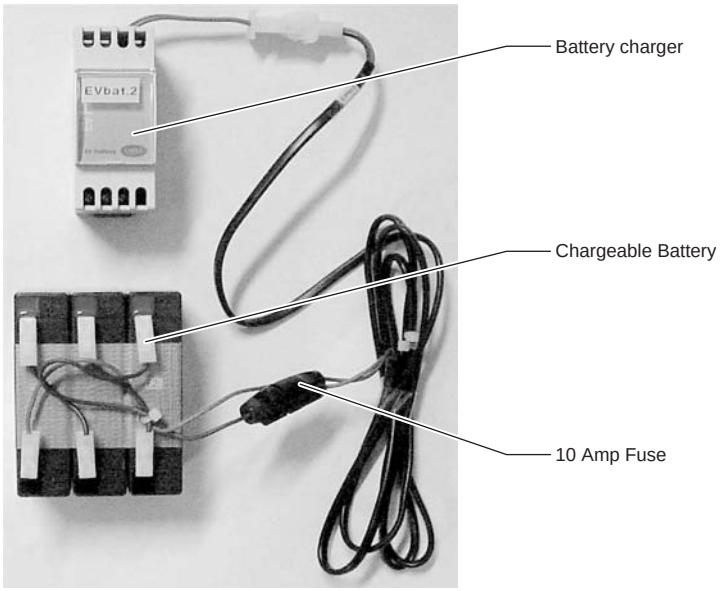
Driver



Inside of driver



Battery assembly



1.4.4 Meaning of the Driver EEXV Status LEDs

Normal conditions

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.

Alarm situations

In presence of critical alarm situations, the combination of the LED's will identify the alarm as shown below. In case more than one alarm is present, the alarm with the highest priority will be visualized. Highest priority is level 7.

Alarms that stop 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

pLAN	**LED pLAN**
Connection OK	On
Driver connection or address error = 0	Off
The Pco Master does not answer	Flashing

1.4.5 Addressing of pLAN

To get the correct functionality of the pLAN net system, it is necessary to address correctly all the installed components. Each component has a series of microswitches that must be set as specified in the table below.

pLAN component	Microswitches					
	1	**2**	**3**	**4**	**5**	**6**
Local DISPLAY	OFF	OFF	OFF	OFF	**ON**	OFF
Remote DISPLAY (if available)	**ON**	OFF	OFF	OFF	**ON**	OFF
COMP. BOARD #1	**ON**	OFF	OFF	OFF	OFF	OFF
COMP. BOARD #2	OFF	**ON**	OFF	OFF	OFF	OFF
COMP. BOARD #3	**ON**	**ON**	OFF	OFF	OFF	OFF
COMP. BOARD #4	OFF	OFF	**ON**	OFF	OFF	OFF
DRIVER EXV #1	**ON**	OFF	**ON**	OFF	OFF	OFF
DRIVER EXV #2	**ON**	**ON**	**ON**	OFF	OFF	OFF
DRIVER EXV #3	**ON**	OFF	OFF	**ON**	OFF	OFF
DRIVER EXV #4	**ON**	**ON**	OFF	**ON**	OFF	OFF

1.4.7 Display and Keypad

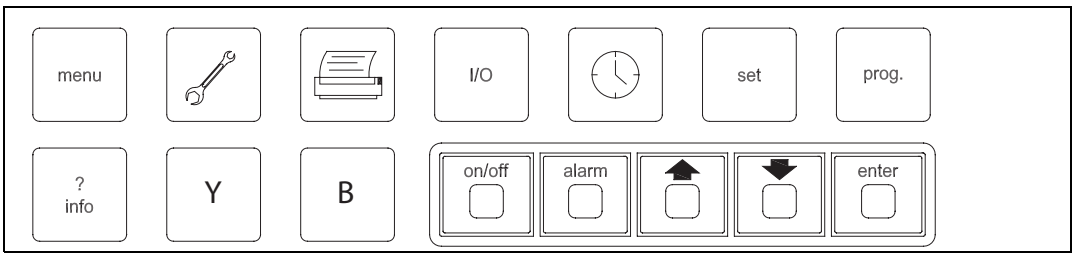
Introduction

The display and the keypad are the main elements of interface between operator and unit. All the operational conditions, the alarms and the setpoints can be monitored with this display and all the values of setpoint can be modified through the keypad.

The keypad MicroTech II is constituted by 15 keys of access to the operational conditions of the unit and to the functions of program. The information requested are shown on the backlight Display 4 lines for 20 characters

Control panel

Keypad keys and their functions

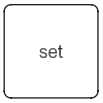
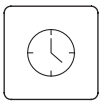
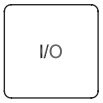
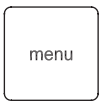
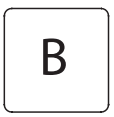
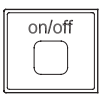


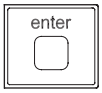
prog.

By the user password it is possible to set the following parameters:

- Setpoint limits
- Setpoints reset values
- Enable double setpoint
- Regulation parameters
- Startup and shutdown values
- Soft load values
- Hot chilled water start values
- Ambient lockout values
- Unit limiting
- Fan silent mode values
- Main pump timing
- Digital and supervisor inputs enabling
- Time scheduling

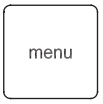
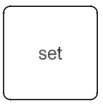
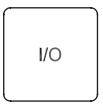
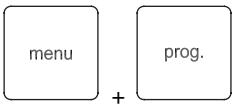
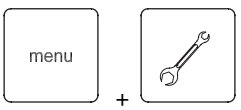
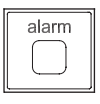
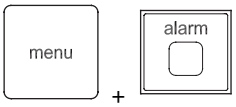
2

	It allows to adjust the setpoints within the limits previously set in prog.
	Date and time setting.
	Input/Output and corresponding circuit functions visualization.
 (=print)	Print (not available).
 (=maint)	By the Password it is possible to access the maintenance functions.
	It allows to visualize the main menu.
	It allows the passage from one board to the other (visualizing parameters of corresponding compressors).
	It allows the changeover between chiller to heat pump (only if enabled).
	It allows the changeover between heat pump to chiller (only if enabled).
	Key On/Off unit.
	It indicates the presence of possible anomalies and their causes.
 (=up)	It allows the passage to the previous display screen.
 (=down)	It allows the passage to the next display screen.

	It enables the set values.

Screen categories

Using the keypad you can access the different menus of the program. In particular there are 9 screen categories, shortly introduced in the following table with the keys to use to access them and with the type of operation they allow.

Category	Description	Keys	Password
Main	Unit operating parameters (view only)		NO
User	User parameter setting		0003
Setting	Setpoint setting		NO
Input/Output	Operating compressors parameters (view only)		NO
Manufacturer	Manufacturer parameters setup		
Maintenance	Maintenance parameter access		
Maint auxiliary	Auxiliary maintenance parameter setting		
Alarm	Alarms view		NO
Alarm history	Previous 10 recorded alarms		NO

Note: The password remains valid for 10 minutes since last access.

1.5 Controller Menu's

Overview

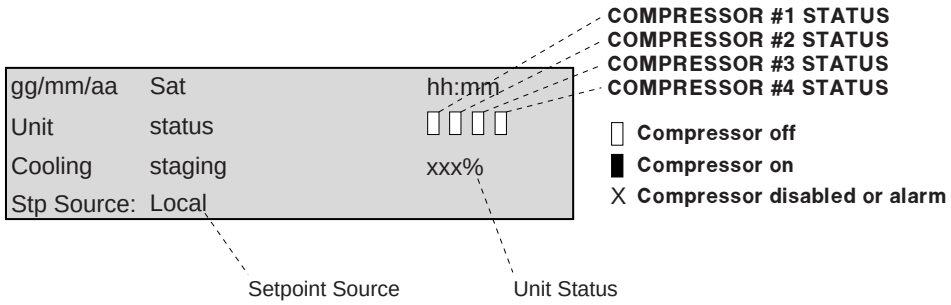
This chapter contains the following topics:

Topic	See page
1.5.1–Main Menu	2–23
1.5.2–User Menu	2–26
1.5.3–Setting Menu	2–30
1.5.4–Input/Output Menu (I/O Menu)	2–31
1.5.5–Manufacturer Menu	2–33
1.5.6–Maintenance Menu	2–38
1.5.7–Service Menu	2–41
1.5.8–Alarm Menu	2–42
1.5.9–Buffer Alarm Menu	2–43
1.5.10–Alarm List	2–44

1.5.1 Main Menu

Introduction

This menu shows only the output parameters throughout the screens listed below (the passage from one to another is allowed by the arrow key).
Current date, time and weekday, setpoint origin and unit status in percent with the possibilities listed below.



Possible status :

- **Off Alarm** : unit Off for alarm
- **Off Rem Comm** : unit Off by remote communication (supervisor or BMS)
- **Off Time Schedule** : unit Off by time schedule
- **Off Loc/Remote Sw** : unit Off through switch
- **Off Keypad** : unit Off through keypad (key on/off)
- **Off Amb. LockOut** : unit Off by low ambient temperature (or tower return temperature)
- **Waiting flow** : unit On waiting for evaporator water flow
- **Waiting load** : unit On without compressors in motion because not required by load.
- **No comps available** : unit On with no compressors available for automatic management (compressor switch OFF or alarm or in manual mode)

Setpoint source

- Local
- Double
- Ret. Reset

Evaporator outlet/inlet water temperature

This screen shows the Evaporator outlet/inlet water temperature (or common temperature for two evaporators units)

Water Temperatures		
ENT Evap	=	xxx °C
LVG Evap	=	xxx °C

First and second evaporator outlet temperature (two evaporators units)

2

Condenser outlet water temperature

This screen shows the Condenser outlet water temperature (in heat pump or pursuit mode)

Water Temperatures		
LVG Rec	=	xxx ˚C

Percent compressor status

This screen shows the Percent compressor status

Comp. #1		
Status:	Auto	xxx%

Possible status :

- **Off Alarm** : Compressor OFF for alarm
- **Off Switch** : Compressor OFF by local switch
- **Off Ready** : Compressor OFF ready to start
- **Oil Heating** : Compressor waiting for oil heating
- **Manual Off** : Compressor disabled by keypad
- **Recycle Time** : Compressor waiting for timing
- **Starting** : Compressor starting
- **Pre Purge** : Compressor unloading at starting
- **Auto xx%** : Automatic control of compressor with percent load
- **Manual xx%** : Manual control of compressor with percent load
- **Downl.** : Compressor download before stop
- **Pumping down** : Compressor pump down

Suction and discharge pressure and saturated temperature

This screen shows the Suction and discharge pressure and saturated temperature

Evap	Press	xx.x barg
Evap	Temp	xx.x ˚C
Cond	Press	xx.x barg
Cond	Temp	xx.x ˚C

Suction temperature, suction and discharge superheat, expansion valve position

This screen shows the Suction temperature, suction and discharge superheat, expansion valve position

Suction	Temp	xx.x ˚C
Suct	SupHeat	xx.x ˚C
DelivSupHeat		xx.x ˚C
Valve	Position	xxxx

Compressor status

This screen shows the Compressor status

Staging	UP	■ or □
Staging	Down	■ or □
Staging	Fixed	■ or □
Compressor	Off	■ or □

- off
- standby
- load
- download

1.5.2 User Menu

In this menu you can set the parameters by entering the password and acceding the following masks:

Item description	Default	U.m.
Cooling Temperature SetPoint Limits ChLW Temperature setpoint limits Low xx.x˚C High xx.x˚C	4.0-10.0	°C
Heating Temperature SetPoint Limits (only in heat pump or pursuit mode)	40.0-50.0	°C
Setpoint reset Return/4-20mA/OAT Lvg Water Temp. setpoint reset NONE	NONE	
Cooling setpoint 4-20mA Override (if enabled) Limits for evaporator leaving water ChLWT Setpoint Override Limits Minimum xxx.x˚C Maximum xxx.x˚C 4-20mA enabled	4.0-10.0	°C
Cooling setpoint 4-20mA Override Limits (if enabled) for condenser outlet water (only in heat pump or pursuit mode)	40.0-50.0	°C
Return Temperature evaporator leaving water Setpoint Override Set (if enabled) Evaporator DT for no override setpoint / Max Setpoint diff. ChLWT Return Reset Start Dt xx.x˚C Max reset xx.x˚C Return enabled	3.0 3.0	°C
Double setpoint enabling Enable double setpoint N/Y	N	

Item description	Default	U.m.
Regulating Band Regul. band xx.x˚C Neutral band xx.x˚C Max Pull Down Rate xx.x˚C/min	3.0	°C
Dead Band	0.2	°C
Max Pulldown Rate	1.2	°C/min
StartUp DT Startup Dt xx.x˚C Shutdn Dt xx.x˚C	2.6	°C
ShutDown DT	1.7	°C
SoftLoad enable Enable Softload N Max Unit Load Max Time Enable Softload Y Maxstage xxx % MaxTime xxx min	N 50 20	 % min
Limits for high chilled water start Evaporator leaving temperature Max Unit Load High ChLWT start LWT xx.x˚C Max Comp. Stage xxx %	 25 70	 °C %

2

Item description	Default	U.m.
Outside ambient temperature lockout Ambient temperature setpoint Ambient temperature differential En. Ambient Lockout N/Y	N 5.0 1.0	 °C °C
Unit limiting Unit Limiting NONE/Superv. Demand/Currnent Limit Demand Limit	NONE	
Delay time between main pump and compressor start Time between main pump/fan and comp. start xxx s		
Delay on switching the main pump off Delay on switching the main pump off xxx s		
Digital input Remote on/ off Digital input remote on/off Y/N Digital input remote Summer/Winter		
Supervisory Remote On/ Off Supervisory remote on/off Y/N Supervisory remote Summer/Winter		
Autorestart after power failure enabling Autorestart after power failure Y/N		

Item description	Default	U.m.
Switch off unit on external alarm Switch Off unit on External Alarm Y/N		
Time scheduling Enable Time Scheduling Y/N Working time from monday to friday Working time for saturday Working time for sunday If enabled Start Stop Mon-Fri xx:xx xx:xx Sat xx:xx xx:xx Sun xx:xx xx:xx 18 days for forced off If enabled Holidays (1 or 2) xx/xx xx/xx xx/xx xx/xx xx/xx xx/xx xx/xx xx/xx xx/xx		
Insert another password Change user password xxxx		

1.5.3 Setting Menu

Introduction

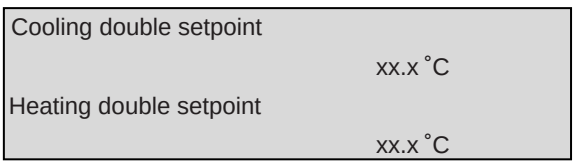
In this menu you can set and display the setpoint values.

Cooling Setpoint

This screen shows the Cooling Setpoint (°C)

Active setpoint

These screens show the Active setpoint (if the "DOUBLE SETPOINT" function is enabled or "RESET SETPOINT" or "AMBIENT COMPENSATION")



If double setpoint enabled

1.5.4 Input/Output Menu (I/O Menu)

Introduction

This menu shows the parameters listed below.

Software type, release

This screen shows the Software type, release

	software version		
Code:	xxxx	xxxx	xxxx
v.	1.xxx		xx/xx/xx

Digital Input and Output status (C, O)

This screen shows the Digital Input and Output status (C, O)

Digital inputs	
xxxxxxxxxxxxxxxxxxxxxx	(C or 0)
Digital outputs	
xxxxxxxxxxxxxxxxxxxxxx	(C or 0)

Analog Output value (Vdc)

This screen shows the Analog Output value (Vdc)

Analog outputs:	
Y1:	xx.x V
Y2:	xx.x V
Y3:	xx.x V

Inlet and outlet water temperature, ambient temp

This screen shows the Inlet and outlet water temp., ambient temperature

Analog inputs:		
B1:	in water	xx.x ˚C
B2:	out water	xx.x ˚C
B5:	cond out	xx.x ˚C

Compressor discharge temperature and load

This screen shows the Compressor discharge temperature and load

Analog inputs:		
B4:	Del temp	xx.x ˚C
B3:		xx.x mA
B6:	slide v.	xx.x %

Condensing and oil pressure

This screen shows the Condensing and oil pressure

Analog inputs:		
B7:	cond pr.	xx.x bar
B8:	oil pr.	xx.x bar

Modem Status, Controller Bios, Boot version and date, SoftLoad Status

This screen shows:

- Modem Status
- Controller Bios and Boot version and date
- SoftLoad Status

Bios Version	xxx.x
Bios Date	xx/xx/xx
Boot Version	xxx.x
Boot Date	xx/xx/xx

EXV Firmware version

This screen shows the EXV Firmware version

	Driver firmware version
H.W	xxxx
S.W	xxxx

1.5.5 Manufacturer Menu

Introduction

In this menu you can set all manufacturer data. Password is required before the operation. The parameters can be modified only by trained persons.

Warning: Improper Setpoint or value, can cause erratic chiller operation and damage to the chiller. Please use caution whenever changing set points or value.

Overview

Unit Configuration	■ 00 = Air cooled Chiller ■ 01 = Water/Water Heat Pump ■ 02 = Water/Water Pursuit Chiller ■ 03 = Water cooled Chiller Unit config. 03 WATER COOLED CHILLER
Probe enable (Master Board)	B1, B2, B4, B6, B7, B8 Probes enable U: X B1: S B2: S B3: - B4: S B5: S B6: N B7: S B8: S
Probe enable (Slave Board)	B4, B6, B7, B8
Discharge probe type (B4)	PT1000/NTC Discharge Temp. Probe Type PT1000
Fase monitor type	UNIT Phase Monitor Type UNIT
■ Pid parameter ■ Integrative time ■ Derivative Time	 200sec 060sec Temp. Regulation Interval Time 200 s Derivative Time 060 s

2

Compressor configuration	■ N. OF COMPRESSOR: 1/2/3/4 ■ N. OF EVAPORATORS (if compressor number >2) Compressors config. N. of compressors 1
■ Max number of pulses to load compressor ■ Max number of pulses to unload compressor	15 15 Number of pulses to load comp. 015 Number of pulses to unload comp. 015
Min. Time between same compressor start	600 s Min T between same comp. starts 600 s Min T between diff. comp. starts 120 s
Min. Time between different compressor start	120 s
Min. Time compressor On	120 s Min Time compressor ON 120 s Min Time compressor OFF 180 s
Min. Time compressor Off	180 s
■ Interstage Timer ■ Double load/unload pulse for compressor load under	210 sec 35% Interstage time 210 s Double pulse under 035 %
Compressor unloading pulse time	■ PULSE TIME = 0.3 s ■ MIN. PULSE PERIOD = 1 s ■ MAX. PULSE PERIOD = 10 s Compressor Unloading Pulse time 00.3 s Min pulse period 01 s Max pulse period 010 s

Compressor loading pulse time	■ PULSE TIME = 0.3 s ■ MIN. PULSE PERIOD = 20 s ■ MAX. PULSE PERIOD = 90 s Compressor Loading Pulse time 00.3 s Min pulse period 05 s Max pulse period 90 s
Pumpdown configuration	■ ENABLING: YES ■ MAX. TIME= 60 s ■ MIN.PRESSURE= 0.5 bar Pump down config. Enable S Max time 030 s Min press. 1.2barg
High pressure stage hold	17.5 bar Cond. P. hold 17.5bar Cond. P. down 18.5bar Evap. P. hold -00.5 bar Evap. P. down -00.8 bar
High pressure stage down	18.5 bar
Low pressure stage hold	1.7 bar
Low pressure stage down	1.2 bar
■ Antifreeze prevent ■ Setpoint ■ Diff.	 3.5°C 1.0°C Freeze prevent Setpoint 03.0 °C Diff. 01.0°C
Condensation enable mode	NONE Condensation Enable NONE Type - Fans Steps -
Enable oil temperature control	Y Enable Oil Heating control S

Enable evaporator flow alarm	YES (MASTER); NO (SLAVES)
Enable condenser flow alarm	YES (MASTER); NO (SLAVES) Solo WHS
Evaporator flow alarm delay (if enabled)	■ STARTUP DELAY = 20 s ■ OPERATING DELAY = 5 s
High discharge temperature setpoint	■ SETPOINT = 120 °C ■ DIFFERENTIAL = 5 °C
High pressure alarm setpoint	■ SETPOINT = 20.5 bar ■ DIFFERENTIAL = 05.0 bar Transducers high pressure alarm Setpoint 20.5 bar Diff. 05.0 bar
Low pressure alarm setpoint	■ SETPOINT = 01.0 bar ■ DIFFERENTIAL = 00.5 bar Transducers low pressure alarm Setpoint -01.0 bar Diff. 00.5 bar
Delay low pressure alarm	■ STARTUP DELAY = 120 s ■ OPERATING DELAY = 60 s Low pressure alarm delays Startup delay 120s Run delay 060 s
■ Ratio alarm setpoint ■ Min Load ■ Max Load	 1.4 1.8 Pressure ratio alarm Min Load Setp 1.4 Max Load Setp 1.8
Delay pressure Ratio alarm	■ STARTUP DELAY = 180 s ■ OPERATING DELAY = 90 s Pressure ratio alarm Startup delay 180s Run delay 090 s

Delay low oil pressure alarm	■ STARTUP DELAY = 300 s ■ OPERATING DELAY = 90 s Oil low pressure alarm delays Startup delay 300 s Run delay 090 s
Delay high oil pressure differential	20 sec Oil high pressure diff. delays Setp 2.5 bar Delay 020 s
Max differential oil pressure	2.5 bar
Freeze protection	■ SETPOINT = 02.0 °C ■ DIFFERENTIAL = 01.0 °C
Liquid Injection	■ SETPOINT = 85.0 °C ■ DIFFERENTIAL = 10.0 °C Liquid injection Setpoint 085.0 ˚C Diff. 10.0˚C
Evaporator heater	■ SETPOINT = 3.0 °C ■ DIFFERENTIAL = 1.0 °C
Supervisor configuration	■ PROTOCOL = CAREL ■ COMMUNICATION SPEED = 19200 ■ IDENTIFICATION NUMBER = 001
Default parameter?	NO
■ Modem connection password ■ Password for driver configuration (Exv manufacture)	0152
Password for driver configuration	Reserved area

1.5.6 Maintenance Menu

Introduction

In this menu you can set the maintenance parameters acceding the masks listed below.

