Digital controller with defrost and fans management
XR44CX

1. GENERAL WARNING

1.1 PLEASE READ BEFORE USING THIS MANUAL

- This manual is part of the product and should be kept near the instrument for easy and quick reference.
- The instrument shall not be used for purposes different from those described hereunder. It cannot be used as a safety device.
- Check the application limits before proceeding.

1.2 ⚠ SAFETY PRECAUTIONS

- Check the supply voltage is correct before connecting the instrument.
- Do not expose to water or moisture: use the controller only within the operating limits avoiding sudden temperature changes with high atmospheric humidity to prevent formation of condensation
- Warning: disconnect all electrical connections before any kind of maintenance.
- Fit the probe where it is not accessible by the End User. The instrument must not be opened.
- In case of failure or faulty operation send the instrument back to the distributor with a detailed description of the fault.
- Consider the maximum current which can be applied to each relay (see Technical Data).
- Ensure that the wires for probes, loads and the power supply are separated and far enough from each other, without crossing or intertwining.
- In case of applications in industrial environments, the use of mains filters (our mod. FT1) in parallel with inductive loads could be useful.

2. GENERAL DESCRIPTION

Model **XR44CX**, format 32 x 74 mm, is microprocessor based controller, suitable for applications on low temperature refrigerating units. It has four relay outputs to control compressor 1 and 2, defrost 1 and 2, which can be either electrical or reverse cycle (hot gas). It is also provided with up to three NTC or PTC probe inputs, the first one for temperature control, the second and third one, to be located onto the evaporator, to control the defrost termination temperature on the evaporator 1 and 2. It allows to program the controller by means the HOT KEY programming keyboard.

3. CONTROLLING LOADS

3.1 COMPRESSOR

The regulation is performed according to the temperature measured by the thermostat probe with a positive differential from the set point: if the temperature increases and reaches set point plus differential the compressor is started and then turned off when the temperature reaches the set point value again.
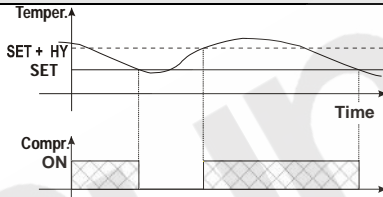
In case of fault in the thermostat probe the start and stop of the compressor are timed through parameters "**COn**" and "**COF**".

3.2 2ND COMPRESSOR MANAGEMENT

The relay of the second compressor is activated in parallel with the relay of the first compressor, with a possible delay set in the **AC1** parameter. Both the compressors are switched off at the same time.

3.3 DEFROST

Two defrost modes are available through the "**tdF**" parameter: defrost through electrical heater (**tdF = EL**) and hot gas defrost (**tdF = in**). Other parameters are used to control the interval between defrost cycles (IdF), its maximum length (MdF and MdS) and two defrost modes: timed or controlled by the evaporator's probe (P2P and P3P).
At the end of defrost dripping time is started, its length is set in the Fdt parameter. With Fdt =0 the dripping time is disabled.
This instrument can manage up to 2 evaporators; the XR44CX waits till the defrost termination on both evaporators before restart with the normal temperature control.

4. FRONT PANEL COMMANDS

SET: To display target set point; in programming mode it selects a parameter or confirm an operation.

(DEF) To start a manual defrost

(UP): To see the max. stored temperature; in programming mode it browses the parameter codes or increases the displayed value.

(DOWN) To see the min stored temperature; in programming mode it browses the parameter codes or decreases the displayed value.

⏻ To switch the instrument off and on.

☀ Not used.

KEY COMBINATIONS:

▲ + ▼	To lock & unlock the keyboard.
SET + ▼	To enter in programming mode.
SET + ▲	To return to the room temperature display.

4.1 USE OF LEDS

Each LED function is described in the following table.

