



## 38RA Series

PRO-DIALOG *Plus* Control

PRO-DIALOG *Plus*



Operation and maintenance instructions



Quality Management System Approval

## TABLE OF CONTENTS

<b>1 - SAFETY CONSIDERATIONS .....</b>	<b>3</b>
1.1 - General .....	3
1.2 - Avoid electrocution .....	3
<b>2 - GENERAL DESCRIPTION .....</b>	<b>3</b>
2.1 - General .....	3
2.2 - Abbreviations used .....	3
<b>3 - HARDWARE DESCRIPTION .....</b>	<b>4</b>
3.1 - General .....	4
3.2 - Electrical supply to boards .....	4
3.3 - Light emitting diodes on boards .....	4
3.4 - The sensors .....	4
3.5 - Connections at the user's terminal block .....	5
<b>4 - PRO-DIALOG PLUS CONTROL OPERATION .....</b>	<b>6</b>
4.1 - Safety loop .....	6
4.2 - Capacity control .....	6
4.3 - Copmpressor start-up sequence .....	6
4.4 - Head pressure control .....	6
4.5 - High pressure load shedding function .....	6
4.6 - Pumpdown .....	6
<b>5 - DIAGNOSTICS - TROUBLESHOOTING .....</b>	<b>6</b>
5.1 - General .....	6
5.2 - Displaying alarms .....	6
5.3 - Resetting alarms .....	6
5.4 - Alarm codes .....	7

The cover photograph is for illustrative purposes only and is not part of any offer for sale or contract.

## 1 - SAFETY CONSIDERATIONS

### 1.1 - General

Installation, start-up and servicing of equipment can be hazardous if certain factors particular to the installation are not considered: operating pressures, presence of electrical components and voltages and the installation site (elevated plinths and built-up up structures). Only properly qualified installation engineers and highly qualified installers and technicians, fully trained for the product, are authorised to install and start-up the equipment safely. During all servicing operations all instructions and recommendations which appear in the installation and service instructions for the product, as well as on tags and labels fixed to the equipment and components and accompanying parts supplied separately, must be read, understood and followed.

- Apply all standard safety codes and practices.
- Wear safety glasses and gloves.
- Use the proper tools to move heavy objects. Move units carefully and set them down gently.

### 1.2 - Avoid electrocution

Only qualified and experienced personnel should be permitted access to electrical components. It is particularly recommended that all sources of electricity to the unit be shut off before any work is begun. Shut off the main power supply at the main circuit breaker or isolator.

#### **IMPORTANT:**

*Risk of electrocution: Even when the main circuit breaker or isolator is switched off, certain circuits may still be energised, since they may be connected to a separate power source.*

*Even when the unit is switched off, the power circuit remains energised, as long as the unit or circuit disconnect is not open. Refer to the wiring diagram for details.*

*Attach appropriate safety labels.*

*Risk of burns: Electrical currents cause components to get hot either temporarily or permanently. Handle power cable, electrical cables and conduits, terminal box covers and motor frames with great care.*

**IMPORTANT:** *This equipment uses and emits electromagnetic signals. Tests have shown that the equipment conforms to all applicable codes with respect to electromagnetic compatibility.*

**IMPORTANT :** *If the boards need to be handled wear anti-static gloves to avoid exposing the electronic components to a destructive voltage. Only unpack the boards from their anti-static bag when they need to be installed.*

## 2 - GENERAL DESCRIPTION

### 2.1 - General

Pro-Dialog is a system for controlling single- or dual-circuit 38RA air-cooled condensing units. The Pro-Dialog system must be complemented by a programmable or non-programmable Carrier 33CS thermostat which ensures start-up of the indoor fan and controls the two cooling stages. This thermostat can also control the two electric heater stages.

In cooling mode Pro-Dialog controls the operation of the outdoor fans to maintain the correct condensing pressure in each circuit. The safety devices are constantly monitored by Pro-Dialog to ensure unit protection. The heating stages are not controlled by Pro-Dialog.

### 2.2 - Abbreviations used

In this manual, the refrigeration circuits are called circuit A and circuit B. The compressors in circuit A are labelled A1 and A2. Those in circuit B are B1 and B2.