To set the maintenance parameters input, insert the maintenance password that gives access to the masks.

2

Working time of evaporator pump/condenser pump

This screen shows the Workingtime of evaporator pump/condenser pump.

Hour counter	U: X
Pump Evap.	XXXXXX
Pump cond.	XXXXXX
*Low Amb. Temp.	

Working time and number of compressor starts

These screens show the Workingtime and number of compressor starts.

Compressor	U: X
Hour counter	XXXXXX
Number of starts.	XXXXX

Last comp. start	
DD/MM/YY	hh/mm
Last comp. stop	
DD/MM/YY	hh/mm

This screens show the PID control status (only master)

These screens show the PID control status (only master).

Cooling PID Errors	
Prop.	xx.x˚C
Int.	xxxx.x˚C x sec
Der.	xxx.x˚C /min

Cool. PID Act.	xxxx
Proportional	xxxx
Integral	xxxx
Derivative	xxxx

Cooling Reg.	
Disable stop	Y/N
Increase stop	Y/N

Global PID request	
Load	Y/N
Unload	Y/N
Standby	Y/N

EXV driver state

This screen shows the EXV driver state.

EXV Driver State	
Batt. Resist.	xxx.x
Batt. Voltage	xx.x

Pressure and temperature sensors correction

These screens show the Pressure and temperature sensors correction.

Input probes				U:	X
offset					
B1:	0.0	B2:	0.0		
B3:	---	B4:	0.0		

Input probes				U:	X
offset					
B5:	0.0	B6:	---		
B7:	0.0	B8:	0.0		

Compressor run hours correction

This screen shows the Compressor run hours correction.

Cond. h. count	U:	X
Treshold	010x1000	
Reset	Y/N	
Adjust	xxxxxx	

Correction of compressor starts

This screen shows the Correction of compressor starts.

	U:	X
Comp. Starts		
Reset	Y/N	
Adjust	xxxxxx	

Correction of evaporator pump/condenser pump and run hours

These screens show the Correction of evaporator pump/condenser pump and run hours.

Evap. pump h. count	
Treshold	010x1000
Reset	Y/N
Adjust	xxxxxx

Cond. pump h. count	
Treshold	010x1000
Reset	Y/N
Adjust	xxxxxx

Compressors minimum load

This screen shows the Compressors minimum load.

2

Time download compressor

This screen shows the Time download compressor.

Minimum evaporator ΔT

This screen shows the Minimum evaporator ΔT.

DT to reload compressor

This screen shows the ΔT to reload compressor.

1.5.7 Service Menu

Introduction

In this menu you can set the service parameters by entering the password and acceding the masks listed below.

Compressor control and compressor load in manual mode

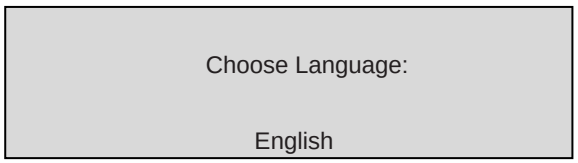
This screen shows the Compressor control (OFF/AUTO/MANUAL) and compressor load in manual mode.

Alarms reset

This screen shows the Alarms reset.

Choose language

This screen shows the language choise.



1.5.8 Alarm Menu

Introduction

When an alarm condition occurs, the display buzzer starts. Pressing the alarm key displays the current fault. Pressing the alarm key twice stops the buzzer while pressing it thrice removes the alarm.

Remark: Sometimes, when an alarm occurs, another spurious alarm of star/delta transition failure also occurs. In this case, solve the spurious alarm first. If the spurious alarm occurs again, check the electrical connections.

If the alarm is not removed even after pressing the alarm key again, it means that faulty conditions still exist.

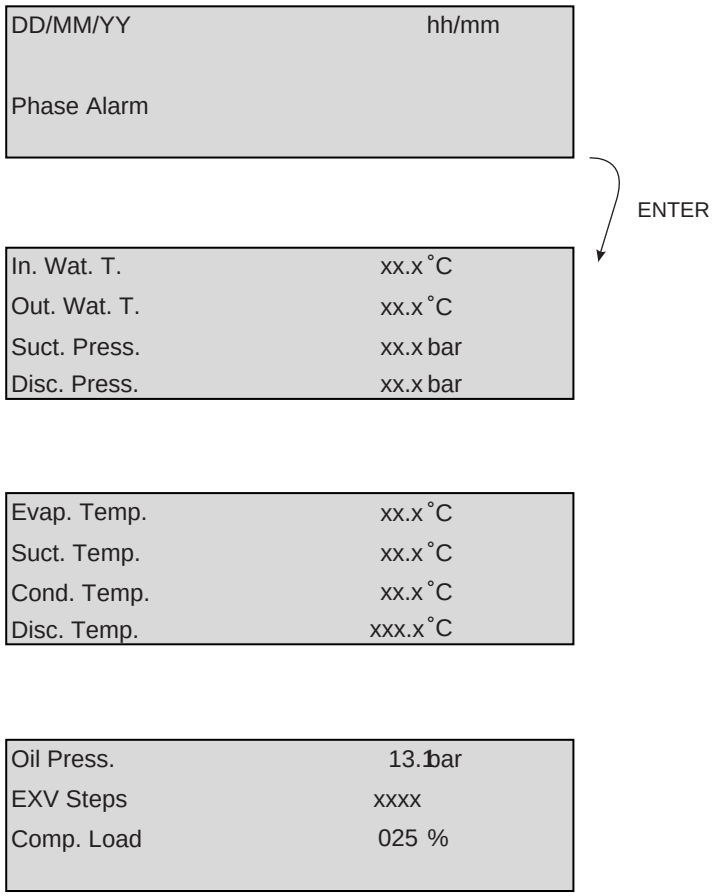
1.5.9 Buffer Alarm Menu

Introduction

Using this menu you can consult the last ten alarms of every chiller circuit.

Each mask displays the date, time and description of the alarm. Pressing the enter key when an alarm description is displayed shows the operating conditions at the time the alarm occurred (temperatures, pressures, expansion valve status and compressor load).

Screens



1.5.10 Alarm List

Introduction

The table below shows the list of the possible alarms with the identifier number, the cause and the reset type (A = auto, M = manual).

2

Alarm table - Chiller

Code	Alarm description	Compressor off	Fan off	Pump off	System off	Reset (auto/man)	Delay	Enabling
AL01	Severe alarm	*	*	*	*	man	no	enabling both on master and slave
AL02	Antifreeze alarm	*	*	*	*	man or auto (default is “manual”)	no	resetting mode can be set by user
AL03	Evaporator pump thermal	*	*	*	*	man	no	
AL04	Condenser pump thermal	*	*	*	*	man	no	
AL05	Evaporator flow control	*	*		*	man	selectable	enabling both on master and slave
AL06	Condenser flow control	*	*		*	man	selectable	
AL10	Low-pressure pressure switch 1	*Circuit 1				man	selectable	
AL11	Low-pressure pressure switch 2	*Circuit 2				man	selectable	
AL12	High-pressure pressure switch 1	*Circuit 1				man	no	
AL13	High-pressure pressure switch 2	*Circuit 2				man	no	
AL14	Oil-differential pressure switch 1	*Circuit 1				man	selectable	
AL15	Oil-differential pressure switch 2	*Circuit 2				man	selectable	
AL16	Compressor 1 thermal	*Comp 1				man	no	
AL17	Compressor 2 thermal	*Comp 2				man	no	
AL20	Fan 1 thermal		*			man	no	
AL21	Fan 2 thermal		*			man	no	
AL22	Fan 3 thermal		*			man	no	
AL23	High press. transducer 1	*Circuit 1	*			man	no	
AL24	High press. transducer 2	*Circuit 2	*			man	no	
AL30	Damaged probe B1	*	*	*	*	auto	60 sec	
AL31	Damaged probe B2	*	*	*	*	auto	60 sec	
AL32	Damaged probe B3					auto	60 sec	
AL33	Damaged probe B4					auto	60 sec	
AL34	Damaged probe B5					auto	60 sec	
AL35	Damaged probe B6					auto	60 sec	
AL36	Damaged probe B7					auto	60 sec	
AL37	Damaged probe B8					auto	60 sec	
AL40	Pump maintenance					man		
AL41	Compressor 1 maintenance					man		
AL42	Compressor 2 maintenance					man	30 sec	
AL50	Offline unit 1					auto	30 sec	
AL51	Offline unit 2					auto		
AL54	Evaporator fan thermal					man		
AL55	Damaged 32k clock card					man		

Alarm table - Driver1

Code	Alarm description	Compressor off	Fan off	Pump off	System off	Reset (auto/man)	Delay	Enabling
AL60	Driver1 - Probe error	*Circuit				man	selectable	
AL61	Driver1 - Step motor error	*Circuit				man		
AL62	Driver1 - Eeprom error	*Circuit				man	selectable	
AL63	Driver1 - Battery error	*Circuit				man	selectable	enabling
AL64	Driver1 - High pressure					man	selectable	
AL65	Driver1 - Low pressure	*Circuit				man	selectable	enabling
AL66	Driver1 - Super-heat					man	selectable	
AL67	Driver1 - Valve not closed during stop					man		
AL68	Driver1 - wait for valve reopening					man		
AL69	Driver1 - wait for battery recharge					man		
AL70	Driver1 - wait for eeprom restart					man		

Alarm table - Driver2

Code	Alarm description	Compressor off	Fan off	Pump off	System off	Reset (auto/man)	Delay	Enabling
AL80	Driver2 - Probe error	*Circuit				man	selectable	
AL81	Driver2 - Step motor error	*Circuit				man		
AL82	Driver2 - Eeprom error	*Circuit				man	selectable	
AL83	Driver2 - Battery error	*Circuit				man	selectable	enabling
AL84	Driver2 - High pressure					man	selectable	
AL85	Driver2 - Low pressure	*Circuit				man	selectable	enabling
AL86	Driver2 - Super-heat					man	selectable	
AL87	Driver2 - Valve not closed during stop					man		
AL88	Driver2 - wait for valve reopening					man		
AL89	Driver2 - wait for battery recharge					man		
AL90	Driver2 - wait for eeprom restart					man		

2 Functional Control

2.1 What Is In This Chapter?

Introduction

This chapter will give more detailed information about the functions used to control the system. Understanding these functions is vital when diagnosing a malfunction, which is related to functional control.

Overview

This chapter contains the following topics:

Topic	See page
2.2–ON / OFF Management	2–48
2.3–Thermostat Control	2–49
2.4–Setpoint Reset of the Chilled Water	2–54
2.5–Return Water Reset	2–56
2.6–Freeze-up Control	2–57
2.7–Enable Soft Load	2–59
2.8–Unit Load Limiting	2–60
2.9–Start Up With High Evaporator Water Temperature	2–61
2.10–Pump Control	2–62
2.11–Auto Restart after Power Failure Function	2–63
2.12–Liquid Injection	2–64
2.13–EXV Pre Opening	2–65
2.14–Compressor Configuration	2–66
2.15–Compressor Management	2–67
2.16–High Pressure Setback	2–69
2.17–LP Prevention	2–70
2.18–Capacity Control	2–71
2.19–Pump Down Configuration at Compressor Stop	2–74
2.20–Pressure Safeties	2–75
2.21–LP alarm delay	2–77
2.22–Oil Management Safeties	2–78

2.2 ON / OFF Management

Introduction

There are four ways of switching the unit on and off:

- Through the local key of the controller
- Through a remote switch
- Through a supervision system (BMS)
- Through a time schedule

Power on

- The initialization takes 10 seconds.
- The controller automatically goes to the first screen.

Remark: An auto restart function is integrated. This means that the on/off status is remembered after a power failure of the unit. This auto restart function can be disabled in the user menu.

On/Off local

Unit shutdown through the controller (on/off key).

If the switch is enabled, “off keypad” will appear on the display of the unit status.

Remote on/off

Unit shutdown through a digital contact.

If the panel switch is in the “0” position the unit is off by local switch and on the display “Off Loc/Rem Sw” will appear.

- If the switch is in “Loc” position, the unit is on (unless there are other shutdown conditions).
- If the switch is in the “Rem” position, the digital contact control allows the start up and the shutdown of the unit from a remote switch. When the unit is stopped from remote, “Off Loc/Rem Sw” will appear on the display of the unit status.

Remark: The remote on/off switch is field supply.

On/Off network

This function allows the start up and the shutdown of the unit through Supervision System Plant Visor 1.0.

In case this function is enabled, the display of the unit status shows “Off Rem. Comm”.

On/Off time schedule

This function, if enabled, allows the start up and the shutdown of the unit based on a user defined time schedule. In case the function is enabled, “Off Time Schedule” will appear on the display of the unit status.

Emergency stop

In the even of an emergency, switch off the unit by pushing the emergency button.

When the problem is solved, do not forget to reset the emergency button.

2.3 Thermostat Control

Introduction

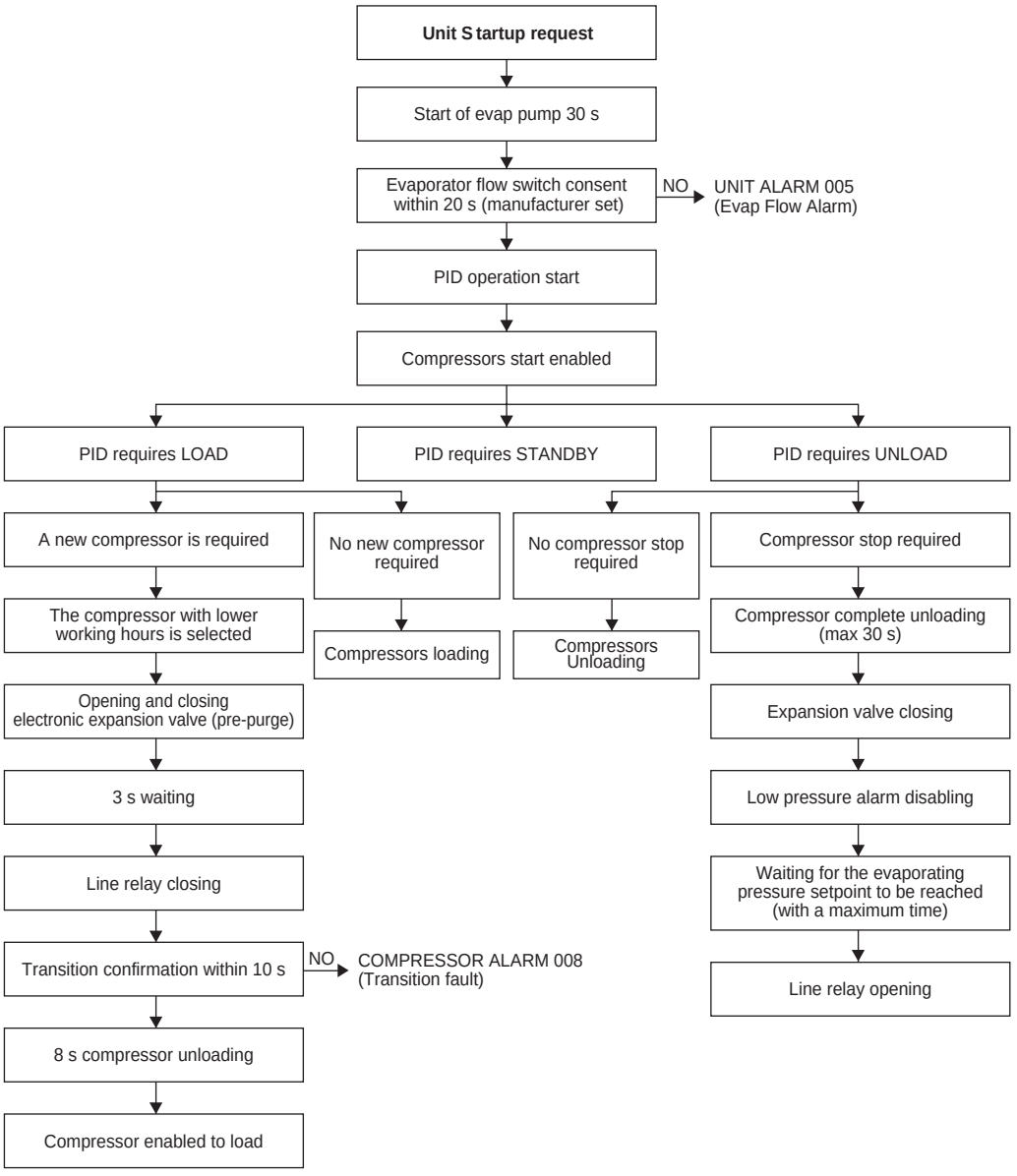
The thermostat control is used to generate a load-up or load-down according to the active PID regulation.

Continuous loading and unloading uses 2 solenoid valves to control the screw compressor slide and thus its capacity. Control is performed by outlet temperature.

2

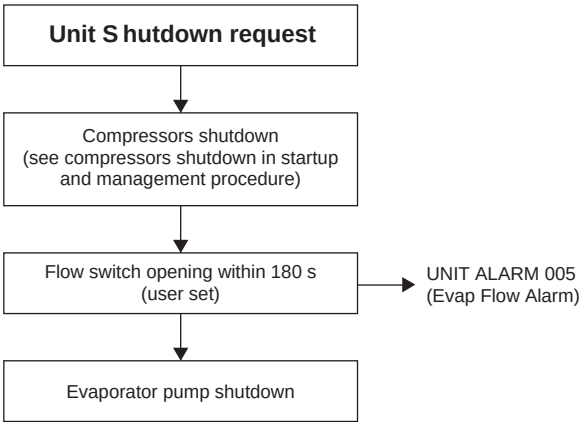
Unit and compressor start up and shutdown procedure

In the following flow chart the unit startup, management and shutdown procedures are shown, as well as the compressors loading and unloading strategy.



2

Unit shutdown



Compressors start up and loading management (4 compressors)

Step n.	Leader Comp.	Lag 1 Comp.	Lag 2 Comp.	Lag 3 Comp.
0	Off	Off	Off	Off
1	If (T – SetP) < Start up DT & Cooling or (SetP – T) < Start up 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 (T in unload band)	Unload up to 50%	Start	Off	Off
6b (T not in unload band)	Fixed at 75%	Start	Off	Off
6	Fixed at 75% or 50%	Load up to 50%	Off	Off
7 (If leader at 50%)	Load up to 75%	Fixed at 50%	Off	Off
8	Fixed at 75%	Load up to 75%	Off	Off
9	If T in Regulation Band Wait interstage time			
10	If T is approaching SetP – Waiting			
10a (T inun load band	Fixed at 75%	Unload up to 50%	Start	Off
10b (T not in unload band)	Fixed at 75%	Fixed at 75%	Start	Off
11	Fixed at 75%	Fixed at 75% or 50%	Load up to 50%	Off
12 (If lag 1 at 50%)	Fixed at 75%	Load up to 75%	Fixed at 50%	Off
13	Fixed at 75%	Fixed at 75%	Load up to 75%	Off
14	If T in Regulation Band Wait interstage time			
15	If T is approaching SetP – Waiting			

Step n.	Leader Comp.	Lag 1 Comp.	Lag 2 Comp.	Lag 3 Comp.
16a (T in unload band)	Fixed at 75%	Fixed at 75%	Unload up to 50%	Start
16b (T out unload band)	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 lag 2 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%	Fix a/Fixed at 75%	Fix a/Fixed at 75%	Fix a/Fixed at 75%
21	Fixed at 100%	Fixed at 100%	Fixed at 100%	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%

Compressors unload and shutdown management (4 compressors)

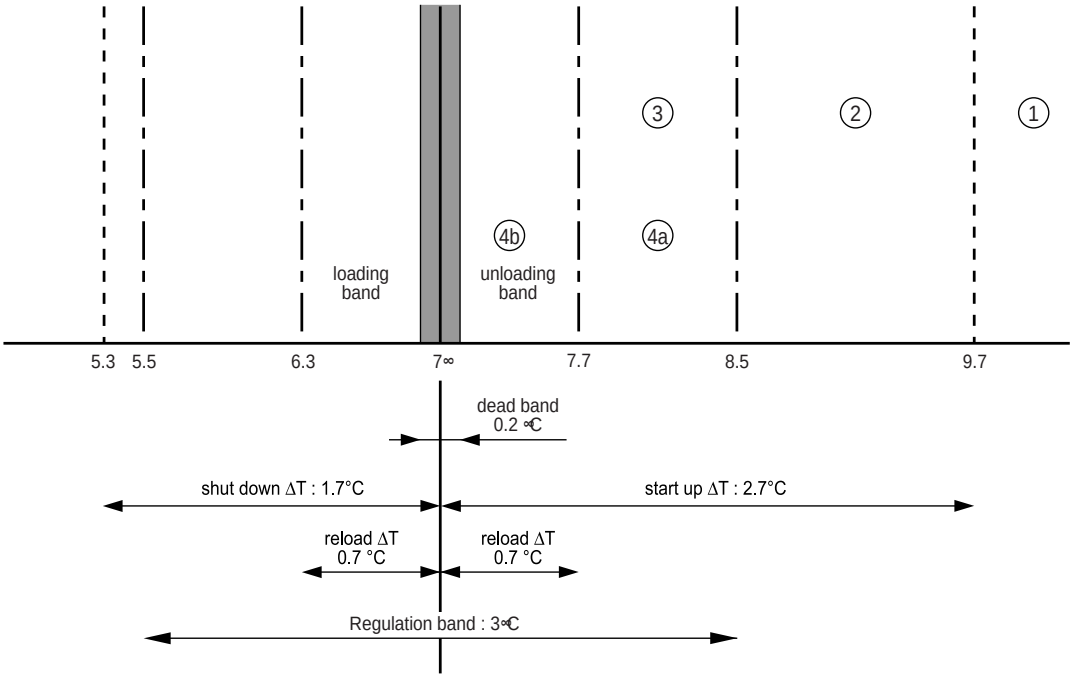
Step n.	Leader Comp.	Lag 1 Comp.	Lag 2 Comp.	Lag 3 Comp.
0	100%	100%	100%	100%
1	Fixed at 100%	Fixed at 100%	Fixed at 100%	Unload up to 75%
2	Fixed at 100%	Fixed at 100%	Unload up to 75%	Fixed at 75%
3	Fixed at 100%	Unload up to 75%	Fixed at 75%	Fixed at 75%
4	Unload up to 75%	Fixed at 75%	Fixed at 75%	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			
8a (T in load band)	Fixed at 75%	Fixed at 75%	Load up to 75%	Stop
8b (T not in load band)	Fixed at 75%	Fixed at 75%	Fixed at 50%	Stop
9 (if lag 2 at 75%)	Fixed at 75%	Fixed at 75%	Fixed at 75%	Off
10	Fixed at 75%	Unload up to 50%	Fixed at 50%	Off
11	Fixed at 75%	Fixed at 50%	Fixed at 25%	Off
12	If T is approaching SetP – Waiting			
13a (T in load band)	Fixed at 75%	Load up to 75%	Stop	Off
13b (T not in load band)	Fixed at 75%	Fixed at 50%	Stop	Off
14 (lag 1 at 75%)	Fixed at 75%	Unload up to 50%	Off	Off
15	Unload up to 50%	Fixed at 50%	Off	Off
16	Fixed at 50%	Unload up to 25%	Off	Off
17	If T is approaching SetP – Waiting			

2

Step n.	Leader Comp.	Lag 1 Comp.	Lag 2 Comp.	Lag 3 Comp.
18a (T in load band)	Load up to 75%	Stop	Off	Off
18b (T not in load band)	Fixed at 50%	Stop	Off	Off
19	Unload up to 25%	Off	Off	Off
20	If T is approaching SetP – Waiting			
21	If (SetP – T) < Shutdown DT & Cooling or (T – SetP) < Shutdown DT & Heating Waiting			
22	Stop	Off	Off	Off
23	Off	Off	Off	Off

Loading and unloading zones

The graph below shows the different loading and unloading zones.