LED	MODE	FUNCTION
❄	ON	Compressor/s enabled
❄	Flashing	Programming phase (flashing with ❄) Anti-short cycle delay enabled
❄	ON	Defrost enabled
❄	Flashing	Programming phase (flashing with ❄) Drip time in progress
🔔	ON	An alarm is occurring
°C/°F	ON	Measurement unit
°C/°F	Flashing	Programming phase

5. MAX & MIN TEMPERATURE MEMORIZATION

5.1 HOW TO SEE THE MIN TEMPERATURE

1. Press and release the **n** key.
2. The "Lo" message will be displayed followed by the minimum temperature recorded.
3. By pressing the **n** key again or by waiting 5s the normal display will be restored.

5.2 HOW TO SEE THE MAX TEMPERATURE

1. Press and release the **o** key.
2. The "Hi" message will be displayed followed by the maximum temperature recorded.
3. By pressing the **o** key again or by waiting 5s the normal display will be restored.

5.3 HOW TO RESET THE MAX AND MIN TEMPERATURE RECORDED

1. Hold press the SET key for more than 3s, while the max. or min temperature is displayed. (rSt message will be displayed)
2. To confirm the operation the "rSt" message starts blinking and the normal temperature will be displayed.

6. MAIN FUNCTIONS

6.1 HOW TO SEE THE SETPOINT

1. Push and immediately release the **SET** key: the display will show the Set point value;
2. Push and immediately release the **SET** key or wait for 5 seconds to display the probe value again.

6.2 HOW TO CHANGE THE SETPOINT

1. Push the SET key for more than 2 seconds to change the Set point value;
2. The value of the set point will be displayed and the ❄ LED starts blinking;
3. To change the Set value push the **o** or **n** arrows within 10s.
4. To memorise the new set point value push the **SET** key again or wait 10s.

6.3 HOW TO START A MANUAL DEFROST

Push the **DEF** key for more than 2 seconds and a manual defrost will start.

6.4 HOW TO CHANGE A PARAMETER VALUE

To change the parameter's value operate as follows:

1. Enter the Programming mode by pressing the **Set** + **n** keys for 3s (the ❄ or ❄ LED start blinking).
2. Select the required parameter. Press the "**SET**" key to display its value
3. Use "**UP**" or "**DOWN**" to change its value.
4. Press "**SET**" to store the new value and move to the following parameter.
To exit: Press **SET + UP** or wait 15s without pressing a key.
NOTE: the set value is stored even when the procedure is exited by waiting the time-out to expire.

6.5 THE HIDDEN MENU

The hidden menu Includes all the parameters of the instrument.

6.5.1 HOW TO ENTER THE HIDDEN MENU

1. Enter the Programming mode by pressing the **Set** + **n** keys for 3s (the "**°C**" or "**°F**" LED starts blinking).
2. Released the keys, then push again the Set+**n** keys for more than 7s. The Pr2 label will be displayed immediately followed from the HY parameter.
NOW YOU ARE IN THE HIDDEN MENU.
3. Select the required parameter.
4. Press the "**SET**" key to display its value
5. Use **o** or **n** to change its value.
6. Press "**SET**" to store the new value and move to the following parameter.
To exit: Press **SET + o** or wait 15s without pressing a key.
NOTE1: if none parameter is present in Pr1, after 3s the "noP" message is displayed. Keep the keys pushed till the Pr2 message is displayed.
NOTE2: the set value is stored even when the procedure is exited by waiting the time-out to expire.

6.5.2 HOW TO MOVE A PARAMETER FROM THE HIDDEN MENU TO THE FIRST LEVEL AND VICEVERSA.

Each parameter present in the HIDDEN MENU can be removed or put into "THE FIRST LEVEL" (user level) by pressing "**SET + n** ".
In HIDDEN MENU when a parameter is present in First Level the decimal point is on.

6.6   HOW TO LOCK THE KEYBOARD

1. Keep pressed for more than 3 s the **UP** + **DOWN** keys.
2. The "POF" message will be displayed and the keyboard will be locked. At this point it will be possible only to see the set point or the MAX o Min temperature stored
3. If a key is pressed more than 3s the "POF" message will be displayed.

6.7   TO UNLOCK THE KEYBOARD

Keep pressed together for more than 3s the **o** and **n** keys, till the "**Pon**" message will be displayed.

