

Digital Controller XR70CX



Operating Manual



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General Warnings

PLEASE READ BEFORE USING THIS MANUAL

This manual is part of the product and should be kept near the controller for easy and quick reference.

The controller shall not be used for purposes different from those described hereunder.

SAFETY PRECAUTIONS

Check the supply voltage is correct before connecting the controller.

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.

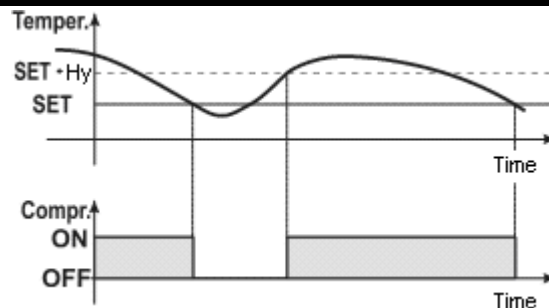
The controller must not be opened.

General Description

The XR70CX, format: 32 x 74 x 60 mm, is microprocessor based controller, suitable for applications on medium or low temperature ventilated refrigerating units. It has three relay outputs to control compressor, fan, and defrost. It also has three NTC probes, the first one for temperature control, the second one, to be located onto the evaporator, to control the defrost termination temperature and to manage the fan, the third one, optional, to connect to the HOT KEY terminals to signal the condenser temperature alarm or to display a temperature.

Regulation

The regulation is performed according to the air temperature probe with a positive differential from the set point: if the air 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.



Defrost






The controller goes into defrost mode every 6 hours. It enables the electric defrost heater for 36 minutes or until the evaporator sensor reaches 60°F—whichever happens first. Immediately after defrost the controller waits for 1 minute before resuming normal operation. This allows time for water droplets which may have formed on the coil to drip off into the drip pan.

Fans





During normal operation, the fan relay is always enabled except for during defrost. Also, there is a 2 minute delay before the fan is enabled after the end of defrost. Furthermore, the evaporator fan will remain off if the evaporator temperature is above 60°F.








Front Panel Commands



- SET** To display target set point, in programming mode it selects a parameter or confirm an operation
-  To start a manual defrost
-  In programming mode it browses the parameter codes or increases the displayed value
-  In programming mode it browses the parameter codes or decreases the displayed value
-  On/Off switch
-  This function is not used

KEY COMBINATIONS

-  +  To lock or unlock the keyboard
- SET** +  To enter in programming mode
- SET** +  To return to room temperature display

LED	MODE	DESCRIPTION
	On	Compressor enabled
	Flashing	Anti short cycle delay enabled
	On	Defrost in progress
	Flashing	Dripping in progress
	On	Fans output enabled
	Flashing	Fans delay after defrost
°C	On	Measurement unit
	Flashing	Programming mode
°F	On	Measurement unit
	Flashing	Programming mode
	On	An alarm is occurring
	--	This function is not used
	--	This function is not used
	--	This function is not used
AUX	On	The alarm relay is energized


HOW TO SEE THE SET POINT

1. Push and immediately release the SET key, the set point will be showed.
2. Push and immediately release the SET key or wait about 5 seconds to return to normal operation.

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 "°C" or "°F" LED starts blinking;
3. To change the set value, push the ▲ or ▼ arrows within 10 seconds.
4. To input the new set point value, push the SET key again or wait 10 seconds.

HOW TO START A MANUAL DEFROST

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

HOW TO CHANGE A PARAMETER VALUE

To change the parameter's value:

1. Enter the programming mode by pressing the SET+ ▼ keys for 3 seconds ("°C" or "°F" LED starts blinking).
2. Select the required parameter. Press the SET key to display its value
3. Use ▲ or ▼ to change its value.
4. Press SET to store the new value and move to the following parameter.

To exit: Press SET+ ▲ or wait 15 seconds without pressing a key.

NOTE: the set value is stored even when the procedure is exited by waiting 15 seconds.

LEVEL 2 MENU

HOW TO ENTER THE LEVEL 2 MENU

1. Enter the Programming mode by pressing the SET + ▼ keys for 3 seconds ("°C" or "°F" LED starts blinking).
2. Release the keys, then push again the SET + ▼ keys for more than 7 seconds. The L2 label will be displayed immediately followed from the "Hy" parameter.

NOW YOU ARE IN THE LEVEL 2 MENU.

3. Select the required parameter.
4. Press the SET key to display its value
5. Use ▲ or ▼ to change its value.
6. Press "SET" to store the new value and move to the following parameter.

To exit: Press SET + ▲ or wait 15 seconds without pressing a key.

NOTE1: if no parameter is present in L1, after 3sec the "nP" message is displayed. Keep the keys pushed till the L2 message is displayed.

NOTE2: the set value is stored even when the procedure is exited by waiting 15 seconds.