Settings

Do not change:

- Max pull down : 0.7° / min
- Dead band : 0.2°C
- Reload ΔT : 0.7°C
- Interstage : 210 s

Other settings

- Start up ΔT : 2.7°C
- Shutdown ΔT : 1.7°C
- Regulation band : 3°C

EXAMPLE: Upload

1)

- If the water temperature is above 9.7°C the chiller can start (below 9.7°C the chiller will wait)
- Unit will start leader compressor

2)

- Unit will load leader compressor till 75%

3)

- If temperature is in Regulation Band

  → wait interstage time (default 210 sec)

- If temperature is approaching setpoint (after interstage time)

  → wait (no need to start new compressors because chilled water temperature is decreasing, prevent undershoot)

- After interstage time check if temperature is in unloading band

4a)

No: Unit will add next compressor (25% capacity) and keep the leader compressor at 75%

Leader comp : 75%
Next comp : 25%

4b)

Yes: Unit will first unload leader compressor to 50%, when this is done the next compressor will start (25%)

Leader comp : 50%
Next comp : 25%

This will give you again 75% capacity but now the unit is able to upload in small steps.

- Unit will upload the running compressors to 75%
  - If another compressor is present and there is still demand for load, the regulation cycle will continue from point **3.**
  - If no other compressors are present and there is still demand for load, the compressors will upload to 100% capacity according to the PID regulation (if needed).
- When the temperature is in the dead band, the unit will operate with the same capacity (no upload or download)

2.4 Setpoint Reset of the Chilled Water

Introduction

Among the MicroTech NC controllers options, there are also several possibilities to regulate the unit with particular logics or outside signals. The setpoint reset function gives the possibility to modify the local setpoint of the chilled water according to the following logics:

- double setpoint
- external signal
- OAT (outdoor ambient temperature) reset
- return water reset

Double setpoint

Through an external contact (optionally a switch is installed on the electric panel control), it is possible to vary the local setpoint of control between two well defined values. Such option results are advantageously applicable in case of installation with ice bank. When the temperatures of evaporator outgoing water are inferior to 4°C, the introduction of the correct quantity of Anti-freeze in the hydraulic system is required.

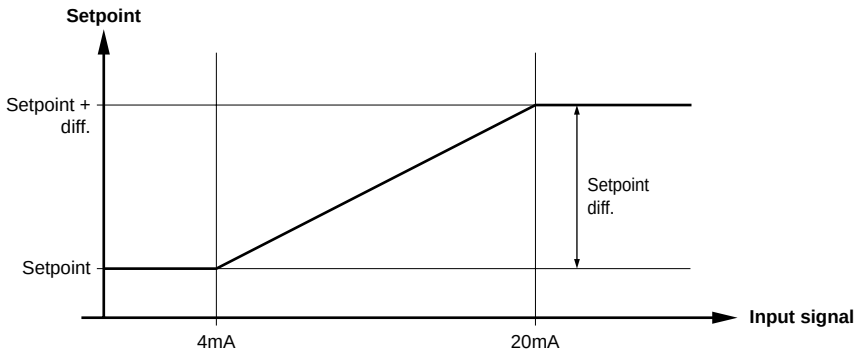
Enable Double	
Setpoint	Y

Cooling Double	
Setpoint	12.0 ˚C
Heating Double	
Setpoint	---- ˚C

External signal

The setpoint override allows, by use of an external signal, to override the chilled water setpoint.

This function is activated by enabling the analog input B3 of the controller. A 4-20mA signal can be used to change the setpoint.



- For inputs lower than 4mA, the water setpoint is set to the local setpoint
- For inputs between 4 and 20mA, the setpoint is obtained by linear interpolation between the setpoint and the setpoint + setpoint diff (entered in the user menu)
- For inputs higher than 20mA, the water setpoint is set to setpoint + diff.

Remark: The value entered for the setpoint diff can also be negative.

Lvg Water Temp
Setpoint Reset
4-20mA

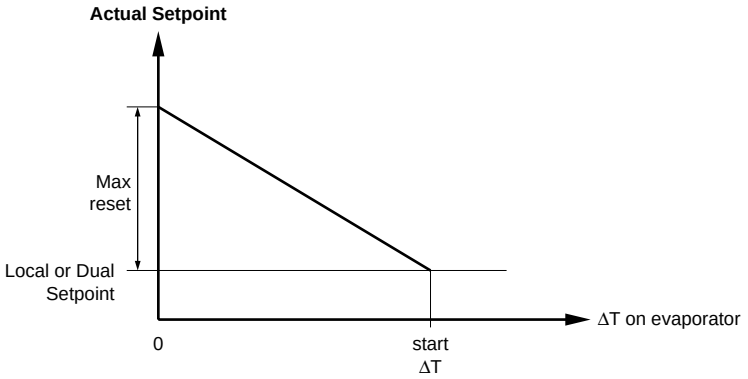
chLWT Setpoint
Override Limits
Setp. Diff. 03.0 ˚C

2.5 Return Water Reset

Introduction

When return water is selected as the reset mode, the MicroTech controller will adjust the leaving chilled water setpoint to maintain a constant return water temperature equal to the return water setpoint. The return water temperature is sampled every 5 minutes and a proportional correction is made to the leaving chilled water setpoint. The corrected leaving water setpoint is never set to a value greater than the return water setpoint and is never set to a value less than the actual leaving chilled water setpoint.

Function description



chLWT Return Reset	
Start dT	3 ˚C
Max Reset	3 ˚C

Remark: When the unit is designed for a ΔT of 5°C (at 100% capacity), then the start ΔT and Max Reset should also be set to 5°C.

Explanation

The return water reset will adjust the leaving chilled water setpoint according to the evaporator ΔT. In this way the chiller can maintain a constant return water temperature.

2.6 Freeze-up Control

Introduction

Freeze up control is used to protect the evaporator against accidentally freezing.

Two protections are present: freeze-up prevention and Anti-freeze alarm.

Freeze-up prevention

Freeze-up prevention will request a load-down when the temperature of the evaporator outlet gets below 3°C (default freeze prevention setpoint).

The unit will go back to normal operation (possibility to load up) when the outlet temperature gets above freeze prevention setpoint + diff.

Characteristics	**Freeze-up prevention**
Control device	Sensor (1 sensor at each evaporator outlet)
Diagram name	
Activation Result	Outlet water temp < Freeze prevention setpoint (3°C) Load down compressor
Reset Result	Outlet water temp > Freeze prevention setpoint + diff (4°C) Normal mode

Anti-freeze alarm

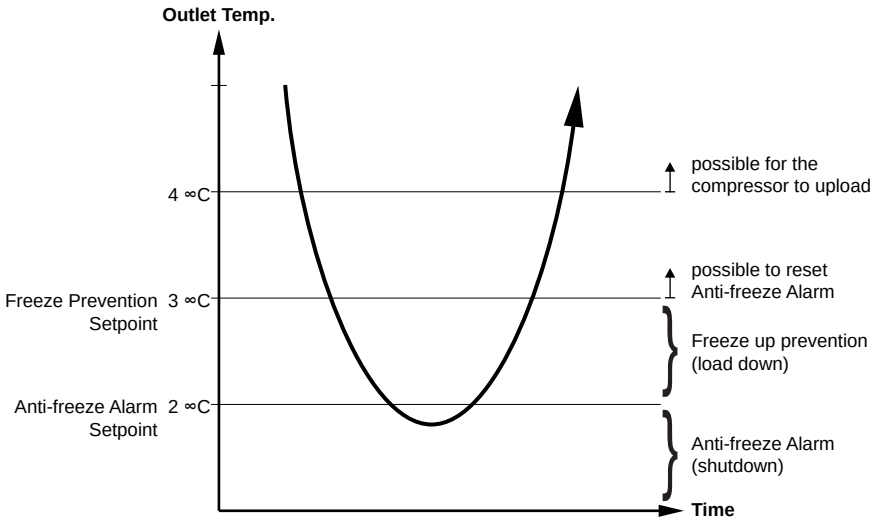
When the evaporator outlet water temperature drops below Anti-freeze alarm setpoint (2°C) the Anti-freeze protection is activated and the unit will shutdown. When the temperature rises above the Anti-freeze setpoint + diff (3°C) it is possible to reset the Anti-freeze alarm.

Characteristics	**Anti-freeze alarm**
Control device	Sensor (1 sensor at each evaporator outlet)
Diagram name	
Activation Result	Outlet water temp < Anti-freeze setpoint (2°C for standard unit) Unit disabled
Result	Manual reset Manual reset possible when outlet temp is above Anti-freeze setpoint + diff.

Remark: In case of 2 evaporators, each evaporator has its own Anti-freeze alarm setpoints

2

Function description



Anti-Freeze Alarm	
Setpoint	02.0 ˚C
Diff.	01.0 ˚C

In case the unit has 2 evaporators:

Evap 1 Anti-Freeze Alarm	
Setpoint	2.0 ˚C
Diff.	1.0 ˚C

Evap 2 Anti-Freeze Alarm	
Setpoint	2.0 ˚C
Diff.	1.0 ˚C

2.7 Enable Soft Load

Function description

The Soft load function can be enabled by keyboard in the user menu. The Soft load function limits the unit load to a predetermined value (Max stage) for a set period (Max time). This function finds wide application where the water temperature is high at the start up but without having a consistent thermal load. This function allows energy saving during unit start up avoiding compressors useless loading.

Enable Soft Load	Y

Enable Soft Load	Y
Max stage	50 %
Max Time	20 min

2.8 Unit Load Limiting

Introduction

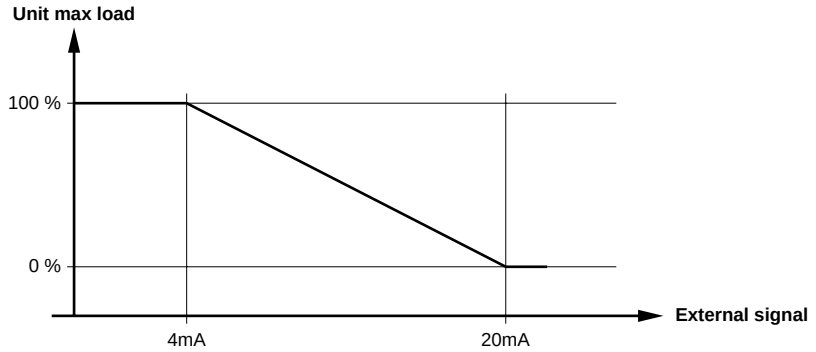
The Unit load limiting function finds application in all those situations when it is necessary to reduce the electric absorption of the unit, in determined periods of the day.

2

Load limiting

It is possible to limit the unit absorption using one of the two options available under user menu.

- The first way, called “Demand Limit” requires a 40mA - 20mA external signal (connections 37 and 38 on M3). The unit max load decreases from 100% to 0% as the input increases from 4mA to 20mA.



Unit Limiting
Demand Limit

- The second way, called “Current Limit” needs a direct measure of the current absorbed by the unit and the set of the maximum current to be absorbed. (Option: SPN unit)

Remark: Current limit screen appears only if b8 probe is enabled under maintenance menu.

Unit Limiting
Current Limit

Current Limit Set	
4m A	000 A
20 mA	400 A
Max Curr.	300 A

2.9 Start Up With High Evaporator Water Temperature

Function description

This function limits the load of each compressor to a set value (default 70%) until the outlet water temperature is below the set value (default 25°C). This function helps the start up of the unit when the water temperature is very high (35°C - 40°C) avoiding dangerous overheating of the motor and disagreeable interventions for high pressure protection.

The value of maximum load of the compressors and the limit water temperature are modifiable under the user menu.

High chLWT Start	
LWT	25.0 ˚C
Max Comp. Stage	70 %

2.10 Pump Control

Introduction

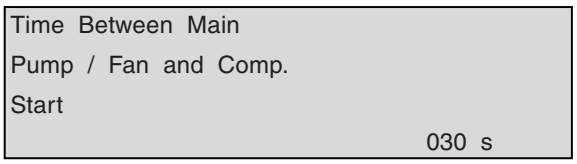
To prevent the chiller to start up without flow, safety checks are performed.

First there is a check to make sure that water flows through the system.

The pump control of the user menu allows the user to define the pump lead and the pump lag time.

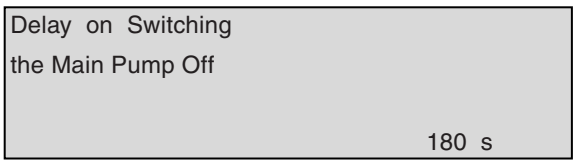
2

Pump lead time



When the unit is switched on, the pump will run for 30 seconds before the chiller (compressors) can start. During this 30 seconds pump lead time you also need a closed flow switch for 20 seconds.

Pump lag time



When an off signal is given to the controller (thermostat, local/remote switch,...) the pump will run for another 180 seconds before switching off (pump lag time). During this 180 seconds, the unit will execute the pump down procedure.

2.11 Auto Restart after Power Failure Function

Function description

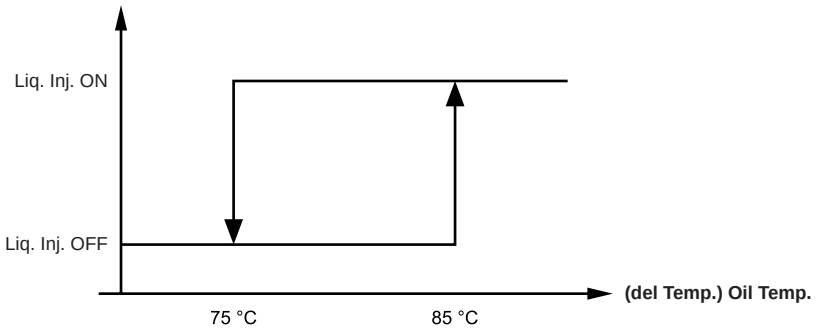
The Auto restart after power failure allows the unit to restart after a power failure.

- When the Auto restart is enabled the unit will automatically restart after the power failure.
- When the Auto restart is disabled the unit will not automatically restart after the power failure. The unit needs to be restarted manually.

This function can be enabled/disabled in the user menu.

2.12 Liquid Injection

Function description



- When the oil temperature (PT1000; del. temp.) is higher than 85°C (default) the liquid injection will be activated.
- When the oil temperature decreases to 75°C the liquid injection will be disabled.

Liquid Injection	
Setpoint	085 ˚C
Diff.	10.0 ˚C

2.13 EXV Pre Opening

Function description

Because the unit stops with a pump down, it will restart with a pre-purge (opening - closing of the expansion valve).

At start up the valve will open (up to 50%) and close to the evaporator with a certain amount of liquid.

2.14 Compressor Configuration

Function description

This controller screen will allow you to modify the number of compressors and evaporators on the unit. The selection of the compressors and evaporators has to be done according to the unit.

2

Compressor Configuration	
Numbers of Compressors	2 - 4
Numbers of Evaporators	1 - 2

2.15 Compressor Management

Introduction

The compressor sequencing mode determines which circuit starts up first in case of a capacity demand. It prevents the unit from always starting the same circuit. Also, compressor timers are implemented to avoid too many compressor starts in 1 hour.

Compressor sequence

The compressor sequence of starting up can be selected in the user menu.

Compressors
Sequencing
Auto / Manual

- Auto: The selection of the compressor sequence will be done by the controller depending on the running hours.
- Manual: The selection of the compressor sequence is fixed according to the entered sequence. When manual is selected, the following screen will appear.

Set Compressor Stage	
C # 1 1st	C # 2 2nd
C # 3 3rd	C # 4 4th

Compressor timers

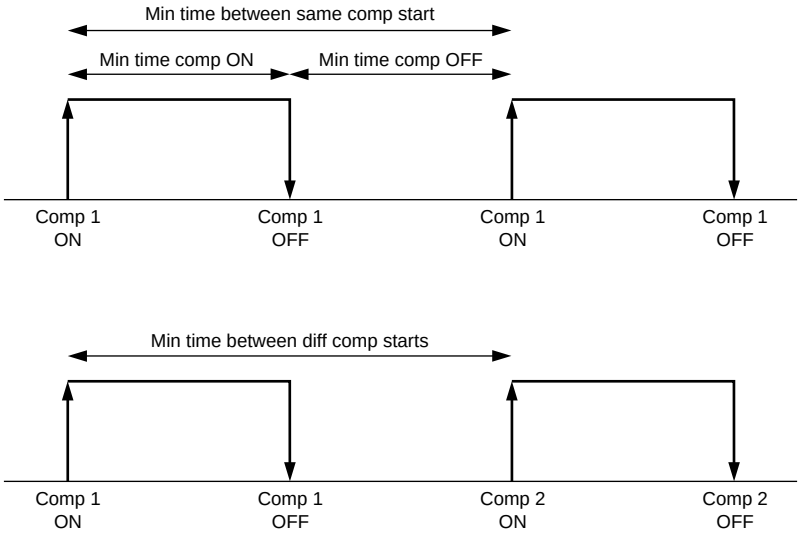
The compressor timers are implemented to prevent too many compressor starts.

The time set for the compressor to start is 600 seconds. This is to prevent breakdown of the compressor.

Min T Between Same	
Comp. Starts	600 s
Min T Between Diff.	Diff.
Comp. Starts	120 s

Min Time Comp ON	120 s
Min Time Comp OFF	180 s

Function description

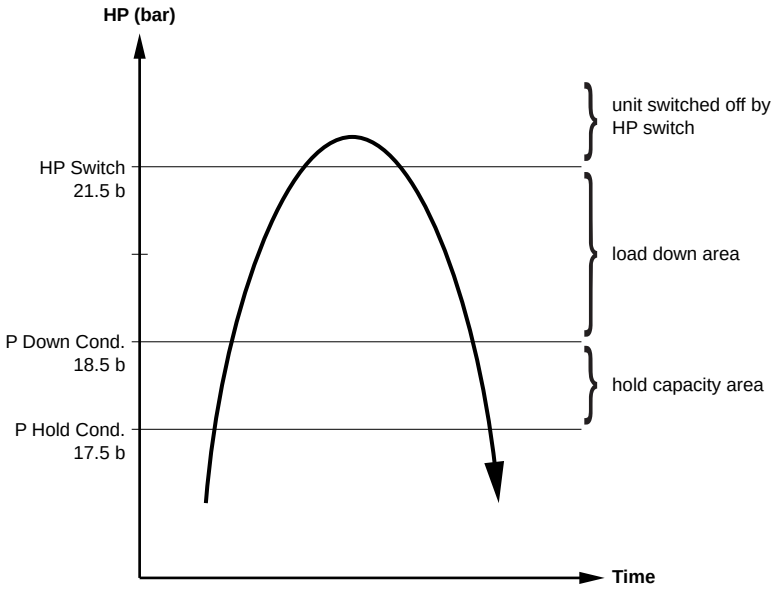


2.16 High Pressure Setback

Introduction

This is a safety prevention function, when high pressure is near to the high pressure switch setpoint. The unit will hold same capacity or will load-down to prevent the unit from tripping on the high pressure switch or transducer high pressure alarm.

Function description



- Hold capacity area: if the HP is above the “P hold cond” setpoint (default 17.5 bar) the compressor will hold the same capacity (no load-up possible)
- Load down area: if the HP is above the “P down cond” setpoint (default 18.5 bar) the compressor will load down in order to decrease the high pressure
- Above HP switch: the unit will shutdown safely

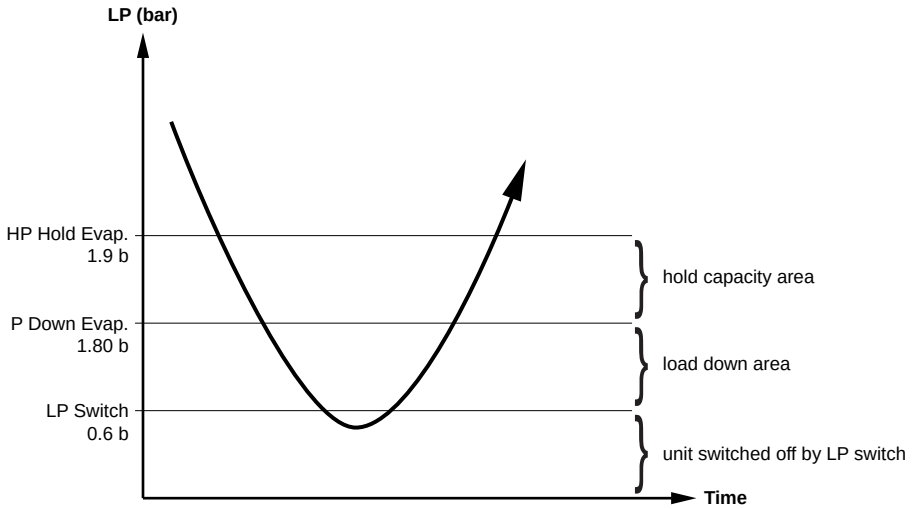
2.17 LP Prevention

Introduction

This is a safety prevention function, when the low pressure is near to the low pressure switch. The unit will hold same capacity or will load down to prevent the unit from tripping on the low pressure switch.