6.8   THE CONTINUOUS CYCLE

When defrost is not in progress, it can be activated by holding the "**o**" key pressed for about 3 seconds. The compressor operates to maintain the "**ccS**" set point for the time set through the "**CCt**" parameter. The cycle can be terminated before the end of the set time using the same activation key "**o**" for 3 seconds.

6.9   THE ON/OFF FUNCTION

With "**onF = oFF**", pushing the **ON/OFF** key, the instrument is switched off. The "**OFF**" message is displayed. In this configuration, the regulation is disabled.
To switch the instrument on, push again the ON/OFF key.

WARNING: Loads connected to the normally closed contacts of the relays are always supplied and under voltage, even if the instrument is in stand by mode.

7.   PARAMETERS

REGULATION

Hy Differential: (0,1 ÷ 25,5°C / 1÷255 °F) Intervention differential for set point. Compressor Cut IN is Set Point + differential (Hy). Compressor Cut OUT is when the temperature reaches the set point.
LS Minimum set point: (- 50°C÷SET/-58°F÷SET): Sets the minimum value for the set point.
US Maximum set point: (SET÷110°C/ SET÷230°F). Set the maximum value for set point.
Ot Thermostat probe calibration: (-12.0÷12.0°C; -120÷120°F) allows to adjust possible offset of the thermostat probe.
P2P Evaporator probe presence: n= not present: the defrost stops by time; **y**= present: the defrost stops by temperature.
OE Evaporator probe calibration: (-12.0÷12.0°C; -120÷120°F). allows to adjust possible offset of the evaporator probe.
P3P Second evaporator probe presence (P3): n= not present:, the terminal operates as digital input.; **y**= present:, the terminal operates as third probe.
O3 Second evaporator probe calibration (P3): (-12.0÷12.0°C; -120÷120°F). allows to adjust possible offset of the third probe.
odS Outputs activation delay at start up: (0÷255min) This function is enabled at the initial start up of the instrument and inhibits any output activation for the period of time set in the parameter.
AC Anti-short cycle delay: (0÷50 min) minimum interval between the compressor stop and the following restart.
AC1 2nd compressor delay at start up (0÷255s) Time interval between the switching on of the first compressor and the second one.
CCt Compressor ON time during continuous cycle: (0.0÷24.0h; res. 10min) Allows to set the length of the continuous cycle: compressor stays on without interruption for the CCt time. Can be used, for instance, when the room is filled with new products.
CCS Set point for continuous cycle: (-50÷150°C) it sets the set point used during the continuous cycle.
COn Compressor ON time with faulty probe: (0÷255 min) time during which the compressor is active in case of faulty thermostat probe. With COn=0 compressor is always OFF.
COF Compressor OFF time with faulty probe: (0÷255 min) time during which the compressor is OFF in case of faulty thermostat probe. With COF=0 compressor is always active.

DISPLAY

CF Temperature measurement unit: °C=Celsius; **°F=**Fahrenheit. WARNING: When the measurement unit is changed the SET point and the values of the parameters Hy, LS, US, Ot, ALU and ALL have to be checked and modified if necessary).
rES Resolution (for °C): (in = 1°C; dE = 0.1 °C) allows decimal point display.
Lod Instrument display: (P1; P2, SET, dtr): it selects which probe is displayed by the instrument: **P1** = Thermostat probe; **P2** = Evaporator probe; **SET** = set point; **dtr** = not set it.