HOW TO MOVE A PARAMETER FROM THE SECOND LEVEL TO THE FIRST LEVEL AND VICE VERSA.

Each parameter present in the LEVEL 2 MENU can be removed or put into "THE FIRST LEVEL" (user level) by pressing SET + ▼. When a parameter is present in First Level, the decimal point is on.

TO LOCK THE KEYBOARD

1. Keep pressed for more than 3 seconds the Δ and ∇ keys.
2. The "PoF" message will be displayed and the keyboard will be locked.

TO UNLOCK THE KEYBOARD

Keep pressed together for more than 3 seconds the Δ and ∇ keys till the "Pon" message will be displayed.

Parameters

REGULATION

- Hy** Differential: (0,1°C to 25°C) 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: (-55°CtoSET/-58°FtoSET): Sets the minimum value for the set point..
- US** Maximum SET POINT: (SETto99°F/ SETto99°F). Set the maximum value for set point.
- ot** First probe calibration: (-9.9to9.9°F) allows to adjust possible offset of the first probe.
- P2P** Evaporator probe presence: n= not present; y= the defrost stops by temperature.
- oE** Second probe calibration: (-9.9to9.9°F) allows to adjust possible offset of the second probe.
- P3P** Third probe presence: n=not present. ; y=present., the terminal operates as third probe.
- O3** Third probe calibration: (-9.9to9.9°F) allows to adjust possible offset of the third probe.
- P4P** Third probe presence: n=not present. ; y=present., the terminal operates as fourth probe.
- O4** Third probe calibration: (-9.9to9.9°F) allows to adjust possible offset of the fourth probe.
- odS** Outputs activation delay at start up: (0to99min) 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: (0to50 min) minimum interval between the compressor stop and the following restart.
- rtr** Percentage of the second and first probe for regulation (0÷100; 100 = P1, 0 = P2): it allows to set the regulation according to the percentage of the first and second probe, as for the following formula $(rtr(P1-P2)/100 + P2)$.
- CO n** Compressor ON time with faulty probe: (0to99 min) time during which the compressor is active in case of faulty thermostat probe. With Cy=0 compressor is always Off (Hidden).
- CCt** Compressor ON time during continuous cycle: (0.0to24.0hour; res. 10min) Allows to set the length of the continuous cycle: compressor stays on without interruption for the CCt time. This can be used, for instance, when the room is filled with new products.

- CCS Set point for continuous cycle: (-50to150°C) it sets the set point used during the continuous cycle.
- COF Compressor OFF time with faulty probe: (0to99 min) time during which the compressor is off in case of faulty thermostat probe. With Cn=0 compressor is always active(Hidden).

DISPLAY

- CF Measurement unit: (°C,°F) °C =Celsius; °F =Fahrenheit.
WARNING: When the measurement unit is changed the Set point and the values of the parameters Hy, LS, US, oE, o1, AU, AL have to be checked and modified if necessary).
- rES Resolution (only for °C):(dE, in) dE= decimal between -9.9 and 9.9°F; in= integer.
- Lod Instrument display: (P1; P2, P3, P4, SET, dtr): it selects which probe is displayed by the instrument: P1 = Thermostat probe; P2 = Evaporator probe; P3 = Third probe(only for model with this option enabled); P4 = Fourth probe, SET = set point; dtr = percentage of visualization.
- dLy Display delay: (0to15 min) when the temperature increases, the display is updated a maximum of 1°F after this time.
- dtr Percentage of the second and first probe for visualization when Lod = dtr (0÷100; 100 = P1, 0 = P2): if Lod = dtr it allows to set the visualization according to the percentage of the first and second probe, as per the following formula $(dtr(P1 - P2)/100 + P2)$.

DEFROST

- dFP Probe selection for defrost termination: nP = no probe; P1 =thermostat probe; P2 =evaporator probe; P3 =configurable probe; P4 = Probe on Hot Key plug.
- tdF Defrost type: EL = electrical heater; in = hot gas
- dtE Defrost termination temperature: (-50to50 °C/-58to122°F) (Enabled only when EdF=Pb) sets the temperature measured by the evaporator probe, which causes the end of defrost.
- ldF Interval between defrost cycles: (0to120h) Determines the time interval between the beginning of two defrost cycles.
- MdF (Maximum) length for defrost: (0to255min) 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.
- dSd Start defrost delay: (0to99min) 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: (0to255min). Sets the maximum time between the end of defrost and the restarting of the real room temperature display.
- Fdt Drip time: (0to120 min) time interval between reaching defrost termination temperature and the storing 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 ldF time)

dAF Defrost delay after continuous cycle: (0to23.5hours) time interval between the end of the fast freezing cycle and the following defrost related to it.