2

Function description



- hold capacity area: if the LP is below the “P hold evap” setpoint (default 1.9 bar) the compressor will hold same capacity (no load up possible)
- load down area: if the LP is below the “P down evap” setpoint (default 4.8 bar) the compressor will load down in order to increase the low pressure
- below LP switch: the unit will shutdown safely

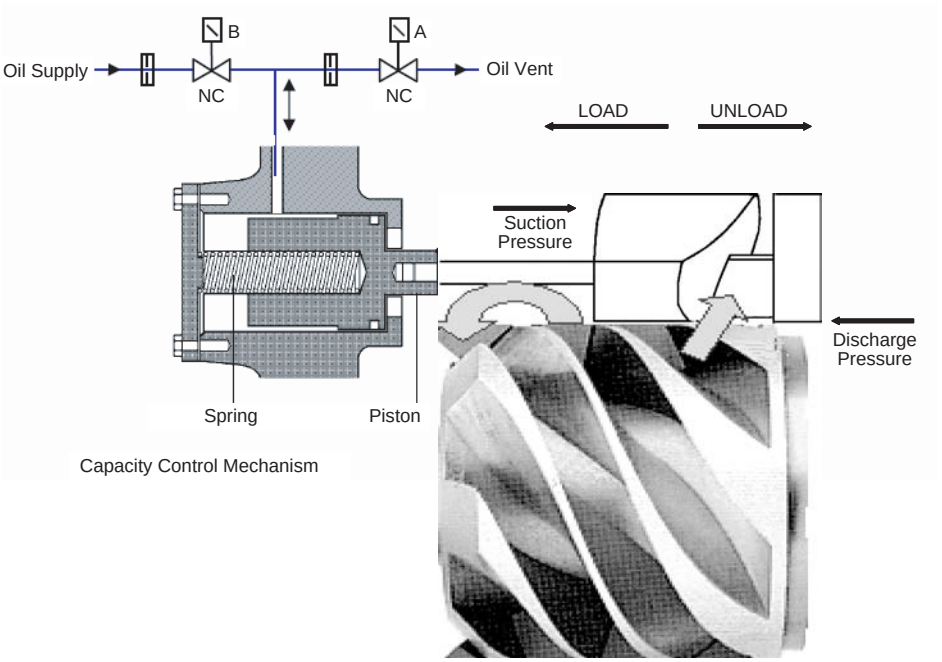
2.18 Capacity Control

Introduction

Cooling capacity control is infinitely variable by means of a capacity slide controlled by a microprocessor system. Each unit has infinitely variable capacity control from 100% down to 6.25% (four compressor units), to 8.3% (three compressor units) to 12.5% (two compressor units). This modulation allows the compressor capacity to exactly match the building-cooling load. The result is a decrease in chiller energy costs, particularly at the part-load conditions at which the chiller operates most of the time. Additionally, in some cases there should be the possibility to avoid inertial tank in the water circuit.

Function description

The compressor capacity, moving of the sliding vane, is done by oil pressure. The controller will decide to feed or to drain oil from the capacity control piston compartment in order to load or download.



Capacity Control Mechanism

- When the unload valve (B) is energized, the valve will feed oil to the piston and the slide will move to the right (loading down).
- When the load valve (A) is energized, the valve (A) will open. The discharge pressure will push the sliding vane to the left and the oil will drain via the loading valve.

Number of pulses

The compressor load regulation is controlled by a fixed number of pulses to the two solenoid valves, draining and feeding oil in the slide valve chamber.

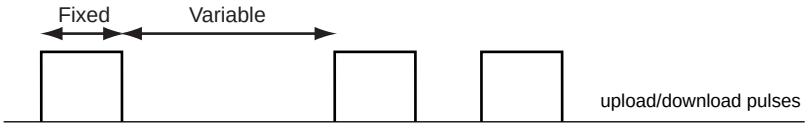
With the default settings, the compressor will load from 25% capacity to 100% capacity in 15 pulses.

Number of Pulses To Load Comp.	15
Number of Pulses To Unload Comp.	15

2

Pulse time

The time of the pulse time is fixed (default 0.3 s). The interval time between two pulses is proportional to the PID (proportional + integral + derivative) unit request.

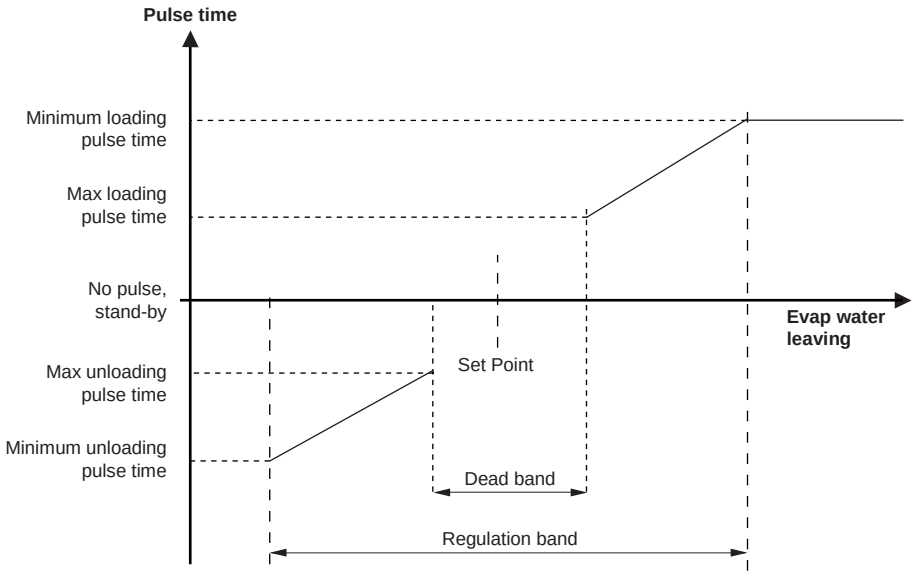


Compressor Unloading	
Pulse Time	00.3 s
Min Pulse Period	01 s
Max Pulse Period	90 s

Compressor Loading	
Pulse Time	00.3 s
Min Pulse Period	05 s
Max Pulse Period	90 s

Graph 1

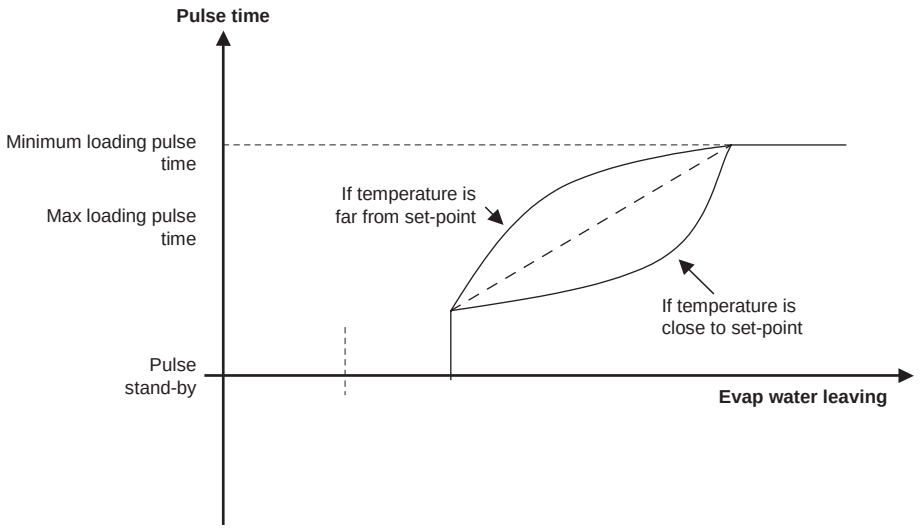
A pure proportional logic will load or unload with a frequency related to the set-point distance.



Graph 2

The derivative part of the logic controls how the temperature reaches the setpoint. If it is getting closer – increases the time between intervals, or if it is far from the setpoint – decreases the time between intervals. The result is having the controller act differently whenever the water temperature changes.

If the derivative time is increased, the control will be more sensitive to temperature changes. For example: the derivative time can be increased when a chiller is working with a very variable load. The integral time stores the memory on how the P+1 controls the temperature.



2.19 Pump Down Configuration at Compressor Stop

Introduction

When the unit is switched off (local, remote, thermostat) the pump down procedure will be executed.

Function description

Pump down procedure:

- request to shut down compressor
- close electronic expansion valve
- stop compressor or when one of the two conditions is met:
  - max time of pump down = 30 seconds
  - LP is below 1.2 bar

Pump Down Config	
Enable	
Max time	30 s
Min Press.	1.2 bar

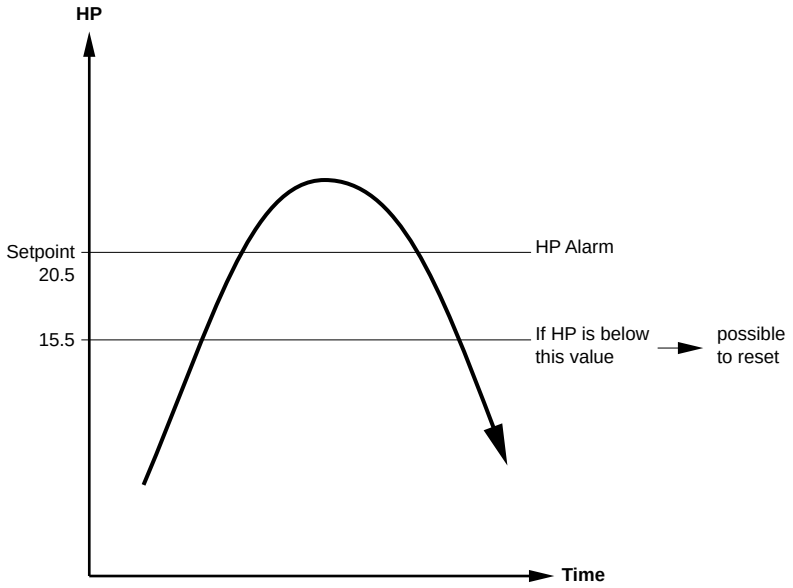
2.20 Pressure Safeties

2.20.1 Transducer high pressure alarm

Introduction

This is a software safety function. When high pressure is near to the high pressure switch setpoint, the unit will shutdown and trip on transducer high pressure alarm.

Function description

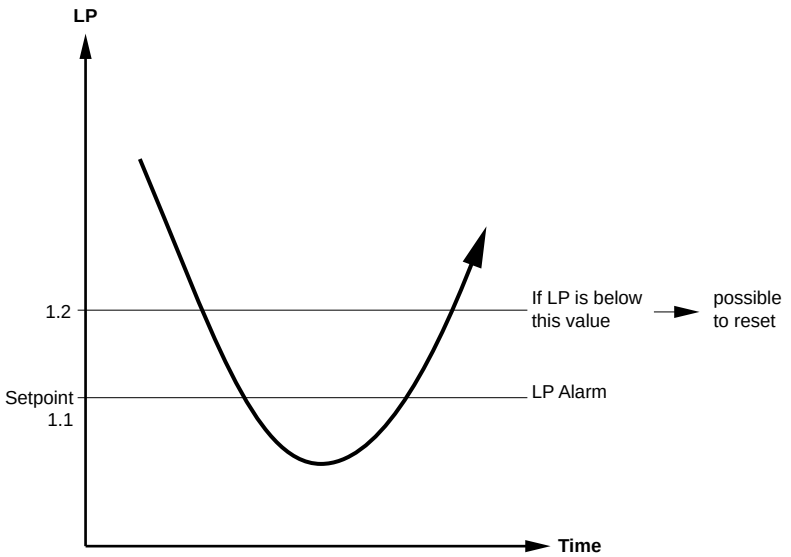


- When the pressure is above the HP setpoint, the unit will go into HP alarm.
- When the high pressure alarm is activated and the HP sinks below HP setpoint-diff, it is possible to reset the transducer high pressure alarm.
- When the high pressure rises above the high pressure switch setpoint (21.5 bar), the unit will go into alarm and a manual reset on the high pressure switch is needed.

Transducers High	
Pressure Alarm	
Setpoint	20.5 bar
Diff.	5.0 bar

2.20.2 Transducer low pressure alarm

Function description



- When the low pressure is below the LP setpoint (for the LP alarm delay time), the unit will go into LP alarm.
- When the low pressure alarm is activated and the LP rises above the LP setpoint + diff, it will be possible to reset the transducer low pressure alarm.
- When the low pressure sinks below the low pressure switch setpoint (0.6 bar), the unit will go into alarm and a manual reset on the low pressure switch is needed.

2.21 LP alarm delay

Function description

Delay timer before the unit goes into LP alarm.

- start delay: At start up the unit has a delay of 120 seconds before the unit can trip on LP alarm (low pressure bypass timer)
- run delay: When the unit is in operation, the low pressure can be below the LP alarm setpoint for a specified time before the unit will trip on LP alarm.

Low Press. Alarm Delays	
Start-Up Delay :	120 s
Run Delay :	040 s

2.22 Oil Management Safeties

2.22.1 Pressure ratio alarm

2

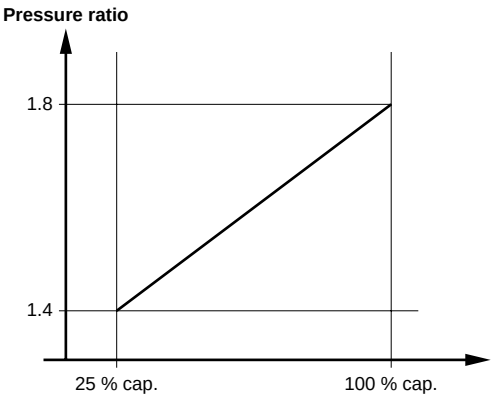
Introduction

Because the capacity control is done by oil pressure it is very important to have a minimum pressure difference between LP and HP to be able to move the sliding vane.

Function description

When the pressure ratio is too small for a specified time, the controller will give an alarm.

$$\text{pressure ratio} = \frac{\text{discharge pressure (Abs)}}{\text{suction pressure (Abs)}}$$



- When the unit is at 25% capacity, the unit will go into alarm when the pressure ratio is below 1.4 for a specified time.
- When the unit is at 100% capacity, the unit will go into alarm when the pressure ratio is below 1.8 for a specified time.
- When the unit is between 25% and 100% capacity the unit will go into alarm when the pressure ratio is below the calculated value for a specified time.

Pressure Ratio Alarm	
Min Load Setp	1.4
Max Load Setp	1.8

2.22.2 Pressure ratio alarm delay

Function description

Delay time before the unit goes into pressure ratio alarm.

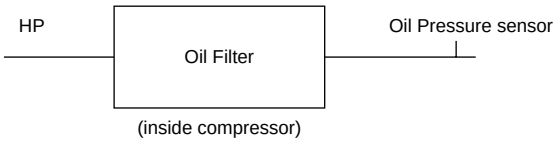
- start up delay: At start up the unit will start to check the pressure ratio after the 180 seconds start up delay timer.
- run delay: When the unit is in operation, the pressure ratio can be below the setpoint for a specified time before the unit will trip on pressure ratio alarm.

Pressure Ratio Alarm	
Start-Up Delay	180 s
Run Delay	90 s

2.22.3 High Oil DP Alarm

Function description

When the pressure drop across the oil filter becomes too big (higher than 2.5 bar) the unit will shut down and generate the high oil DP alarm.



Alarm activates when DP is higher than 2.5 bar (default) for 20 seconds (default).

DP = (HP – oil pressure)

High Oil DP Alarm	
Setpoint	2.5 bar
Delay	20 s

Part 3
Troubleshooting

Introduction

When a problem occurs, all possible faults have to be checked. This chapter gives a general idea of where to look for faults. Furthermore the general procedures for refrigeration circuit repair and for electrical circuit repair are explained.

Remark

Not all repair procedures are described. Some procedures are considered common practice.

What is in this part?

This part contains the following chapters:

Chapter	See page
1–Procedure for Software Upload/Download	3–3
2–pLAN Setting	3–23

1 Procedure for Software Upload/Download

1.1 What Is in This Chapter?

Overview

This chapter contains the following topics:

Topic	See page
1.2–Copy from the Software Key to pCO²	3–4
1.3–Copy from pCO² to the Software Key	3–5
1.4–Installation of Winload32 on the PC and Programming a Controller	3–6
1.5–Copy Software from WinLoad32 to the Software Key	3–21

1.2 Copy from the Software Key to pCO²

- Switch off the pCO^2 and remove the "expansion memory" cover with a screwdriver (see "Copy from pCO² to the Software Key" on page 3–5/Fig. 1)
- Set the key selector on 
- Insert the key in the corresponding pin connector as shown. (see "Copy from pCO² to the Software Key" on page 3–5/Fig. 2)
- Press simultaneously the buttons UP an DOWN then supply power to the pCO^2
- Check the LED on the key is on (red color )
- Wait until the request of copying appears on the LCD display, then release the buttons and confirm by pressing ENTER.
- The data transfer operation takes about 50s using the 1MB key and 100s using the 2MB one.the display will show a progressive series of numbers.
- Once copied the application program starts, then switch off the pCO^2, remove the key, put the cover in its place and switch on the pCO^2 again,
- Now the pCO^2 works with the program transferred by the key.

1.3 Copy from pCO² to the Software Key

- Switch off the pCO^2 and remove the "expansion memory" cover with a screwdriver (see Fig. 1)
- Set the key selector on
- Insert the key in the corresponding pin connector as shown. (see Fig. 2)
- Press simultaneously the buttons UP an DOWN then supply the pCO^2
- Check the LED on the key is on (green color)
- Wait until the request of copying appears on the LCD display, then release the buttons and confirm by pressing ENTER.
- If the application includes a password to protect the software, use the UP and DOWN buttons on the terminal to enter the correct password. Then press enter.
- The data transfer operation takes about 50s using the 1MB key and 100s using the 2MB one.the display will show a progressive series of numbers.
- Once copied the application program starts, then switch off the pCO^2, remove the key, put the cover in its place and switch on the pCO^2 again,
- Now the key has the program transferred by the pCO^2.