DEFROST

tdF Defrost type: EL = electrical heater; in = hot gas
dtE First defrost termination temperature: (-50÷50 °C/ -58÷122°F) Enabled only when P2P=y. It sets the temperature measured by the evaporator probe, which causes the end of defrost.
dtS Second termination temperature: (-50÷50 °C/ -58÷122°F) Enabled only when P3P=y. It sets the temperature measured by the second evaporator probe, which causes the end of defrost.
IdF Interval between defrost cycles: (0÷120h) Determines the time interval between the beginning of two defrost cycles.
MdF (Maximum) length for first defrost: (0÷255min) When **P2P = n**, (not evaporator probe: timed defrost) it sets the defrost duration, when **P2P = y** (defrost end based on temperature) it sets the maximum length for defrost.
MdS (Maximum) length for second defrost: (0÷255min) When **P3P = n**, (not evaporator probe: timed defrost) it sets the defrost duration, when **P3P = y** (defrost end based on temperature) it sets the maximum length for defrost.
dSd Start defrost delay: (0÷99min) This is useful when different defrost start times are necessary to avoid overloading the plant.
dFd Temperature displayed during defrost: (**rt** = real temperature; **it** = temperature at defrost start; **SEt** = set point; **dEF** = "dEF" label)
dAd MAX display delay after defrost: (0÷255min). Sets the maximum time between the end of defrost and the restarting of the real room temperature display.
Fdt Drip time: (0÷120 min) time interval between reaching defrost termination temperature and the restoring of the control's normal operation. This time allows the evaporator to eliminate water drops that might have formed due to defrost.

dPo First defrost after start-up: (y = immediately; n = after the IdF time)
dAF Defrost delay after continuous cycle: (0÷23.5h) time interval between the end of the fast freezing cycle and the following defrost related to it.

ALARMS

ALC Temperature alarms configuration: (Ab; rE)
Ab= absolute temperature: alarm temperature is given by the ALL or ALU values. rE = temperature alarms are referred to the set point. Temperature alarm is enabled when the temperature exceeds the "SET+ALU" or "SET-ALL" values.
ALU MAXIMUM temperature alarm: (SET÷110°C; SET÷230°F) when this temperature is reached the alarm is enabled, after the "ALd" delay time.
ALL Minimum temperature alarm: (-50.0 ÷ SET°C; -58÷230°F when this temperature is reached the alarm is enabled, after the "ALd" delay time.
AFH Differential for temperature alarm/ fan recovery: (0,1÷25,5°C; 1÷45°F) Intervention differential for recovery of temperature alarm. It's also used for the restart of the fan when the FSt temperature is reached
ALd Temperature alarm delay: (0÷255 min) time interval between the detection of an alarm condition and alarm signalling.
dAO Exclusion of temperature alarm at startup: (from 0.0 min to 23.5h) time interval between the detection of the temperature alarm condition after instrument power on and alarm signalling.

OTHER

Adr Serial address (0÷244): Identifies the instrument address when connected to a ModBUS compatible monitoring system.
PbC Type of probe: it allows to set the kind of probe used by the instrument: **PbC** = PBC probe, **ntc** = NTC probe.
dP1 Thermostat probe display
dP2 Evaporator 1 probe display
dP3 Evaporator 2 probe display
rSE Real set point: it shows the set point used during the energy saving cycle or during the continuous cycle.
rEL Software release for internal use**.**
Ptb Parameter table code: readable only**.**

8.   INSTALLATION AND MOUNTING
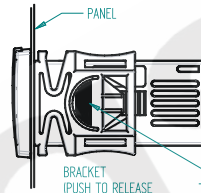
Instrument **XR44CX** shall be mounted on vertical panel, in a 29x71 mm hole, and fixed using the special bracket supplied.
The temperature range allowed for correct operation is 0÷60 °C. Avoid places subject to strong vibrations, corrosive gases, excessive dirt or humidity. The same recommendations apply to probes. Let air circulate by the cooling holes.

9.   ELECTRICAL CONNECTIONS

The instrument is provided with screw terminal block to connect cables with a cross section up to 2,5 mm². Before connecting cables make sure the power supply complies with the instrument's requirements. Separate the probe cables from the power supply cables, from the outputs and the power connections. Do not exceed the maximum current allowed on each relay, in case of heavier loads use a suitable external relay.

9.1   PROBE CONNECTION

The probes shall be mounted with the bulb upwards to prevent damages due to casual liquid infiltration. It is recommended to place the thermostat probe away from air streams to correctly measure the average room temperature. Place the defrost termination probe among the evaporator fins in the coldest place, where most ice is formed, far from heaters or from the warmest place during defrost, to prevent premature defrost termination.