FANS

- FnC Fans operating mode: C-n= runs with the compressor, OFF during defrost; o-n = continuous mode, OFF during defrost; C-Y = runs with the compressor, ON during defrost; o-Y = continuous mode, ON during defrost;
- Fnd Fans delay after defrost: (0to255min) Interval between end of defrost and evaporator fans start.
- Fct Temperature differential avoiding short cycles of fans (0to59°C; Fct=0 function disabled). If the difference of temperature between the evaporator and the room probes is more than the value of the Fct parameter, the fans are switched on.
- FSt Fans stop temperature: (-50to50°C/122°F) setting of temperature, detected by evaporator probe, above which fans are always OFF.
- Fon Fan ON time: (0to15 min) with Fnc = C_n or C_y, (fan activated in parallel with compressor). It sets the evaporator fan ON cycling time when the compressor is off. With Fon =0 and FoF ≠ 0 the fan are always off, with Fon=0 and FoF =0 the fan are always off.
- FoF Fan OFF time: (0to15 min) with Fnc = C_n or C_y, (fan activated in parallel with compressor). It sets the evaporator fan off cycling time when the compressor is off. With Fon =0 and FoF ≠ 0 the fan is always off, with Fon=0 and FoF =0 the fan is always off.
- FAP Probe selection for fan management: nP = no probe; P1 =thermostat probe; P2 = evaporator probe; P3 =configurable probe; P4 = Probe on Hot Key plug.

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: (SETto110°C; SETto230°F) when this temperature is reached the alarm is enabled, after the "ALd" delay time.
- ALL Minimum temperature alarm: (-50.0 to SET°C; -58to230°F when this temperature is reached the alarm is enabled, after the "ALd" delay time.
- AFH Differential for temperature alarm/ fan recovery: (0,1to25,5°C; 1to45°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: (0to255 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.

CONDENSER TEMPERATURE ALARM

- AP2** Probe selection for temperature alarm of condenser: nP = no probe; P1 = thermostat probe. P2 = evaporator probe; P3 = configurable probe; P4 = Probe on Hot Key plug.
- AL2** Low temperature alarm of condenser: (-55to150°C) when this temperature is reached the LA2 alarm is signalled, possibly after the Ad2 delay.
- Au2** High temperature alarm of condenser: (-55to150°C) when this temperature is reached the HA2 alarm is signalled, possibly after the Ad2 delay.
- AH2** Differential for temperature condenser alarm recovery: (0,1to25.5°C; 1to45°F)
- Ad2** Condenser temperature alarm delay: (0to255 min) time interval between the detection of the condenser alarm condition and alarm signalling.
- dA2** Condenser temperature alarm exclusion at start up: (from 0.0 min to 23.5h, res. 10min)
- bLL** Compressor off with low temperature alarm of condenser: n = no: compressor keeps on working; Y = yes, compressor is switched off till the alarm is reset, in any case regulation restarts after AC time at minimum.
- AC2** Compressor off with high temperature alarm of condenser: n = no: compressor keeps on working; Y = yes, compressor is switched off till the alarm is present, in any case regulation restarts after AC time at minimum.

FOURTH RELAY

- tbA** Alarm relay silencing (with oA3=ALr): n= silencing disabled: alarm relay stays on till alarm condition lasts, y=silencing enabled: alarm relay is switched OFF by pressing a key during an alarm
- oA3** Fourth relay configuration: ALr: alarm; Lig: light; AuS: Auxiliary relay; onF: always on with instrument on; db: do not select; dEF: do not select; FAn: do not select ; dF2: do not select.
- AoP** Alarm relay polarity: it set if the alarm relay is open or closed when an alarm happens. CL=terminals 1-2 closed during an alarm; oP = terminals 1-2 open during an alarm

DIGITAL INPUT(NOT USED)

- i1P** Digital input polarity: oP: the digital input is activated by opening the contact; CL: the digital input is activated by closing the contact.
- i1F** Digital input configuration: EAL = external alarm: "EA" message is displayed; bAL = serious alarm "CA" message is displayed. PAL = pressure switch alarm, "CA" message is displayed; dor = door switch function; dEF = activation of a defrost cycle; AUS =not enabled; Htr = kind of action inversion (cooling – heating); FAn = not set it; ES = Energy saving. did: (0to255 min) with i1F= EAL or i1F = bAL digital input alarm delay: delay between the detection of the external alarm condition and its signalling. with i1F= dor: door open signalling delay with i1F = PAL: time for pressure switch function: time interval to calculate the number of the pressure switch activation.
- nPS** Pressure switch number: (0 to15) Number of activation of the pressure switch, during the "did" interval, before signalling the alarm event (I2F= PAL).If the nPS

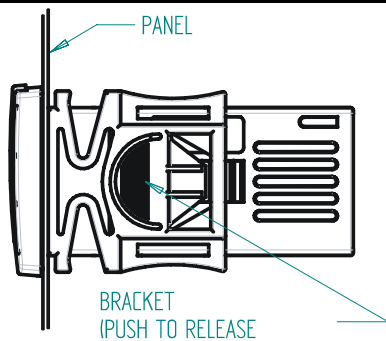
activation in the did time is reached, switch off and on the instrument to restart normal regulation.