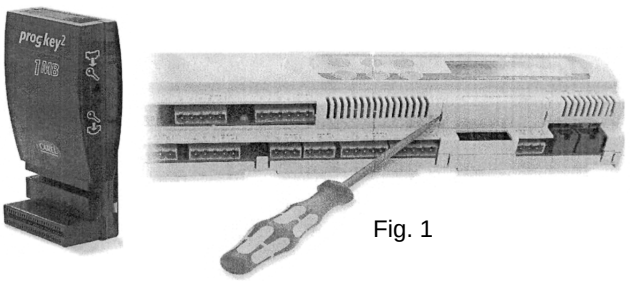


Fig. 1

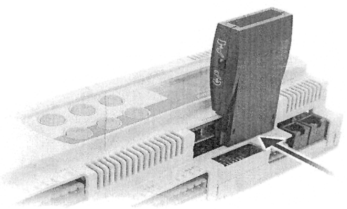
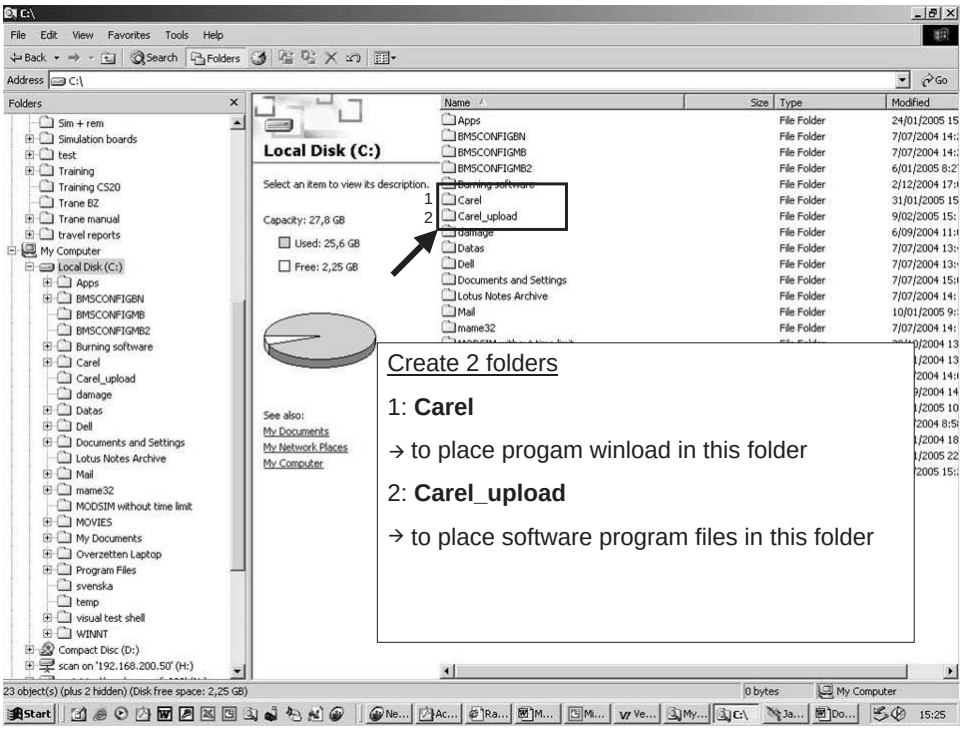
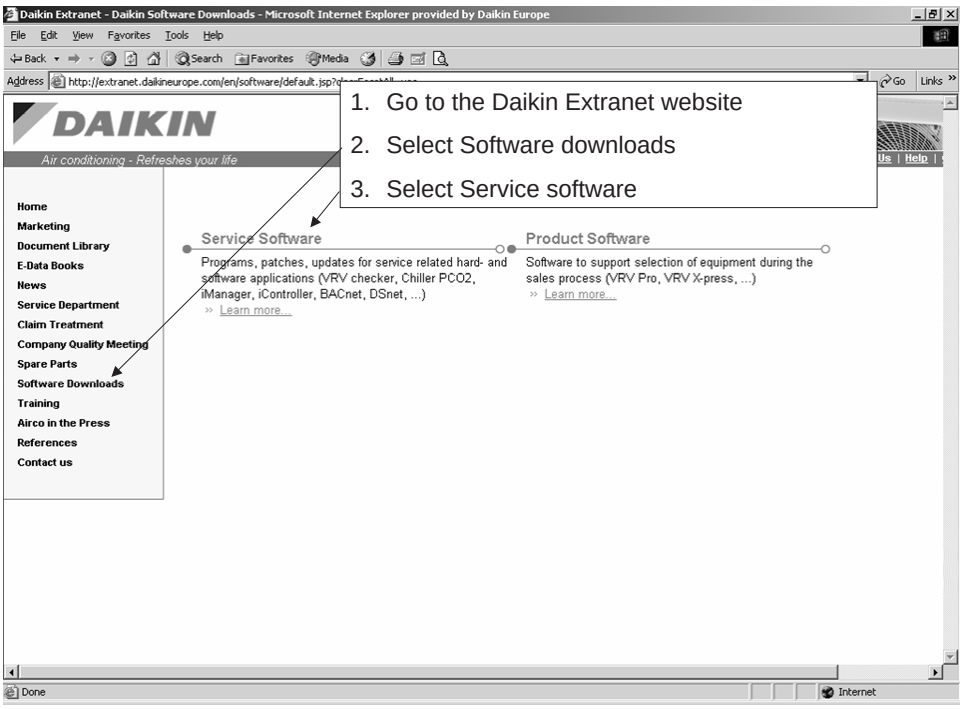
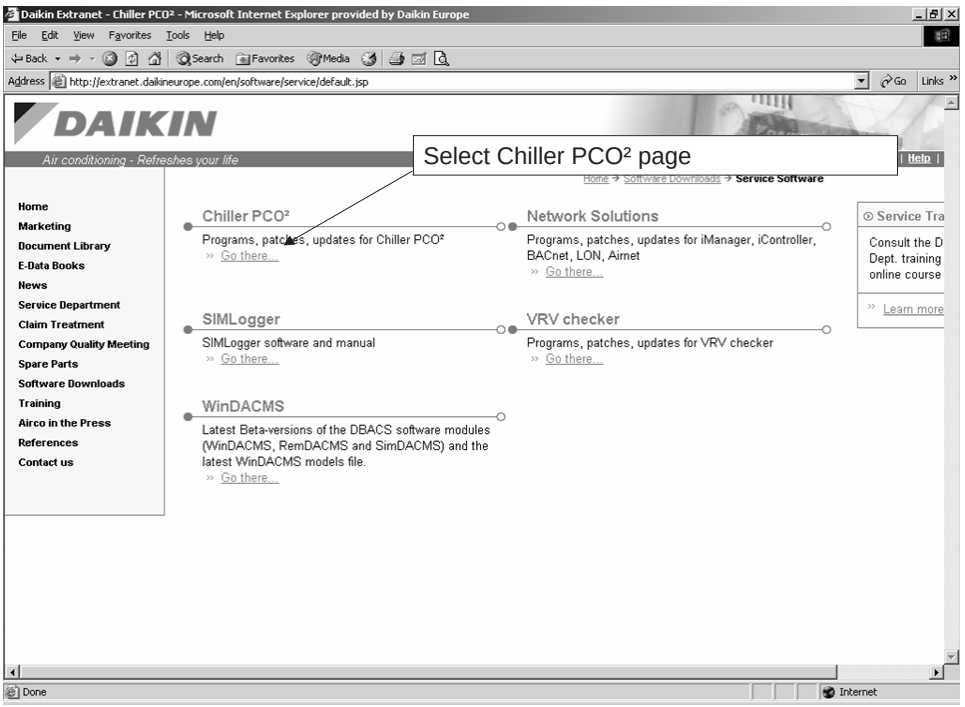
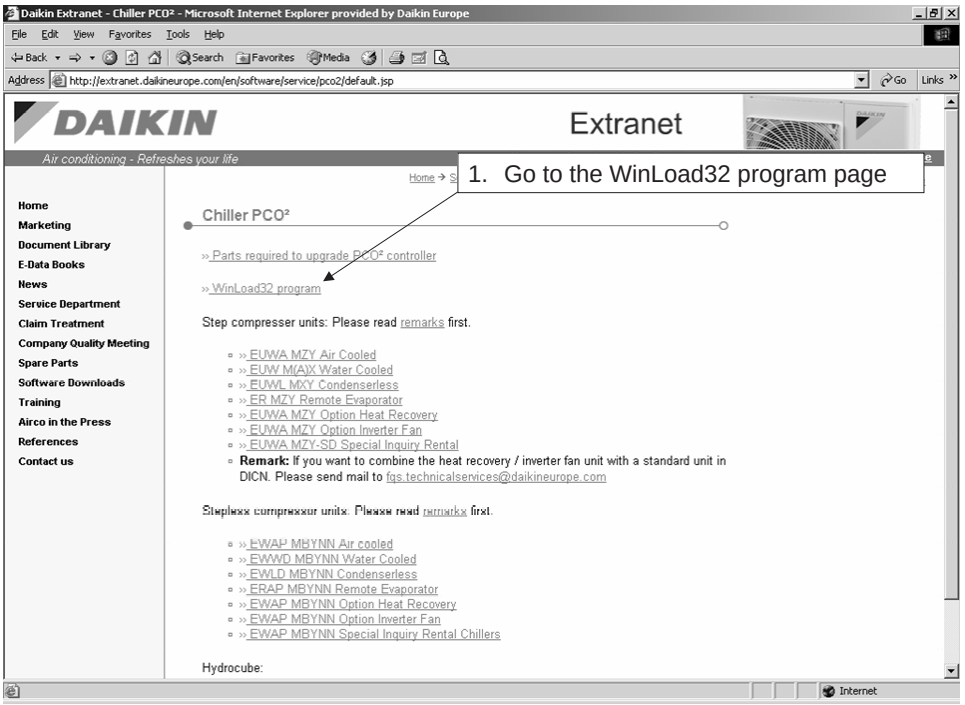
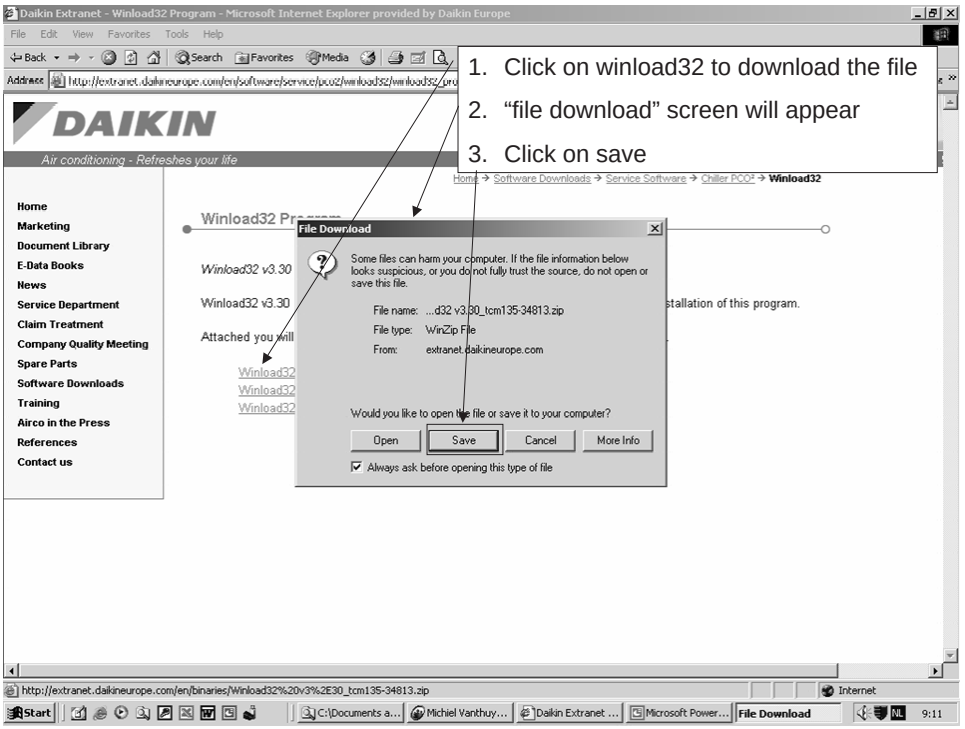
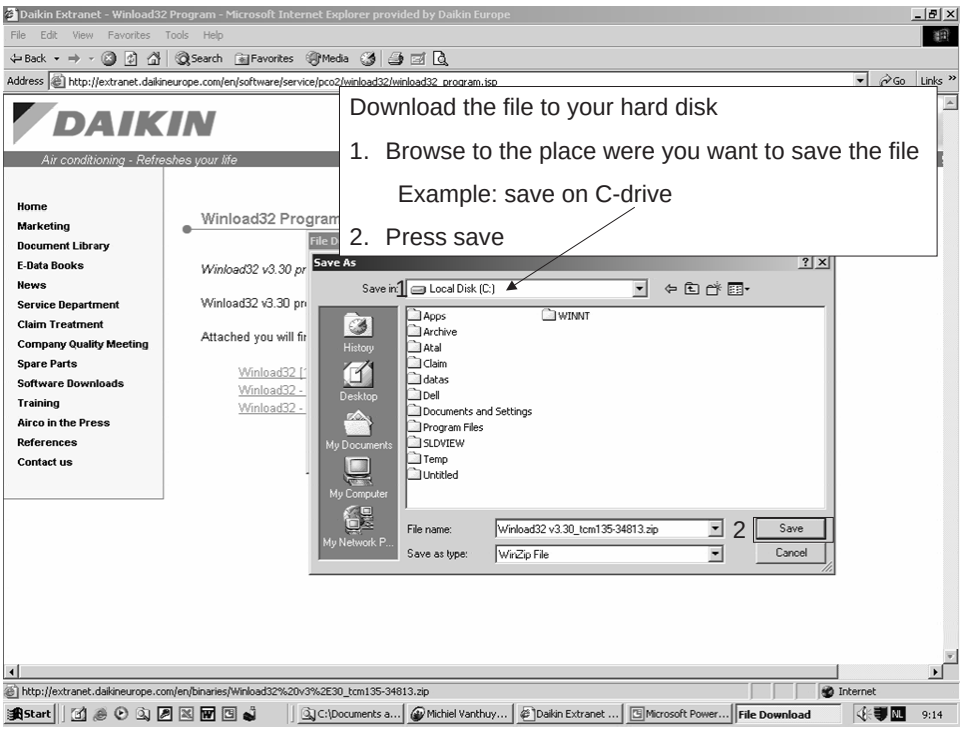


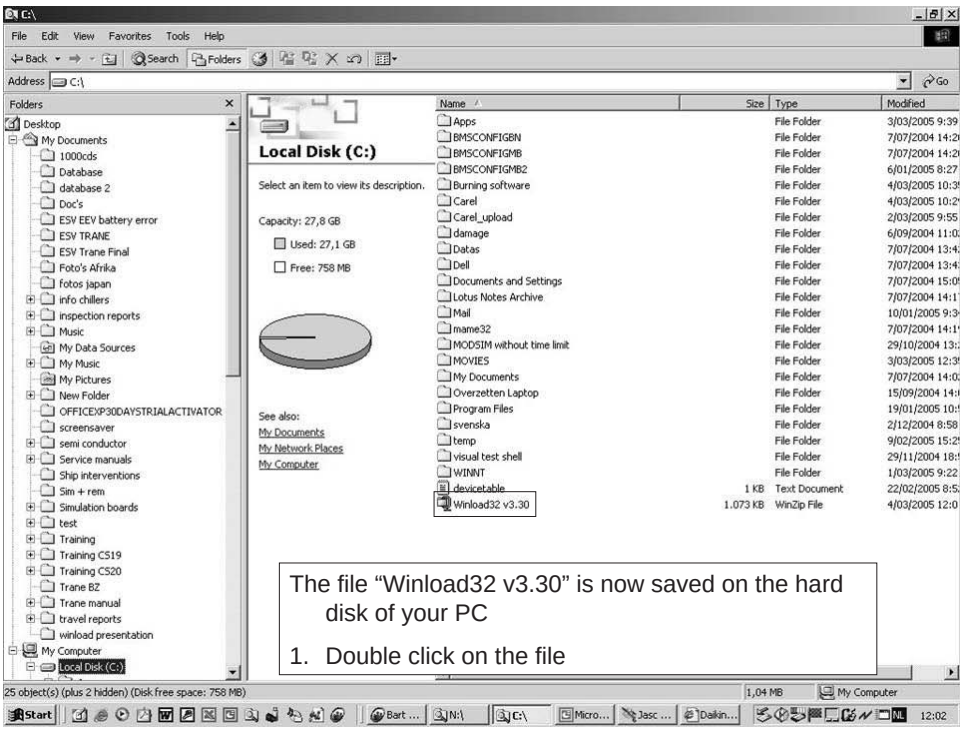
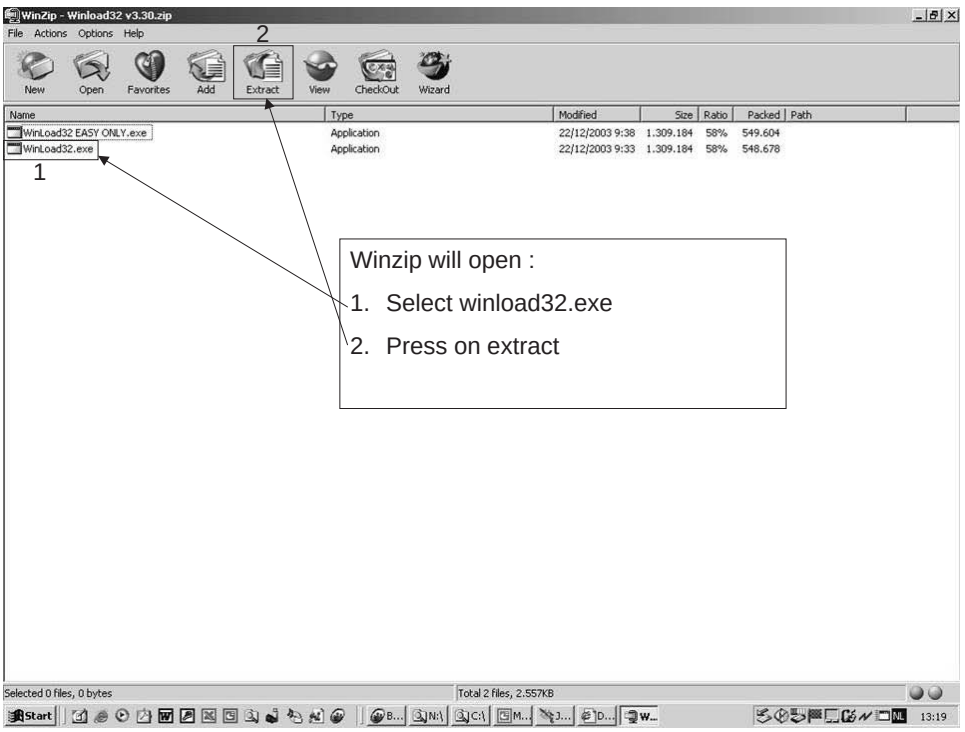
Fig. 2

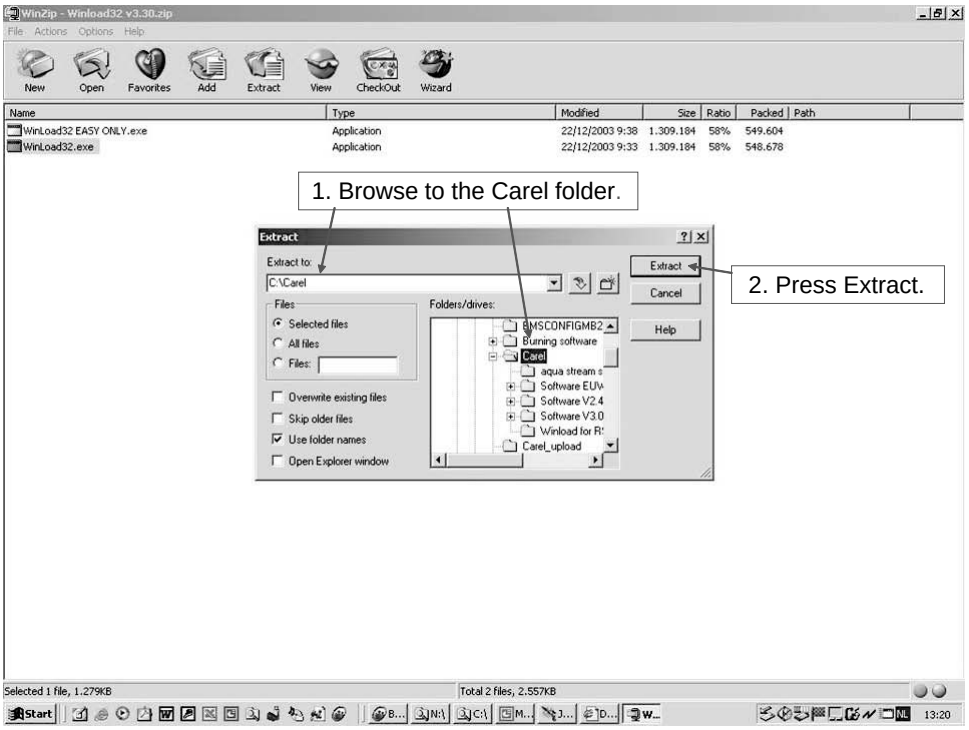
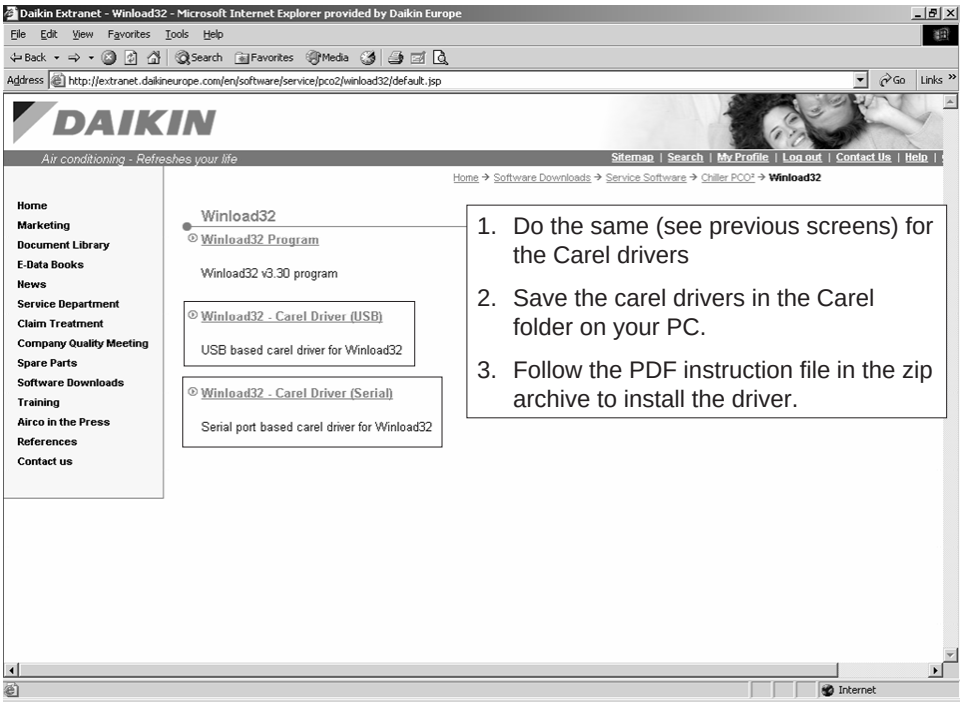
1.4 Installation of Winload32 on the PC and Programming a Controller