10.   HOW TO USE THE HOT KEY

10.1   HOW TO PROGRAM A HOT KEY FROM THE INSTRUMENT (UPLOAD)

1. Program one controller with the front keypad.
2. When the controller is ON, insert the "**Hot key**" and push **o** key; the "**uPL**" message appears followed a by flashing "**End**"
3. Push "**SET**" key and the **End** will stop flashing.
4. Turn OFF the instrument remove the "**Hot Key**", then turn it ON again.

NOTE: the "**Err**" message is displayed for failed programming. In this case push again **o** key if you want to restart the upload again or remove the "**Hot key**" to abort the operation.

10.2   HOW TO PROGRAM AN INSTRUMENT USING A HOT KEY (DOWNLOAD)

1. Turn OFF the instrument.
2. Insert a **programmed "Hot Key" into the 5 PIN receptacle** and then turn the Controller ON.
3. Automatically the parameter list of the "**Hot Key**" is downloaded into the Controller memory, the "**doL**" message is blinking followed a by flashing "**End**".
4. After 10 seconds the instrument will restart working with the new parameters.
5. Remove the "**Hot Key**"..

NOTE the message is "**Err**" is displayed for failed programming. In this case turn the unit off and then on if you want to restart the download again or remove the "**Hot key**" to abort the operation.

11.   ALARM SIGNALS

Message	Cause	Outputs
"P1"	Room probe failure	Compressor output acc. to par. "Con" and "COF"
"P2"	Evaporator probe failure	Defrost end is timed
"HA"	Maximum temperature alarm	Outputs unchanged.
"LA"	Minimum temperature alarm	Outputs unchanged.
"dA"	Door open	Compressor and fans restarts
"EA"	External alarm	Output unchanged.
"CA"	Serious external alarm (i1F=bAL)	All outputs OFF.
"PAL"	Pressure switch alarm (i1F=PAL)	All outputs OFF

Labe	Value	Level	Name	Range
dP1	--	Pr2	Room probe display	Probe value
dP2	--	Pr1	First Evaporator probe display	Probe value
dP3	--	Pr1	Second evaporator probe display	Probe value
rSE	--	Pr2	Real set point	actual set
rEL	--	Pr2	Software release	Read only
Ptb	--	Pr2	Map code	Read only

11.1 ALARM RECOVERY

Probe alarms **P1**", "**P2"**, "**P3**" start some seconds after the fault in the related probe; they automatically stop some seconds after the probe restarts normal operation. Check connections before replacing the probe.
Temperature alarms "**HA**", "**LA**" automatically stop as soon as the temperature returns to normal values.
Alarms "**EA**" and "**CA**" (with i1F=bAL) recover as soon as the digital input is disabled.
Alarm "**CA**" (with i1F=PAL) recovers only by **switching off and on** the instrument.

12. TECHNICAL DATA

Housing: self extinguishing ABS.
Case: frontal 32x74 mm; depth 60mm;
Mounting: panel mounting in a 71x29mm panel cut-out
Protection: IP20; **Frontal protection:** IP65
Connections: Screw terminal block ≤ 2,5 mm² wiring.
Power supply: according to the model: 12Vac/dc, ±10%.
Power absorption: 3VA max.
Display: 3 digits, red LED, 14,2 mm high; **Inputs**: Up to 4 NTC or PTC probes.
Digital input: free voltage contact
Relay outputs: compressor 1, 2 relay 16(6)A 250Vac
        defrost 1, 2: relay 16(6)A 250Vac
Buzzer: optional.
Data storing: on the non-volatile memory (EEPROM).
Kind of action: 1B; **Pollution grade:** normal; **Software class:** A.;
Operating temperature: 0÷60 °C;**Storage temperature:** -25÷60 °C.
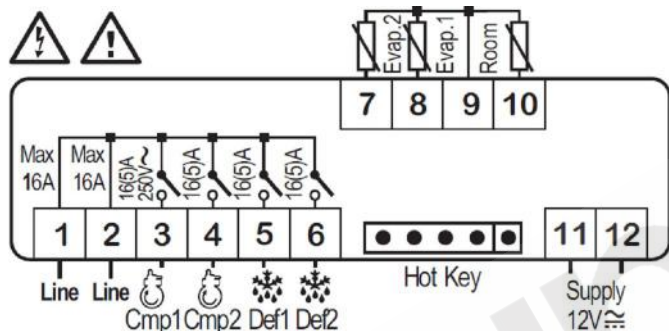**Relative humidity:** 20÷85% (no condensing)
Measuring and regulation range: NTC probe: -40÷110°C (-40÷230°F);
        PTC probe: -50÷150°C (-58÷302°F)
Resolution: 0,1 °C or 1 °F (selectable); **Accuracy (ambient temp. 25°C)**: ±0,7 °C ±1 digit

