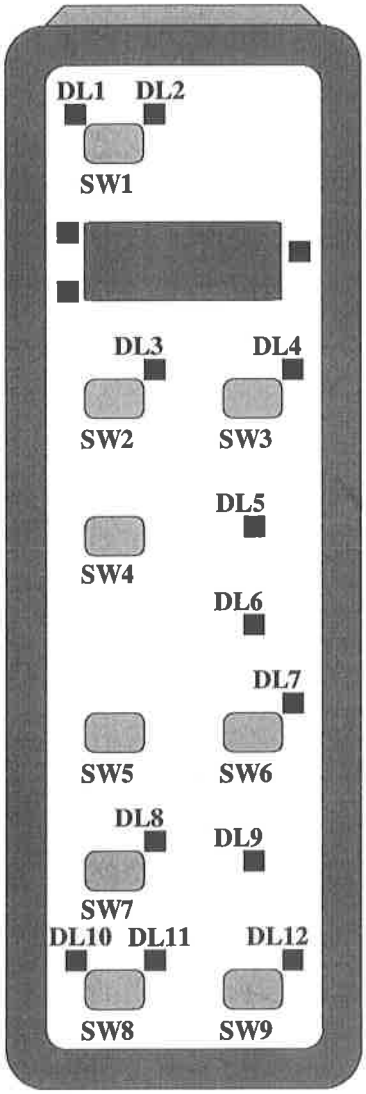
OPERATING MANUAL
Advanced Control System

The basic control system for the Ecologic

with three to six compressors



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CONTENTS

1. PREFACE

Please read this operating manual carefully prior to commissioning the Refac water chiller or condensing unit. Familiarise yourself with the working and operation of the control and closely follow the instructions.

We would like to stress the importance of training with respect to the correct handling of the chiller or condensing unit. Please consult Refac on the options available in this field. It is important that this manual be stored in a permanent location in the vicinity of the machine.

To determine the relevant functionality for your application, this user manual must be consulted in conjunction with the user instructions specific to your REFAC chiller

For all guidelines pertaining to safety, use and maintenance and warranty, reference should also be made to the user instructions applying to your specific REFAC chiller.

Please do not hesitate to contact one of our employees should you require further information on specific chiller subjects. For telephone numbers see bottom of this page.

The data published in this manual is based on the most recent information available. It is supplied conditional to later modifications. We reserve the right to modify the construction and/or design of our controls, at any time, without prior notification or obligation to adapt previous supplies accordingly.

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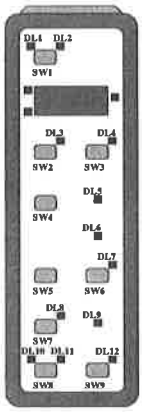
2. DESIGN

2.1. Basic configuration

The basic configuration consists of an autonomous control unit. The microcontroller conforms to the following standards: EN50081-1 / EN50082-1 / EN55014 / EN55104 / EN60335

The basic configuration consists of a microcontroller with one or two fan-speed regulators for one or two circuits respectively. The machine is prevented from starting up when the outside air temperature is too low (less than 0°C) by an outside air temperature thermostat.

A microcontroller



Outside temperature thermostat

When the condensing unit control is operated, the water inlet and outlet sensors are deactivated. A special interface and an outside air sensor are added. Depending on their type, the condensing units in the Ecologic range have 2 to 6 capacity levels. In order to activate a level, an (external) floating contact must be made. The interface translates these 6 (maximum) levels into a signal that the microprocessor can use. If it is not possible to control the condensing unit with floating contacts, you should contact the sales department at Refac B.V. to obtain the right control system for your needs.

2.2. Sensors

In order to be able to measure different temperatures, the microcontroller and the outside air thermostat are provided with type PTC temperature sensors. This PTC comes in two versions:

Code A750500050 (PTC sensor with 3 metre cable)
Code A750500052 (PTC sensor with 10 metre cable)

Position of the microcontroller sensors	Chiller		Condensing units	
	1 circuit	2 circuits	1 circuit	2 circuits
Water inlet sensor	1 x	1 x	-	-
Water outlet sensor	1 x	1 x	-	-
Outside air sensor	-	-	1 x	1 x
Condensation temp. sensor circuit 1	1 x	1 x	1 x	1 x
Condensation temp. sensor circuit 2	-	1 x	-	1 x

In both the chiller and condensing unit versions, the outside air thermostat has one sensor.