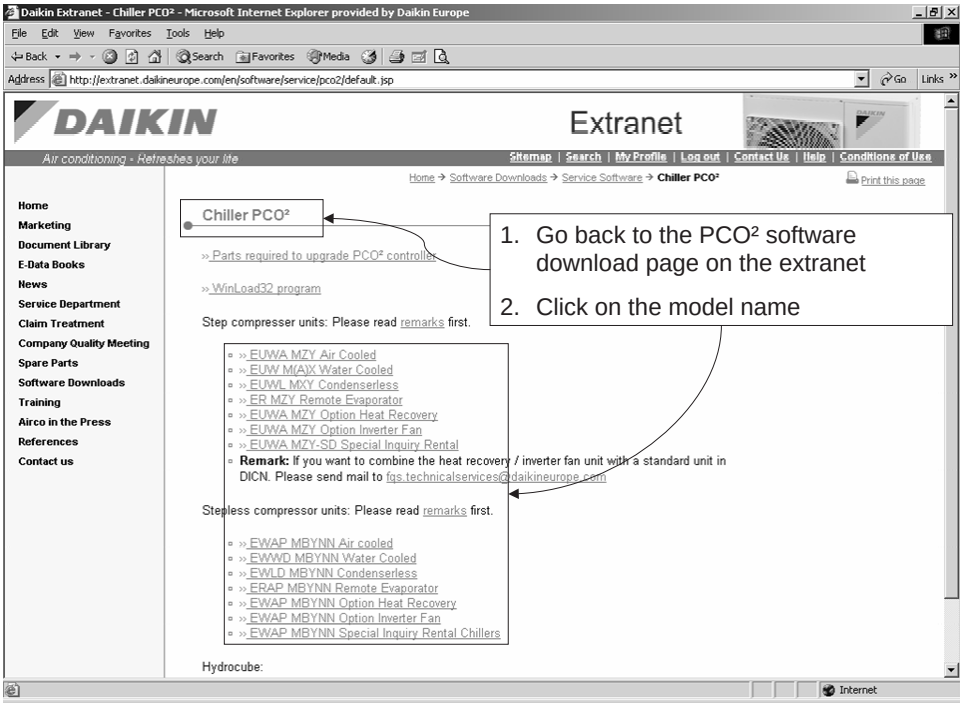
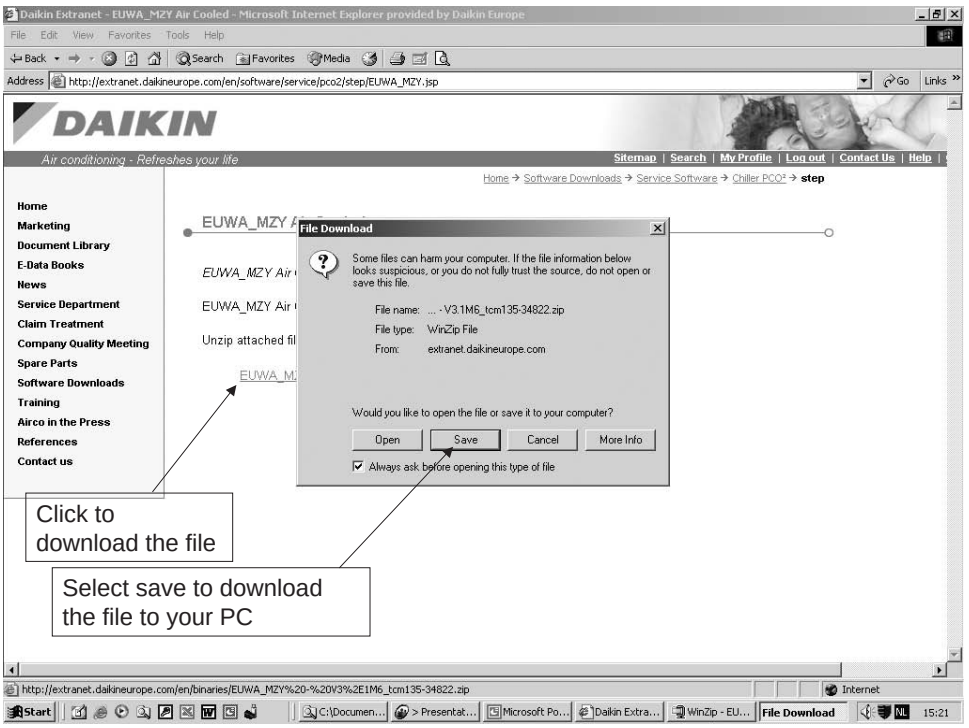
Step	Action
1	
2	

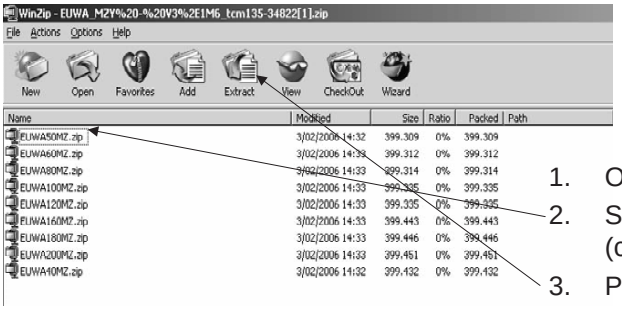
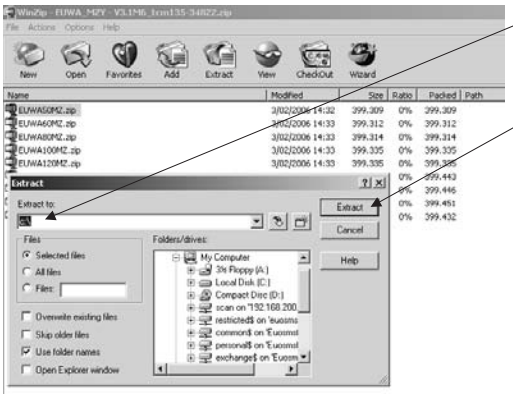
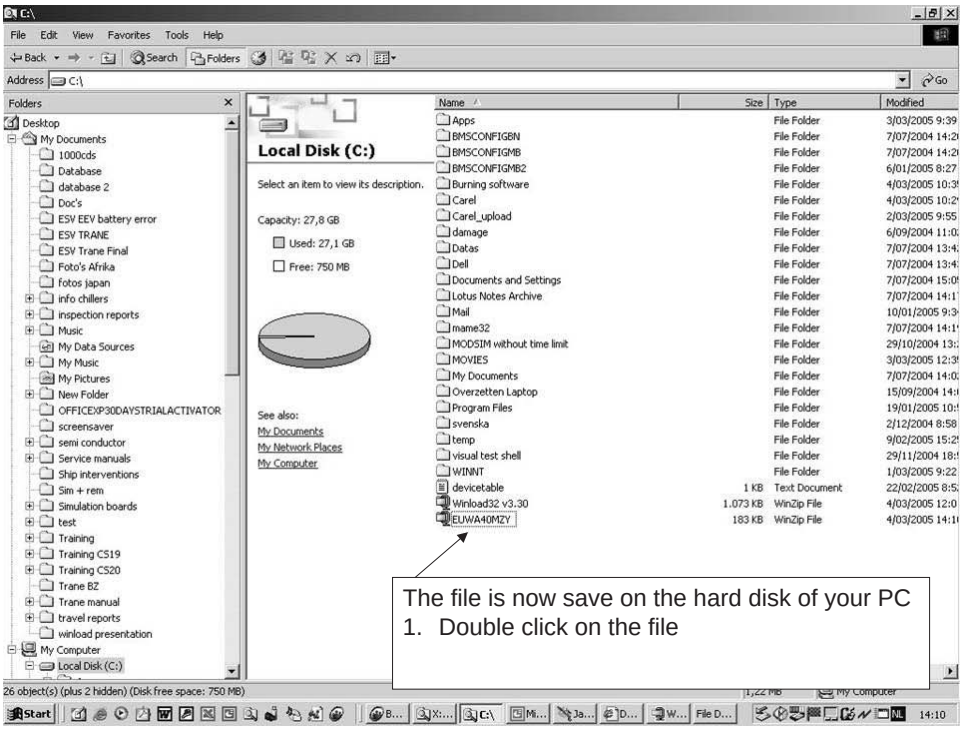
Step	Action
3	
4	

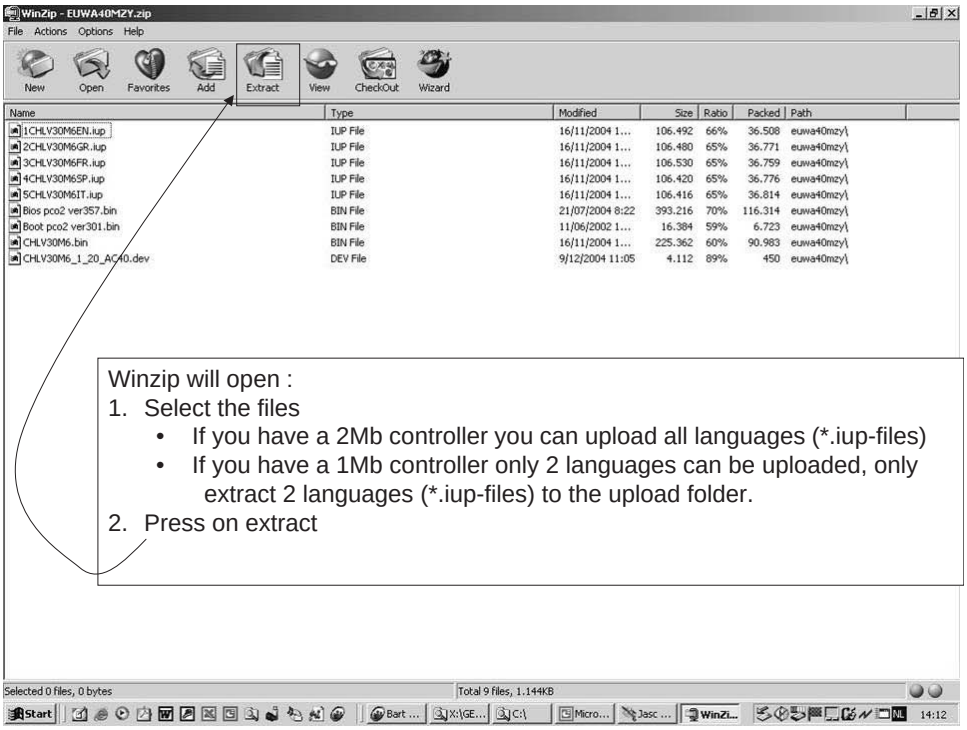
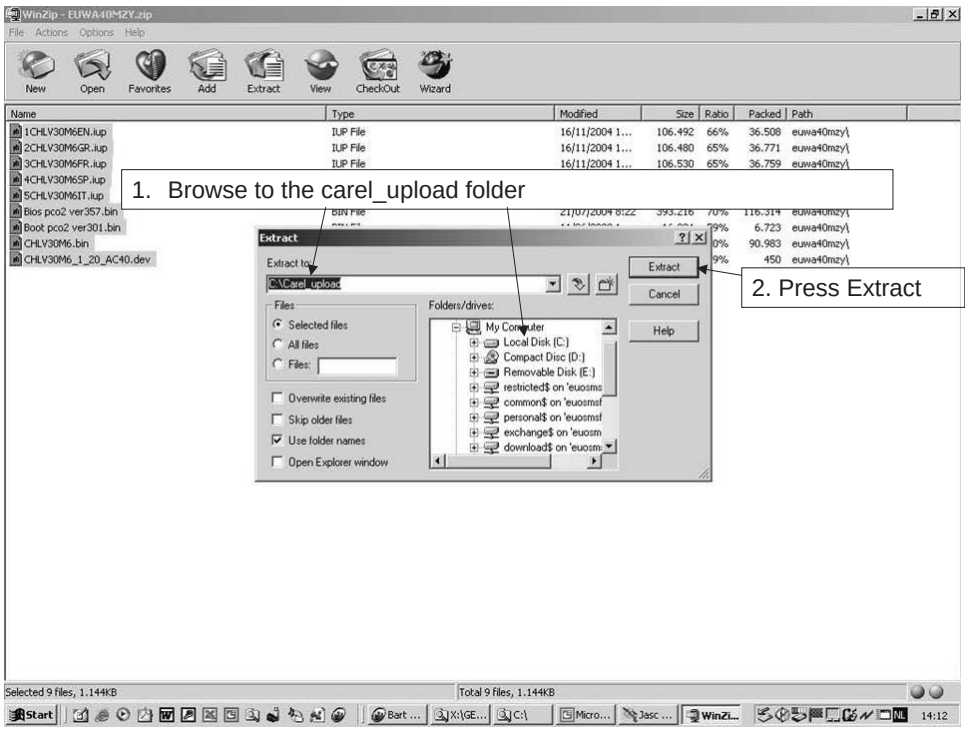
Step	Action
5	
6	

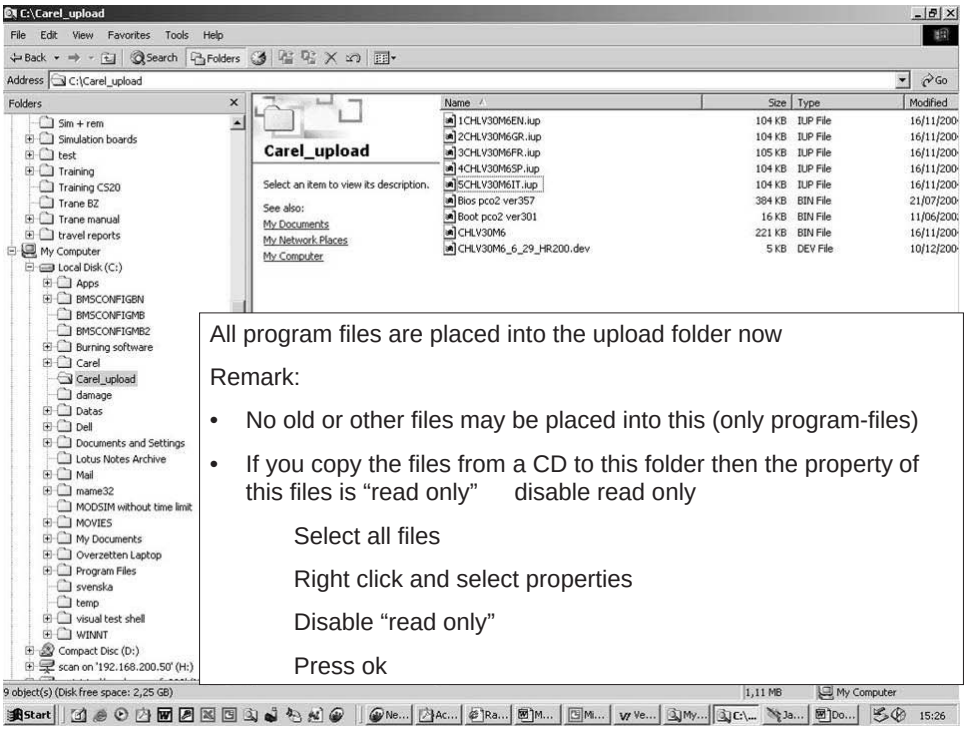
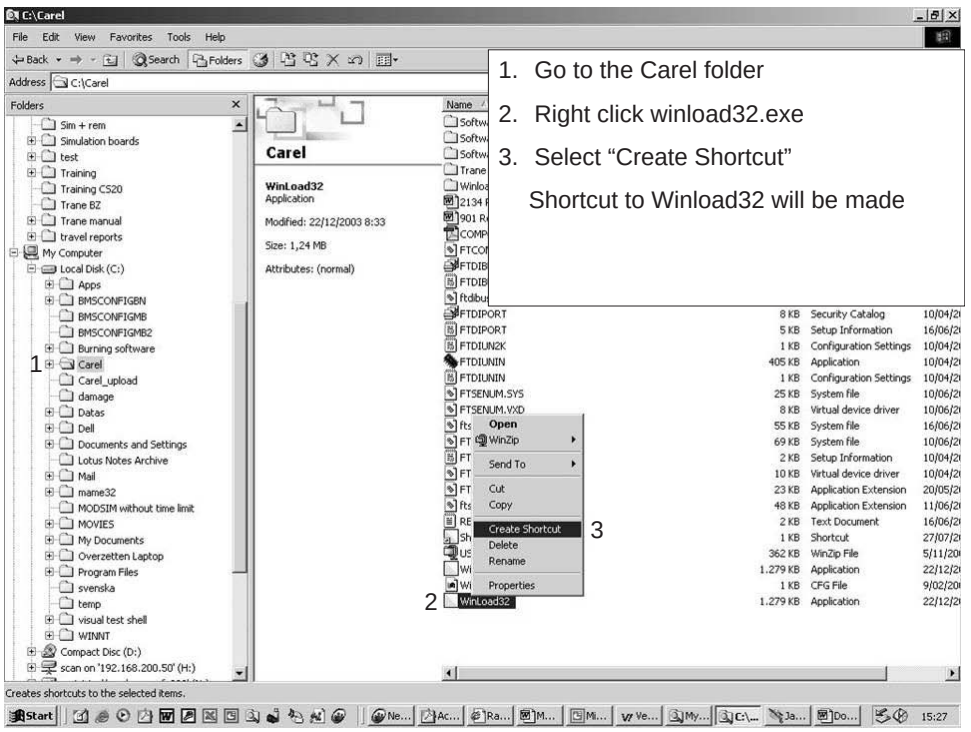
Step	Action
7	
8	

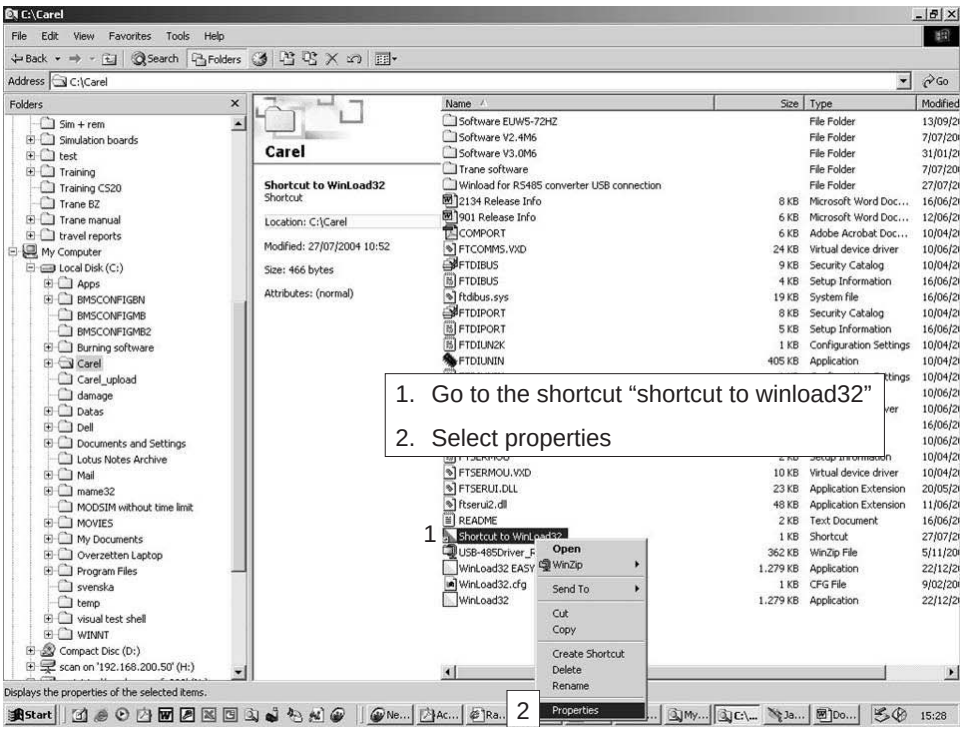
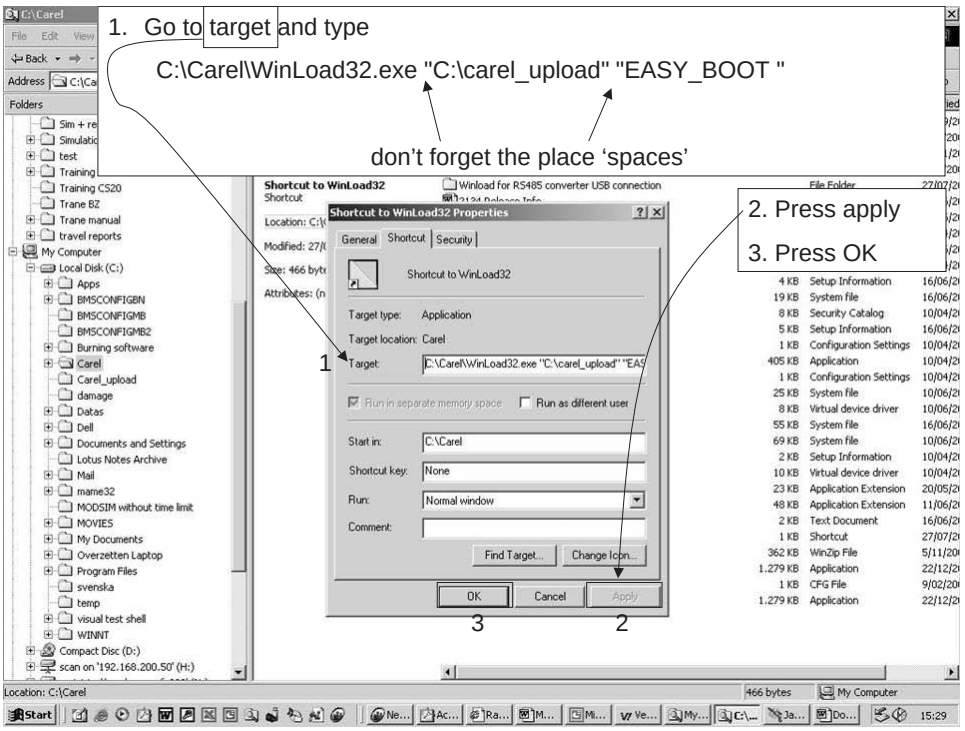
Step	Action
9	
10	