#### **The following abbreviations are used frequently:**

CCN : Carrier Comfort Network

LED : Light Emitting Diode

SCT : Saturated Condensing Temperature

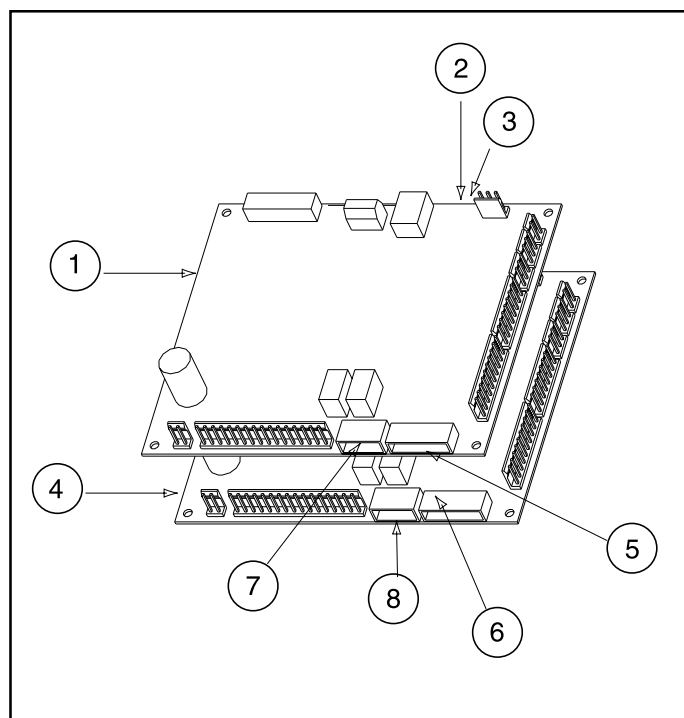
SIO : Sensor Bus (internal communication bus linking the basic board to the slave boards)

SST : Saturated Suction Temperature

### 3 - HARDWARE DESCRIPTION

#### 3.1 - General

**Fig. 1 - Control board**



**Legend**

- 1 Master NRCP basic board
- 2 Red LED, status of the board
- 3 Green LED, communication bus SIO
- 4 Slave NRCP basic board
- 5 Remote master board customer control connection contacts
- 6 Remote slave board customer control connection contacts
- 7 Master board customer connection relay outputs
- 8 Slave board customer connection relay outputs

The control system consists of an NRCP-BASE board for single-circuit units and two NRCP-BASE boards (a master and a slave board) for dual-circuit units. All boards communicate via an internal SIO bus. The NRCP-BASE boards continuously manage the information received from the various pressure and temperature probes. The NRCP-BASE master board incorporates the program that controls the unit.

#### 3.2 - Electrical supply to boards

All boards are supplied from a common 24 V a.c. supply referred to earth. In the event of a power supply interrupt, the unit restarts automatically without the need for an external command. However, any faults active when the supply is interrupted are saved and may in certain cases prevent a circuit or unit from restarting.

#### 3.3 - Light emitting diodes on boards

All boards continuously check and indicate the proper operation of their electronic circuits. A light emitting diode (LED) lights on each board when it is operating properly.

- The red LED flashing for a 2 second period on the NRCP-BASE board indicates correct operation. A different rate indicates a board or a software failure.
- On dual-circuit units or units equipped with optional board, the green LED flashes continuously on all boards to show that the board is communicating correctly over its internal bus. If the LED is not flashing, this indicates a SIO bus wiring problem.

#### 3.4 - The sensors

##### Pressure sensors

Two types of electronic sensors (low and high pressure) are used to measure the suction and discharge pressure in each circuit.

##### Thermistor

The outdoor temperature sensor is mounted below the control box.

##### Solenoid valves

A solenoid valve must be mounted on the liquid line of each circuit, in order to permit pumpdown of the circuit during shutdown and at restart.

##### Alarm LED

An LED, mounted on the front of the control box, displays the unit alarms.

##### Alarm reset button

A push button, mounted on the front of the control box, permits resetting of all active unit alarms.

## 3.5 - Connections at the user's terminal block

### 3.5.1 - General description

The contacts below are available at the user's terminal block on the NRCP-BASE board or on a customer terminal block (see figure 1). The following table summarises the connections at the user's terminal block.

#### SINGLE-CIRCUIT UNITS

Description	Connector/channel	Terminal	Board	Remarks	Remarks
Alarm relay output	J3 / CH24	30 - 31	NRCP-BASE	Indicates alarms in circuit A	Volt-free contact 24 V a.c. 48 V d.c. max., 20 V a.c. or V d.c. min., 3 A max., 80 mA min., external power supply.  Connector: 4 pin WAGO 231-304/026000 pitch 5.08
Contact 1: Indoor unit fan	J4 / CH8	32 - 33	NRCP-BASE	This contact may be used for indoor fan reverse operation. If this contact is not used, it must be bridged.	24 V a.c., 20 mA  Connector: 8 pin Wago 734-168, pitch 3.5
Contact 2: Cooling 1	J4 / CH9	63 - 64	NRCP-BASE	This contact is used to control the first cooling stage: connected to the thermostat.	
Contact 3: Cooling 2	J4 / CH10	73 - 74	NRCP-BASE	This contact is used to control the second cooling stage: connected to the thermostat.	
User safety loop input	J4 / CH11a	34 - 35	NRCP-BASE	This contact can be used for any customer safety loop that requires that the unit is stopped, if it is open. If the contact is not used, it must be bridged.	
Connection to solenoid valve A1		52 - 12	Customer board	Contact used to control the solenoid valve of compressor A1	Maximum 18 VA, 10 W, 24 V a.c.
Connection to solenoid valve A2		53-12	Customer board	Contact used to control the solenoid valve of compressor A1	Maximum 18 VA, 10 W, 24 V a.c.
24 V a.c. power supply for thermostat		"R.C."	Customer board		Maximum 10 VA