The sensors have the following relationship between temperature and electrical resistance:

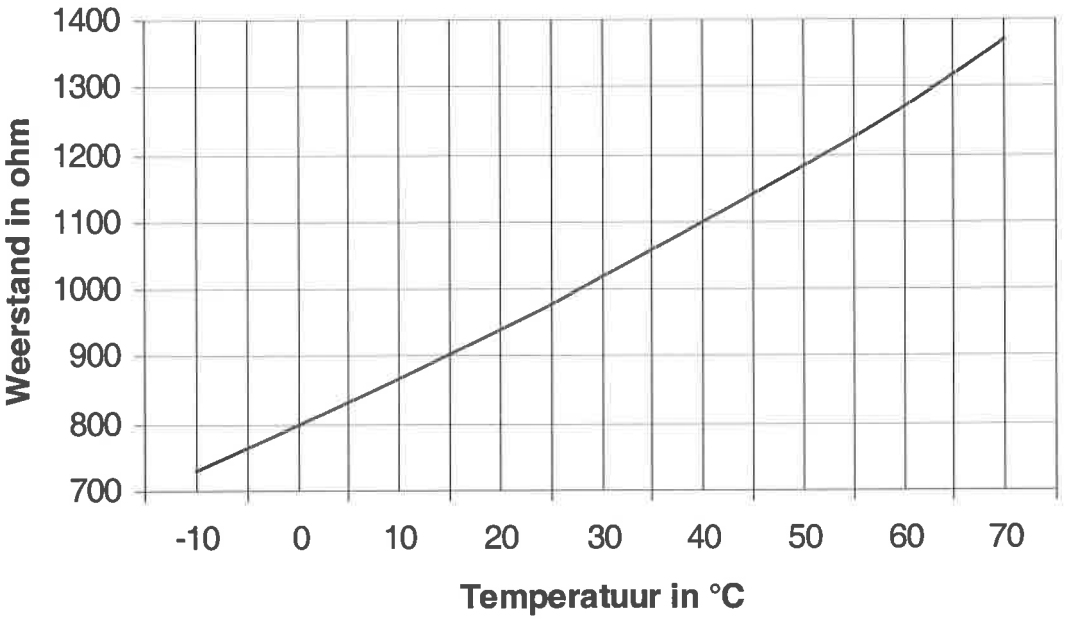


Figure 1 Temperature resistance relationship of the PTC sensors

3. DESCRIPTION OF THE USER INTERFACE

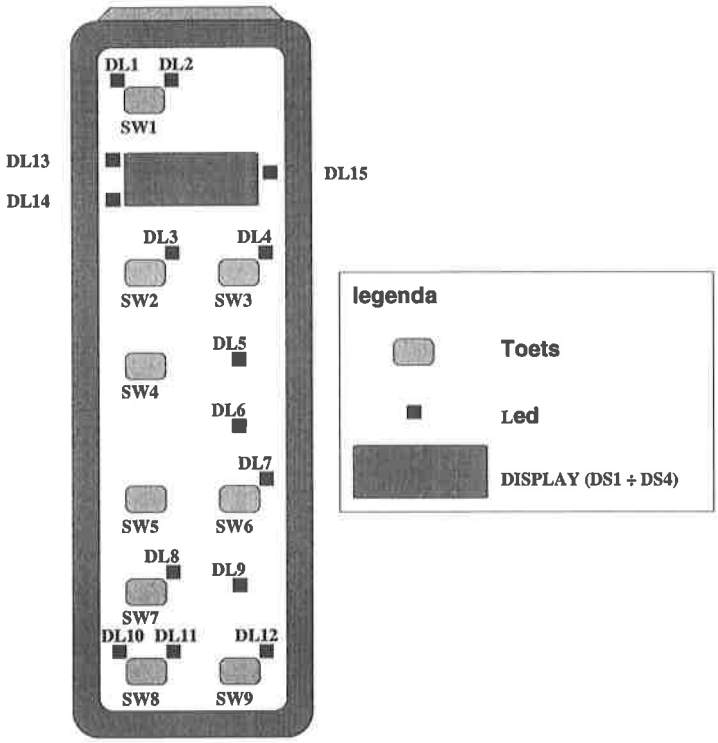
3.1. Standard display

The control panel has a number of keys, a display and various LEDs. Depending on the type of machine, it may be that certain keys and/or LEDs are irrelevant for you. After the voltage is checked, all the LEDs should light up so that their operation can be verified. After a few seconds, the water outlet temperature appears on the display. If your machine is a condensing unit, the outside air temperature should be displayed. Using the SW1 key, you can quickly show certain data on the display.