Step	Action
11	
12	

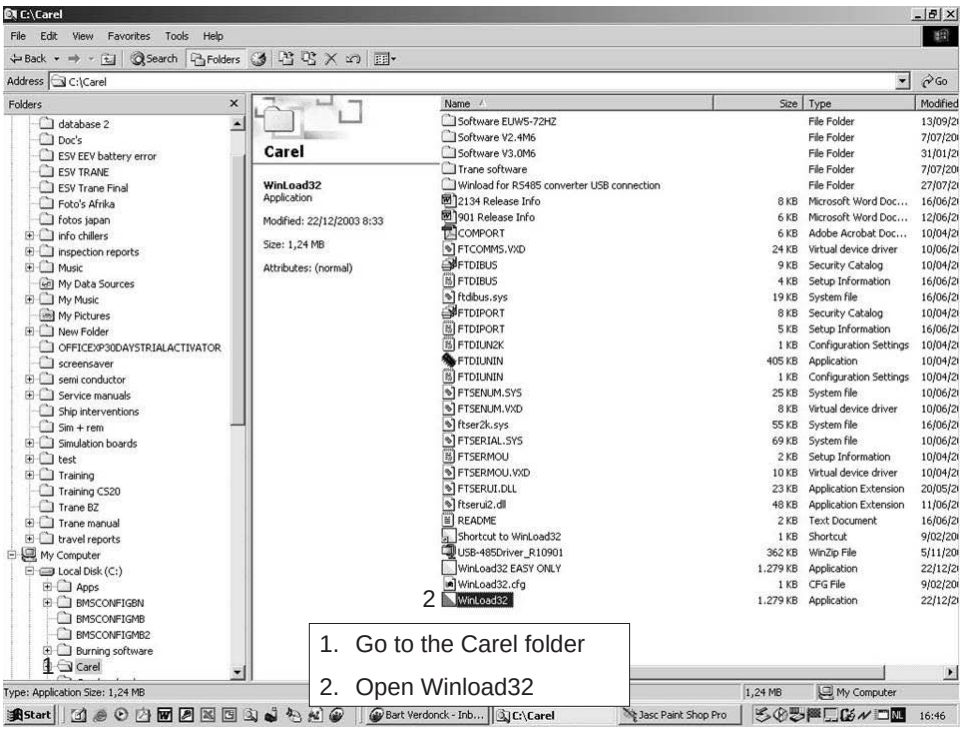
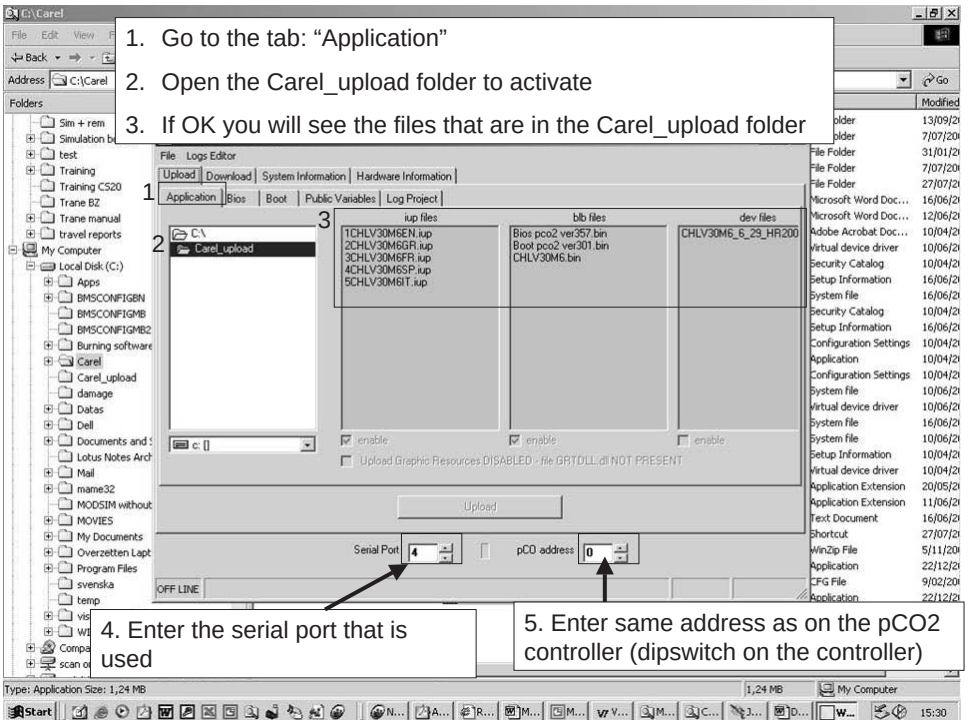
Step	Action
13	  1. Open the saved zip file 2. Select the file for the unit (capacity 3. Press extract 4. Choose a location where you want to save the file (example: C-drive) 5. Click extract
14	 The file is now save on the hard disk of your PC 1. Double click on the file

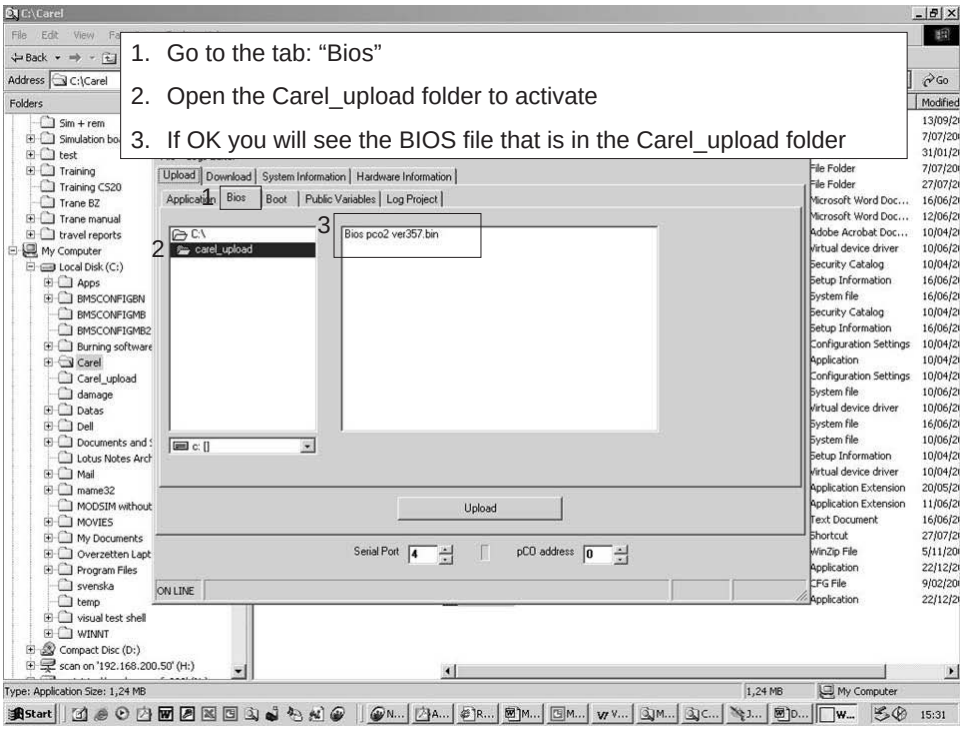
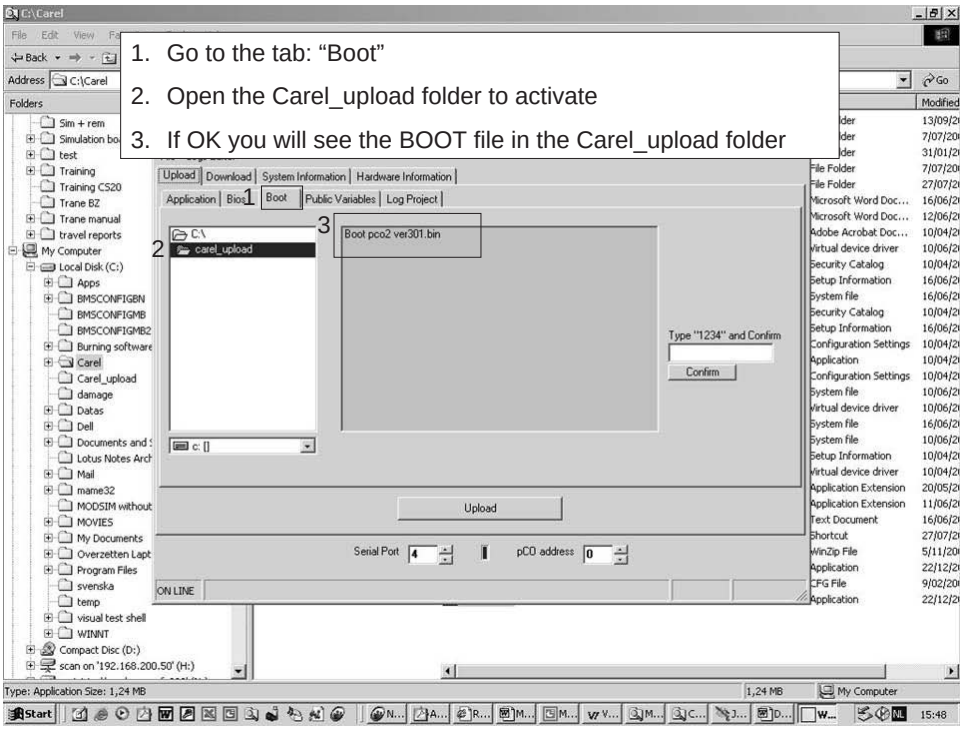
Step	Action
15	
16	

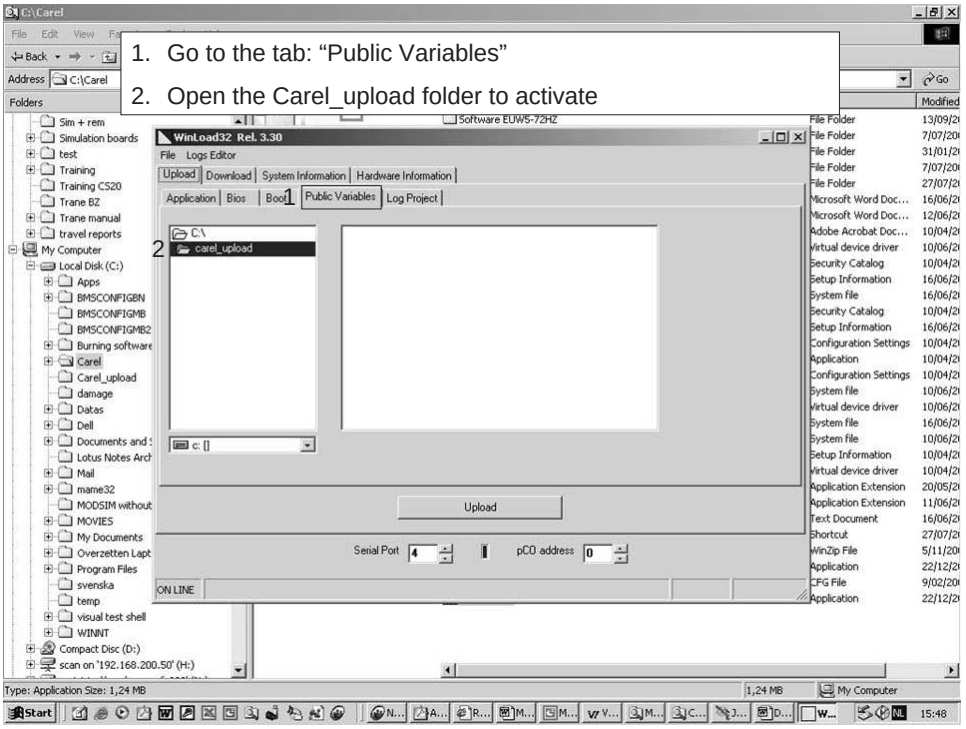
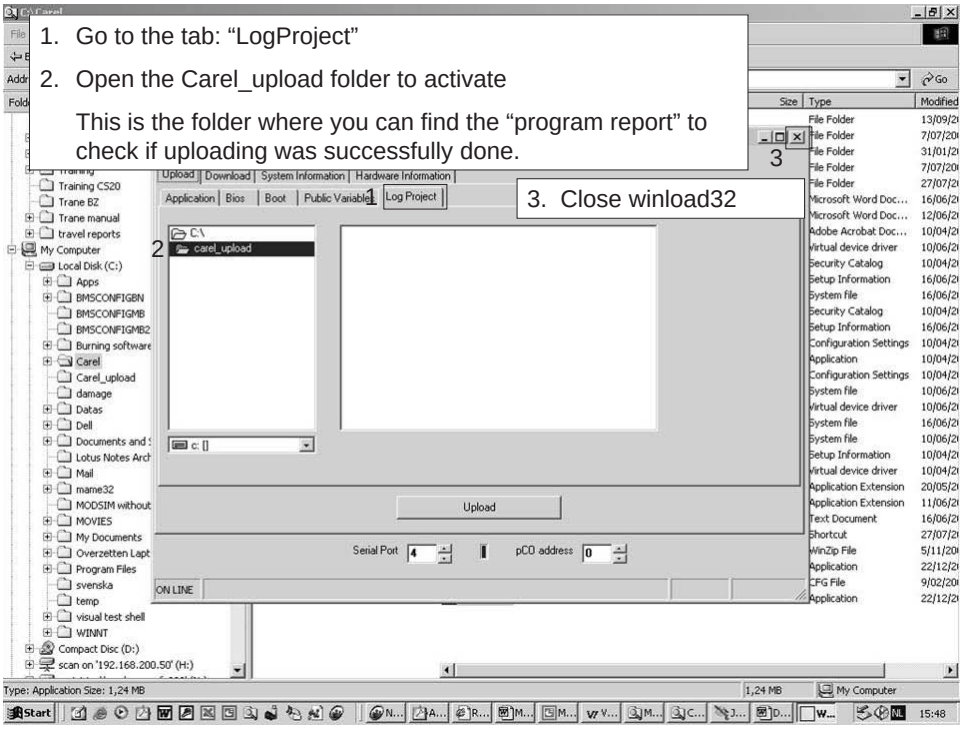
Step	Action
17	
18	

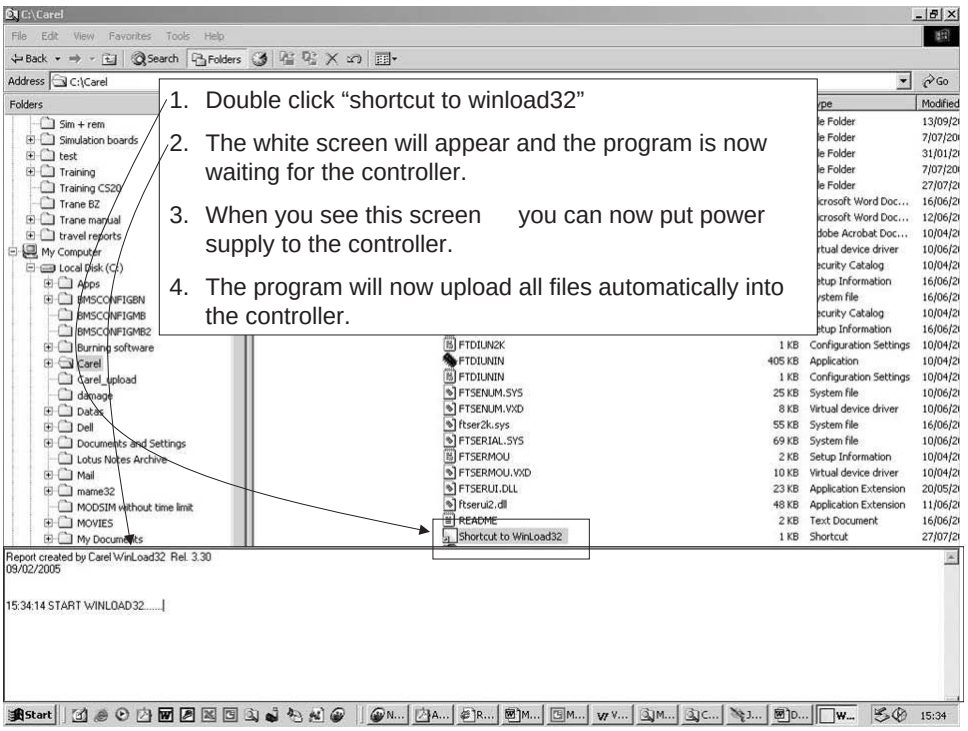
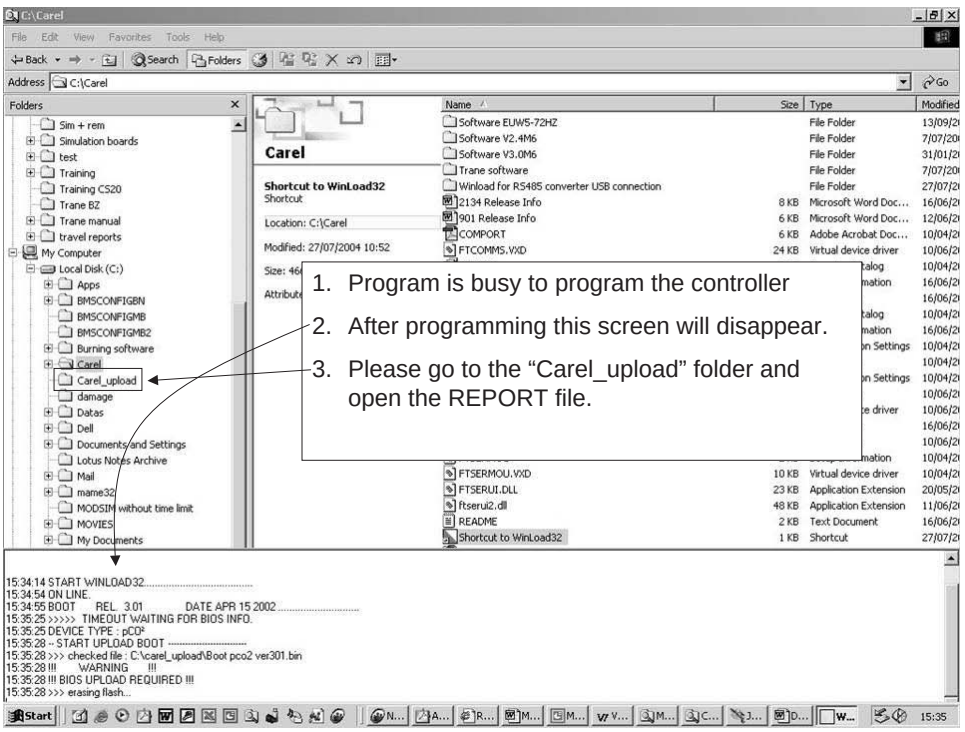
Step	Action
19	
20	

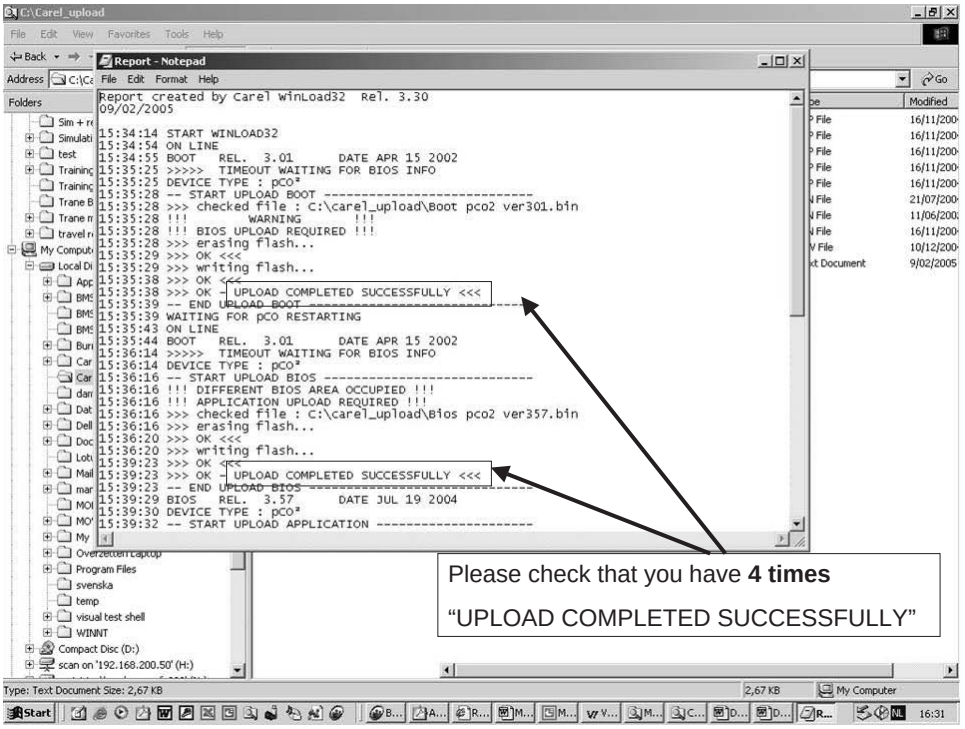
3

Step	Action
21	
22	

Step	Action
23	
24	

Step	Action
25	
26	

Step	Action
27	
28	

Step	Action
29	

1.5 Copy Software from WinLoad32 to the Software Key

Optional: Carel RS Converter (software Winload + drivers: are available on intranet)

- Switch off the pCO^2 and remove the "expansion memory" cover with a screwdriver (see "Copy from pCO² to the Software Key" on page 3–5/Fig. 1)
- Set the key selector on  (from key to pCO^2)
- Insert the key in the corresponding pin connector as shown. (see "Copy from pCO² to the Software Key" on page 3–5/Fig. 2)
- Prepare the connection for downloading the program for WinLoad32. (see also previous chapter)
- Supply power to the pCO^2 (check the red LED on the key  is on)
- Make the upload
- Once finished, switch off the pCO^2, remove the key and put the cover in its place.
- Now the key has the program transferred from WinLoad32.

2 pLAN Setting

2.1 What Is in This Chapter?

Overview

This chapter contains the following topics:

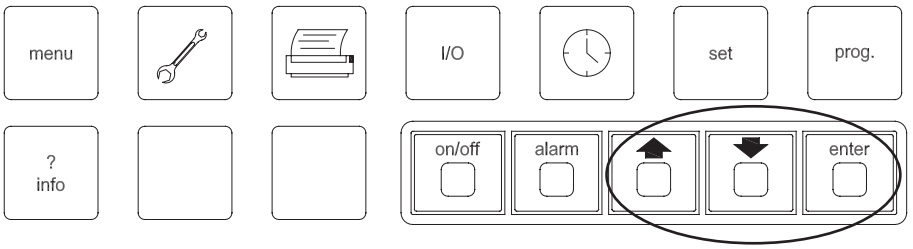
Topic	See page
2.2–pLAN Setting	3–24

2.2 pLAN Setting

Procedure

To add a terminal in the pLAN or change the settings, follow this procedure:

1 Press the UP, DOWN and ENTER buttons for at least 10 seconds.



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

Terminal Adr:	16
I/O Board Adr:	n

3 You can choose between the different boards (1, 2, 3, 4 for the compressors and 5, 7, 9, 11 for the electronic valve drivers) using the UP and DOWN buttons.

4 Select in correspondence of “I/O Board Adr” number 1(Board with address 1) and push ENTER. After 2 seconds the following screen will appear:

Terminal Config
Press ENTER
To continue

5 Push ENTER again. The following screen will appear:

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

6 If you want to add a second terminal (remote terminal), change the line “Trm2 None -” into Tmr2 17 sh”. To enable the new configuration, put the pointer on “No” using the ENTER button and change it into “Yes” using the UP and DOWN buttons and push ENTER again.

Repeat the operations from 1 to 6 for all the compressor boards. (“I/O Board” from 1 to 4)

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

Remark

It is possible that the terminal is stuck on a unit after restart. 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, disconnect the batteries from all drivers and therefore connect again.