#### DUAL-CIRCUIT UNITS

Description	Connector/channel	Terminal	Board	Remarks	Remarks
Alarm relay output circuit A	J3 / CH24	30A - 31A	Master NRCP-BASE	Indicates alarms, circuit A	Volt-free contact 24 V a.c. 48 V d.c. max., 20 V a.c. or V d.c. min., 3 A max., 80 mA min., external power supply.  Connector: 4 pin WAGO 231-304/026000 pitch 5.08; One per board needed. 24 V a.c., 20 mA
Alarm relay output circuit B	J3 / CH25	30B - 31B	Slave NRCP-BASE	Indicates alarms, circuit B	
Contact 1: Indoor unit fan	JJ4 / CH8	32 - 33	Master NRCP-BASE	This contact may be used for indoor fan reverse operation. If this contact is not used, it must be bridged.	24 V a.c., 20 mA  Connector: 8 pin Wago 734-168, pitch 3.5
Contact 2: Cooling 1	J4 / CH9	63 - 64	Master NRCP-BASE	This contact is used to control the first cooling stage: connected to the thermostat.	
Contact 3: Cooling 2	J4 / CH10	73 - 74	Master NRCP-BASE	This contact is used to control the second cooling stage: connected to the thermostat.	
User safety loop input	J4 / CH11a	34 - 35	Master NRCP-BASE	This contact can be used for any customer safety loop that requires that the unit is stopped, if it is open. If the contact is not used, it must be bridged.	
Connection to solenoid valve A1		52 - 12	Customer board	Contact used to control the solenoid valve of compressor A1	Maximum 18 VA, 10 W, 24 V a.c.
Connection to solenoid valve A2		53-12	Customer board	Contact used to control the solenoid valve of compressor A1	Maximum 18 VA, 10 W, 24 V a.c.
24 V a.c. power supply for thermostat		"R.C."	Customer board		Maximum 10 VA

## 4 - PRO-DIALOG PLUS CONTROL OPERATION

### 4.1 - Safety loop

This contact checks the status of a customer safety loop. It prevents the unit from starting if it is open. If this contact opens, while the unit is running, this will immediately shut down the faulty unit.

### 4.2 - Capacity control

The control activates the compressors, based on the thermostat cooling stage demand.

**NOTE:** *Pro-Dialog imposes a minimum delay of 4 minutes, before adding an additional cooling stage, and a minimum delay of 3 minutes before cutting out a stage.*

### 4.3 - Compressor start-up sequence

The compressors are started and stopped in a sequence designed to equalise their run times (value weighted by the number of compressor start-ups).

### 4.4 - Head pressure control

Condensing pressure control is automatically ensured by a two-speed fan (no adjustment).

### 4.5 - High pressure load shedding function

This function does not require an additional board. It prevents high pressure breaks on a circuit by the following means:

- Preventing any capacity increase on the circuit once the high pressure value has reached an initial threshold.
- Shedding one compressor once a second protection threshold has been reached.

In the event of a compressor being unloaded, no capacity increase will be authorised on the circuit concerned for a period of 10 minutes.

### 4.6 - Pumpdown

If a circuit is shut down or started after more than 15 minutes of being shut-down, it is subjected to a pumpdown cycle in order to purge the refrigerant from the evaporator and the suction line. The maximum duration of the pumpdown cycle is 2 minutes.

## 5 - DIAGNOSTICS - TROUBLESHOOTING

### 5.1 - General

The PRO-DIALOG Plus control system has many fault tracing functions. If an operating fault is detected, an alarm is activated and an alarm code is generated.

### 5.2 - Displaying alarms

The alarm LED on the unit gives an immediate display of the alarm. It is followed by a flashing sequence that describes the alarm code: the first for the alarm code number, and the second for the units.

#### Example:

Alarm 36 is detected by the Pro-Dialog Plus control, the LED is on continuously for 5 seconds, then flashes 3 times, goes off and flashes 6 times, goes off and restarts the cycle.