	Chiller	Condensing unit
Standard	Water outlet temperature	Outside air temperature
Press SW1 once	Water inlet temperature	Converted input signal
Press SW1 twice	If there is a second circuit, condensation temperature circuit 2 Otherwise the reading is 000.0	If there is a second circuit, condensation temperature circuit 2 Otherwise the reading is 000.0

In the case of condensing units, the switching signal for the desired number of cooling levels is converted to a value between 0 (machine switched off) and a maximum of 30 (6 cooling levels active). The maximum value depends on the number of levels in your condensing unit:

Number of active compressors	0	1	2	3	4	5	6
Converted value	-1 to 1	4 to 6	9 to 11	14 to 16	19 to 21	24 to 26	29 to 30



Element	Description
Display	4 digit display with decimal point. Three LEDs to indicate the units or whether a value is positive or negative.
SW1	Display key
SW2	Menu key
SW3	"SET" or "VALUE" key
SW4	"UP" key
SW5	"DOWN" key
SW6	Alarm list key
SW7	Not applicable
SW8	Operating mode key
SW9	Alarm on/off/reset key
DL1	Water outlet temperature / Outside air temperature
DL2	Condensation temperature of the first circuit
DL3	LED of the "MENU" key
DL4	LED of the "SET" or "VALUE" key
DL5	Sensor alarm LED
DL6	General alarm LED
DL7	LED for the alarm list key
DL8	Not applicable
DL9	Not applicable
DL10	"COLD" LED indicates the operating mode
DL11	"WARM" LED indicates the operating mode
DL12	LED indicates whether the supply voltage is present
DL13	LED indicates that measurements are in degrees Celsius
DL14	LED indicates that measurements are in Bar
DL15	LED indicates that measurements are in hours

3.2. Displaying hour counters and measured values

When the "menu" button is pressed, the hour counters or the values measured by the sensors can be displayed. The correct parameters can be selected using the "UP" (SW4) and "DOWN" (SW5) buttons. After finding the correct parameter, the value can be read by pressing the "SET" (SW3) button. If you now want to return to the standard display, press the "SET" (SW3) button followed by the "MENU" (SW2) button.

Parameter	Description	Range / Unit
SET C	**Setpoint for the chiller**	°C
PR1	Sensor 1	°C
Pr2	Sensor 2	°C
Pr3	Sensor 3	°C
Pr4	Sensor 4	°C
Hr 1	Hour counter for compressor 1	0 .. 32000 hours
Hr 2	Hour counter for compressor 2	0 .. 32000 hours
Hr 3	Hour counter for compressor 3	0 .. 32000 hours
Hr 4	Hour counter for compressor 4	0 .. 32000 hours
Hr 5	Hour counter for compressor 5	0 .. 32000 hours
Hr 6	Hour counter for compressor 6	0 .. 32000 hours

4. Alarm messages

When the general alarm LED is lit up (DL6), this indicates an alarm/fault. Press the alarm button (SW6) to display the first alarm message. By pressing UP (SW4) and DOWN (SW5), any other alarms that may be present can be displayed. Each alarm has its own code. This code indicates which fault is causing the alarm. A number of alarms are automatically reset when the fault is rectified. Faults where an inspection by specialised personnel is required must be reset manually. The microcontroller can be reset by briefly pressing the "ON/OFF" button (SW9) once.

Alarm code	Description of the alarm	Blocked	Delay (sec.)	Reset
AL01	Alarm compressor 1 or high pressure circuit 1	compressor 1 or circuit 1	0 0	Automatic or manual (high pressure switch)
AL02	Alarm compressor 2 or high pressure circuit 1	compressor 2 or circuit 1	0 0	Automatic or manual (high pressure switch)
AL03	Alarm compressor 3 or high pressure circuit 1	compressor 3 or circuit 1	0 0	Automatic or manual (high pressure switch)
AL04	Alarm compressor 4 or high pressure circuit 2	compressor 4 or circuit 2	0 0	Automatic or manual (high pressure switch)
AL05	Alarm compressor 5 or high pressure circuit 2	compressor 5 or circuit 2	0 0	Automatic or manual (high pressure switch)
AL06	Alarm compressor 6 or high pressure circuit 2	compressor 6 or circuit 2	0 0	Automatic or manual (high pressure switch)
AL07	n/a	-	-	-
AL08	n/a	-	-	-
AL09	n/a	-	-	-
AL10	Maximum water temperature (if chiller version)	machine	60	Automatic
AL11	External alarm/Start value e.g. flow switch	machine	10	Automatic. If this occurs more than 5 times per hour, it must be reset manually.
AL12	Frost alarm (chiller version)	machine	0	Manual
AL13	Diagnose alarm circuit 1 (low pressure fault)	circuit 1	120	Manual
AL14	Diagnose alarm circuit 2 (low pressure fault)	circuit 2	120	Manual
AL15	Thermistor 1 alarm	machine	+/- 10 sec.	Automatic
AL16	Thermistor 2 alarm	machine	+/- 10 sec.	Automatic
AL17	Thermistor 3 alarm	machine	+/- 10 sec.	Automatic
AL18	Thermistor 4 alarm	machine	+/- 10 sec.	Automatic
AL19	n/a	-		-

Alarms 1 to 6 are used if an individual compressor fails, and also if the high pressure switch for the corresponding circuit trips.