Part 4
Commissioning and Test Run

Introduction

Commissioning and test run are well known practices in service engineering. This part contains a systematic approach on test run checks and test values, which guarantees a high quality installation and operation of the units.

What is in this part?

This part contains the following chapters:

Chapter	See page
1–Pre-Test Run Checks	4–xx
2–Test Run and Operation Data	4–xx

Part 5
Maintenance

Introduction

Preventive maintenance should be set up for operation at maximum capacity or to avoid damage. The following chapters explain how to or when to maintain the units.

What is in this part?

This part contains the following chapters:

Chapter	See page
1–Maintenance	5–3

1 Maintenance

1.1 What Is in This Chapter

Introduction

As shown in the table below, we have grouped the maintenance in maintenance of the main parts (condenser, compressor and evaporator) and periodical checks.

Precautions

Correct choices and decisions have to be made before any maintenance is done. Opening the refrigerant circuit may cause a loss of refrigerant or lead to system contamination.

- Avoid high gas concentrations.
  While the heavy concentration of the refrigerant gas will remain on the floor level, good ventilation is a must.
- Avoid all contact with open fires or hot surfaces.
  By high temperatures, the refrigerant gas R 410A may decompose into irritating and poisonous gas. Avoid skin and hand contact with the liquid refrigerant and protect your eyes against liquid splashes.

Overview

This chapter covers the following topics:

Topic	See page
1.2–Screw Compressors	5–4
1.3–Standard Controls	5–5
1.4–System Maintenance	5–6
1.5–Preventive Maintenance Schedule	5–9
1.6–Refrigerant	5–10

1.2 Screw Compressors

The newest Stargate™ single-screw compressor has a well balanced compression mechanism which cancels the screw rotor load in both the radial and axial directions. Inherent to the basic single-screw compressor design is the virtually load-free operation, that gives main bearing design life of 3-4 times greater than twin-screws, and eliminates expensive and complicated thrust balancing schemes. The two exactly opposed gaterotors create two exactly opposed compression cycles. Compression is made at the lower and upper parts of the screw rotor at the same time, thus cancelling the radial loads. Also, both ends of the screw rotor are subjected to suction pressure only, which cancels the axial loads and eliminates the huge thrust loads inherent in twin-screw compressors.

Oil injection is used for these compressors in order to get high COP at high condensing pressure. EWWQ-AJYNN units are provided with an high efficiency oil separator to maximise oil extraction.

Compressors have a infinitely variable capacity control down to 25% of its total capacity. This control is made by means of capacity slides controlled by microprocessors.

Standard start is star-delta type; Soft start type is available (as option) in order to have lower inrush current.

1.3 Standard Controls

High pressure control

The high pressure switch will shut-down the compressor when the discharge pressure exceeds the setting point value.

Warning: during testing, stand by the emergency stop switch on control panel, to shut the unit down should the safety control malfunction. Be sure that the installed gauge is accurately adjusted.

Phase/voltage monitor

The phase/voltage monitor is a device which provides protection against three-phase electrical motor loss due to power failure conditions, phase loss, and phase reversal. Whenever any of these conditions occur, a contact opens to the microprocessor which then de-energizes all inputs. When proper power is restored, contacts close and microprocessor enables compressors for operation. When three-phase power has been applied, the output relay should close and the "run light" should come on. If the output relay does not close, perform the following tests:

1. Check the voltages between L1-L2, L1-L3 and L2-L3 (L1, L2, L3 are the three phases). These voltages should be approximately equal and within + 10% of the rated three-phase line-to-line voltage.
2. If these voltages are extremely low or widely unbalanced check the power system to determine the cause of the problem.
3. If the voltages are good, using a phase tester, verify that phases are in A, B, C sequence for L1, L2 and L3.

Correct rotation is required for compressor operation. If required to do so by phase sequence, turn off the power and interchange any two of the supply power leads at the disconnect. This may be necessary as the phase voltage monitor is sensitive to phase reversal. Turn on the power. The output relay should now close after the appropriate delay.

1.4 System Maintenance

General

To ensure proper operation at peak capacity and to avoid damage to package components, a program of periodic inspections should be set up and followed. The following items are intended as a guide and are to be used during inspection and must be combined with sound coming from compressor and electrical practices to ensure troublefree performance. The liquid line sightglass indicator on all circuits must be checked to be sure the glass is full and clear. If the indicator shows that a wet condition exists and/or there are bubbles in the glass, even with a full refrigerant charge, the filter-drier element must be changed.

Compressor maintenance

The screw Frame 4 compressor does not require frequent maintenance. However, vibration test is an excellent check for proper mechanical operation. Compressor vibration is an indicator of the requirement for maintenance and contributes to a decrease in unit performance and efficiency. It is recommended to check the compressor with a vibration analyser at or shortly after start-up and again on an annual basis. When performing the test the load should be maintained as closely as possible to the load of the original test. The vibration analyser test provides a fingerprint of the compressor and when performed routinely it can give a warning of impending problems.

The compressor is supplied with a cartridge oil filter. It is a good policy to replace this filter anytime the compressor is opened for servicing.

Electrical control centre

Warning: Electric shock hazard. Turn off all electrical power supplies before continuing with following service.

Caution: It is necessary to de-energise the complete electrical panel, including crankcase heater, before doing any servicing inside.
Prior to attempting any service on the control centre it is advisable to study the wiring diagram so that you understand the operation system of the water chiller. Electrical components do not require particular maintenance other than a monthly tightening of cables.

Warning: The warranty becomes void if the wiring connection to the unit is not in accordance with the specification. A blown fuse or tripped protector indicates a short ground or overload. Before replacing the fuse or restarting the compressor, the problem must be found and corrected. It is important to have a qualified electrician to service this panel. Unqualified tampering with the controls can cause serious damage to equipment and void the warranty.

Refrigerant sight-glass

The refrigerant sight-glasses should be observed periodically (a weekly observation should be adequate). A clear liquid sight-glass indicates the right refrigerant charge in the system to insure proper feed through the expansion valve. Bubbling refrigerant in the sight-glass, during stable run conditions, indicates that the system may be short of refrigerant charge. Refrigerant gas flashing in the sight-glass could also indicate an excessive pressure drop in the liquid line, possibly due to a clogged filter-drier or a restriction elsewhere in the liquid line. If sub-cooling is low add charge to clear the sight-glass. If sub-cooling is normal and flashing is visible in the sight-glass check the pressure drop across the filter-drier. An element inside the sight-glass indicates the moisture condition corresponding to a given element colour. If the sight-glass does not indicate a dry condition after about 3 hours of operation, the unit should be pumped down and the filter-driers changed.

The following table is a guide to determinate the dry or wet condition of the system:

COLOUR	MEANS
Green (Sky Blue)	Dry
Yellow (Pink)	Wet

Filter-driers

A replacement of the filter-drier is recommended during scheduled service maintenance of the unit, any time excessive pressure drop is read across the filter-drier and/or when bubbles occur in the sightglass with normal subcooling. The maximum recommended pressure drop across the filter-drier at 75% to 100% circuit loading is 70 kPa. The maximum recommended pressure drop across the filter-drier at 25% to 50% circuit loading is 35 kPa.

The filter-drier should also be changed if the moisture indicating liquid line sightglass indicates excess moisture by the wet system color indicators. During the first few months of operation the filter-drier replacement may be necessary if the pressure drop across the filter-drier exceeds the values listed in the paragraph above. Any residual particles from the unit heat transfer tubing, compressor and miscellaneous components are swept by the refrigerant into the liquid line and are caught by the filter-drier.

To change the filter drier, pump the unit down by moving the ON/OFF compressors switches in “off” position. Move the ON/OFF switch unit Q0 to the “off” position. Turn off all power to the unit and install jumpers across the terminals. This takes out the low pressure control. Close the manual liquid line shutoff valve. Turn the power of the unit back on and restart the unit by moving the ON/OFF switch unit Q0. The unit will start pumping down past the low pressure setting. When the evaporator pressure reaches 0.3 bar, move switch Q0 to the “off” position. Remove the jumper.

Close the suction line valve. Remove and replace the filter-drier. Evacuate the lines through the liquid line manual shutoff valve to remove non condensables that may have entered during filter replacement. Open the suction line valve. A leak check is recommended before returning the unit to operation.

Electronic expansion valve

The EWWQ-AJYNN water cooled chiller is equipped with the most advanced electronic expansion valve to achieve precise control of refrigerant mass flow. As today’s system requires improved energy efficiency, tighter temperature control, wider range of operating conditions and incorporate new features like remote monitoring and diagnostics, the application of electronic expansion valves becomes mandatory. EWWQ-AJYNN’s electronic expansion valve proposes features that makes it unique: short opening and closing time, high resolution, positive shut-off function to eliminate use of additional solenoid valve, highly linear flow capacity, continuous modulation of mass flow without stress in the refrigerant circuit and corrosion resistance stainless steel body.

Evaporator

The evaporator is a direct expansion type with refrigerant inside the copper tubes and water on the outside. The evaporators are manufactured with carbon steel shells, high efficiency copper tubes and polypropylene baffles. The copper tubes are roll expanded into carbon steel tube plates.

Condensers

Condensers are shell and cleanable, through-tube type (1 pass). The unit has independent condensers, one per circuit. Each condenser has a carbon steel and seamless, integrally finned high efficiency copper tubes, roll expanded into heavy carbon steel tube sheets. Water heads are removable and include vent and drain plugs. Condensers come complete with liquid shut-off valve, spring loaded relief valve.

Note: The units are furnished with 1 pass condensers as standard (water entering a side and water leaving the opposite side of the heat exchanger).

Lubrificating oils

Besides lubrificating the bearing and other moving parts, the oil has the equally important task of sealing the clearances between the rotors and other potential leakage paths thereby improving pumping efficiency; the oil also assists in dissipating the heat of compression. The amount of oil injected is therefore well in excess of that required for lubrification only.

Lubricating oil approved for use with the Screw compressor in this type of unit is POE Emkarate RL220H. The oil differential pressure switch monitors the pressure differential between oil injection pressure and compressor suction pressure.

After the compressor has started and been in operation for a short time, allowing sufficient time for the system pressure differential to become established, the oil differential pressure switch is brought into the safety trip circuit. Oil is now being supplied to the compressor under the action of the system pressure differential, monitored by the switch. If the pressure differential falls below the switch contacts 'break' setting and the oil differential pressure switch trips and stops the compressor.

Because the oil pressure is generated by discharge pressure, a minimum discharge pressure must be maintained; this minimum pressure increases as the suction pressure increases in order to maintain the pressure difference required.

Crankcase and oil separator heaters

The function of the heaters is to prevent oil diluition with refrigerant during compressor shutdown, which would cause foaming and consequent reduction in lubricating oil flow to the moving parts. Electric heaters are energized every time the compressor shuts-down.

Warning: Verify the heaters have operated for at least 12 hours prior to start-up.

1.5 Preventive Maintenance Schedule

Overview

Operation Ref. No.	TYPE OF OPERATION	SCHEDULE			
		Weekly	Monthly	Six-Monthly	Yearly
1	Reading and recording of suction pressure	**x**			
2	Reading and recording of discharge pressure	**x**			
3	Reading and recording of supply voltage	**x**			
4	Reading and recording of current intensity	**x**			
5	Check refrigerant charge and possible moisture in the circuit refrigerant through the liquid sight glass	**x**			
6	Check the suction temperature and the superheating		**x**		
7	Check setting and operation of safety devices		**x**		
8	Check setting and proper operation of control devices			**x**	
9	Inspect the condenser for possible scaling or studging				**x**

1.6 Refrigerant

Refrigerant charging

EWWQ-AJYNN water cooled screw chillers are shipped factory charged with a full operating charge of refrigerant but there may be times that a unit must be recharged at the jobsite. Follow these recommendations when field charging.

EWWQ-AJYNN water cooled screw chillers are more sensitive to under-charging than to overcharging therefore it is preferable to be slightly overcharged rather than undercharged on a circuit. The optimum charge is the charge which allows the unit to run with a solid stream of liquid in the liquid line at all operating conditions. When the liquid line temperature does not drop with the addition of 2.2-4.5 Kg of charge then the subcooler is nearly full and proper charge has been reached. If the liquid line temperature does not drop and the discharge pressure goes up 20.7-34.5 kPa as 2.2-4.5 Kg of refrigerant is added the correct maximum charge has been reached. Unit charging can be done at any steady load condition, at any outdoor ambient temperature. Unit must be allowed to run 5 minutes or longer so that the condenser fan staging is stabilized at normal operating discharge pressure.

In case moisture is noticed in the system, through the moisture indicator, the system must be evacuated to eliminate cause of trouble. After the evacuation, the system must be dried reducing it to an almost perfect vacuum. For this purpose, a displacement vacuum pump should be used.

Any moisture and air left in the system will be absorbed by the dry nitrogen used to break the vacuum, and they will be almost completely removed by the three evacuations. If burnt oil or sludge are found in the refrigerant circuit (caused by the compressor motor burn-out), before the vacuum operation it will be necessary to carefully clean the system using the filter dryer cleaneout method; which basically involves the use of special filter dryers incorporating a suitable desiccant in both the liquid and suction lines.

Excessive refrigerant losses can also leak oil from the system. Check the separator oil level during operation and ensure that oil is visible in the top sightglass.

1 If the unit is slightly undercharged the unit will show bubbles in the sightglass. Recharge the unit.

2 If the unit is moderately undercharged the unit will most likely trip on freeze protection. Recharge the unit as described in the charging procedure below.

Procedure to charge a moderately undercharged EWWQ-AJYNN unit

1 If a unit is low on refrigerant you must first determine the cause before attempting to recharge the unit. Locate and repair any refrigerant leak. Evidence of oil is a good indicator of leakage however, oil may not be visible at all leaks. Liquid leak detector fluids work well to show bubbles at medium size leaks but electronic leak detector may be needed to locate small leaks.

2 Add the charge to the system through the schrader fitting on the tube entering the evaporator between the expansion valve and the evaporator head.

3 The charge can be added at any load condition.

Charging the refrigerant

1 Connect the refrigerant bottle with a filling pipe to the filling valveon the evaporator head. Before firmly tightening the refrigerant bottle valve, open it and force the air out from the filling pipe. Tighten the charging valve connection.

2 When the refrigerant stops to enter the system, start the compressor and complete the refrigerant charge.

3 When the exact quantity of refrigerant has been predetermined, check the liquid sight glass.

If you do not know how much refrigerant has to be added, shut off the bottle valve every 5 minutes and continue to charge the refrigerant until the sight glass is clear and free from bubbles.

Note: Do not discharge the refrigerant into the atmosphere. To recover it, use empty, clean and dry bottles. The liquid refrigerant recovery can be made through the valve provided on the condenser coil subcooler outlet. To facilitate the recovery of refrigerant, put the bottle inside a container full of ice; avoid excessive filling of the bottle (70÷80% max).

2 Appendix B

2.1 What Is in This Chapter

Overview

This chapter covers the following topics:

Topic	See page
2.2–General Chiller Start-up Guide	5–20

2.2 General Chiller Start-up Guide

Introduction

Detailed procedures will vary from chiller to chiller, but this guide is intended to indicate the principle items to be checked on any Daikin chiller to ensure that the commissioning process is adequate. It is not exhaustive and could be added to if necessary, particularly where optional accessories are included. Whilst all chillers are run at the factory, this is only a brief functional test and it does not remove the need for all relevant commissioning checks to be carried out.

(he procedures are in approximate chronological order.

Air cooled chillers

- Once delivered to site, ensure that the installation instructions are followed carefully: particularly the correct lifting and moving of the unit, spacing from walls and other chillers, pipework connections etc.
- Check the correct positioning of anti-vibration mounts (if fitted) and check that any devices for transportation are removed.
- Make a close visual inspection of the chiller for transport damage and general condition. Inform the Service Department at Daikin Europe of any problems.
- Carry out a refrigerant leak check of the whole unit, report and fix any leaks.
- Check that there is a suitable strainer in the water-pipes to the evaporator, that the pipes are purged of air and that at no time does the water flow exceed 120% of the design figure.
- Check that the main power cables have been installed correctly, with the correct phase rotation, with no mechanical strain on the terminals and correctly glanded in the electrical panel entry plate.
- Opening the power and control sections of the panel, make a visual inspection for damage or omissions. Check the tightness of all accessible cable terminations.
- Remove the main compressor fuses and apply power to the panel. Check functioning of the Carel controller. Make any required changes to default settings. Make a written record of all set-up parameters.
- Using calibrated gauges and thermometer, check the calibration of all pressure transducers and temperature sensors. Re-calibrate as necessary.
- Carry out a ‘dry run’ of the start sequence and check correct functionality.
- Check all refrigerant service valves and ensure that they are in the correct position for normal operation
- Start evaporator pump and check for correct water flow by measuring evaporator pressure drop. Correct as necessary by throttling the water in the evaporator outlet or by other means if available. Check correct operation of flow switch.
- Check evaporator water inlet temperature. If it is above the maximum catalogue value ensure that the ‘soft-load’ and/or ‘high temperature start’ and/or EXV MOP features are enabled to ensure safe operation. If these features are not available, and it is not possible to reduce the water temperature, either operate the compressor capacity control manually or consider the possibility to reduce the water flow temporarily to ensure that the suction pressure is not too high. If in any doubt, consult the Daikin Europe Service Department.
- Replace main fuses and, if oil heaters have been on long enough to establish superheat in the oil separator, start circuit 1, leaving the other circuit(s) manually switched off.
- Observe operating conditions, in particular, suction and discharge superheats, liquid subcooling and evaporator and condenser approach temperatures. Adjust refrigerant charge, and/or control settings, as necessary.
- Check correct operation of compressor capacity control, expansion valve operation, condenser fan control plus other optional devices.
- Ensure that all condenser fans are rotating in the correct direction. Most units do not have dividers between fans and so the only way to be sure that all fans are rotating correctly is to check them visually. Make sure that this is done in a safe way.

- Check the operation of all safety devices, either by adjusting the operating conditions to cause an alarm, or by changing the alarm setpoint.
- Repeat for all other circuits, one at a time. And then with all circuits together.
- When the unit is operating correctly with all circuits, and as close to design conditions as possible, take a full log and record the final software settings. Complete the standard log sheet and return to Daikin Europe Service Department.
- Make a note of any anomalies in the operating conditions or application.
- Check that the unit is acceptable to the client and establish with him that the warranty starts from this date, preferably in writing.

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Direct Expansion Water-cooled chillers

- Once delivered to site, ensure that the installation instructions are followed carefully: particularly the correct lifting and moving of the unit, spacing from walls and other chillers, pipework connections etc.
- Check the correct positioning of anti-vibration mounts (if fitted) and check that any devices for transportation are removed.
- Make a close visual inspection of the chiller for transport damage and general condition. Inform the Daikin Europe Logistic Department in case of transport damage.
- Carry out a refrigerant leak check of the whole unit, report and fix any leaks.
- Check that there is a suitable strainer in the water-pipes to the evaporator and condenser and that all pipes are full of water and purged of air. At no time must the water flow exceed 120% of the design figure.
- Check that the main power cables have been installed correctly, with the correct phase rotation, with no mechanical strain on the terminals and correctly glanded in the electrical panel entry plate.
- Opening the power and control sections of the panel, make a visual inspection for damage or omissions. Check the tightness of all accessible cable terminations.
- Remove the main compressor fuses and apply power to the panel. Check functioning of the Carel controller. Make any required changes to default settings. Make a written record of all set-up parameters.
- Using calibrated gauges and thermometer, check the calibration of all pressure transducers and temperature sensors. Re-calibrate as necessary.
- Carry out a ‘dry run’ of the start sequence and check correct functionality.
- Check all refrigerant service valves and ensure that they are in the correct position for normal operation
- Start evaporator pump and check for correct water flow by measuring evaporator pressure drop. Correct as necessary by throttling the water in the evaporator outlet or by other means if available. Check correct operation of flow switch.
- Start condenser pump and check for correct water flow by measuring condenser pressure drop. Correct as necessary by throttling the water in the condenser outlet or by other means if available. Check correct operation of flow switch if fitted.
- Check the correct functioning of whatever means the client is using to control condenser water inlet temperature.
- Check evaporator water inlet temperature. If it is above the maximum catalogue value ensure that the ‘soft-load’ and/or ‘high temperature start’ and/or EXV MOP features are enabled to ensure safe operation. If these features are not available, and it is not possible to reduce the water temperature, either operate the compressor capacity control manually or consider the possibility to reduce the water flow temporarily to ensure that the suction pressure is not too high. If in any doubt, consult Daikin Europe Service Department.

- In addition, ensure that there is sufficient temperature difference between evaporator and condenser entering temperatures to provide a ratio of more than 2 to 1 between the saturated evaporator and condenser pressure, in absolute, at the start-up. If not, either change the temperatures if possible or, at least, monitor the pressure difference at start-up as the unit may trip if the pressure ratio is too low.
- Replace main fuses and, if oil heaters have been on long enough to establish superheat in the oil separator (Min 4 hours), start circuit 1, leaving the other circuit(s) manually switched off.
- Observe operating conditions, in particular, suction and discharge superheats, liquid subcooling and evaporator and condenser approach temperatures. Adjust refrigerant charge and/or control settings, as necessary.
- Check correct operation of compressor capacity control, expansion valve operation, condenser water temperature control plus any other optional devices.
- Check the operation of all safety devices, either by adjusting the operating conditions to cause an alarm, or by changing the alarm setpoint.
- Repeat for all other circuits, one at a time. And then with all circuits together.
- When the unit is operating correctly with all circuits, and as close to design conditions as possible, take a full log and record the final software settings.
- If the unit incorporates heat-recovery or heat pump operation, repeat the unit operation checks in heating mode and, again, take a full log. Complete the standard log sheets and return to Daikin Europe Service Department. If heating operation is not possible at the time of commissioning, arrange with the client to return when it is possible.
- Make a note of any anomalies in the operating conditions or application.
- Check that the unit is acceptable to the client and establish with him that the warranty starts from this date, preferably in writing.

IF IN DOUBT CALL DAIKIN EUROPE SERVICE DEPARTMENT

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