- odc Compressor and fan status when open door: no = normal; Fan = Fan OFF; CPr = Compressor OFF; F_C = Compressor and fan OFF.
- rrd Outputs restart after doA alarm: no = outputs not affected by the doA alarm; yES = outputs restart with the doA alarm;
- HES Temperature increase during the Energy Saving cycle : (-30,0°Cto30,0°C/-22to86°F) it sets the increasing value of the set point during the Energy Saving cycle.

OTHER

- Adr Serial address (1to244): Identifies the instrument address when connected to a ModBUS(RTU) 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.
- onF on/off key enabling: nu = disabled; oFF = enabled; ES = not set it.
- dP1 Thermostat probe display
- dP2 Evaporator probe display
- dP3 Third probe display- *optional*.
- dP4 Fourth 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: read only.

Installation and Mounting



Instrument XR70CX shall be mounted on vertical panel, in a 29x71 mm hole, and fixed using the bracket supplied. The temperature range allowed for correct operation is 0to140°F. Let air circulate by the cooling holes.

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.

PROBES

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.

How to Use the Hot Key

HOW TO PROGRAM THE HOT KEY FROM THE CONTROLLER(UPLOAD)

1. Program one controller with the front keypad.
2. When the controller is powered, insert the "Hot key" and push \triangle key; the "UL" message appears briefly followed a by "En" which stays displayed for 15 seconds.
3. Power down the controller and remove the "Hot Key".

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

HOW TO PROGRAM A CONTROLLER USING THE HOT KEY (DOWNLOAD)

1. Power down the controller.
2. Insert a programmed "Hot Key" into the 5-PIN receptacle and then place power to the controller.
3. Apply power to the controller. Automatically the parameter list of the "Hot Key" is downloaded into the controller memory, the "dL" message appears briefly followed by "En" which stays displayed for 15 seconds.
4. Power down the controller and remove the "Hot Key".

Alarm Signaling

Message	Cause	Outputs
"P1"	Room probe failure	Compressor output according to "Cy" and "Cn"
"P2"	Evaporator probe failure	Defrost end is timed
"P3"	Product probe failure	Outputs unchanged
"P4"	Not used	N/A
"HA"	Maximum temperature alarm	Outputs unchanged
"LA"	Minimum temperature alarm	Outputs unchanged
"HA2"	Not used	N/A
"LA2"	Not used	N/A
"EA"	External alarm(not used)	Outputs unchanged
"CA"	Serious external alarm(not used)	All outputs off
"dA"	Door open(not used)	Compressor and fans restart

ALARM RECOVERY

Probe alarms P1", "P2", "P3" and "P4" 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" "HA2" and "LA2" 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 the instrument off and on.

OTHER MESSAGES	
Pon	Keyboard Unlocked
PoF	Keyboard Locked
noP	In programming mode: no parameter is present in Pr1 On the display or in dP2, dP3, dP4: the selected probe is not enabled

Technical Data

Housing: self-extinguishing ABS

Case: front 32x74 mm; depth 60mm

Mounting: panel mounting in a 71x29mm panel cut-out

Protection: IP20

Frontal protection: IP65

Connections:

1 through 8: ¼ inch spade terminal

9 through 12: screw terminal block $\leq 2.5 \text{ mm}^2$ wiring

Power supply: according to the model: 110Vac $\pm 10\%$, 50/60Hz, 230Vac $+10\%$ to -15%

Power absorption: 3VA max

Display: 3 digits, red LED, 14.2 mm high

Inputs: Up to 4 NTC

Relay outputs: compressor SPST 16(6)A 250Vac

defrost: SPDT 8(3) A, 250Vac

fan: SPST 5A, 250Vac

aux: SPDT 8(3) A, 250Vac

Data storing: on the non-volatile memory (EEPROM).

Kind of action: 1B

Pollution grade: 2

Software class: A

Rated impulsive voltage: 2500V

Over-voltage Category: II

Operating temperature: 0 to 60 °C (32 to 140 °F)

Storage temperature: -30 to 85 °C (-22 to 185 °F)

Relative humidity: 20 to 85% (non-condensing)

Measuring and regulation range: NTC -40 to 110 °C (-40 to 230 °F)

Resolution: 0.1 °C or 1 °C or 1 °F (selectable)

Accuracy (ambient temp. 25 °C): $\pm 0.7 \text{ °C}$ (1.3 °F) ± 1 digit

Connections

XR70CX