13. CONNECTIONS

14. DEFAULT SETTING VALUES

Labe	Value	Level	Name	Range
Set	-5.0	- - -	Set point	LS÷US
Hy	2.0	Pr1	Differential	0,1÷25.5°C/ 1÷ 45°F
LS	-40.0	Pr2	Minimum set point	-550°C÷SET/-67°F÷SET
US	110	Pr2	Maximum set point	SET÷150°C/ SET ÷ 302°F
Ot	0.0	Pr1	Thermostat probe calibration	-12÷12°C /-21÷21°F
P2P	Y	Pr1	Evaporator probe presence	n=not present; Y=pres.
OE	0.0	Pr2	Evaporator probe calibration	-12÷12°C /-21÷21°F
P3P	y	Pr2	Third probe presence	n=not present; Y=pres.
O3	0	Pr2	Third probe calibration	-12÷12°C /-21÷21°F
OdS	0	Pr2	Outputs delay at start up	0÷255 min
AC	1	Pr1	Anti-short cycle delay	0 ÷ 50 min
AC1	5	Pr1	2nd compressor delay at start up	0÷255 sec
CCt	0.0	Pr2	Continuos cycle duration	0.0÷24.0h
CCS	0	Pr2	Set point for continuous cycle	(-55.0÷150,0°C) (-67÷302°F)
COn	15	Pr2	Compressor ON time with faulty probe	0 ÷ 255 min
CoF	15	Pr2	Compressor OFF time with faulty probe	0 ÷ 255 min
CF	°C	Pr2	Temperature measurement unit	°C ÷ °F
rES	dE	Pr1	Resolution	in=integer; dE= dec.point
Lod	P1	Pr2	Probe displayed	P1;P2; SEt ; dtr
tdF	EL	Pr2	Defrost type	EL=el. heater; in= hot gas
dtE	8	Pr1	First Defrost termination temperature	-55 ÷ 50 °C
dtS	8	Pr1	Second Defrost termination temperature	-55 ÷ 50 °C
IdF	6	Pr1	Interval between defrost cycles	1 ÷ 120 h
MdF	30	Pr1	(Maximum) length for defrost 1	0 ÷ 255 min
MdS	30	Pr1	(Maximum) length for defrost 2	0 ÷ 255 min
dSd	0	Pr2	Start defrost delay	0÷255 min
dFd	it	Pr2	Displaying during defrost	rt, it, SEt, DEF
dAd	30	Pr2	MAX display delay after defrost	0 ÷ 255 min
Fdt	0	Pr2	Draining time	0÷255 min
dPo	n	Pr2	First defrost after startup	n=after IdF; y=immed.
dAF	0.0	Pr2	Defrost delay after fast freezing	0 ÷ 24h
ALc	Ab	Pr2	Temperat. alarms configuration	rE= related to set; Ab = absolute
ALU	110	Pr1	MAXIMUM temperature alarm	Set÷110.0°C; Set÷230°F
ALL	-50.0	Pr1	Minimum temperature alarm	-50.0°C÷Set/ -58°F÷Set
AFH	1	Pr2	Differential for temperat. alarm recovery	(0,1°C÷25,5°C) (1°F÷45°F)
ALd	10	Pr2	Temperature alarm delay	0 ÷ 255 min
dAO	1.3	Pr2	Delay of temperature alarm at start up	0 ÷ 24h
Adr	1	Pr2	Serial address	0÷247
PbC	ntc	Pr2	Type of probe	Ptc; ntc