The Pro-Dialog control permits the display of up to 5 fault codes that are active on the unit.

### 5.3 - Resetting alarms

When the cause of the alarm has been corrected the alarm can be reset, depending on the type, either automatically on return to normal, or manually when action has been taken on the unit. Manual resetting must always be made at the unit and the following procedure must be followed: Press the alarm reset button, until the LED showing the alarm codes lights up. Press it a second time to reset the alarms.

Alarms can be reset even if the unit is running. This means that alarms can be reset without stopping the machine. In the event of a power supply interrupt, the unit restarts automatically without the need for an external command. However, any faults active when the supply is interrupted are saved and may in certain cases prevent a circuit or the unit from restarting.

## 6.4 - Alarm codes

The following list gives a complete description of each alarm code and its possible cause.

ALARM CODE DESCRIPTIONS					
Code	Alarm name	Alarm description	Action taken	Reset type	Probable cause
1	Compressor A1 failure	Motor safety input has opened due to compressor overtemperature protection.	Compressor is shut down	Manual	Compressor overheat
2	Compressor A2 failure	As above	As above	As above	As above
3	Compressor B1 failure	As above	As above	As above	As above
4	Compressor B2 failure	As above	As above	As above	As above
5	Outdoor temperature sensor failure	Thermistor outside range	Unit shut down	Automatic, if temp. measured by sensor returns to permitted range of values	Faulty thermistor
11	Discharge pressure transducer failure, Circuit A	Voltage delivered by the sensor is incorrect	Circuit A shut down	Automatic if the voltage delivered by the sensor returns to normal	Faulty sensor or wiring error
12	Discharge pressure transducer failure, Circuit B	As above	Circuit B shut down	Automatic	As above
13	Suction pressure sensor failure, Circuit A	Value read by the sensor is incorrect	Circuit A shut down	Automatic	As above
14	Suction pressure sensor failure, Circuit B	As above	Circuit B shut down	Automatic	As above
15	CCN/clock board failure	The clock board is no longer detected	Unit shut down	Automatic if board is detected again	Defective CCN/clock board
16	Loss of communication with slave board	Communication has been lost with the slave board (circuit B control)	Circuit B shut down	Automatic if communication is re-established	Bus wiring fault, wrong software in slave board or faulty slave board
21	Low pressure failure, circuit A	Circuit running and the suction pressure below threshold	Circuit A shut down	Manual	Shortage of refrigerant, filter blocked or faulty pressure sensor
22	Low pressure failure, circuit B	As above	Circuit B shut down	As above	As above
23	High pressure failure, circuit A	Circuit running and the discharge pressure exceeds the high pressure trip point	Circuit shut down	Manual, the high pressure switch must be reset manually with the push-button located on or in the pressure switch	Fan circuit fault, high condenser entering air temperature
24	High pressure failure, circuit B	As above	As above	As above	As above
25	High pressure switch not reset or compressor reverse rotation, circuit A	The high pressure switch has not been reset following a high pressure trip or one circuit compressor runs in reverse rotation	Circuit shut down	Manual	The high pressure switch has not been reset, poor electrical compressor connection
26	High pressure switch not reset or compressor reverse rotation, circuit B	As above	As above	As above	As above
31	Repeated low evaporator suction temperature unloading, circuit A	More than 6 successive circuit capacity unloads because of low suction temperature.	Circuit shut down	Manual	Faulty pressure sensor, clogged filter or low refrigerant charge
32	Repeated low evaporator suction temperature unloading, circuit B	As above	As above	As above	As above
33	Repeated high pressure unloading, circuit A	More than 6 successive circuit capacity unloads because of high pressure override.	None	Automatic	Faulty transducer, high condenser air temperature, condenser fouled or fan flow rate too low.
34	Repeated high pressure unloading, circuit B	As above	As above	As above	As above
35	Indoor fan status incorrect	The thermostat sends a cooling stage demand, when the indoor fan is stopped	Unit is prevented from starting	Manual	Thermostat faulty, fan faulty
36	Safety loop open	Safety interlock open during operation	Unit shut down	Manual	
41	Emergency shut-down	CCN command received for emergency shutdown of the unit	Unit shut down	CCN	CCN Network command
42	Illegal factory configuration	Wrong factory configuration	Unit is prevented from starting	Automatic	No factory configuration or factory configuration error



Order No. 13051-76, 06.2000. Supersedes order No. New  
Manufacturer reserves the right to change any product specification without notice.



Environmental Management System Approval

Manufactured by: Carrier s.a., Montluel, France.  
Printed in the Netherlands on chlorine-free paper.