In the event of a high pressure fault, the entire circuit will be blocked. The alarm messages in the case of a high pressure fault in circuit 1 will be "AL01 + AL02 + AL03". All three compressors in the corresponding circuit cannot be started as a result and will therefore signal a fault. In the event of a high pressure fault in circuit 2, the alarm code will be "AL04 + AL05 + AL06".

A low pressure fault must always be reset manually.

5. Description of the outside air thermostat

Machine locking and control of the evaporator heating is performed using a two-stage thermostat. The appropriate parameters for the thermostat are set in the factory.

Thermostat type EWDR 905/T/PTC

Sensors: see section 2.2

Values for the setpoints

DESIGN	BASIC CONTROL SYSTEM / ADVANCED CONTROL SYSTEM
FIRST STAGE	0 °C
SECOND STAGE	5 °C

The second stage is only used for chillers

6. Settings and timers

6.1. Controlling the water temperature (chiller)

The advanced control system controls the water temperature at the water inlet. With increasing water temperature, more compressors should become active. With decreasing water temperature, compressors should be disconnected.

The following table shows the connection and disconnection points of the compressors at a setpoint of 6°C. The stated water temperatures are water inlet temperatures.

		3 compressors	4 compressors	6 compressors
Connection point compressor	1	8.0°C	7.5°C	7.0°C
Disconnection point compressor	1	7.0°C	6.5°C	6.0°C
Connection point compressor	2	10.0°C	9.0°C	8.0°C
Disconnection point compressor	2	9.0°C	8.0°C	7.0°C
Connection point compressor	3	12.0°C	10.5°C	9.0°C
Disconnection point compressor	3	11.0°C	9.5°C	8.0°C
Connection point compressor	4		12.0°C	10.0°C
Disconnection point compressor	4		11.0°C	9.0°C
Connection point compressor	5			11.0°C
Disconnection point compressor	5			10.0°C
Connection point compressor	6			12.0°C
Disconnection point compressor	6			11.0°C

6.2. Safety features in the controller

SAFETY FEATURES MICROCONTROLLER	Alarm activated	Alarm cancelled	Disconnection delay	Connection delay	Reset micro-controller	Reset safety feature
Low pressure	3.0 Bar(Pe)	3.9 Bar(Pe)	2 minutes	10 sec.	Manual	Automatic
High pressure operation	24.0 Bar(Pe)	20.5 Bar(Pe)	Direct	Direct	Automatic	Manual pressure switch
High pressure security	25.0(Pe)	21.5 Bar(Pe)	Direct	Direct	Automatic	Manual pressure switch
Frost (chiller version) Frost (condensing unit)	4.0 °C n/a	5.0 °C n/a	Direct	Direct	Manual	-
Klixon of compressors	105 °C	Compressor dependent	Direct	Direct	Automatic	Automatic
Motor current too high compressor	See electrical diagram	See electrical diagram	Direct	Direct	Automatic	Manual Motor protection
External fault (e.g. flow switch)	External	External	10 sec.	20 sec.	Automatic	Automatic

6.3. Blocking at low outside temperature /activating the evaporator heating

SAFETY FEATURE OUTSIDE AIR THERMOSTAT	Activated	Cancelled	Disconnection delay	Connection delay	Reset micro-controller	Reset safety feature
Activate evaporator heating	5 °C	6 °C	Direct	Direct	Automatic	Automatic
Blocking at low outside temperature	0 °C	1 °C	Direct	Direct	n/a	Automatic

6.4. Setpoint

The setpoint can only be adjusted by qualified service personnel

Description	Minimum	Maximum	
Setpoint	6	12	°C

6.5. Switching the timers on and off

TIMERS		
Delay between two starts of the same compressor	**300**	**sec.**
Delay between the starts of two compressors	**60**	**sec.**
Delay before starting a compressor after stopping a compressor	**60**	**sec.**

7. Warnings

If your machine experiences a fault, it is important to identify and rectify the fault. Frequent resetting of the machine can cause damage. If after one reset the fault still persists, the cause of the fault must be eliminated before resetting again.

The fans can rotate even when the compressors are inactive. Fans which are not speed regulated rotate if the condensation temperature exceeds 45°C. Once activated, the fans will rotate until the condensation temperature falls below 30°C.

Subject to modification

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